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STUDY ON THE SCOPE FOR THE RECONSTRUCTION OF THE GRAZING LIVESTOCK SECTOR OF XINJIANG BASED ON ORGANIC FARMING METHODS

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Abstract

This paper explores the feasibility of developing organic livestock farming in the pastoral area of Xinjiang, in order to address the problems of grassland degradation and to promote the sustainable development of the grazing livestock sector. Research shows that organic grazing farming may reduce the stocking rate of grassland and relieve the strained relationship between animal and grassland, as well between man and nature. As a result, the value of multifunctional grazing systems may be more widely recognized. As well as including production and economic objectives, cultural, social and environmental implications will also be taken into account. Additionally, herders may also have an improved source of income to poor rural people. The potential markets for organic products are very big and the traditional ruminant livestock husbandry systems in Xinjiang are very close to organic livestock farming. It is considered necessary to change from a production-oriented approach to farming system research to a wider consideration of the systems and policies needed to support the development of organic grazing livestock alongside consideration of how to fund the relevant research and training and establish the systems of quality guarantee associated with organic production.

1. Introduction

Xinjiang, at 1.66 million km^2, is China's largest autonomous region. Its dominant geographic features are three large mountain ranges - the Kunlun Shan in the south, Tien Shan in the centre, and Altay Shan in the north - and two large desert basins - the Tarim in the south and the Junggar in the north. Xinjiang is an arid area. Average annual precipitation ranges from under 10mm at the centre of the deserts to over 500mm in some mountain areas. Rainfall of less than 250mm per annum is typical at the edges of the basins, where human population and agricultural area are concentrated. The Junggar basin is in the north, which stretches to the southern flanks of Altay Prefecture in Xinjiang. Average temperatures are approximately 23 °C in July and -15.6 °C in January. In the mountain areas, the frost-free period is approximately 90 days.

Xinjiang is one of the major pastoral regions in China. The total grassland area amounts to some 56 million hectares, of which 47 million hectares are useable. Pastures are classified in terms of their seasonal use, as winter, spring-autumn or summer pastures. Winter pastures are located at low altitudes, usually along rivers or in the desert basins. Spring-autumn pastures are located on the plains between arable land area and hills and in the lower hills. Nearly half of all the grassland is high altitude summer pasture. Pastoralism has historically been an integral part of the lives of the Kazak, Mongol, and Kirghiz ethnic groups. At present, more than 80 percent of the pastoralists are semi-sedentary and practice a vertical migration system. Different pastures, as far as 150 km or more apart, are used on a seasonal basis.

In the past 50 years, the number of livestock has been increased rapidly and there are more and more people living in pastoral farming areas. However, the sustainable development of grazing livestock has been compromised by grassland degradation caused largely by overstocking and the difficulties faced by farmers seeking a reasonable livelihood.

In fact, the problems faced by grazing livestock of Xinjiang exist not only in Xinjiang, but also in many other regions of the world. In near eastern countries, small ruminants play an important role in rural livelihoods (Bahhady, 1986; Nygaard and Amir, 1987). During recent decades, the sustainability of these systems has been compromised (Steinfeld et al., 1998). The main reason is the feed shortage caused by the extension of crop production (Hamadeh et al., 2001). In the Mediterranean basin, a gradual degradation of the mountainous and hilly grazing lands has taken place as a result of overgrazing of some areas and under-grazing of others (Zervas et al., 1996). In North East Africa, research conducted by Abule et al. (2005) in the Middle Awash Valley of Ethiopia shows that the condition of the rangelands is poor, mainly due to overgrazing, droughts and increased pressure from a growing human population.

Some studies have given suggestions as to how to find the way to promote the sustainable development of grazing livestock. These suggestions can be typically categorized as:

(1) Organic livestock farming may contribute to increase sustainability of grazing livestock systems (Ronchi and Nardone, 2003; Chander and Mukherjee, 2005; Lei Hua and Muxiaofeng, 2006). According to their opinions, traditional livestock farming is very close to organic farming, and organic farming is of particular interest for pastoral areas. The application of organic farming may promote more sustainable land use; enhance environmental conservation, and improve animal health and welfare and product quality.

