



Multiple pathways: case studies of sustainable agriculture in China

Edited by Seth Cook and Lila Buckley

Contributing authors:

Qiao Yuhui, Qi Gubo, Seth Cook, Lila Buckley, Song Yiching,
Zhang Yanyan, Zhang Li, He Xueqing, Friederike Martin,
Yue Shizhong and Wang Zhen

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Acronyms, abbreviations and terms

CAU	Chinese Agricultural University
CCAP	Center for Chinese Agricultural Policy
CEA	Chinese Ecological Agriculture
CNCA	Certification and Accreditation Administration of the People's Republic of China
CSA	Community Supported Agriculture
GMO	Genetically modified organism
CGFDC	China Green Food Development Center
Ha	Hectare
IPM	Integrated pest management
K	Potassium
MOA	Ministry of Agriculture
Mu	Traditional Chinese term for land area, equal to 1/15 of a hectare
N	Nitrogen
NGO	Non-governmental organisations
P	Phosphorous
PAR	Participatory action research
PGS	Participatory guarantee systems
PPB	Participatory Plant Breeding
SAAS	Sichuan Academy of Agricultural Sciences
SRI	System of rice intensification
T	tonne
Yuan	Unit of Chinese currency; equivalent to RMB or CNY

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1 Back to its roots: sustainable agriculture in China

By Seth Cook, Qiao Yuhui, Lila Buckley and Qi Gubo

Chinese agriculture currently faces major environmental challenges. China's applications of fertilisers and pesticides are among the highest in the world, which in turn has negative impacts on human health and the environment. Soil erosion and soil pollution are widespread, as is the loss of agricultural biodiversity as high-yielding hybrid crop varieties replace traditional landraces. Water scarcity affects many parts of the country, as evidenced by plummeting water tables in northern China. Meanwhile, food safety risks – exemplified by a series of well-publicised incidents such as the 2008 milk-melamine scandal – are a source of great public anxiety.¹

At the same time, the challenges that China is facing with respect to its food system do not solely hinge on the environment and public health. The rapid pace of urbanisation has led to a mass exodus from rural areas, with major implications for the availability of agricultural labour. Labour shortages in rural areas are a key issue throughout China, as in many other countries. Agriculture holds little appeal for young people, who are migrating to cities in large numbers. Many middle-aged farmers have also migrated to urban areas in search of better livelihoods and social benefits. The result has been that the rural population is increasingly made up of women and the elderly. Moreover, many villages are simply being abandoned. In the first decade of the 21st century alone, the number of villages in China fell from 3.6 to 2.7 million, a net loss of 900,000 villages (Yang, 2013: 141). As Yang warns, 'if there are no effective policies put into place to attract the younger generation into farming, China's ability to produce enough food for its people and sustain agriculture development as a whole, along with the overall development of China, will be severely threatened' (Yang, 2013:136). Given that sustainable production methods are often more labour intensive than conventional ones, the availability and cost of labour in rural areas is an important factor in determining the viability of different production systems.

China's agricultural practices also have important global ramifications. China has been among the top ten importers and exporters of agricultural goods since 2010, with imports

1. With less than one-tenth of the world's arable land, China accounts for about one-third of global applications of nitrogen fertiliser (Zhu, 2008). High pesticide use rates are also confirmed in 2013 data from the Food and Agriculture Organization of the United Nations (FAO), FAOSTAT Statistics Database, Agri-Environmental Indicators (<http://faostat3.fao.org>, viewed 13 December 2015). For issues of pollution and land degradation, including in agriculture, see Kong (2014), Smil (1984) and Smil (1993). For a recent examination of social, economic and environmental problems and transformations in China's food system, see Garnett and Wilkes (2014). For water resource issues, see Liu et al. (2001), Wang et al. (2007), Yuan and Shen (2013). See Pei et al. (2011) for an examination of the melamine milk scandal and its implications for food safety regulation.

becoming an increasingly important driver of global agricultural production and trade.² A shift towards more sustainable production methods would have benefits for China's environment, for public health both within China and beyond its borders, as well as for agricultural productivity in the long term. It could potentially also have positive ramifications for the global environment – particularly if it entailed reductions in greenhouse gases associated with the food system.

Fortunately, as this report demonstrates, there is a small but growing trend towards sustainable food production and consumption in China, witnessed by the rise in ecological farms, organic farmers' markets in major cities, as well as increasing emphasis on sustainability elements in Chinese policies related to agriculture. For instance, the relatively recent phenomenon in China of Community Supported Agriculture (CSA) is growing rapidly and there are now over 300 CSA farms scattered throughout the country.³ Agribusinesses focused on organic and green foods are increasingly common. This trend is being driven by burgeoning demand for 'safe' and healthy food, which is reflected in the rising market share of organic and 'green' products, both from domestic and imported sources. This report explores these emerging initiatives through a series of case studies, and draws out some key lessons and recommendations of wider relevance both for China and other developing countries.

1.1 What does sustainable agriculture in China look like?

The history of traditional agriculture in China stretches back thousands of years, and has laid a solid foundation for sustainable agricultural initiatives in the modern era. Despite very difficult circumstances of rapid population growth, resource scarcity and low per capita arable land availability, China has managed to maintain the productivity of its agricultural land. In his 1910 book 'Farmers of Forty Centuries: Permanent Agriculture in China, Korea and Japan', the American agronomist F.H. King introduced many ingenious examples of traditional Chinese agriculture to the world, and explicitly highlighted that the key to thousands of years of soil fertility was its adoption of 'an agriculture without waste' with no use of external inputs. As King (1911) describes, traditional Chinese agriculture included the return of all human and animal waste to the land, the use of legumes as green manures, the recycling of crop residues, composting, terracing, crop rotations and intercropping, and the use of a wealth of crop varieties to increase diversity, maintain soil fertility and prevent diseases and insect pests. These techniques, coupled with traditional forms of ecological agriculture, such as mulberry dike-pond sericulture and rice-fish-duck systems, enabled the maintenance of soil fertility and healthy agroecosystems over thousands of years of intensive cultivation (Schumilas, 2014).

2. Confirmed by data from the FAOSTAT Statistics Database (<http://faostat3.fao.org/browse/T//E>, viewed 13 December 2015).

3. CSAs vary in form, but generally involve an urban 'member' paying a lump fee for a share of the harvest of a local farm. CSAs allow upfront investments in farming activities and provide market stability to farmers, while allowing city residents to have direct access to seasonal produce grown by regional farmers. CSA equivalents developed originally in Japan (*teikei*, or "food with the farmer's face") and Europe (through biodynamic farming) in the 1960s, and have become popular in the US, and now increasingly elsewhere. For more information, see <https://www.biodynamics.com/content/community-supported-agriculture-introduction-csa> or <http://www.justfood.org/csa>. Data on the number of Chinese CSAs are from an interview with Cheng Cunwang, 11 May 2015.

Before the revolution of 1949, China's agriculture was a largely self-sufficient, traditional system. From the 1950s and 1960s in the context of industrialisation, however, the transition towards conventional agriculture began. In the 1970s and 1980s, the government made further efforts to modernise the nation's agriculture and increase productivity through mechanisation, improved plant breeding and high inputs of agrochemicals. These measures enabled food production to keep up with high population growth – a major achievement for a developing country with limited arable land (Wang, 1999). However, they also resulted in serious pollution, food safety problems, over-exploitation of water resources due to the significant increase in irrigation, excessive land reclamation, and heavy dependence on agrochemicals to achieve high yields. These side effects of conventional production not only pose a threat to the nation's agriculture; they also undermine public health and sustainable development overall. These problems have aroused the attention of scientists, policymakers and the managers of related industries, who are beginning to rethink the direction of China's agricultural development. Government and consumer concerns over food safety and environmental sustainability are spurring the development of a diverse array of sustainable agriculture approaches, supportive policy directives and labelling initiatives (Ye et al., 2002).

There are two overarching, related concepts in China pertaining to sustainable agriculture – ecological agriculture (*shengtai nongye*) and circular agriculture (*xunhuan nongye*) – neither of which have clear standards. Ecological agriculture in China – also known as Chinese Ecological Agriculture (CEA) – has been promoted by the Chinese government from the early 1980s, mainly through conferences, propaganda and the establishment of demonstration sites (Sanders, 2006). Ecological agriculture in China combines traditional, biological and organically-based agricultural production systems with modern science and technology, and at the same time represents an alternative to decades of conventional agricultural practices (Ye et al., 2002). By applying concepts of ecology and systems thinking, proponents of ecological agriculture in China have tried to use improved production systems such as vertical planting and biological control of pests and promote the use of household courtyards for growing vegetables, fruits and raising livestock. Whereas in the West, ecological agriculture emphasises low external inputs and eschews the use of agrochemicals, in China it prioritises high land productivity and allows for some external inputs of energy and agrochemicals, while seeking to reduce soil and water pollution from these inputs. This reflects China's need to keep agricultural productivity high in light of its large population and limited arable land base (Wang et al., 2007).

Circular agriculture mainly focuses on the reuse, reduction and recycling of materials and energy in agricultural production systems. Based on sustainable development thinking and circular economic theory, circular agriculture uses ecological engineering methods and environmental protection technology to control pollutants, reduce agricultural waste and environmental pollution in order to realise a positive cycle of ecology in agricultural production systems (Zhou et al., 2004). Circular agriculture has been promoted by the Ministry of Agriculture since 2006 and is mentioned specifically in the central government's 'No. 1 Document for Chinese Agricultural Development'.⁴ More than 1,400 circular agriculture demonstration projects have been established in 19 provinces and treatment processes for garbage, sewage, crop residues, human and animal waste have been developed.

4. <http://english.agri.gov.cn/hottopics/cpc/>

China also has a unique system of eco-labelling for food products. There are three official standards: organic (*youji shipin*), green food (*lüse shipin*) and hazard-free (*wugonghai shipin*), which focus on environmental protection and food safety at different levels. Green foods and hazard-free foods allow 'rational use' of chemical fertilisers and pesticides, whereas organic agriculture and organic products do not, and are more closely related to ecological agriculture in Western countries than the other two systems (Table 1.1). The sections which follow describe each of these production standards in China in detail.

Table 1.1 Organic, green food and hazard-free production standards compared

	Organic (<i>youji shipin</i>)	Green food (<i>lüse shipin</i>)	Hazard-free (<i>wu gonghai shipin</i>)
Year established	1994 (with national standards established in 2005)	1990	2001
Permits genetically modified organisms?	No	Yes	Yes
Permits synthetic fertiliser and pesticides?	No	Yes (only some kinds of chemical applications are permitted and amounts are regulated)	Yes (a wider range of agro-chemicals are allowed than for green food)
Residue testing	Yes	Yes	Yes
Initial force	Market (demand-driven)	Government and market	Government initiated
Certifiers and costs	Third party certification; 20–40,000 yuan (before new regulations in 2012)	Ministry of Agriculture— Green Food Development Centre; 10,000 yuan	Ministry of Agriculture—Centre for Agri-Food Quality and Safety; no certification fee
Traceability	Yes	No	No
Period of validity	One year	Three years	Three years
International / domestic market	Both	Both	Domestic

Source: Scott et al. (2014: 161)

1.1.1 Organic agriculture and organic products

Organic agriculture is a holistic system of agricultural production that aims to promote ecological balance, the cycling of resources and the conservation of biodiversity. Organic standards strictly prohibit the use of genetically modified organisms (GMOs) and their products, as well as synthetic chemical fertilisers, pesticides, regulators and feedstuff additives in agricultural production (IFOAM, 2012).

Chinese agriculture was entirely organic for most of its long history. Certified organic agriculture in China began for export in the 1990s, though is now gaining strength in the domestic market as well. The first product to be certified as organic in China was green tea from Lin'an, Zhejiang province, certified by the Dutch certification agency Skal in 1990,⁵ marking the launch of organic production in China (Sheng et al., 2009). Because of this history, modern organic agriculture in China is based on the concepts, standards, organisation, accreditation, monitoring and trade developed in the West (Guo et al., 2007).

The China National Standard for Organic Products was adopted on April 1, 2005. This standard was developed from the basic standard of the International Federation of Organic Agriculture Movements (IFOAM), the CODEX standard of the United Nations, the European Union EU2092/91 and the US National Organic Program (NOP) (Wang and Lu, 2012). Today, the China National Certification and Accreditation Administration (CNCA), belonging to the General Administration of Quality Supervision, Inspection and Quarantine (AQSIQ), is responsible for handling organic certification. The China National Accreditation Service for Conformity Assessment (CNAS) is also authorised to handle accreditation for certification bodies. As of December 2015, 24 certification bodies had been approved and accredited in the country.⁶

China has 2.1 million hectares under organic management (out of a total of 130 million ha), of which 1.3 million hectares are certified to China organic standards for the domestic market, and 0.8 million hectares certified by foreign certification bodies for export markets (CNCA, 2014). China's domestic organic market is the fourth largest in the world, with sales of organic food products estimated to be around US\$ 500 million per annum as of 2013.⁷ By early 2015, organic foods accounted for approximately 1% of the total Chinese food market (Chandran and Yoon, 2015).

The development of organic agriculture practices in China built upon the existing foundation of ecological agriculture and green food production (Scott et al., 2014). Organic products are becoming popular among middle-class consumers concerned about food safety. Since organic farming often entails decreases in crop yields compared to conventional production (Seufert et al, 2012), it has not received significant support from the central government, although some local governments are promoting it as a means of economic development for their localities. However, Sternfeld (2009) notes that there has been a shift in attitude on the part of the Chinese Ministry of Agriculture towards organic agriculture, partly because authorities have become more aware of the growing market opportunities for organic products in both international and domestic markets.

5. Now known as Control Union.

6. China food and agro-product certification information system, <http://ffip.cnca.cn/ffip/publicquery/orgSearch.jsp>.

7. www.chinaconnections.com.au/en/magazine/back-issues/73-novdec-2010/849-australias-share-of-chinas-organic-pie.

While it is growing rapidly, organic agriculture in China still faces major obstacles. Severe pollution of air, soil and water in urban and peri-urban areas means that it is difficult to meet the purity standards required for organic products and for land following the three-year conversion period. Widespread use of pesticides means that traces of these chemicals may still be found in land and food under organic management. Moreover, methods of pest management used in organic farming may not be effective when pesticides have already decimated populations of beneficial insects and birds. For this reason, organic farmers in China are often heavily dependent upon applications of bio-pesticides. On top of these environmental factors, the organic certification process is difficult for producers to navigate, and they also struggle to win the trust of consumers weary of food safety scandals (Sternfeld, 2009).

1.1.2 Green food certification

Green food is a unique food safety standard developed by the Ministry of Agriculture in 1990 in an attempt to alleviate severe the ecological impacts of intensive farming practices and to seek a more sustainable farming model appropriate for Chinese conditions. Green food production can incorporate limited amounts of agro-chemicals, although they may not exceed specified levels in the production environment and products (Paul, 2008). In 1992, the China Green Food Development Centre (CGFDC) was founded under the administration of the Ministry of Agriculture. Since then, CGFDC has been carrying out green food governance and certification as a government certifier with 60 designated product test agencies, 65 designated environmental monitoring agencies for production areas, as well as 36 provincial management authorities under its supervision.⁸

In 1995, green food was divided into two standards: Grade A and Grade AA. The Grade AA standard forbade synthetic chemical inputs and GMOs, making it closer to the organic standard (Lin et al., 2009; Thiers, 2006). Grade AA green food was later merged with the organic standard and has not been used in green food certification since 2008. In this sense, green food contributed to the development of organic farming in its early stage.

In 2007, the sales value of green food certified products stood at US\$ 20.7 billion (up from US\$ 2.9 billion in 1997), with an export value of US\$ 2 billion (Paul, 2008). By 2014, this figure had grown to US\$ 85 billion, with an export value of US\$ 2.48 billion, which represents an annual increase of 16.4%. The production of green foods has reportedly enabled more than 20 million farmer households to increase their incomes.⁹

8. www.moa.gov.cn/sydw/lssp/jg/zxjj/201110/t20111018_2358700.htm.

9. www.greenfood.agri.cn/zl/zyjh/201510/t20151029_4883053.htm.

1.1.3 Hazard-free certification

Hazard-free certification has been formally promoted by the Ministry of Agriculture since 2001. According to Taylor (2008: A348), 'hazard-free certification focuses on controlling illegal use of highly toxic agricultural chemicals and violations of pesticide residue standards.' The original impetus for creating the hazard-free agro-product standard can be traced back to conditions in China's food markets in the late 1990s: the low threshold for pesticide residues and other substances in the green food standard was too strict to be adopted widely. At the same time, a set of minimum standards was needed for food sold in mainstream markets (Scott et al., 2014).

In 2001, the Ministry of Agriculture launched the Hazard-Free Agro-Product Action Plan, designed to address food safety concerns and contamination by agro-chemicals. The hazard-free (also translated as 'pollution-free') agro-product standard was developed later than the green food standard and is less stringent. As Scott et al. (2014: 160) note, 'although hazard-free food does help to respond to food safety concerns, its weak standards mean that it does not constitute an ecological agriculture standard.'

About 21 million ha of arable land in China have been certified as hazard-free (Paul, 2008), including 33,000 enterprises and 80,000 products.¹⁰ As of 2007, the Ministry of Agriculture had developed 386 hazard-free agro-product standards. In 2014, the standards were simplified into production quality control standards for 13 categories of hazard-free agro-products and production site environmental evaluation rules were revised. As of 2015, the Agro-Product Quality and Safety Centre has 158 designated product-testing agencies and 184 designated environment monitoring agencies.¹¹

Unlike organic and green food products, hazard-free products are only for the domestic market. Nonetheless, unlike organic certification, both green and hazard-free food labels are promoted by the government. The government covers the cost of hazard-free certification, whereas for green food and organic agriculture certification costs must be borne by enterprises (Scott et al., 2014).

These three different certification systems correspond to different levels of environmental sustainability, with organic being the highest, hazard-free being the lowest, and green food somewhere in between. The existence of a gradation of certification systems gives consumers a range of choices. It is also beneficial for a developing country such as China to be able to gradually phase in higher standards, rather than having to meet the highest standards at the outset, which is unrealistic. However, the proliferation of standards makes it difficult for consumers, producers and even officials to understand the exact criteria for each certification system. The application process for certification is complicated and therefore not easy for farmers to undertake. Furthermore, the term 'ecological' (*shengtai*) has no specific criteria attached to it and can be used by anyone to label their products. These factors, together with numerous food safety scandals, have led to a lack of consumer trust in certified agricultural products.

10. www.aqsc.agri.gov.cn/zhxx/xwzx/201503/t20150320_136684.htm.

11. http://www.aqsc.agri.gov.cn/zhxx/xwzx/201503/t20150320_136684.htm.

1.1.4 Geographic labelling

In addition to the three certification systems discussed above, there are also a number of geographic labelling schemes in China. Geographic labelling can be a useful complement or alternative to sustainability certification, creating added value around an origin-based product (Blackmore and Keeley, 2012). Geographic labelling is known in China as 'produce with a geographical brand' (*dili biaozi chanpin*). Three authorities are in charge of the registration and supervision of geographic labelling, including The General Administration of Quality Supervision, Inspection and Quarantine (AQSIQ), the State Administration for Industry and Commerce (SAIC) and the Ministry of Agriculture. By the end of 2014, 1,588 products had been registered under geographic labelling schemes authorised by the Ministry of Agriculture,¹² and 1,923 products had been authorised by AQSIQ by the end of October 2015.¹³

1.2 This study: aims and approach

There is a growing trend towards sustainable agriculture in China and a growing body of research on this topic. There have been many studies of different agroecological production modes and some of them have developed evaluation systems to assess the benefits of ecological agriculture.¹⁴ There are several national and local research programmes and projects on ecological and circular agriculture, such as the 12th Five Year National Science and Technology Support Programme on the 'Science and Technology of Circular Agriculture',¹⁵ which is being funded by the Ministry of Science and Technology at a cost of more than 100 million yuan (US\$ 15.5 million). These studies mainly focus on the key technologies and modes of waste recycling, pollutant reduction and control, as well as technology integration and demonstration in different regions in China. While there are many successful examples of demonstration projects in China, few pay attention to who applies the technology or the driving forces behind their success. In short, there is a dearth of ground-level analysis of what these different approaches to sustainable agriculture look like in China, and their motivations, complexity and socioeconomic aspects and the factors which made them viable.

This report presents eight sustainable agriculture initiatives from around China, with the aim of exploring in detail the diverse alternative models of agriculture with which communities, local governments and companies are experimenting. The eight case studies were selected from seven provinces, representing a wide variety of geographies, levels of development, agricultural practices and leadership (see Table 1.2).

12. www.aqsc.agri.gov.cn/zhxx/xwzx/201503/t20150320_136684.htm.

13. www.chinapgi.org/news/3805.html.

14. For instance, see Li et al. (2008); Liu et al. (2010); Luo (2010); Shi (2003); Wang et al. (2007); Ye et al. (2002); Zhou et al. (2004); Zhu et al. (2000).

15. http://zihuan1.cau.edu.cn/art/2014/1/13/art_1527_238691.html.

The eight case studies fall into two broad categories: (1) those that have some level of sustainability certification; and (2) those that are not certified, but that are striving to practise 'sustainable agriculture' in some way (Box 1.1). The case studies include cooperatives, companies, CSAs, government-led and farmer-led initiatives. As China is a state-centric society, it is not surprising that many initiatives originated at different levels of government. Others began as commercial operations by agribusiness. Some were spearheaded by NGOs. Still others were pioneered by farmers or by idealistic urbanites wishing to take up farming as a profession. Of course, these categories are not mutually exclusive, and farms started by peasants or urban professionals may have also had government support.

Box 1.1 Defining sustainable agriculture in this study

The term 'sustainable agriculture' is used broadly in this report to encompass a number of different systems, which in fact represent a spectrum of sustainability. Treated holistically, sustainable agriculture should be economically viable, environmentally sustainable and socially just.¹⁶ Of course, this concept of sustainability is in itself contested (Pretty, 1998). Indeed, in our cases, different actors emphasise different aspects of 'sustainable agriculture' – with some focusing more on environmental aspects, some stressing the need to ensure food security and others emphasising aspects of social justice or the need to provide economic opportunities for rural people.

Our in-depth treatment of environmental, economic and social aspects of each initiative reflects our belief that, at a minimum, sustainable agriculture needs to include these three aspects.¹⁷ At the same time, in this report sustainability is conceived of as a continuum rather than an endpoint, and this is reflected in the fact that only one of the initiatives is practising fully certified organic agriculture. The inclusion of less rigorous certification systems such as hazard-free and green foods in this report does not constitute an endorsement of these systems. It is not our aim to assess the sustainability of each form of certification, but rather to investigate the extent to which different models – including various forms of sustainability certification – work for farmers and for rural areas.

To have chosen only organic farms as the subject of research would have been overly narrow and would have overlooked the diversity of pathways towards greater sustainability that are being taken in China today. Initiatives which are attempting to reduce applications of chemical pesticides and fertilisers can be considered to be on the road to greater sustainability, and hence also worthy of consideration in understanding the opportunities and barriers in realising sustainable agriculture in China. Hence our approach is pragmatic rather than purist.

16. See the World Commission on Environment and Development (1987) for one of the earliest definitions of sustainability. See FAO (2013) for a definition of sustainable agriculture which encompasses social, economic and environmental parameters.

17. One could also add climate resilience and cultural appropriateness to this list, but these aspects are not treated in any depth in this report.

In each case, we examine the motivations for adopting sustainable agriculture, the types of practices being used, what aspects of sustainability are being addressed (social, economic, environmental) as well as their environmental, economic and social impacts, the factors that have enabled them to be commercially viable and in some cases even scaled up, the role of local government and other actors, the challenges faced, as well as the implications for farmers' livelihoods and rural areas in the context of large-scale urbanisation and demographic change. The aim is to distil lessons learned and ultimately to provide insights for researchers, practitioners, and policymakers into how sustainable agricultural practices can be better supported, both in China and elsewhere. As China is a laboratory for development in many respects, its experience is highly relevant for other developing countries.

1.2.1 Methodology

The research for these case studies was conducted by two China Agricultural University (CAU) professors and their students, two researchers from the Chinese Centre for Agricultural Policy (CCAP), and two senior researchers from IIED. Most of the research was conducted between June and December 2014, with some additional research in 2015. Data collected in 2014 refer to the 2013 calendar year. Some of the research sites – such as Shanggula in Guangxi, Wanzai county in Jiangxi, Nanmazhuang in Henan and Shuanghe in Sichuan – are longstanding partners of CAU and CCAP. For these sites, data collected in 2014 build upon a more comprehensive foundation.

In four of the sites, surveys were conducted using a questionnaire. Survey sizes ranged from between 50 and 99 farming households in each site, and were complemented by structured and semi-structured interviews, government reports and secondary literature. In the two Shandong sites, 22 structured and semi-structured interviews were conducted with a range of stakeholders. In the case of Shared Harvest, data are mainly drawn from several lengthy interviews with the founders of the CSA, numerous WeChat¹⁸ exchanges, as well as the Shared Harvest website and secondary sources. In Guangxi, the overall study was based on a long-standing collaboration between the authors from CCAP and Shanggula village, which was supplemented with a few targeted interviews with community members. A more detailed description of the research methodology is given in each case study.

18. A popular Chinese social media and networking platform.

Table 1.2 Summary of the case studies

Ch. No.	Name of the cases	Location (province)	Type of sustainability certification system	Geo-graphical labelling	Coop-erative	Prime movers in adopting sustainable production methods
2	Nanmazhuang village	Henan	Hazard-free	No	Yes	Outsiders + villagers
3	Wanzai county	Jiangxi	Organic (mainly), green food, hazard-free	No	Yes	Local government
4	Guangxi CSA	Guangxi	Non-certified organic	No	Yes	Villagers + outsiders
5	Shared Harvest	Beijing	Non-certified organic	No	Yes	Urban entrepreneurs
6	Bishi Ecological Farm	Shandong	Hazard-free; Applying for green food certification	No	No	Entrepreneur / owner
6	Xincheng Chinese Yam Cooperative	Shandong	Non-certified	No	Yes	Cooperative leader
7	Zengjipan village	Ningxia	Non-certified	Yanchi Tan Yang	No (none involved in animal husbandry)	Villagers
8	Shuanghe village	Sichuan	Green food; transition to organic certification	No	Yes	Villagers + outsiders

The next eight chapters treat each of the case studies in detail, while the final chapter presents the lessons and recommendations drawn from all of these studies.



**Beans planted near the gate to a
farmer's courtyard**

© Zhang Li

2 Ecological agriculture in Henan province: a portrait of Nanmazhuang village

By Qi Gubo, Seth Cook and Zhang Li

2.1 Background and characteristics of the case study area

Visiting Nanmazhuang village (Henan province) in summer, one could easily mistake the village for a garden or recreation centre. Colourful flowers and fields of green lotus extend into the distance. Houses with red iron doors, roofs decorated in green, red and blue hues and courtyard gardens bursting with vegetables of every kind are as aesthetically pleasing as they are functional. When you meet people sitting and chatting around small grocery shops and supermarkets, you may wonder if this is a small town rather than a village. Although the verdant fields of green maize and newly ploughed plots equipped with sprinkler irrigation systems are typical of many villages in China's Central Plains, the development of sustainable agriculture in this village sets it apart from its neighbours. This case study examines the evolution and challenges of ecological agriculture in Nanmazhuang village (Box 2.1).

Box 2.1 Methodology

Most of the data in this case study are from fieldwork conducted by a team of four researchers from China Agricultural University (CAU) over a period of 14 days in July 2014, supported by ActionAid China. Some data were collected by CAU researchers prior to 2014, as the university has had long-term cooperation with the village since 2004. In July 2014, structured and semi-structured interviews using a questionnaire were conducted with 63 households, accounting for 16% of all households in the village. Resources mapping and annotation of historical events were also used to crosscheck data. Data collected in July 2014 are from the 2013 calendar year, unless stated otherwise.

Nanmazhuang village is located in a plateau area of Kaifeng municipality, Henan province. All villagers are ethnically Han Chinese. The total population of the village is 1,581 people in 392 households; 46% of villagers are female and 20% are older than 60 years of age. In 2013, the agricultural labour force consisted of 500 people, while 300 villagers worked outside the village for more than 6 months that year. Average annual per capita income in 2013 was 4,100 yuan.

The village has 2,860 mu (190 ha) of arable land. It obtained hazard-free certification in 2006 and produced 1,300 mu (87 ha) of hazard-free rice in 2013. The main crops in the village are rice, corn, wheat, lotus (combined with crab cultivation) and vegetables (see Figure 2.1 for a rough map of the spatial distribution of different crops).

Figure 2.1 Resource mapping of Nanmazhuang village, done by Mr. Fan on 17 July 2014



Water resources are unevenly distributed in the village, which affects households' yields. With good access to water, yields per mu can reach 550 kg (8.3 tonnes/ha) for wheat and 500 kg (7.5 tonnes/ha) for maize;¹ while with poor access to water and good soil, yields per mu are about 350 kg for wheat (5.2 tonnes/ha) and 250 kg (3.7 tonnes/ha) for maize. Land with good access to water and high quality soil only accounts for 30% of the total arable land in the village. As for rice production, it is highly dependent on the availability of water and drought can cause a decline in production levels.

The village leaders, one of whom is the Communist Party Secretary, are responsible for developing projects with government or enterprises and for improving the living standards of villagers. In the past, the village received subsidies for crop production from the central government, as well as other support such as electricity, irrigation systems, village roads and technology. However, all of these efforts only enabled agricultural production to break even, and villagers' incomes remained low. At the same time, collective awareness and collective actions were weak after the implementation of the household responsibility system in the late 1970s, which broke up the communes and distributed land to individual households.

1. Interview with Fan Yuzhong, 18 July 2014, Nanmazhuang.

One of the signs of this was the absence of public spaces for villagers to assemble, while another was the limited capacity for mutual aid and support.²

When outside researchers raised the idea of forming cooperatives and applying for hazard-free certification (see Section 2.6 on Motivation), village leaders were receptive, since they saw this strategy as a means of raising villagers' incomes, establishing collective institutions and garnering outside investment. As the Party Secretary observed, 'cooperatives were an experiment for making our village famous to attract more external resources.'³ Villagers were also receptive. Every household had a piece of land for growing rice. 'Since there are not many vehicles and factories in the area, the quality of soil, air and water are quite good',⁴ one villager observed. At the same time, pesticides were not used at all and fertiliser use was low, so it was not difficult for the villagers to commit to producing rice following the hazard-free standard.⁵

The production of hazard-free food has been a core activity of the Nanmazhuang Economic Development Cooperative (*Nanmazhuang jingji fazhan hezuoshe*), set up in September 2004 with the help of researchers from China Agricultural University and Renmin University. It began with 39 participating households, each paying a one-off membership fee of 300 yuan per household. In its first year the cooperative focused on three key activities: purchasing wheat seed, piglets and fertiliser. However, all these activities proved to be ill-fated, as wheat production plummeted following frost damage and the piglets died from swine plague. Villagers were also disappointed about the lack of a difference between the market price of fertiliser and the joint-purchase price, which villagers had expected to be lower than the market price.⁶

In May 2005, the cooperative created the Association of Nanmazhuang Hazard-Free Rice and the registered label Nanmazhuang, with certificates of commercial business, a hygiene license and tax registration. The association was set up to facilitate business operations and was managed as a department within the cooperative. Preferential policies for cooperatives, such as tax exemptions, helped the number of members to reach 400 by 2005, one year after the establishment of the association. The cooperative obtained a place-based certification from the Henan Agricultural Department, as well as a hazard-free certification from the Ministry of Agriculture. The village produced 700 tonnes of hazard-free rice in October 2005, but found it difficult to sell this rice at a favourable price despite tremendous efforts by all parties, including marketing assistance from university researchers (see Section 2.1.1).⁷ Realising that unprocessed rice is not easy to market even under the

2. After the establishment of the household responsibility system, usufruct rights for collective land were distributed to individual villagers, so the outputs from the land no longer belonged to the collective. Today villagers are busy with their own individual business and pay little attention to public issues such as the environment, entertainment, information exchange, etc. Collective action tends to be limited to mutual support during the busiest times of the agricultural season.

3. Interview with the Party Secretary, 17 July 2014, Nanmazhuang village.

4. Interview with villager, 18 July 2014, Nanmazhuang village.

5. Environmental assessment is the basis for testing hazard-free agricultural products. Heavy metal content is one key indicator for soil assessments; sulphur, nitrogen and fluoride are indicators for air assessment; heavy metals, nitrate nitrogen, total salt content and chloride are indicators for water assessment. Agricultural products are also assessed, particularly for pesticide and chemical fertiliser residues. The use of biological pest management methods and organic fertiliser are encouraged in hazard-free certification, and the hygiene and nutritional content of the products are supposed to adhere to a high standard (see Ministry of Agriculture, 2014).

6. Rather than buying production materials such as fertiliser individually, the farmers purchased them collectively, and they had expected to get a better price that way. However, even their combined bargaining power was not sufficient to obtain a lower price for inputs.

7. <http://news.sohu.com/20060104/n241260391.shtml>.

hazard-free brand, several cooperative members bought a rice processing machine to do primary processing, packing and marketing.

Following the launch of the China Farmers' Professional Cooperative Law in 2006, Nanmazhuang Ecological Agricultural Products Professional Cooperative (*Nanmazhuang shengtai nong chanpin zhuanye hezuoshe*) – hereafter referred to as the ecological cooperative – was registered in 2008. The village Party Secretary became the cooperative leader. The cooperative was renamed the Nanmazhuang Ecological Agricultural Products Cooperative in 2008 to emphasise its main focus. In addition to hazard-free rice, several new products were sold by the ecological cooperative, such as millet and black beans. Lotus cultivation combined with crab raising began in 2008 and expanded to 100 mu (6.7 ha) in 2010. Furthermore, the ecological cooperative registered the brand 'Happy Pig' in 2009 and began raising a local breed of pigs in 2010 using crop residues as feed. The cooperative also set up a Department of Mutual Financial Aid (*zijin huzhubu*) in July 2013 to allow members to invest their savings and obtain loans. This fund has attracted remittances from villagers working in urban areas and lends money to farmers who need funds during the production season.

2.1.1 Marketing the village's products

Promoting hazard-free products has not been a smooth process for the cooperative. While cooperation was eventually established between the Nanmazhuang Rice Association and Beijing Hualian Supermarket, it faced stiff competition from other brands of rice on the market. At the end of 2006, 13 cooperative members spent 1 million yuan on purchasing a rice processing machine and setting up a processing facility. These efforts garnered good profits in 2007, but profit levels could not be sustained in 2008. Another five farmers later bought this facility and started processing at a smaller scale. At the same time, they searched out markets for their rice, and signed contracts with many customers, including institutions such as banks and communications companies.

Marketing issues are a frequent topic of discussion by cooperative members and external personnel, such as researchers from China Agricultural University. Every year, students from various universities come to the village for practical training, and have helped design labels for the village's products. Efforts to build a robust brand gradually paid off.

Media reports as well as visits by county, municipal and provincial officials have helped the village's fame to grow. For example, in 2006, the media reported on hazard-free rice production in the village and how professors and students from CAU were assisting with the sale of hazard-free rice in big cities such as Beijing. Nanmazhuang Ecological Agricultural Products has now become a well-known geographical label. In addition to direct marketing linkages with customers and middlemen, shops have been established in Lankao county, as well as large cities such as Kaifeng, Zhengzhou and Beijing. The team responsible for marketing activities in the cooperative has developed over time, and the products sold have become diversified beyond just rice to include beans and lotus as well.



The Nanmazhuang rice brand

Access to markets is not a problem for most crops and there are always middlemen coming to the village to collect products such as wheat and maize. However, speciality products such as hazard-free rice and Happy Pigs require special marketing. After several years of trial and error, the collective has found marketing channels for hazard-free rice, but Happy Pig products are still marketed on an individual basis, partly because the number of villagers engaged in raising pigs is more limited than those engaged in rice production. More than 80% of the hazard-free products produced in Nanmazhuang are sold on the market (Figure 2.2).

Another marketing arrangement in the village involves customers from urban areas 'renting' a piece of land. Villagers help these urbanites with production activities; after harvesting, the latter have access to their products directly. About 10% of the land used for hazard-free production is under this type of arrangement.⁸

In October 2009, the village started eco-tourism activities. It held two tourism events, inviting people from urban areas to stay in the village and enjoy farming activities, fresh vegetables and local rice, crab fishing from lotus ponds and the charms of quiet nights and starry skies. In 2015, the Henan provincial government officially designated Nanmazhuang as a model site for eco-tourism, based on its previous activities in 2009 and 2010. This official designation is a kind of authorised brand for promoting the village to the outside world and can also be useful in attracting external resources.

8. This is not a common arrangement for hazard-free agricultural production or for use of village land in general.

2.2 Ecological sustainability

2.2.1 The practice of ecological agriculture in Nanmazhuang

Agricultural practices in the village combine modern technologies – such as mechanised ploughing and harvesting – with traditional ones, such as using compost and manure as fertiliser.⁹ Agricultural production has progressed over time from hazard-free rice to ‘organic rice’,¹⁰ the combined production of lotus and crabs, and planting a diversity of grain crops (*xiao zaliang*). Some biological pest control methods are used in the village, such as spraying water boiled with chili peppers, as well as some manual control of insect pests (eg catching rice skipper butterflies by hand). As the village adheres to hazard-free standards in its agricultural production, some use of agro-chemicals is permitted.

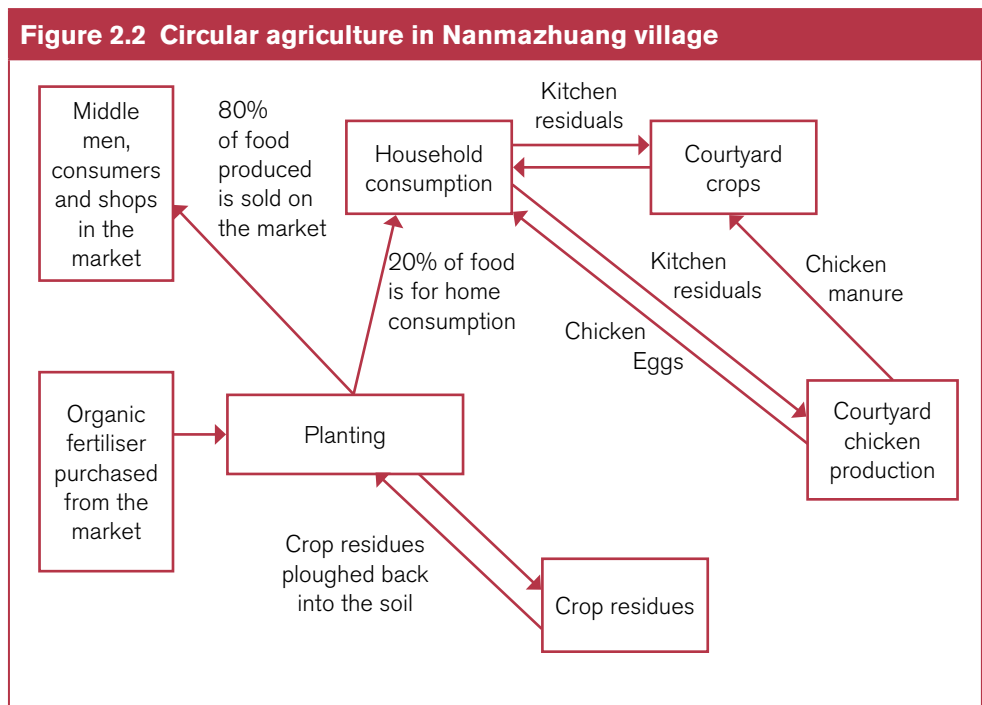


Irrigation tanks and mechanised production in a neighbouring village © Zhang Li

9. There are not many functioning biogas facilities in Nanmazhuang village. While nearly all households received subsidies to construct biogas digesters in 2004 and 2009, they have gradually fallen into disrepair and most villagers have abandoned them. Surveys conducted in 2014 and 2015 found only one household that is still using its biogas digester. This is a common problem with household biogas digesters in China. See Xia (2013).

10. The villagers refer to their production of rice as ‘organic’ because it does not use synthetic chemicals, but it is not formally certified.

Crop rotations are a common practice in Nanmazhuang village, involving maize-wheat and rice-wheat over a one-year period. Some villagers also intercrop wheat and cotton, but on less than 5% of the village's arable land. Inter-cropping requires more labour, which is a disincentive to its adoption where labour is scarce in the context of out-migration. Mechanised ploughing is practised on all of the village lands, and nearly all crop residues are ploughed back into the soil. The machines for recycling the stalks include a maize harvester and grinder, maize planter for deep ploughing and precision planting, wheat planter without plough and wheat stalk grinder. Few chemicals are used for hazard-free rice, but chemical fertilisers are used for other crops, such as wheat and maize. The average quantity applied is 50 kg per mu (750 kg/ha), which is the same as in other parts of China's Central Plains. Normally manure is used as a base fertiliser for planting, and organic fertilisers are purchased from the market by those farmers who do not have any animals. The system of circular agriculture practised in Nanmazhuang is shown in Figure 2.2.



Family courtyards are very important for meeting villagers' food requirements. No chemicals are used in the courtyards and all products are solely for household consumption. Animal manure is used for vegetable production, and maize and vegetable leaves are used for chicken production. Normally chickens and vegetables, such as green pepper, beans, cucumbers and Chinese cabbage, are produced in the courtyard area of 0.5–1.0 mu.



Villager watering vegetables near her courtyard © Zhang Li

Although villagers have been using many agroecological practices since 2005, they each have their own individual understandings of the meaning of sustainable or ecological agriculture. Out of 50 responses to the question of what sustainable agriculture is, 13 said they were not clear, 10 mentioned using fewer pesticides and fertilisers, 5 mentioned the protection of water resources, 5 mentioned the maintenance of soil fertility over several generations, 4 mentioned land consolidation and having sufficient labour for planting, 4 mentioned that their existing practices such as lotus and rice production are already sustainable, 4 mentioned the use of modern technology such as mechanisation, 2 mentioned returning crop residues to the fields, 2 mentioned the combination of cropping and animal husbandry and 1 mentioned weeding when there are weeds and applying pesticides when pests appear.

2.2.2 Advantages of ecological agriculture

Farmers believe that soil quality in their village is good due to their crop rotations, the reuse of crop residues and the application of organic fertilisers. They have not experienced the same soil compaction problems that have appeared in many other areas. Interviews with farmers revealed that 81% of households return crop residues to their fields and 100% of them are satisfied with this practice, 'because it fertilises the soil, saves labour and time due to the use of machinery and is clean'.¹¹ Most villagers interviewed (70% of interviewees or 44 out of 63 respondents) believe that sustainable agricultural practices such as crop rotations, hazard-free production methods and circular agriculture have positive impacts on the environment.

11. Interview with farmers, July 2014, Nanmazhuang village.

Concerning organic fertiliser applications, 35% of villagers interviewed (22 out of 63 respondents) said that they did not apply any. Within that group, 73% said that the reason is because they do not have any organic fertiliser. Another reason is that they do not think maize, wheat and other non-organic crops need it. Two respondents said that it is not easy to buy organic fertiliser and it is also very expensive.

Climate change poses direct threats to agricultural production in the village. For example, rice production was badly affected by a serious drought in July 2014. Farmers had to replant maize in their paddy fields in order to make up for the loss of rice, but maize did not grow well that year either. Villagers also sought help from the government in order to save their rice production, but they could not get immediate aid. Crop rotations and inter-cropping are helpful in adapting to climate change, though these practices cannot completely address the problem.

2.3 Economic sustainability

In Nanmazhuang village, agriculture contributes slightly more to villagers' incomes than off-farm activities. The ratio of income from farming activities and off-farm activities is around 5.1:4.9. Sufficient labour is crucial for sustaining agricultural activities but it is difficult to keep farmers (particularly young people) on the land given the opportunities to earn more money outside the village. In the words of farmers, if they could get more benefits from agriculture than from outside employment (*zhongdi geng huasuan*), then they would prefer to stay in the village and continue to cultivate the land. The fact that it is difficult to obtain the same or greater benefits from agriculture compared with off-farm work is one key reason why more and more farmers, particularly the young and middle-aged, are leaving the village. Out-migration enables villagers to earn higher incomes and gain easier access to public services. Therein lies the challenge for agriculture in general and sustainable agriculture in particular: in order to provide sufficient incentive for farmers to stay on the land, the economic returns from agriculture (as well as other social concerns such as the security that farmers obtain from retaining their landholdings) should at least equal if not exceed the income that can be obtained from off-farm activities.

2.3.1 Economics of rice production

Off-farm employment can provide at least 6,000 yuan over a four-month period (which is the growing season for rice). Barring risks from weather, such as the drought mentioned previously, it is more profitable to plant rice than to work off-farm, provided that farmers cultivate at least 10 mu (0.7 ha) of land. Farmers with 10 mu of paddy fields can earn around 6,200 yuan over a four-month period (Table 2.1). This is true even without including other income from farming. However, fewer than 20% of villagers have this much land; most villagers plant only 1–5 mu of rice, which is much less profitable than off-farm work. Table 2.1 shows the income differential between hazard-free rice production and off-farm work.

In 2013, rice production was 300 tonnes, all of which was sold at the market price of 3 yuan/kg, around 1 yuan higher than conventional rice. At this price, farmers' net income was around 820 yuan per mu of paddy land, after deducting input costs (but not labour costs). Factoring in the opportunity costs of villagers' labour (at 50 yuan per day) that they could obtain from other work in the area, net income from rice production was 620 yuan per mu

(Table 2.1).¹² When considering the average landholding area of 1.4 mu per capita, this income looks even less competitive with off-farm employment opportunities.

Table 2.1 Profits from hazard-free rice versus off-farm work over four months in 2013 (yuan)

Activities	1 mu of hazard-free rice production	5 mu of hazard-free rice production	10 mu of hazard-free rice production	Off-farm work
Net profit (incl. labour)	620	3,100	6,200	6,000
Net profit	820	4,100	8,200	6,000

Source: data collected in July 2014 based on the average data of sample interviewees.

Net profit = Quantity of rice sold multiplied by price, minus the cost of all production inputs except labour costs

Net profit (incl. labour) = Quantities of rice sold multiplied by price, minus the cost of all production inputs including labour

2.3.2 Economics of free-range pork production

Another source of income for farmers is the Happy Pig brand. Happy Pig is free range pork and the brand (*kuailie zhu*) was registered in 2009. The profits per pig amounted to 655 yuan in 2013 (Table 2.2). Production costs include purchasing piglets, home-made fodder from maize, from maize, compound feed and labour inputs.

The differences in profits between Happy Pig and conventional pig raising are shown in Table 2.2. While theoretically the profits of raising Happy Pigs are higher than raising conventional pigs, this depends on them being sold at the higher price, otherwise the profits would only be around 34 yuan per pig.

Table 2.2 Net profits of Happy Pig production compared to conventional pigs, 2013 (yuan per pig)

Item	Buying piglets	Home-made fodder from maize	Compound feed	Labour	Total cost	Total income	Net profit
Happy Pig	280	960*	120	285	1645	2300	655
Conventional pigs	280	0	924	214	1418	1679	261

Source: data collected in July 2014; data reflect the averages of interviewees' responses.

*960 yuan is the market price of the maize used to feed pigs over a period of one year in 2013. Villagers could have sold this maize on the market had it not been used to feed their pigs, hence it is included as a cost above.

The price of each conventionally grown pig is 14.6 yuan per kg and for each Happy Pig is 20 yuan per kg; piglets are 28.4 yuan per kg, maize is 2.4 yuan per kg, compound feed is 3.3 yuan per kg. At sales time, a pig weighs around 115 kg and Happy Pigs need around

12. Interviews conducted in July 2014.

200 days to reach sales weight, while conventionally grown pigs only need 150 days. For the purposes of comparison, Table 2.2 assumes the scale of production is around 35 pigs per household. In fact, most households raising Happy Pigs could not reach such a large scale, while conventional pig production among specialised households in the region often exceeds this scale.

Making the brand profitable has been difficult.¹³ In 2010, 30 pigs were sold before the Spring Festival and supply was insufficient to meet demand. In 2011, villagers raised 120 pigs, but less than 80 pigs were sold after the Spring Festival. The price of Happy Pig brand pork was double that of ordinary pork, so only those clients who trusted the Nanmazhuang brand were willing to pay this price. And the only marketing channel in Zhengzhou was through the recently established Guoren Supermarket that did not have enough experience to advertise its goods. The rest of the pigs that could not be sold were used to produce smoked meat since 'we didn't want to sell the live pigs at that time because its quality deserves a higher price', as the Party Secretary explained.¹⁴

2.3.3 The role of the cooperative

The practice of ecological agriculture is not limited to agronomic aspects; it is also closely tied to the organisation of the cooperative. The ecological cooperative has helped the villagers develop their brand of rice and to sell it at a higher price. The direct benefit to farmers of involvement in the cooperative is higher incomes. Per capita income increased by 35% from 2009 to 2013 for cooperative members, compared to 32% for non-members.

The cooperative operated at little cost in the beginning. One source of income for the cooperative was the difference between the price at which it sold commodities on the market, and the price it gave to farmers after the harvest. About 70% of this income was distributed to cooperative members and 30% was retained for use by the cooperative. It started a mutual aid-fund that supports the establishment of marketing channels. The cooperative produces, processes and packages hazard-free products. In 2013, it sold 300 tonnes of rice, 1,600 tonnes of lotus, 15,000 kg of black and mung beans and obtained profits of 3.6 million yuan, 70% of which were distributed to cooperative members.¹⁵ In 2014, it continued to operate in the same way. The geographical brand of Nanmazhuang, along with marketing channels in cities, have made it more and more competitive.

The cooperative provides access to seeds, organic fertiliser and other production materials. The villagers find the market for agricultural inputs confusing and so they prefer to obtain most of their inputs from the cooperative.

One villager was proud to note that at the start of the operation of the ecological cooperative, 'our family planted organic rice on 5–6 mu of land, we participated in the village cooperative that purchased seeds and fertiliser for us and also purchased and processed our products together. The price of rice sold through the cooperative is 0.25 yuan higher per kg than that in the market, so it is more profitable than planting wheat or maize.'¹⁶

13. <http://finance.ifeng.com/news/region/20120209/5551941.shtml>

14. Interview with the Party Secretary, 17 July 2014, Nanmazhuang.

15. http://www.kf.cn/kfrb/html/2014-03/28/content_159817.htm

16. http://www.kf.cn/kfrb/html/2014-03/28/content_159817.htm

The cooperative has also provided training for members (Table 2.3). Officials from the county and township government always participate in these training and exchanges, even though the funding might not be provided by the government directly.

