

Agriculture and water in Shunyi District, Beijing

This survey was part of the project 'Resource Management Options in the Greater Beijing Area' and funded by the International Co-operation Programme of the Dutch Ministry of Agriculture, Nature Management and Food quality

# **Agriculture and water in Shunyi District, Beijing**

## **Results of a Rapid Diagnostic Appraisal**

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## ABSTRACT

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Land use and agriculture in Shunyi District were studied in a Rapid Diagnostic Appraisal (RDA) held November 2003 in the frame of the project "Resource Management Options in the Greater Beijing Area". Officials of governmental institutions in Shunyi were interviewed and during three days, a team of nine Chinese and three Dutch researchers visited three townships in Shunyi District and interviewed local leaders and farmers on farm structures, farming systems, water-related issues and future developments. In addition, documentation and statistics about land use development and agriculture in Shunyi have been collected. The results of this rapid diagnosis have been presented during a feedback meeting with a major part of the interviewed officials and farmers. This report presents the results of the RDA. After a general description of land and water use developments in Shunyi, the major characteristics of agriculture are described. Subsequently, the main characteristics of the visited townships and farms are summarized. More detailed information about the approach and organisation of the RDA can be found in Appendix 2 of this report.

Keywords: Beijing, environmental pollution, farming systems, horticulture, land use, livestock production, nutrient emission, Rapid Diagnostic Appraisal, Shunyi, water use

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The Editors





# 1 Introduction

The following description of land use and agriculture in Shunyi District is mainly based on a Rapid Diagnostic Appraisal (RDA) held November 3-11, 2003 in the frame of the project "Resource Management Options in the Greater Beijing Area". That project is aimed at identifying options for sustainable agricultural land use and production systems in Shunyi district that lead to less water pollution. Officials of governmental institutions in Shunyi were interviewed and during three days, a team of nine Chinese and three Dutch researchers visited three townships in Shunyi district and interviewed local leaders and farmers on farm structures, farming systems, water-related issues and future developments. In addition, documentation and statistics about land use development and agriculture in Shunyi have been collected. The results of this rapid diagnosis have been presented during a feedback meeting with a major part of the interviewed officials and farmers. More detailed information about the approach and organisation of the RDA can be found in Appendix 2 of this report. This report itself focuses on the results of the RDA. After a general description of land and water use developments in Shunyi, the major characteristics of agriculture will briefly be described. Subsequently, the main characteristics of the visited townships and farms are summarized. These results will be used for further implementation of the project, in particular for the selection of farms for monitoring and for quantification of technical coefficients for land use modelling.



Figure 1.1 Location of Shunyi District



## 2 Land use and Water use developments in Shunyi district

### 2.1 Brief introduction of Shunyi District

Shunyi District is located in the north-east suburbs of Beijing, about 30 kilometres from the centre, at latitude 40°00'-- 40°18' North and longitude 116°28' -- 116°58' East. The total area is 1,021 km<sup>2</sup> and it has a population of 593,000, of which 419,000 are permanent agricultural residents (Beijing Statistical Office, 2001). It comprises 12 towns, 7 regional offices and 2 sub-district offices, 428 natural villages and 27 neighbourhood committees. The city zone covers 21 km<sup>2</sup> with a population of 100,000. The central government is located in Renhe Region. In April 1958, Shunyi was transferred to Beijing City. In March 1998, with the approval of the State Council, the county system was changed into a district system. (The information in this paragraph has been extracted from the Shunyi website: [www.english.bjshy.gov.cn](http://www.english.bjshy.gov.cn))

In 1999, GDP in Shunyi reached 7.84 billion RMB, a growth of 13.5% from the year 1998. The per capita GDP in Shunyi exceeded 14,500 RMB on average and 4,817 RMB in agriculture. According to the Beijing Well-off Standard and the standard made by Shunyi itself, 395 administrative villages are able to meet the standard at the rate of 93.6%, including 53 example well-off villages, which account for 12.6% of all the villages in Shunyi. Enterprises from around 40 countries and regions came to invest in Shunyi. The main industries include machinery & electronics, costume & textile, toy manufacturing, food & beverage production, real estate, etc. The Capital International Airport, the largest airport in China with the most advanced equipment, is located in Shunyi District, five kilometres from the city zone.

Shunyi has a warm temperate wet continental monsoon climate. Average annual temperature is 11.5 °C, that in January 4.9 °C, and in July 25.7. The lowest temperature in January is -19.1 °C and the highest in July 40.5 °C. The frost-free period lasts around 195 days. Annual sunshine duration is 2750 hours, average annual relative humidity about 50%. Average annual precipitation is about 625 mm, of which 75% falls in summer. More than 20 rivers run across Shunyi, all of which belong to the North Canal, Chaobai River and Ji Canal water systems. The total length of the rivers equals 232 kilometres, and the total flow rate reaches 170 million cubic meters. The usable surface water in normal years is 43 million cubic meters, and the groundwater that can be exploited is 400 million cubic meters. Of this, 200 million cubic meters of drinking water is supplied to Beijing. However, the last few years' rainfall has been far below average and the rivers have (almost) dried up.