(2) Reform of particular forms of pastoral land tenure may be needed (Abule et al., 2005). These studies attribute the grassland degradation to "the tragedy of commons". They argue that introduction of well-defined individual use rights will give pastoralists the incentive to stock at sustainable rate and invest in rangeland improvement on the land under their control.

(3) There may be scope to take advantage of agro-industrial by-products. Hadjipanayiotou, (1992) and Amin (1997) assert that agro-industrial by-products can fill the gap between supply and demand for conventional feed resource, arising from the loss of some grassland to cropping or increased grazing pressure.

Whilst recognising the legitimacy of these different arguments, the focus in this study is on the use of organic farming systems as a regenerative strategy.

2. Objective of research

The aim of this paper is to evaluate the feasibility of the development of organic livestock farming in the pastoral area of Xinjiang under organic production methods. Based on the results of the evaluation, it will offer some information and suggestions for decision-makers on how the problems faced by grazing livestock of Xinjiang might be addressed.

3. Materials and Methodology

The research combines both normative analysis and positive analysis. It includes a review of the literature surrounding the improvement of grazing livestock systems in other semi arid parts of the world and a more detailed analysis of the particular conditions in Xinjiang. In order to demonstrate the feasibility of organic grazing farming in Xinjiang, the research builds on two basic assumptions:

- Assumption 1: degradation of rangelands is human-induced, and anthropogenic climate change is part of the explanation;
- Assumption 2: pastoral land tenure systems are not the root cause of grassland degradation in Xinjiang.

The reasons for degradation of rangelands are usually divided into first, climate-triggered and, second, human-induced degradation, (Evans and Geerken, 2004; Geerken and Ilaiwi, 2004; Richardson et al., 2005). In practice, the assertion of anthropogenic climate change would suggest a need to distinguish between local human factors and global human factors. If the first assumption is valid, human activity at global scale should account for the greatest part of grassland degradation. The Projection Pursuit Regression (PPR) (Appendix A) is used to test the assumption. The relevant index includes the average annual temperature, the average monthly rainfall, the average monthly sunshine hours, cultivated area, and the number of animals. Meanwhile, the authors argue that the former three reflect the impacts of climate; and the latter two reflect the influence of human activities through locally determined land management practices. In order to test the assumption, the research takes the Altay grazing region of Xinjiang as an example. This is for two reasons. The first is that Altay is a typical grazing region in Xinjiang; the other is that the data relevant to the construction of the index is easy to obtain. The data mainly come from Xinjiang Meteorological Administration, Xinjiang's Altay 50 years (1955-2005) and existing studies (Xu Peng, 2005).

The paper divides the local human-induced reason for grassland degradation into two parts: property rights and production systems practised. If the second assumption is valid, grassland degradation can reasonably be attributed to the particular production models of grazing livestock systems in Xinjiang. This is the premise of the research. Under this circumstance, the paper can focus the problems on how to improve the production model. The research thus enables a comparison between the standard of organic grazing livestock farming from the EEC-Regulation (1804/99) and the actual conditions of grazing livestock in Xinjiang.

4. Results of the analysis

4.1. The reasons for degradation of rangelands are human-induced, including climate change

The result of PPR show that human activity account for 55% of grassland degradation during 1961-2005, and climate reason just account for 45% (Table 1).

Some studies show that the main causes of human-induced degradation are attributable to overpopulation (Kaplan, 1994) and overgrazing and backward farming practices (Cleaver and Donovan, 1995; Cleaver and Schreiber, 1996). In relation to the specific rangeland ecosystem of Xinjiang, the degradation problems are the inevitable result of the demands for animal products far exceeding the ability of supply of natural grazing and the failure of rangeland users to balance stock numbers with available fodder.