Table 2.3 Training received by members of Nanmazhuang Cooperative

Year	2008	2009	2010
Number of training courses	20	35	28
Business & management training	11	15	13
Agronomic training*	9	20	15

Source: data from the ecological cooperative.

*Includes training in ecological techniques for planting, fertilisation, weeding and harvesting during the crop growing season, particularly for hazard-free rice.

2.4 Social sustainability

2.4.1 Managing shortages of land and labour

Villages in this part of central China have undergone fewer changes in recent decades compared to rural areas in eastern China. Staple crops such as rice and maize still form the mainstay of agricultural production. The flat land of the region facilitates mechanisation, unlike mountainous areas of south and southwest China. The division of the land after decollectivisation into plots averaging 1.4 mu per capita poses a potential obstacle to the use of agricultural machinery, but this has been overcome through joint ploughing and harvesting. Labour-saving approaches of this kind have become increasingly important as more and more villagers leave the area to seek outside employment.

Overall, the practice of sustainable agriculture has had contradictory effects on labour demand. The use of machinery for recycling crop stalks has reduced the labour required for harvesting and dealing with crop residues. This practice has also decreased pollution and waste from crop residues while contributing to soil nutrients. On the other hand, certain sustainable agricultural practices – such as catching crop pests by hand – has required more labour, particularly for women (see Box 2.2 below).

The high cost of labour is a key concern in Chinese agriculture today, as is the ageing rural labour force. There are more than 300 people above the age of 60 in Nanmazhuang, accounting for approximately 20% of the village's total population of 1,581 people. Though the amount of labour required for wheat and maize production is limited due to mechanisation, transplanting paddy fields still requires a lot of labour (3.5 working days per mu), and this normally has to be hired. Labour costs can reach 180 yuan per mu on average for the entire planting season. Harvesting lotus is also labour-intensive and requires meticulous work. Harvesting entails 10 working days per mu at 100 yuan per day. As most young people have left the village in order to earn more money, it is very difficult to find sufficient labour to gather manure and deliver it to the fields. There are some migrant labourers from other areas but not enough to meet demand, so villagers cope with this situation by exchanging labour. The ecological cooperative model is one means of coping with labour shortages, in the sense of promoting labour exchange and collective marketing.

Village collective lands have been contracted to individual households since the end of the 1970s when the household responsibility system was introduced. Though the land is still owned by the village as a collective, individual households have usufruct rights during the period of the contract, which normally lasts 30 years and can be extended. Around 50% of villagers have 3–10 mu (0.2–0.7 ha) of land; 35% have 10–30 mu (0.7–2 ha); 10% have less than 3 mu, and only 1.5% have around 30 mu (2 ha). Those with up to 30 mu of land leased it from relatives and friends who have left the village for long-term off-farm work. Land consolidation has occurred gradually after more and more people left the village for off-farm work. Currently, about 10% of land in the village has been transferred among the villagers. As mentioned earlier, different crops are planted in separate but integrated fields. Thus large fields planted with the same crop actually belong to many different households. For maize and wheat production, machinery is brought to the village for collective ploughing and harvesting, but the farmers purchase inputs and sell their produce individually. However, the purchase of inputs and sale of lotus and rice products go through the ecological cooperative. In both farming and animal husbandry, most of the production activities are in the hands of individuals, whose approach to preparation and marketing activities may be different.

Box 2.2 The effects of ecological farming from a woman's perspective

Aunt Yu started growing rice in an ecological manner in 2010. Her rice yields using an ecological approach were originally only half those of conventional agriculture. In order to solve this problem, she changed the spacing in the rows and between rows, which increased her rice yields. She also applied several hundred kilos of chicken manure to her wheat fields. As a result, her wheat yields are higher than for other villagers who did not use this method. She also avoids using chemical pesticides to treat aphids; instead she controls them using water boiled with chili and cigarette butts;¹⁷ furthermore, with no chemical fertiliser applications, she observed that the leaves are less attractive to aphids. In her rice paddies, the rice skipper butterfly became a problem in the absence of pesticides; this meant she had to go to the fields every day to capture the butterflies by hand. She also had to weed manually several times, all of which is very time consuming.

In spite of these issues, she says she is very happy to avoid using pesticides. In the past, spraying pesticides always irritated her skin. Though the instructions for applying pesticides told farmers to wear masks and gloves, nobody followed them. Women in the village did not make noodles or steamed bread after spraying pesticides and they claimed it took three days to get rid of the smell. Furthermore, she is 60 years old and cannot carry the pesticide container very long. As a result, it took her two days to spray her household's 8 mu of land, which she could previously finish in one day. Eschewing pesticides has had health benefits for women, but at the same time, they have to spend more time weeding and catching pests.

She has persuaded her neighbours to apply the same approach and plans to raise ducks in her paddy fields to control insects. She also discussed buying pig manure for her fields from those households raising Happy Pigs.

Source: http://blog.sina.com.cn/s/blog_66a2fc2e0100vr3m.html

17. Nicotine is a potent pesticide, so this practice may not be wholly consistent with ecological agricultural principles.

2.5 The role of government

In recent years there has been policy support for sustainable agriculture at the provincial level (guided by some key policies, listed in Table 2.4). With respect to ecological agriculture, there have been certain changes in policy. The earlier more general discourses about developing high quality and hazard-free food have now evolved into specific targets for hazard-free, green food and organic products that need to be achieved in the future.

The development of the ecological cooperative in Nanmazhuang also reflects local responses to policy. Members' products have expanded beyond hazard-free rice to encompass a variety of ecological agricultural products such as lotus, millet, beans, and pigs. The cooperative advertises its ecological rice using the term 'organic rice', which reflects the provincial government's policy targets for hazard-free, green and organic products, even though its rice is not officially certified organic.

The local government also implements provincial and county policy requirements. For instance, after a policy was announced prohibiting the burning of crop residues, villagers discontinued this practice. If farmers did not comply with this rule, they would be fined. At the same time, along with official encouragement, cooperatives specialising in machinery, harvesting and planting machines were organised by some farmers using government subsidies, particularly in north and east China. Mechanisation has eased the process of returning crop residues to the soil. Techniques for doing this have also been taught and extended along with the mobilisation of machinery. Gradually in Nanmazhuang, ploughing crop residues back into the soil has replaced the burning of crop residues.

Farmers receive subsidies from the government for two practices: returning crop residues to the fields and building biogas tanks. In addition to subsidies, government support mostly takes the shape of visits by officials, including the visit in 2009 by then Vice President Xi Jinping (see next section). These visits have greatly raised the profile of the Nanmazhuang brand and attracted interest from consumers.

Some 20% of villagers surveyed mentioned the need for further government support including funding, access to organic fertiliser after stopping animal husbandry, official government recognition of superior farming practices, as well as guidance on marketing ecological products.

Table 2.4 Key Henan province policy documents on sustainable agriculture

Year	Name of document	Contents
Feb 2005	No. 16, Henan Government Office (2005)	Enhancing the high quality production of wheat
March 2005	No. 19, Henan Government Office (2005)	Developing hazard-free animal products
Aug 2005	No. 67, Henan Government Office (2005)	Developing a circular economy
Dec 2011	No. 96, Henan Government (2011), Announcement of Henan Government Issuing The 12th Five Year Plan of Environmental Protection of Henan Province	Encouraging farmers to use organic fertiliser, bio-pesticides, IPM, appropriate fertilisation; targets for 80% of key crops to apply formula fertilisation ¹⁸ by 2015 and for hazard-free food, green food and organic food to be 30% of total agricultural products by 2015
Jan 2013	Announcement of Henan Government Issuing the Outline of Construction Planning of Henan 'Ecological Province'	Circular agriculture, 'four uses of stalks' (fertiliser, feed, raw materials for processing and industry, energy) Developing green and ecological agriculture; target for hazard-free food, green food and organic food to be 30% of total agricultural products by 2015 (same as December 2011 policy document)
Dec 2013	No. 65, Henan Government (2013), Henan Province Guidance on Accelerating the Promotion of Strategic Adjustment of Industrial Structure	Ecological agriculture development, innovating community supported agriculture, urban farming, etc.
April 2014	No. 39, Henan Government (2014), Henan Province 2014 National Economic and Social Development Plan	Encouraging and facilitating the development of family farms, agricultural cooperatives, professional farmers and enterprises Accelerate the comprehensive use of crop residues

18. Formula fertilisation refers to applications of fertiliser based on soil data and fertilisation experiments; fertiliser is applied according to specific amounts of N, P, K and other elements, at specified times and according to specified methods.

2.6 Motivation for ecological agriculture

Initially, it was researchers from Beijing who came up with the idea of organising farmers to obtain greater benefits from agricultural production and marketing activities. For example, a well-known researcher from Renmin University had been involved in rural reforms in many parts of China, inspired by the rural reconstruction movement spearheaded by Liang Shumin and Yan Yangchu in the 1930s. Another researcher from CAU was sent to Kaifeng County in 2004 as vice-governor of the county.¹⁹ She is a sociologist who believes that theories only have meaning when they are applied in practice. The logic behind the activities of these researchers was to import external ideas and methods to stimulate the endogenous strength of the villages (He, 2007). Researchers like her have been longstanding observers of Chinese rural development and they wanted to apply what they had learned to rural realities in China. After they arrived in Nanmazhuang, they organised meetings on village development with farmers and encouraged villagers to set up a cooperative. After the establishment of the cooperative, they started to look for appropriate activities that could be undertaken by the cooperative to bring more benefits to farmers. This village is located in the Central Plains of China, where maize and rice are the main crops and fewer pesticides are used in vegetable production than in other areas. The outside researchers suggested that the village apply for hazard-free certification for rice production from the Ministry of Agriculture, with the expectation that this rice could be sold at a higher price in the market.

These researchers persuaded the villagers to set up an ecological cooperative to implement ecological agriculture in the village. Simultaneously, they also helped to explore marketing channels for the cooperative to sell ecological agricultural products at a good price. Through their advocacy and involvement in the policy-making activities of the county government, these researchers helped the village to garner government support. Other outside intellectuals who were interested in farmers' organisations and sustainable development were also attracted by the initiative in Nanmazhuang. They came to the village and contributed their time in different ways. Gradually the ecological cooperative attracted investors' attention due to its relatively high returns from grain processing.

Township and county government officials together with other outside researchers also provided assistance through exchange visits and training for cooperative members. The objectives of 'new rural construction', introduced in 2005,²⁰ were a priority for the local government, so officials were exploring innovative approaches that could integrate agricultural development with the improvement of villagers' livelihoods. What the researchers suggested exactly matched officials' expectations. For officials, sustainable agriculture contributes to food security at the national level while improving village and household livelihoods at the village level.²¹ Xi Jinping's visit to the village in 2009 when he was Vice President further spurred these efforts. As the new village secretary (*cun zhishu*) Xiao commented during an interview in 2014, 'Comrade Xi Jinping came to Lankao in 2009 and encouraged Nanmazhuang to become famous as an outstanding ecological village in China. We are doing circular agriculture and green animal husbandry. Our ecological pigs

19. This was undertaken through a cooperation programme between universities and cities designed to facilitate rural development which was initiated by the central government. This type of programme is still ongoing.

20. This is a strategy in the 11th Five Year Plan and promoted by the central government which includes developing production, improving living standards, enhancing village civilisation, beautifying the rural environment and improving democracy. Guided by this strategy, there are corresponding funds provided by the government.

21. Interview with township leader, July 2014.

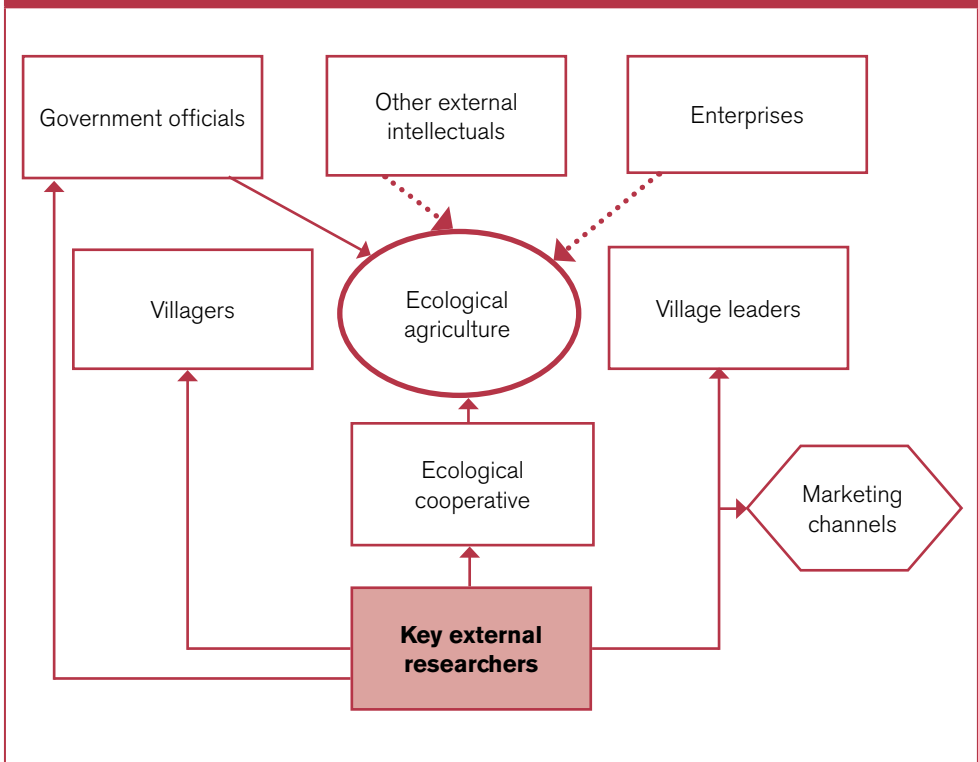
are sold in Beijing, and organic rice is sold to large restaurants. So Secretary General Xi's expectations are gradually becoming a reality:²²

The shared motivation for the various people involved in ecological agriculture has been to generate added value for agricultural products. One researcher from CAU helped villagers to sell their rice and pigs directly to urban consumers. As she explained, 'some consumers choose to purchase hazard-free pork and I could not persuade all consumers to buy it. But compared with pigs fed with additives, hazard-free pork has its own market demand because people are taking care of their health more and more' (Fang, 2010).

Enterprises joined in as well after realising the potential benefits of rice processing. The rice processing factory set up by the cooperative in 2007 also processed other grains and sold them on the market at a better price than that of unprocessed products. After seven years of efforts, this factory accounted for more than 50% of the cooperative's income. In 2014, one enterprise from the county saw the profits of this factory and decided to invest in it.

Figure 2.3 summarises the influence of the various actors on ecological agriculture in Nanmazhuang. While external actors played a key role in the development of ecological agriculture in the village, the driving force behind it was still the villagers themselves.

Figure 2.3 Key external actors and their role in ecological agriculture in Nanmazhuang



22. http://news.eastday.com/eastday/13news/auto/news/china/u7ai965057_K4.html

'When the pigs sell well in the market, the villagers do not know the reasons. We need to look more closely at market conditions and broaden the marketing channels', a CAU researcher commented. As she explained, 'we intellectuals should help the villagers to market their products and to communicate the benefits of ecological products to consumers'. However, this researcher insists that the recent achievements of villagers in ecological agriculture were due mostly to their own exploration of different approaches, rather than the role of outsiders such as herself. 'They do things in their own way, and not necessarily in the way I had imagined. Establishing the processing factory, building brands and other initiatives were thought up by the farmers themselves and not suggested by me, and these efforts have paid off', she said.²³

2.7 Challenges faced

This section discusses several challenges for sustaining and promoting ecological agriculture in Nanmazhuang.

2.7.1 Labour shortages and out-migration

The balance between labour demand in agriculture and off-farm work is a universal problem in China. Opportunities for work outside of the village dampen the enthusiasm of the villagers (particularly young people) for ecological agriculture. Yet ecological agriculture has higher labour demands – for weeding, pest control, etc. Even though the mechanised processing of crop residues can save labour, it increases the cost of inputs. For example, the total cost of processing and ploughing in crop residues is around 135 yuan per mu (2,025 yuan/ha). Some households avoid these costs by doing this work by hand. But this increases the burden on women and older people.

One way to address the labour challenge is to employ more people in non-farm work in the village, such as marketing. As mentioned before, there are already several supermarkets selling ecological products from Nanmazhuang; commerce and eco-tourism could be one way to attract young people back to the village.

2.7.2 Sourcing inputs

A second challenge is fluctuating input prices. Villagers have to buy seeds²⁴ and chemicals on the local market. Almost all maize seeds bought on the market are commercial strain numbers 619, 007 and 008 developed by the Monsanto Company. The agro-chemicals that villagers purchase are also the corresponding package ones. Their prices keep rising and farmers have no control over these market forces. At the same time, there is no easy access to manure or organic fertiliser in the market and villagers have limited manure supplies from their own animal husbandry. As one villager observed, 'there is not enough manure now for cropping. The main reason is there is not so much animal husbandry in the village. The second reason is that young people do not like to collect manure and older people are not able to collect it. The third reason is that human waste from urban areas and manure from pig and cattle farms could not be easily transported to rural areas where it is needed.

23. Interview with Prof. He, 11 April 2015, China Agricultural University.

24. For maize, rice and wheat villagers generally purchase hybrid seeds on the market. For a few crops like buckwheat, villagers save their seeds and use them in future years.

Therefore, most households in Nanmazhuang apply organic fertiliser in paddy, lotus and cotton fields, which have higher requirements for soil fertility, but not for wheat and maize.²⁵

The cooperative has helped members to secure supplies of seeds and organic fertiliser. The Party Secretary explained that if a villager plants at least 5 mu of contracted rice (following the requirements of the cooperative), then the cooperative provides them with seeds and organic fertiliser. This is the minimum amount of land required for getting support from the cooperative. Production is supposed to follow the regulations of 'organic farming' required by the cooperative (although farmland in the village does not have organic certification), and the cooperative purchases rice from the villager. If the villager does not want to take the payment in cash, this money can be saved in the cooperative and the cooperative pays interest to the contracted villagers.²⁶

2.7.3 Low marketing capacity

A third challenge is marketing the village's agricultural products. There has been consistent support from outside of the village, particularly from researchers and social activists, and the current management structure of the cooperative is based on long-term market research. In light of its multiple functions, the cooperative needs more capacity in planning, risk management, personnel management, marketing, information management, etc.

Volunteers assist the marketing team every year, but they do not stay for long. For example, the brand of Nanmazhuang Rice was designed and revised by several university student volunteers. There have also been college graduates who have helped the village leader or participated in the management of the ecological cooperative. However, these young people are only in the village for a brief period and cannot contribute significantly to the management of the cooperative. If training in ecological agriculture and organisational management could be integrated into the basic training programmes for civil servants, this would be helpful for building the capacity of the ecological cooperative as well.

Another important question is how to raise consumer awareness of healthy food and the importance of ecological farming. Integrating educational outreach into the marketing strategy of the cooperative is one way, but this requires more resources.

2.7.4 Dearth of research on ecological farming techniques

A fourth challenge is the need for technological innovation related to ecological agriculture. Current research and development focusing specifically on ecological agriculture is limited and therefore it is difficult to find appropriate technologies that can be applied in the village. Regular exchanges between agricultural practitioners, researchers, policymakers, and farmers are key to developing a more active and innovative R&D system for ecological agriculture.

According to villagers, there is little training in Nanmazhuang on ecological agriculture. Some villagers mentioned innovations by neighbouring villages or entrepreneurs, such as ecological pig raising using crop residues as fodder in neighbouring Batou Township. This involves special procedures for processing crop residues into feed and was introduced by a company in Zhejiang which has marketing outlets in Beijing and Shanghai.

25. Interview with villager, 18 July 2014, Nanmazhuang village.

26. news.dahe.cn/2014/03-21/102698239.html

2.8 Conclusions

In terms of its geographic, ethnic and social characteristics, Nanmazhuang is a typical village in China's Central Plains. However, the development of sustainable agriculture in this village sets it apart from its neighbours. In Nanmazhuang, external researchers played a pivotal role in introducing new concepts (eg cooperatives and hazard-free certification), obtaining policy support and developing marketing channels for the products of ecological agriculture. Over the past decade, it has been crucial to have outsiders with greater access to information and commitment to preserving cultural heritage and environmental protection who could help initiate ecological agriculture practices in the village, because villagers lacked information and access to ecological technologies, relevant policies and marketing channels. Thus the role of outsiders has been to facilitate information sharing and build bridges among various actors, as well as providing inspiration. The capacity for understanding the implications of policies and villagers' behaviour, and the ability to communicate with various actors and bring people together are key qualities brought to the village by outside researchers. The researchers' long-term commitment to village activities and local governance have also been important.

At the same time, outside influence would not have had much impact had villagers themselves not shown so much receptivity, initiative and persistence. While the idea of establishing cooperatives came from researchers, the actual management and activities of the cooperative have been undertaken by the villagers themselves. In spite of disappointments with the cooperative's three initial activities (purchasing wheat seed, piglets and fertiliser), villagers continued to experiment with different production and marketing arrangements until they eventually succeeded. Establishing a processing factory, building brands and other initiatives were thought up by farmers, rather than by outsiders.

In addition to the catalytic role played by informed, committed outsiders and proactive, enterprising villagers, Nanmazhuang offers a number of other lessons for sustainable agriculture and rural development that are of wider relevance:

- **Cooperatives have an indispensable role to play in rural development and the promotion of sustainable agriculture.** In Nanmazhuang, the cooperative has had a critical role in responding to and mitigating price fluctuations, in providing a platform to share ecological knowledge and raising awareness among members and in creating opportunities for villagers to access external resources. The cooperative has helped villagers to develop their own brand of rice and to sell it at a higher price. It assisted households raising 'Happy Pigs' to obtain contacts with marketing companies, as well as making linkages with enterprises interested in the processing factory for ecological produce. The cooperative also organised eco-tourism, bringing in visitors from outside. Finally, it facilitated collective social activities such as dancing. The case of Nanmazhuang illustrates that cooperatives can raise farmers' incomes, facilitate collective action and make possible economies of scale even where smallholders don't have much land.
- **Larger scale production is possible even in the absence of external capital investment.** In Nanmazhuang, the presence of the cooperative as well as the mechanisation of ploughing and harvesting on a collective basis have enabled villagers to enjoy some of the advantages of scale while still retaining their individual household usufruct rights to land. The practice of ecological agriculture with mechanisation can

save labour and can facilitate larger-scale farming. Providing support for cooperatives is one way to achieve the dual goals of increased productivity and ecological sustainability without the need for outside investment. Thus even within the context of existing local resources, it is possible to achieve larger-scale production.

- **Attention to branding has been crucial.** Nanmazhuang Ecological Agricultural Products has become a well-known geographical label in China, and the products have become diversified beyond just rice to include beans and lotus as well. Speciality products such as hazard-free rice and Happy Pigs require special marketing. The case of Nanmazhuang brand rice illustrates that it takes considerable time and effort to build a reputable brand, and this is difficult to do without some outside support. Media reports as well as visits by county, municipal, provincial and even central government officials have helped put Nanmazhuang on the map and greatly enhanced its efforts to establish a brand.
- **Policy support can accelerate the extension of agroecological practices,** as has been the case with ploughing crop residues back into the fields. Farmers' own practice of reusing crop residues got a significant boost as a result of government support, particularly the use of machinery to save labour. Moreover, a ban on the burning of crop residues has effectively discouraged this practice in Nanmazhuang.
- **Eco-tourism offers a potential income-generating stream for villages** such as Nanmazhuang which are practising sustainable agriculture. Until now tourist visits to the village have been organised by the cooperative, which has had concrete benefits for villagers. In the future though, it may be preferable to organise tourism at the county level or beyond, to take advantage of all that the region has to offer and to attract more tourists. For example, visits to Nanmazhuang could be combined with excursions to well-known scenic and historical sites in the area. The local tourism development strategy could include visits to several villages in the region demonstrating different ecological practices, rather than just to Nanmazhuang.

The case of Nanmazhuang is an example of the expansion of commodity chains from within villages rather than through outside investment. In this case, it took place within the context of hazard-free production and geographic labeling, but it is possible to do this with green food, organic or other systems as well.



Intercropping rice and soybeans

© Qiao Yuhui

3 The development of organic agriculture in Wanzai county, Jiangxi province

By Qiao Yuhui, Seth Cook, He Xueqing and Friederike Martin

3.1 Background and characteristics of the case study area

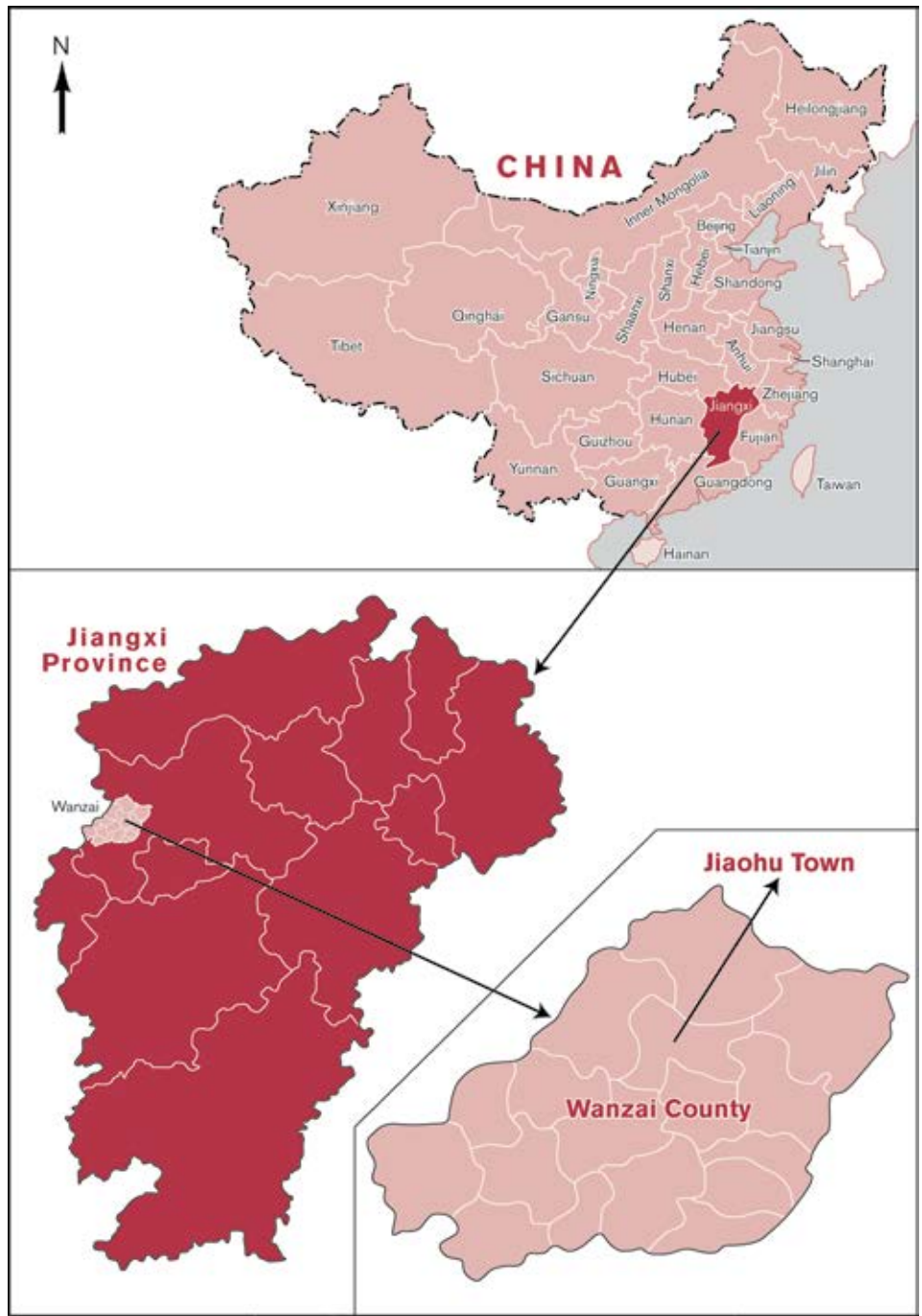
Organic agriculture began 15 years ago in Jiaohu township, before expanding to several other townships in Wanzai county. Today Wanzai county is a national organic agricultural demonstration area – one of about 30 nationwide. Although this area is rich in natural resources, its economy is still relatively undeveloped. Over the years, organic agriculture has become the main strategy for income generation, environmental protection and economic development in the region. The county's experience and model can serve as a useful example for other areas in China (as well as other countries) with similar environmental and economic conditions.

Wanzai county is situated in the western part of Jiangxi province (300 km west of the provincial capital city of Nanchang; Figure 3.1). The county covers 1,718 km², including 33,300 hectares (ha) of farmland and 108,649 ha of forest. According to 2012 figures, it is home to 531,116 people.

The climate is moderate and sub-tropical, with an average annual precipitation of 1,600–1,800 mm and average annual temperatures of 14.7–17.4° Celsius. Average annual sunshine is 1,693.2 hours with 227–257 frost-free days. The topography is hilly and local soil types are mainly Dystrochrept (yellow earth) and Haplic Luvisols (yellow brown earth). These natural conditions are suitable for agricultural production, with the main crops being rice, ginger, sweet potato, soybean, peanut, garlic, and radish.

The case study area of Jiaohu township is located in the mountainous north of Wanzai county (Figure 3.1). It covers 86.55 km², of which 848 ha is farmland (770 ha of paddy fields and 78 ha of dryland fields). It includes seven villages with about 3,000 households (11,000 people) and each family cultivates 0.27 ha on average. Organic agriculture was initiated in Jiaohu township in 1999; our study focuses mainly on the development of organic farming in this township and compares its benefits with other areas in Wanzai county.

Figure 3.1 The case study area



3.1.1 Methodology

The main methodologies used in the study were semi-structured interviews with key stakeholders, as well as a household survey. Wanzai county was originally selected as a case study in 2007 for an Asian Development Bank Institute project carried out by China Agricultural University (CAU) and other organisations to clarify the extent to which organic agriculture can contribute to the Millennium Development Goals (MDGs).¹

In 2014, CAU carried out follow-up research in the same part of Wanzai as that of the Asian Development Bank Institute study. The research involved three fieldtrips (each of about five days) in July, September and November 2014. Questionnaires were hand-delivered and completed in the interviewers' presence – a process which took about 30 minutes. The questionnaires were first tested in June 2014 in Wanzai county with about 20 organic farmers and revised before the July trip. In September 2014, seven people from CAU split into three groups to carry out the survey. One last trip was made in November 2014 to verify the data collected during the September trip and to interview more farmers. This approach ensured a good understanding of the villages and the validity of data.

The research took place in three townships in Wanzai county (Jiaohu, Xinyuan and Chixing) that have been practising organic farming for different lengths of time. In each township, three villages were selected for farmer interviews. Additionally, three villages practising conventional agriculture in Chixing township were studied as a control group.² A total of 99 farmers (73 organic and 26 conventional) were randomly selected for interviews with the help of village leaders. Local cooperative members and village heads were also interviewed to obtain general information about the cooperative or villages. Farmers were divided into three types: small-scale organic farmers, large-scale organic farmers and conventional farmers. Small-scale farmers were defined as those with up to 10 mu (0.7 ha) of land per household, both owned and rented. Large-scale farmers were defined as those with over 10 mu of land.³ They generally have to hire workers, as a household would not have sufficient labour to manage this amount of land by themselves. There were no large-scale conventional farmers involved in our survey. Basic information about these three types of farmers is presented in Table 3.1.

The small-scale organic farmers tend to be a little older than the others and also had more farming experience (30 years on average). In terms of educational level, 72.3% of small-scale organic farmers and 73.9% of large-scale organic farmers had attended secondary school, while only 42.3% of conventional farmers had. Organic farmers in Wanzai thus have higher levels of education on average than conventional farmers. On average, large-scale organic farmers had more than 10 times the amount of land held by small-scale farmers, while conventional farmers had the least amount of land. While all the large-scale organic farmers are involved in cooperatives, most of the small-scale farmers are not.

1. www.adb.org/sites/default/files/publication/156048/adbi-wp193.pdf.

2. Conventional farmers are defined as those farmers using agro-chemical inputs.

3. By global standards, 10 mu of land (0.7 ha) is hardly a large farm; in fact, it can be considered quite small. However, given that the average landholding in the four organic groups in Wanzai county is between 3.6 mu and 6.4 mu per household, a household with 10 mu has relatively ample landholdings. Therefore, we have labelled those households with over 10 mu of land as 'large-scale farmers' for the purposes of this study, even though it doesn't correspond to global standards of farm scale.

Table 3.1 Farmers interviewed in Wanzai county during the field survey, 2014

Item	Small-scale organic farmers	Large-scale organic farmers	Conventional farmers
Township	Xianyuan/Jiaohu/ Chixing	Xianyuan/Jiaohu	Chixing
Farmers interviewed (no.)	50	23	26
Average age (years)	54	51.5	52
Educational level ^a	2.1	2.24	1.77
Average arable land area (mu) ^b	4.88	59	3.53

^a Educational level: 1 = primary school, 2 = middle school, 3 = high school

^b Mu is a Chinese measurement of land area; 1 mu = 1/15 ha

3.1.2 The agricultural context

According to a 2012 report on Wanzai county,⁴ the county's grain production area was 50,000 ha with an annual yield of 281,000 tonnes. The area planted with organic rice was more than 5,000 ha and rice with green food⁵ certification accounted for another 8,000 ha. Animal husbandry accounted for 32% of Wanzai's agricultural gross domestic product (GDP). The county's 376,000 pigs produce large quantities of organic fertiliser, which is a critical input for sustainable agriculture. Rabbits and sheep are also very common in the area.

Hazard-free certification⁶ emerged in late 2013 in Wanzai. In 2014, eight areas of certified hazard-free crops (a total of 233 ha) were established around the county by farmers with support from the local government. Cash crops such as rice, corn, vegetables, lily flowers, and soybean have received the hazard-free certification. These crops are contracted with and mainly sold to local processing companies, such as Jiangxi Jinyuan Agriculture Development Co., Ltd., and are marketed solely in China.

Green food has a longer history in Wanzai than hazard-free food. In 2002, Jiangxi Wanzai Qiannian Food Co., Ltd. started to grow green food products and the first plots were certified in 2004. Today, about 8,000 ha of rice fields are officially certified and 12 companies produce or process green food. Most companies that process organic agricultural produce also have a green food production section, such as Jiangxi Yiwanjia Organic Agricultural Development Co., Ltd. and Jiangxi Jinyuan Agriculture Development Co., Ltd. Most of these companies have a ratio of 30–40% of green food and 60–70% of organic produce. On the

4. www.moa.gov.cn/ztl/xdnysfq/jyj/201302/t20130204_3215187.htm.

5. Green food is a food quality standard in China that is less strict than organic standards. See the description in Chapter 1 and Scott et al. (2014).

6. 'Hazard-free' is a type of certification in China which is less strict than green food and organic certifications. See the description in Chapter 1 and Scott et al. (2014). Hazard-free products were the basis for food safety standards initiated by local governments in the 1980s, and then formally promoted by the Ministry of Agriculture from 2001.

whole, Wanzai county pays more attention to the development of organic agriculture than to green food or hazard-free products, as described in the next section.

3.1.3 Organic agriculture takes root

Prior to the adoption of organic agriculture in Wanzai county, rice was the main staple crop and was cultivated using synthetic agro-chemicals. That portion of the rice harvest not consumed locally was sold on the market.

The case study area was traditionally a ginger-producing region. In the late 1990s, the Jiaohu township government leader (*xiang shuji*) met the general manager of export company Fujian Longhai Jinfu Food Co. Ltd, which organised the processing and trade of ginger for export. During their meeting, they discussed the organic market in western countries and how to grow products organically according to international standards. This led to a decision to produce organic ginger on a limited scale in Jiaohu township; however, it turned out to be impossible due to the small, scattered plots and the buffer zone required in organic rules.

In 1999, the town's branch of The People's Congress voted to convert the entire township to organic production (with government encouragement) in order to address this problem, and banned all synthetic agrochemicals from entering the township. The local government formulated ecological agricultural development plans and implementation measures, which included the diversification of crop varieties, soil fertility improvement (e.g. green manure planting), and pest control (e.g., protection of animals like frogs and cats which eat pests, inter-cropping and other agronomic measures). Not only was the town government the initiating force, it also supported the process by training farmers and disseminating new technologies, collecting produce and handling the marketing of organic products.



Rice production in Jiaohu township © Friederike Martin



Vegetable production © Friederike Martin

The first test plot of 3.3 hectares was organically certified in 2001. By the end of 2002, all arable land in Jiaohu township had completed the conversion to organic farming. From 2004, production shifted towards more profitable cash crops such as ginger, soybeans and scallions. In some villages such as Dongjiang, traditional paddy terraces were converted to fields for strawberry production. About 32 kinds of crops have been organically certified, including ginger, rice, soybean, strawberry, scallion and bamboo.

In December 2005, Jiaohu township was designated as a national organic food production base by the State Environmental Protection Agency (now the Ministry of Environmental Protection).

3.1.4 Organic agriculture spreads throughout the county

Encouraged by the positive development of organic production in Jiaohu township, in 2003 the Wanzai county government initiated a five-year development plan for its organic agricultural sector with the motto 'ecological county – enriching the people with organic agriculture'. This five-year strategy aimed to promote an organic agricultural industry centred on Jiaohu township. The Wanzai Organic Food Office was also established and has been in charge of developing organic farming in this county ever since, including spreading organic agriculture to neighbouring townships in similar mountainous areas, such as Gaocun, Xianyuan, Lingdong and Chixing. All of the agricultural area in Gaocun and Xianyuan townships and some villages in other townships have now been converted to organic production.

By 2013, 17,000 households in 48 villages in 11 townships were growing organic cash crops. Wanzai county had a total of 5,400 ha of organic farmland by the end of 2014. Today organic agriculture is the county's main development strategy, and has also been one of the major sources of income since 2003 (Jiang and Huang, 2011). This strategy has strengthened the confidence of local organic companies. Besides Fujian Longhai Jinfu Food Co. Ltd., several other local organic food processing enterprises have been attracted from all over China to invest in Wanzai county, including Jiangxi Jinyuan Agriculture Development Co., Ltd. (since 2006), and Jiangxi Ever Bright Agriculture Science and Technology Co., Ltd. (since 2012). The latter has invested a total of US\$300 million.

Wanzai is now one of China's major organic food production centres, gaining the titles of *First County in the South for Organic Agriculture* in 2005 and *National Certification Demonstration County* in 2011 (Jiang and Huang, 2011; CNCA, 2014). In 2012, the Ministry of Agriculture also designated Wanzai as one of 153 national modern agricultural demonstration zones. Covering an area of 2,000 ha, the demonstration zone features organic and ecological agriculture and integrates agricultural science and technology extension with production and agro-ecotourism.

3.1.5 Contracts and cooperatives

The introduction of the household responsibility system⁷ and the dissolution of collective agriculture occurring nationwide in the early 1980s allowed households to contract and manage agricultural plots by themselves, but it also meant that small farmers lacked any

7. Beginning in 1984, the household responsibility system awarded contracts to use land (but not private ownership) to rural households for 15 years and opened the door for farmers across the country to sell surplus production. These contracts were extended in 1993 for 30 years, and then extended through the Land Administration Act in 1998 for another 30 years, suggesting that the state has no immediate intention to either re-collectivise or privatise land (Whyte, 2010: 11).

kind of collective organisation. In response, from 2004 onwards the central and local governments began to promote the development of professional farmers' cooperatives. By the end of 2013, the number of farmers' cooperatives had reached 957,000 nationally, encompassing 72 million households (Ma, 2014).

With the development of organic farming in Wanzai county, farmers' cooperatives and private enterprises were established from 2005 and became involved in organic production and processing. In each village, several cooperatives have been set up with official support from the government. In 2011 there were about 256 cooperatives in Wanzai (Zhang, 2011), and by 2014 the number had reached 419.

Organic production and marketing are organised in three main ways in the case study area, described below:

1) Contracts between individual farmers and processing companies, mediated by local government

In Jiaohu, most households' organic products are traded through the public company (Jiaohu Organic Food Development Co, Ltd.) established and owned by the township office. In this model, the processing company cooperates with the township government and villages to help them organise farmers into groups for organic production. Private processing companies sign contracts with the township office, and in most cases these contracts specify a specific amount of organic produce to be delivered the following season at a guaranteed minimum price and with certain quality specifications. These contracts commit companies to purchasing a certain amount of ginger, soybeans, rice or other cash crops at a contracted price, and the township office (public company) makes the arrangements with individual farmers, who are then assured of a market and price premium before the planting season.

At the beginning of each growing season, the township office asks farmers to report the quantity of organic products likely to be produced and signs a contract with them at a fixed price. The processing company will then distribute seeds and organic inputs to farmers according to this plan. The amount of organic produce varies every year. To ensure compliance with organic standards, companies offer training, seeds and inputs. Additionally, technical personnel check farmers' fields and documents, as well as interviewing farmers on a regular basis. They also test organic produce for chemical pesticides and heavy metal residues before acquiring the produce.

2) Collaboration between farmers' cooperatives and processing companies

The development of the organic food industry has helped build ties between enterprises and farmers through cooperatives. This approach helps to produce profits, lower risks and improve the quality of organic farming. Companies and cooperatives sign a contract specifying the quantity and price of a certain cash crop for the following season. Cash crops are planted by cooperative members according to the contracts with companies. Cooperatives usually provide seeds, organic fertiliser and pesticides, training, and technical guidance to their members.

Most of the cooperative members are large-scale farmers (those with 10 mu or more of land per household), who usually have better technology and sales channels than small-scale farmers and who can devote a larger percentage of their production to commercial sales rather than for their own consumption. Farmers can also invest money in their cooperative fund. This gives cooperatives more financial flexibility, while farmers receive interest and greater benefits.

3) Organic companies lease and manage land

As the number of processing companies involved in organic farming has increased, the production of raw materials for processing has become more important. Even though they cooperate with households and cooperatives, it is hard for companies to manage hundreds of small households in terms of quality control and produce enough raw materials. For this reason, some companies have set up their own production bases for raw material production such as rice, ginger, soybeans, etc. Renting land is the first step in establishing a production base.

As many Chinese farmers have migrated to cities or other provinces for work, agricultural land has been abandoned. Companies often seek assistance from the local government to rent agricultural plots from farmers at a rate of up to 350 yuan (US\$56)⁸ per mu per year. In this procedure, the government acts as intermediary and mediator in the event of misunderstandings and disagreements. Each enterprise can decide what crops to cultivate according to market demand and hires farmers to work on the land.

3.1.6 Marketing organic products

Before 2005, 90% of Jiaohu township's organic products were produced for export. Since 2006, with the development of the domestic organic market, rice has also become an important cash crop. In addition to certified rice, ginger, soybeans, strawberry, scallion, yam and other cash crops are produced both for the domestic market and for export.

Organic households market 30% of their rice on average. Jiaohu township is a long way from urban markets so their perishable produce, such as vegetables, cannot be sold directly to consumers. For this reason, most produce is sold to local organic processing companies.

Organic products receive higher market prices than conventional products. In 2006, the price of organic rice was almost twice that of conventional rice. While this price premium has since stagnated or slowly decreased, organic prices can be still 20–80% higher than conventional prices.

The development of markets for organic products in Wanzai county is an ongoing process. With the development of organic farming, several agro-processing companies have been attracted to establish processing plants in Wanzai. Overall, 12 organic companies are involved in the organic trade in Wanzai county, both for domestic and overseas markets (Table 3.2).

8. Exchange rate of 20 January 2014 (1 yuan = US\$0.16), www.xe.com.

Table 3.2 The main companies engaged in organic production, processing and trade in Wanzai county

Company	Product	Investment type / year started organic agriculture	Markets
Fujian Longhai Jinfu Food Co., Ltd.	Ginger	Private, foreign capital / 2000	Hong Kong, Italy, France
Wanzai Qingye Food Co. Ltd.	Bamboo shoot	Private / 2003	Japan
Wanzai Jinjiang Organic Food Co. Ltd.	Ginger	Private / 2003	Germany, US
Jiangxi Jinyuan Agricultural Development Company	Soybean, shallot, strawberry	Private / 2004	US, European domestic
Jiangxi Jinjia Cereal Co., Ltd.	Rice	Public stock / 2005	Domestic
Jiangxi Wanzai Qiannian Food Co. Ltd.	Sour jujube	Private / 2005	Domestic
Jiangxi Yongkang Rice Industrial Co., Ltd.	Rice, processed rice products	Private / 2007	Domestic, export
Jiangxi Kangqiang Organic Agriculture Development Co., Ltd.	Rice, soybean, ginger	Private / 2010	Domestic
Wanzai Deshun rice processing factory	Rice	Private / 2010	Domestic
Jiangxi Wanzai Maoling Oil Tea Industrial Co. Ltd.	Tea tree oil	Private / 2012	Domestic
Jiangxi Shuosheng Ecological Agricultural Sci. and Tech. Co. Ltd	Pork	Private / 2012	Domestic
Jiangxi Ever Bright Agriculture Science and Technology Co. Ltd.	Vegetables, fruit	Private; capital from H.K. 2012	Hong Kong, EU; domestic

During the field research, three of the 12 companies were visited: Jiangxi Wanzai Jinjiang Organic Food Co., Ltd., Jiangxi Yongkang Rice Industrial Co., Ltd. and Jiangxi Jinyuan Agricultural Development Co., Ltd. (hereafter referred to as Jinjiang, Yongkang and Jinyuan, respectively).

Jinjiang was founded in 2001 and specialises in ginger processing. It was one of the earliest companies to get involved in organic agriculture in Wanzai. It has two product categories – wet and dry – and 95% of its products are organic. Sixty per cent of the fresh ginger used in its processed products comes from Jiaohu township, and 30% from

Xianyuan township. Wet products, such as ginger syrup, have a production volume of about 200 tonnes and are destined entirely for the German market. Dry products, such as candied ginger, have a production volume of 450 tonnes, and are mainly destined for the European Union (EU) market (60%), North America (30%) and the Middle East (10%). Jinjiang's total output value is 25 million yuan (US\$4 million) with an export value of US\$3 million in 2013.

Yongkang was established in 2004 and began growing organic rice in 2007. In 2013, Yongkang purchased 50% of its organic rice from Jiaohu township (5,000 tonnes), 40% from Gaocun township and 10% from Xianyuan township. Yongkang also has 200 ha of its own land, which is rented from local farmers. Contracts are worth 400 yuan (US\$64) per mu per year for a period of five to ten years.

Yongkang has 20 retail stores nationwide where around 60% of the organic rice is sold, and an additional 10% is sold via the Internet or in supermarkets. Some rice is processed into organic rice maltose and organic protein powder, both of which are still in an early phase of development and will be launched for export. In 2013, 2,000 tonnes of organic maltose were exported to the USA (50%), Hong Kong (20%) and Europe (30%).

Jinyuan Company was established in 2004, with financial support from investment and development institutions, such as the US International Finance Corporation (IFC), the German DEG and the French Proparco. Its registered capital amounts to US\$39.33 million with a total investment of US\$100 million. Its main organic products on an annual basis include scallion (70–80,000 tonnes), soybean (15,000 tonnes), strawberries (7,000 tonnes) and rice (8,000 tonnes) from Jiaohu, Xianyuan and Gaocun townships. Its products are certified organic according to regulations in Japan (JAS), the EU and the USA (NOP); they are also certified Kosher and HACCP (Hazard Analysis and Critical Control Point). Ninety per cent of the organic scallions are exported to Europe and 10% to the US. Soybeans are exported to the US, Europe, Japan and also sold on domestic markets. Organic rice is mainly sold in supermarkets in large cities or through the Internet to domestic markets. A certified organic agricultural area of 3,533 ha is currently managed and farmed by the Jinyuan Company in Wanzai county.

In the last three years, all three companies had an average profit margin of 10% in spite of rising input prices. Domestic market share has grown due to rising incomes in China. Jinjiang Company and Jinyuan Company both mentioned that they have a good market and were able to meet market demand.

3.2 Ecological sustainability

Organic agriculture can help to preserve biodiversity and soil fertility while reducing pollution, eutrophication and greenhouse gas emissions (Pimentel et al., 2005; Mäder et al., 2002). Agroecological practices are very important in organic agriculture to ensure stable ecosystems and to increase productivity. The practice of organic agriculture in the study area – including the ban on chemical pesticides – supports the preservation of biodiversity. Our surveys and interviews indicate that farmers have realised the positive effects of organic agriculture in their region in terms of increasing biodiversity and soil fertility, eliminating contact with chemical fertilisers and pesticides, as well as producing safe food for household consumption. Moreover, the use of livestock manure in organic households is more efficient

than in conventional households (less waste), thus reducing risks of eutrophication of water bodies (Qiao et al., 2014).

3.2.1 Ecological measures adopted by farmers

Organic farmers in Wanzai maintain and improve soil fertility by growing green manures, applying animal manure (from pigs, sheep and cattle) and practising crop rotations. Rice is usually rotated with other crops such as soybeans, rye grass or safflower. After rice is harvested, safflower is planted during the winter season and eventually tilled into the soil. Some farmers also flood rice paddies to kill pests and diseases.

Our field surveys showed clear differences between the organic and conventional farms in the use of agroecological methods such as composting, intercropping and insect traps and also in the diversity of crops grown and livestock reared (Table 3.3). Moreover, efforts to maintain soil fertility through the use of legumes as intercrops and other soil conservation methods, such as mulching, were significantly more widespread in the organic villages. It is evident when visiting the organic villages that widespread experimentation in methods for biological pest-control and soil fertility improvement is taking place, which again presumably will benefit biodiversity and environmental protection (Qiao et al., 2009).

Table 3.3 Use of agroecological practices in organic and conventional households in Wanzai county (average per household)

Agroecological methods	Organic farmers	Conventional farmers	P values ^a
Number of agroecological methods used	7.5**	5.1	<0.0001
Number of soil conservation methods used	4.9*	4.2	0.019
Portion of land planted with legumes (%)	21**	4	0.0004
Fertiliser use (kg) per mu	109	192	n.a.
Amount of organic fertilisers purchased (kg)	464**	15	0.0002
Manure use (kg/ha)	21,190**	12,656	0.001
Number of crops planted	12.4*	11.0	0.033
Livestock diversity	5.2	4.2	0.128
Area with applications of chemical pesticides (%)	0	40	n.a.
Area with applications of natural pesticides (%)	29	0	n.a.