Shunyi has a fertile soil, ranging from sandy to loamy soils, see figure 2.1. Production conditions in Shunyi are favourable for various agricultural sectors and for that reason. Shunyi District has become an important food production base for Beijing. Shunyi produces 34% of the slaughtered pigs in Beijing, 21% of the vegetables, 21% of the fish, 14 % of the broilers, 13% of the eggs and it is the major production base

of Peking ducks. Modernization of agriculture in Shunyi has brought it to a leading position in China in recent years. The agricultural structure and farming system will be described more in detail in Chapter 3 and the following.

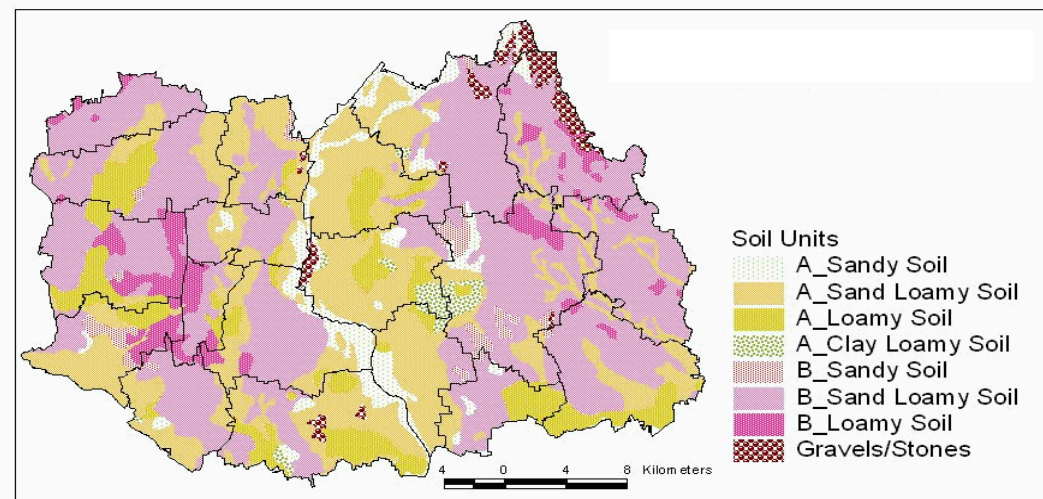


Figure 2.1 Major soil units in Shunyi

## 2.2 Water resources and land use developments in Shunyi District

By Dr. Lu Changhe

### 2.2.1 Water resources

Water shortage and surface water pollution are recognized as two major problems for sustainable agricultural development in Shunyi. Before 1989, irrigation water for agriculture in Shunyi was supplied from the Miyun Reservoir, but since then the supply has stopped, because of the increased water demand in the urban area of Beijing Municipality. Since then, groundwater has become the only water source for Shunyi to meet the demand for agricultural and industrial use.

Although the arable land area decreased substantially in the last decade, the total water consumption by agriculture increased until 1999, in particular due to the increasing livestock number and area of vegetables. The recent decline in water use is caused by the drought.