(1) The growth of population

Taking Altay prefecture as example, since 1955, the population has increased greatly. The annual growth rate of population has been 3.51% from 1955 to 1975, and growth continues today, albeit at lower rates. Population growth creates two results: one is the increased demand for arable land; the other is the increasing demand for animal products (contingent on an adequate level of wealth needed to acquire those products). The coefficient of correlation between the population and the number of livestock amounts to 0.91. Based on GIS techniques and land use data for Xinjiang between 1990 and 2000, which were interpreted by landsat TM remote sensing images (Hou Xiyong et al., 2004), there are about 52,000 ha of grassland which have been transferred into cultivated land during the ten years from 1990 to 2000. Because of the bottleneck of insufficient water resources, most of them cannot be cropped continuously. They become 'black' or bare fallow. Pressure on land resources tends to stimulate further cultivation and this stimulates a vicious cycle of land degradation.

(2) Economic development

Economic development has the same influence (and perhaps a greater impact) than population growth. Further, because of the development of secondary industry, especially mining, some grassland has been damaged seriously. On the other hand, the aggregate regional income has been increased with the development of the mining economy and, predictably, food demand and consumption have also increased. According to our research, with an income increase of 1%, the consumption will rise by 1.23%; price rise 1%, the consumption only drop by 0.529. In such a region as Xinjiang, food demand is price inelastic and income elastic. The results show that consumption has strong relationship with the income, and is not very sensitive to changes in the price.

(3) The pursuit of maximum utility by herders

Herders' lifestyles are affected strongly by the production methods of transhumance. As

Table 1. Influence of grassland degradation driving factors

Indicator / Influence period	Keeping the largest volume		The area of arable land		Average annual temperature		Average monthly precipitation		Average monthly sunshine hours	
	Relative impact	Weight	Relative impact	Weight	Relative impact	Weight	Relative impact	Weight	Relative impact	Weight
1961-1983	0.43	0.14	1.00	0.34	0.54	0.18	0.40	0.13	0.60	0.20
1984-2005	1.00	0.39	0.47	0.18	0.44	0.17	0.41	0.16	0.24	0.09
1961-2005	1.00	0.33	0.69	0.22	0.33	0.11	0.51	0.16	0.54	0.18
Projection indicator	Coefficient S = 0.1, the number of projectors M = 3, MU = 3									

consumers, a basic feature of their livelihoods is a demand for few durable goods and simple foods. Their traditional attitude towards life can be seen as based on a need for subsistence economy with an associated respect for nature. Since they have settled, however, they are stimulated by the expanding opportunities for consumption and the disparity of income between them as herders and the peasants, so that their demands for increased disposable income is increasing rapidly.

An important problem is how to meet these new income aspirations. Theoretically, herders can migrate to another enterprise which offers more income. In fact, thanks to the different language, culture, and the traditional habits, most of them still live on the proceeds of their grazing livestock systems. Their main source of income still comes from breeding and selling animals.

Under these circumstances, they can improve their income by two ways. One is to improve the productivity by the application of appropriate technology (breeding, feeding and productivity). The second is to enlarge the scale of breeding. The former is regarded commonly as the more rational choice. The main manifestation of technological progress relevant to improving herders' incomes should be the reduction of the risk of production, and the increase in production per breeding animal by a variety of means. Table 2 shows the fluctuation of the risk variable (Appendix B) between 1991 to 2002. It is obvious that the level of fluctuation has declined. The production per animal has been rising, in which the production of wool and meat per sheep have been raised respectively by 0.2 kg and 0.89 kg. There is no doubt that technological progress has contributed to improve the production. However, the technological promotion is so slow that it cannot be relied to improve the herders' incomes significantly. Therefore most herders have chosen the method of enlarging their enterprise scale in order to improve their livelihoods.

4.2. Pastoral land tenure is not the root cause of grassland degradation in Xinjiang

There is the common perception among government officials and researchers that the situation in Xinjiang is a classical "tragedy of the commons" problem, an apparently invariable outcome of having privately owned livestock grazing on (unregulated) land occupied under commons regimes. The policy of individualising land tenure is predicated on the assumption that it will improve tenurial security and create the incentives for owners of property rights to adopt more sustainable resource management strategies. Obviously, the idea is on the basis of two economic theories relevant to land tenure. One is Hardin's "tragedy of the commons" (Hardin, 1968); the another one is the theory of property rights within an individualistic ownership structure.