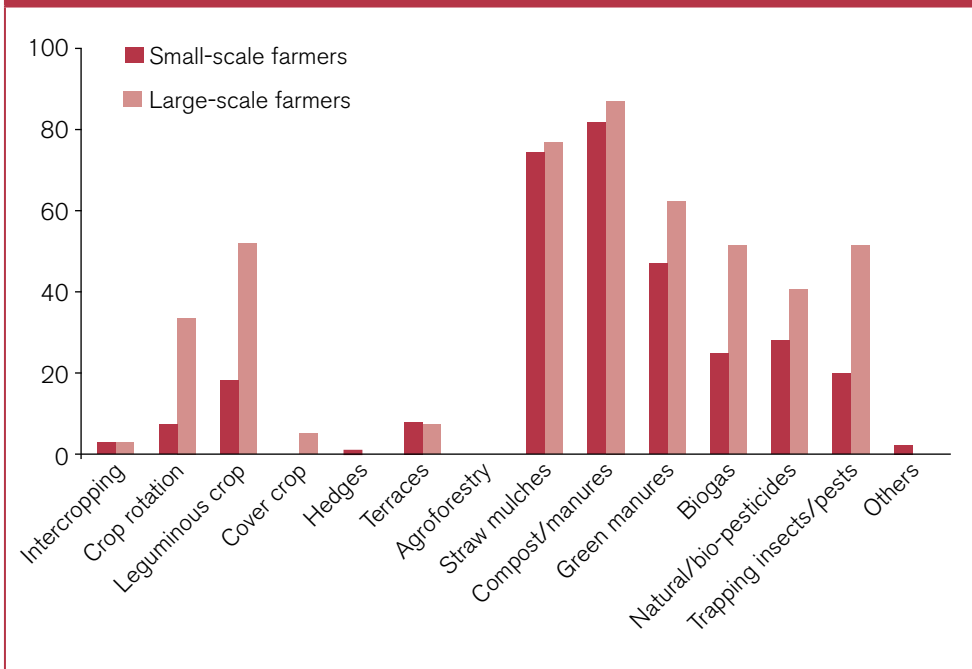
Notes: ^aP values denote a statistically significant difference at 5% * and 1% ** levels;
Source: Qiao et al., 2009



Ecological measures applied in organic farming: intercropping (left) and mulching with green manures (right) © Qiao Yuhui

The 2014 survey found that the small and large-scale organic farmers interviewed used four or five different ecological farming practices on average. The most popular practices among small and large-scale farmers respectively were organic fertilisers (81.9%; 80%), use of straw as mulch (74.4%; 64%), green manures (47.1%; 64%), natural pesticides (28.3%; 40%) and biogas digesters (24.9%; 48%) (Figure 3.2).

According to Figure 3.2, large-scale farmers use more agro-ecological practices than small farmers. This implies that small-scale farmers may need to receive further training to broaden their knowledge of agroecological practices, as they can enhance soil fertility, improve ecosystem functions and therefore increase yields. They can also protect water resources from pollution and reduce energy needs for fertiliser production.

Figure 3.2 Use of agroecological practices by small-scale and large-scale organic farmers (% of farmers)

3.2.2 Environmental perceptions

In general, interviewees perceive organic agriculture very positively. Both large and small farmers recognise the benefits of organic farming, such as better health (88%; 80%) and positive impacts on the environment (48%; 56%). Small farmers also stated that organic farming allows them to avoid contact with chemicals (40.7%) and improve soil fertility (24.9%).

According to observations by organic farmers and local extension officers during the interviews, there has been a great improvement in biodiversity (e.g., birds, reptiles, amphibians) in the villages after conversion to organic production, as compared with the past when they used synthetic pesticides and chemical fertilisers.

3.3 Economic sustainability

Rice is the most important staple crop in Wanzai county and makes up the largest share of the cultivated area for all the farmer groups in the study (4.36 mu for small-scale farmers; 41.5 mu for large-scale farmers and 3.12 mu for conventional farmers per household in 2014). Since 2005 it has also been the main organic product in Wanzai. Given its importance to the region, an economic evaluation of rice production was done for the three different groups of farmers (Table 3.4).

Table 3.4 Rice yields of different farmer groups during the field survey, 2014

Item	Small-scale organic farmers	Large-scale organic farmers	Conventional farmers
Rice output (t/ha)	5.63±0.81	6.03±0.96	6.8±0.77
Rice output (kg/mu)	375±54	402±64	453±51.5

Table 3.4 shows that small-scale organic farmers had the lowest yields at 375 kg/mu (5.63 t/ha), followed by large-scale farmers at 402 kg/mu (6.03 t/ha). Conventional farmers had the highest yields at 453 kg/mu (6.8 t/ha), explained by the higher applications of chemical fertiliser. Their yields are about 17% higher than small-scale organic farmers and about 11% higher than large-scale organic farmers.

3.3.1 Net economic value of rice on a per land unit basis

As most of the large-scale organic farmers contract directly with processing factories, they normally receive higher prices than small-scale organic farmers (4.2 yuan/kg, compared to 3.4 yuan/kg on average). For conventional rice, the price is only 2.8 yuan/kg (Table 3.5).

The gross value of organic rice is highest for large-scale organic farmers. While it is lower for both small-scale organic and conventional farmers, the price is almost the same for both categories. This signifies that the price premium can compensate for the lower yields of organic rice. Small-scale organic farmers have the lowest input costs (including seeds, fertiliser, pesticides, machinery, transport and irrigation; Table 3.5). Input costs were highest for large-scale organic farmers because they use more organic fertiliser and lease more land. Input costs were also high for conventional farmers, due to their use of chemical fertilisers and pesticides.

Without considering labour or land rental costs (discussed below), large-scale organic farmers have the highest net economic value of rice per unit of land area. Conventional farmers have the lowest net economic value on a per land unit basis (Table 3.5).

Table 3.5 Net economic value of rice per land unit (yuan/mu)

Item	Small-scale organic farmers	Large-scale organic farmers	Conventional farmers
Rice output (kg/mu)	375	402	453
Market price (yuan/kg)	3.4	4.2	2.8
Gross value of rice production (yuan/mu)	1,275	1,688	1,269
Agricultural input costs (yuan)	351	497	475
Net economic value (yuan/mu)	924	1,191	794

3.3.2 Net profits from sales of rice

The study found that small-scale organic farmers consumed about 35% of the rice they produced, and sold 65%. Large-scale organic farmers kept 18% for themselves and sold 81.6%, while conventional farmers consume 51.6% of their rice production (Table 3.6).

Net profits from rice production were calculated by subtracting agricultural input, labour and land rental costs from the gross value of rice sales (Table 3.6). None of the interviewed conventional farmers hired labour; neither did they pay any rent. Sometimes neighbours or relatives lent agricultural land without receiving any monetary compensation. Large-scale farmers had the highest labour costs (for hired workers) and the highest land rental costs. Rent was usually paid in an annual lump sum.

Table 3.6 Profitability of rice on an annual basis (per unit of land area and per household)

Item	Small-scale organic farmers	Large-scale organic farmers	Conventional farmers
Rice output (kg/mu)	375	402	453
Rice sold on the market (% of total production)	65.0	81.6	48.4
Market price (yuan/kg)	3.4	4.2	2.8
Gross value of rice sales (yuan/mu)	829	1,378	614
Agricultural input costs (yuan/mu)	351	497	475
Labour cost (yuan/mu)	50	300	
Land rental cost (yuan/mu)	27	201	
Net profits per unit of land area (yuan/mu)	401	380	139
Land devoted to rice production (mu/household)	4.36	41.5	3.23
Net profits from rice (yuan/household)	1,748	15,770	449

Net profits for rice production per unit of land area are highest for small-scale farmers due to higher prices received and lower input costs; they are slightly lower for large-scale organic farmers. Net profits of conventional rice farming are only about one-third of those of organic farming, even though conventional farmers in this study had higher yields and no labour or land rental costs. The lower profitability of conventional rice production can be explained by the lower prices that conventional farmers receive in the market.

As large-scale organic farmers have much more land (41.5 mu on average) than small-scale organic farmers (4.36 mu on average) and conventional farmers (3.23 mu on average), their net profits per household from rice are much higher (15,770 yuan/household on average

in 2014). Small-scale organic farmers have the second highest net profits from rice (1,748 yuan/household), with conventional farmers having the lowest by far (449 yuan/household).

Thus, regardless of whether calculations of profitability are made on a per land unit basis or per household basis, rice farming is far more profitable for organic farmers in Wanzai than for conventional farmers. Studies of rice in the Philippines (Mendoza, 2004) and Bangladesh (Rasul and Gopal, 2004), tea in China (IFAD, 2005) and cotton in India (Frank et al., 2007) also showed that organic crops can generate higher net revenues than conventional crops.

3.3.3 Organic farming's contributions to household income

Total household income in our study consists of income from crops, livestock and non-farm sources (wage labour, remittances, as well as products and services not related to agricultural production). Total household income varies among the three groups, with large-scale organic farmers having the highest total income, followed by conventional farmers and small-scale organic farmers (Table 3.7). The agricultural income of small-scale organic farmers was 2,926 yuan per household per year on average, accounting for 7% of total household income. The low ratio of agricultural income to total income can be explained by the very limited agricultural land available to small-scale organic farmers, their high reliance on off-farm income, and the fact that they do not belong to cooperatives. Conventional farmers had by far the lowest agricultural incomes (1,392 yuan/household), accounting for a mere 3% of total household income. Large-scale organic farmers had much higher agricultural incomes (63,173 yuan on average), about 21.5 times that of small-scale organic farmers. This reflects their much larger land area, as well as the fact that agricultural income accounts for a far higher percentage of their total household income (63%).

Table 3.7 Average annual income sources compared, 2014 (yuan/household)

Item	Small-scale organic farmers	% of total income	Large-scale organic farmers	% of total income	Conventional farmers	% of total income
Agricultural income	2,926	7%	63,173	63%	1,392	3%
Livestock income	3,063	7%	4,700	5%	2,888	6%
Off-farm income	35,875	86%	32,678	32%	45,760	91%
Total income	41,864	100%	100,551	100%	50,040	100%

About 60% of organic farmers have more than 10 animals, while this was the case for only 4% of conventional farmers. The most common animals raised by farmers were rabbits, sheep, chickens and cattle. All three groups of farmers had similar numbers of poultry. Livestock income was highest for large-scale farmers, at 4,700 yuan per household. The survey revealed that large-scale farmers raise more animals because of the vital role they play in providing manure.

Even though conventional farmers earn less from agricultural production than the two other groups, they have the highest off-farm incomes, followed by small-scale organic farmers. Both groups are likely to migrate for work, as income-generating opportunities are very limited in their villages. For large-scale organic farmers, off-farm income only accounts for about one-third of their total household income, mainly from remittances sent by their children.

These data show that for small-scale farmers (whether organic or conventional), agricultural income can only meet basic subsistence needs and cannot sustain their livelihoods on the whole. This is not the case for large-scale organic farmers, whose total incomes are more than double those of small-scale farmers and whose farming income accounts for about two-thirds of their total household income.

As illustrated in Table 3.7, agricultural income accounts for less than 10% of total household income for small-scale farmers. When the income from animal husbandry is added, farm income still represents only about 14% of total household income for small-scale farmers, and only covers food and daily consumption needs. According to interviews with farmers and local officials, off-farm income is what allows small-scale farmers to build houses and purchase other fixed assets.

This indicates that scale increases the commercial viability and economic sustainability of rice production, and is an important consideration for making organic farming a viable livelihood strategy.

3.3.4 Market linkages and contract farming

The market linkages developed around certified organic cash crops offer opportunities for farmers to enter into globalised food chains. The economic benefits of secure market access and guaranteed prices can be significant for cash crops, which have become an important source of income for farmers in Wanzai, as discussed above.

The development of the organic food industry has helped link enterprises with farmers through cooperatives. This approach promotes profitability, lowers risks and improves the performance of organic farming. As organic certification has created jobs in the organic food sector, the county government has prioritised the creation of larger cooperatives to ensure compliance with standards and increase scale and intensity, and has invested a total of 70 million yuan (about US\$10.9 million) in their development.

Cooperatives usually provide seeds, organic fertiliser and pesticides, training and technical guidance to their members. Additionally, the government distributes subsidies so that the cooperative can pay the certification fees for the farmers. Usually, a cooperative keeps a small share of the subsidies in order to pay for these supportive structures. Most cooperatives have direct contracts with local companies.

The survey clearly revealed that in the conventional villages, there were no engagements with companies which merited the label 'contract farming'. In the organic villages, on the other hand, a number of companies have established long-term collaborations with local farmers mediated by the Jiaohu township office for agriculture, or via the cooperatives (see Section 3.1.5).

With the active participation of local institutions like the Jiaohu township organic company and cooperatives, organic contract production has the potential to link market-oriented companies and their customers with smallholder farmers in geographically disadvantaged areas.

3.4 Social sustainability

3.4.1 Labour and migration

Increased local employment opportunities in organic cash crop production were mentioned by women in the focus group interviews as being a major advantage. More women in the organic villages now have the opportunity to work as hired labour – especially on larger farms or in the village cooperatives (in addition to growing their own crops). During the survey, members of Pengfei Cooperative – which has 20 ha of vegetables in Xiexi village, Jiaohu township – mentioned that they employ a number of local women. Teams of hired labourers from the local area play a key role in harvesting soybeans. Women are paid 70–100 yuan per day. Men earn 100–120 yuan per day for heavy manual labour.

One potential impact of organic agriculture in Wanzai could be to reduce and/or reverse the migration of poor farmers to urban areas. By increasing incomes and the security of market access, organic farming can make it more attractive for smallholders to stay in the villages and work on their land. However, our survey did not find evidence of reduced out-migration in the case study area.

Based on the survey data, it is evident that a high proportion (40%) of villagers have migrated for work within the county, province or even further away. Migration typically leaves children, women and the elderly behind in the villages and increases the average age of farmers. Nationally, the average age of farmers is 55 years (Yang, 2013: 158). In our study sites, the average age of small farmers is 54 and of large farmers is 51.5. As a result of out-migration, some farmland is abandoned or rented to other farmers or village cooperatives.

The survey did not find any evidence of differences in out-migration rates between organic and conventional households. Almost two-thirds of all households reported that a family member had gone to work outside the village in the last 12 months. During the focus group interviews, most farmers said they assumed that migrant workers would not come back to the villages to engage in organic farming. In fact, most organic farmers want their children to work outside the village. However, some farmers and town officials also mentioned that if farmers could earn about 2,000 yuan/month at home in their villages, they would prefer to stay there rather than migrating to cities for temporary work, where they would earn salaries of 3,000–4,000 yuan/month (but would also have higher expenses). Currently, only a small portion of our interviewees were earning 2,000 yuan/month, mainly large-scale organic farmers growing cash crops with high returns like strawberry and ginger.



Hired workers harvesting soybeans and strawberries © Friederike Martin

Interviews also indicated that the opportunity to sell organic cash crops has curbed the process of land abandonment in organic areas, unlike in conventional villages, where part of the paddy land is left fallow due to migration. In the organic villages, farmers or cooperatives have also rented abandoned land in order to plant organic cash crops. Town officials also confirmed that more and more organic farmers want to expand their production because of their experience with organic farming over the last several years. This finding is consistent with the analysis in Section 3.3, which shows that large-scale organic farmers earn far more agricultural income than either small-scale farmers or conventional farmers and that a larger land area enhances the commercial viability of organic farming in Wanzai.

3.4.2 Education and training

Training in management and agricultural techniques is another social benefit. Local cooperatives, town governments and the organic office in Wanzai all offer training. The organic office organises three to four training courses every year for cooperative members and village group leaders.

According to our interviews, the majority of farmers (76%) have also participated in at least one training course: 78% of organic farmers have participated in soil fertility training; 76% have been trained in organic production technology; 73% have been trained in organic production standards; and 64% have been trained in integrated pest management.

The actual numbers could be higher, as farmers might not have regarded the village meeting as a training session. The organic office offered most of the training courses (76%), while 30% of large-scale farmers also received training from their contracted company.

Cooperatives offer very little training; most training is conducted by government extension workers. This is one area which could be improved, along with the establishment of farmer-to-farmer knowledge exchange groups and educational forums.

3.5 The role of government

This case demonstrates the important role that local government can play in the promotion of sustainable agriculture. Overall, government support has been vital for the development of organic agriculture in Wanzai, without which it might not have progressed so quickly or successfully.

3.5.1 Township government

In Jiaohu township, there has been strong and consistent public support for organic product development and marketing. At the very beginning, farmers were not familiar with the concept of organic farming and also distrusted its benefits. The most important work done by village and town leaders was to demonstrate organic production and guarantee a market for organic products. The perceived benefits of a secure market for organic produce made farmers take part actively in organic agriculture. In 2003, with the development of the organic market, the local government decided to set up Jiaohu Organic Farming Development Company, which acted as an intermediary – contacting trading companies and organising farmers to produce organic products.

The strong involvement of Jiaohu's local government agricultural office (*xiang nongye bangongshi*) has led to continuous experiments with alternative organic cash crops and the adoption of agroecological methods such as intercropping and insect traps. The local agricultural office also supplied inputs such as high quality seeds, organic fertilisers and biopesticides. These measures provided incentives for farmers to adopt organic production and reduced costs.

Training and development were organised partly by the companies (for example, a full-time extension worker was employed by Jinyuan Company to promote strawberry production) and partly by the town office (also drawing on the agronomists at the county level). Internal auditors assigned by the town also supervised organic production. At the beginning, Jiaohu Organic Farming Development Company covered the costs of organic certification for all farmers and cooperatives, as well as handling organisational issues. Today, the costs of certification are covered by the county government.

3.5.2 County government

The county government has been the driving force behind promoting and implementing organic agriculture in Wanzai. The sector has been supported mainly through the following actions: providing financial support for certification and organic inputs; strengthening the organic sector by attracting investment; mediating between farmers and enterprises; supervising organic production; and providing overall direction, described in detail below.

Financial support for organic certification and production inputs

County level support was initiated by the Wanzai Agricultural Development Office, which has a certain amount of money to invest in agricultural infrastructure and development every year. In 2003, they heard about organic farming in Jiaohu township and decided to provide financial support for developing organic farming in other parts of the county. In 2004, Wanzai Organic Agriculture Office (*Wanzai youji nongye bangongshi*) was set up to support organic farming in Wanzai county. From then on, about 1.5–2.0 million yuan have been granted every year to pay for certification costs, introduce new seed varieties, conduct training, support

the processing and distribution of organic produce and strengthen the organic food brand. Between 2000 and 2007, Wanzai Organic Agriculture Office organised about 2,000 training courses involving more 100,000 participants to increase awareness of the importance of good farming and to promote organic practices.

Attracting private investment to strengthen the organic sector

With the rapid development of organic agriculture in Wanzai county, the county government gradually realised that the market was the main driving force of agricultural commodity chains, and that processing and trading companies were the key actors propelling the organic market. From 2006, the county government altered its strategy for developing organic agriculture in order to strengthen the confidence of local organic companies and also to attract companies from all over China to invest. The government started to encourage private companies to invest in the development of agriculture, including new types of organic products, organic fertilisers, pest and disease control, as well as the construction of biogas digesters.

The government supports individual organic entrepreneurs with specific policies such as financial support to businesses (6 million yuan annually), tax breaks, small loans and improved market access. In 2006, Jiangxi Jinyuan Agriculture Development Co., Ltd. was the first organic company from outside the county to invest in organic agriculture development. Today Jinyuan Company has become the leading organic food company in the county and one of the largest organic vegetable companies in China. In all, 12 organic companies are involved in trading organic products in Wanzai county, both on domestic and overseas markets.

Furthermore, a national agricultural demonstration zone is currently being built in Wanzai, which consists of several sections for research, industry, crop production, processing and ecotourism. In addition to the support from the government, Hong Kong Ever Bright Group has also invested in the demonstration zone from 2012. Hong Kong Ever Bright Group has set up Jiangxi Ever Bright Agriculture Science and Technology Co. Ltd. in Wanzai county with an investment of US\$300 million.

Mediating between farmers and enterprises

As described in Section 3.1.5, organic companies contract directly with farmers, while local governments like that of Jiaohu township act as mediators to negotiate with companies and organise farmers for organic production. At the same time, some organic companies would like to lease land from farmers to manage themselves. It is not easy for companies to negotiate with individual households in order to lease land, as it is time consuming and sometimes farmers do not trust the companies. Local governments in Wanzai have therefore played a key role as intermediaries between companies and farmers to guarantee mutual benefits for both sides. Local officials explained that due to the special requirements of organic production, especially the three-year conversion period, it is not possible for companies to lease land for short periods of time. At the same time, there are many uncertainties faced by the companies (particularly market demand), who cannot guarantee benefits for farmers. Mediation and guarantees from local governments have helped to enhance cooperation between companies and farmers and to smooth over any misunderstandings and disagreements.

Supervising organic production and providing overall direction

As compliance with standards is vital for certified organic agriculture, Wanzai government has implemented a comprehensive monitoring system. Each organic township and village has its own monitoring team, which checks compliance with standards and develops appropriate evaluation methods. Furthermore, farms' soil and water are inspected regularly without prior notice. If misuse of agro-chemicals is detected, a deadline is set for correction. In case of non-compliance, the farmer has to pay a fine and in a worst case scenario, his/her certification will be withdrawn for several years. Today, the county government's direct financial support is mainly for certification costs, at about 0.7–1 million yuan per year.

Since 2003, Wanzai county has developed a series of development plans for the organic industry. It initiated the first five-year development plan for its organic agricultural sector, from 2003 to 2007, with the motto "Ecological county – enriching the people with organic agriculture". The current five-year Wanzai County Organic Industry Development Plan (2009–2015) aims at achieving a total of 6,667 ha of organically certified arable land, plus 13,333 ha of wild collection area, where mushrooms and wild herbs are harvested. Furthermore, the regional organic industry and large-scale production have been promoted beyond the county level to improve the level of international and domestic competitiveness of organic products and to ensure the sustainable development of Wanzai's agriculture.

3.6 Motivation for adopting organic agriculture

What factors have promoted the popularity of organic farming in Jiaohu township? First, the township is located in a remote mountainous area. Despite its superior natural environment, farm households' incomes were very low and the township lacked industries. The leader of Jiaohu township understood the farmers' situation and decided to improve their livelihoods based on local resources. Through a chance meeting with a ginger merchant he learned about organic markets overseas. This led to the decision in 1999 to increase farmers' incomes in the township by cultivating organic ginger for export.

Second, in order to persuade farmers, village cadres planted demonstration plots of organic ginger. At the same time, the Jiaohu Organic Agricultural Development Company was established to organise organic production through contract farming with farmers and it also signed a contract with Fujian Longhai Jinfu Food Co. Ltd.

Third, the high prices for organic products and the ban on all synthetic inputs encouraged farmers to adopt organic farming. Farmers started growing organic ginger in 2000; by the end of 2003, the total area of organic ginger had increased to 150 ha. At the same time, all 848 ha of arable land in the township were certified as organic. Processors offered farmers a price premium of up to 200% more than conventional ginger to encourage them to convert to certified organic agriculture. Processing firms also bought products such as ginger, bamboo and rice for export to the EU, USA and Japan. As a result of their involvement in organic agricultural production, the average annual per capita income of farmers in Jiaohu township rose from 1,000 yuan (US\$161) before 1998 to 2,200 (US\$354) in 2003 (Hu, 2012).

Motivation is maintained by the involvement of an increasing number of organic companies in organic processing in Jiaohu township. The township is their main supplier of raw materials. This has promoted the further development of organic farming in the town. Every

year, the township contracts with the companies for 400 ha of paddy rice, 70 ha of ginger and 70 ha of soybeans to provide raw materials for processed products.

In 2012, Jiangxi Shuosheng Ecological Agricultural Science and Technology Co., Ltd. invested 60 million yuan in organic pig production in Jiaohu township. The company wanted to make full use of local organic products as feed and to develop biogas and vegetable production. With the involvement of Shuosheng Company, farmers can grow more diverse crops such as sweet potatoes and maize as organic feed for pigs. The manure produced can be returned to the land as a key input for organic agriculture.

3.7 Challenges faced

While prospects for organic agriculture in Wanzai county seem very positive overall, a number of challenges have arisen. These challenges are discussed in detail below.

3.7.1 Poor financial returns for small-scale organic farmers

Small-scale production is still prevalent in Wanzai organic agriculture. However, the analysis in Section 3.3 suggests it is not economically attractive for small-scale farmers due to the small land area per household. This is in spite of the fact that small-scale farmers have 15 years of experience with organic agriculture on average. Only farmers in cooperatives and/or those with larger plots of land have seen better economic benefits.

3.7.2 Lack of trust between farmers and cooperatives and companies

Some farmers pointed out that the price of organic paddy rice paid by processing companies is only 20–40% higher than conventional rice, while the price of organic rice sold in supermarkets is 300%–500% higher than conventional rice. Given that most of the economic value of organic rice is captured by companies, farmers are naturally dissatisfied with this skewed distribution of benefits.

Some farmers also complained that although the companies and cooperatives will give them seeds or organic fertiliser before planting, they subtract the cost of inputs from the total amount paid to farmers after the harvest, and at prices higher than prevailing market prices. Moreover, some companies are very strict about quality, and agree to buy only a small part of the produce at the contracted price.

While joining cooperatives is a good way for small farmers to engage in commercial production, there are still some challenges. Normally commercial production tends to be large scale, and it is not easy for farmers to rent enough land for large-scale production. Furthermore, some cooperatives are not well organised, and lack clear procedures for production and internal management. Some of them do not organise trainings for small-scale farmers.

Most cooperatives sign direct contracts with local companies. However, some of the cooperatives reported negative experiences, such as breach of contracts by companies or failure to fulfil contract conditions. The loss of trust between cooperatives and companies has in some cases led to a rupture of business relations, which can be difficult to rebuild. One notable example was a cooperative from Xianyuan township, which signed a contract with a processing company for strawberries. However, according to interviews, farmers

lost a lot of money because the company did not purchase the strawberries from them and withdrew from the relationship. To date they have not signed another contract with the company.

3.7.3 Overly rigorous organic standards

The latest version of China National Standards for Organic Products (CNCA 2012) has been in place since 2012 in order to protect the interests of consumers and maintain the integrity of organic products. These standards are considered by some to be the strictest in the world (Katto-Andrighetto, 2012). These revised standards and rules require the certification body to visit every household involved in organic farming, which is time consuming and expensive. It is also difficult to organise small farmers to produce organic products according to these standards, so most of the products have been exported rather than targeted towards the domestic market.

3.7.4 Labour shortages in rural areas

Labour shortages are a common problem in rural areas across China, not just in Wanzai. All three processing companies interviewed mentioned difficulties hiring labour, as well as high labour costs.

Though organic farming requires more labour and provides good opportunities for cooperatives or large farmers, the benefits are currently insufficient to entice migrants to return to rural areas. Most farmers assume that migrant workers will not come back to the villages to engage in organic production. In fact, most organic farmers want their children to work outside the villages.

3.7.5 Marketing constraints and processing of organic products

Food marketing in Wanzai county is poorly organised, information is not well distributed and there is no official food sales network (Jiang and Huang, 2011). The majority of farmers do not participate in cooperatives and trading companies are scattered. Since 2011, the number of cooperatives has increased, but they are dominated by large-scale farmers. Furthermore, one village may have several cooperatives, which can lead to lower bargaining power vis-a-vis local companies.

Wanzai's mountainous location hinders the development of large-scale industry, as it is difficult to reach and infrastructure is poor. To ship fresh fruit and vegetables to large cities is costly, which constrains the development of these high value agricultural products. Therefore, local food processing companies are indispensable, as they add value to the products, reduce production costs and eliminate the requirement for transporting fresh produce quickly. In spite of rapid development in the region, production is not diverse enough and processing techniques still lag behind more developed areas (Jiang and Huang, 2011). Another problem is that the level of value-added processing is too low.

3.7.6 Difficulties with land transfers to companies

During interviews, processing companies such as Jinyuan Agriculture Development Co., Ltd. mentioned that demand exceeds supply for some organic products, such as green beans, making it difficult for them to source sufficient quantities. According to interviews with officials in Wanzai county, the local government has tried to help enterprises to rent land

from farmers so that they can expand their production. Yet cooperation with farmers can be difficult, especially during the land transfer process, because not all of the farmers want to transfer their land or are content with the rental payment. It is also difficult to manage market fluctuations. Normally, enterprises will expand production according to market demand and need to be able to react quickly. On the other hand, if market demand falls short of original expectations, there is a risk they will abandon land. One potential role for government can be to help smooth out these market fluctuations.

3.8 Conclusions

Overall, the organic industry in Wanzai county has undergone a remarkable evolution over the last 15 years. The commitment of farmers and the local government has seen the county become one of the most important organic agricultural production zones in China. The good reputation of organic agriculture has attracted new customers for Wanzai's products, as well as investment in agro-processing, both of which could further enhance the sustainability of the organic sector.

Combining farmers' perceptions and experiences of organic farming with our own economic analysis, it appears that organic farming does offer advantages in terms of higher and more secure incomes. During the field survey carried out in 2014, the farmers interviewed in Jiaohu township recognised the benefits of organic farming in terms of increased incomes, particularly some of the large farmers. The township government officials also feel that organic farming is very important to farmers in remote areas who mainly depend on income from agriculture.

Wanzai has played a pioneering role in the development of sustainable agriculture in China, and offers many key lessons that are relevant not only to Chinese stakeholders, but also to those interested in sustainable agriculture outside China. Some of these lessons can be summarised as follows:

- **Organic farming can provide better economic returns than conventional farming.** In the study area, organic farmers have better economic returns, higher profits and higher incomes from agriculture than conventional farmers. The main reason for this is that organic products such as rice have higher market prices than conventional products. This is the case in spite of the fact that yields for conventional farming are higher than for organic farming.
- **Large farmers have benefitted more from organic agriculture than small farmers.** Large-scale organic farmers – all of whom are involved in cooperatives – have better economic returns from agriculture than small-scale organic farmers or conventional farmers. Overall, the differences are clear, whether in terms of net economic value of rice production, net profits from rice production or total household income. The reasons include the fact that large-scale farmers have more land, get higher prices for their products, cultivate a higher variety of crops and use more agroecological practices than small-scale farmers. In addition to supporting large-scale farmers in accelerating the development of the organic sector in Wanzai, more small-scale farmers should be supported to join cooperatives and to increase their agricultural land holdings through involvement in organic farming.

- **Organic farming has generated employment opportunities and environmental benefits.** Whether organised by cooperatives or local companies, organic production has increased employment opportunities for farmers. Women in particular have benefitted, as their labour is less costly than men's and hence is favoured by companies for certain kinds of work like harvesting soybeans and strawberries. Environmental protection seems to be a priority for farmers, who recognise its importance for sustainable agriculture and food safety. Farmers also have strong environmental consciousness, as described in Section 3.2, which has contributed to their willingness to expand organic production.
- **Local government has been the key driver of organic agriculture in Wanzai, but its role is changing.** In a region characterised by low levels of economic development and low purchasing power, local government support has been vital for the development of organic agriculture. Local government still plays a pivotal role today, though some of its original functions have been taken over by companies. One key role that local government still plays is to pay for the costs of organic certification, thereby relieving farmers of that burden.
- **The private sector plays an important role** in providing resource-poor rural households with market linkages and new technology for organic cash crops. Care should be taken to link this commercial incentive with training for all stakeholders (especially small farmers), securing broader capacity building in order to improve the overall sustainability of local farming systems and supporting the establishment of local institutions such as cooperatives or village-based self-help groups.

With the active participation of local institutions like the Jiaohu township organic company and cooperatives, the case of Wanzai clearly illustrates that organic production has the potential to link companies and their customers with smallholder farmers in geographically disadvantaged areas. While the organic industry has achieved considerable economic gains in Wanzai, many farmers still lag behind, and more needs to be done to ensure that small-scale organic farmers can garner a larger share of the benefits.



Picking vegetables

© Simon Lim

4 Linking rural farmer cooperatives with urban restaurants in Guangxi

by Song Yiching, Zhang Yanyan and Lila Buckley

In a remote mountainous area of Guangxi province, characterised by steep karst mountain formations and fast-running streams, sits the village of Shanggula – a ‘natural village’¹ in Mashan county. In addition to vegetables, farmers plant maize in minute pockets of soil on the steep slopes between rocks in flat, tiny fields. The topography makes irrigation water scarce. Heavy rains tend to cause floods, regularly damaging field crops. There are no major roads, and access to markets is limited. In recent decades, most households have relied heavily on income from temporary work in cities in south and southeast China.

This situation is starting to change, however, because of the work of a dynamic women’s organisation and its collaboration with a non-governmental organisation (NGO) in the provincial capital of Nanning, Guangxi province, and a policy-research centre in Beijing. This is the story of this community’s experiences, their laughter and their tears, in exploring and adapting the Community-Supported Agriculture (CSA) approach to revitalising agriculture in their village. Though this initiative is not a CSA in the conventional sense of networked members who pledge to support local farms (see Chapter 5), those involved feel that the term captures what they are trying to achieve and we have therefore remained consistent with their use of the term. Through this case study, we explore what lessons they have learned and how these may be useful more generally for strengthening sustainable agriculture in China and elsewhere. The data for this case study are based on collaboration between the authors and the community over the lifespan of the initiative, supplemented by interviews conducted by Song Yiching and colleagues with key community members during field visits in 2015.

4.1 Background and characteristics of the case study area

Shanggula village has 89 households and a population of 359, one-third of whom belong to the Yao and two-thirds to the Zhuang ethnic groups. Most households cultivate some crops, at least for personal consumption, with average landholdings of about two mu (0.13 hectares) per household. Maize, a traditional staple crop, dominates the landscape and is

1. ‘Natural villages’ developed organically in pre-Mao China, and are the smallest units of local governance in modern Chinese society. They are distinguished from, but can form part of, ‘administrative villages’ set up for governance purposes by Mao’s administration.

produced for personal domestic consumption as well as for culturally important ceremonies and art. The area has a high diversity of maize varieties, including a glutinous 'waxy maize', thought to have originated in this area (Song, 1998).

As of 2014 there were 142 full-time farm labourers cultivating approximately 135 mu (9 ha) of land in the village (Table 4.1). Total cultivated land decreased from 153 mu (10.2 ha) in 2000 to 135 mu (9 ha) by 2010 due to some villagers moving into urban areas to pursue non-farming livelihoods. During this time, however, within the village, non-farming income had also been decreasing due to the influence of the CSA enticing youth back to the villages to engage in farming livelihoods. Since 2011 non-farm income has been increasing again due to problems marketing the CSA goods, as well as the introduction of stone, brick, timber and bamboo-processing facilities in the area that are providing new local non-farm opportunities. This trend seems to be reversing somewhat once again, however, as the number of full-time farm labourers has increased steadily since 2013.

Table 4.1 Demographic and agricultural trends in Shanggula village²

	Total population	Households	Full-time farm labourers	Total cultivated land	Land for maize	Land for vegetables	Average per-capita annual income	Share of non-farming income
Unit:	No. people	No.	No. people	mu	mu	mu	yuan	%
Year:								
2000	279	68	60	153*	95	11	1,200	70
2005	196	73	79	148*	95	15	1,700	61
2010	342	84	130	135*	100	32	2,600	40
2011	341	79	130	135	124	11	2,600	38
2012	346	86	130	135	115	20	2,760	60
2013	353	87	139	135	104	31	4,200	67
2014	359	89	142	135	113	23	4,360	70

* Prior to 2010, small amounts of cassava, sweet potatoes and soybeans were also grown in the village, making the total cultivated area larger than the sum of the area planted in maize and vegetables. From 2011 onwards, villagers stopped cultivating these other staples in favour of maize and vegetables.

2. Based on data gathered by author Song Yiching through collaboration with the village.

In 2008, a group of five local elderly women farmers, led by Lu Rongyan, began experimenting with ecological vegetable farming. They forged links with an organic restaurant called Tusheng Liangpin in the provincial capital of Nanning, with whom they have a verbal sales agreement. Their goal was to expand ecological farming practices as well as marketing efforts through a Community-Supported Agriculture model, linking farm production with consumers through the restaurant.³



Picking vegetables © Simon Lim

Initially, production focused on vegetables and grain (primarily maize). Two years after the project started, three of the member households in the women's group started to experiment and expand into organic pig farming, using a 'circular-farming' approach that integrated maize, pig manure and biogas production,⁴ using processed pig manure to fertilise the vegetables. They also explored other innovations such as organic flower tea, herbal medicines, fresh maize, and chicken and duck farming. They have introduced simple processing and packaging of their products for additional added value. Their overall farming philosophy is based on small-scale subsistence farming producing a variety of goods in a circular farming system, rather than specialising in only one or two commodities.

3. The CSA roughly follows organic-growing techniques, and many of the products used in the restaurant are organic, but neither the CSA nor the restaurant are organically certified.

4. Biogas is popular, and every household in the village uses it, supported by a local government programme for poverty alleviation over the last two decades.

In March 2012, the group—now 28 strong and mostly comprised of women aged 45 to 60 years of age—formally registered as the Mashan Rongyan Ecological Farming Cooperative (Mashan CSA). Mashan CSA is one of the earliest CSAs in China, and one of the only CSAs located in a remote, impoverished area. The cooperative members support each other in practising agriculture that is free from chemical pesticides and fertilisers, makes use of local resources as much as possible while protecting the land and water.

The CSA model directly links small producers to ordinary consumers through the provision of reasonably priced, high quality organic vegetables. These products generally have no formal sustainability certification; the CSA model instead aims to increase interaction between producers and consumers so as to build mutual trust and benefits. CSAs are founded on the principle of building fair and equitable links between rural and urban areas through direct and personal contacts between producers and consumers.

Shanggula village is one such model. For the women who founded the Rongyan cooperative, 'sustainable agriculture' balances consumers' demands with the need to support ecological health and social cohesion. There is no formal written contract between the women and Tusheng Liangpin restaurant—only verbal agreements on aspects such as quality control (during cultivation and of end products), price, quantity, transparency, delivery, etc. Though lacking official organic certification, the women follow a kind of 'community-based certification' for quality control and insurance as well as monitoring and trust building within the group and community. This model has proved stable so far, and both the restaurant and the group have been quite satisfied over the last few years, although this is changing (see the challenges section). Despite the strength and success of the CSA, its members have also experienced some problems and challenges. The story and process are described in the following sections.

The role of the cooperative

The Shanggula cooperative is a self-organising and member-empowering women's collective—though there are also some newer male members who have joined recently. In 2012, the cooperative expanded its activities from one to four natural villages within the regional Guzhai Administrative Village, increasing the total number of farmers involved as well as its productive base to include soybeans, herbs, and the raising of chickens and ducks.

The cooperative has a formal management structure with a variety of functions. The elected leader is a very dynamic farmer and organiser named Lu Rongyan, leader of the original group. Her leadership has been instrumental in many regards (Yang, 2010). Rongyan is also supported by several newly arrived younger members, both women and men. The main work of the cooperative is to grow and collectively sell local produce including organic vegetables, pork, and hybrid maize seeds of a variety named 'Guinuo 2006' that was developed through Participatory Plant Breeding (Box 4.1).

The cooperative offers technical services for plant and livestock production. These services are provided by a township public service extension worker funded by the government, and by village level farmer technicians partially financed by the cooperative through interest earned on the community fund (see below), and partially provided free by a young extension officer who recently returned from the city and became a member of the cooperative.

Box 4.1 Participatory Plant Breeding in Guangxi

Participatory Plant Breeding (PPB) is an approach linking formal plant-breeding systems of the state with informal farmers' seed-saving and breeding systems. China's first PPB programme was initiated in 2000 in six communities in Guangxi, including Shanggula. It aims to address declining genetic diversity in farmers' fields, and to improve livelihoods. As well as developing improved crop varieties for farmers, the programme is facilitating the negotiation of local agreements by which farming communities can benefit from sharing their genetic resources and related traditional knowledge with breeding institutes (Li et al., 2012).

The cooperative also builds members' capacity through the purchase and circulation of reading materials (such as a Chinese farmers' cooperative magazine produced by the Ministry of Agriculture), organising visits to other farmers and farmer groups, and periodic participation in training events locally and regionally. The collective's organisational capacities have become stronger, as evidenced by the expansion of its scope of activities.

Members of the Shanggula farming cooperative also participate in a traditional song and dance performance group (Dalang), which has grown more cohesive through the strong ties formed in the agriculture cooperative. The performance group's repertoire and schedule have both grown, as members feel inspired to work together to strengthen their cultural heritage, and even develop new songs and dances—inspired by the innovation achieved in their farming. In 2011, the group's performance was nominated 'The Intangible Cultural Heritage of the Guangxi Zhuang Autonomous Region' — a prestigious government award. In recognition of the award, the provincial government constructed a brand-new theatre in the village.

Another important activity of the cooperative is the management of a community fund. This fund was set up in 2004 as a means to strengthen local rural development by the project team that introduced the Participatory Plant Breeding efforts. To date, it has assisted more than 70 farming families, some of them with extremely low income, in purchases related to health and education. It serves both as a loan facility (with relatively low interest rates compared to commercial banks) for individual households and as a fund for collective investments and activities such as purchasing breeding materials, or water pumps. The fund also benefits non-cooperative members; 34 loans to non-members have been granted to date.

According to our interviews, the cooperative members are happy with the current management, and they like their leader, Lu Rongyan.

4.2 Ecological sustainability

The establishment of the cooperative was motivated by a shared concern for the environment, the conservation of agricultural biodiversity, and the maintenance of local culture. The farmers in Shanggula village had realised that their soil fertility had been getting poorer from modern agricultural methods, including using too much fertiliser. They started to apply more residual manure from biogas production on their crops, and stopped using fertilisers and pesticides on their vegetables and other organic crops such as medicinal herbs. Instead they reintroduced traditional bio-control methods, such as intercropping with insect-repellent plants, pest-control lights, fire, etc. For ecological pig-raising, they

adopted circular farming practices, linking the maize feed, biogas, and organic crops in a sustainable process.

in recent years the group has also been adapting to changes in the climate, especially more frequent and extended droughts, rising temperatures and increased pests. For instance, they have used Participatory Plant Breeding approaches to improve local varieties of maize and vegetables that are more drought-resistant, and have begun growing more diversified vegetables and other crops for pest control. As a result, they considered themselves as having achieved 'healthy food for healthy people (both consumers and themselves), a good environment, and happy profit' (group discussion and interview in September 2013 by the CCAP team). What kind of 'happy profit' have they made? The next section explores this question.



Sustainably produced vegetables © Simon Lim

4.3 Economic sustainability

The CSA has grown from five initial member households producing a few crates of vegetables on about 2 mu (0.1 ha) of land, to 57 members cultivating 23 mu (1.5 ha; Table 4.2). The original five members produced nearly 55 kilos of vegetables per month in 2008; in 2011, production had increased to 820 kilos per month. Total vegetable production, the number of varieties, and product quality are now able to satisfy the pork and vegetable needs of the Tusheng Liangpin restaurant and its patrons, although demand for other things such as eggs, rice, poultry, soy, and wine currently outstrips production capacity. The Tusheng Liangpin restaurant therefore relies on a number of other small villages in the network for these other goods.



Tusheng Liangpin restaurant in Nanning © Simon Lim



Cook in the Tusheng Liangpin restaurant © Simon Lim

Prices have also increased, from 4.4 yuan/kilo in 2008 to 4.8 yuan/kilo in June 2010, and in 2012 reached 5 yuan/kilo. Total vegetable sales in 2011 reached almost 66,072 yuan.⁵ For households involved in the CSA, annual farming income has increased from an average of 146 yuan in 2008 to a high of 6,600 yuan in 2011 (Table 4.2). It has since decreased, falling to 1,614 yuan in 2014. Even so, the current income is still double the average total income for the village.

Table 4.2 Eco-vegetable production and marketing in Shanggula village

	Households involved	Average acreage used/household	Annual production	Average price through year	Total annual income	Average household annual income
Unit: Year:	No. households	ha	kg/ha	yuan/kg	yuan	yuan
2008 (Sep-Dec only)	5	0.1	1,376.25	4	734	146
2009	7	0.2	24,032.25	4	19,226	2,746
2010	11	0.3	22,912.5	4–4.4 ¹	29,629.2	2,694
2011	13	0.7	26,632.5	4.4	85,938	6,600
2012	36	1.3	22,500	5	150,000	4,160
2013	57	2.1	15,000	5	155,000	2,719.3
2014	57	1.5	12,000	5	92,000	1,614

¹ During Jan–May 2010 the price was 4 yuan per kg, and from Jun–Dec 2010 it was 4.4 yuan per kg.

Pork sales started in 2009 by three members, and had expanded to twelve members by 2012. This has resulted in a steady increase in income derived from pig farming between 2009 and 2013 (Table 4.3). Overproduction in 2013, however, led to a large portion of the product being sold in conventional markets rather than to the restaurant at premium prices. Pig production levels have been reduced since 2014 as a result.

5. One US dollar was worth 6.3 yuan at that time.

Table 4.3 Pig farming and marketing in Shanggula village

	Households	Total farming	Pigs sold per year	Price	Total annual income	Average household annual income
Unit: Year:	No. households	No. people	No.	yuan per kg	yuan	yuan
2009 (Dec only)	3	17	0	20	0	0
2010	5	34	9	20	10,900	2,180
2011	3	57	36	20	66,072	22,024
2012	9	162	160	24	384,000	43,660
2013	16	250	250	22	450,000	28,125
2014	16	162	154	22 ^a	277,200	17,325

^a Average of 20 yuan per kg for white pigs and 24 yuan per kg for black pigs



Ecological pig farming © Simon Lim

The unit prices of the CSA ecological vegetables and pork sold to the restaurant are significantly higher than prices received on the conventional market (Table 4.4). However, in 2014 only part (less than half, in terms of fresh maize and pork) of the CSA ecological production was sold to the restaurant at these higher prices. The rest of the cooperative's products had to go to the conventional market to be sold at lower prices. A simple calculation revealed that if Rongyan Cooperative could have gained access to a fair CSA market for their ecological products in 2014, they would have increased their annual income by an additional 113,750 yuan. This shows that the economic sustainability of the initiative is not only about price, but about access to markets. The farmers rely too heavily on the restaurant as their sole target market and have limited market information, management experience or pricing strategy.

Table 4.4 Rongyan Cooperative CSA production, income and marketing, 2014

Item:	Cooperative annual CSA ecological product	Annual product sold to the restaurant	CSA price offered by the restaurant	Annual combined farmer income from sales to the restaurant	Annual CSA ecological production sold to the conventional market	Conventional market price received	Annual CSA ecological product income from conventional market	Additional potential income at CSA ecological product price
Unit:	kg	kg	yuan per kg	yuan	kg	yuan per kg	yuan	yuan
Vegetables	16,800	10,500	5	52,500	6,300	3	18,900	12,600
Fresh maize	325	150	5	750	175	4	7,000	350
Pork	17,000	5,000	22	110,000	12,000	13.6	164,000	100,800
Total actual and potential annual income				163,250			189,900	113,750

Source: Interview with Cooperative Director Lu Rongyan; based on 2014 production and prices.

Recent decreases in total volume of and income from organic pork and fresh maize reflect the restaurant's limited demand, rather than any limits on farmers' own production capacity. So the barrier for further scaling up is primarily limited market access. As a result, the cooperative is considering expanding its market channels, including opening organic stores in the township and Nanning city, and even selling through the Internet.

For profit-sharing, the cooperative keeps 20% of total vegetable sales and 8% of pig sales (because vegetable production requires more labour and complexity in packing and delivery), to cover transportation and packaging and to contribute to a collective revolving fund initiated by the community and assisted by the PPB project for enhancing the collective spirit and supporting collective activities.

4.4 Social sustainability

Since the formal registration of the CSA in 2012, eight young people have returned from cities or given up local non-farming jobs to join the cooperative as new farmers. For the villagers of Guzhai region, especially the women, the return of young people to join the ecological cooperative is a source of great happiness, and also indicates the social sustainability of the initiative. Villagers attribute this success to the strong leadership of the cooperative, and to support from the CCAP team and the NGO Farmer's Friends (Box 4.2). Although the villagers had already started to grow organic vegetables and raise organic pigs on an individual household basis, the formation of the cooperative allowed for much stronger information, technology and labour exchanges, and also for common trust-building and collective bargaining in the sale of their products to the restaurant.



Preparing vegetables © Simon Lim

These collaborations have gradually strengthened their collective spirit and led to other collective actions such as village folk dances and contributing to village road building.

Another effect of this initiative is a heightened awareness among farmers of the health benefits of CSA—their own, the environment's, and that of consumers. As one villager said, 'We are healthier than before, due to the healthy food we grow and eat everyday.' Other villagers benefit through sharing of ecological concepts, healthy food, and collective funds gathered from the growers' organic vegetable and pig-raising profits. Based on villager's comments and ongoing interactions with these communities, we observed that on the whole, the entire village has become more happy, healthy and harmonious, and less tense and individualistically driven in economic terms.

4.5 The role of government

In its initial stages the CSA did not attract much support from local government. Gradually, however, it attracted attention from the county government, which now showcases the group as a model woman-led cooperative, and also as a model for ecological farming. Lu Rongyan has also received some recognition; she has been named head of the administrative village, and was identified as a model labourer in Nanning. In addition, the provincial government's biogas project provided a good support base for the circular farming practices.

Lu Rongyan and her group were initially supported by a PPB and CSA project team started by CCAP, which started working in a number of villages in Guangxi in 2000. The Rongyan Cooperative belongs to a wider Guangxi project-based organic cooperative network. This network emerged from many years of participatory action research in Guangxi led by CCAP, in collaboration with the Guangxi Maize Research Institute and a Guangxi NGO called Farmers' Friends (Song and Vernooy, 2010; Box 4.2). The network connects various cooperatives, six local and organic restaurants, and urban consumers.

Box 4.2 Farmers' Friends: linking producers and consumers

The NGO Farmers' Friends was established in Liuzhou city in 2004. It started with one organic restaurant that linked a few like-minded farmers with consumers who cared about traditional farming practices, quality products and food safety. Now the NGO has expanded to include eight restaurants and a network of 16 rural communities and cooperatives including Mashan Guzhai Rongyan. The network acts as a platform for market information and knowledge-sharing and exchange among villages and other stakeholders. It also provides crop-improvement and seed-production technology training and institutional support for involved villages and cooperatives. As Lu Rongyan explained, 'The PPB project platform really helped us to link to more stakeholders, and significantly enhanced our confidence and capacity in ecological farming and marketing.'