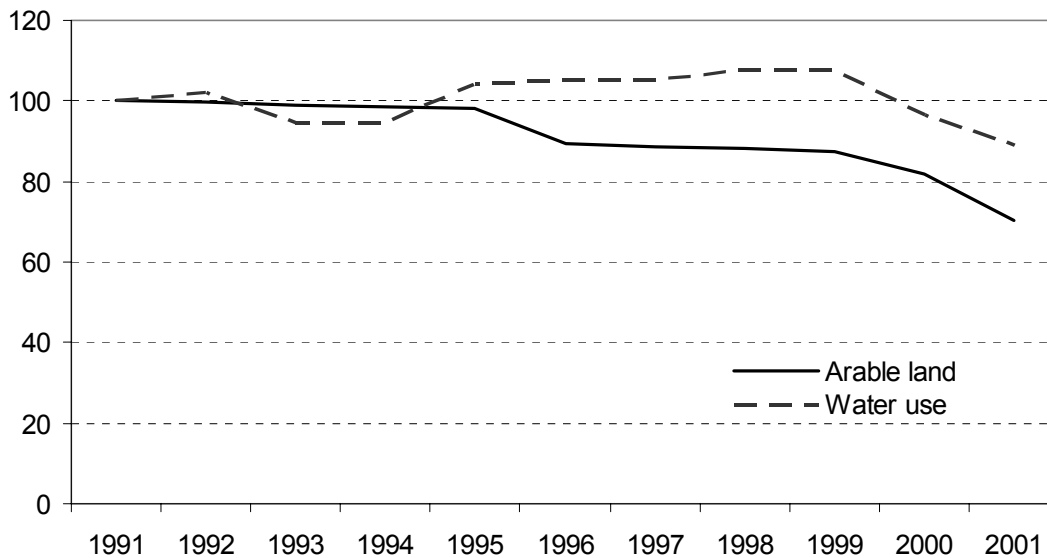


Figure 2.2 Development of arable land and water use in agriculture in Shunyi (1991= 100)

No accurate data are available on the availability of usable groundwater. Estimates of available groundwater from the government are 410–430 million cubic meter per year, of which half (200 million cubic meter) has been supplied annually to the urban area of Beijing since 1984. In recent years, groundwater table depth has been reported to continuously increase, to an average depth already of 30-50 m, even lower than 60 m in the Eastern and Western parts of Shunyi. In addition to the increased use of groundwater, the below-average rainfall in recent years is also considered as an important factor for the decline in groundwater table depth. Vegetable and fruit production and animal husbandry are the three major agricultural users of water resources in Shunyi.

Groundwater quality is generally good, because of its great depth. However, serious nitrate pollution of groundwater has been found in some sandy areas, where small-scale vegetable farming is practiced. One research discovered that nitrate is mainly accumulated in the soil profile between 1 and 60 cm, in which the concentration gradually decreased with the increasing irrigation water, while the concentration of nitrate in the layer between 80 and 320 cm was not correlated with the irrigation water. Another survey on 146 wells in Shunyi district showed that the average nitrate concentration in shallow wells (6-20m deep) was 36.8 mg/l higher than the national standard of critical point (10 mg/l), particularly in vegetable producing areas. In 7.4% of the deeper wells (70-100m deep), the nitrate concentration exceeded the critical point, and in 6.3% it was approaching that level. Although the water quality is still good for more deep wells (120-200m), the situation is becoming serious.

Water pollution occurs mainly in surface water, based on monitoring data before 2000. Since then, no additional data have been collected, because all the rivers in

Shunyi have dried up (no runoff). The major causes of water pollution are over-use of manure and agro-chemicals (fertilizers and biocides) for vegetable production, and wastes from animal husbandry, particularly from the pig farms. Most animal farms (particularly the small ones) have no capacity to process the excretions that are often dumped into rivers without any or only simple processing (just picking up the faeces). The large pig enterprises are mainly located in the towns/townships of Dasungezhuang, Longwantun and Yangzhen. They cause not only water pollution, but because of the dried-up rivers also soil pollution in the areas along the river. The reduced run-off indirectly increased the severity of water pollution. In addition, wastewater from the households in the rural area contributes to water pollution.

These water problems have been well recognized by the governments at district and municipal levels. Various measures have been taken to tackle these problems, including:

- Promotion of the use of new irrigation systems (e.g. drip irrigation) to improve water use efficiency;
- Restructuring of cropping pattern, by reducing the area of crops with high water requirements;
- Water rationing: water use for all enterprises in general should not exceed a given amount. If the quota are exceeded, the enterprises are fined and have to pay the excess water use at a much higher price;
- Control of groundwater use: Building of wells is strictly controlled by the government. Construction of wells must be done by licensed builders with permission of the Shunyi government. A water meter has to be installed at each well;
- Water price for vegetable production is set to 0.4-0.5 Yuan per cubic meter;
- Implementation of a safe food certification system to promote environment-friendly food production;
- Introduction of integrated animal manure processing systems in some big pig farms, with partial support of the government: using the excreta to generate biogas and to produce organic fertilizers.

### **2.2.2 Land use changes**

Arable cropping, residential and industrial use and forest are the three major types of land use in Shunyi (Figure 2.3). In the past decades, land use in Shunyi has undergone a quick change due to the fast economic growth and urbanization, characterized by conversion of arable land into built-up and green area. The major part of the district is in use for agriculture, but the agricultural land use shows a considerable restructuring, which will be described in the following chapter. Figure 2.4 presents the expansion of the built-up area between 1990 and 2000, showing the rapid growth of the urban area. This rapid expansion will be continued in the near future, which is largely associated with the 2008 Olympic Games.