A precondition of the Hardin's theory is the assumption of free access to the common land. Indeed, he asserts that freedom of the commons means ruin for all. But open access commons are not consistent with experience in Xinjiang or indeed in many other areas where communal forms of tenure are practiced (Ostrom, 1990). In addition, some research shows that Hardin has overlooked some other factors which prevent the tragedy happening. The power may come from the either the government but may also come from the interaction and choices of local people (Ostrom, 1990; Ouchi, 1980; Bowles and Gintis, 2002) However, none of these solutions can solve the problems completely (Bowles, 2006). Which kind of tenure form is most appropriate depends on many factors, such as the situation of resource, the differences of actors/stakeholders (their wealth, social status, technical ability.), and social capital and social preferences, etc.

Table 2. The change in the Coefficient of Risk in the livestock industry in Xinjiang

Year	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Coefficient of risk	0.0331	0.0542	0.0577	0.0549	0.0473	0.0392	0.0255	0.0166	0.0090	0.0187	0.0004

In practice, for reasons related to both the resource configuration and Kazak culture, it is questionable whether an institutional change based on reallocating property rights would improve resource management and reduce grassland degradation. Firstly, the nature of the resource configuration, particularly the extensiveness and seasonality of resource use, makes the definition, monitoring, and enforcement of individual household boundaries difficult and costly. It is simply not practical. Secondly, Kazak pastoral households have long history of co-operation and co-ordination that cuts across more spheres than just land management. They know each other very well, and have established equitable governance mechanisms regarding pasture use. These characteristics make the common property regimes of Xinjiang suitable for a combination of government regulation and community governance (Banks, 2001).

5. Discussion and Comment

5.1. The design of policies needs to be changed radically

In general, governments have two choices to resolve the problems of compromised livelihoods and resource degradation. One is to enhance the carrying capability of the ecological system of grassland by investment to the infrastructure, such as irrigation, fencing or fertilizer application; another is to reduce the people's economic reliance on grassland. In recent years, many measures have been taken by government in Xinjiang to improve the production of grassland, such as planting seeds by airplane, offering to provide irrigation systems, fencing etc. However, because of the complex topography and the shortage of water resource, the beneficial effects are not very obvious. Meanwhile, government has also carried out policies, such as trying to balance grass availability and animal numbers, permanently settling nomadic people and reducing stocking rate of grassland. (Xu Peng, 2005; Hou Xiyong et al., 2004). There is no doubt that these policies have proved effective to some extent.

However, most of these policies have constrained the herders' mobility. Constriction of mobility is associated with development interventions to settle nomadic pastoralists into ranches, encroachment of rangelands by other forms of land-use such as cultivation and conservation, increasing population densities in rangeland areas, and the proliferation of water points, often accompanied by settlements. Some research shows that the reduction of mobility of herders in semi-arid and arid pastoral systems has increased the risk of degradation because of the way it concentrates grazing pressure on the resource and reduces the opportunities for resting parts of the vegetation (e.g. Coughenour, 1991; Perkins and Thomas, 1993; Oba et al., 2000; Fernandez-Gimenez and Swift, 2003; Kerven et al., 2003). In sparsely populated arid areas, grazing impact is often concentrated in biospheres or 'sacrifice zones' around water points or settlements (Perkins and Thomas, 1993; Sullivan, 1999; Leggett et al., 2003).

From the point of view of sustaining the multifunctionality of montane grazing systems, policy is underpinned by a desire to enhance production, and the technology to also be developed along the ideas of a production-oriented grazing system. The other functions of grazing livestock, such as environmental protection and supporting cultural development, have been given limited attention. To some extent, it can be said that grassland degradation is the inevitable result of ignoring a multifunctional approach.

Of course, the desire to increase production originates in the huge pressure for food demand in China. Under these circumstances, production is the primary objective. However, with the economic development of China, the situation of food security is increasingly being transformed from a quantity issue to one of quality (involving both better choice and food safety), and more and more people hope to improve their quality of life. These changes have created some advantage to explore the new methods of production based on the multifunctionality of grazing livestock systems in delivering watershed management, high biodiversity and landscape values and speciality food for an increasing and increasingly affluent population. The new methods of production should allow that the rangelands continue to support a significant livestock industry, accommodate important watershed protection functions,

and provide valuable and biological diverse resource. It also should reflect a diverse cultural landscape (ICIMOD, 2002).