4.6 Motivation for Community Supported Agriculture

The CSA model for organic farming and marketing was introduced to southwest China (the provinces of Guangxi, Guizhou, Yunnan and Sichuan) in 2005 by the Partners for Community Development, a Hong Kong-based NGO. CSA concepts and CSA-inspired farms have developed rapidly in China in the last few years. There are now several hundred known

CSA farms under the national CSA network, and hundreds more outside it. They all follow the same concepts and principles, but operate with different protocols in different cities. A few CSA farms are trying to practise a form of community-based agriculture certification introduced from India.

The establishment of the cooperative was motivated by a shared concern for the environment, for the conservation of agricultural biodiversity, and for the maintenance of local culture. Although established without any government support, the cooperative had grown out of more than a decade of informal agricultural research and cooperation at the village level, in the form of participatory membership in a plant-breeding group, supported by the NGO Farmers' Friends (Box 4.2) and by a research project of the Center for Chinese Agricultural Policy (CCAP) of the Chinese Academy of Science. The cooperative was also strengthened by a firm foundation of friendship among its members, established through many years of sociocultural cooperation involving collective dance, song theatre and other activities.

Through discussions with women in the farmer group, we know that sustainable agricultural products are much more labour-intensive and time-consuming to produce than conventional ones. Yet the women tell us that they like to grow eco-vegetables. They care more about healthy production processes and achieving good prices. For the villagers, 'economic sustainability' means satisfactory returns that provide a balanced livelihood and sustain farming in the long term.

4.7 Challenges faced

Generally, the CSA practices in Guzhai village in the past eight years have proved successful, ecologically, socially and economically. Yet they have recently faced a few challenges that are hindering further sustainable development and scaling up.

The current challenge today is a conflict with the new manager of the Tusheng Liangpin restaurant since July 2014. His attitude towards the villagers is not as friendly or collaborative as that of the previous manager. Specifically, he does not honour verbal agreements regarding product quantity, quality, price, etc., and new practices such as strict supply quotas and pre-set buying prices seem unfair to the cooperative. Rongyan and her team have discussed these issues with him a number of times, but have not been able to reach a new agreement. As a result, the restaurant has begun purchasing fewer and fewer products from the village in the past year.

Learning how to manage the market is a key challenge for the community and the cooperative for the coming years. As one farmer said, 'I have a great interest in doing organic farming. The main reason is for our own and others' health; the second reason is increased income due to the higher prices provided by the organic restaurant; the last reason is for our land and environment by not using fertiliser and pesticide. However, there are also challenges and limitations in marketing, for instance; we have to rely on the organic restaurant now, which has limited demand.'

As Rongyan pointed out, 'We realised that we need to expand and diversify our marketing channels, and to rely more upon ourselves.' She has begun helping the farmers to explore other market channels, whilst some individuals have had to sell their organic products in the normal market at lower prices. This has affected the common trust built through the

CSA network, and lowered farmers' incentives to stay involved. However, Rongyan and the cooperative's core members decided to learn from this lesson and expand their marketing channels. They aim to ultimately develop their own full-value chain by opening their own organic store and farmers' market in Nanning, but they need more support to realise this goal. A supportive policy framework for farmers' markets would be a positive step in supporting organisations like these. In addition, better market information, marketing skills and management training are needed, especially for the newly returned young people.

Another challenge they are confronting is finding new organic technologies. For example, they continually seek inputs and better information for integrated pest management (IPM) know-how and safety, and also lack reliable access to organic seeds. The CCAP team has been helping them find potential partners to more effectively address these challenges.

4.8 Conclusions

This case study illustrates an important rural development path in China—community-based, diversified agriculture combined with strong horizontal integration. It represents '... a locally driven empowerment process in which farmers, led by women, have improved their capacity to deliberate about choices of action, experiment with options, create new practices and enlarge the network of horizontal relationships, and thus obtain more autonomy in realizing their aspirations according to own agendas' (Song and Vernooy, 2013). Farmers in Shanggula village have retained a large degree of control over their resource base (land, water, labour, seeds). Market integration in Shanggula village has a discernible face—buyers are known by face and name. Agricultural production in the village has become more diversified—from a maize-based system to an integrated crop-livestock system.

The system benefits from strong technical support and capacity building, accompanied by targeted research, and the support is more focused on broad rural development than on commercial motives. It also benefits from relationships with other cooperatives, restaurants, NGOs, research centres and universities, and the government's agricultural extension service. The process of expansion is a capacity building and empowering process for this self-directed community.

The success of this case reflects the value of farmers' cooperatives for linking producers with urban markets and linking producers to consumers through rural-urban interaction for mutual trust-building, and for improving local production and consumption of sustainable agricultural products. It is centred around the creation of a small-scale local market focusing on a diversity of local products in small quantities. This model is optimal for subsistence farmers and ordinary local organic consumers. In this way, this approach could be one way to influence the choices of domestic consumers and help close the rural-urban divide.

Despite the ongoing challenges, the experiences of the self-directed, women-led Shanggula farmer cooperative provide lessons and inspiration for ecologically, financially and socioculturally sustainable agriculture. Their mutual cooperation and success at integrating new technologies and concepts within a traditional farming framework to support the health of farmers, consumers and the environment alike illustrates the possibilities for smallholder ecological agricultural production in China and beyond.



**Shi Yan preparing vegetables with a
French volunteer**

© Shared Harvest

5 Food, farmers and community: a case study of Shared Harvest CSA

by Lila Buckley

It was a cold and overcast winter day when I made the journey to Shared Harvest farm in Shunyi, a northeastern suburb of Beijing. Shi Yan, the Director of Shared Harvest Farm, had instructed me to go to the village assembly hall, since it would be 'easier to find' than her home office. After a two-hour journey, I arrived at the small cement courtyard complex, and two middle-aged village officials invited me into their office to wait.

The unheated room was filled with silent closed-circuit television screens monitoring the sleepy village, and the officials sat smoking and sipping tea, seemingly pleased at my intrusion breaking up the monotony of their day. They told me that everyone in the village knew Dr Shi. 'She has a very important farm here,' explained one of the men.

'People visit from all over the world!' the other chimed in, recalling how their office had been visited by representatives from large companies, and 'even ambassadors from other countries' on their way to Shared Harvest Farm. They seemed to take pride in having the Community Supported Agriculture (CSA) project in their village.

When I told them that I was from a village in America, they wanted to know how theirs measured up. 'Is America divided into cities and countryside, like China?' asked one of the men. 'What are your villages like? Are they just like this, with only a few hundred households, or are they bigger?' Though I had taken only a brief journey from downtown Beijing, it was clear that I had entered another world, where officials and residents feel far removed from the realities of the capital.

Shi Yan arrived, dressed in long, flowing cotton robes reminiscent of Qing Dynasty peasant dress. She exchanged friendly greetings with the two village officials, and we walked a short distance down the road to her home office, where a group of half a dozen students and reporters were waiting for a tour. She took us into the clean, bright sitting room filled with modern furniture, dried-fruit snacks, and simple artwork. Upon seeing the office, someone in the group commented, 'This is the countryside, but it doesn't feel like it.'

Cheng Cunwang—Shi Yan's husband and Shared Harvest cofounder—responded, 'Just because you're in the country doesn't mean it has to look like it. You were expecting us to sleep on a kang¹?' The visitors laughed and departed with their guide, leaving Shi Yan and her husband to get on with their work for the day. This included an interview with me, a meeting about plans to build and run an on-site farm restaurant in the coming year, and lunch with representatives of an agriculture NGO in Hong Kong.

5.1 Background and characteristics of the case study area

Shared Harvest (*fenxiang shouhuo*) is a community-supported agriculture (CSA)² initiative established in Beijing in 2011 by Director Dr. Shi Yan and her husband Cheng Cunwang. The CSA, consisting of administrative staff and member farmers, sells a range of vegetables, grains and meat directly to urban consumers who purchase membership plans costing between 3000–8000 yuan (500–1300 USD) per year. The majority of the production comes from two farms on the outskirts of Beijing: Shunyi Farm in Liu Zhuangzhu Village and Tongzhou Farm in Tongzhou Mafang Village.

These 'suburbs' of Beijing are a world away from the bustling economy and plentiful opportunities of the capital, and farmers here are increasingly squeezed out of farming and into factory jobs to make ends meet. Shared Harvest works to reverse this trend by bringing back 'Real Food, Real Farmers, and Real Community' to China, to quote the motto of Local Harvest (www.localharvest.org), a US organisation seeking to connect farmers with consumers.

Inspired by this mission, the CSA also aims to bring more young people back to farming livelihoods. Indeed, 20 Shared Harvest staff (or 'new farmers,' as Shi Yan describes them), who are mostly young and college-educated, support all aspects of production and marketing. Some of the staff are from rural areas, and aspire to start CSAs in their own home towns. Shared Harvest's website explains that these staff have 'accumulated a rich store of technical knowledge' about applying aspects of sustainable agriculture such as biopesticides and organic soil treatment. In addition, staff gain experience in marketing approaches and the functions of a CSA, such as 'ensuring that each week's harvest can meet the needs of customers, and ensuring that customers receive the freshest possible vegetables.' Indeed, Shi Yan herself spent time working on a CSA in the US before setting up Shared Harvest.

Shared Harvest's goods come primarily from 20 additional 'member farmers' working either as labourers on the Shunyi Farm or on their own land in Tongzhou (the Shunyi Farm is run as a company, while Tongzhou Farm is run as a cooperative). There are also five villagers working full-time in delivery and sales. The total land area covered by these farms is over 100 mu (6.7 ha), with about 60 mu (4 ha) in Shunyi and about 40 mu (2.7 ha) in Tongzhou. This includes orchards, greenhouses for vegetable production, and areas for animal husbandry. The Shunyi Farm is the major production area, and Shared Harvest have signed a 17-year land use contract with the Shunyi government. There is also an independent but affiliated CSA based in Tianjin, with 70 mu (4.7 ha) of land.

1. A *kang* is a traditional Chinese bed made of a wooden board raised above the ground, often with heating from a nearby stove vented underneath. *Kang* can still be found in villages throughout rural China.

2. Cheng Cunwang estimates that there are about 300 CSA farms in China, with a total of approximately 50,000–80,000 member families.



Chickens grazing outside the greenhouses © Shared Harvest

As explained on their website, Shared Harvest is a programme of ‘direct cooperation with family farmers’. In other words, staff consult with the farmers at every step of production—drafting planting plans, designing farming methods and standards, and developing marketing strategies. The approach is thus to utilise staff’s technical knowledge while honouring and integrating the capability of the farmers. ‘We are using our specialised knowledge,’ the company brochure explains, ‘to train farmers to supervise themselves, establish cooperative relations, and employ their diverse cultural knowledge.’ In this way, Shared Harvest aims to promote ‘the diversity of rural China’s cultures of sustainability.’

Profits are shared among all CSA members. ‘After guaranteeing ecological farming methods and meeting basic costs,’ the Shared Harvest website explains, ‘we return the majority of profits to the farmers and our core CSA members.’ Shared Harvest’s vision is that this collaboration between community-based local farmers and ‘returned youth’ (*fanxiang qingnian*) can ultimately help revive rural economies while providing healthy livelihood options for both urban youth and rural peasants.

Towards this end, some of the goods sold by Shared Harvest are purchased from other producers, as long as they meet their strict internal organic standards (see Section 5.2). ‘We have very high standards for the products we sell. They have to be organic whenever possible, or at minimum absolutely no additives (*wu tianji*)’, explains Shi Yan. So far, they have identified several products that meet these standards, including rice, wheat flour, pork, lard, chicken, eggs and peanut oil. But they have not yet found fish or beef that meet their requirements, so they simply don’t sell these items. In the future, they hope to add processed

goods such as breads, noodles and steamed buns. During one interview, she shared some delicious dried persimmons and dates from two new producers they had recently approved.

As part of its goal of reviving rural communities, Shared Harvest also aims to educate urban residents about healthy eating and sustainable food systems. Their consumer base is comprised of over 500 members who invest upfront in the farm production each season, and in return receive weekly deliveries of goods to their homes throughout the year. In addition, there is a growing number of 'group buyers' (300 at the time of the research) who collectively order goods for weekly pickup at five locations throughout Beijing. While these buyers aren't members and don't invest in farm production, the quantity they are consuming makes up an increasingly significant portion of Shared Harvest's sales. The CSA has achieved rapid growth without the use of conventional advertising. Rather, their marketing has been exclusively through new media channels such as WeChat (an influential Chinese social media platform), blogs, Facebook, Twitter, and even Pinterest, as well as word of mouth. They currently conduct most of their outreach, sales and arrangement of deliveries through WeChat. In the summer of 2015 they launched a software application to promote sales of sustainably grown foods from CSAs throughout China, as well as their own.

Shared Harvest's consumers are much more than just a source of revenue—they are an integral part of the operations and mission of the CSA. As the website explains: 'In becoming a Shared Harvest CSA member, you enter into a cooperative relationship with the producer in which you both share the risks inherent in the growing process.' The farmers base their planting and supplies procurement each season on the number of shares that have been purchased. 'Throughout the production process,' the site continues, 'all of the risks are jointly shared by both parties.' As Cheng Cunwang points out, 'the CSA model is a means of combatting risk. The biggest difference between this model and that of modern agriculture and its industrial supply chains is that the relationship between producers and consumers is one of fair trade.'

CSA member consumers are encouraged to visit the farm 'to observe or to work alongside the farmers whenever they please.' They also organise 'farm days' and other activities on-site, bringing Beijing urbanites to the farm to participate in farm activities for a day. These activities may include working on the farm, or direct education such as viewing a DVD on the problems of industrial agriculture in China, or discussing international initiatives and celebrity chefs such as the UK's Jamie Oliver.³ In addition, they send out a weekly 'Shared Harvest Newsletter' with information about the farmers and the production process. Through this model, they aim to 'promote healthy, environmentally-friendly lifestyles' for urban residents and consumers of their products.

5.2 Ecological sustainability

Shared Harvest view sustainable agriculture as a tool for promoting healthier rural and urban communities. By 'sustainable agriculture' they mean that they use 'no pesticides, no [chemical] fertilisers, and no GM [genetically modified] species.' Their production methods aim 'to protect water, soil, air and biodiversity for the next generation'. Besides the ecological benefits, they also include social considerations, adopting a 'fair trade model to support local farmers and local economy' with the aim of building 'a community based on trust and

3. www.slowfood-beijing.org/events/be-farmer-for-one-day/ accessed 23/12/14.

a sharing relationship between citizens and farmers.' Shi Yan further explains, 'Farmers are the ultimate beneficiaries of organic production, because they aren't exposed to harmful chemicals.' They also benefit from the higher values, and thus higher earnings, of their organic products. And urban consumers benefit from the improved taste and health benefits of fresher, chemical-free local foods.

According to their website, each individual consumer-member represents a reduction of 50 kg of chemical fertilisers, 0.3 litres of pesticides and 0.6 m³ of waste pollution. In addition, they calculate that 'for every ten customers involved, one acre of field can be changed to sustainable production; for every twenty customers involved, one new farmer will be able to make a livelihood from farming sustainably; for every 100 customers involved, five young people will be able to live in the countryside; and for every 1,000 customers involved, a rural community will [take] shape.'



Sustainably produced vegetables © Shared Harvest

Though Shared Harvest goods are not certified organic (see Box 5.1), they are produced using organic techniques, which are developed and monitored by the staff. Instead, they prefer to rely on close oversight of farming practices, supported by active communication with their consumers to ensure the marketability of their goods. In this context, 'organic' food is not the end goal, but rather a means to an end in promoting a sustainable food system. Part of this trust-based relationship is due to their strict, uncompromising standards for the goods that they sell. At a minimum, their goods must include 'absolutely no pesticides, no [chemical] fertilisers, and no GM species.' They are extremely rigorous in regularly testing their soil, water and end-products. They conduct on-site soil tests twice a year, and send samples of their vegetables to be tested by an independent company. They also publish the results on their website.

Shi Yan explained that in the most recent tests (conducted late last year), all of the vegetables were completely free of trace chemicals, showing that they met the strictest of organic standards. The lemons, apples and rice from two of the farming households, however, were found to contain traces of pesticides. 'We have had a lot of discussion among ourselves, and with the farmers, as to how this happened,' recalled Shi Yan. 'The farmers said that they did not use any pesticides, and we believe them. Actually, the level of pesticides found was so low that the food would still pass domestic organic standards.' They had used a testing company that followed European standards, which are more sensitive. They concluded that the contamination likely came from one of three avenues:

1) contamination from neighbouring farms, since those products were not grown in the contained environments of the greenhouses; 2) residual pesticides in the soil, since these farms only converted to organic methods one or two years ago (full organic conversion generally takes at least three years); or 3) there may have been traces of pesticides in the bags that they used to store and transport the goods, since those bags had also been used for conventionally grown items.

Box 5.1 Beyond organic certification...

While sustainable agriculture is at the heart of this project, Shi Yan explains that organic certification is not necessarily required in China: 'The consumer's belief in you is more important than certification.' Organic products can sell at three to eight times the market prices of conventionally produced foods, and consumers are understandably reluctant to pay this premium when they cannot trust the authenticity of the products in a poorly regulated organic market. 'Instead,' explains Shi Yan, 'consumers want to be personally involved in the production process, to visit the farm and see for themselves how the food is produced—or at least hear about how it is produced from friends who have visited.' In addition, she adds, 'from the farmer's perspective, this direct link to the consumer through the CSA model is a form of income guarantee. They receive the investment up front, and don't have to worry about producing goods that may be challenging to market later in the season.'

Urban consumers are indeed willing to pay a premium for high-quality food from a trusted source. 'Perhaps more important—at least to me as consumer,' explains reporter Manuela Zoninsein, 'is that I am confident that what I'm getting is *actually* organically grown. This can't be overstated, because mislabelling is rampant.' She concludes that even though the food she buys from Shared Harvest is 'two to three times more expensive than what I would pay at the local market, it is absolutely worth the cost.'⁴

Shared Harvest staff work closely with farmers in developing their organic-production skills. Farming practices include the use of biopesticides such as *chucongju* (extracted from wild chamomile), *liansu* and *hasimumeijun*. They generally use fertilisers and biopesticides available in the Chinese market, following common practice for organic production in China. There aren't any sources of organic seeds in China, and for the most part farmers are forced to purchase conventional hybrid varieties. Shi Yan explained that on smallholder farms, it is not very practical to save seeds, because this requires farmers to let part of their field overgrow, which cuts down on production in an already limited area. Shared Harvest farmers do save some of their seeds for select plants, such as soy, vanilla and some kinds of beans.

Climate change mitigation is not an explicit goal of Shared Harvest agriculture practices, but Shi Yan emphasised that the farmers 'certainly do feel the effects of climate change on our farming practice.' They rely on greenhouses for temperature control and micro-climate regulation, since 'temperatures can fluctuate wildly and are increasingly unpredictable.' Despite these direct effects, however, Shi Yan does not see climate mitigation as a current priority of Chinese farmers. 'In general,' she says 'people are just trying to survive and make ends meet, through a better farming approach and stronger market connections. They aren't thinking beyond this to the global climate implications of their actions.'

4. <http://zesterdaily.com/world/skeptical-of-chinas-organic-farmers-csa-helps/>

Shared Harvest's experience so far suggests that productivity in organic farming is lower overall than for conventional farming. For example, as shown in Table 5.1 below, production rates for Shared Harvest's grains such as soy, corn and rice are comparable to, or only slightly lower than, conventional rates. However, vegetable production is much lower. 'A conventional vegetable farm in Shandong might produce 5,000 kg of vegetables per greenhouse,' says Shi Yan, 'where Shared Harvest only gets 4,000 kg.' Production costs are also two to three times higher for organic vegetable farming, primarily due to the much more intensive labour required.

Table 5.1 Shared Harvest organic and conventional yields compared

Crop	Shared Harvest production	Conventional production
Soy	2,550 (kg/ha)	3,000 (kg/ha)
Corn	4,500 (kg/ha)	5,250 (kg/ha)
Rice	10% lower than conventional	
Vegetables	4,000 kg/standard greenhouse	5,000 kg/standard greenhouse

Source: From interview with Shared Harvest Director, based on 2014 production rates.

'However, these lower production rates and higher production costs exclude environmental costs,' explains Shi Yan. 'If you included environmental costs, our organic methods would cost *much, much* less than conventional agriculture—in some cases, our costs would actually even be negative.' For example, using soil as an indicator, 'Conventional agriculture destroys soil. But we are actually increasing the organic matter in our soil.' Based on their most recent testing, in just the last year, organic matter in Shared Harvest soil has increased from 1.5% to 2.5%.⁵ 'These factors are not usually measured when we talk about the so-called higher costs and lower production rates of sustainable agriculture.'

5.3 Economic sustainability

Shi Yan describes Shared Harvest as a 'family business'. She and her husband established it using 88% of their own personal investment. The remaining 12% came from 12 people who contributed up-front investment paid back by five years of vegetable deliveries. The focus from the start was on developing a strong market for the vegetables—'because,' explains Shi Yan, 'If you want farmers to stay in their villages and grow organic food, you have to have a way for them to sell the goods.'

Cheng Cunwang agrees that the main challenge facing farmers practising sustainable methods is marketing, not production. 'China's farmers and cooperatives have no real problems with sustainable agricultural production using both traditional and modern technology. The main problem is the market, and the difficulty of communicating the ecological value of sustainable food products.' Indeed, Shi Yan argues that it is precisely

5. Organic matter is an important measure of soil quality and fertility. Less than 1.5% is considered low, and evidenced by a yellowish-grey soil colour; 1.5%–2.5% is considered moderate, and manifested by reddish-brown soil colour; above 2.5% is considered high, and seen in a 'very dark soil colour' indicating the highest fertility. See Pamela Anne Hazelton, 'Interpreting Soil Test Results: What Do All the Numbers Mean?' <http://tinyurl.com/om4pxdy>.

the way that Shared Harvest sells the goods—through the CSA model—that is promising an innovative solution to achieving ecological, economic and social sustainability for food production in China. ‘The philosophy for the CSA consumer is, explains Shi Yan, ‘that I invest first, then you produce.’

5.3.1 Consumer investment to promote stability

The income streams of the CSA are designed to match the specific patterns of agricultural production: the influx of funding from investor-consumers comes at the beginning of each season, when farmers’ capital needs are greatest. They are thus able to invest in seeds, fertilisers and equipment up-front, and then produce goods based on consumer demand. This ensures stable financial support for these farming livelihoods.

In 2014 the Shared Harvest farm had a total income of about 6 million yuan and a net profit of 10%, without *any* direct subsidies or government policy support. Staff are paid regular salaries based on profits, while farmers’ earnings as labourers on the Shared Harvest farm are based on their production. In Tongzhou, farmers work their own land and are paid for the goods they provide; annual profits from sales made by the village collective (*cun jiti*) are distributed among the farmers.

At Shunyi Farm, most of the farmers had previously been employed as labourers in industrial jobs because they did not see farming as a viable livelihood option. Most had to commute long distances to work, and their jobs were taxing to their health. These workers are labourers on Shared Harvest’s Shunyi Farm, on land rented from the Village Collective.⁶ Their salaries with Shared Harvest are currently 2,000–2,500 yuan/month, or 20,000–30,000 yuan/year (or 310–390 US\$/month, 3,100–4,700 US\$/year). This is comparable to what they made previously, explains Shi Yan, ‘but they are now able to live at home, without long commutes—and the work is better for their health, and for the social cohesion of the village.’

At Tongzhou Farm, the social and economic benefits are even more striking. The producers are small-scale farmers working on their own land, who had been practising conventional agriculture prior to engaging with Shared Harvest. Shi Yan states that many of them were struggling and in fact ‘would have abandoned agriculture production for other livelihoods.’ They struggled to compete in Beijing’s increasingly cut-throat food market. Now, working with Shared Harvest, explains Shi Yan, they focus solely on production, and don’t have to worry about the market. These farmers have seen significant increases in income. The most technically skilled members of the farmer cooperative in Tongzhou are earning up to 120,000 yuan per year (10,000 per month), and between 30,000–40,000 yuan per year if they are less skilled. However, income levels vary depending on the profits of the CSA in a given year.

5.3.2 Innovative marketing

A key feature that distinguishes Shared Harvest’s economic model from other sustainable agriculture projects is its focus on innovative marketing tactics. Rather than relying on the farmers to find the market themselves, the CSA model allows farmers to focus exclusively on production, while the support staff develop the market channels and handle deliveries

6. The farmland is rented for 1,500 yuan/year, with greenhouses available for an additional per-unit fee.

for them. As mentioned above, they have over 900 urban consumers including both local Chinese and expatriates, and this number is growing rapidly without any conventional advertising. The majority of their consumers invest in the CSA early in each growing season, and in turn receive weekly deliveries to their homes throughout the year.

Shared Harvest is also experimenting with a 'group-buying' approach, whereby groups such as school parents or company employees purchase items in bulk. This reduces handling and delivery costs, as well as enhancing the social integration of these 'food communities'. According to Shi Yan, 'Another advantage of group buying is that these six [group pickup] areas already have an existing sense of community. Many are schools where the parents already know each other to some degree. This makes them better able to organise themselves, promote the concept of local-food consumption, and bring in new buyers.'

Shi Yan explains that Shared Harvest's marketing approach would not have been possible without the recent development of social media in China. 'This new kind of market channel is showing up all around China' she says, 'and is made possible by new media channels like WeChat, which enables groups to organise and communicate rapidly.' Shared Harvest staff are young, cosmopolitan, and highly educated. They bring fresh ideas to the concept of 'rural markets' as well as rural-urban inequalities, and they attract like-minded urbanites seeking an alternative to urban lifestyles. Indeed, the majority of Shi Yan's time is spent receiving visitors to the Shared Harvest farm. 'There is a lot of interest in what we are doing here,' she observes, 'because it is a model that isn't seen elsewhere in China.' Even though they don't explicitly advertise the opportunity for farm visits, they have visitors nearly every day, year-round. They recently launched an app call Good Farm (*Hao Nongchang*) to connect CSAs, cooperatives, farmers markets and organic stores with consumers and restaurants throughout the country. Consumers can use this app to explore products offered by various CSAs. Once a person joins a CSA, they can also use the app to place their orders.

Though only four years old, Shared Harvest is already branching out into new ventures. They have begun to capitalise on the popularity mentioned above, charging 50 yuan for a visit, plus 50 yuan for a lunch of food grown on the farm and cooked in its small kitchen. They also offer ad-hoc classes on subjects such as making peach liquor, in which families can come to pick the peaches, eat the peaches, learn how to make the liquor, and then eat lunch on site. Shared Harvest opened an organic restaurant adjacent to their Shunyi Farm in July 2015, and this is being used for events and hosting visitors on a daily basis. Restaurant customers include individuals coming for a farm tour and lunch, groups reserving the dining room in advance, and participants in farm courses that include meals.

'Our philosophy for the restaurant is to introduce a different approach to eating in China: Eat local; eat in season,' explains Shi Yan. 'We want people to accept eating whatever is available: If we don't have any eggs today, you just don't eat eggs.' This approach is not only highly practical but results in foods that are fresher as well as healthier, consumed in their natural season. She explained that good storytelling is an important part of their marketing approach, getting consumers to shift the very core of their thinking about food production and consumption. For example, 'You might have a package of the best tea in the world, but that alone doesn't mean that I'm going to buy it. You have to draw out the story about this tea, about the farmers who grew it, the community it supports, the process of growing and harvesting it, and the wonderful flavours and benefits to my health. Then I won't be able to resist buying your product.'



Harvesting vegetables © Shared Harvest

They have had marketing success in this way with the help of a few key charismatic individuals. 'We used to have a colleague,' Shi Yan recalls. 'His cooking was only average, but he was a great storyteller. He always said, 'Cooking is one of life's great pleasures.' He didn't see it as just a job or a chore. And guests loved his energy. He would really bring the dishes to life, emphasising for example the freshness of the ingredients and how they had just been picked that very morning. And he encouraged the social aspects of the meal, telling guests to "bring your friends and have a good time together!"'

This cook was also savvy about using new media channels to reach out to consumers. He sent out regular messages to his WeChat group, telling them about the harvests currently available, the new dishes being developed, etc. 'People really responded to his stories,' adds Shi Yan. 'We want diners to have this kind of experience at our restaurant too.'

As for future marketing plans, Shared Harvest is not focused on expanding their efforts, though their consumer base is growing rapidly through word-of-mouth. 'We don't want to be bigger,' says Shi Yan, 'We want to do better...I want to make something where nothing was before,' she says. Cheng Cunwang explains that they aspire to set a good example and inspire others, rather than to expand indefinitely. 'We hope that every city can have a CSA—not necessarily our own, not necessarily a Shared Harvest,' says Cheng Cunwang. 'We support any CSA effort, anywhere.'

For this reason, they are putting effort into training farm managers so that they can run their own independent agricultural operations. The first farmer-manager training was held on 8 June 2015, and they plan to hold other such trainings in the future that cover ecological agricultural practices, marketing and other essentials skills. They also have ideas for expanding into new complementary areas such as developing more formal outreach and education programmes for schools and visitors to the farm, and direct collaboration with schools on organic gardening and school food programmes.

5.4 Social sustainability

The core of Shared Harvest's efforts is a focus on the social aspect of farming as a threatened livelihood in China. 'At a minimum,' says Shi Yan, 'the market needs to be strong enough to reverse the trend of farmers leaving the land.' She explained that the biggest obstacle for smallholder farmers in China is the up-front investment inherent in food production.

The CSA model offers dramatic advantages in terms of livelihood and rural community. Seventy percent of produce consumed in Beijing now comes from other provinces where labour and land is cheaper. Much of this food is produced by large agribusinesses. Beijing-area farmers are finding it increasingly hard to compete with the low prices of this food, and many have been abandoning farming altogether. Shi Yan explains that when Shared Harvest was established, many of the farmers in Tongzhou were considering converting to grain production because they were finding it too difficult to turn a profit from vegetables. The farmers in Shunyi had in fact already abandoned farming and their own land, and were working in factory jobs. Shared Harvest has offered these farmers a viable livelihood option in sustainable agriculture. By eliminating the need for farmers to market their goods themselves, this lifts a tremendous burden from the already heavy workload of small-scale farmers, and may be a decisive factor in the viability of their lifestyle.

In the Shared Harvest philosophy, farmers are seen as central to the sustainability of the food system. 'As producers of food itself,' write CSA staff on their blog, 'farmers undoubtedly play the most important role in the food sector; at the same time, they hold wisdom about their land that is based in their own experience.'⁷

Shared Harvest's goal then, is to support this knowledge and way of life, 'to ensure that farmers maintain their dignity and livelihood while also gaining the support and understanding of consumers.' The entire business model of Shared Harvest is built on this basic foundation. 'If consumers are aware of where the food on their tables comes from; if they establish close relationships with farmers and offer words of encouragement,' they reason, then 'engaging in the work of agriculture will have more dignity and meaning for producers.'⁸

Indeed, Shi Yan maintains, consumer attitudes really are changing. Ten or more years ago, consumers looking for better quality would simply buy only imported goods. Now, more and more are willing to buy local. 'They are realising that foods taste better when they are bought locally,' she says. 'I thought it would be hard to sell this idea in China, but actually people are realising this on their own, just through experiencing the quality of the goods we are selling.' Many consumer members are actually becoming active in this process, organising themselves to promote local-food consumption. Shared Harvest member farmers are living proof that such consumer attitudes and investments can make a difference.

In addition to the direct impacts on farmer/producers and their village communities, Shared Harvest supports an entirely new kind of 'farming' livelihood for the 20 'new-farmer' (*xin nongfu*) staff members who run the CSA. These are primarily college-educated youth in their twenties or early thirties, many of whom didn't even come from farming families. 'They have chosen this as a way of living a village life,' declares Shi Yan.

7. http://blog.sina.com.cn/s/blog_a569abc901012bq9.html.

8. Ibid.

5.5 The role of government

5.5.1 Local government

The government has not had any direct role in the founding or operations of Shared Harvest, which is an independent, private company. Prior to founding Shared Harvest, Shi Yan had established Little Donkey Farm, another CSA, using government investment and government land. In setting up Shared Harvest, she wanted to focus on the market and have more autonomy in the operations. She used her own personal savings, with additional investment from various individuals, and developed collaborations with individual farming households working on their own land.

However, they do benefit indirectly from government support and involvement in some areas. The government provides low-cost land for the company to rent in Shunyi, as well as subsidising certain inputs such as organic fertiliser. The Shunyi Village Committee also engages in distributing farm profits to the farmers. In addition, based on interviews and observations, village officials in Shunyi seem to enjoy the moral support derived through positive relationships with local government.

From my visit to the Committee office, it is clear that Shared Harvest also maintains generally good relations with the local government leaders, who see the CSA as positive since it brings in respected visitors, employs local villagers, and promotes sustainable development. 'The government is currently very concerned about the quality of food,' says Shi Yan. 'There is strict management of our products from a quality perspective, and there is support for some of our agriculture inputs, such as subsidies for our organic fertilisers from the village government. They also come to the farm on official visits, additionally promoting what we are doing.'

5.5.2 National government

Broadly speaking, the national government's major policies align well with the CSA model and the social, economic and ecologic objectives of Shared Harvest. Its 2015 Number-One Document⁹ stresses the importance of farmers to China's development, arguing that 'better-off rural residents are a prerequisite for a prosperous China.'¹⁰ Specifically, the current emphasis is on food security as a number-one priority—an issue central to most of Shared Harvest's consumer members.

Three of the government's five main areas highlighted for improvement are also direct goals of Shared Harvest: 1) integrated urban-rural development; 2) injecting new vitality into rural development; and 3) increasing farmers' incomes.¹¹ Chinese leadership is increasingly concerned about the migration of youth out of villages, and what this will mean for China's future food security. The government therefore aims to improve financing options for farmers, and to improve pricing mechanisms, as well as investing more in rural infrastructure such as power and water provision.

9. The Number-One Document (www.cctv.com/english/special/rural_development/Homepage/index.shtml) outlines policy priorities for the year and is published annually every January; it has highlighted rural issues since 2003.

10. http://english.agri.gov.cn/news/dqnf/201502/t20150203_24952.htm.

11. Ibid.

Although ecological sustainability receives less direct attention than in previous years, there is a focus on specific goals such as cleaning up land contaminated with heavy metals, reforming water resources management systems, and setting aside 'permanent farmland' that will not be available for industrial or urban development. The Ministry of Agriculture has estimated that approximately 3.33 million hectares of farmland are now too polluted for agricultural use, and the State Forest Administration has stated that 34,000 square kilometres of wetlands have disappeared over the last decade.¹²

In general, Shi Yan sees a shift in the high-level Chinese leadership's priorities relevant to Shared Harvest's efforts. 'Before, the government's focus was to produce more food,' Shi Yan says of government agricultural subsidies. 'Now, the focus is on protecting the environment.'

Implementation of these goals, however, remains a challenge. While high-level policy may align with Shared Harvest's mission, the current policy environment falls short on many specifics. Shi Yan explains that local governments are tasked with decreasing the use of chemical pesticides, but many do not really accept or acknowledge organic agriculture. In addition, there are a lot of problems in the organic market in China including corruption, cheating and poor market links. This means that most organic farmers have to worry not just about the issues of organic farming practices—which, as we have seen, are challenging enough—but about whether they will be able to find a market willing to pay the extra costs.

5.6 Motivation for Community Supported Agriculture

The inspiration behind Shared Harvest's philosophy and strategy comes from founders Dr. Shi Yan and her husband Cheng Cunwang, who have spent the past decade promoting sustainable agricultural development in China. They met as M.A. students at Renmin University, where both of them studied under Professor Wen Tiejun, a well-known advocate of rural reconstruction. Shi Yan wrote her PhD dissertation on Community Supported Agriculture in China at the Renmin University School of Agricultural Economics and Rural Development.

Together with Cheng Cunwang, Dr. Shi has produced Chinese translations of three books related to sustainable agriculture and rural economics: *Farmers of Forty Centuries: Permanent Agriculture in China, Korea and Japan*; *Sharing the Harvest: A Citizen's Guide to Community Supported Agriculture*; and *Slow Money*. In addition to her academic pursuits, she also spent six months working on CSA-linked farms in the US, and returned to Beijing in 2008 to help found and run Little Donkey Farm (one of China's earliest and most influential CSAs) along with Cheng Cunwang and about 15 other people, using government land, equipment and investments.

When asked about their motivations for starting a CSA, Cheng Cunwang recalls their graduate-school days: 'Our main subjects of study were ecological agriculture and food-safety issues, including chemical agriculture. During our research, we realised that many scholars had already contributed quite a few ideas about addressing agricultural problems—but these problems persisted nonetheless. So we decided that we needed to find solutions involving practical measures. Professor Wen found an opportunity to send Shi Yan to

12. <http://chinawaterrisk.org/notices/2014-no-1-doc-arable-land-food-and-water/>.

Minnesota to study CSAs; when she returned, we began to set up a CSA in China, and that was (part of) the inspiration for Little Donkey Farm.'

Dr. Shi Yan is a strong character who has become something of a celebrity in food and agriculture circles. Cheng Cunwang tends to keep a lower profile, but his role has been equally important. He is now responsible for two offices in Beijing that handle the marketing and IT aspects of the business; these offices each have about ten employees. Shared Harvest's success has benefited from their combination of initiative, scholarly expertise, hands-on CSA experience abroad, and advantageous relationships with academics, farmers, consumers and officials in Beijing and the surrounding region.

Shi Yan's charisma has likely been crucial to Shared Harvest's financial success, but she insists that its operational success is thanks to farmers' and staff dedication to the larger mission of their work. 'You have to want to live this kind of life to do this kind of thing,' she explains. 'This is not just a business—it is a way of life. If you try to set up a CSA just to make money, you will be disappointed. It is a lot of hard work, and requires intense dedication. Agriculture is simply not a highly profitable sector. You have to want the life that comes with it—and then you can use this model to support that life, focusing on the things you can do that the big companies cannot. If not, you might as well work in textiles or something else.'

As discussed above, Shared Harvest's mission is to promote 'Real Foods, Real Farmers and Real Community' in China. This highlights the three problems that Cheng Cunwang and Shi Yan have identified with China's current food system and its increasing rural-urban divide: food commodity chains are getting longer, and the quality of food is decreasing; farmers are being pushed out of the agricultural sector by large agribusiness; and rural communities are suffering as farming livelihoods become less and less viable. Indeed, there have been countless food-safety scares in recent years throughout China, and the health of Chinese people today will inevitably be adversely affected by any decrease in the quality of the food they consume. As Cheng Cunwang points out, prevention through improved nutrition may be a more efficient and cost-effective solution: 'China is now spending huge amounts of money on medicine and insurance. Many (medical) problems are caused by food and agriculture. Why not take some of that money and invest it in sustainable agriculture?' Organic imports now far outnumber exports, as Chinese consumers turn abroad seeking sources of safe, trustworthy food. Shi Yan argues that the CSA model solves many of the problems of rural/urban food systems in China, and Shared Harvest farms provide a model for these solutions on a local level.

Through active communication with their urban consumers, Shared Harvest aims to build strong market ties for farmers while transforming urban consumption habits. This model has proven attractive; Shared Harvest's consumer base continues to expand rapidly even without the use of any conventional advertising strategies. Urban residents appreciate the close ties with farms. As reporter Manuela Zoninsein expressed it, 'I have the opportunity to support and build a relationship with local producers. I receive updates in Chinese and English on how things are going on the farm, and make regular trips to work and cook with the farmers and observe farming practices myself.'¹³

13. <http://zesterdaily.com/world/skeptical-of-chinas-organic-farmers-csa-helps/>.



Shi Yan weighing vegetables © Shared Harvest

CSA members have opportunities to take part in many promotional events such as ‘farm days’. ‘It was the very first time in my life that I pulled fresh carrots and giant radishes out of the ground!’ writes Beijing resident TJ in a blog post about his visit to the farm. ‘How excited I was!!’¹⁴

This kind of contact can have a lasting impact far beyond the enjoyment and novelty of on-site experiences. The greater hope is that it will actually change the consumption habits of Chinese urbanites. As TJ further noted, ‘I don’t know if it was because of the fun I had at the farm or the freshness of the vegetables—but everything I cooked that night tasted so much better than the dishes made with store-bought veggies... Once you go to farm-fresh veggies, you don’t want to go back! Especially the carrots—oh, my, my!—they were so juicy, and packed with such flavours and sweetness that I hardly had to put any seasoning on them.’

5.7 Challenges faced

Shared Harvest has enjoyed a strong start; it has benefited from dynamic leadership, young farmers eager to try new approaches, high ecological standards for their goods, a rapidly growing and enthusiastic consumer base, and positive government involvement. In a few short years, it has been able to realise the production of high-quality, ecologically sound food, strengthened rural-urban market links, and improved livelihoods for lifelong farmers and ‘new farmers’ alike. However, these ‘successes’ have not been without challenges and setbacks.

14. www.musichef.com/farm-trip-to-csa/

5.7.1 Chemical contamination

One of the main challenges is technical barriers to achieving truly organic production in a country with increasingly contaminated soil and water. This was highlighted when the Shared Harvest team discovered traces of chemicals in their most recent product testing (see Section 5.2). 'You can see that it is currently not really possible to truly achieve 100% organic production in China,' concludes Shi Yan. 'It is impossible to ever fully 100% control all the steps. There are so many inputs—water, land, seeds, tools, fertilisers, storage equipment, packaging, transport, etc.—from so many diverse sources. Controlling these even partially requires a huge amount of time and energy and research.' Instead, she says, Shared Harvest aims 'to completely eliminate chemical pesticides and fertilisers in our own fields. To achieve even this goal requires intensive collaboration with farmers and consumers.' 'Still,' she continues, 'it is important for us to understand, and to share with our consumers, the possible avenues for this kind of contamination, because it reflects the challenges of truly organic food production in China.'

In this, Shi Yan explains that some farmers have a hard time accepting a complete ban on agro-chemicals. 'Organic food takes good care of farmers because they don't have to use the chemicals,' she says. 'In principle, they may agree that limiting chemicals is good for their health and for the quality of the vegetables, but when it comes down to it, they think, "not using pesticides at all—that's just stupid!" They see chemicals as a useful tool that perhaps should be managed better, but not completely abandoned.'

5.7.2 Sceptical and poorly-informed consumers

Despite their strong and growing consumer base, Shared Harvest's message of supporting local-food production still only reaches a small niche group. 'Consumers are still sceptical of goods produced in China,' says Shi Yan. 'There's still much work to be done throughout the country to get consumers to trust the domestic market, to believe that good-quality food can be produced here, and to understand the importance and power of buying locally. By buying local, organic food, consumers can actually create the reality of more local, organic food, along with vibrant rural communities.'

She emphasises the importance of dedicated staff coupled with new social media tools in achieving the success that Shared Harvest has experienced so far. 'To succeed at this kind of project, you need to make full use of new media tools such as WeChat, as well as continually having activities and meetings to reach out to consumers.'

Education and outreach are an essential part of developing acceptance for organic CSAs in China. Consumers with disposable income in both developed and developing countries have a tremendous range of choices; thanks to international trade in food products, they are able to enjoy fresh produce out of season, and have been conditioned by supermarkets to expect it to be cosmetically perfect. As a result, a tremendous amount of perfectly good food that doesn't meet these standards is wasted.

On the other hand, CSA consumers receive a regular supply of fresh produce but can only select the types of foods they want to receive, not the individual specimens. Thus they may have to accept oddly shaped or otherwise imperfect produce that they may have rejected in the supermarket. Also, they are forced to eat in season. If there are no eggplants or oranges

at a particular time of year, then they have to go without, or buy them elsewhere. Accepting the value of irregular-looking and seasonal-only produce will take education and a shift in consumer perspective.

Educating consumers is a key aspect of CSAs, although not necessarily their main objective.

By giving members a chance to visit their farms and participate in activities, CSAs connect their members directly with the agricultural production process, and give them a new appreciation for what it means to grow, market and distribute food in a healthy manner. This is an aspect all too often lost in our modern food system.

5.7.3 Policy barriers to organic production

Even if Shared Harvest did decide to pursue organic certification, new requirements would make it cost-prohibitive. In 2013, the government issued new organic-certification standards requiring each crop to be certified separately. The costs of certification for Shared Harvest's products would therefore be over 150,000 yuan per year. Furthermore, explains Shi Yan, current standards and subsidies are geared towards industrial production. And there are currently no government-sponsored programmes to support Chinese farmers in learning best practices in organic farming, nor to purchase or implement new sustainable technologies.

The result is that few small-scale farmers are able to engage in sustainable agriculture livelihoods. Instead, larger companies operating larger-scale farms (over 7 ha) tend to dominate organic production. Despite this challenging policy environment, Chinese agriculture is likely to remain dominated by small and medium-sized farms of 3–4 ha.

'You need to be either very committed or very rich to succeed in sustainable farming,' says Shi Yan, admitting that 'all of Shared Harvest's success has been due to very committed people.' Shi Yan would like to see policies in place that support small-scale farmers in more tangible ways. She also suggests that agricultural policies need to shift from a myopic focus on food *production* to a more holistic focus on food *systems*.

Ultimately, overcoming these barriers is about changing mindsets and social norms. Both consumers and the government want controlled inflation and low food prices. However, as Cheng Cunwang points out, 'We need to teach consumers that low food prices are not conducive to the development of agriculture, and that sustainable agriculture is vital to protecting the environment and maintaining a healthy society.' The Chinese government has also expressed doubt that sustainable agriculture will ever be able to support China's large population. However, Cheng Cunwang maintains that, based on their own experience, technical improvements can bring the productivity of sustainable agricultural practices up to levels near those of conventional, large-scale agriculture. 'We want to convince the government that sustainable agriculture can bring benefits they hadn't imagined.'

5.8 Conclusions

This case study has attempted to understand Shared Harvest CSA in terms of its ecological, social and economic sustainability. Despite the inherent and considerable challenges of achieving organic food production in China, Shared Harvest seems to be succeeding, largely because of its holistic vision of sustainability as a socioeconomic and ecological system.

As a staff member on the Shared Harvest blog wrote, 'An old Chinese proverb has it that the common people value food as they value the heavens—above all else (*wangzhe yi min wei tian, er min yi shi wei tian*)'. However, Shared Harvest feels that this value has seriously diminished. 'So-called modern cultivation—which is industrialised and chemical-dependent—is gradually replacing China's centuries-old agrarian culture,' continues the writer. 'More and more, we do not recognise the importance of the Earth's life-sustaining resources: clean air, water, and soil... During this modernisation process, the farmers who provide our food do not make enough money to maintain a dignified livelihood! For these reasons, concludes the writer, 'We cannot use a purely economic lens to evaluate our agricultural system; its significance vastly exceeds its strictly "economic" attributes, as it provides the very basis of healthy human existence.'¹⁵

Shi Yan also notes the increasing food-safety issues that inevitably arise from the lengthening of market chains for food commodities. 'We believe that there should be planning around what we eat,' she explains, 'not just on the goods in the field, but on the entire system that produces and delivers our foods.' Such planning would encompass the ecological health of farming practices, the economic profitability of food production, and the social viability of farming as a livelihood.

In the meantime, initiatives like Shared Harvest will continue to expand, spurred by passionate individuals and an increasing hunger in urban consumers for healthier, trustworthy food options. 'In the face of food safety problems, environmental pollution, and the decline of village life,' writes the Shared Harvest blogger, 'we cannot help but feel alarmed. However, we believe that through collective action and the sharing of knowledge we can change the present and work towards a better future.'¹⁶

15. http://blog.sina.com.cn/s/blog_a569abc901012bq9.html.

16. Ibid.



Harvesting Chinese yam (*shan yao*)

© Li Ming

6 Two case studies of sustainable agriculture in Huantai county, Shandong province

By Qiao Yuhui, Seth Cook, He Xueqing and Yue Shizhong

The North China Plain is one of China's main grain producing regions (Chen et al., 2009). The core farming system involves a winter wheat-summer maize rotation. Grain production from this region accounted for 40.1% of the national harvest in 2012 (Chen et al., 2015). In recent years, the cropping area of wheat and maize in the North China Plain has decreased slightly, but these two crops still predominate in the region and production is characterised by high yields with high inputs (Zhao et al., 2009).

In the process of agricultural intensification in this region, excessive applications of agrochemicals have had many negative impacts, including pollution, resource waste and low nutrient use efficiency. Various means are being explored to address these problems.

This chapter describes two case studies selected as representatives of a growing trend towards sustainable agriculture in this region: Bishi Ecological Farm and the Xincheng Chinese Yam Cooperative, both located in Huantai county (Figure 6.1). We begin by providing some agricultural, environmental and socioeconomic background on the case study area, as well as outlining the history of the growth in sustainable agriculture and the case study methodology.

6.1 Agricultural development in Huantai county, Shandong province

6.1.1 Environmental and socioeconomic background

Huantai county is in a relatively developed area of the North China Plain, characterised by intensive agricultural production. The county covers a total area of 509 km². It is located at the confluence of the Luzhong mountainous area and the northern Shandong plain, and has a typical plain topography. The region's climate is temperate continental monsoon, with an average annual precipitation of 558 mm and evaporation of 1,843 mm. The average annual temperature is 12.5°C (ranging from 31.8°C to -7.9°C). The county receives 2,832.7 hours of sunshine on average every year and 198 frost-free days. The main soil types include cinnamon soil and fluvo-aquic soil. These natural conditions are suitable for agricultural production, with the main crops being winter wheat, summer maize and vegetables.

Figure 6.1 Map of Huantai county, Shandong province, China



In 2010, the population of Huantai county was 497,000 (119,000 rural households), 80% of whom were engaged in agriculture. Based on its construction and oil processing industries, Huantai county is now one of the nation's top 100 counties for its level of economic development, according to the Huantai county land consolidation plan (2011–2015).

6.1.2 Agricultural development

In 2010, Huantai county had 35,101 ha of agricultural land, accounting for 69% of its total land area. This comprises 30,257 ha of arable land, 273 ha of vegetable production, 1,150 ha of forest and 3,421 ha of other agricultural land. Grain production is mainly wheat and maize.

Agricultural productivity in Huantai county is high. Huantai was the first county in northern China to achieve yields of one metric tonne/mu¹ (15 tonnes/ha) from two seasonal crops of wheat and maize in 1990 (7.5 tonnes/ha of wheat and 7.5 tonnes/ha of maize). However, at the same time Huantai is facing deterioration in its agro-ecological environment, waste of resources and food safety issues. According to one study, while the available nutrients in the soil have continuously increased due to high inputs of chemical fertilisers, use efficiency has remained at a very low level, meaning that a large amount of nitrogen is lost and leaches into the groundwater (Liu et al., 2005). Between 1998 and 2002, nitrate (NO₃-N) levels increased by 27.2mg/l; 6% of the shallow groundwater was slightly polluted and about 38 villages were at risk from polluted drinking water. Nitrate pollution of groundwater in this region is a serious issue, with more than half the area having suffered nitrate contamination (Xue et al., 2015).