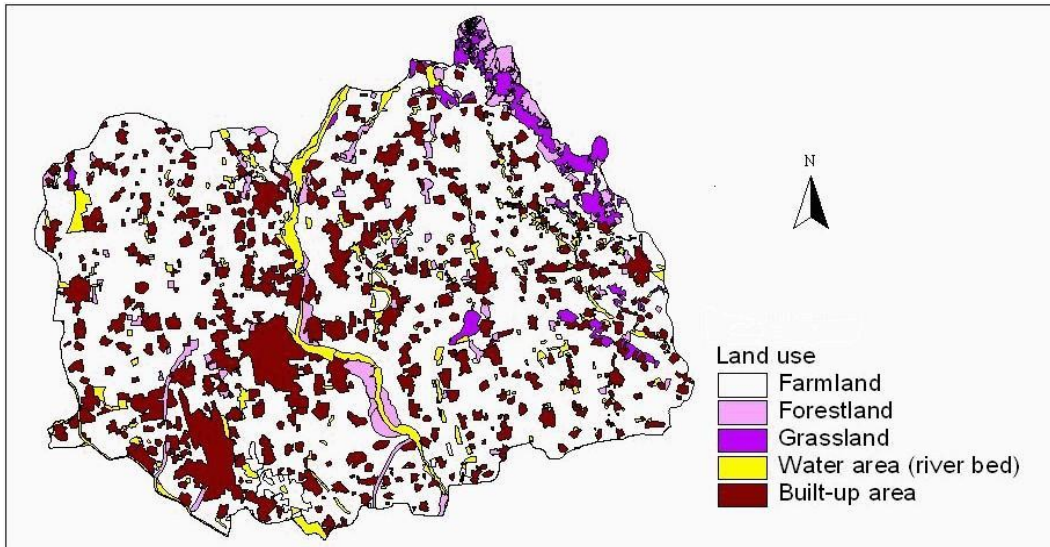


Figure 2.3 Land use in Shunyi in 2000

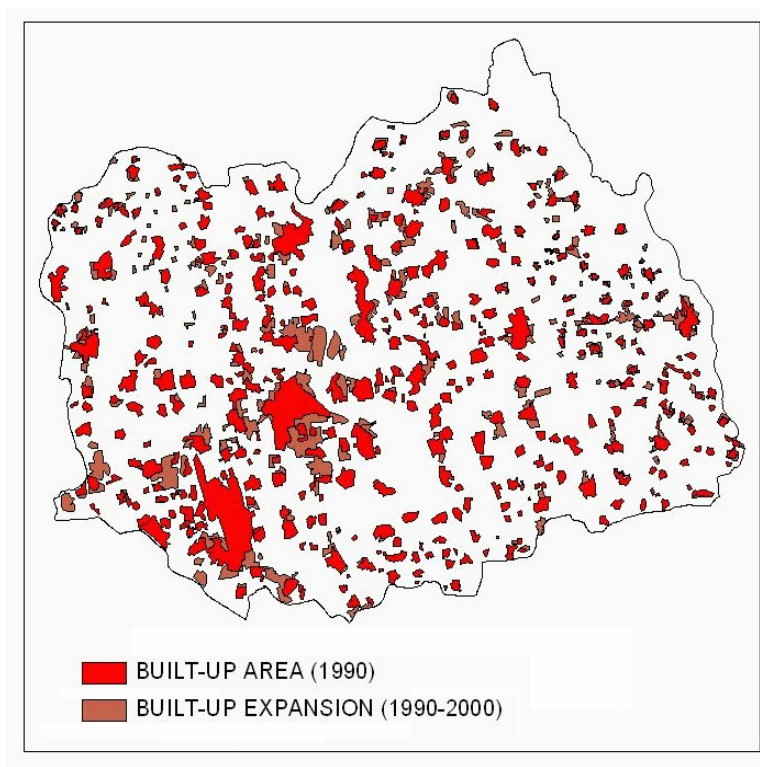
The following changes in land use are foreseen in Shunyi:

- A new airport will be built before 2007, covering a land area of 22,000 mu, with 9 villages (3,100 households and 8,800 population) to be moved; ***Mu is the traditional Chinese area unit, 1/15<sup>th</sup> of a hectare (667 m<sup>2</sup>)***
- An International Conference & Exhibition Centre will be built near to the Capital Airport before the Olympic Games. Associated with it, a national forest park will be constructed nearby (now 10,000 mu of land has been planted with trees);



- An area for water sports of the Olympic Game has been planned in the middle north of Shunyi along the Chaobai River;
- New industrial and residential areas and infrastructure have been approved and will start to be constructed, including a car factory area (6,3 km<sup>2</sup>), the New City of Shunyi (12 km<sup>2</sup>), Konggang Goods Area, and the City railway;
- Greening projects: In 2003, Shunyi has a total forest area of 32,426 ha, covering 32% of the district. Presently, the following greening projects are under way: Greening belts (planting of trees) of 200 m wide along the Chaobai River, Wenyu River, the Sixth Ring of Beijing, Shun-Ping Highway, Jing-Cheng Highway and Da-Qin Railway. The total greening area is 30,000 mu in Shunyi district, which will be completed around 2007. Tree planting around villages has been implemented. In 2002, 2,086 mu of trees has been planted in

seven selected key villages in three towns of Niulanshan, Houshayu and Zhaoquanying.