5.2. Organic livestock farming should benefit the grazing system

Recently, organic livestock farming has developed rapidly, especially in developed countries. Organic farming is substantially different from more intensive conventional production systems, but is less significantly different from extensive grazing practices in some parts of the world. Organic farming focuses on building a harmonious relationship between man and environment and pays more attention to animal health and welfare, to environmental conservation and to food quality and safety (Ronchi and Nardone, 2003; Sundrum, 2001, Prasad, 2005) than many conventional systems of production. Organic farming aims to establish and maintain soil-plant, plant-animal and animal-soil interdependences and to create a sustainable agro-ecological system based on local resources (Nardone et al., 2004). Organic farming principles are consistent with the resolution of the problems of overgrazing which might be solved during the development of organic grazing livestock in Xinjiang, as long as there are no problems in meeting organic specifications with respect to organic feeds and use of fertilizers and pesticides. Specifically, organic livestock farming will bring some benefits in following aspects:

- It will deliver potential environmental benefits. According to the principles of organic livestock farming, the stocking rate should be reduced. It will reduce the grazing pressure on grassland, and relieve the strained relationship between animal and grassland, as well that between man and nature. As a result, it will also help to increase bio-diversity, improve the animal welfare, enhance the multifunctionality of grazing stock, especially the ecological function, and improve the utilisation of local and renewable resources (Ye Mao et al., 2006).
- It will help to preserve and develop the traditional culture of nomadic ethnic groups in the grazing livestock sector; multifunctional values of grazing systems are widely recognised and, together with production and economic objectives, cultural, social and environmental implications need to be taken into account.
- It will contribute to taking advantage of the existence of a market of organic food as a means by which herders can be compensated for internalising the external benefits that will otherwise be appropriated by wider societal interests. Herders should also have some new source of income, because of the multifunctionality of grazing livestock, such as subsidies from government, income from off-farm sources, etc. (Padel et al., 2002).

However, these benefits will only arise if the livestock rearers reduce their stocking rate, if organic agriculture can be adequately regulated and if there is a premium price for the product in the market place. It must also be noted that the general requirements of organic husbandry will mean that only a limited amount of conventional feeds should be used, especially when the stock is 'down the slope' on winter pastures and may make use of arable by-products during the winter months.

5.3. The scope for developing organic livestock farming

(1) The traditional husbandry practices are very similar with those of organic livestock systems.

Conversion from conventional grazing stock to organic is relatively easy. Of course, the traditional grazing farming is different from organic gazing livestock (Chander and Mukherjee, 2005). In comparison with traditional production methods, organic grazing livestock always is perhaps more dependent on knowledge-intensive production methods (Morgan and Murdoch, 2000), whereas traditional grazing livestock systems of livestock husbandry are more experience-based. However, the difference does not deny that the two production methods have many similarities. That (and the very low levels of use of chemical inputs, is the reason

Table 3. The difference between the basic rules of organic animal agriculture in Europe and the actual situation of grazing livestock in Xinjiang.