6.1.3 Status of sustainable agricultural development

In the last ten years, Huantai county has begun to actively change its agricultural cultivation practices towards more ecological and circular agricultural approaches. The main activities are described below.

Re-using wheat and maize straw

Since 1996, wheat straw has been returned to the fields, and maize stalks since 2008. This effectively improves the soil structure, enhances soil fertility, and provides a good foundation for developing ecological and circular agriculture. The county government has also supported the establishment of five straw-processing enterprises to convert straw into feed, fertiliser, energy and raw material. Crop straw has reached a utilisation rate of nearly 100%.

'Pig-biogas-crop' production system

The local agricultural bureau has been promoting the construction of biogas digesters both at a community level as well as at a household level (Box 6.1).

Several cooperatives and ecological farms are now trying to integrate animal husbandry (e.g. pigs and cows) into their production systems. This has greatly promoted the development of circular agriculture and increased farmers' incomes.

1. Mu is a Chinese measurement of land area equivalent to 1/15 of a hectare.

Box 6.1 Biogas: central to circular farming systems

Farming cooperatives and farmers provide straw from their crops to livestock farms. Straw and livestock manure (sometimes mixed with human waste) are used as fermentation material in biogas digesters on smallholder farms. The resulting biogas can be used for cooking, lighting and heating. Biogas slurry, a by-product of the digester, can be used as high quality organic fertiliser for crops. The fermentation process also inhibits the growth of bacteria, effectively reducing the incidence of plant diseases. This can also reduce the use of chemical fertilisers and pesticides, as well as the incidence of soil nitrate pollution and pesticide residues. The use of biogas slurry as fertiliser not only increases soil organic matter content and improves soil quality, it also protects local water resources from pollution. In this way, biogas is a key element in the circular economy of rural areas. To date, more than 5,800 biogas digesters have been constructed in the rural areas of Huantai County, although only about 1,000 are in operation.¹

Precision agriculture

In 2009, Huantai county started to implement precision agriculture, involving 11 kinds of grains and 7 kinds of vegetables in a demonstration zone. Tests as well as demonstrations of precision planting, fertilisation, seeding, irrigation, dynamic management and harvesting have been carried out. This system is designed to optimise applications of fertiliser and other inputs to enhance soil fertility, in order to achieve the same or higher levels of productivity while minimising investment, and improve the environment with the efficient use of agricultural resources.

Non-point source pollution control measures

Agricultural non-point source pollution is being controlled through the use of formula fertiliser (*peifang feiliao*). This is designed to meet the specific requirements of certain crops and regions, resulting in more efficient uptake of nutrients by crops.

Another measure is the construction of 18 food (vegetables) standard demonstration areas and farms. Seven varieties of vegetables have obtained either the national hazard-free or green food certification. This has laid the foundation for the development of circular agriculture in Huantai county.

6.1.4 Methodology

Selection of the two study cases

Today, Huantai county has 12 ecological farms. One of these – Bishi Ecological Farm – has been chosen as the first case study. Established in 2006, it is a good example of circular agro-ecological management, combining livestock, vegetable production and biogas to reduce waste and the use of synthetic fertilisers and pesticides.

The second case study – Xincheng Chinese Yam Cooperative – examines a national farmers' demonstration cooperative. In recent years, Huantai county has developed professional cooperatives in order to increase farmers' incomes. With active guidance and support from relevant departments, several kinds of professional farmers' cooperatives have

2. The disuse of biogas digesters in rural areas of China is a common problem. See Xia (2013), at <http://pubs.iied.org/16553IIED.html?k=biogas>.

been developed in response to market demand for local specialty products. Today, Huantai county has a total of 265 farmer cooperatives involving more than 40,000 households. Unlike Bishi Ecological Farm, Xincheng Chinese Yam Cooperative does not involve animal husbandry, but instead focuses on a single product.

Data collection

Data for this study were collected from five types of sources: interviews, site visits to ecological farms, Huantai government reports, secondary literature and a research thesis done by a graduate student at Chinese Agricultural University (CAU).

To better understand the current development of ecological agriculture in Huantai county, semi-structured interviews were conducted with various participants in the sector between May 2013 and December 2014 in Huantai. Interviewees included: six government officials from the vegetable production office and eco-agriculture construction office of the Huantai Agricultural Bureau; one farm owner and four farmers employed by Bishi Ecological farm; the cooperative director and ten members of the Xincheng Chinese Yam Cooperative.

6.2 Case study 1: Bishi Ecological Farm

6.2.1 Background and characteristics of the case study area



Pig pens at Bishi Ecological Farm © Qiao Yuhui



Greenhouse with tomatoes © Qiao Yuhui

Shandong Bishi Ecological Agriculture Co. Ltd. (Bishi Ecological Farm) was established in 2006. Bi is the family name of the 60-year-old owner of the farm (his full name is Bi Lijou). Mr. Bi worked in the construction industry in the 1990s, and later formed his own construction company; this allowed him to accumulate enough capital to invest in the ecological farm.

The farm is located in Qianbi village, Suo township and has a production area of 1,280 mu (85.33 ha). Bishi Ecological Farm practises a 'pigs-biogas-cash crop' ecological production system, involving cash crop production (grain, fruit and vegetables), livestock breeding and biogas production, as well as catering and tourism. The goal is to produce safe and high quality agricultural products while ensuring the efficient use of agricultural waste and comprehensive economic, ecological and social benefits.

The production base includes 25 greenhouses which combine vegetable production with pig breeding. Pig stalls account for 200 mu. Agricultural acreage



Greenhouse in winter © Qiao Yuhui

includes 750 mu of grain, 90 mu of lotus root ponds, 51 mu of walnut and 54 mu of ornamental maple cultivation. The rest of the land is used for processing and catering.

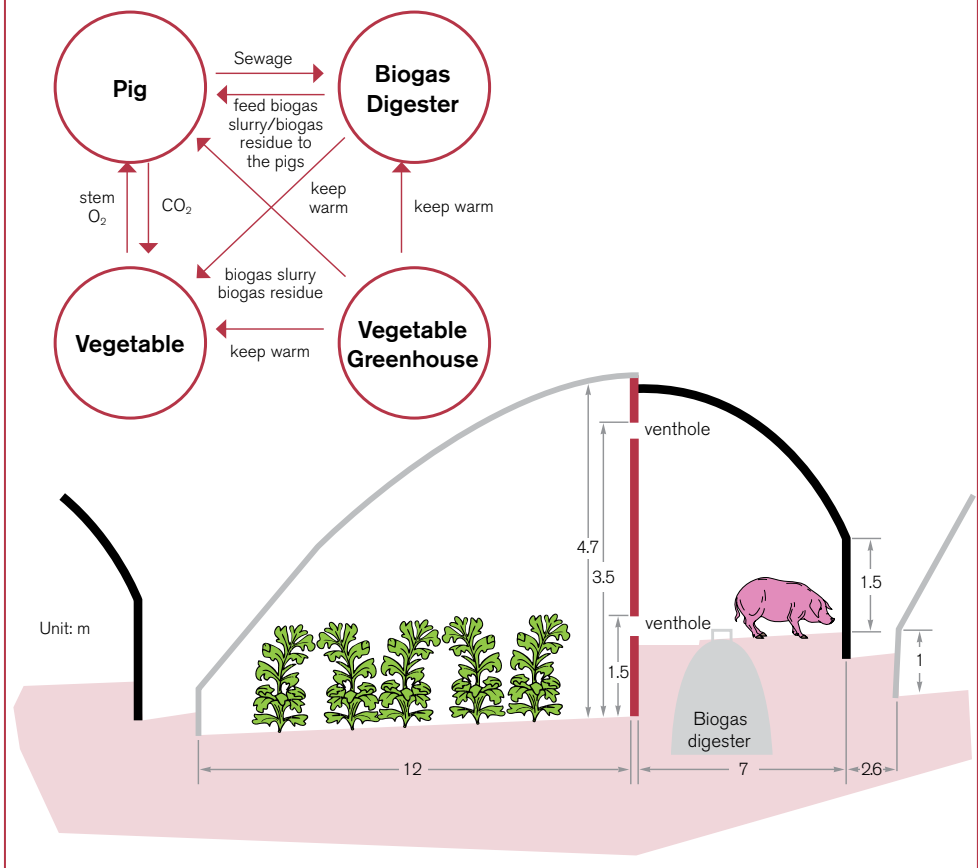
In the greenhouses, vegetables such as tomato, pepper, eggplant, cucumber, and squash are produced. The simple structure of the greenhouses entails easy assembly and disassembly as well as a low level of investment. Greenhouses are suitable for spring, summer and autumn cultivation (Figure 6.2). They are designed to optimise sunlight absorption,

ensuring a suitable ambient soil temperature for a long period during the winter. Pig stalls are built adjacent to each greenhouse, with a biogas digester situated directly below the pig stall to make use of the pig manure. In this way, the greenhouse, pig stall and biogas digester function as a single unit.



Lotus pond in winter © Qiao Yuhui

Figure 6.2 Diagram of 'pig, biogas and vegetable' 3-in-1 ecological greenhouse



In total, 1,000 pigs (including Laiwu black pigs, wild pigs and other local varieties), 150 sheep, 200–300 chickens, and 1,000 ducks are raised on the farm. About 300 pigs are slaughtered every year.

The current inputs into Bishi Ecological Farm mainly include vegetable seedlings, young ducks, pigs, sheep, soybean, and sorghum. Bishi Ecological Farm buys non-genetically modified soybean varieties from northeast China. Soybeans are pressed to supply the farm restaurant with oil and the soybean meal is used as animal feed and organic fertiliser for vegetable cultivation. Several crops are cultivated for feedstuff and liquor processing. Sorghum and other grains are also purchased from the local market to produce liquor. Grain used in the distilling process is fermented as feed for pigs. Manure from pigs, poultry and other animals is collected and fed into the biogas digesters, and the residue from digesters is applied as organic fertiliser for vegetable or lotus root cultivation. This approach effectively recycles agricultural wastes, maintains and improves soil fertility, reduces external inputs and ensures an efficient production of agricultural products (Box 6.1).

In 2012, Bishi Ecological Farm received hazard-free certification from the Ministry of Agriculture for its pig production. The farm is also applying for green food certification for vegetables (see Chapter 1 for an explanation of terms). According to Bishi's owner during the interview, though vegetables are produced through ecological production methods, they have not yet obtained green food certification, and there is no price premium for the farm's ecologically produced products. In most cases, prices are even lower than for conventional products due to their imperfect appearance.

Some arable land in the village has been transferred to Bishi Ecological Farm for unified management and production, partly in order to address the problem of abandoned agricultural land. Bishi Farm rents 200 mu of land from farmers as well as more than 1,000 mu of land from the village, at a rate of 380–400 yuan per mu per year. In general, the lease period is 10 years, but part of the land has been leased indefinitely.

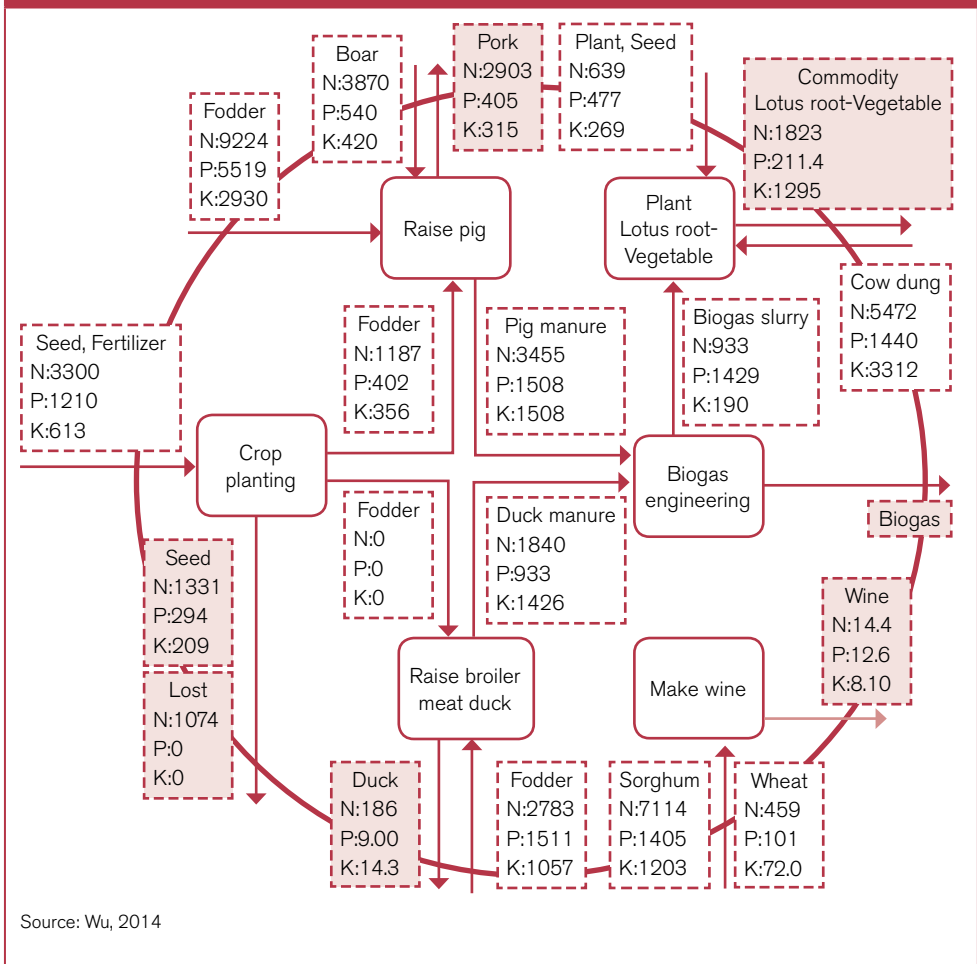
More than 90% of the farm's staff members are local farmers. While more than 100 workers are employed during the high season, this drops by about half (to 50–60 farmers) during the winter season. Most of the workers are aged between 40 and 60 years old, which means that older farmers can also find a job locally. It also enables farmers to get employment after they transfer their lands.

6.2.2 Ecological sustainability

In 2013, a detailed investigation of nine circular agricultural enterprises in Huantai county was carried out, including Bishi Ecological Farm (Wu, 2014). The nutrient cycling and balance of these enterprises were calculated. Figure 6.3 shows the nutrient cycle of Bishi Ecological Farm. The main nutrient inputs into the whole production system are compound fertiliser for grain production, cattle manure for vegetable cultivation, breeding pigs, as well as sorghum and wheat to distill liquor. The outputs are mainly pork, grain (largely maize), liquor, vegetables, lotus and ducks, as well as some nutrient losses.

The total annual nutrient inputs into the whole system were 20,854 kg of nitrogen (N), 5,175 kg of phosphorus (P) and 5,888 kg of potassium (K). The total outputs were 8,214 kg of nitrogen, 1,372 kg of phosphorus and 2,193 kg of potassium. In addition, 933 kg of nitrogen, 1,429 kg of phosphorus and 190 kg of potassium were recycled back into the system through grain cultivation, pig manure and biogas residues, accounting for 4.47%, 27.6% and 3.22% of the total nutrient inputs, respectively (Wu, 2014).

Ecological farms such as Bishi, Yikang and Xiangrui make use of the complementarities between crop production and animal husbandry in order to fully use the by-products of the production system; they have therefore achieved higher nutrient use efficiency than conventional farms. For example, the grain production system operated by a flour processing factory which purchases wheat and maize from farmers has a N, P, K nutrient cycle re-use rate of less than 2%. For Bishi, Yikang and Xiangrui ecological farms, the nutrient re-use rate ranged between 3.22% and 27.6%, 17.5% and 66%, and 7.65% and 75.9%, respectively. This case study illustrates that the combination of crop production and animal husbandry can reduce nitrogen, phosphorus and potassium inputs, promote the recycling of nutrients and facilitate circular agriculture.

Figure 6.3 Annual nutrient cycling at Bishi Ecological Farm (kg)

6.2.3 Economic sustainability

The products from Bishi Ecological Farm include grain, all kinds of vegetables, pork (including large volumes of pork from wild black pigs), sheep, chicken, duck and fish. The main sales channels are local markets. A small share of the products is consumed or sold to tourists and local people who come to visit the farm. The farm is also building a restaurant and two food-processing factories; the aim is to attract tourists to visit their farm and consume their products on site.

In 2013, the farm had a total annual income of about 2 million yuan, including income from 25 greenhouses (750,000 yuan), catering (500,000 yuan), plus sales of pork or/and live pigs (240,000 yuan) as well as some poultry and fish. The owner has invested 70 million

yuan in the farm to date, including a 30 million yuan bank loan. Without capital from his other income sources, it would not have been possible for him to establish and run this farm. The income from the farm has not yet covered the high initial investments made. He plans to expand the farm by another 1,000 mu with a total investment of 150 million yuan over the next five years.

Between 2009 and 2013, the net profit of Bishi ecological farm was 13,000 yuan/mu/year, which is lower than the average profit of vegetable growers in Shandong Province of 22,257 yuan/mu/year (Lang et al., 2014).³

Loan repayments and high initial start-up costs mean that the farm is still operating at a deficit; however, the owner is not concerned as he is confident of the farm's future and has other sources of capital to rely on. He also hopes the following initiatives will increase the farm's returns and commercial viability:

- 1) Certification and niche marketing: in 2012, Bishi Ecological Farm received hazard-free certification from the Ministry of Agriculture for its pig production. The farm is also applying for green food certification for vegetables. The owner believes that this certification will increase market access and generate a higher return on investment. The farm plans to contract with buyers who recognise the principles of ecological agriculture and negotiate prices with buyers to ensure stable production.
- 2) Value-added through processed products: the farm has established two food processing companies in order to process its livestock and poultry products on site and obtain higher profits. Livestock and poultry can also be processed to supply restaurants as another income source.
- 3) Direct sales and advocacy: the farm's restaurant increases available sales channels and also plays an advocacy role for the farm's ecological agricultural products.

6.2.4 Social sustainability

At present, most young people in rural areas are migrating to cities for work, leaving the older generation behind in the villages. In light of the labour shortages caused by out-migration, Huantai county is now trying to transfer agricultural lands from small to large-scale farmers or cooperatives and ecological farms.

In the case of Bishi Farm, local farmers originally rented their land to the farm and are now given the opportunity to work on the farm as labourers. At least 35 workers take care of the 25 greenhouses, and 30 more are involved in pig breeding. The farm also employs staff in the restaurant and lotus production. Normally the salary is around 2,000 yuan per month. This amounts to an annual income of 24,000 yuan per person. Without this job, farmers would have to depend on grain production, and their annual net income would be around 1,500 – 2,000 yuan per mu per household. As an average farming household only has 4–5 mu of land, this limits their annual income to between 6,000 and 10,000 yuan. However, this model is not risk-free (Box 6.2).

3. With a range of 14,949 yuan to 28,836 yuan per mu.

Box 6.2 Are land transfers socially sustainable?

The financial gains to farmers of the land transfer approach have come at the expense of their independence. Once a large farm has been established, will the farmers ever be able to get their land back should they wish to? What if they are fired from their jobs? Then they are left without land or livelihood. Given the exodus of farmers from rural areas to seek employment in urban areas, combined with the promotion of large farms as a key element of agricultural policy, the issue of land transfers is one which deserves more attention. It is essential to minimise the risks for farmers entailed by land transfers while ensuring their livelihoods and access to land in the face of changing circumstances.

Another benefit of working at Bishi Farm is that farmers are not exposed to agro-chemicals, such as synthetic pesticides, and therefore their health risks are reduced. Furthermore, they are learning new production techniques, thereby improving their skills and knowledge.

In order to support the prosperity of the region and to expand the scale of sustainable agriculture therein, Bishi Ecological Farm also works with cooperatives and other farmers, signing contracts to produce grain, vegetables, and pigs. Bishi provides them with seeds, seedlings and piglets and provides technical guidance and regular training to farmers.

As well as employing local farmers, Bishi has also attracted young people from outside the area, such as the 30-year-old manager of the catering department who accompanied us during the trip. He comes from Zibo city where he worked in a hotel for several years. He has worked on this farm for eight months, and he likes the idea of circular agriculture and appreciates the traditional ways of cooking required by the owner. He likes to work on the farm in spite of the fact that it is in a rural area.

6.2.5 The role of government

Huantai county set up an Ecological Agriculture Office in 2003, which is in charge of the development of ecological agriculture and biogas construction. The office provides funds for the development of ecological farms. Since 2007, the Ecological Agriculture Office has provided Bishi Ecological Farm with subsidies of about 0.7 million yuan to build and maintain biogas digesters of 2,500 m³. The Agriculture Development Office has also supported the expansion of pig farming through the provision of 0.6 million yuan. The Vegetable Production Office has provided 0.4 million yuan for greenhouse construction.

Bishi Ecological Farm has also received several awards. In 2013, it obtained the honour of 'leading enterprise' and 'demonstration circular farm' of Zibo city, Shandong province. In 2014, it was also listed as the demonstration base for the Zibo Green Food Association. The farm has started investing in agricultural processing with support from the town.

Huantai Agricultural Bureau and Huantai Husbandry Bureau have also invited some agricultural experts to carry out technical training in Integrated Pest Management, soil testing and formula fertilisation, as well as marketing and management skills for professional farmers. Technicians and farmers from Bishi Ecological Farm are given priority by the local government for this training as it supports staff capacity and improves management.

6.2.6 Motivation for adopting ecological agriculture

Originally the owner, Mr. Bi Liyou, planned to build an ecological farm to occupy his free time and to maintain a healthy lifestyle after retirement. In 2006, he rented 84 mu (5.6 ha) of land from Qianbi village (including an abandoned brick factory containing caves where the pigs are housed) and started constructing the farm. He began to pay more attention to agricultural development and national agricultural policy, the requirements of farmers and agricultural development abroad. He also noticed that economic development was having a negative impact on food safety and the environment.

A visit in November 2014 by a team from China Agricultural University researching ecological and circular agriculture had a positive influence on the owner, encouraging him to adopt sustainable agricultural practices. Additionally, his Buddhist beliefs underpin his business philosophy of 'managing the enterprise with conscience and credibility.'

Mr. Bi has a strong environmental ethic and believes in the benefits of circular agriculture for improving the environment and human health. He has already invested 70 million yuan in this farm, though without capital from other incomes sources, it would not have been possible for him to establish the farm. The use of industrial capital is the most important channel for funding such farms, and this is also the case for other ecological farms in the area (Box 6.3).

Box 6.3 Ecological farms in Huantai county

Today, Huantai county has between 12 and 15 ecological farms. Most of them have a similar situation to Bishi, with financial investment coming from money earned in other industries. Most of the owners have shown a strong interest in the principles of ecological agriculture and have tried to integrate animal husbandry into their farms. Additionally, processing of cash crops adds value to their products and ensures a broader market, while also meeting consumer demand for safe and healthy food.

Another good example is Zibo Baicuiyuan Agriculture and Tourism Company in Yijia village located in Jingjia township. This farm was established in 2013 through financial investment by Shandong New Century Steel Structure Engineering Co. Ltd. Yijia village is the hometown of the head of the steel company and years after his own success, he came back to help the farmers in the villages. He was elected as village head and set up the Zibo Baicuiyuan Agriculture and Tourism Company. Farmers transferred all their land to the company and became employees of the company. The company now has more than 20,000 mu of land. In the future, it plans to develop ecotourism, catering, and green food oriented production.

6.2.7 Challenges

In recent years, China's central government policy has been to support the development of modern intensive agriculture through subsidies for seeds and investments in formula fertiliser. While there is also central policy support for sustainable agriculture, such as the National Sustainable Agricultural Development Plan issued in 2015, there are a number of challenges to be overcome, such as the certification of agricultural products, financial support and technical issues.

Certification and trust

There is a plethora of certification standards for agricultural products in China, such as hazard-free, green food, organic, good agricultural practice (GAP) and geographic labelling. The proliferation of standards makes it difficult for consumers, producers and even officials to understand the exact criteria for each certification system. The application process for certification is complicated and therefore not easy for farmers to undertake. Furthermore, the term 'ecological' (*shengtai*) has no specific criteria attached to it and can be used by anyone to label their products. These factors, together with numerous food safety scandals, have undermined consumer trust in certified agricultural products.

The chemical and construction industries are the twin pillars of the economy in Huantai county, but have contributed to serious pollution and possible soil contamination. For this reason, Zibo city does not support enterprises in Huantai county in applying for organic certification. Bishi Ecological Farm has not applied for organic certification, even though they apply organic agricultural practices. In the course of applying for hazard-free certification, the soil in Bishi Ecological Farm was tested for contaminants. According to the farm management, no contaminants were found.

Financial support

Most agricultural enterprises in China are small and have low profit levels. Moreover, financial support is difficult to obtain. One possible way to address this would be to adjust policies to facilitate investment in ecological agriculture. Another possibility is for banks to offer preferential loans for small agricultural enterprises.

Technical challenges

Some technical challenges that the farm has encountered include disease control in vegetable production and animal breeding due to the high humidity in the greenhouses. Biogas digesters require regular maintenance and this has been another problem for the farm. Furthermore, the cosmetic imperfections of vegetables grown on the farm can limit sales.

Consumer recognition of their products is an important aspect of the farm's marketing strategy. Bishi Ecological Farm actively invites consumers to visit the farm and taste their products. Meanwhile, the production process is strictly controlled to ensure quality and to meet the requirements of ecological agriculture.

6.3 Case study 2: Xincheng Chinese Yam Cooperative

Chinese yam (*shanyao* or *Dioscorea opposita*) is one of the most famous traditional vegetables in Huantai County, having been planted as far back as the Ming and Qing dynasties. Local soil conditions are particularly suited to this species of yam, and make it a superior product compared to other yam varieties. Its high yields, good quality and economic efficiency are superior to traditional crops such as maize and wheat. Long used as a food and medicine in China, Chinese yam is rich in nutrients and aesthetically appealing. It is also easy to store, convenient to transport and has a long shelf life. This explains why Chinese yam occupies an important position and has traditionally been widely cultivated by local farmers.

Prior to 2000, about 1,000 mu of land were planted with Chinese yam in Huantai county. But a shrinking labour force and the loss of traditional knowledge about this crop, such as efficient planting techniques, have meant that the area planted to Chinese yam has shrunk dramatically, falling to less than 100 mu. Meanwhile, the price of Chinese yam also fell to historical lows, resulting in a general disinterest in planting the crop.

The Xincheng Chinese Yam Cooperative has been encouraging local farmers to adopt efficient yam planting and management techniques. Today, thanks to their efforts, Chinese yam cultivation has greatly increased, as have the incomes of the households involved. Meanwhile, the cooperative ensures that the traditional local yam variety can be maintained, while also increasing the economic and ecological benefits for Xincheng township.



Office of Xincheng Cooperative © Li Ming



The demonstration farm © Li Ming

6.3.1 Background and characteristics of the case study area

Xincheng township is located in the southwest of Huantai county. It covers an area of 44.55 square kilometers, includes 40 administrative villages and has a total population of 36,000.

Xincheng Chinese Yam Professional Farmers' Cooperative was founded in 2008 in response to the Chinese yam production situation and government policy of supporting professional farmers' cooperatives. Local farmers with their own land are invited as cooperative members. The cooperative members sell their yam to the cooperative at a fixed price. The cooperative provides their members with ecological planting techniques, technical training and procurement of inputs. It is also involved in marketing, brand promotion and facilitating the development of commodity chains for local speciality agricultural products.

How does the cooperative work?

When the cooperative was first established, Chinese yam production centred on Henan village, Xincheng township. The cooperative began with only five member households in Henan village. As business opportunities increased, so has the number of cooperative members, reaching 286 households in 2014 and covering the entire township of Xincheng. At the same time, the yam cultivation area has increased from 1,000 mu to 3,000 mu, spreading to the other 40 administrative villages in Xincheng township. Farmers from several villages outside Xincheng now also cultivate Chinese yam. Xincheng Chinese Yam Cooperative influenced this development, but the crop area is still scattered. Today the core growing area is focused on three villages – Henan village (population 600), Gongjia village (population 500) and Xingmiao village (population 700). Most of the farmers are between 40 and 60 years old.

The establishment of the cooperative allowed land and labour as well as the production and trade of Chinese yam to be scaled up and to become more profitable. It applied for and obtained the awards of 'country protection of geographical indications products' and 'Zibo eight standardization vegetable production base'. This was an opportunity to promote the production and marketing of local speciality agricultural products. As a result, the goals of brand recognition, higher prices and higher incomes for farmers have been achieved.

An ecological approach to Chinese yam production

Chinese yam is highly demanding of nutrients during its growth period. Therefore, farmers were investing in large amounts of chemical and organic fertilisers. Normally, Chinese yam has fewer pests and diseases than other vegetables, but fungal diseases can be a problem. The use of fungicides in conventional production can effectively inhibit the disease. However, this use was increasing threats to the environment, food safety and human health.

The cooperative actively organised farmers to implement ecological planting patterns. Under their goal of "comprehensive utilisation of resources, material circulation, sustained economic growth and environment protection", they use biogas as part of the eco-cycle model of 'animal husbandry – biogas – vegetable production'. This puts the control of diseases and pests, as well as comprehensive use of biogas residues, at the core of the production system (Box 6.1). Compared with conventional production, farmers have greatly reduced their applications of chemical fertilisers and pesticides, and at the same time they have increased applications of organic manure.



Application of biogas residues © Li Ming



Farmers harvesting yams © Li Ming

Human and animal manure as well as crop straw are fermented in the biogas digesters to produce biogas, biogas slurry and residues. The use of biogas residues as organic fertiliser can increase yields as well as improve yam quality. Biogas slurry is applied to the plant and the soil, as it can inhibit the growth of bacteria and effectively reduce the incidence of plant diseases. This also improves the rural environment and living conditions, particularly compared with the dirty, disorderly and poor conditions of the past.

At present, Henan village has more than 30 biogas digesters. The other villages also have biogas digesters but fewer and on a smaller scale. Thus, the ecological mode of production does not cover the whole township and there is still great potential to expand it.

Xincheng cooperative applied for organic certification in 2009,

but the complicated procedures and conversion rules for the land forced them to withdraw from the scheme in 2011. In 2009, Chinese yam was listed as a 'National Geographical Indication Product' (*guojia dili biao zhi baohu chanpin*) and received the National Geographic certification trademark registration in 2011.

6.3.2 Ecological sustainability

According to an investigation carried out in 2013, Chinese yam is a very nutrient-demanding crop (Wu, 2014). On an annual basis, farmers at Xincheng Cooperative on average apply 100 kg/mu of high potassium compound fertiliser (N:P:K ratio 2:1:3); 50 kg/mu of potassium sulfate, potassium fertiliser (pure K content 52%); 100 kg/mu of commercial organic fertiliser; 100 kg/mu of home-made organic fertiliser (soybean as raw material) and biogas residues (Table 6.1).

Table 6.1 Nutrient inputs, outputs and budget of yam grown by Xincheng Cooperative (kg/yr)

	Nutrient input		
Nutrient origin	N	P	K
Seedlings	445,190	2,703	42,770
Fertilisers	192,000	31,437	238,979
Cow manure	51.8	13.6	31.4
Biogas residue	102,99	1,817	6,058
Total input	647,541	35,971	287,838
	Nutrient output		
Yam	N	P	K
	105,406	640	10,127
	Nutrient budget		
	N	P	K
Total output	542,134	35,331	277,712

Source: Wu, 2014

Table 6.1 shows the nutrient input, output and budget of Chinese yam production in 2012. As can be seen from the table, the nutrient sources of Chinese yam came from seeds, fertiliser, manure and biogas residues. As the total inputs of N, P, K are greater than the outputs, a large amount of nutrients are not absorbed by the crops. This leads to potential pollution and waste of resources.

The cooperative advocates applications of organic fertiliser and manure, which greatly improve the utilisation rate of nutrients. Yam yields are higher (1500–2000 kg/mu) than in the conventional system (about 1000 kg/mu),⁴ which does not use biogas residues or deep sowing techniques. Furthermore, the yams have better taste, higher quality and according to tests are more nutritious, so are favoured by consumers. The cooperative avoids using synthetic pesticides. In order to control pests, some non-toxic bio-pesticides such as abamectin are used. As mentioned in Box 6.1, the fermentation process involved in biogas production also kills pathogens, thus helping to avoid the incidence of plant diseases.

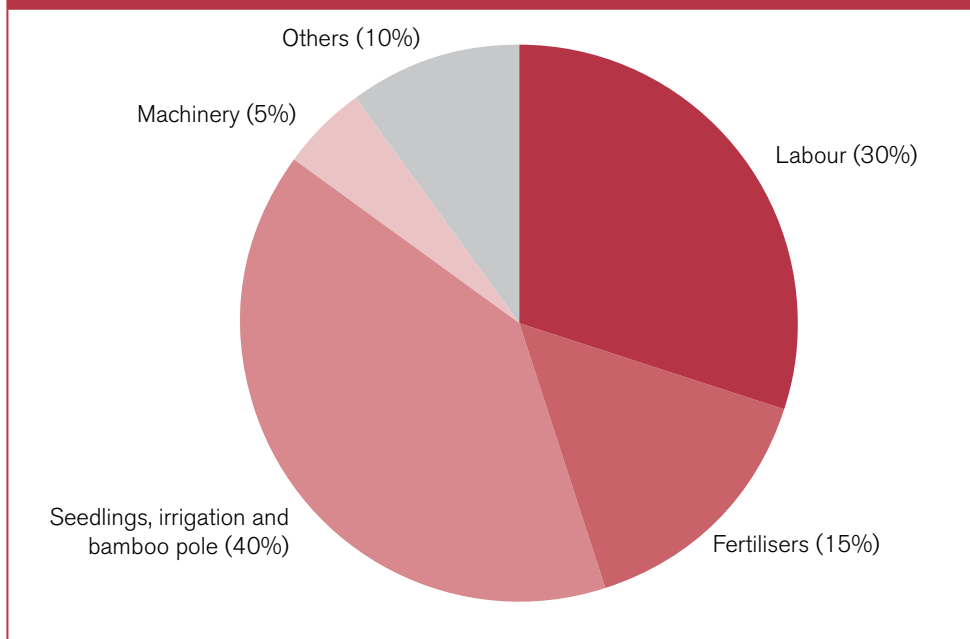
6.3.3 Economic sustainability

Total production costs of Chinese yam can reach 10,000 yuan per mu (150,000 yuan/ha). The distribution of input costs can be seen in Figure 6.4. Labour accounts for 30% of the total cost, fertiliser 15% and irrigation, bamboo frames and seedlings represent 40%. The annual labour inputs by the cooperative for yam cultivation are several times higher than in conventional production. This is especially the case during the harvest, as the yam roots

4. Interview with the Director of the Xincheng Chinese Yam Cooperative, 13 December 2014.

extend deep into the soil and must be dug out manually. The labour costs of harvesting alone are around 3,000 yuan per mu. Cooperatives also hire workers for the yam harvest.

Figure 6.4 Distribution of input costs for Chinese yam production



Normally the net income for wheat and maize production is 1,500–2000 yuan per mu. Wheat yields average 500 kg per mu (7.5 tonnes/ha) with a price of 2.4 yuan per kg, while maize has an average yield of 650 kg per mu (9.75 tonnes/ha) and a price of 2 yuan per kg. Input costs are 500–600 yuan per mu of maize and wheat. Yam has both higher input costs but also earns a higher income than maize and wheat. In fact, the annual net profits of yam can reach 10,000 yuan per mu. The price of Chinese yam on the market increased from 10 yuan/kg to 20 yuan/kg in 2009, with the highest prices reaching 40 yuan/kg. While prices levelled out at 16 yuan/kg in 2011, they increased to 26 yuan/kg in 2014.⁵

The average annual income of cooperative members in 2013 was 36% higher than that of non-members from the same village (China Broadcast Net, 2013). Annual net profits of cooperative members are nearly 4–5 times higher than conventional wheat or maize farmers. Cultivation of Chinese yam and membership in the cooperative have greatly improved farmers' livelihoods.

Chinese yam is planted in April and harvested in October. It is noteworthy that in the first year, farmers use seeds from their own farms for planting. In the second year, they will plant small yams harvested from the previous year, thus obviating the need to buy seed. During the growing period, crop management is simple. Farmers only need to irrigate at certain times according to the weather.

5. One factor may have been newly designed packaging that was introduced in 2014.

During the survey, we discussed yam sales with members. One member said he had planted 2 mu of Chinese yam which yielded over 1,500 kg per mu. With a sales price of 14 yuan/kg, his income was more than 20,000 yuan per mu. 'In the past, the market was not guaranteed and prices were low. Since joining in the cooperative, we do not need to worry about prices and the market. Income is also a lot higher than before.'⁶

Prior to the establishment of the cooperative, small farmers managed the production and sale of Chinese yam themselves. Due to technical and environmental constraints, however, yields were relatively low. Farmers sold their Chinese yam at the local market in Xincheng town at a low price and on a small scale.

Since the establishment of the cooperative, both infrastructure and brand awareness have improved and the market for Xincheng Chinese yam has gradually begun to expand. However, sales are still mainly concentrated in Zibo city and several surrounding cities in Shandong province. Chinese yam can be sold both by the farmer and the cooperative. If a farmer is not able to sell his yams, the cooperative will purchase them and sell them on his behalf.

The good reputation of Xincheng Chinese yam means it has favourable development prospects. Consumers in Huantai county like to buy Chinese yam directly from Xincheng Cooperative. Some consumers from Zibo city and other regions are aware of the high quality of the product and are also keen to buy them directly.

In addition, some yams have been sold online via the Xincheng Chinese Yam website.

A local association for handicapped people is helping the cooperative with publicity and promotion on Taobao.com (the best known e-commerce platform). However, cooperation with local supermarket chains has not developed yet as production is still small scale.

For brand promotion, the cooperative has employed professionals to design a high-grade gift box for yam packaging, which has been well received (see photo). Xincheng Cooperative has also participated in exhibitions of various kinds of agricultural products organised at the city and provincial level. Online publicity has also helped to increase popularity. In 2010 March, CCTV 7 recommended Xincheng Chinese yam in their 'agro-zone' column. In addition, TV stations and other news media have reported on the Chinese yam quality and its development, which has further enhanced brand popularity and reputation.



A gift box for yam packaging © Li Ming

6. Interview with cooperative member, 12 December 2014

How to improve economic benefits?

The cooperative plans to expand production in 2015, leasing agricultural land from surrounding farmers through contracts. Cooperative members will be organised together to cultivate Chinese yam intensively. An ecological agriculture demonstration area has been established by the cooperative at the yam expo-park with government support. According to interviews with farmers, they trust the cooperative and support it financially. Farmers contribute money to the cooperative and are paid interest on their deposits. These funds can be used more flexibly and farmers can receive larger benefits than with bank loans.

6.3.4 Social sustainability

According to Director Li and local officials, economic conditions in Huantai are good – young people can find jobs in the county in construction, industrial equipment repair and interior decoration and hence do not need to migrate elsewhere to find work. In recent years, the development of yam production in Xincheng township has attracted some young people back to the villages during the yam planting and harvesting season to earn extra money as labourers. According to interviews with local officials and farmers, more and more young people (some of them women) have begun to return to the villages to engage in agriculture. The income from agricultural production can be equal to off-farm work (particularly considering the higher costs of living in urban areas compared with rural areas). Despite this being a small-scale trend compared to out-migration, it is nonetheless important and has relevance to many other parts of China, and also creates some job opportunities for women.



Yam technical training for farmers © Li Ming



Yam competition for cooperative members © Li Ming

Cooperatives and local government organise yam competitions and communication events for members every year. They also carry out agricultural training for farmers every year. Many women are also active in these activities, which allow them to access technical knowledge on planting, breeding and environmental protection and improve their awareness of sustainable production.

6.3.5 Role of government

In recent years, the Huantai county government has gradually increased its support to the development of Xincheng Chinese yam. In 2008, Xincheng Chinese yam was listed as a 'Zibo famous brand vegetable'. In 2012, the cooperative registered Chinese yam under the Huan Cheng brand trademark. In 2009, the local production standard of 'Technical Specification of Xincheng Chinese Yam Production Technology' (DB37/T 1399–2009) was published by the Shandong Provincial Bureau of Quality and Technical Supervision. In April 2009, the State Administration for Quality Supervision listed Xincheng Chinese yam as a 'National Geographical Indication Product' (*guojia dili biao zhi baohu chanpin*).

Every year the Huantai county government provides subsidies for re-using crop residues, building biogas digesters and developing hazard-free, green and organic vegetables in order to promote circular agriculture. Since its establishment, the cooperative has received about 0.7 million yuan in government funds, including the 0.2 million yuan required for registration. It received provincial demonstration cooperative project funds of 0.2 million yuan in 2009, and subsidies of 0.15 million yuan. The cooperative receives another 30,000–40,000 yuan every year for technical training.

In addition, Huantai County Agricultural Bureau organises two or three cooperative training sessions every year. Training sessions last for eight days, and are mainly on vegetable cultivation, livestock breeding and management skills. About 300–400 people participate in training every year. This has greatly improved the professional knowledge and skill levels of cooperative members. Collaboration with China Agricultural University, the Chinese Academy of Sciences, Shandong Agricultural University and other research institutes has led to testing, promotion, new techniques and other achievements.

6.3.6 Motivation for ecological agriculture

Mr. Li Ming is the director of Xincheng Cooperative and one of its five founders. He is the main person responsible for its operation today. He is 36 years old and comes from Henan village. Before the cooperative was set up, he had a part-time job in the town, and later he was nominated as the director of Henan village. He had been distressed to see the decline of Chinese yam and wanted to promote this local speciality.

The land in the area has been seriously affected by agrochemicals and the negative effects of previous production practices may continue for some time. Director Li believes that agriculture in the early 1980s was truly ecological agriculture, because at that time no chemical fertilisers and pesticides were used. Farmers relied primarily on animal manure as fertiliser. In fact, the quality of Xincheng Chinese yam can be improved through the traditional yam planting method



Mr. Li Ming, Director of the cooperative in his office © Qiao Yuhui



Yam sales outside the office © Li Ming

involving large applications of manure. Based on this knowledge, Director Li proposed that the ecological production system should integrate animal husbandry, biogas and yam planting. With the application of manure and biogas residues, yam quality could be improved, increasing its popularity with consumers. This is also a way to increase the incomes of cooperative members.

6.3.7 Challenges

The main challenges faced by Xincheng Cooperative include lack of skilled personnel, lack of land and investment, technical issues and organic certification barriers.

Shortages of skilled personnel

During its development, the biggest challenge facing the cooperative has been the lack of skilled personnel willing to engage in agriculture. The Director of the cooperative is responsible for all management duties, leaving him little time to work on other important issues such as land transfers or market development. He urgently needs an assistant, but most of the villagers are more than 50 years old and lack computer skills. For example, organic certification requires a lot of documentation, including a quality control system. Although certification would be helpful for the cooperative, it is too complicated for one person to manage, and they have been forced to abandon organic certification partly for this reason (for other reasons, see below).

Lack of land and investment

Another challenge faced by the cooperative is limited land. Henan village has a total of 900 mu (60 ha) of arable land. Due to allelopathy⁷ and other characteristics of yam, it cannot be planted continuously on the same piece of land. Crop rotations of at least three years are vital to ensure high yields until it can be planted on the same plot again. Most fields in Henan village have already cultivated yam, so only some of the fields could be used for yam planting in any given year. As a result, Xincheng Chinese Yam Cooperative is desperately short of land to plant yam. The cooperative leader mentioned that they want to transfer some land from other villages, but it is not easy.

The cooperative also lacks the funds to expand production. At the same time, it has high expenditures on equipment and crop management, but government support for cooperatives is limited. All of this is hindering the cooperative's development. Cooperative members would like the government to increase agricultural financing channels in order that cooperatives can receive more investment.

Technical challenges

Although Xincheng Chinese yam has over 300 years of cultivation history and farmers also have a lot of experience, technical knowledge is still insufficient. The current development model of ecological agriculture is still in a nascent stage and awareness and understanding of ecological agriculture among cooperative members still needs to be improved.

Another technical challenge faced by the cooperative is adequate fertilisation. Households without biogas digesters apply animal manure directly to their fields. But it is hard for compost to mature fully using this approach; incompletely composted manures contain many harmful bacteria which can cause serious yam diseases and pests. Cooperatives have been affected by some disease and insect pest outbreaks. They hope to cooperate with researchers and technical personnel engaged in yam planting to seek solutions.

Fake chemical fertilisers are another problem. Cooperatives have experienced losses due to fake fertilisers. Hence stronger government monitoring is vital to ensure that fertilisers and pesticides on the market meet minimum standards.

The challenges of organic production

In order to set up its own brand and increase income, in 2009 the cooperative began to convert to organic farming and applied for certification. However, there are several obstacles which have hindered organic yam production and certification:

- Organic production requires that yam be grown in a rotation, which requires a large amount of land. But because yam can only be planted continuously for two to three years in one field as explained above, after the two-year conversion period, the organic fields could not grow yam, and therefore organic certification could not be maintained. The crop rotation with yam tends to be wheat and maize, and the economic returns from these crops is low, hence there is little enthusiasm for planting them. The farm has not yet experimented with other cash crops such as vegetables in rotation with yam.

7. Allelopathy is an interference interaction in which a plant releases into the environment a compound that inhibits or stimulates the growth or development of other plants.

- Chinese yam has heavy nutrient requirements (mainly phosphorus and potassium), and no chemical fertilisers can be used in organic farming. However, the application of organic fertiliser is also subject to certain limitations under organic farming (less than 170 kg N/ha according to European Union organic regulations, which is insufficient to ensure high yields of yam). Although the nutritional quality of Chinese yam has improved with organic farming, yields have dropped by 30–50%.
- Organic certification costs 10,000 yuan per year for the farm, yet the government has no corresponding subsidy policy. This undermines the economic benefits of organic production.

Consequently, in 2011 the cooperative canceled the organic yam certification process.

Counter measures

Faced with these problems, the cooperative plans to use existing resources to further improve yam yields and quality. It aims to expand the scale of production, attract further attention from the government and investment agencies, begin to establish its own professional team, invite technical personnel, set up an expert technical advisory group, and establish a sales and marketing department. The cooperative also hopes to strengthen the Xincheng Chinese yam brand.

Farmers in surrounding areas would like to join the cooperative as members by signing land lease contracts. With more farmers and more land under its management, the cooperative will then have enough land for proper crop rotations. It is hoped that this and other measures will enable the cooperative to obtain certification and grow their yams organically.

There are also plans to establish an organic fertiliser factory in order to ensure a supply of high quality organic manure. The manure could be sourced from nearby dairy, pig and chicken farms. Mixing raw materials with microorganisms (EM bacteria) will allow compost to be fully fermented, thereby reducing the incidence of pests and diseases.

The animal-biogas-yam ecological agricultural model used by the Xincheng Cooperative could be extended to other areas, provided they have a certain scale of livestock and vegetable planting. Other factors necessary for the viability of this model are suitable environmental and climatic conditions, adequate water resources, available labour, convenient transportation and markets for local speciality products.

6.4 Conclusions

The two case studies from Shandong province represent two models of sustainable agriculture in China which share certain characteristics, such as their large scale and geographic location. However, they are very different in other respects. For example, in terms of their ownership structure, Xincheng Chinese Yam Cooperative operates as a cooperative owned by its members, while Bishi Ecological Farm is a private company, funded primarily from the money that its owner accumulated in the construction industry. As the farm depends on this capital, and so far, the profits from the farm have not been nearly sizeable enough to recoup the owner's initial investment, this model is not readily replicable in other contexts, except where there are wealthy individuals wishing to invest in agriculture as a sideline.

Both case studies do demonstrate, however, the advantages to ecological agriculture in a relatively developed region such as Hantai county. Over the past several years, the recognition of ecological principles and the availability of capital for investment have been driving the development of ecological farms in this region. The county's healthy economic base has attracted a young rural labour force to work in the chemical, construction and other industries. The fact that many farmers in the region have taken non-agricultural jobs has facilitated land transfers. In the case of Bishi Ecological Farm, farmland was transferred from local farmers and then the company hired those farmers wanting to remain in agriculture to work on the farm as labourers. This has had the benefit of providing economies of scale and labour for ecological agriculture, as well as increasing farmers' incomes, although it is not without risks (discussed above in Box 6.2).

Bishi Ecological Farm's combination of crops with livestock production in a developed part of the North China Plain offers social and agricultural benefits, as well as ecosystem services. As the operation of the farm includes agricultural production, processing, sales and catering, it encompasses the entire commodity chain for its products. Food processing has added value to its products. At the same time, the recycling of all resources means that production costs and pollution are minimised.

Thanks to government support and their own efforts, Bishi Ecological Farm has built a solid foundation for further development. Although the economic returns of the farm are not as good as originally anticipated, local farmers benefit through regular salaries and lighter work than before. While there are also clear ecological benefits, these are neither recognised nor compensated for in the price premium for its products.

The key factors for the success of the Xincheng Chinese Yam Cooperative are its focus on a single speciality product; the energy, drive and vision of the cooperative Director; and a sustainable production system, which makes use of local resources, such as manure, in order to reduce applications of chemical fertiliser. It offers a more sustainable alternative to the conventional production of wheat and maize prevalent in the area, while increasing farmers' incomes.

The cooperative capitalises on the local suitability, long history, high quality and popularity of the Chinese yam. As there are other local speciality products also being produced in an ecological manner in Hantai county (e.g. four-colour leek, Jingjia celery, etc.), this model could be expanded to other parts of the North China Plain. However, certain challenges remain, such as high labour costs at harvest time, the need for sufficient land for crop rotations and the rigorous requirements of organic production. The cooperative is in great need of more young people, as well as more investment for an organic fertiliser factory and yam processing. In spite of these challenges, the benefits of cooperatives such as this one are clear, as several of the other case studies in this report also demonstrate.

曾记畔行政村
ZENGJIPAN XINGZHENG CUN



Landscape in Zengjipan

© Wei Lijing

7

Sustaining green farming systems: experience from Zengjipan village, Ningxia

By Qi Gubo and Lila Buckley

7.1 Background and characteristics of the case study area

Zengjipan village sits at the edge of the Maowusu Desert, in the Ningxia Hui Autonomous Region of northwest China. Situated on a cold, dry loess plateau at an altitude of 1,600 metres, its average temperature is around 8°C, ranging from a low of minus 20°C in winter to a high of 32°C in summer. Average annual rainfall is 150–250 mm, most of which falls during the summer. Water is in short supply, and the village experiences annual sandstorms and droughts.