*Fig. 2.4 Changes in the built-up area in Shunyi*

### **2.3 Challenges for the future**

Challenges with respect to land use, agriculture and water resource management:

1. Impact of a further increasing water price and a decreasing availability of usable water on the profitability of agriculture;
2. Impact on agricultural profits of the increasingly tighter environmental standards and the related increase in production costs;
3. Potential pollution of water and soils caused by further agricultural intensification with an increasing input of agro-chemicals;
4. Choices for agricultural development to cope with the rapid decrease in arable land caused by the expansion of non-agricultural land use (built-up area).

Major measures to deal with the land use problems from the government:

1. Development of large-scale, industrialized and standardized agriculture;
2. Development of high value-added agriculture (high standard (safe food) vegetables), fruits, breeding pigs and sheep, ducks and dairy farming and vegetable/ornamental seedlings
3. Development of recreation agriculture (now 40 recreation fruit orchards in Shunyi)



4. Development of flower production and ornamental tree nurseries.

During the feedback meeting on November 10, the following measures were mentioned to address the water resource problems:

1. Reducing runoff losses. Hundreds of millions of RMB have been invested in Chaobei He for building a plastic dam, to reduce runoff and thus to increase recharge of the groundwater;
2. Promotion of new irrigation systems in agriculture (e.g., drip irrigation);
3. All enterprises are encouraged to collect rainfall (in summer) and to re-use industrial water;
4. About 1.2 billion m<sup>3</sup> water will be diverted from rivers in south China to Beijing (mainly for industries), probably before 2008.



### 3 Agricultural land use in Shunyi district

#### 3.1 Introduction

The total land area of Shunyi is 102,000 hectares of which about 40,000 ha agricultural land (2002). Shunyi is one of the food and meat production bases in China. As it has been mentioned above there has been a rapid conversion of land use from agricultural to non-agricultural functions in Shunyi: the agricultural area decreased from 625 km<sup>2</sup> in 1990 to 486 km<sup>2</sup> in 2001. The 'traditional' agricultural land use system in the district was growing of winter cereals (wheat) combined with maize in summer. In the last decade, this area declined substantially, from a historical maximum of about 80,000 ha to a current level of about 30,000 ha.

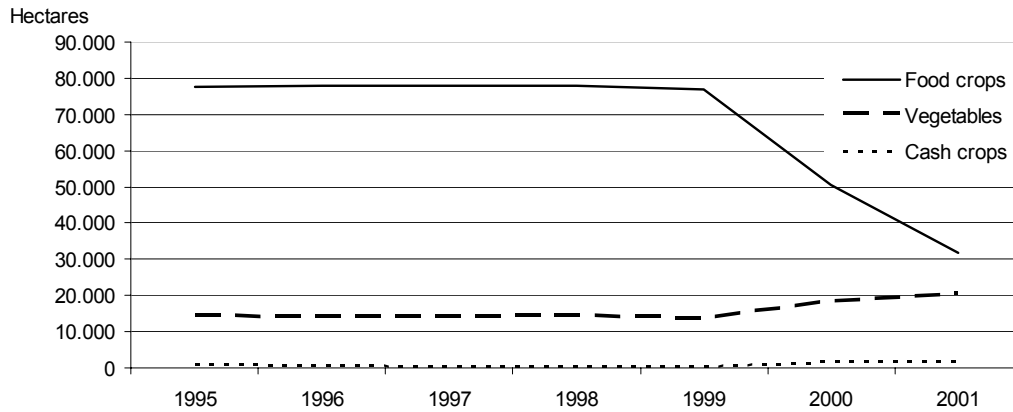


Fig. 3.1 Agricultural land use changes in Shunyi 1995-2001 (Shunyi Statistical data)

The profitability of wheat and maize is low and therefore, this traditional system has largely been replaced by the production of vegetables, fruit and forage crops, particularly silage maize and alfalfa. Figure 3.1 shows the sharp decline of food crops (wheat and corn) after 1999. At present (2003) still, a major part of the farmland in Shunyi is used for these crops, but the transition to intensive farming is ongoing. Figure 3.2 shows the cropping pattern in 2002. (Note: The numbers in this report are approximate data; it appeared very difficult to unequivocally establish actual land use patterns on the basis of different data sources.)