	EEC-Regulation(1804/99)	The actual condition of grazing livestock in Xinjiang
Animal feedstuffs	---Up to 25% conventional feed in a daily ration ---Antibiotics and other additives are forbidden in regular feedstuffs as well as the use of hormones and growth promoters	--->80% natural feed; ---Hormones, growth promoters and other additives never be used in raising.
Housing conditions	---Allow farm animal to perform all aspects of their innate behaviour; ---Dry litter for their bedding; ---Tethering of farm animal is forbidden.	---Most of time livestock are fed through grazing on pasture. Their house is big enough for moving freely; ---Application of dry litter for bedding;. ---Generally speaking, sheep are never tethered.
Disease prevention	---Selection of breeds with abilities to resistance to disease, to avoid specific disease or health problems, which prevail in conventional livestock production. ---Livestock should be raised in a manner which suits the requirements of the species and promotes a good resistance against diseases and infections. ---Application of good quality feeds, which together with application of outdoor areas and grazing strengthen the natural immune system of the animal. ---Securing a suitable space allowance in order to prohibit overcrowding and associated health problems.	---In Xinjiang native breeds are well adapted to local situation. being hardy, resistant to diseases; ---Grazing in the nature pasture; It is the best way for native breeds; --- In general, the phenomenon of overcrowding does not exist.
Veterinary treatment	---Non-allopathic medicine should be chosen prior to allopathic medicine; ---Preventive treatments with allopathic medicine are not allowed; ---Keep a log of all veterinary treatment use of disease control agents; ---It is not allowed for an adult animal to receive allopathic medicine more than three times during the year.	In general, the cost of animal medicine is very low in grazing system in Xinjiang. One reason is the native breeds have good natural immune system; the other is that the transhumance has influence on the treatment immediately.

Source: Chander and Mukherjee, 2005; Nardone et al., 2004

why some researchers think that traditional production methods are very close to organic ones (Chander and Mukherjee, 2005; Nardone et al., 2004), not least because both tend to use few chemical inputs and are reliant on adapting production systems to natural cycles. Table 3 shows the difference between the basic rules of organic animal agriculture in Europe and the actual situation of grazing livestock in Xinjiang. Obviously, it is not too difficult to convert from traditional grazing livestock to organic systems in these areas.

(2) Producers have good traditional idea of environmental protection

From the point view of the producer, the traditional culture of the nomadic ethnic group establishes a good base for the development of organic livestock farming. Their culture comes from the nomadic production methods based on the traditional (or indigenous) knowledge which respect natural forces. In the dimension of ecological ethics, the core idea of nomadic culture is centred on the respect of life, respect of nature and harmonious co-existence of humans with nature (Gegenguva, Oyunbatu, 2002; Zhang et al., 2007). These value systems will help the producers to accept the idea of organic grazing livestock very easy, as long as there are no other factors that drive such nomadic herders to desperate measures (such as drought, animal disease etc).

(3) The potential market for organic food is very big in China

China has a very big domestic market with striking trends of growth of demand with respect to various foods. Consumers' ideas have changed significantly. Food safety has been a major concern with issues of pesticide contamination to the fore. More and more consumers do not satisfy only their basic need, but begin to pursue a wider diet. There are also distinct policy preferences for increasing food safety.

The consciousness of food safety is becoming stronger in Chinese domestic markets. Meanwhile, the levels of green and organic consumption have been increasing with the development of Chinese economy. Consumers have a much more comprehensive understanding of green production process, compared with pesticide-reduced and organic food, since it is the earliest of the food quality standards adopted in China. The majority of households have positive attitudes towards green foods. According to a survey in Urumqi (Zhou Lili and Chen Tong, 2007), about 87.7 percent of respondents reported that they had bought green food before. Up to 60% of consumers hold the belief that it is reasonable for green food to be a bit more expensive than conventional food.

These arguments suggest that it is important to decide whether the objective should be the production of green 'nearly organic' food or food that is fully certifiable as organic.

5.4. The challenges for the development of organic livestock farming in Xinjiang

(1) How to exploit the market of organic food

The market should be the decisive factor for the development of organic grazing livestock in Xinjiang. Although China has a very big domestic food market, the market for organic food only commenced in 2000. By the end of 2005, the sale of organic foods was only valued at about 0.3 billion Euro, in which exports (presumably of speciality crop products not red meat) account for nearly 53% of the total, and domestic consumption is no more than 0.15 billion Euro only account for 0.02% of food consumption in China (Dong Zhengguo, 2006). According to a recent survey (Zhou Lili and Chen Tong, 2007), the market for organic products in Urumqi, which is the capital of Xinjiang Uygur Autonomous Region, is right at the beginning of its development. About 44.9% of Urumqi consumers had never heard of organic food. Urumqi consumers who know organic food consider organically-grown products as very healthy, of good quality and tasty. However, on average, consumers are not very familiar with the supply of organic food in the market.