This case study describes the predominant farming system practised in the village. This system, with its circular integration of crops and livestock, requires few external inputs and maximises resource recycling. The study suggests ways in which the government can further support the system, so that it may more effectively provide a sustainable livelihood for villagers.

Data in this report are mainly from a survey conducted from 10–19 July 2014 by a research team from China Agricultural University (CAU), supported by ActionAid China. Fifty households were interviewed, accounting for 12.5% of all households in Zengjipan village. The average age of interviewees was 55, ranging from 35 to 79; interviewees under the age of 40 comprise only 6%, reflecting the age distribution in the village as a whole.

7.1.1 Agricultural development

Zengjipan village has 26,000 mu (1,700 ha) of arable land—all rainfed, and some of it terraced—plus 42,775 mu (2,850 ha) of pasture land (desert steppe) and 33,850 mu (2,250 ha) of semi-wild lands containing mostly alfalfa and *Caragana korshinskii*, a thorny, perennial, leguminous shrub.

The village contains 558 households with a registered population of 2,058 people. However, only 60% of all households, representing 40% of the population, actually live in the village; others live outside the village but are still registered there.¹ Villagers' income sources

1. The household registration system is called '*Hukou*' in Chinese, and is linked to a person's birthplace and related administration category. It is difficult or impossible to change one's '*Hukou*' even when a person has changed residence and workplace, due to differences in administration systems.



Landscape in Zengjipan © Wei Lijing



A view of pasture land near the village © Wei Lijing

are about 10% from farming, 40% from animal husbandry, and 50% from off-farm work. Of the 1,186 employment-age individuals present in 2013, 40% were employed in non-farm work outside the village for more than six months per year, while 30% were employed in both farm and non-farm work. The annual average income per capita in 2013 was 4,200 yuan, lower than the Yanchi county average (5,521 yuan) but higher than the average for Wangleijing township (3,993 yuan), the region in which Zengjipan is located.

Income from animal husbandry, particularly the raising of sheep, makes up 40% of total household income. Most crops grown are for household consumption, and for feeding the sheep. Thirty households raise more than 100 sheep each; 25 households raise 50–100; and 40 households raise less than 50. The total annual stock is around 17,000 and slaughters totalled 13,000 in 2013.

A rainwater collection tank provides 60% of the water used by villagers and their animals.

There is a cooperative in the village that provides financial support for various village activities, but it is not directly involved in sheep production and marketing. Sheep products are mainly sold at the township's open market, and to a nearby company under the geographical label of 'Yanchi grassland sheep', marketed individually by the farmers.

7.1.2 Status of sustainable agricultural development

Crop production

Without irrigation, crop productivity is very low in Zengjipan (Table 7.1). The main crops grown are maize, buckwheat, foxtail millet, common millet, wheat, potato, black beans, flax and sunflower. Most of the farmers do not use synthetic fertilisers and pesticides; nor do they feed condensed fodder to their sheep.² However, chemical fertiliser is still applied

2. Interview with Zengjipan villagers, 11 July 2014. Chemical fertilisation requires water for application, which is not feasible in Zengjipan. Pesticides are seldom used because, in this dry environment, pests and diseases are seldom a major concern. As for sheep production, villagers want to preserve the good flavour of their 'Tan Yang' sheep products, which could be destroyed by feeding the animals condensed fodder.

to 10,000 mu of land (660 ha), accounting for 35% of all arable land, with an average application rate of 75 kg per mu (1,125 kg/ha) per year. Organic fertiliser is used on 8,000 mu (530 ha) of land, while crop residues are used as fertiliser on another 8,000 mu (530 ha) of land.

No chemical pesticides or plastic sheeting are used in this village; while farmers are able to afford these inputs, they do not consider them worthwhile.³ Since fertility is so low, the farmers use crop rotations and fallowing to improve productivity. They rotate potatoes with common millet, and black beans with foxtail millet. Buckwheat is not rotated, and 20% of all arable land is fallowed every year. Ploughing and harvesting are mechanised, at an annual cost of 375–450 yuan per hectare. Farmers select, store and resow their own seeds, while the government subsidises potato seeds.

Table 7.1 Crops planted in Zengjipan village, 2013

Crops	Area (ha)	Yield (kg/ha)	Commercial value
Buckwheat	666.7	750	0
Common millet	333.3	750	0
Foxtail millet	253.3	600	0
Potatoes	133.3	3,750	0
Black beans	133.3	750–2,250	100%
Sunflowers	66.7	600–1,125	100%
<i>Eruca sativa</i> Lam	53.3	300	0

Note: Buckwheat, common millet, foxtail millet and potato are for self-consumption by farming households and their animals, so no commercial value is listed here. Black beans and sunflowers are grown for sale in the market. *Eruca sativa* is grown to make oil for household consumption. Residues from economic crops including *Eruca sativa* are also used in animal husbandry.

Crops are sold in several ways:

- 1) Through a middleman who comes to the village. Although prices offered this way are relatively low, this saves farmers the expense of going to market.
- 2) At the market in Wanglejing township, eight kilometres from the village. Farmers only go to this market, usually by three-wheeled vehicle, when they urgently need to sell their products.
- 3) Direct sales to consumers who come to the village. These are normally the villagers' relatives or friends seeking high-quality food, and this group is relatively fixed. There is also a small amount of exchange among villagers.

3. Interview with farmers in Zengjipan village, 13 July 2014. Plastic sheeting of crops is popular in China nowadays, as it receives promotion by the government. The promotion policy covers the whole of China with varying focus in different regions, but is not applied to this area of such limited rainfall. The Ministry of Agriculture's Administrative Department issued *Guidelines for Plastic-Sheeting Technology* (2012), which apply to areas with annual rainfall of 250mm or greater, and areas with irrigation and plentiful rainfall, but not areas with rainfall under 250mm. The guidelines emphasise maize, potato, wheat, vegetable, cotton and orchard fruits, but not other grains and beans.

While the low-external input farming system and the generally healthy environment suggest that the products could be eligible for certification as 'hazard-free', 'green' or even 'organic' food, none of the products from the village are certified. The villagers are not interested in certifying food crops such as buckwheat, common millet, foxtail millet or potato because yields are low and primarily for home use, so certification would not result in significantly higher prices for these. However, for commercial cash crops such as black beans and sunflowers, they do see potential for income improvement through price premiums. At the same time, they also realise that the sunflowers demand high fertility and will degrade soil quality if grown continuously. Black beans are appropriate for long-term production in terms of soil fertility, but villagers noted that 'they are produced everywhere, so you never know when the price will go down because more people are producing it'.⁴

In light of the fact that the area possesses good environmental conditions for producing buckwheat, and that there is market demand for it as a healthy food, the Party Secretary in the village, who initiated the community mutual fund (Box 7.1), is now thinking about applying for green food certification for buckwheat despite the reluctance of the villagers. He has already encouraged the villagers to increase buckwheat production, 'because only when you have extra to sell can you benefit from its higher value'.⁵ He adds, 'We should take advantage of green cropping, to get the most benefit from its potential to increase farmers' incomes.'

Livestock

The primary animals raised in Zengjipan for cash income are sheep, pigs and chickens (see Table 7.2).

Table 7.2 Animal husbandry in Zengjipan village

Animals*	Average stock quantity	Annual slaughter quantity	Proportion sold outside the farm
Sheep	17,000	13,000	100%
Pigs	600	800	70%
Chickens	4,000	6,000	10%

*Note: 90% of piglets and all lambs for market are reared on the farms, as are the 90% of piglets reared for household consumption. Chicks are bought at the market; 33% of sheep are a local variety known as Tan Yang and fed in part by grazing.

A local variety of sheep called 'Tan Yang' (see photo) takes two to three months to fatten. The fodder used is mainly maize, buckwheat and stalks, leftover household food, and some *Caragana korshinskii* and alfalfa, without any additives. Since there is no maize production in Zengjipan, the cost of maize for fodder represents a large proportion of the total production expense. The mutual fund in the village plays an important role for sheep farmers, particularly when they need assistance in buying fodder. Community development funds, the Rural Credit Cooperatives, and other commercial banks are also available for providing loans to farmers.

4. Interview with the farmers in Zengjipan village, 13 July 2014.

5. Interview with the village leader of Zengjipan village, 11 July 2014.



Tan Yang sheep being brought to market © Wei Lijing

Grazing is another traditional way of feeding sheep, supplementing their mineral and vitamin intake while saving on feed costs. However, since 2003 there has been a ban on grazing in Ningxia. This ban was imposed by the government in an effort to address the problem of desertification in the county. The productivity of pastureland had decreased significantly due to likely over-grazing and exacerbated by climate

change; for example, in the Kelamayi prefecture of the Xinjiang region, productivity had declined from 80 kg/mu in the 1980s to 20–30 kg/mu in 2003. In the 1980s in Yanchi, 15 mu (1 ha) of pasture land could support one sheep, but even 30 mu (2 ha) was insufficient in 2000. Further complicating this issue are the changing climatic conditions, with aridity increasing; in Yanchi in 2002 for example, there were 36 occurrences of sandy wind and 6 of sandy windstorms, the stronger ones lasting 6.5 hours with visibility less than 100 metres (Bai, 2010).

The grazing ban initially prevented sheep production in the village altogether, but this is less strictly enforced now as local farmers and officials together explore ways to balance sheep-raising and grassland protection. Grazing is only monitored by the grassland-management station during the daytime, so villagers graze their sheep for six to eight hours in the evening hours.⁶ While this is not technically allowed, there is a 'silent' consensus among stakeholders that this is acceptable (Yang et al., 2014).

An anonymous informant in the county agriculture and animal husbandry bureau commented that the purpose of the grazing ban was to ensure the reasonable use of grassland, and that the quality of the recovered grass and its increased productivity can be sustained for agricultural use and should be permitted, even if only tacitly.

The environmental change since the ban was imposed is very significant in Yanchi county; for instance, the vegetation coverage rate has increased from 25% to 50–75%, and the yield of pasture grass has increased from an average of 1,020 kg/ha to 2,250 kg/ha, with a maximum of 5,730 kg/ha (Jia et al., 2013; Pang, 2013). The villagers recall that 'there was a hill of sand in front of every household before those policies took effect' but 'now there is less and less sand and wind, and grass quality is improved, making living conditions more comfortable.'

6. Regarding the advisability of this grazing practice, there are many ongoing research projects, policy dialogues and experiments, but no solution has yet been reached; so current efforts are about finding a balance between grassland health and livestock productivity, through the cooperation of the various actors.

The sheep are supplied with 60% of their water from rainwater collection tanks, and 40% from the village drinking water system. The latter costs 8 yuan annually on average (each household consumes about two tonnes of water per year at a cost of 4 yuan per tonne). This does not represent a significant financial burden for villagers.

The main marketing channels for sheep are different than for crops, and include:

- 1) Sales through a middleman in Wanglejing Market. Villagers take their sheep to market on Tuesdays by three-wheeled vehicle and a middleman sells the sheep to a professional market. This is the main channel used by villagers in Zengjipan to sell sheep.
- 2) Sales to a local processing enterprise in Yanchi county, where quality requirements are higher than in the township market, but the prices received are also higher. Normally villagers sell the larger local sheep variety through this channel.
- 3) Direct sales to consumers coming to the village. Only a small percentage of sheep is sold through this channel. The price through this marketing channel, which was 36–38 yuan per kg for a whole sheep, is higher than through the other two channels: 30–32 yuan per kg and 32–34 yuan per kg, respectively, in 2013.

The circular farming system used in raising these sheep, involving the internal recycling of most resources (see Figure 7.1), has proved sustainable for the past 60 years. Because of the natural production process and healthy environment, sheep raised in Zengjipan village could qualify for green food certification. However, to date, individual farmers have not yet considered applying for certification, and the lack of an agricultural cooperative in the village makes it difficult to create a unique brand for the village's agricultural products. In addition, none of the three sales channels mentioned above recognises green food as such, so a premium price would be difficult to obtain through normal channels.

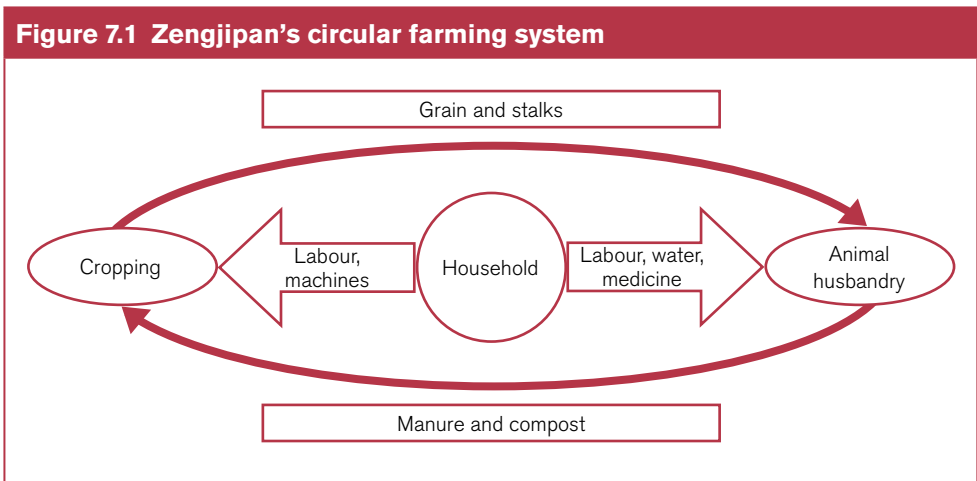


Figure 7.2 The geographical logo for 'Yanchi Tang Yang'



However, sheep sold to big enterprises via middlemen in the township market can use the geographical brand 'Yanchi Tan Yang',⁷ which is authorised by the Trademark Office of the State Administration for Industry and Commerce of the People's Republic of China (see logo, Figure 7.2). If agricultural produce comes from a specific geographical area, and its qualities and character are determined by the natural ecology and human history of that area, it can be registered as 'produce with a geographical brand' (*dili biao zhi chan pin*) by the state, under the auspices of the Ministry of Agriculture.⁸

Enterprises in this geographical area whose operations qualify, and who follow specific regulations regarding product quality, can then use this trademark on their packaging and produce, as well as for advertising and exhibition (Ministry of Agriculture, 2007).

Box 7.1 Livelihoods in Zengjipan village

All households in Zengjipan have electricity and cable television; 5 households have computers, 150 have cars, and all have landlines or mobile telephones. In 2014, 50 households installed solar-electric facilities through a government-supported project. The main agricultural machines in the village are tractors (6 households) and three-wheeled vehicles (300 households, accounting for 53.8% of all households). One household also has a harvester.

The mutual and community development funds⁹ support villagers' emergency needs such as purchasing animal fodder in the spring. Grain production means that households are self-sufficient in food for themselves, and most of the feed for animal husbandry, while cash crops contribute on average 10% of households' total incomes. The availability of arable land, the mechanisation of ploughing and harvesting, and opportunities for producing their own food and animal production materials without a cash outlay are the basic conditions allowing villagers to sustain their crop production. Of all households surveyed, 90% thought that arable land is very plentiful; 98% used machines in their crop production; and 80% practised both animal husbandry and crop production in order to recycle resources.

7.2 Ecological sustainability

The main factors influencing the sustainability of the current system are illustrated in Figure 7.3 below. By recycling resources in the production process, this farming system saves on inputs and multiplies the value of the final products. Inputs for farming are seeds, chemical fertiliser and mechanisation. Fertiliser use is reduced through the use of animal manure, which helps enhance soil fertility and crop yields. Inputs for animal husbandry are mainly fodder, half of which can be derived from stalks of buckwheat, common millet, and other

7. Zengjipan is located in the county of Yanchi. 'Tan Yang' is the local variety of sheep, which is traditionally fed by grazing rather than being raised in sheds.

8. This is similar to the European Union scheme of 'Protected Designation of Origin' products.

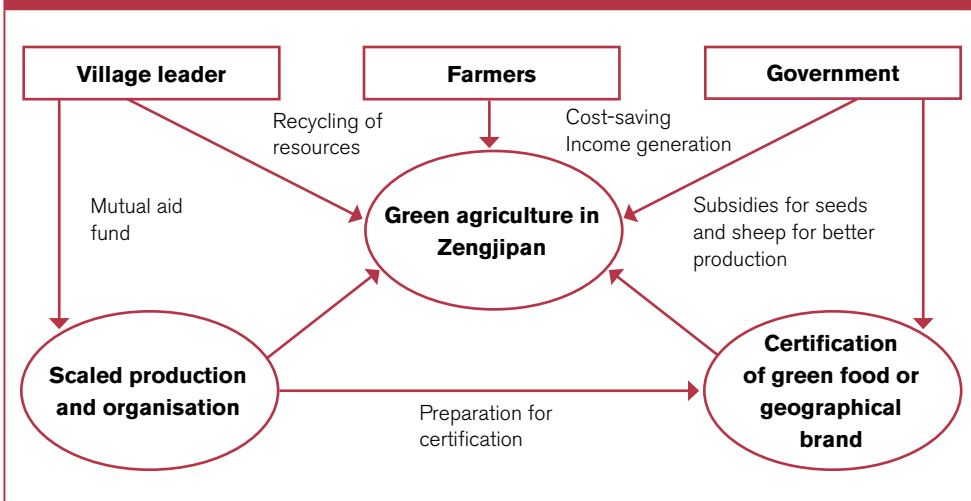
9. Sandaojing sub-village has its own community development fund of 100,000 yuan.

crops. Animal manure and crop stalks, as residues of the production process, are recycled efficiently in this way. The crops are sold, consumed by the farmers themselves, and also used as feed for the animals.

The practice of grazing sheep for six to eight hours every night seems to be maintaining a balance between agricultural utilisation and grassland protection. The village leader states that available grassland per capita is much higher than ten years ago when the grazing ban began, because more and more farmers are seeking off-farm work. Grassland productivity is now relatively high after ten years of restricted grazing. The villagers feel that grazing avoids 'wasting' the potential fodder growing there. This experience parallels the generally-accepted knowledge among dryland scientists that grazing at reasonable levels benefits grass quality compared to no grazing, since the grazing encourages new grass to grow. For example, because this grassland is not accessible to wild animals, it depends on the sheep to fulfil the ecological functions of grazing and trampling (Gu and Li, 2013). In general, the current farming system appears to maintain a harmonious balance between the needs of people and those of nature.

However, this system is threatened by climate change, which is bringing more extreme weather and droughts to this area. If this affects crop production, farmers will need to purchase more fodder for their sheep, and livelihoods could suffer. Adaptive activities are already emerging to address this problem, such as storing crop products every year, or seeking off-farm work.

Figure 7.3 Factors influencing the sustainability of green agriculture in Zengjipan



Most farmers in Zengjipan have not heard of sustainable agriculture, and while some have heard about it from TV or from friends and relatives, most do not understand it very well. The expression 'sustainable agriculture' seems to most of them to be jargon from the outside world.

When asked for examples of both economic and ecological issues in their production methods, half of the farmers we interviewed talked about a stable and plentiful irrigation source, because they consider rainfed agriculture too risky to be sustainable. Twenty-five per cent of interviewees talked about crop rotations and fallowing; one commented that if land is left fallow for one year, yields the following year will equal two years' worth. Ten per cent mentioned applying more organic fertiliser for the 'good of the land', i.e., to improve soil fertility.

Villagers put particular emphasis on the high quality of their agricultural products. People coming to the village to buy sheep or various food grains also stress the good quality and taste. 'The taste, you can tell from the first bite, is very special, and quite different from foods bought in the market,' explained one of the city consumers, 'because products here do not use additives or chemicals, and sheep run in the grassland; they are a truly natural health food'.

Another added, 'You can also see for yourself that there are no factories, and no pollution in this village. And the watering is completely from rain, which is also very natural!' Another urban consumer emphasised that since, as the villagers joke, their sheep are 'sports sheep'—meaning that they run around in pastures rather than staying in a shed—this makes them especially 'delicious and good for your health'.

As to the impacts of their farming methods on the environment, 92% of villagers interviewed believe that they do not harm the environment. Those who did identify impacts included one villager who thought that ploughing in spring might induce more dust storms, and another who suggested that chemical fertiliser could decrease land fertility and food production, and suggested that these should be limited where possible.

There are other practices in the village that are not so environmentally friendly, however. These include lack of wastewater treatment, and burning solid waste rather than using the 100 existing garbage receptacles in the village.

7.3 Economic sustainability

Of the 50 households interviewed, 26 earn off-farm income through seasonal or daily migration to work elsewhere in the county. The total annual off-farm income is 963,200 yuan, with a household average of 37,046 yuan. Off-farm work accounts for more than 50% of family income, and is relatively stable and not generally vulnerable to natural risks.

Income from animal husbandry is around 40% of the total household income, and is also relatively stable. Though it is expensive to buy lambs and fodder, the rate of return is quite high (see Box 7.2).

Box 7.2 The contribution of green farming to livelihoods: a small farm case study

Zhanying is 53 years old, and her husband is 56. Both of them graduated from primary school. Zhanying is involved in housework and farming activities, and her husband usually makes the decisions about agricultural production. Their income is derived from agriculture and government subsidies, and totalled 38,380 yuan in 2013 (Table 7.3), which is slightly above average for this village.

Table 7.3 Annual income and expenses for Zhanying's family, 2013

Income		Yield or inputs (kg or unit)	Value (yuan)
Crops and animals	Buckwheat	375 kg/ha (x 1.3 ha)	1,200
	Common millet	375 kg/ha (x 0.4 ha)	250
	Potatoes	11,250 kg/ha (x 0.4 ha)	4,500
	Stalks as fodder	1.6 ha	1,200
	Sheep	40 slaughtered	29,000
Total agricultural income		–	36,150
Other income: Government payment		–	2,230
Other income:	Loan	–	110,000
Expenses	Buckwheat	50 kg seeds, 70 kg fertiliser	224
	Common millet	10 kg seeds, 12,000 kg manure	0
	Potatoes	300 kg seeds, 13,000 kg manure	0
	Sheep	80 lambs, 6,000 kg maize and stalks, immunisation and disease control, water, 8 labour hours per day for grazing, feeding and watering	82,814
	Quadricycle	Oil for ploughing	600
Total agricultural expenses			83,638

Their income (before deducting expenses) consists of 7,150 yuan from crops, 29,000 from animal husbandry, and 2,230 from government payments (basic living allowances, agricultural subsidies, and subsidies for converting arable land to forestry).¹⁰ Their backyard vegetable production is only for self-consumption. The livestock includes sheep, chickens (ten) and pigs (two), but only the sheep are sold for cash income, and the family have just started expanding their sheep operations.

They grow 20 mu (1.3 ha) of buckwheat, 6 mu (0.4 ha) of common millet and potatoes, and 5 mu (0.3) of rangeland planted to *Caragana korshinskii*; but only potatoes were sold on the market. Seed potatoes are provided by the government, and other seeds are saved and reused. Expenses for buckwheat include 50 kg of seeds and 70 kg of diammonium phosphate fertiliser, which cost 224 yuan for one year. The yield was 25 kg per mu, with a total production value estimated at 1,200 yuan. Inputs for common millet are 10 kg of seeds and 12,000 kg of sheep manure, with no cash expense involved. The yield is 375 kg per hectare, with a total production value of about 250 yuan. Inputs for potatoes are 300 kg of seeds and 13,000 kg of sheep manure (no cash expense). The yield was 11,250 kg per hectare (35% of which was sold on the market in the township), for a total output of 4,500 yuan. The rest of the products were used to feed the sheep. This family uses its own quadricycle to plough twice a year, spending 600 yuan on fuel for all arable land. No chemical pesticides were used. Therefore, their total crop expenses were 824 yuan, while the total output value was 7,150 yuan (see Table 7.3).

In 2013 the family expanded their sheep production. The expenses involved were 82,814 yuan, consisting of 64,000 yuan for buying lambs, 13,500 yuan for buying maize and stalks for fodder, 2,400 for disease control, and 1,460 yuan for water. The money came from loans, including 90,000 yuan from two banks, 15,000 yuan from relatives and friends, and 5,000 yuan from the mutual fund in the village. The sheep purchased were 40 of the Tan Yang local variety, and 40 Chinese 'little fat-tailed sheep' (*xiao wei han yang*) at 800 yuan per sheep. To save costs, the household grazes their sheep for six to eight hours a night; total labour input is eight hours per day including watering and feeding. The total yield in 2013 was 40 lambs, which were sold for a total of 29,000 yuan. From this, Zhanying and her husband expect to earn enough income in 2014 to pay off the loans for investments made in 2013.

Animal husbandry, particularly sheep production, plays a very important role in this green farming system in terms of income generation. Taking advantage of the abundance of food and fodder produced from the large area of arable land, these farmers can concentrate their investment on sheep production, which is more profitable than crops even though the products are not officially certified for marketing as a high-quality animal product. This benefit is even more significant on a larger scale, as indicated in Box 7.3.

10. At the end of the 1990s, the government introduced a policy of returning arable land to forestry.

Box 7.3 The contribution of green farming to livelihoods: a large farm case study

Fengshan is 56 years old and lives with his son, daughter-in-law and one-year-old granddaughter. His son and daughter-in-law work outside the farm in Yanchi county, so Fengshan farms alone. He farms 150 mu (10 ha) of arable land, including 90 mu (6 ha) that he borrows from his son and his brother for free. He grows buckwheat on 100 mu (6.7 ha), yielding 450 kg per hectare and used for self-consumption and feeding sheep, plus 10,000 kg of stalks. Based on a market price of 2.4 yuan per kg, the value of this buckwheat would be 7,200 yuan, plus 4,800 for the stalks (Table 7.4). The input costs were 2,325 yuan, mainly chemical fertilisers. Seeds are saved from the previous harvest, and ploughing is done using Fengshan's own machine. The labour involved in planting and harvesting was 67.5 days. 3.3 hectares were planted to potatoes, with a yield of 10,500 kg per hectare, which earned about 28,000 yuan at a price of 0.8 yuan per kg. Seed potatoes were subsidised by the government, and sheep manure was used for fertiliser, so the only cash involved was for hiring four people to dig potatoes for one day, costing 600 yuan. His own labour input was 75 days. In all, his total income from crops was 40,000 yuan, and costs were 2,925 yuan, so the net income from crops was 37,075 yuan. However, if deducting the labour input of 75 days at an opportunity cost of 150 yuan per day, the profit would be 25,825 yuan.

Fengshan has 200 sheep, and slaughtered 170 in 2013. Normally the family do not consume sheep meat, but only sell it to the market. Fattened sheep were sold to the Wanglejing market at an average price of 1,070 yuan per sheep, for a total of 181,900 yuan. Ninety of the lambs were born on the farm, while the rest (120) were bought at a price of 700 yuan each, making the total payment for lambs 84,000 yuan.

The feed used was 10,000 kg of buckwheat stalk grown on the farm, and 175,000 kg of maize bought at a total cost of 40,250 yuan (at 0.575 yuan per kg), plus 60,000 kg of maize stalks bought for 3,600 yuan (at 1.5 yuan per 100 kg). The cost of immunisation and disease control was 4,000 yuan, and the cost of water was 1,460 yuan. The labour input was 360 days. In total, animal husbandry earned 181,900 yuan, with costs (excluding labour) at 133,310 yuan, leaving a net income of 48,590 yuan. If including 360 days' labour input equivalent to 54,000 yuan (assuming an opportunity cost of 150 yuan per day), the activity operated at a loss (minus 5,410 yuan).

Fengshan received 105,000 yuan in loans for buying production materials in 2013. Of this amount, 20,000 yuan came from relatives, 80,000 from the bank, and 5,000 from the community mutual fund.

The gross output value of the farming system was 221,900 yuan, and the total net income was 75,165 yuan. If the labour costs are deducted, the profit would be 63,915 yuan.

Table 7.4 Annual income and expenses of Fengshan's family, 2013

Income		Yield or inputs (kg or unit)	Value (yuan)
Crops and animals	Buckwheat	450 kg/ha (x 6.6 ha)	7,200
	Potatoes	10,500 kg/ha (x 3.3 ha)	28,000
	Stalks as fodder	10,000 kg	4,800
	Sheep	40 slaughtered	181,900
Total income		–	221,900
Other income	Loan	–	105,000
Expenses	Buckwheat	Chemical fertiliser (plus non-cash inputs of saved seeds and 67.5 self-labour days)	2,325
	Potatoes	4 hired labour days (plus non-cash inputs of seeds, manure, and 7.5 self-labour days)	600
	Sheep	Lambs, buckwheat stalks, maize and maize stalks, immunisation and disease control, water (non-cash inputs of 8 labour hours per day)	133,310
	Interest	–	10,500
Total expenses			146,735

The profits made, however – even in large-scale farming households like Fengshan's¹¹ – do not compare well with off-farm work. While staying in farming can ensure secure food consumption and generate a profit from labour inputs, easy access to food everywhere in China does not make this an exceptional situation.

Apart from the lower comparative profits of farming livelihoods, farmers face the risks of losing money from fluctuating market prices and interest rates, and natural disasters such as drought. About 80% of farming households in the village receive loans for developing animal husbandry, particularly for production inputs, which they pay back at the end of the year.

When seeking off-farm work, villagers' options are limited by their generally low education level, and they face the prospects of being unemployed or injured in the workplace. However, villagers seeking off-farm work are looking for more than wages and jobs. According to one analyst, 'Cities are much more than a source of jobs for unskilled people from the countryside: They are places in which people face new opportunities and accumulate new skills' (Lucas, 2004).

11. Eighty per cent of all farming households in the village operate on a smaller scale than this.

In Zengjipan village today, most farmers are over 45 years old, and are not searching for opportunities outside the village. They seek better incomes and higher cost-benefit ratios from agriculture, so larger-scale production and an extension of value chains from animal husbandry or crops production could help improve these households' livelihoods.

7.4 Social sustainability

Sheep production is an important income source for improving farmers' standard of living. However, 365 days of labour a year are required for sheep production. Crop farming, on the other hand, requires less labour inputs than sheep husbandry. Zhanying's household mentioned inputs for buckwheat, millet and potato ploughing, planting and harvesting of about six days, seven days, and seven days, respectively (Box 7.2).

Apart from using family labour, there are alternatives for meeting these labour demands. For example, 98% of all households in the village use machines for ploughing and harvesting; 80% of them rent tractors, while 20% own their own. Rental costs are 25–30 yuan per day, and total annual costs can reach 3,600 yuan for ploughing and harvesting 60 mu (4 ha) of arable land. So the annual machinery rental expense (not including the farmer's own labour involved) is equivalent to hiring 24 days' worth of labour, assuming a labour price of 150 yuan. Doing these tasks manually on 60 mu (4 ha) of arable land would normally require 42 working days. Thus mechanisation is a viable alternative to manual labour.

Households that lack family labourers hire labour from outside. In 2013, 13% of the households hired labour for potato, buckwheat and foxtail millet harvesting. A family's decision to hire labour does not seem to correlate with their land area (landholdings in the village range from 23 to 150 mu, or 1.5 to 10 hectares, per household). Nor does the family's wealth seem to matter, as the economic standing of households ranged from poor to high-income. Rather, the decision to hire labour seems to depend on the number of labourers in a given family; if these are insufficient, they find a way to get the help they need. At the same time, land commonly changes hands or is lent in the village, with half of the households interviewed farming on borrowed land from neighbours or relatives at no cost.

Though there is no cooperative in Zengjipan to help them sell their produce, the villagers mobilise their social networks for marketing activities. They have a long-term cooperative relationship with the market in the township, around 8% have their own connections with various enterprises, and 18% sell sheep directly to consumers. There are also links between the village leader and township and county governments, which could help with guidance on market requirements for green and organically certified products.

7.5 The role of government

The government promotes the improvement of crop varieties, mechanisation and environmental protection through the use of subsidies, policy regulations and marketing linkages. It is also responsible for high-quality food branding, such as the Tan Yang sheep products, and green food. From this perspective, the government helps create alternative linkages between Zengjipan village and outside markets.

In addition, various subsidies are available for farmers, including direct food subsidies, forestry subsidies and farming subsidies. Subsidies for arable land include the provision of 50 kg/mu (750 kg/ha) of new varieties of seed potato for free, and the new varieties of buckwheat developed and disseminated by Yanchi County Science and Technology Bureau. The total of these subsidies per farmer comes to around 260 yuan per mu (3,900 yuan/ha) of arable land. So a farmer with 35 mu (2.3 ha) of arable land would receive subsidy income of 9,100 yuan. Forestry subsidies are mainly for returning arable land to forestry, and are provided at 90 yuan per mu (1,350 yuan/ha) to all households in this village.

Sheep production receives stronger government support than cropping. This support is provided by the county government because it can be integrated into the development of sheep production countywide. The main subsidies in Zengjipan include 200 yuan per productive ewe and 100 yuan per newborn lamb if the farmers have more than 30 ewes. There are also subsidies for buying breeding rams (800 yuan toward the purchase of one ram), an allocation based on a breeding pool of 292 Tan Yang rams in Wanglejing Township. There are also other subsidies for sheep production, including loans to construct sheep sheds, purchase fodder, develop animal production parks,¹² and organise animal-husbandry cooperatives.

There is a large amount of government input into promoting the Yanchi Tan Yang brand. The Ningxia provincial government spends 40 million yuan a year on promotional activities, including advocacy, brand certification and marketing supervision. There are 68 enterprises and cooperatives with the right¹³ to use the Yanchi Tan Yang brand, 43 of which are in Yanchi. The government is trying to expand the influence, power and market share of the Yanchi Tan Yang brand through various means. Currently, 7 enterprises process Tan Yang products, and there are 71 Tan Yang cooperatives and 292 animal husbandry parks involving a total of 7,800 households. The gross domestic product (GDP) from Tan Yang products was 0.6 billion yuan in 2013, accounting for half of Yanchi's total agricultural GDP. The average annual per capita income in Yanchi is 5,521 yuan, and 1,793 yuan are from the Tan Yang production industry.

There is no such direct government support in Zengjipan because there are no enterprises or cooperatives there; but since sheep in Zengjipan are sold to professional markets meeting the Tan Yang requirements, the village benefits from this support through stable market prices. Market demand has been increasing as a result of promotion effects for the Tan Yang brand, and relatively fixed marketing channels for these products have been developed. The numbers of Tan Yang sheep in Zengjipan have increased gradually in recent years, and farmers are starting to get loans for buying the sheep, expanding sheds, and buying fodder to expand their scale of production. Forty-two per cent of farmers in Zengjipan are involved in Tan Yang production. However, this occurs in individual households rather than in animal husbandry parks or cooperatives, which means they do not qualify for direct government support for activities such as training or market outreach.

12. This term appears in policies promoting the sheep industry in Ningxia. If 25 or more sheds are concentrated in one area, it can be considered an 'animal husbandry park' for which the government will provide a one-off subsidy of 4,000 yuan per shed, up to a maximum of 100,000 yuan per park.

13. Enterprises and cooperatives can apply for this right from the Industrial and Commercial Bureau (ICB), and ICB decides whether or not to authorise it based on the applicants' scale and annual gross production.

7.6 Motivation for green agriculture

The Party Secretary of Zengjipan village is always looking for positive ideas for improving village life. He keeps in close contact with various county departments. Through his efforts, along with external support from local NGOs, Zengjipan was designated as a pilot village for implementing a mutual fund for poverty alleviation, authorised by the Poverty Alleviation Office of the State Council in 2012. This fund is still operating, and functioning very well; in 2013 it had more than 1.3 million yuan.

The Secretary now wants to set up a professional farmers' cooperative for buckwheat production, and to get the village's buckwheat certified as a green food, to add to its market value. He began by enlarging the buckwheat production area to 10,000 mu (670 ha). He is also looking for a processing factory with which to cooperate; several liquor factories have expressed an interest. Most households in the village became involved in expanding buckwheat production when the possible benefits of marketing surplus beyond their own household needs became clearer.

While recent improvements in their livelihoods mean that villagers are not under immediate economic pressure (Box 7.1), they still desire more income from their activities because most of them would like to be able to afford better education for their children.

Even though villagers are not aware of terms like 'sustainable agriculture', cropping and animal husbandry in this area encompasses many ecologically sound practices, such as integration of livestock and crop production, use of animal manures as fertiliser, minimal use of agro-chemicals, fallowing, etc. Many of these are traditional practices and have persisted because of their efficacy. In this sense, the motivations for villagers to continue sustainable agricultural practices are pragmatic.

7.7 Challenges

7.7.1 The increasing severity of climate change

While Zengjipan's green farming system is adapted to its harsh natural conditions, its sustainability is facing new challenges. There is no irrigation in Zengjipan, so drought years exacerbate the already low yields. The situation in 2014, for instance, which was a serious drought year, could not compare with that in 2013, when this field work was done. Rainfed agriculture also limits the production of crops such as maize, which is the main source of fodder for sheep in China. During droughts, maize and stalk prices are much higher, which significantly increases the cost of sheep production. When crop production is negatively affected, there are repercussions for entire commodity chains, and the sustainability of the whole farming system is called into question.

7.7.2 Market price fluctuations

The farmers in Zengjipan do not have their own organisation, or any institutionalised connection with the other links in their commodity chain, particularly for sheep products. While the scale of sheep production is not small in terms of access to the market, individuals have fewer marketing options than cooperatives or scaled-up animal husbandry parks. Processing enterprises normally sign contracts with animal husbandry parks and cooperatives, since transaction costs are lower than when negotiating with individuals in the

market. In turn, the joint strength of these organised entities gives them greater negotiation power. Individual farmers cannot get access to these big enterprises—and even if they could, it would be more difficult for them as individuals to negotiate with the buyers. The market channels through which they operate are not stable, so farmers have to accept the market prices they offer. In March 2014, the price of Tan Yang sheep was quite low because of diseases in other villages in Yanchi. Villagers in Zengjipan sold their fattened sheep at this low price, even though they were healthy, and made no profit.

7.7.3 Market competition is squeezing out sheep production in Zengjipan

The extensive sheep production system in Zengjipan raises Tan Yang sheep using green methods without chemical inputs. Grazing to some extent helps the farmers save on feed costs. However, the emerging large-scale animal husbandry parks (where sheep are kept indoors or fenced in) can get subsidies from the government, and their intensive production methods can provide high returns. In an animal husbandry park, the cost of purchasing a lamb is 600 yuan, and it costs 170 yuan to raise the sheep. A fattened sheep sells for about 1,000 yuan, so the profit made on one sheep from a park is 230 yuan. In Zengjipan village, the cost of production for one sheep is 250–300 yuan, and lambs also cost them 600 yuan. Therefore the profit per sheep is only 100–150 yuan if also sold at 1,000 yuan, without factoring in villagers' labour costs.

With increasing pressure to adopt modern-scaled sheep production, villagers in Zengjipan may face more difficulties in making a good profit from their farming system. Though the upscaled production is not green—and so the quality of its products cannot compare with those in Zengjipan—the difference is not obvious after processing, and large-scale operations can still use the Tan Yang brand. And there does not yet exist a differentiated standard for the purer, free-range 'green sheep' raised in the open air, and so the market does not reflect either the higher quality or the environmental services of this more sustainable mode of animal husbandry.

7.7.4 Ageing population and farmers leaving agriculture

The average age of villagers in Zengjipan is 55, and people older than 60 exceed 25% of the total population. Under the influence of urbanisation, more and more young people are leaving the village permanently for off-farm work; only 40% of the total original inhabitants live in the village. Of these, only 30% work exclusively on farms, and 40% combine both farming and off-farm work during the year. Although those who stay on the farms are working hard to make better profits from agriculture, labour shortages are still a problem.

7.8 Conclusions

This case study has described a circular farming system for raising sheep which has proven sustainable for at least 60 years. Unlike many sustainable agriculture initiatives which employ models introduced by outsiders, this method of sheep raising in Zengjipan has emerged naturally, achieving a delicate balance between the economic, social and ecological sustainability of the community. Economically, the market appeal of the meat comes from the remoteness of the village, ideal for the production of uniquely free-range, ecological meat. Though it is not certified in any way, urban consumers can come to the village and see

'the sheep running in the field' for themselves, and be reassured that production is 'natural' and 'healthy.'

This strength, however, is also the system's greatest weakness, in that access to the market and other means of support can be limited. Though the government promotion of the Tan Yang brand has provided some boost to market channels, the concept of Protected Designation of Origin is still nascent in China, and government subsidies and support still tend to favour larger producers and formal cooperatives. Furthermore, without a designated free-range category in China, Zengjipan community members are not able to market the distinct value of their approaches over other producers of the Tan Yang breed. Finally, other certification schemes – such as green food or organic – are likely too costly for the small-scale production levels in such a remote village.

The tensions between ecological benefits and economic trade-offs inherent in remote, smallholder agriculture communities are also playing out against a backdrop of complex social, legal and economic changes at the local, regional and national level. In this case, we see how the current ecological conditions of production in the village rely on a delicate balance within the grazing ban, which could be threatened by changing climate conditions on the one hand, or heavier handed rule of law on the other. At the same time, the ecological balance of grazing levels is currently only possible within the context of more than 50% of family income sourced through off-farm work elsewhere within the county, creating a sense of abundant land resources very rarely found in agrarian China. However, there is a pull for larger-scale grazing operations by some individuals, as well as a push from village leaders to invest more in crop production. If the pull for off-farm work lessens, or larger-scale production models emerge, the villagers could potentially feel these resources squeezed in new ways. On the other hand, as villagers increasingly accumulate new skills through work in urban areas and as current farmers continue to age, there may be less interest in continuing the animal husbandry traditions in the future.

Ultimately, this case offers important insights into a unique production model which maximises recycling of resources between crops and animals, while reflecting the precarious place of smallholder farmers in a country where market chains are increasingly dominated by large players. Considering the challenges faced by this system and the role of government, there could be some alternatives for policymakers to consider which could improve the livelihoods of farmers involved in these sustainable practices:

- **Integrate the green farming system into the industrial development strategy for sheep.** This system is not the same as modern and scaled-up production, so its sustainability implications first need to get government recognition. Though the villagers already receive subsidies for sheep production, they are not targeted at supporting social and environmental benefits such as resource conservation and natural outputs. In order to allow farmers to take advantage of the brand of Yanchi Tan Yang, the government could include the green farming system within the geographical brand description, which was actually drawn from this local practice. In this way subsidies won't be limited only to encouraging an increase in numbers, but also to preserving quality. However, the supervision system needs to be built up in line with that integration.

- **Encourage the establishment of a cooperative for green sheep production in Zengjipan.** Local organisation is needed to sustain and expand Zengjipan's farming system. A cooperative could help villagers access more stable market channels by becoming a contracting farm, for example. It would also make it easier for the government to approve an application for their own geographical brand. This could be done along with farmers' efforts at green buckwheat production, and application for green food certification. The increased income generated in these ways could directly help to retain younger villagers.
- **Implement water-saving irrigation in the village.** Farmers have already taken many steps to adapt to climate change, including diversifying crops and looking for alternative farming methods. Effective crop production, however, is essential for sustaining the farming system. Lack of water is a key vulnerability in villagers' livelihoods; installing water-saving irrigation technology, such as drip irrigation systems, could be one external support for enhancing resilience to drought. Drip irrigation can be combined with small-scale rainwater harvesting systems to supply crops during droughts and water scarce periods of the cropping season (Cook et al., 2000).
- **Organise exchange and outreach activities for farmers, cooperatives, officials and enterprises.** Training courses, and exchanging ideas and methods with other farmers in similar villages, could enhance farmers' confidence in practising green production, and encourage them to learn new technologies. The development of marketing channels should also be included in these activities, as greater awareness of and connections with buyers would improve farmers' knowledge of market demands and how to add value to their products. Such activities could be organised for farmers in other areas as well, helping to bring green production into the mainstream.

We cannot predict the future of this village; it may disappear one day, just like the 900,000 sub-villages in China that have already disappeared in the last ten years. However, this case suggests some of the practical needs of such communities, such as improved commodity chains for agricultural products, which could bring more benefits and encourage people to stay on farms or even return to farming. If the practical challenges can be recognised and overcome, this kind of small-scale, green and circular method of agriculture could model an alternative direction for more sustainable farming and farming communities in China.



Pest control lamp

© Zheng Jiawei

8 Agricultural sustainability embedded in villagers' livelihood strategies: a case study of Shuanghe village

By Qi Gubo, Lila Buckley and Wang Zhen

8.1 Background and characteristics of the case study area

Shuanghe village is located in a hilly, subtropical part of China, where the agricultural economy is dominated by grain and cash crops. The area, like many parts of rural China, has seen recent large-scale out-migration, bringing changes to and raising challenges for the farming system. This case study examines how ecological agriculture in Shuanghe village is helping the village to respond to these challenges (Box 8.1).

Shuanghe village lies on the east bank of the Tuojiang River, within the jurisdiction of Dongxi township, Sichuan province. It is adjacent to the Chengdu–Chongqing Railway, 9 kilometres from Jianyang City and 65 kms from Chengdu. It is also near a highroad, and is served by regular buses. Roads in the village are mainly of earth or cobblestones, and the township highroads reach directly into the village centre, forming a 'chicken-claw' shape.

The village's landscape is dominated by hills and mountains, and most of the residences, mainly bungalows and two-storey buildings, are situated at the foot of a hill and beside the river. They are either stand-alone houses or courtyard buildings, and are scattered throughout the area. Near the residences are many bamboo and other evergreen trees, and the forest coverage rate is fairly high. Shallow sandy soil, known as 'shingle soil', predominates in this area. This soil type is convenient for farming because it is loose and easy to work, but it has a poor water-retention capacity, which can lead to high runoff.

Village land includes 1,980 mu (about 132 hectares) of arable land, consisting of 460 mu (30 ha) of paddy fields, 800 mu (53 ha) of irrigated land, 300 mu (20 ha) of dry fields, and 420 mu (28 ha) of woodlands. There are also 500 mu (33 ha) of orchards and 120 mu (8 ha) of ponds for aquaculture. Irrigation water is scarce, supplied mainly by rain and groundwater. As Shuanghe village is located in a subtropical area rich in sunlight and warmth, many broad-leaved evergreen trees are scattered throughout the village, and many citrus and other trees line the roads.

Box 8.1 Research methods

This chapter is based on data collected through a survey conducted in July-August 2014, supported by ActionAid China. The survey sampled 72 rural households in nine natural villages,¹ with an average of five family members in each household. Four graduates from China Agricultural University (CAU) conducted the survey using questionnaires and checklists. The remaining data derive from field observations during 2010 and 2013, when CAU engaged with this village and helped to set up a farmer cooperative alongside exchange activities among around 20 organisations promoting cooperative development. This work was co-supported by the International Development Research Centre, Canada (IDRC). All data collected without a specific citation are from 2013.

As an administrative unit, Shuanghe village includes a total of nine natural villages, 430 permanent households and 1,647 residents. Everyone is of Han ethnicity, and the male-to-female ratio is equal. The problem of ageing is severe in Shuanghe village, as about 90% of the young and middle-aged work outside the village throughout the year, which limits the village's agricultural labour force. According to 2013 statistics, about 300 residents in the village were over 60 years of age; more than 170 of them were members of the Old Age Association, and about 20% of the population was older than 60.

For geographical and historical reasons, the nine natural villages that make up Shuanghe village are scattered on or at the foot of the hills and mountains. The topography means that each village is isolated, and villagers seldom come in contact with each other. The Shuanghe Village Committee is responsible for overseeing village-level administrative affairs, thus making the links among the natural villages.

The Shuanghe Village Committee Office is located between two mountains in No. 2 Village Group, where the terrain is relatively flat, close to the ponds, and adjacent to the main road to No. 114 Township Highway. Because of its concentrated population, this is also the administrative and cultural centre of Shuanghe village. There are 17 noticeboards hanging outside the Shuanghe Village Committee Office; in addition to general signboards for the 'Shuanghe Village Committee' and 'CPC Shuanghe Village Party Branch', the signboards name agencies established jointly by the village and other agencies, such as the 'Experimental Teaching Base of the Rural Construction Centre of Renmin University of China'.

The Village Committee Office includes the Village Party Secretary/Director's Office, reading room and conference room. Although contained in a small area, the office is fully functional, equipped with computers, telephones, a wireless network and multimedia devices. In front of the Village Committee Office is a large cement court equipped with a basketball stand. Near the Village Committee Office, there is a small shop selling daily necessities and featuring mah-jong tables. The young and elderly alike from No. 2 Village Group come here for recreation, though few farmers from other natural villages take part in the activities here. A rice-processing plant is also located nearby.

1. 'Natural villages' developed organically in pre-Mao China, and are the smallest units of local governance in modern Chinese society. They are distinguished from, but can form part of, 'administrative villages' set up for governance purposes by Mao's administration.

8.1.1 General agricultural context

Local rice planting, based on double-season cropping, mainly meets farmers' own needs. In the winter, farmers primarily grow rape on the arable land for its edible seed oil. They also plant citrus trees in the mountains, along with maize and sweet potato. Due to poor management, however, the citrus output is not high, and the oranges are mostly small and sold only to dealers or in local produce markets. The villagers also grow peanuts, but the planting area is limited and the peanuts are mainly Baisha peanuts, which are small and not well marketed. Green soybeans are planted in vegetable fields or farmland, generally producing an average-sized yield.



Rice paddies and rapeseed fields in Shuanghe village © Jia Liping

In terms of coverage, maize is grown on 1,200 mu (80 ha), intercropped with sweet potato and citrus; rice is grown on 400 mu (27 ha). Of the cash crops, rapeseed accounts for 700 mu (47 ha), citrus 500 mu (33 ha) and peach trees 100 mu (6.7 ha). According to an interview with the Principal of the Village Committee, little change has taken place in the village's agricultural production modes and institutions, and experienced farmers are still the main force of agricultural production.

Some rural households also raise pigs, and some households near the ponds breed chickens and ducks. In recent years, due to the increase in out-migration, it is mainly women and the elderly who engage in farming. As a result, livestock breeding has been expanded since this activity is relatively easy for them. While this change is not economically significant, free-range poultry breeding mainly meets households' own needs, and is an important part of the circular livestock/poultry-biogas-rice agriculture system.²

Shuanghe village has rich biogas resources, and almost all rural households here have biogas digesters and auxiliary equipment. The biogas digesters were constructed from the 1980s through to 2013. The biogas is mainly used as fuel, and the biogas residue is mainly transferred to the fields to be used as fertiliser.

2. 'Circular agriculture' means using both plants and animals in a cycle in which animal manure feeds crops that feed animals that provide manure. This system is restorative by design, aiming to keep products, components and materials at their highest utility and value, at all times, in a perpetually self-sustaining system.

Since 2011, under the guidance of Dongxi Township Agricultural Technology Service Centre (the Service Centre), Shuanghe village has organised ecological agricultural production, focusing on ecological rice planting and livestock breeding and based on the village's specific geographical, economic and social conditions. As shown in Table 8.1, Shuanghe villagers use ecological techniques for growing rice, vegetables and animal husbandry, and some maize, sweet potato, rapeseed and citrus. These comprise 50% of the total land area of the village. Other products are still grown using conventional approaches.