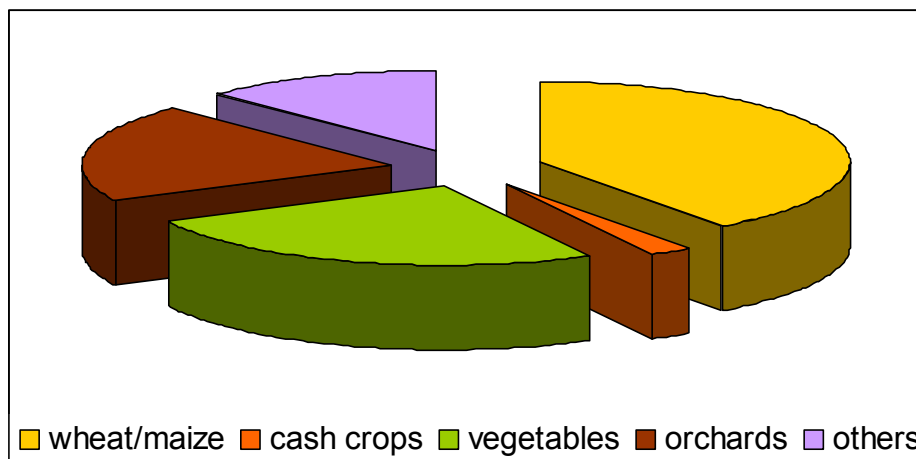


Fig. 3.2 Cropping pattern in Shunyi in 2002 (Shunyi Statistical data: from wheat/maize top right, to vegetables at bottom of pie to others top left)

### 3.2 Cropping patterns

#### *Vegetables*

The total area under vegetables is 153,000 mu currently (2002, Figure 3.2), and is expected to continue to expand in the future. Of this, 40,000 mu is under plastic tunnels and 20,000 under sunlight greenhouses (i.e. greenhouses with a brick or clay wall about 3 meters high on the northern side and a plastic dome on the southern side and a cultivated area of about 350 - 450 m<sup>2</sup>, see the pictures in this report). Vegetable growing is concentrated in five townships in the South East of Shunyi District, Dasungezhuang, Liqiao, Beiwu and Lisui, covering about 100,000 mu. In this area, more than 90% of the vegetables are grown by individual households with holdings of 3-10 mu. The remainder originates from (6-7) large-scale operations exceeding 10,000 mu. More than 100 different vegetable types are grown, the main ones being: cucumber, watermelon, tomato, Chinese cabbage and bean. Total annual production is 1.18 million tons (fresh), with an estimated value of 600 million RMB. Income from vegetables is approximately 3000 Y/mu/year (2 cycles); from open fields about 2000 Y/mu and from protected crops 4000 – 5000 Y/mu.

#### *Fruit*

The total area used for fruit production is about 175,000 mu. Fruit trees are mainly grown in the Northeast of Shunyi, especially in Longwantun, a mountainous area, and to a less extent in the Northwest. Fruit trees use less water than vegetables. Main species are apples and pears. Apples occupy 27,000 mu, pears 40,000 mu. See Table 3.1 for more detailed information per township. Individual farmers cultivate 80% of the total fruit area and a fruit company 20%.

#### *Forage crops*

The forage crops silage maize and alfalfa each cover about 70,000 mu. They are mainly grown in the Southeast of Shunyi. The maize is planted pre-dominantly in spring. The revenue is about 200 – 300 Y/mu. Alfalfa is mainly grown in large-scale

operations. It is irrigated 4-5 times per year. Alfalfa is partly locally fed to animals, partly sold outside the region. Revenues from alfalfa are about 300 – 400 Y/mu.

### ***Wheat***

Wheat is grown in the Central North. The area is 50 – 60,000 mu now, from a historical maximum of 650,000. Especially lately, it has been strongly decreasing (20,000 mu). New varieties are being introduced with emphasis on grain quality, to increase or maintain revenue that currently is about 200 Y/mu.

*Table 3.1 Area and yield in fruit production in Shunyi in 2002*

Townships		Total fruit	Of which:			
			Apple	Peach	Pear	Grape
Shunyi District	Area (mu)	221,152	26,844	14,239	39,938	17,807
	Yield (tons)	57,204	27,130	5,563	10,547	11,851
Of which in:						
Zhaoquanying	Area (mu)	12,000				1,000
	Yield (tons)	309,000				
Longwantun	Area (mu)	17,100	5,230		9,750	
	Yield (tons)	12,948	7,885		4,090	
Dasungezhuang	Area (mu)	10,443				7,964
	Yield (tons)	6,508				4,806
Zhangzhen	Area (mu)	10,800	4,875			1,725
	Yield (tons)	8,114	5,386			1,607
Liqiao	Area (mu)	13,770		1,260	8,565	
	Yield (tons)	5,500		1,300	2,500	