Over and above the issue of the small established market, building new market networks and separate supply chains is another challenge. While the general principles of livestock systems in the mountain areas are very close to organic and indeed in many cases may be organic, the transaction costs of regulation need to be considered for it will be essential to separate out organic and non-organic produce in food supply chains and this has been a reason for much higher prices to consumers in some countries where duplicate supply chains must be established. Owing to the main market of organic food being in major conurbations such as Beijing and Shanghai, these main markets are far from Xinjiang, There is also a persistent danger that any increases in value of product will be swallowed up in increased costs of regulation and supply chain management, or by benefiting supply chain intermediaries, so how to build the supply chains in ways that support local livelihood enhancement is also a big problem.

(2) How to build the technological system of organic grazing livestock

Modern technologically based livestock production systems focus on and include the breeding, feeding, disease control, management; processing, marketing, of production and use scientific methods to improve performance. Few concerns relevant to animal welfare and the environment have historically been associated with these so-called 'productivist' methods, except insofar as poor welfare reduces productivity. However, organic farming is also knowledge-intensive, and modern technologies should be developed based on the scientific understanding of organic farming. The main challenges are:

- Awareness about organic production practices is currently inadequate, especially at the level of extension workers and trainers, farmers, and researchers;
- It is necessary to better understand which ideas, standards, and elements of the production system influence disease incidence and welfare, and how to deal with these in ways which are appropriate in the organic standard.

(3) How to guarantee the high quality of organic animal products

Some studies (Yiridoe et al., 2005; TNS, 2003) show that the most important reason why consumers are willing to pay premium price for organic food is the benefits to health, and the perceived high quality. That is to say, it is very important that consumers believe that organic food is of better quality than conventional food. This relies on the system of quality guarantee. Generally speaking, there is a quality assurance system in the slaughterhouse to prevent any contaminated diseased meat product entering the market in Xinjiang. It is not enough just to control the quality during breeding, feeding, fattening and transport. The systems need to be in place all along the food supply chain from common pasture to chopstick (or field to fork in Euro-parlance).

6. Conclusions

Grassland degradation has adversely influenced not only the sustainable development of grazing livestock systems, but also herders' livelihoods, as well as the condition of the ecological environment of Xinjiang. In essence, grassland degradation in Xinjiang is a reflection of imbalanced relationship between the man and nature in the region. The root cause is considered to be an overly production-oriented set of farm policies, as well as the specific production methods that have evolved in the region. The reform of pastoral tenure to individual rights is not seen as appropriate to the resolution of the identified problems.

Organic farming is one strategy to enable the development of more sustainable agriculture. It is obvious that organic farming differs completely from more intensive and narrowly productivist forms of conventional agriculture. According to principles of organic livestock farming, the stocking rate should be reduced. Organic agriculture will reduce the yield of grassland, but reduce pressure on that yield and relieve the strained relationship between the ruminant animal population and the grassland on which it depends, as well the strained relationship between man and nature. By placing a greater premium on the inherent qualities of organic production, organic agriculture can break the cycle of intensification which has been occurring. Further, the important multifunctional dimensions of semi-natural grazing systems will be more widely recognised and, together with production and economic objectives, cultural, social and environmental implications will also be taken into account. Meanwhile, herders may also have new sources of income, because of the multifunctionality of the grazing livestock system. The benefits may be reflected in subsidies from government, and increased income from farming.

Although conventional agriculture is often associated with unsustainable farming, practices, especially in areas with significant agri-environmental problems, it should be recognised that food shortages have not been solved completely in China, so conventional agriculture will still exist as mainstream agriculture in China for a long time. Meanwhile organic livestock farming is not a panacea to solve all the problems facing the grazing system of Xinjiang. At present, organic livestock farming still faces some major challenges, such as developing the market of organic food, building the technological systems of organic grazing livestock, guaranteeing the high quality of organic animal products and ensuring cost effective forms of certification and regulation for poor farmers.