Most of the maize produced is for feeding animals. Sweet potato is intercropped with maize, and several farmers with larger areas sell their sweet potatoes to local households. Rapeseed is mostly converted to oil for local consumption. While orange production accounts for a large proportion of the villagers' cash income, ecological vegetable and animal husbandry generate more cash income than ecological rice, 40% of which is sold on the market. Animals include pigs, chickens and ducks, which are sold to consumers in the nearby city.

Table 8.1 Crops and livestock in Shuanghe village, 2013

Crop/Livestock	Area (ha) or animals (number)	Yield (kg/ha)	Gross value of products (yuan/ha)	Average percentage of product sold on the market (%)
Maize	59.3	6,525	13,050	20
Sweet potato	61.3	2,550	2,550	10
Ecological rice	20.0	7,500	30,000	40
Ecological vegetables	13.3	—	—	100
Rapeseed	46.7	1,950	9,000	0
Citrus	33.3	22,500	22,500	100
Experimental ecological crops (maize, sweet potato, rapeseed, citrus, soybeans, small grains)	46.7			
Ecological animal husbandry (pig, chicken, duck)	100.0	—	—	90

The average per capita arable land area in Shuanghe village is only 1.2 mu, which is less than 0.1 hectares. Agricultural production is limited by the internal resources of the village such as paddy fields, dry land, groundwater for irrigation, and subtropical-climate field weeds for feeding livestock. The landscape is mainly hilly, which is not suitable for the operation of large agricultural machinery, so farmyard manure transportation and agricultural production are all done by hand.

The village's agricultural production has to rely on available labour resources. These have been heavily affected by urbanisation and industrialisation in China as a whole, attracting most of the young and middle-aged people away from the village for off-farm work. Ageing and feminisation of farmers in Shuanghe village are thus highly significant, as in other parts of China. Therefore, a lack of enthusiasm for pursuing modern³ agricultural-production modes and a diminished agricultural labour force are both constraints to the development of agriculture in Shuanghe village.

On the other hand, women and the elderly can fairly easily undertake basic livestock and poultry breeding, maintaining a stable if low-efficiency agricultural production in Shuanghe, where most products are used for local household consumption.

8.1.2 The Jianyang Xintiandi Professional Rice-Growing Cooperative

In 2010, the Director of the Service Centre (and Technical Supervisor for the cooperative), the Village Party Secretary and the Village Committee Director came up with the idea of creating a farmers' cooperative to promote organic farming in Shuanghe village (see Section 8.6).

Through village meetings they persuaded individual farmers to join the cooperative and commit to producing rice in a more sustainable way. Seventy-four farmers agreed to join. However, it took some time to complete the official registration. They initially named the cooperative the 'Organic Agricultural Production Cooperative' and tried to register it with the Jianyang Bureau of Industry and Commerce in March 2010, but they were immediately refused, as the term 'organic' requires the prior certification of organic products. So they decided to rename it the 'Professional Planting and Animal Husbandry Cooperative' (*Zhongyang Zhuanye Hezuoshe*), but the bureau informed them that the name could only represent one type of production. It was then changed to 'Planting Professional Cooperative' in August, but this too was denied, since the name was required to reflect a specific product.

Again the cooperative was renamed—this time to 'Jianyang Xintiandi Professional Rice-Growing Cooperative' (hereafter 'the Xintiandi Cooperative')—and this name was accepted. A planning workshop was held in August 2010 (see photo), and registration was finally completed in November 2010. The cooperative set up a board of directors and board of supervisors, and currently has 323 registered members, accounting for 75% of all permanent households in the village. The Service Centre Director is now the cooperative's Technical Supervisor, and the Village Party Secretary acts as the Chief Financial Officer.

After the Service Centre reported to the Jianyang City Government that over 400 households had joined the cooperative for ecological production, Jianyang allocated 100,000 yuan to improve the village road, providing easier access from the village entry to the cooperative office.

3. 'Modern agriculture' in China refers to conventional agriculture, which has been introduced and promoted in recent decades throughout the country as part of China's effort to 'modernise' its agriculture sector.



Development planning workshop for the Jianyang Xintiandi Professional Rice-Growing Cooperative © Jia Liping

In September 2013, the Shuanghe Village Farmers' Cooperative was named a 'Provincial Demonstration Farmers' Cooperative Organization'. Jianyang city has put forward the concept of 'modern green urban agriculture' which local officials believe will further encourage Shuanghe village's development of organic agriculture.

8.1.3 Ecological agricultural production patterns in Shuanghe village

Shuanghe village mainly engages in ecological agriculture through the Xintiandi Cooperative, focusing on the production of ecological vegetables, pigs, minor grain crops, and especially rice. Shuanghe village's ecological rice-production area is now nearly 300 mu (20 ha). Some farmers differentiate production for self-consumption from production for the market. As one villager said, 'I divided my family's farmland into two parts—one for [ecological] rice planting and the other for ordinary rice planting; the former was for ourselves, and the latter for marketing.'

The Xintiandi Cooperative has a total vegetable planting area of 20 mu (1.3 ha), which is still in the experimental planting stage. Six people are responsible for planting and maintenance, two are full-time vegetable marketers, and one acts as the delivery driver. Two lots of the cooperative's woodlands have been leased to tenants for about 12 years.

Shuanghe village also has an ecological pig farm with an annual output of 40 pigs. It was built by the cooperative with an investment of over 200,000 yuan by three shareholders.⁴ The pig farm is equipped with biogas digesters, and the biogas residues are used for fertiliser on the Xintiandi Cooperative's arable land. One reason that more households have not joined the pig-farming venture is that the Village Party Secretary, one of the three pig-farming investors, had proposed a few years ago to establish a local citrus cooperative, and that attempt had failed.

As in other areas, land in Shuanghe village is collectively owned, and land-use rights are contracted to individual households. There are three types of relationship between the Xintiandi Cooperative and its members (Ziyang City Food Industry Association, 2013):

- 1) 'Close linkage' (*jinmi*), which involves 20 mu (1.3 ha) of land planted to grapes, strawberries and vegetables. Members invest their land with the cooperative, and the cooperative works the land and markets the produce, sharing the profits with the land-use rights owners. The owners are organised by the cooperative to work on the land together, and each has a specific role and schedule.
- 2) Loose cooperation, called 'trusteeship' (*tuoguan*). This concerns only two households in Shuanghe, each with 5 mu (0.3 ha) of land. These two households all have jobs off-farm and have authorised the cooperative to work and manage their land. For this they receive a flat fee of 9,000 yuan per hectare per year, but do not receive the profits from sales.
- 3) 'Half-close linkage' (*ban jinmi*). This is most common arrangement, involving the rest of the members and accounting for a total of 300 mu (20 ha) of paddies and other fields planted to grain and rapeseed. Members farm their own land independently, but follow the cooperative regulations on the purchase of production materials, procedures and practices. The cooperative provides rice seed, plastic film, insect lights, biogas residues, instruction in fertilisation techniques, etc. For some activities, such as spraying biogas residues or harvesting, members also voluntarily organise and cooperate with each other directly. Agricultural products, particularly ecological rice, are purchased by the cooperative. The members participating in growing organic rice each provide 65 kg of rice to the cooperative, and surplus ecological rice can be sold to the cooperative at a specific price (3 yuan/kg in 2013). The cooperative then packages and sells the rice on the market, returning any profits to the members, currently only ecological rice farmers, based on the purchase volume.

These cooperation mechanisms make the best use of existing resources, increasing the efficient application of labour and land inputs and aiding in the implementation of ecological planting.

When asked in an interview how to identify whether or not the rice is ecological, the Village Committee Director said—and other villagers agreed: 'This is self-monitored. From our experience, rice with light-coloured leaves is organic; otherwise, we can tell that fertiliser has been used.' The Xintiandi Cooperative has been advertising its rice as an 'ecological agricultural product', which does not require official certification. The Shujiao brand (or 'Pride of Sichuan'—see photo below), was originally registered as ecological rice in 2011 to better adapt it to modern society and the formal market's requirements. The cooperative began the application process for green food and organic food certification in 2011.

4. No profit was made from this, and the other members considered the risk too high, so only three farmers invested in this project.

The Xintiandi Cooperative has been trying to apply for green and organic certification for several years. It received green-food certification (number LB-03-1410224224A⁵) on 4 March 2015, and was approved for entering the organic-farming conversion phase in 2015.⁶ It is expected to gain final certification in 2016.

8.1.4 Marketing

Shuanghe's locally grown organic rice and vegetables are mainly sold to acquaintances and local food markets, neither of which provides stable demand. However, since ecological vegetables are not easy to store and transport, and are sold at the same price as ordinary vegetables on the market, the cooperative has played a major role in improving the marketing of ecological rice. Since the establishment of the cooperative, there is at least one 'ecological rice-tasting meeting' a year, held in various locations, for advocating the good taste and health benefits of ecological rice among consumers. For example, in 2010 the cooperative invited consumers to Shuanghe village; in 2011 it brought rice to CAU for a tasting; and in 2012, 2013 and 2014 it held tasting events at the farmers' market in Jiangyang City, with each event attracting over 100 participants.⁷

Shuanghe village's ecological rice is not well known. Advertising is mainly through word-of-mouth, particularly at local universities, research institutes and by NGOs working with the village to promote Shuanghe's organic products. Marketing has been minimal, and no particular investment has been made in advertising. The cooperative is finding it difficult to target the market for organic products, and as a result, many of its products are being sold at the same price as ordinary ones. High profits, of course, cannot be achieved in this way.

While staying in Shuanghe village in 2014, the research team studied the marketing process. At about 4 o'clock in the morning, the personnel responsible for vegetable harvesting started working in the field. At about 6 o'clock, the vegetables were sent to the city on a truck, and the delivery process took most of the day. This so-called direct marketing, however, has not yet created much profit for the growers because the Xintiandi



'Shujiao' brand ecological rice package © Wang Zhen

5. www.moa.gov.cn/sydw/lssp/xw/ggl/cpgg/rengong/201503/t20150304_4424547.htm.

6. Email interview with the Service Center Director, 15 August 2015.

7. Interview with the Village Committee Director in Shuanghe, 8 August 2014.

Cooperative's vegetables are still in the organic conversion process and are therefore sold at the same price as ordinary vegetables in the market.

In order to reach consumers receptive to ecological agricultural products, Shuanghe villagers have connected with the Huafude Ecological Market (*Huafude Shengtai Shiji*) in Chengdu and the Tian An Life Company (*Tian An Shenghuo*), who are helping connect farmers with consumers. This approach, based on social contacts, could provide an alternative for marketing ecological produce for other regions as well.

8.2 Ecological sustainability

Twenty Chinese characters are written in red on the wall of the office of the Xintiandi Cooperative. They say, 'Respect nature and protect the environment, and you receive blessings; destroy the environment and waste resources, and you get misfortune' (*jingwei ziran baohu huanjing fuzhi, pohuai shengtai langfei ziyuan huo lai*). Walking in the fields, you don't see pesticide bottles or other chemical packaging, and you can smell fresh air. As one villager said with satisfaction, 'We do not smell the unpleasant odour of pesticides. Birds in the hills and earthworms in the soil are increasing. Eels, loach and other small fish are increasing as well; and river shrimp are starting to dig holes in the field berms. In the summer, we can see fireflies sparkling everywhere again. In previous years, when large amounts of pesticides were used, fewer and fewer small fish, eel, loach and shrimp appeared. And river shrimp could be seen coming out of their holes and dying immediately after pesticides were sprayed.'

Villagers also made positive comments about local water and land resources. When talking about the protection of their cultivated land resources, many respondents said: 'Livestock and poultry manure can be used to maintain soil fertility, and crop straw can also be used directly as fertiliser.' All these are effective traditional measures to ensure land productivity, used by local residents for many years.⁸ One villager expressed his appreciation of the advantages of ecological farming: 'The benefits are not only getting a good price now, but also eating without worrying about the negative effects of chemicals, having a good environment with fresh air—and, more important, having clean land for future generations!' (Zhou, 2014).

Table 8.2 shows that villagers apply various ecological methods in producing their crops. These methods are integrated, as explained by a villager: 'We are returning stalks to the fields, to reduce the use of plastic film. We use plastic film only in the fields that leak water, and not in those that don't. Mulching with stalks preserves moisture in the early production phases, increases the soil's organic matter, and loosens the soil when stalks are allowed to rot in the field. This helps crops grow better.'⁹ The villagers learned these methods through their own experiences and exchange with other villages, as well as from researchers from Sichuan Academy of Agricultural Sciences (SAAS) and CAU and other organisations and technicians from outside the village (Box 8.2). They commit to use these methods when they join the Xintiandi Cooperative.

8. Interview with villagers in Shuanghe village, 12 August 2014.

9. Interview with villagers in Shuanghe village, 8 August 2014.

Box 8.2 Villager innovations for ecological farming

Shuanghe villagers have adapted and improved on traditional Chinese methods to suit their local conditions, under the guidance of the Service Centre and SAAS. One example is applying 1,500 kg of rapeseed meal (*youku*) per ha of land; utilising this agricultural by-product reduces the need for manure, and saves the labour needed to transport and apply it.¹⁰ Another example is simply not weeding until weeds grow taller than the crops. Yet another example is applying biogas residues to prevent insect damage and diseases in rice. The frequency of this spraying was once every two weeks in the first two years after stopping pesticide use, but by the fourth year it is needed only twice during each growing season. Earlier or later dates for transplanting seedlings, and using more local varieties, are other methods Shuanghe villagers have used to enhance rice's resistance to pests and diseases.

There are similar examples in other villages, such as a 'donkey-plus-small-engine weeding machine' developed by villagers in Erbaihu village in Zhangbei county of Hebei province, and other examples elsewhere in China.¹¹

More and more farmers are planting local varieties of organic rice, although this is not strictly required by the Xintiandi Cooperative. They have even introduced traditional varieties from other villages in neighbouring provinces, which is helpful in increasing biodiversity and minimising farmers' reliance on major seed companies. From the farmers' perspective, they can save the seeds themselves and have more rights to select the seeds.



Using enzymes to make organic fertiliser with traditional methods © Yuan Yong

The Xintiandi Cooperative plans to extend the ecological methods throughout the village, although they have some difficulties to overcome. For example, most fruit plantings on the hills are still using chemical fertilisers because labour shortages make it difficult to move manure to the hilly terrain. The cooperative is trialling intercropping with green manures (nitrogen-fixing crops that can be ploughed in to fertilise the soil) as an alternative fertilisation method for ecological fruit planting on hillsides.¹²

Villagers are also incorporating green concepts, such as waste recycling and wastewater reuse, into their daily household activities (Table 8.2). Each natural village has one person who is responsible for environmental protection, supervising, for instance, the gathering of plastic wrappers from snack foods eaten by children, and plastic film left in the field.

10. Rapeseed meal is the residue of rapeseed after grinding to remove the oil, and can be used as an organic fertiliser (油枯, 菜籽榨油后的残渣制成的有机肥, 也即菜籽饼).

11. Natural farming is practised in many villages in China, with various methods. See 中国好大米——‘一粥一饭’鲜米来袭 <http://news.163.com/14/1020/15/A90RSKGS00014AEE.html>, and 用自然农法种稻 http://news.ifeng.com/a/20141231/42837467_0.shtml.

12. Interview with the Service Center Director, 9 August 2014.

Table 8.2 Technologies and methods used by villagers in production and daily life

	Ecological rice production and animal husbandry	Conventional production
Ploughing	Plough not used	Plough used
Planting	Reduce use of plastic film; intercropping with leguminous fodder; intercropping of maize and sweet potato; crop rotation; local varieties of red rice and black rice; introduction of regional varieties of fragrant rice from Guangxi and Guizhou; no weeding or less weeding, done by hand rather than chemically	Plastic film; intercropping of maize and sweet potato; crop rotation; hybrid rice; herbicide application
Fertilisation	Composted manure; enzymes (<i>jiaosu</i> —see photo); biogas residues (<i>zhaoqi</i>)	Application of chemical fertilisers
Prevention and treatment of diseases and pests	Biogas residues; yellow insect-trap boards (<i>huangse you chong ban</i>); insect-killing lights (<i>pin zhen shachong deng</i>)	Pesticide application
Harvest residuals	Returning stalks to fields	Returning stalks to fields
Dealing with wastewater	Recycled and reused	Recycled and reused
Dealing with waste production materials	Separated and sold to specific collectors	Separated and sold to specific collectors

Some respondents, however, maintain that livestock and poultry excrement will pollute the village, especially in summer. For example, many pig-raising households' biogas digesters have a small capacity. Excess pig manure is discharged directly onto the farmland near the house, creating a pungent odour and aggravating mosquito proliferation. Some pig farmers live near ponds; in summer, sewage flows directly into the ponds, also creating pollution. These concerns will need to be addressed if livestock and poultry farming are to be sustained or expanded.

8.3 Economic sustainability

For farmers in Shuanghe village, ecological rice has more potential than conventional rice to satisfy both self-consumption and income generation. From Table 8.3 we can see that the per-unit yield of households growing ecological rice is 397 kg (equal to 5.95 tonnes per ha), while that of the households growing conventional rice is 467 kg (equal to 7 tonnes per ha). But comparing the market prices (5 yuan/kg for organic rice versus 3 yuan/kg for conventional rice), we find that the net economic benefit of organic rice is actually 214 yuan more per mu (3,210 yuan/ha) than for conventionally grown rice. Furthermore, once this rice attains organic certification, this differential will be even greater.

Table 8.3 Profits from ecological versus non-ecological rice production, 2013

Item	Ecological rice	Conventional rice
Rice output (kg/ha)	5,955	7,005
Rice sold on the market (% of total production)	40	40
Market price (yuan/kg)	5	3
Gross value of rice sales (yuan/ha)	11,910	8,400
Agricultural input costs (yuan/ha)	1,650	1,350
Net profits per unit of land (yuan/ha)	10,260	7,050
Share of rice-planting income in total household agricultural income (average %)	8	5

Since the local per-capita arable land area is only 1.2 mu (0.08 ha), however, the rice grown is mainly used to feed family members. This means that even though families can potentially obtain higher income from organic rice, this would still represent a relatively low proportion of the family's total revenue. This makes organic rice production for cash-income generation less attractive for most small-scale local farmers. The economic details of three specific cases detailed in Box 8.3 help to illustrate this.

The ecological agricultural products sold by the Xintiandi Cooperatives in 2013 included 12 mu (0.8 ha) worth of bean products, and more than 30 mu (2 ha) of rice. These were mainly sold in Chengdu, Zhejiang, Guangzhou and Shenzhen. The cooperative, with an annual expenditure of 400,000–500,000 yuan, made little profit, according to its director.

Box 8.3 Farmers' stories

Li is 70 years old, but is still a core member of the cooperative. There are six people in his family, but only he and his wife are engaged in farming, including 1.6 mu (0.1 ha) of ecological rice. They use local varieties so they do not need to buy seed; their annual expenses include 20 yuan a year to buy ordinary mulching film and 160 yuan to rent agricultural machinery. With this investment of about 180 yuan, they achieved a total output of 680 kg, equivalent to 425 kg per mu (6.4 tonnes per ha). Based on the unit price of 5 yuan/kg, the gross output value would be about 3,400 yuan, but as all the rice is used to feed the family, they earn no cash income.

Another household is led by Zhou, 45 years old. Although there are three people in his family—his son, his grandson and himself—only Zhou is engaged in agricultural production. To grow 1.2 mu (0.08 ha) of hybrid rice with conventional methods, he spent 65 yuan on seed, 80 yuan on fertiliser, and 30 yuan on ordinary mulching film. He achieved a yield of 600 kg, equalling 500 kg per mu (7.5 tonnes per hectare). Based on the unit price of 3 yuan/kg, the gross output value would be 1,800 yuan—but again all the rice is consumed by the family (Zhou, 2014).

For those with larger areas of paddy land, however, it is apparently profitable to produce ecological rice. For example, Fu produces 7 mu (0.5 ha) of ecological rice, yielding 3,800 kg of gross output. The price is 2,714 yuan per mu (180 yuan per ha), and the cost of inputs including manure, labour and machinery is around 7,500 yuan per ha. This gives him a profit of 33,210 yuan per ha and a total profit of 15,498 yuan from his 7 mu (0.5 ha) of paddy land, assuming the entire yield is sold on the market. Fu said, 'I kept my rice production ecological and organic; we did not apply any chemicals, but used biogas residues, fermented for preventing bacteria and diseases, and insect-killing lamps for controlling insects'.

8.4 Social sustainability

The future of ecological agriculture in Shuanghe village is uncertain given the labour shortages and ageing population. Ecological agriculture as practised here is more labour-intensive than conventional farming, as it includes activities such as preparing bio-enzymes, biogas residues and compost; transporting manure; spreading plastic mulch, etc. Furthermore, the hilly terrain limits the scope for mechanisation. The elderly and women have difficulty sustaining the intensity of labour required.

For example, Wu is 55 years old and head of her production team. She notes that organic agricultural production is very beneficial, but that she is too old to transport the farmyard manure to the arable land at high altitudes. Chen, a 50-year-old woman, emphasises the labour-intensive nature of ecological planting. In the spring of 2013, she spent more than half a month ploughing, fertilising and transplanting her 2 mu (0.13 ha) of paddies. This was almost twice the number of days that she previously spent when she used chemical fertiliser.¹³

Yet, younger people are unwilling to stay in farming. For example, a driver was the only worker in Shuanghe village younger than 40 who had returned to agriculture, and only after his father's sustained efforts to persuade him.

13. Interview with villagers in Shuanghe village, 13 August 2014.

Director Yuan also discussed this problem of labour pressure; he does not know of a viable solution for attracting more young people to agriculture at the moment. The Xintiandi Cooperative once held a young people's party during the Spring Festival in 2012, but young people did not attend because 'They are not interested in agriculture, only off-farm work,' according to Director Yuan.¹⁴ The Party Secretary warned that the leaders of the Xintiandi Cooperative are getting older – they will soon have to find younger replacements. However, young people are unwilling to work in the village because the working environment and salary are not attractive.¹⁵

Nevertheless, efforts to promote ecological practices have improved social connections in Shuanghe village, increasing access to external resources. The development of organic agriculture has enhanced the popularity of Shuanghe village, attracting the attention of many agencies, government departments and the media. It has also increased the sales of other local farm produce such as grain, sweet potatoes and citrus. City and county leaders have paid many visits to the village, and the village successfully applied for 'central financial support for pilot innovative projects of agriculture and forestry economic cooperative organizations in 2013' (the Financial Project) in the name of the Xintiandi Cooperative.

Production conditions have been improved with this external support, including road repair in the village (with funding from Jianyang city), installing anti-mosquito lamps for members (funded by IDRC, the International Development Research Centre in Canada, through CAU), and providing improved seeds, maize seeds, plastic film and organisation for helping members unable to work (funded by the Financial Project).



The Establishment of the Women's Association and Celebration of Youth Day © Yuan Yong

Practising ecological agriculture has also increased public space¹⁶ in the village, and the social capital of individual villagers. Apart from the cooperative itself, a series of groups has been set up based on members' needs, e.g., a farmers' field school, a production interest group, an elders association, a women's association, and an entertainment group. All of those groups were set up by the cooperative members themselves with their own money and a small amount of the cooperative's earnings. Each group has between

100 and 200 members who organise annual activities. These include a tea party on Elders' Day, taking part in Celebrating Youth Day, celebrating Communist Party Day, and organising a 'Comforting Exchange' for elders left in the village without family. These activities have helped villagers, especially women and elders who live alone, to organise themselves around mutual interests and to enrich their spare time with something other than watching television or playing cards and mah-jong.

14. Interview with the Director of Dongxi Town Agricultural Technology Service Centre, 14th August 2014.

15. Interview with the Party Secretary in Shuanghe village, 12 August 2014.

16. More information in Zhang et al., 2014.

Before the collaborative farming started, villagers mainly cared about their own houses, yards and land, and did not pay much attention to public areas. They had tended to think that they were the only ones who noticed the bad smells, and to hope that their neighbours would act to clean up first (Yi, 2012: 144). Participation in the cooperatives, technology-exchange conferences, and other collective activities has made villagers feel more community-minded in areas such as public sanitation. Villagers are much more willing to clean public areas than previously, for two reasons. One is that after attending courses on organic agriculture, many realised the harmfulness to the environment of garbage dumping; another reason is that the residents are more easily organised for projects such as cleaning the roads and pond, as they are now used to working together regularly.

An 80-year-old villager gave a general assessment of ecological practices and livelihood change in Shuanghe village in poetic form: 'Xintiandi is excellent, and farmers' incomes could not be increased without it; modern rural areas need both growth and cultural enhancement; associations for production and entertainment contribute to a comprehensive livelihood...' (*xintiandi ban de hao, nongmin zeng shou li buliao... xin nongcun yao fazhan, jingshen wenhua ye dei gan. Ban xiehui, gao yichu, shengchan yule liang bu wu*).¹⁷

8.5 The role of government

The government has assisted in the development of organic agriculture in Shuanghe village through policy guidance and institutional, technical and financial support. This has involved various levels of government departments, as well as partner organisations such as SAAS.¹⁸

There is no distinct policy on ecological agriculture in Sichuan province, but some ecological agriculture-related policies touch upon various agricultural and environmental practices. The most significant are biogas policies and projects, implemented throughout Sichuan province since 2003. Households using biogas have increased from 2 million in 2003 to more than 6 million in 2015, and the coverage percentage has reached 65% of all households suitable for installation of biogas, according to the Vice-Director of the Sichuan Province Rural Energy Office (Zhou, 2015).

Regulations on circular agriculture in the circular economy were issued in 2005 and developed in 2011; at the provincial level in Sichuan, these include support for the reuse of crop stalks and disposal of manure (Sichuan Province Government, 2005; Sichuan Government Office, 2012). Some relevant aspects also appear in 2012 modern agricultural development guides on developing hazard-free, green and organic food; reducing agricultural inputs by recycling agriculture waste and circular farming with cropping and animal husbandry; encouraging formula fertilisation¹⁹ and natural control of pests and diseases; continuing the implementation of rural biogas use; and facilitating farmers' cooperatives through capacity and brand building (Sichuan Province Government, 2012).

17. Interview with villagers, 8 August 2014.

18. Interview with the village's Party Secretary, the Village Committee director, and the cooperative's technical director.

19. Formula fertilisation refers to applications of fertiliser based on soil data and fertilisation experiments; fertiliser is applied according to specific amounts of N, P, K and other elements, at specified times and according to specified methods.

There is also a specific policy for promoting farmers' cooperatives, which aims to involve 20% of households in Sichuan province in cooperatives, in order to develop modern agriculture and increase farmers' incomes by 30% (Sichuan Province Government Office, 2011). In 2011, the Ziyang City government, which administers the area that includes Shuanghe village, categorised the cooperatives into three types: functionally operational, operating with difficulties, and non-functioning—and supports them accordingly (Ziyang Government, 2011). The Ziyang City government policy seeks to produce 'high-quality agriculture, ecological agriculture, well-recognised brands and agriculture for tourism for a wealthy rural Ziyang' (Ziyang Daily, 2013).

Shuanghe village has received support through some of these policies. Households started biogas construction in the 1980s, and began to receive government subsidies around the start of this century. For instance, in 2004 each household received 1,000 yuan for installing biogas. By 2010, every household had biogas facilities, which have become an essential source of fertiliser and pest control for ecological agriculture. The municipal and county governments praised the ecological agricultural production methods of Shuanghe village in 2012. A delegation of ten experts, headed by Secretary Chen of the Agricultural Technology Promotion Centre of the Ministry of Agriculture, paid a visit to Shuanghe village, accompanied by the city Party Secretary, Deputy Party Secretary, Deputy Mayor responsible for agricultural production, Director of the Agricultural Bureau, and Director of the Food Bureau. Deputy Mayor He of Ziyang city has visited Shuanghe village three times. To reward Shuanghe's efforts, the Jianyang city government provided more than 100,000 yuan to support the Shuanghe village farmers' cooperative in 2011, a record in financial aid to cooperatives.

Technical support from SAAS and the Service Centre continues to ensure the success of organic agricultural development in Shuanghe village. A team headed by Professor Lü Shihua of SAAS is responsible for technical trainings and field demonstrations. The Service Centre and the cooperative provide specific technical guidance on the use of farmyard manure and insect-killing lamps, and distribute technical guidance materials. They also provide rice seed free of charge to members of the cooperative.

8.6 Motivation for ecological agriculture

Outside input has also been instrumental in raising villagers' environmental awareness and technical knowledge, and supporting the development of ecological agriculture practices. The Service Centre Director has been very active in mobilising external resources to support cooperatives, in close collaboration with Professor Lü Shihua from SAAS. This longstanding collaboration began in 2005, when Professor Lü tried to introduce the system of rice intensification (SRI)²⁰ and plastic mulching to Dongxi township through technical training and field demonstrations. Together they had the idea of setting up an association to improve agricultural production. The Jianyang Dongxi Township Ecological Agricultural Science and Technology Development Association (*Jianyang Dongxizhen Shengtai Nongye Keji Kaifa*

20. The system of rice intensification (SRI) is a method for rice production developed in Madagascar and adopted in at least 28 countries, which has been proven to raise the productivity of land, labour, water, and capital invested in irrigated rice production. With appropriate application SRI can become labour-saving over time, and can also save water, seed and costs, while raising paddy output. See the SRI website: <http://ciifad.cornell.edu/sri/>.

Xiehu) was set up in 2005 and continued until 2010. The Service Centre Director has been strongly committed to improving agricultural production among his clients in the villages of Dongxi township, even in the face of drought.

In 2009, when the association faced development frustrations, the Service Centre Director and Professor Lü began to consider forming a cooperative in Shuanghe village, where villagers were very receptive to adopting SRI and plastic mulching. That same year, they exchanged ideas with Kadoorie Farm in Hong Kong and researchers at CAU and other organisations belonging to an informal network on cooperative development in China. Along with the application process in 2010 and the Xintiandi Cooperative Congress in 2011, researchers and graduates from CAU came to Shuanghe to help organise meetings, draft an outline of regulations for the cooperative, and generally support ecological farming techniques.

Gradually, more and more people learned about ecological practices through Director Yuan's attendance at various agricultural extension-related meetings, cooperative-related meetings, and through public media advocacy. Partnerships for Community Development, a community-development NGO in Hong Kong, organised a visit for interested people from Guangxi. The Tzu Chi charity in Taiwan invited several members of the cooperative to exchange information about their activities outside of Sichuan. Zhang Zemei of the Sichuan Academy of Social Sciences (SASS) organised a consumer group that has been buying organic agricultural products on-site since 2012.

The cooperative has remained in touch with these agencies, not necessarily through specific cooperation projects but by contacting them as needed, such as asking for guidance in applying for organic certification. These agencies have also helped publicise the cooperative by introducing it in published articles, or inviting members to attend meetings for sharing ecological practices.

As for farmers' motivation, once the idea of food safety was spread in the village in 2010 and emphasised by the researchers of the Sichuan Academy of Agricultural Sciences (SAAS), a technician and the Director of the Service Centre, some farmers considered changing their production methods for the sake of their own food safety. Despite the fact that grain yields are relatively low, grain production mainly supplies household consumption, and this has a direct positive impact on the farmers' attitude towards organic agriculture. In the words of local farmers, 'The food is mostly used to feed ourselves, so it is better not to use fertiliser and pesticide. Besides, the surplus grain can be sold to the Xintiandi Cooperative, and we'll earn some money that way.'²¹

Another reason the farmers in Shuanghe village adopted ecological agriculture was the potential for higher prices and increased income. Most respondents said that they wanted to increase their income through the production and marketing of organic agricultural products, even though only 40% of ecological rice products are currently sold on the market.

With limited land, however, price and income are not necessarily the major factors influencing farmers' agricultural production behaviour. When asked, 'Will price have an impact on your selection of sustainable farming methods?', 34 (or 47%) of the 72 farmers surveyed said 'Yes', and the rest said 'No'. When asked, 'Will earnings have an impact on your

21. Interview with villagers in Shuanghe village, 8–14 August 2014.

selection of sustainable farming methods?', 28 (or 39%) of the surveyed farmers said 'Yes', and others selected 'No'. It appears that while some farmers who support the development of organic agriculture have economic considerations, more than 50% do not. Other considerations such as interpersonal relationships and resource allocation within the village were also very important for farmers.

We note that, in the interviews, farmers had various understandings of 'sustainable agriculture', 'organic agriculture' and 'green agriculture'. Their understanding of these three forms of agriculture is mainly based on what they hear in the media, and from information presented by technical personnel from the Service Centre. The Director of the Service Centre and the initiators of the Xintiandi Cooperative made efforts to legitimise ecological production in Shuanghe village, for example through applying for organic certification. The Service Centre Director explained that 'there is still a base for making more possible profits for the producers'.²²

Village Committee leaders are optimistic about developing organic agriculture in Shuanghe village in the long run, because 'It improves the food's taste and safety'.²³ On the whole, most local households support the development of organic agriculture, as expressed by a positive response from almost 100% of 72 respondents who were surveyed. Many respondents said, 'The food is more delicious. We feel at ease in eating the organic rice, as no pesticide or fertiliser is used.'

8.7 Challenges faced

8.7.1 Meeting market demand through small-scale production

In policies promoting modern agriculture in China, aspects related to ecological or organic agriculture are increasingly important. However, the goals expressed in these policies normally focus on large-scale and high-efficiency production, and ecological aspects are mostly related to building demonstration parks, processing industrialised resources, and scaling up institutional construction.²⁴ In the meantime, smallholders such as those in Shuanghe village are practising ecological agriculture using practices adapted to small-scale landholdings and family operations. Such cases are overlooked by the policy documents.

The burden of repairing the disconnect between the policy discourse and the realities on the ground for smallholder farmers has generally fallen on smallholders. In Shuanghe, villagers took it upon themselves to develop the cooperative in an attempt to access the wider market.²⁵ Once they took the initiative, they did receive support from the city government to strengthen this effort, however.

22. Interview with the Director of Dongxi Town Agricultural Technology Service Centre, 14th August 2014.

23. Interview with two officials in Shuanghe village, 12 August 2014.

24. Even biogas support is now transferring from household-based to large-scale biogas construction projects.

25. As described in Sichuan's policy for developing modern agriculture, farmers' cooperatives are seen as a way to standardise production and agricultural produce brands, to link with wholesale markets, supermarkets and schools, hotels and large enterprises, and to construct storage, cold-storage and primary-processing facilities.

Modern agriculture's standardised and large-scale production is well-suited to existing markets, and its products are easily sold. Xintiandi's experience, however, has been that small-quantity production cannot always satisfy market needs after contracts were signed. More farmers joining the cooperative, not only in Shuanghe village but from neighbouring villages as well, are essential for smallholders in ecological agriculture to stabilise their output quantities and meet market demands.

The disconnect between developing modern agriculture and existing smallholder production will likely exist for some time, despite the organising efforts of cooperatives and institutionalising of connections to market channels.

8.7.2 Compatibility of a healthy life with income generation

Within the cooperative opinions vary on how to scale up ecological and organic agriculture. The differences are mainly over whether organic agricultural development should be based primarily on economic means and benefits.

The cooperative's Technical Supervisor (and Service Centre Director) believes that the original intention and fundamental purpose of developing ecological agriculture is to improve conditions in the village, such as farmers' health, the environment and the way of life and to achieve self-sufficiency. He explains, 'At present, we do not want to sell our products in the supermarket. Although the prices and sales volume would both rise, it would benefit the businesses more than the people. The high price and large sales volume would make the farmers expand their production scale, and then we'd have to face the risk of lower-quality products. We should reduce our dependence on the outside world; my hope is that ecological agriculture will change the farmers' whole way of life'.

The Village Party Secretary, on the other hand, thinks that, 'Without specific arrangement of operational activities and without related funds, it is very difficult for the cooperative to develop effectively. We should identify projects that are beneficial to us, and not blindly refuse them.' He believes that the primary task of the cooperative is to enrich the farmers financially.

As the native-born village head, the Service Centre Director loses face if he is unable to create wealth for local residents, as well as if the cooperative fails to succeed. However, he adheres to the aim of the comprehensive development of the cooperative, holding that its success or failure depends on the scope of the farmers' thinking rather than their income. According to him, relying on external financial support will only make the cooperatives' members seek more economic benefits, which is not in line with the original purpose of developing organic agriculture. In his opinion, they developed organic agricultural production less for the goal of profit than for the goal of improving the farmers' health and environment.

In reality, income generation and consideration for nature and a healthy life are interrelated. However, during rapid development, pursuing economic benefits may take priority over environmental and health concerns. While the health benefits of ecological agriculture are clear, the reality is that income considerations will continue to play an important role in decision making about agricultural production and marketing methods.

8.7.3 Labour shortages

As mentioned above, ecological and organic agriculture is a labour-intensive mode of production, and the disparity between the limited (and decreasing) number of agricultural workers and the development of organic agriculture is unlikely to be resolved soon.

Organic agriculture without an adequate labour force is of course not sustainable. Labour inputs in this area could be retained and strengthened by confidence in ecological agriculture's contribution to a healthy life and/or by the attraction of economic profits. Therefore, improving the confidence of villagers and at the same time increasing the income from their produce are major challenges for developing ecological agriculture as the population continues to age.

8.7.4 Marketing of organic agricultural products

Organic agricultural products in China nowadays are marketed not for mass consumption, but for the relatively few customers who have realised the importance of organic food for a healthy life. Considering that consumers interested in ecological food currently live mostly in big cities such as Chengdu and Ziyang, this puts Shuanghe village at a geographic disadvantage for selling their ecological products at higher prices. Furthermore, they produce too few vegetables to make long-distance transportation profitable.

Shuanghe's ecological vegetables are not sold at higher prices than ordinary farm produce. This is partly due to the lack of organic certification; however, it is unclear how much they will be able to charge even once they achieve basic organic certification. Chengdu and Ziyang have a high demand for organic agricultural products, but Shuanghe village's capacity to deliver a continuous supply is not fully established. It is difficult for the village's products to be sold in supermarkets as these require more certification procedures, regulated management, higher deposits and other marketing costs. Markets in nearby towns have a smaller capacity, and are less likely to recognise the quality of Shuanghe's products, and may even lack any awareness of organic produce at all.

The Village Party Secretary noted that the village intends to increase its marketing, and its pending organic certification will likely help this effort significantly.²⁶ Successful marketing, however, is about much more than product sales; it also requires relevant product certification; a consistent, adequate supply of goods; a stable market capacity; and high market acceptance—and for all of these factors to be simultaneously and indefinitely sustained.

8.7.5 The need for more adaptive technologies

Although Shuanghe village has received financial support for its ecological practices in technical training and infrastructure construction, about 30% of the farmers interviewed expressed a need for more appropriate technologies to ease labour requirements. And over 50% of the farmers expressed a desire to increase ecological rice productivity. When the villagers stopped using chemical fertilisers and pesticides, the per unit yield decreased in the first two years before increasing again, though not to the same levels as conventional rice production. As sales prices are higher than for ordinary rice, however, the decline in output

26. Interview with the Party Secretary, 12 August 2014.

has not resulted in a decrease in farmers' income. Instead, farmers have obtained more income—but labour inputs have doubled.

The villagers still feel this imbalance between income and expenditure. There is, therefore, an urgent need for cooperative members to increase their output further. The challenge is to introduce more adaptive ecological planting practices to improve the land utilisation rate and rice yield per unit of land.

8.8 Conclusions

This case has detailed a system of integrated rice farming and animal rearing in which farmers are actively adapting and improving traditional Chinese methods to suit their local conditions. In many ways, Shuanghe village reflects the conditions of villages throughout China. As such, it is a useful case for examining both the opportunities and challenges of developing organic agriculture in these contexts.

In this case, external actors – including local government, researchers and universities working closely with the villagers – have played an important role in initiating and supporting innovation in the use of agricultural by-products as fertilisers, labour-saving techniques for weeding, and ecological pest control, as well as actively experimenting with planting timing and crop varieties for climate resilience. These technical inputs have been complemented by financial support and in-kind donations of agriculture inputs, as well as visits by local government leaders. Crucially, various outside parties have also been central to supporting the social organisation of the villagers through helping to create a formal cooperative and linking them with urban consumers.

Local people's desire for a healthier life, more stable agricultural outputs and greater economic benefits has also been an important factor in rural households' enthusiasm for developing organic agricultural production in the village. This in turn has resulted in a series of changes in the village's social cohesion, greater awareness of and care for public space in the community, and increased interactions among villagers.

As with many other villages in China, however, we also see how the small land area, and the ageing and feminisation of Shuanghe's agricultural population, raise major challenges for the sustainable development of organic agriculture in the village, even once the green food and organic food certifications are achieved.

This case reminds us that the organic conversion process is a challenging one—particularly for smallholders who carry the costly, labour-intensive burden of producing organically for several years without the ability to capture the added value in the market during the conversion process. There is also the issue of getting the scale right, as villagers struggle with managing increased manure from ecological pig raising.

And even when issues of certification and scale are addressed, the challenge of targeting the market remains key for smallholder farmers in rural China. Shuanghe farmers struggle to satisfy market needs on the one hand, and lack adequate markets on the other. With organic markets still relatively niche in China, remote villages like Shuanghe are at a geographic disadvantage for selling their ecological products at higher prices locally, and small-scale production makes long-distance transport to urban markets unfeasible. In this case, we see the crucial role that outside support has played in helping Shuanghe village establish a

cooperative and reach out to consumers such as the Huafude Ecological Market (Huafude Shengtai Shiji) in Chengdu and the Tian An Life Company (Tian An Shenghuo) who are helping connect farmers with consumers. This approach, based on social contacts, could provide an alternative approach for marketing ecological produce for other regions as well.

The multifaceted challenges Shuanghe village faces in marketing its goods highlight the fact that successful marketing of sustainable agriculture goods is about much more than product sales: it also requires relevant product certification, a consistent, adequate supply of goods, a stable market capacity, and high market acceptance—and for all of these factors to be simultaneously and indefinitely sustained.

Furthermore, the future of ecological agriculture in Shuanghe village is uncertain given the labour shortages and ageing population. Ecological agriculture as practised here is more labour-intensive than conventional farming. Adaptive solutions will be required to address the multifaceted socioeconomic challenges of Shuanghe's organic agriculture, while maintaining the stability of production and improving the local price obtained for villagers' products.

This will require using the cooperative as a platform, making it a real market player, and using economic incentives to mobilise farmers' enthusiasm for organic production. Without these actions, the motivation of the parties involved in developing organic agriculture may decline.

The cooperative plays a crucial role and as such needs specific government support

Despite the village's small area of arable land per capita, villagers have no desire to give up their land. The cooperative is still the best way to make ecological agriculture feasible for satisfying the farmers' own household needs as well as those of consumers. This type of cooperative has a mandate to increase the profits of its members and, just as importantly, to sustain a more healthy and environmentally friendly lifestyle. Government support could help it do so, by:

- 1) Allowing it to register as an ecological or simply sustainable agricultural cooperative without being limited to one type of crop or livestock.
- 2) Recognising that this type of cooperative makes a dual contribution to both agricultural development and environmental protection, and supporting its initiation and development accordingly. Ecological agriculture could be regarded as a niche business mode in the modern agriculture era.
- 3) Establishing the cooperative as a government-backed 'pilot' for testing models of ecological agriculture implemented by smallholders. This would enable the cooperative to get financial and technical support from the government and, more importantly, could provide avenues for policy influence by fulfilling policy objectives that increase sustainability in China, in large-scale agriculture as well as smallholdings.

Research and exchange of adaptive technologies for ecological agriculture should be promoted

Developing and sharing labour-saving technologies underpin successful ecological agriculture. However, such technologies are seldom supported by public research funding due to their small target populations and limited production scale. Specific indigenous methods are practised by only a few people in distinct areas, making it difficult to share them with others who could benefit from them.

Research foundations could support participatory action research (PAR) projects in which researchers, local people and companies with related interests would get together to examine local needs for ecological agriculture technologies, and sponsor activities for sharing existing adaptive practices. What the Service Centre and SAAS accomplished together with Shuanghe villagers provides a good example of the effectiveness of PAR in ecological agriculture (Box 8.2 above).

Develop cooperatives' capacity for marketing of ecological produce

Marketing is quite a different activity from farming. Marketing requires professional capacities and modern sales knowledge, which are not often found in traditional farming societies. Though some commercial ideas reach the villages through information exchange, self-education and people's own mobilisation—the Party Secretary in Shuanghe village, for example, has been working in the city for more than a decade—entering successfully into the market calls for more institutionalised mechanisms and skills.

While some guidelines on the marketing of organic agriculture enterprises are available online,²⁷ and universities or other enterprises can provide relevant information, marketing and its concrete regulations should be integrated into cooperatives' operational plans. There is an ongoing need for sustained, supportive guidance and consultation, formal training, and even the involvement of individuals from enterprises with these professional capacities.

Ecological agriculture offers indisputable benefits for the health of both humans and the natural environment, and for this reason it is valued by farmers and consumers alike. However, ecological farming practices cannot be maintained unless they are also economically feasible, and this presents unique challenges that require creative solutions and wide support. The experience of Shuanghe village illustrates the types of benefits and obstacles that can occur at any scale, and the crucial need for government and other support in order to effectively overcome these challenges, enabling farmers to maintain a lifestyle that is both healthy and financially sustainable.

27. Such as 2015有机农业进入'互联网+'时代 有机产品6种营销推广模式分析, 中国有机农业网, <http://www.cnoa360.com/news/28170673.html>.



**Dalang Folk Dance, Guzhai Community,
Mashan County**

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9 Towards a viable and sustainable Chinese agriculture: lessons and policy recommendations

By Seth Cook, Lila Buckley, Qiao Yuhui and Qi Gubo

Chinese agricultural policy in recent decades has focused on increasing crop efficiency and output through 'modern' inputs of agrochemicals, large-scale irrigation, mechanised farm management, and market incentives for developing industrialised food chains. The widespread dissemination of technical innovations and the entrepreneurial energies of Chinese farmers have enabled food production to keep up with rapid population growth – a major achievement for a developing country with the world's largest population and limited arable land. However, this linear approach to food security has had significant social and environmental costs—as well as creating economic inequalities.

The eight case studies contained in this book paint a rich picture of the diverse alternative models of agriculture with which communities, local governments and companies are experimenting throughout China. From small community-led farmers' associations and remote sheep-rearing societies with targeted local urban consumers, to large certified organic companies with national distribution, they illustrate the wide range of interpretations and manifestations of 'sustainable agriculture' in China.

This research report views sustainability in all its social, economic and environmental dimensions – each case study has shown us the complex interconnections among these three aspects. Furthermore, we have used the term 'sustainable agriculture' to reflect a continuum rather than an endpoint: from less rigorous systems such as the hazard-free standard, to the very stringent organic standards. In this conception, emerging attempts to reduce applications of chemical fertilisers and pesticides are seen as the first step towards more sustainable forms of agricultural production. To have focused solely on organic farms would have missed the panorama of initiatives emerging in the country which merit exploration and support.

While these case studies offer many lessons on sustainable agriculture for China and other countries, their central insight is into the value of and need for a diversity of models. Individually, none of the case studies contains all of the answers to the challenges of how to make sustainable agriculture viable for Chinese farmers and consumers. Taken together, however, they offer a wealth of potential solutions. This is one of the values of the case study approach used in this report; one case study can answer some of the questions raised by another. Through the diverse cases discussed here, we see that there are many different pathways towards sustainable agriculture. These are shaped by a tremendous variety and

complexity of local conditions which demand context-specific approaches. Small, medium and large-scale farms all have a place. Initiatives spearheaded by farmers, cooperatives, companies, local governments and urban intellectuals have all proved to be viable in different contexts.

Similarly, we have seen how the different certification systems create space for a variety of sustainable agriculture approaches to capture value in the market. Hazard-free, green food and organic certification systems have their advantages and disadvantages, but each of them can be avenues for communities and companies to garner greater economic value for their products. Likewise, several of the case studies demonstrate that non-certified systems can also be viable. Policy therefore needs to preserve and foster a range of models: a diverse food system will be more resilient and in any case there is no blueprint model that works everywhere.

Just as these case studies present a spectrum of models, they also encompass a variety of motivations for adopting sustainable agricultural practices. For some, economic motivations were primary. In the case of Wanzai (Chapter 3), for instance, the local government spearheaded the promotion of organic agriculture for the export market in order to raise farmers' incomes and promote development in a poor county. In Shuanghe village (Chapter 8), in addition to economic factors, villagers were motivated by the health and environmental benefits of eschewing agro-chemicals. For villagers in Guangxi (Chapter 4), the establishment of an ecological cooperative was driven by a shared concern for the environment, for the conservation of agricultural biodiversity, and for the maintenance of local culture. In Ningxia (Chapter 7), many traditional practices such as land fallowing, the integration of livestock and crop production and use of animal manures as fertiliser have persisted because of their efficacy – here villagers had more pragmatic motivations for continuing sustainable agricultural practices.

In the context of an overall trend towards conventional and industrial forms of agricultural production, it takes real leadership and vision to chart alternative pathways. In this sense, these case studies are also about the catalytic role played by pioneering individuals. In the case of the Bishi Ecological Farm in Huantai county, Shandong (Chapter 6), it was the owner who played the leading role, inspired to establish an ecological farm by his strong environmental ethic and backed up by his capital accumulated in the construction industry. For the nearby Xincheng Chinese Yam Cooperative, the cooperative's founder was the prime mover. Distressed at the decline of Chinese yam and the negative impacts of agrochemicals in the area, he resolved to promote the sustainable production of this local speciality. For Shi Yan and Cheng Cunwang of Shared Harvest (Chapter 5), Community Supported Agriculture (CSA) was a means to simultaneously address problems of food safety, out-migration, the decline of rural areas and the environmental damage caused by conventional agriculture.

These cases also emphasise the many challenges to the practice of sustainable agriculture in China today. Some of these challenges are agronomic in nature, such as declines in yields during the conversion period to organic production, disease control in vegetable production and animal breeding, avoiding pesticide contamination, finding sufficient land for the crop rotations mandated by organic standards, and the need for regular maintenance of biogas digesters. However, the technical problems encountered in these case studies are dwarfed by marketing and social issues. Adopting sustainable agriculture in China is quite achievable from a technical standpoint, particularly given China's longstanding traditions of ecological

agriculture, its formidable research and dissemination apparatus and its resourceful and enterprising farmers. The major bottlenecks for moving forward are economic and social. For example, how to ensure an adequate market for the products of sustainable agriculture, and to ensure that market returns reflect the environmental, social and health benefits of these more sustainable modes of production? How to ensure that smallholders benefit? Finally, how to find sufficient labour to carry out labour-intensive sustainable agricultural practices in the context of widespread out-migration from rural areas?