## **3.3 The use of agro-chemicals**

### ***Fertilizer use in vegetable cultivation***

Vegetables are heavily fertilized, especially in greenhouses with the general practice of a base application of 5000 kg/mu of organic manure, mainly pig and chicken manure, which may be combined with a chemical potassium fertilizer. This is followed by a topdressing of 150 kg/mu of chemical compound fertilizer of which 80 – 90% consists of nitrogen, mainly in the form of urea and ammonium sulphate. Fertilizer recommendations have been formulated by the extension service, based on crop requirements. These practices tend to result in over-fertilization (applications exceeding crop demands), with the risk of emissions of nutrients to the environment, leading to health risks and damage to the landscape.

### ***Weed/pest/disease management***

The use of crop protection agents (biocides, such as pesticides) on vegetables to control weeds, pests and diseases is widespread, with possible risks for human health (chemical residues on vegetables) and the environment (emission of toxic compounds). In an attempt to reduce the risks, regulations have been formulated, banning the use of at least the most toxic agents. Moreover, periodically (3-4 times per year) vegetable samples are checked locally for residues.

Some growers use biological control systems; however, pesticides are still used.

### 3.4 Summary of food safety policies in China

The Chinese central government has launched several programmes in association with vegetable quality/safety since the late 1980's. These programmes include the "Vegetable Basket Project", the "Action Plan for Public-Health-Hazard-Free Agricultural Products", and the "Green Food Development Project".

The "*Vegetable Basket Project*" (VBP) was launched by the Chinese government in 1988. The VBP in the first phase (1988-1994) aimed to increase vegetable production in order to overcome vegetable supply shortage problem and succeeded in that.

The VBP in the second phase (1995-2001) aimed to diversify the varieties of vegetables to meet the consumers' demands. The second phase VBP was also considered a big success. As a result, the supply of vegetable varieties increased from less than 10 to more than 40 over the 1995-2001 period and the consumers can buy different types of fresh vegetables the whole year around. Recently, the Chinese government started the third phase VBP, which is aimed at improving the quality and safety of vegetables

In 2001, the MoA started the "*Action Plan for Pollution-Free Agricultural Products*". The APPAP is not particularly set for vegetables. In fact, it covers all the edible agricultural products, including vegetables, fruits, cereals, beans, meats, aquatic products, etc. The overall objective of the APPAP is to establish a sound system, including institutions for superintending, inspecting and controlling the whole process of agricultural production and marketing for food safety purposes, from the field to plate. The priority task for the APPAP is to control the levels of agro-chemical residues, anti-biotic and heavy metals to food safety standards. Several measures have and will be taken to achieve the goals.

In May of 1990, the MOA formally announced to start the "*Green Food Development Project*" in order to protect ecological environments, improve agricultural products quality, speed up food processing industry development, improve people's health conditions and increase agricultural exports as well. "Green Food" in the Chinese official language means "healthy food". The green food industry has developed very rapidly since 1990: in 1990, China produced only 127 different varieties of green food products, but now China is able to produce 2400 different varieties of green food products.

#### ***Safe food standards***

The food standards are set by either the central government and different ministries or the local/provincial governments. There are three categories of food standards representing different levels of governmental standard: national standards set by the central government, the ministry/trade standards of individual ministries and local/provincial standards set by provincial governments.

The "*green food standards*" are ministry level standards set by the MOA. There are two grades in the green food standards, or grade A and grade AA. The level A standard

allows using agro-chemicals, but there should not be any residues tested positive in the products. The level AA allows no agro-chemicals to be applied in the complete process of the production and high environmental standards such as air, water, soil, etc. are required to produce grade AA products. The AA standards are stricter and come close to western standards for 'organic food', but do not meet all the requirements.

In 2001, therefore, *the "Organic Food Standard"* was introduced. This standard meets the standards of the International Federation of Organic Agricultural Movements (IFOAM) (to a large extent).

Besides the two product labels mentioned above there is the *"Pollution Free Vegetable"* (PFV) label (Figure 3.3). The PFV label is being used by local governments, aiming at enhancing the production of healthier food by the introduction of production standards. The standards for getting a PFV certificate are lower than those of the "Green Food" certificate.



Fig. 3.3 Logos of three types of food





## 4 Animal production in Shunyi district

### 4.1 Current livestock production systems

Animal husbandry in Shunyi has a production value of 60% of all agricultural activities. The total turnover of animal production in Shunyi is 550 million RMB, of which 330 million from the production of ducks. This section gives a brief overview of the status of livestock production in Shunyi district <sup>1)</sup>, with emphasis on the number of animals, main production areas, structure of production and possible impact on water quality and quantity. First, the structure and densities of ruminants (Figure 4.1) are described, followed by those of pigs and poultry (Figure 4.2).