In relation to supporting multifunctionality, Western European agriculture has developed significant agri-environmental policy measures since the late 1980s, including organic aid schemes. The environmentally rich grasslands of the hill and mountain lands of west China might benefit from similar schemes where farmers are rewarded for maintaining or enhancing environmental features. As well as supporting organic production, paying farmers for the delivery of particular environmental goods and services which comprise public goods is an alternative strategy that merits attention. However, these may be seen as mature economy policies inappropriate in China at present.

As a form of agricultural development, China should think seriously about developing a twin track strategy with regard to organic livestock farming: one is an export-oriented sector which is driven by market imperatives and the demand for quality foods; the other is in places with serious environmental problems, where an organic solution might contribute to economic development and where the reduction of total food production might have no big impacts on overall security of food in China. The grazing livestock systems in the pastoral regions of Xinjiang constitute a potentially suitable case for the development of organic agriculture as an agri-environmental and rural development policy. Moreover, the traditional technology is very close to organic livestock farming. It needs to shift from a predominantly production-oriented state to a more integrated and holistic vision based on quality food and sustainable environmental management. This cannot be done without further market research and action research on how to effect the full transformation to organic agriculture.

7. References

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Appendix A

This study used a projection pursuit regression (PPR) which was newly developed in nearly 20 years. This is mainly because that PPR can solve the problem of "dimension curse" which may be caused by the non-linear, non-normal data and conventional regression technique. The basic idea of PPR is to project high-dimensional data to low-dimensional space, and to look for a meaningful projection direction by computer constantly so that data in these projection directions can show the structural features of the original data. Thus we can study and analyze high-dimensional data by the analysis of the data structure in low-dimensional space. PPR model and its implementation are as follows:

Let $X=(x_1,x_2,...x_p)$ is a p-dimensional random variable, y=f(x) is a one-dimensional random variables. To avoid the contradiction that linear regression does not reflect the actual nonlinear situation, PPR takes the sum of a series of Ridge functions of Gm(Z) to approach the regression function.

$$f(x) \sim \sum_{m=1}^{M} \beta_m G_m(Z_m) = \sum_{m=1}^{M} \beta_m G_m(\alpha_m \cdot X)$$

Of which, Gm(Zm) is the m Ridge function, $Z_m=\alpha_m \cdot X=\alpha_{m1}x_1+\alpha_{m2}x_2+...+\alpha_{mp}x_p$ is Ridge function variables, it represents the projection of p-dimensional vector X in the direction of $\alpha_m \cdot \alpha_m$ is also a p-dimensional vector in a certain direction. m is the number of the Ridge function. β_m is the weight coefficient of the m Ridge function's contribution to f(x).

The key is the ultimate model of the estimated coefficients α_{mj} and β_m in the formula, Gm Ridge function and the optimization number Mu. The discriminant of the minimum of the model still use least-squares criteria, that is to say, we should select appropriate parameters of α_{mj} and β_m, Gm(z) and the combination to satisfy the following formula:

$$L_2 = E[y - \sum_{m=1}^{M_u} \beta_m G_m(\sum_{j=1}^{p} \alpha_{mj} x_j)]^2 = \min$$

The specific practice is to divide the whole parameters into several groups, with the exception of one group, give an initial set, and then optimize the parameters of the group left. The results obtained, set the extreme point as the initial value, and then optimize another group of parameters in this initial value, repeated until the convergence of parameters. That is to say, $\alpha_{mj}, j=1,2,\Lambda, p; \beta_m, G_m$ can be included in one group, m=1, 2,..., M ; There are total M groups. Fix one M-1 for a group, only optimize α_{mj}, β_m and Gm(z) in this group. Now divide it into three sub-groups to optimize again, and then repeat this process until L2 no longer decrease.

Appendix B

The paper defines risk as a kind of uncertainty which bring loss to producer. So the Coefficient of risk can be calculated by the formulation as following:

$$r = \frac{\sum |y_i - \hat{y}_i|}{\overline{Y}} = \frac{\sum |e_i|}{\overline{Y}}$$

which, r is the Coefficient of risk; $\hat{y}$ is the value of production forecasted; $\overline{Y}$ is the average of sample; $e_i=y_i-\hat{y}_i<0$.