9.1 Lessons

It is not possible in this brief conclusion to discuss all of the insights and lessons emerging from these case studies. Further details are provided in the conclusion section to each case study. What follows here are some of the most salient findings that have emerged from our research. The chapter then concludes with policy recommendations for how to promote sustainable agriculture more widely.

9.1.1 Scale depends on context

Our case studies show that sustainable agriculture can be practised at a small, medium or a large scale, and that there are advantages and disadvantages to each. The small scale of the Guangxi case, for example, enabled farmers to retain a large degree of control over their resource base (land, water, labour, seeds), even as they struggled with marketing. The larger scale of the Bishi Ecological Farm (Chapter 6), on the other hand, meant it could integrate all aspects of the production chain, although this entailed some degree of risk for farmers who transferred their lands to the company.

At the same time, cases of collective action for some activities—such as planting and harvesting, or processing and application of crop residues—illustrate that certain aspects of agricultural production are best done at a larger scale than the household level in order to increase efficiency. Similarly, the cases from Shandong demonstrate how it is easier to construct and maintain biogas facilities at a collective level; it is also far easier to make use of biogas slurry and residues with machinery, which individual farmers may not have access to. At every scale, these cases highlight how marketing is also best done on a collective basis in order to maximise bargaining power while saving labour and time. Thus from these cases, it seems that as long as there are structures in place such as CSAs or collectives which enable farmers to amalgamate their efforts, sustainability can be pursued at any scale—and indeed is best pursued at the scale that matches the circumstances of the particular actors and geographies involved.

Some sustainable agricultural practices once prevalent in traditional Chinese smallholder farming systems have not yet been adapted to larger-scale operations. For example, the practice of combining pigs, chickens and other animals in addition to growing crops is being rapidly replaced by the type of large-scale feedlot production practices prevalent in developed countries. This presents problems for sustainable agriculture in several respects. First, animal husbandry is separated from crop production, preventing recycling of resources and resulting in vast amounts of biological waste. Second, this can pollute the surrounding environment and pose health threats to local communities. Yet as Bishi Ecological Farm demonstrates, crop production can be combined with animal husbandry at scale in a way that addresses these problems.

Though sustainable agriculture is increasingly supported in principle in China, policies normally focus on large-scale and high-efficiency production models, and ecological aspects are mostly related to building demonstration parks, processing industrialised resources, and scaling up institutional construction. In the meantime, smallholders such as those in Shuanghe village are practising ecological agriculture using methods adapted to small-scale landholdings and family operations. Efforts to promote sustainable agriculture in China would benefit from a closer look at the benefits of operating at different scales according to the specific needs and circumstances of different systems.

9.1.2 Collective organisation is key to the viability of sustainable agriculture

For all the diversity in approaches, geographies and scales seen in these cases, none of the models of sustainable agriculture lend themselves to individual smallholder farmers operating independently.

The cases highlight a number of factors that make collective organisation essential to increasing farmers' incomes and enabling them to derive more benefits from farming. First, smallholders acting by themselves often lack market information and marketing channels – as illustrated by the Guangxi case – just as they have difficulty garnering better prices for their produce. Second, they may struggle to adopt technical innovations, such as biogas (Nanmazhuang village, Chapter 2), mechanisation (Shuanghe village), or agroecological practices (Wanzai). They often lack sufficient inputs such as organic fertiliser or have difficulty getting it to their fields, as in Shuanghe village. Whether the challenges are technical, social or economic, they are difficult to overcome at the household level.

Third, collective organisation opens up a whole range of resources and services to farmers. For instance, as shown in Wanzai county, cooperatives can provide seeds, organic fertiliser and bio-pesticides, training, and technical guidance to their members. At the Bishi Ecological Farm in Shandong, the company employed farmers at far higher incomes than they had previously earned, while giving them access to training and new skills. Farmers involved in Shared Harvest and the Guangxi CSA benefitted from reduced risks, higher incomes, as well as the camaraderie of being part of a joint effort for ecological agriculture. In the case of Shared Harvest, farmers didn't have to think about marketing, as this was taken care of by the CSA. For individual farmers, marketing can be burdensome. All of these examples demonstrate the importance of a diverse set of channels for collective organisation for smallholder farmers to achieve sustainable agriculture—particularly in the context of markets that are increasingly dominated by larger players.

Collective organisation can be accomplished in a number of ways. One way is for farmers to form cooperatives, as in most of the case studies. A second model is Community Supported Agriculture, which can either function as companies, cooperatives or both. A third model is for farmers to transfer their land to enterprises, such as the Bishi Ecological Farm, which then hire them as workers.

The cooperative emerges as the dominant approach, present in six out of the eight case studies. Even in Zengjipan – where there was no registered cooperative – the group operated very much like a cooperative, but faced real obstacles for its lack of formal cooperative status. The evidence here suggests that cooperatives have been extremely beneficial in enabling smallholder farmers to come together and achieve much more

sustainable and vibrant food systems than they would have been able to achieve acting individually. Cooperatives can bring myriad benefits to farmers, including higher incomes. For instance, the average annual incomes of Xincheng Chinese Yam Cooperative members were 36% higher than those of non-members from the same village. In Wanzai county and Nammazhuang village, cooperative members also enjoyed higher incomes than non-members.

Moreover, the benefits of cooperative membership are not simply higher incomes. Prior to the establishment of the Xincheng Chinese Yam Cooperative, small farmers managed the production and sale of Chinese yam themselves. Technical and environmental constraints meant their yields were low and farmers sold their Chinese yam at the local market at a low price and on a small scale. Since the establishment of the cooperative, both infrastructure and brand awareness have improved and the market for Xincheng Chinese yam has gradually begun to expand. This illustrates the power of cooperatives to address the technical and marketing constraints facing individual smallholder farmers.

In Guangxi, the formation of the cooperative allowed for much stronger information, technology and labour exchanges, and also for common trust-building and collective bargaining in the sale of their products to the restaurant. In Nammazhuang, the cooperative has played a critical role in responding to and mitigating price fluctuations, in providing a platform for sharing ecological knowledge and raising awareness among members, and in creating opportunities for villagers to access external resources. For instance, the cooperative helped the households raising 'Happy Pigs' to obtain contacts with marketing companies, as well as making linkages with enterprises interested in the processing factory for ecological produce. The cooperative also organised eco-tourism, bringing in visitors from outside, as well as facilitating collective social activities. By contrast, the absence of a formal cooperative for sheep production in Zengjipan village in Ningxia restricted the ability of villagers to market their products and gain access to subsidies and other services.

The cooperative is a singularly powerful tool for sustainable agriculture in China precisely because of its flexibility, which allows it to support a wide diversity of models. The cooperatives described here are led by a wide variety of people, exist at different scales, and have different focus activities and benefits. Policy on cooperatives needs to be flexible enough to reflect this diversity, particularly by allowing for multi-product cooperatives.

9.1.3 External actors and local government can be catalytic

These case studies emphasise the important role of various outside actors for promoting sustainable agriculture pathways in China. Over and over, we have seen key contributions by idealistic urbanites, university professors, scientists and local NGO workers with easy access to information and strong commitment to preserving cultural heritage and environmental protection. Their role has been as diverse as their job titles: from introducing new concepts, facilitating information sharing and building bridges among various actors, to obtaining policy support and developing marketing channels for the products of ecological agriculture.

The ideas for creating a cooperative and applying for hazard-free certification in Nammazhuang, for example, came from China Agriculture University researchers; they planted a seed which was then nurtured and developed by local people. Likewise, the promotion of Participatory Plant Breeding (PPB) in Guangxi is a particularly powerful example of outside actors valuing and enhancing local knowledge. PPB allows farmers

and plant breeders to participate equally in decision making at every stage, from identifying desirable traits and parent lines, to evaluating the resulting varieties. In Guangxi, this approach has enabled the use of resilient local varieties in developing new high-yielding varieties with greater resilience. It has also allowed crop breeding to be tailored to diverse local environments, greatly improved technology adoption rates and generated incentives for agrobiodiversity conservation (Song and Li, 2011; Swiderska et al., 2011).

In each case, outside involvement has been about finding synergies between local knowledge and needs, and the ideas, market linkages and technical knowledge that outsiders can bring. These cases thus illustrate how agriculture is embedded in specific localities and socioeconomic contexts, and how outsider input needs to complement this local knowledge in varied ways.

Another key lesson emerging not only from these case studies, but from China's experience with agricultural development more broadly, is the essential role of the state. These cases confirm the government's crucial enabling role in supporting a diversity of pathways to sustainable agriculture—a role that can take a variety of forms depending on the context.

In Wanzai, for instance, it was local government that successfully spearheaded the adoption of organic agriculture, which has since spread to other neighbouring counties in Jiangxi province. Both the township and county governments in Wanzai were deeply involved in this process, including providing technical training to farmers; giving financial support for certification and organic inputs; guaranteeing a market for organic products; attracting investment in the organic sector; mediating between farmers and enterprises; supervising organic production; and providing overall direction to the development of organic agriculture. Wanzai is proof that sustainable agriculture can be done at scale, and that local government is indispensable in such upscaling.

While Wanzai is the most dramatic example of government contributions to the development of sustainable agriculture, there are many others. In Ningxia, the government has devoted substantial resources to promoting the Yanchi Tan Yang sheep brand, helping to create new linkages between Zengjipan village and outside markets. In Guangxi, the county government now showcases the Rongyan Cooperative as a model woman-led cooperative, and also as a model for ecological farming. In addition, the provincial government's biogas project provided a solid support base for ecological farming practices. There is also policy support for sustainable agriculture in provinces such as Henan, driven by specific targets for hazard-free, green food and organic products.

9.1.4 Certification is one important marketing tool, but not the only one

Marketing is a critical factor in the success and failure of sustainable agriculture efforts in China. These case studies illustrate the diverse approaches that people are experimenting with, from hazard-free and organic certification to CSAs and geographic origin schemes.

Of the eight case studies, four had some level of sustainability certification, while four had none. Whether and what type of certification makes sense for a given community depends partly on geographic location, the nature of markets in that area, and the extent to which the community is integrated into wider commodity chains. In the Ningxia case study, none of the three marketing channels used by villagers recognises green food products; hence there is

little incentive for villagers to obtain green food certification, even though the Party Secretary in Zengjipan is keen to get the village's buckwheat certified as a green food in order to augment its market value. For some rural communities with distinctive regional products, geographical branding is a potentially good option. In Zengjipan, sheep sold to large enterprises via middlemen in the township market can use the geographical brand 'Yanchi Tan Yang'. However, this geographical brand does not distinguish between conventional and ecological production, so free-range sheep produced in the village are marketed under the brand in the same way as sheep from large feedlots in the area. This is a serious limitation to the market's ability to reflect the superior husbandry practices in Zengjipan.

Organic certification can be prohibitively complicated and expensive for small farmers. It can also be expensive for cooperatives and CSAs if there is no subsidy or other support available. One of the reasons that the Xincheng Chinese Yam Cooperative abandoned its pursuit of organic certification is that its costs (at least 10,000 yuan per year) would undermine any economic benefits. It also lacked sufficient personnel to handle the paperwork required for certification. Similarly, Shared Harvest were facing costs of about 150,000 yuan per year to get their farms and produce organically certified. In fact, as Shi Yan of Shared Harvest points out, certification is not essential in the CSA model. As she puts it, 'The consumer's belief in you is more important than certification.' The CSA model is built upon trust between producers and consumers fostered by bringing consumers to visit the farm that supplies their produce.

On a larger scale, however, and with more complex supply chains, sustainability certification can be important for verifying claims of good environmental practices. One of the most important contributions of the local government in Wanzai county has been to cover the costs of organic certification, which obviates the need for farmers to shoulder this burden. While Wanzai also has some green food and hazard-free certified areas, organic farming is being practised on a larger scale and is the main priority for the local government. Today Wanzai is a national organic agricultural demonstration area – one of about 30 nationwide – and is one of the most important organic agricultural production zones in China. Organic certification has been an engine of economic development and has contributed to improved livelihoods for many farmers in the county. On the other hand, small-scale farmers in Wanzai have benefitted less from organic certification than larger-scale farmers. These findings are in line with those of Blackmore and Keeley (2012), who found that sustainability certification does not necessarily benefit the poorest farmers.

A diversity of sustainability certification models is not always a good thing. There are some benefits to giving consumers and producers a choice of labels and to gradually phasing in higher standards, rather than insisting that farms meet the highest standards (e.g. organic) at the outset, which is not realistic for a developing country like China. However, the proliferation of standards makes it difficult for consumers, producers and even officials to understand the exact criteria for each certification system. Moreover, the diversity of certification schemes that exists today was neither intended nor planned.

Another ongoing challenge reflected in these cases is the fact that certification systems do not fully or accurately represent the extent of sustainable agricultural practices in China. For instance, a village's lands may be certified hazard-free, but the village may actually be undertaking more rigorous practices than those required by the hazard-free standard. Certain crops, such as rice in Nanmazhuang village, may actually be produced organically, but for various reasons are not organically certified.

The inability of the market to fully reflect the social, economic and environmental values of sustainable agricultural production – and to compensate farmers accordingly – is a recurring theme in our case studies. At the same time, the case studies do point to a number of pathways beyond certification for overcoming this problem, at least to some extent. Social media has changed the way many goods are marketed and can be a huge asset to practitioners of sustainable agriculture, as Shared Harvest can attest. Much of their marketing is done via WeChat and their new social media platform called *Hao Nongchang*, which is designed to link sustainable food producers and consumers. The Xincheng Chinese Yam Cooperative markets its yams directly to consumers in nearby cities, as well as selling online, and a local charity is helping them to link to Taobao.com. The operation of Bishi Ecological Farm encompasses the entire commodity chain for its products, including agricultural production, processing, sales and catering. Food processing and catering add value to its products and this is one possible approach for other larger operations. Shared Harvest has also established its own restaurant, which is another effective marketing channel.

Branding can also be a means of augmenting the value added of sustainably produced foods, as demonstrated in Nanmazhuang. The Ningxia case is another example, as the local government has put a lot of investment into the Tan Yang brand. Even investment in high-grade packaging can reap rewards, as the Xincheng Chinese Yam Cooperative has witnessed. Publicity has made a big difference for several of the case studies for enhancing brand popularity and reputation. However, it can often be a long and arduous process to build a strong brand and branding can only be done at a collective level; it is not feasible for individual farmers to undertake by themselves.

Just as our case studies underscore the need for a diversity of models, they also point to the need for a diversified marketing strategy. Initiatives such as Shared Harvest which have multiple avenues for marketing their produce have fared better than those such as the Guangxi case where farmers are overly reliant on a single marketing channel. Closely related to this is the need to find ways to distinguish sustainably produced foods in the market. Where this is lacking, these foods may be sold at even lower prices than conventional products due to their imperfect appearance. This has been the case with vegetables from the Bishi Ecological Farm and Shuanghe village in Sichuan.

9.1.5 Labour is a key constraint

The availability of labour is another critical issue in China today. Labour shortages are a major obstacle for the promotion and expansion of sustainable agricultural practices, which tend to be more labour-intensive than conventional practices. While there are no easy answers to this dilemma, these cases offer a variety of possible ways forward.

For example, scarcity of labour can sometimes be compensated for by mechanisation. For instance, crop residues in Nanmazhuang are generally processed and applied to fields mechanically. This is possible due to the flat terrain in China's Central Plains. It is less feasible in mountainous areas such as Sichuan and Guangxi. For example, in Shuanghe village, older and female residents form the bulk of the permanent population in the village. They have difficulty transporting animal manure and biogas residues by hand to the hillside fields where it is needed, and the mountainous terrain makes mechanised transport of materials difficult.

On-site food processing, such as in Wanzai county, creates jobs for local people and decreases incentives for out-migration. It also facilitates the expansion of organic agriculture in remote areas where the transport of perishable produce to urban areas is not feasible. Another potential solution is highlighted by Nanmazhuang village, where the number of local marketing jobs is expanding as the Nanmazhuang brand gains currency.

The two CSA cases were not challenged by labour shortages. This is primarily because the CSA model itself aims to create jobs in order to reverse the out-migration trend. While in both cases, out-migration was an issue prior to the establishment of the CSAs, these CSAs are now drawing people back into farming through higher wages and better marketing arrangements. While this reverse migration is a trickle compared to the flood of rural workers moving to urban areas, it is significant nonetheless.

While CSAs may be the most successful example of the potential of sustainable agriculture to reverse out-migration, albeit at a small scale, interviews with local officials and farmers in Huantai county indicate that young people there have begun to return to the villages to engage in agricultural production as the income from agricultural sources reaches parity with off-farm work (particularly considering the higher costs of living in urban areas compared with rural areas).

The cases of Nanmazhuang and Shared Harvest point to increased opportunities in commerce and eco-tourism – spurred by the practice of ecological agriculture – which could be another way to attract young people back to rural areas. Thus we see through these cases that though labour shortages are an obstacle to the pursuit of sustainable agriculture in China, there are a variety of approaches to overcome it—despite the relatively higher labour input requirements of sustainable practices. These include innovations in farming techniques, as well as bringing new actors into agriculture itself through the higher market value and greater appeal of sustainable food production.

9.1.6 Awareness of the value of sustainable agriculture is vital

A final key lesson is that we cannot use a purely economic lens to evaluate agricultural systems, particularly those involving sustainable practices. As agriculture provides the very basis of a healthy human existence, as well as a variety of social and ecosystem services, its significance vastly exceeds any economic returns. There are many examples of this from our case studies. For instance, the Xincheng Chinese Yam Cooperative is helping to ensure that the traditional local yam variety can be maintained, which is an important contribution to preserving agrobiodiversity. In Wanzai, villagers have observed a marked resurgence in local biodiversity after abandoning the use of agrochemicals. In Guangxi, villagers have experienced improvements in their health after switching to sustainable agricultural methods; an added benefit has been the greater social cohesion that the cooperative has brought to the village. In Shared Harvest, farmers expressed satisfaction with being able to find work in their own villages rather than commuting to urban areas for off-farm work.

The demand for sustainably produced foods hinges upon well-educated consumers, and these case studies show a variety of ways that this can be achieved. In Guangxi, a restaurant reaches out to urban consumers, educating them about where their food comes from as well as increasing their awareness of local agricultural heritage. In Zengjipan, urban 'tourists' visited the village and became dedicated to the quality of free-range meat raised in a clean, natural environment. One of the greatest assets of Community Supported Agriculture

as practised by Shared Harvest is that consumer education is integral to its operational model. By giving members and non-members a chance to visit their farms and participate in activities, CSAs connect consumers directly with the production process, giving them a new appreciation of what it means to grow, market and distribute food in a healthy manner. This aspect is increasingly being lost in the modern food system. Today social media offers huge potential for consumer education and outreach.

Difficulty marketing cosmetically imperfect produce is also related to consumer expectations, which reinforces the need for educational efforts. Only once consumer awareness is raised can a market for sustainable food develop, in turn stimulating farmers to grow these products. Hence, supporting the types of measures developed within these cases for raising consumer consciousness is key to the development of sustainable agriculture.

9.2 Policy recommendations

These case studies have demonstrated that sustainable agriculture can be approached using a variety of different models at a number of different scales. There is value in preserving and fostering this diversity for several reasons. First, encouraging diversity will lead to more robust and resilient food systems. Second, as agriculture is embedded in specific local contexts – each with their own unique history, culture, society, economy and ecology – agricultural models need to reflect that complexity rather than attempting to simplify it. Hence agricultural policy in general, and specifically policy on sustainable agriculture, needs to support different models and different scales. In this final section we offer recommendations drawn from our research findings for how this can be achieved.

9.2.1 Strengthen policy support to cooperatives and revise the national cooperative law

Cooperatives require more support from the government if they are to fulfil their role of balancing economic benefits with the provision of public services (Song et al., 2014). This is especially true of farmer cooperatives involved in ecological or organic farming. The national cooperative law currently requires cooperatives to be 'professional' (*zhuanye*) entities, which according to local authorities means that they should focus on only one agricultural activity. Even if the cooperative has several activities, it cannot be registered as a comprehensive entity. However, ecological agricultural practices necessarily encompass both farming and animal husbandry – they cannot be limited to only one crop or animal.

The multiple benefits of ecological agriculture need to be presented to government at various levels. These benefits relate not only to food security and food safety, but also to social harmony and other less tangible but equally important elements. In cooperative support policies, this type of cooperative should be considered as making a dual contribution to both agricultural development and environmental protection, and receive support for its initiation and development accordingly. Therefore, the national cooperative law needs to be revised to allow for greater flexibility in the registration of cooperatives.

9.2.2 Simplify and systematise certification procedures

Certification is an important means to connect products with the market, but the application procedures are relatively complicated. The skills required to set up the necessary management and documentation systems are in short supply in rural areas. More attention needs to be directed towards simplifying the required procedures and documentation.

The plethora of certification standards in China today (hazard-free, green food, organic, good agricultural practice), as well as branding measures such as geographic labelling, can be confusing for consumers, farmers and government officials alike. There are also areas of overlap in some cases, and gaps in others. There is no comprehensive system for certification, covering the range of possibilities for sustainable agriculture in an efficient way—and thus no means by which to accurately signal value in the market. Several standards such as hazard-free and green food could be unified. In addition, definitions should be clear, certification procedures should be simplified and traceability should be improved. Certification fees need to be covered by government, not by individual farmers or cooperatives, as this burden acts as a disincentive to applying for certification.

At the same time, China's strict standards for organic agriculture require effective supervision and monitoring, but this is difficult to achieve given the large numbers of farmers involved. Revision of the organic standards should include consultation with all stakeholders in order to incorporate their experiences. Long-term development plans and appropriate subsidies are needed to reduce risks and increase the willingness of farmers to comply with standards.

9.2.3 Ecological agriculture research needs to be better resourced and participatory

The agricultural research and development system in China prioritises commercialisation and modernisation, with the aims of achieving higher productivity and food security in the short term. However, it is also important to devote resources to research on ecological agriculture methods, particularly those that are viable in the context of labour shortages and difficulties in accessing markets. Modern approaches and local knowledge should be integrated into research on specific technologies, as was the case with Participatory Plant Breeding techniques used in Guangxi. The evidence from these case studies points to the efficacy of conducting participatory action research together with villagers to support ecological agriculture.

Research foundations could support participatory action research (PAR) projects in which researchers, local people and companies with related interests collaborate to examine local needs for ecological agriculture technologies, and sponsor activities for sharing existing adaptive practices. The joint achievements of the Dongxi Township Agricultural Technology Service Centre, the Sichuan Academy of Agricultural Sciences and the Shuanghe villagers are a good example of the effectiveness of PAR in ecological agriculture (Chapter 8). National policies under which researchers or officials from relatively developed areas assume official positions in counties, townships or villages in less developed areas (e.g. *guojia ganbu guazhi duanlian*) offer untapped potential for replicating the types of rich collaboration occurring in Nanmazhuang.

Since farmers often lack expertise in organic farming, a more effective agricultural extension system and information network are vital for the further development of the organic sector. Similarly, indigenous methods developed by farmers in specific areas tend to be localised and poorly-known; networking and information exchange for farmer leaders are important for sharing such knowledge and empowering farmers' cooperatives for collective actions in ecological farming and market access. Setting up a network at national or regional level for information and techniques exchange would be one way forward.

Biogas, combined with crop and livestock production, plays an indispensable role in circular agriculture. While central and local governments have invested substantial resources in building biogas digesters, many of them fall into disrepair soon after construction. Biogas could benefit from more research with local involvement in order to understand how people actually use the technology, and to uncover the obstacles to its maintenance. The government should also increase technical support for the operation of biogas digesters and improve the subsidy system for biogas production. Subsidies could reward farmers for their output of biogas per cubic metre instead of for the number of digesters they build. This would ensure that digesters are used. At the same time, social service organisations should be established to maintain biogas projects at the county level.

9.2.4 Increase farmer training and consumer education for ecological agriculture

Raising awareness of food safety and environmental protection is crucial in order to increase demand for ecological products. Consumer education should be an important component of environmental and food safety policy implementation. This could be accomplished through a number of avenues, such as organic restaurants, advertisements, television and radio programmes, training courses and government supported projects.

For producers, training and extension in ecological agriculture is vital in order for them to understand its benefits and to be able to effectively implement agroecological practices. Training in marketing is also essential. A related issue is the need to cultivate leadership on ecological agriculture among local officials, cooperative directors, and other influential people at the grassroots level. Given the vital role that local leaders have played in our case studies, this is crucial.

Introductions to ecological agriculture could be integrated into the education system, which already includes some social education components. Nanmazhuang, Wanzai and other areas could serve as educational sites for students at various levels to demonstrate how ecological agriculture works in practice. They could also serve as learning centres for communist party members in various organisations who normally take part every year in collective activities (*dangyuan huodong*).

As a major part of cooperatives' operations, marketing and its concrete regulations should be integrated into cooperatives' operational plans. As marketing is quite a different activity from farming, the marketing capacities of cooperatives need to be supported and developed. Marketing operations require very professional capacities and modern sales knowledge, which are not often found in traditional farming societies. While some guidelines on the marketing of organic agriculture enterprises online and field guidance from universities or other enterprises can provide information for this type of activity, there is an ongoing need

for sustained, supportive guidance and consultation, formal training, and even involvement of individuals from enterprises with these professional capacities.

9.2.5 Support innovative ways to attract farmers back to the land

These case studies have highlighted the need to attract youth back to rural areas, or to prevent them from leaving in the first place. This is crucial in the light of the country's ageing rural population – the average age of farmers in China is 55. Doing so will require enabling farmers to earn incomes which are attractive enough to keep them on the land. From our surveys, it was clear that many farmers would prefer to stay in rural areas if they could earn similar net incomes as they would working outside their villages. Joining CSAs and cooperatives, or working for large farms, are several possible avenues to achieve this in the context of sustainable agriculture. Hence policies should support all of these initiatives in order to attract more young people to stay in rural areas.

References

- Bai, F. 14 September 2010. The narratives of new mechanisms for protecting ecological grassland in Ningxia. *Nongmin Ribao*. www.farmer.com.cn/agri/xmsy/xmdt/201010/t20101014_584953.htm
(白锋哲. 10月14日 2010. 宁夏探索草原生态保护新机制纪实. 农民日报)
- Blackmore, E. and Keeley, J. 2012. *Pro-poor certification: Assessing the benefits of sustainability certification for small-scale farmers in Asia*. Natural Resources Issues No. 25. IIED, London.
- Chandran, N. and Yoon, E. 2 January 2015. China goes organic amid food scandals. *CNBC*. <http://www.cnbc.com/2015/01/02/china-goes-organic-amid-food-scandals.html>
- Chen, J., Yu, Z., Ouyang, J. and Mensvoort, M. 2009. Factors affecting soil quality changes in the north China Plain: A case study of Quzhou County. *Agricultural Systems* 91: 171–188.
- Chen, L., Hao, J., Ai, D., Zhu, C., Li, M. and Yuan, L. 2015. Balanced yield increasing potential of grain and its spatial differentiation in the Huang-Huai-Hai Plain [J]. *Transactions of the Chinese Society of Agricultural Engineering (Transactions of the CSAE)*. 31(2): 288–297.
(陈丽, 郝晋珉, 艾东, 朱传民, 李牧, 袁凌波. 2015. 黄淮海平原粮食均衡增产潜力及空间分异. 农业工程学报31(2): 288–297.)
- China Broadcast Net. 17 March 2013. Xincheng yam cooperative. http://zgxczs.cnr.cn/zftd/201303/t20130317_512169696.shtml (中国广播网 来源: 新城山药合作社)
- CNCA. 2012. *China Organic Product Standard GB/T 19630: 1–4*. China Standard Press, Beijing.
(国家标准委员会 中国有机产品标准“GB/T 19630: 1–4”, 中国标准出版社, 北京, 2012)
- CNCA. 2014. *China Organic Industry Development Report*. China Standard Press, Beijing.
(国家认证认可监督管理委员会. 中国有机产业发展报告. 中国质检出版社, 北京, 2014)
- Cook, S., Li, F. and Wei, H. 2000. Rainwater harvesting agriculture in Gansu province, China. *Journal of Soil and Water Conservation* 55(2): 112–114.
- Fang, D. 2010. Narratives starting from female Vice County Governor selling pork in a Zhengzhou street market. *Agricultural Technologies and Facilities* 4 (187): 64–65.
(东方. 2010. 由女副县长郑州街头卖猪肉说起. 农业技术与装备4 (187): 64–65.)
- FAO. 2013. *Sustainable food and agriculture: vision, principles and approaches*. FAO, Rome.
- Farmer's Daily. 9 November 2012. Huantai Yam cooperative: we don't worry about the market for Chinese yam this year. (农民日报: 桓台细毛山药合作社:今年山药不愁卖. 2012.11.09)
- Frank, E., Ramakrishnan, M. and Mäder, P. 2007. The viability of cotton-based organic farming systems in India. *International Journal of Agricultural Sustainability* 5(1): 25–38.
- Garnett, T. and Wilkes, A. 2014. *Appetite for change: social, economic and environmental transformations in China's food system*. Food Climate Research Network.
- Gu, Y. and Li, W. 2013. Study on the impacts of the grazing ban on grassland quality. *Acta Scientiarum Naturalium Universitatis Pekinesis*, 49 (2): 288–296.
(北京大学学报, 自然科学版)
- Guo, C., Xiao, X., Lu, Z., Li, X., Cong, L., Jiao, X. and Lin, Y. 2007. Research on the current situation of organic agriculture in China and its development strategy. Collected papers of the International Workshop on the Development and the Market for Organic Food Products in China.
(郭春敏, 肖兴基, 卢振辉, 李显军, 丛林晔, 焦翔, 林园耀. 2007. 中国有机农业现状和发展战略研究. 中国有机食品市场与发展国际研讨会论文集)
- He, H. 2007. Experiments in new rural reconstruction in Lankao. *Chinese Sociology and Anthropology*. 39(4): 50–79.
- Hu, P. 3 March 2012. Organic agriculture in Wanzai county: From governmental support to farmers' initiative. *Farmer's Daily*.
(胡萍. 2012. 万载有机农业: 政府扶持到农民自觉. 农民日报, 2012年3月26日第006版)

- IFAD. 2005. *Organic Agriculture and Poverty Reduction in Asia: China and India Focus Thematic Evaluation*. IFAD Report No. 1664. IFAD, Rome.
- IFOAM. 2012. The IFOAM Standard for Organic Production and Processing. IFOAM, Bonn, Germany. See http://www.ifoam.org/about_ifoam/standards/norms/IS_V0.2_20111107formotions.doc
- Jia, Q., Zhang, Y. and Zhang, Y. 2013. Dynamic monitoring of the vegetation coverage using remote sensing technology in Yanchi County. *Journal of Agricultural Sciences* 34 (1): 46–49.
- Jia, X., Huang, J. and Xu, Z. 2012. Marketing of farmer professional cooperatives in the context of transformed agro-food markets in China. *China Economic Review* 29 (3): 665–674.
- Jiang, M. and Huang, G. 2011. Development of organic agriculture in Wanzai county, Jiangxi province. *Journal of Agriculture* 2 (6): 72–77.
(江梦微, 黄国勤. 2012. 江西省万载县有机农业的发展进展. 农学学报 2 (06). pp. 72–77)
- Katto-Andrighetto, J. 2012. Is the new Chinese organic regulation unintentionally setting the stage for PGS? International Federation of Organic Agriculture Movements Newsletter 16(2). See http://www.ifoam.org/about_ifoam/standards/pgs/pdfs/2012_03_PGS_Newsletter.pdf.
- King, F. 1911. *Farmers of Forty Centuries, or Permanent Agriculture in China, Korea and Japan*. Rodale Press, Inc., Emmaus, Pennsylvania.
- Kong, X. 2014. China must protect high-quality arable land. *Nature* 506(7486): 7.
- Lang, F., Cao, Q., Li, L., Yang, N. and Sun, X. 2014. Farmers' production and operation status in the main vegetable producing area of Shandong. *China Vegetables* 5: 1–5.
(郎丰庆, 曹齐卫, 李利斌, 杨宁, 孙小镭. 2014. 山东蔬菜主要产区农户生产经营状况分析 [J] 中国蔬菜 5: 1–5)
- Li, J., Zhang, S., Qiu, J., Ren, T. 2008. Categories of eco-agriculture models in China. *Chinese Journal of Eco-Agriculture* 16(5): 1275–1278.
(李金才, 张士功, 邱建军, 任天志. 我国生态农业模式分类研究. 中国生态农业学报. 2008, 16(5): 1275–1278)
- Li, J., Jiggins, J. and Song, Y. 2012. Changing the system from within: Participatory Plant Breeding and ABS in China. Chapter in *Participatory Learning and Action* 65. IIED, London. <http://pubs.iied.org/G03401.html>
- Lin, L., Zhou, D., Ma, C., 2009. Green food industry in China: development, problems and policies. *Renewable Agriculture and Food Systems* 25(1): 69–80.
- Liu, C., Yu, J. and Kendy, E. 2001. Groundwater exploitation and its impact on the environment in the North China Plain. *Water International* (26): 265–272.
- Liu, G., Wu, W., Liu, Z. and Wang, L. 2005. Characteristics and environmental impacts of non-point pollution of groundwater under the high-yield farmlands of North China: A case study from Huantai county, Shandong province. *Chinese Journal of Eco-Agriculture* 13(2): 125–129.
(刘光栋, 吴文良, 刘仲兰, 王立平. 2005华北农业高产粮区地下水污染源污染特征及环境影响研究以山东省桓台县为例[J].中国生态农业学报 (02):125–129)
- Liu, M., Zhang, D., Li, W. 2010. A comparative analysis of the comprehensive benefits of rice-fish agriculture and rice mono-cropping—A case study of Qingtian county, Zhejiang province. *Chinese Journal of Eco-Agriculture* 18 (1)1: 164–169.
(刘某承, 张丹, 李文华. 稻田养鱼与常规稻田耕作模式的综合效益比较研究. 中国生态农业学报. 2010, 18 (1)1: 164–169.)
- Liu, Y. 2014. *Good Performance of Local Governance Without Democracy? A Case Study of A Farmers' Specialized Cooperative and Public Goods Provision in Rural China*. MSc Degree Thesis. Saint Mary's University, Canada.
- Long, H., Liu, Y., Li, X. and Chen, Y., 2010. Building a new countryside in China: a geographical perspective. *Land Use Policy* 27: 457–470.
- Lucas, R. 2004. Life earnings and rural-urban migration. *Journal of Political Economy* 112(1): 29–59.

- Luo S. 2010. On the technical package for eco-agriculture. *Chinese Journal of Eco-Agriculture* 18(3): 453–457.
(骆世明. 论生态农业的技术体系. 中国生态农业学报 2010, 18(3): 453–457)
- Ma, R. 24 May 2014. The current situation of farmer cooperatives' development and existing problems in our country. *Farmers' Daily*.
(马荣才. 2014. 我国农民专业合作社发展现状和存在的问题. 农民日报. 2014年5月24日)
- Maeder, P., Fliessbach, A., Dubois, D., Gunst, L., Fried, P. and Niggli, U. 2002. Soil fertility and biodiversity in organic farming. *Science* 296: 1694–1697.
- Mendoza, T. C. 2004. Evaluating the benefits of organic farming in rice agroecosystems in the Philippines. *Journal of Sustainable Agriculture* 24(2): 93–115.
- Ministry of Agriculture. 2007. *Management Regulations of Agriculture Produces Geographical Brand Document No. 11*. Ministry of Agriculture of the People's Republic of China.
(农产品地理标志管理办法, 农业部令 (第11号)).
- Ministry of Agriculture. 2012. *Guidelines for Plastic-Sheeting Technology*. (农业部办公厅关于印发《地膜覆盖技术指导意见》的通知, 农办农 (2012) 70号, Ministry of Agriculture of the People's Republic of China, www.moa.gov.cn/govpublic/ZZYGLS/201209/t20120924_2948593.htm.
- Ministry of Agriculture. 27 September 2014. *Part 1: Basic conditions, technology regulations of safety control on the production and quality of hazard-free products*. Ministry of Agriculture, Beijing.
(农业部. 10月27日2014. 无公害农产品生产质量安全控制技术规范第1部分: 基础条件).
- Qi, G., Wu, B. and Wu, B. 2013. Access to resources for farmer professional cooperatives in China: an empirical study of two cases in Shicun Village, Tengzhou City, Shandong. In: Bin Wu, Shujie Yao, and Jian Chen, (eds.). *China's Development and Harmonization: Towards a Balance with Nature, Society and the International Community*. Routledge, London.
- Qiao, Y. and Halberg, N., 2007. 'Comprehensive Benefits of Organic Agriculture in Jiangxi Province in regard to the United Nations' Millennium Development Goals'. China Agricultural University and ICROFS, Beijing and Copenhagen.
- Qiao, Y., Setboonsarng, S. and Halberg, N. 2009. *PRC Country Study on Organic Agriculture and the Millennium Development Goals*. ADBI (Asian Development Bank Institute) Working Paper 2009.
- Qiao, Y., He, W. and Wu, W. 2014. Comparison between organic and conventional rice production in soil nutrient balance. *Journal of Ecology and Rural Environment*, 30(3): 341–345.
(齐玉辉, 何菀婷, 吴文良. 2014. 有机与常规水稻生产中土壤养分平衡比较生态与农村环境学报30(3): 341–345)
- Pang, J. 2013. *Studies on Ecological Restoration of Desertification of Grassland in Yanchi, Ningxia*. MSc Thesis. Beijing Forestry University.
- Paull J. 2008. The greening of China's food – green food, organic food, and eco-labelling. Sustainable Consumption and Alternative Agri-Food Systems Conference. 27–30 May. Liege University, Arlon, Belgium.
- Pei, X., Tandon, A., Alldrick, A., Giorgi, L., 2011. The China melamine milk scandal and its implications for food safety regulation. *Food Policy* 36: 412–420.
- Pimentel, D., Hepperly, P., Hanson, J., Seidel, R., and Douds, D. 2005. Environmental, energetic and economic comparisons of organic and conventional farming systems. *Bioscience* 55(7): 573–582.
- Pretty, J. 1998. Supportive policies and practice for scaling up sustainable agriculture. In: Roling, NG and Wagemakers, MAE (eds). *Facilitating Sustainable Agriculture: Participatory Learning and Adaptive Management in Times of Environmental Uncertainty*. Cambridge University Press, Cambridge.

- Rasul, G. and Gopal, B. T. 2004. Sustainability of ecological and conventional agricultural systems in Bangladesh: An assessment based on environmental, economic and social perspectives. *Agricultural Systems* 79(3): 327–51.
- Sanders, R., 2006. A market road to sustainable agriculture: ecological agriculture, green food and organic agriculture in China. *Development and Change* 37(1): 201–226.
- Schumilas, T. 2014 *Alternative Food Networks with Chinese Characteristics*. PhD thesis, University of Waterloo.
- Scott, S., Si, Z., Schumilas, T., and Chen, A. 2014. Contradictions in state- and civil society-driven developments in China's ecological agriculture sector. *Food Policy* 45(2): 158–166.
- Seufert, V., Ramankutty, N. and Foley, J. 2012. Comparing the yields of organic and conventional agriculture. *Nature* 485: 229–234.
- Sheng, J., Shen, L., Qiao, Y., Yu, M. and Fan, B. 2009. Market trends and accreditation systems for organic food in China. *Trends in Food Science and Technology* 20, 396–401.
- Shi T. 2003. Moving towards sustainable development: Rhetoric, policy and reality of ecological agriculture in China. *The International Journal of Sustainable Development and World Ecology*, 3: 195–210.
- Sichuan Province Government. 2005. *The Suggestions of the People's Government of Sichuan Province on Accelerating the Implementation of Circular Economy*, No. 38, issued 28 December 2005.
(四川省人民政府关于加快发展循环经济的实施意见, (川府发 [2005])
- Sichuan Province Government. 2012. *The Suggestions of the People's Government of Sichuan Province on Accelerating the Development of Modern Agriculture*. No. 32 issued 12 September 2012
(四川省人民政府关于加快发展现代农业的意见, 2012年09月12日, 川府发[2012]32号)
- Sichuan Province Government Office. 2011. *The Suggestions of the People's Government Office of Sichuan Province on Supporting strongly Farmers Professional Cooperatives and Accelerating the Implementation of Modern Agriculture*. No. 38 issued 3 September 2011.
(四川省人民政府办公厅关于大力支持农民专业合作社建设推进现代农业加快发展的意见 (川办发 (2011) 52号), 2011年9月3日; 关于下达2012年支持农民专业合作社建设加快推动现代农业发展项目资金的通知 (川财农 [2012] 132号))
- Sichuan Government Office. 2011. *The 12th Plan of Circular Agriculture Development*. No. 79 issued 2 December 201138
(号二〇〇五年十二月二十八日);四川省'十二五'循环经济发展规划, (川办发 (2011) 79号二〇一一年十二月二日))
- Smil, Vaclav. 1984. *The Bad Earth: Environmental Degradation in China*. M.E. Sharpe, Armonk.
- Smil, V. 1993. *China's Environmental Crisis: An Inquiry into the Limits of National Development*. M.E. Sharpe, Armonk.
- Song, Y. 1998. "New" Seed in "Old" China: Impact Study of CIMMYT's Collaborative Programme on Maize Breeding in Southwest China. PhD dissertation. Wageningen University.
- Song, Y. and Li, J. 2011. *The role of biodiversity, traditional knowledge and Participatory Plant Breeding in climate change adaptation in karst mountain areas in SW China*. Chinese Centre for Agricultural Policy, Beijing.
- Song, Y., Qi, G., Zhang, Y. and Vernooy, R. 2014. Farmer cooperatives in China: diverse pathways to sustainable rural development. *International Journal of Agricultural Sustainability*. 12(8): 95–108. <http://dx.doi.org/10.1080/14735903.2013.858443>
- Song, Y. and Vernooy, R. 2010. Seeds of empowerment: Action research in the context of the feminization of agriculture in Southwest China. Paper for a special edition of the *Gender, Technology and Development Journal*. IAC, SAGE Publication.
- Sternfeld, E. 2009. Organic food 'made in China'. *EU-China Civil Society Review*. 10/2009 – 11 August 2009. pp. 1–11.

- Swiderska, K., Song, Y., Li, J., Reid, H. and Mutta, D. 2011. *Adapting agriculture with traditional knowledge*. IIED briefing. IIED, London.
- Taylor D. 2008. Recovering the good earth: China's growing organic market. *Environmental Health Perspectives*, 116(8): A346–A349.
- Thiers, P., 2006. China and global organic food standards: sovereignty bargains and domestic politics. In: Bignen, J., Busch, L. (Eds.), *Agricultural Standards: The Shape of the Global Food and Fiber System*. pp. 193–217. Springer, Dordrecht.
- Wang, H., Qin, L., Huang, L. and Zhang, L. 2007. Ecological agriculture in China: Principles and applications. *Advances in Agronomy* 94: 181–208.
- Wang, J., Huang, J., Rozelle, S., Huang, Q. and Blanke, A. 2007. Agriculture and groundwater development in northern China: trends, institutional responses, and policy options. *Water Policy*, (9)S1: 61–74.
- Wang M. and Lu, Y. 2012. An overview of organic product certification management. *Certification Technology*, 5: 35–36, 39.
(王茂华, 吕艳. 2012. 有机产品认证管理新规概述. 认证技术. 5: 35–36, 39.)
- Wang, Z., 1999. Theoretical bases of Chinese ecological agriculture. In: Wang, Z.Q., Li, Q.S., (Eds.), *Chinese Ecological Agriculture and Intensive Farming Systems*. China Environmental Science Press, Beijing, pp. 1–16.
- Whyte, M. K. 2010. The paradoxes of rural-urban inequality in contemporary China. In M. K. Whyte (Ed.), *One Country, Two Societies: Rural-Urban Inequality in Contemporary China*. Harvard University Press, Cambridge, Massachusetts.
- World Commission on Environment and Development. 1987. *Our Common Future*. Oxford University Press, Oxford.
- Wu L. 2014. *An analysis of the nitrogen and phosphorus balance of agro-ecosystems in high-yield grain areas in North China: A case study of Huantai County, Shandong Province*. China Agricultural University M.A. degree thesis, pp. 41–49.
(吴凌芬. 2014华北高产粮区县域农田生态系统氮磷平衡分析—以山东省桓台县为例. 中国农业大学硕士论文: 41–49)
- Xia, Z. 2013. *Domestic biogas in a changing China: Can biogas still meet the energy needs of China's rural households?* International Institute for Environment and Development, London.
<http://pubs.iied.org/16553IIED.html?k=biogas>
- Xue D., Pang F., Meng F., Wang Z. and Wu, W. 2015. Decision-tree-model identification of nitrate pollution activities in groundwater: A combination of a dual isotope approach and chemical ions. *Journal of Contaminant Hydrology* (180) 25–33.
- Yang, H. 2010. Farmer cooperation and organization: new challenges, new networks, new identities. In: Song, Y. and Vernooy, R. (eds.): *Seeds and Synergies: Innovation in Rural Development in China*. Practical Action, Bourton-on-Dunsmore; International Development Research Centre, Ottawa.
- Yang, R., Qi, G. and Zuo, T. 2014. An exploratory study on the utilization and management of rangeland in a farming-pastoral ecotone after the grazing-ban policy based on a field study of a planned grazing pilot in Ningxia. *China Population, Resources and Environment* 24 (1): 118–125.
- Yang, Z. 2013. Demographic changes in China's farmers: The future of farming in China. *Asian Social Science* 9(7): 136–143.
- Ye, X., Wang, Z., and Li, Q. 2002. The ecological agriculture movement in modern China. *Agriculture, Ecosystems and Environment* 92 (2–3): 261–281.
- Yuan, Z. and Shen, Y. 2013. Estimation of agricultural water consumption from meteorological and yield data: a case study of Hebei, North China. *Plos One*, 8: e58685.

- Zhang, C., Jia, L. and Qi, G. 2014. Rural public space: An unintended consequence of farmers specialized cooperative development. *Journal of Nanjing Agricultural University* (Social Sciences Edition) 14 (2): 8–14.
(张纯刚, 贾莉平, 齐顾波. 2014. 乡村公共空间: 作为合作社发展的意外后果, 南京农业大学学报 (社会科学版) 14(2): 8–14)
- Zhang Q. 2011. On the road of cooperation to boost the rapid development of organic agriculture in Wanzai County – the exploration and practice of promoting the development of farmers' professional cooperatives. *China Farmers' Cooperatives* 5:33–34
(张清华. 以合作之路助推有机农业快速发展—万载县推进农民专业合作社发展的实践与探索. 中国农民合作社, 5:33–34)
- Zhao, R., Chen, X. and Zhang, F. 2009. Nitrogen cycling and balance in a winter wheat – summer maize rotation system in the North China Plain. *Soil Bulletin* 46(4): 684–697.
(赵荣芳, 陈新平, 张福锁. 2009. 华北地区冬小麦-夏玉米轮作体系的氮素循环与平衡. 土壤学报46(4): 684–697)
- Zhou, D. 4 August 2014. The prospects for organic ecological agriculture in Shuanghe are broad. Recommended News. <http://j.news.163.com/docs/10/2014080408/A2PPNP4F9001NP4G.html>
(周大鹏. 8月4日2014. 双河村有机生态农业前景阔. 荐新闻)
- Zhou, J. 17 July 2015. Standing at the crossroads: how households using biogas take the next steps. *Sichuan Rural Daily*, 5th version of Views. <http://country.scol.com.cn/shtml/scncrb/20150717/34118.shtml>
(周金泉, 站在转型十字路口 四川户用沼气建设何去何从, 四川农村日报20150717期, 第05版:视点)
- Zhou, Z., Wang, J., Zhou, Y. 2004. Reflections on the development of circular agriculture. *Research of Agricultural Modernization* 5: 348–351.
(周震峰, 王军, 周燕, 等. 关于发展循环型农业的思考[J]. 农业现代化研究. 2004 5: 348–351.)
- Zhu, C. 2008. China's Nitrogen Fertilizer Industry 2008 Outlook. http://www.marketavenue.cn/upload/articles/ARTICLES_1384.htm
- Zhu, Y. Chen, H., Fan, J. 2000. Genetic diversity and disease control in rice. *Nature* 406: 718–722.
- Ziyang City Food Industry Association. 2013. The Narrative of the Development of Jiangyang City Xintiandi Rice-Planting Professional Cooperative' *Study on Food Issues* 2: 40–43.
(资阳市粮食行业协会. 2013. 简阳市新天地水稻种植合作社发展纪实. 粮食问题研究. 2: 40–43).
- Ziyang Daily. 2013. Improve 'five agriculture' to make rural wealthy. *Ziyang Daily*, 14 October 2013, Public Service Platform of Agriculture Business Information
(资阳日报, 四川资阳: 抓实'五个农业' 做富农村, 2013年10月14日, 全国农产品商务信息公共服务平台, http://nc.mofcom.gov.cn/article/xw/xw/dsxw/201310/18590526_1.html)
- Ziyang Government. 2011. Identification and Categorization of Farmers' Professional Cooperatives. Sichuan Province Government website, 27 June 2011, www.sc.gov.cn/10462/10464/10465/10595/2011/6/27/10167086.shtml
(资阳市府, 资阳市'科学界定 分类指导' 农民专业合作社建设, 2011年06月27日, 四川省人民政府网站).

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Chinese agriculture today faces major environmental challenges, from unsustainably high applications of fertilisers and pesticides to widespread soil erosion, pollution, water scarcity and the loss of agricultural biodiversity. Coupled with the dramatic depopulation of rural areas and high-profile food safety scares, these challenges are prompting the emergence of a growing movement towards sustainable agriculture, witnessed by the rise in ecological farms, organic farmers' markets in major cities, as well as increasing emphasis on sustainability in Chinese policies related to agriculture. But what impact is this movement having on these challenges and how can it best be supported?

This research report assesses the economic, social and environmental impacts of eight sustainable agriculture case studies from seven provinces in China to build a deeper understanding of the multiple emerging pathways towards sustainable agriculture. From uncertified small community-led farmers' associations and remote sheep-rearing societies which target local urban consumers, to large certified organic companies with national distribution, these initiatives illustrate the diverse alternative models of agriculture with which communities, local governments and companies are experimenting across China. The aim is to distil lessons learned and ultimately to provide insights for researchers, practitioners, and policymakers into how sustainable agricultural practices can be better supported, both in China and elsewhere. As China is a laboratory for development in many respects, its experience is highly relevant for other countries.



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