Livestock figures over the last ten years show a large increase, except those for goats. According to the Shunyi governments website (<http://english.bjshy.gov.cn/> October 20, 2003), there are 188 pig farms (including 50 farms annually producing over 10,000 pigs), 37 poultry farms (annually producing over 500,000 broilers, 8 of them over 1,000,000). There are 23 beef cattle farms producing more than 1,000 heads per year, and 3 sheep farms annually producing over 10,000 animals. There are also 47 cow-raising villages with a total capacity of 13,200 head and 31 sheep raising villages with the capacity of annually raising 54,600 breeding ewes and supplying 200,000 sheep to the market. Besides, there are a number of slaughterhouses and meat packing factories: nine for pork, two for broilers, five for ducks, and one for sheep. The area for aquatic products has reached 30,000 mu (2000 ha), with an output of 16 million kg.

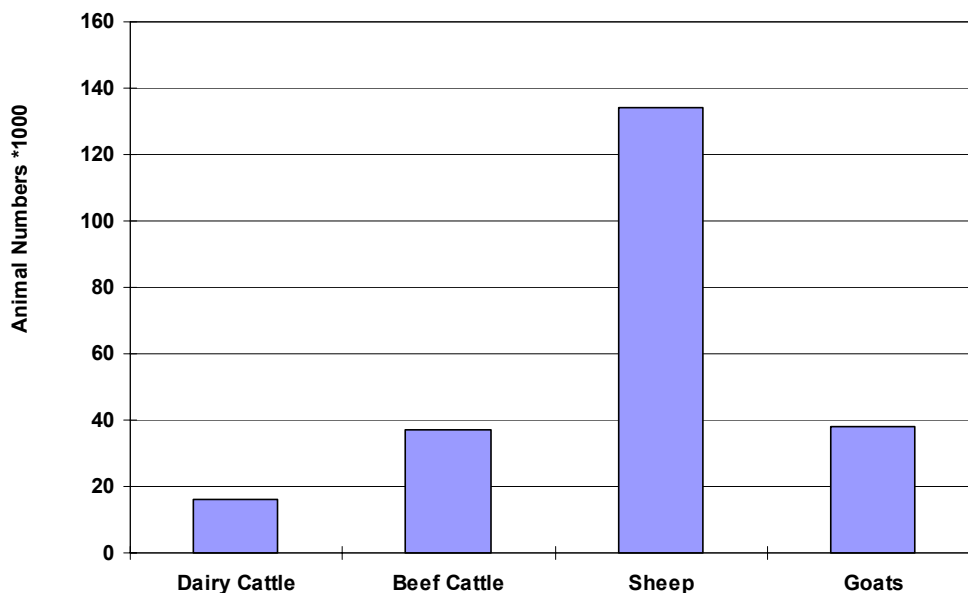


Fig. 4.1. Overview of major ruminating animals in Shunyi in 2003

<sup>1)</sup> A major part of this information was provided by Miss Yang Shuming, who is in charge of the Shunyi Husbandry Service Centre

### ***Dairy cattle***

There are in Shunyi about 15,800 dairy cattle (2002), which are amongst others kept on 50 associative farms (rearing plots) with more than 200 cows each. Both from these holdings and from smaller ones, milk is also delivered for the market by the farms with a low number of dairy cattle. Dairy cows are mainly kept in four townships: Mapo, having 1450 farms of which 7 farms with about 100 animals each; Da Sungezhuang, with 4 farms with over 1,000 head; Beiwu, with 1 specialised farm and 1 association with in total 3 000 head; and Lisui, having 2 farms with 500 head each. In the associative farms, the faeces are collected manually, but urine is voided in the yard.

### ***Beef cattle***

There are about 37,000 beef cattle in Shunyi (2002) kept amongst others on eight farms with more than 1,000 head sold per year. Beef cattle are mainly in three townships: Bei Xiao Ying, having one farm with 1,000 head; Nancai, having one farm with 600 to 700 animals; and Zhao Quan Ying, 1 farm with 700 head. In total about 87,000 head are sold for per year. Most beef cattle are kept in feedlots. Faeces from beef cattle are collected manually and urine is lost in the yard.

### ***Sheep and goats***

There are in total 134,000 sheep for meat production, of which 82,000 ewes. Sheep production is mainly located in 3 townships: Zhao Qun Ying, having 3 farms with advanced performance and breeding facilities; Da Sungezhuang, having 5 big farms with about 3,000 ewes each; and Lisui, having 60,000 – 70,000 breeding sheep. Sheep are housed in small paddocks. Manure from sheep is manually collected. There are about 21 farms with in total about 38,000 goats.

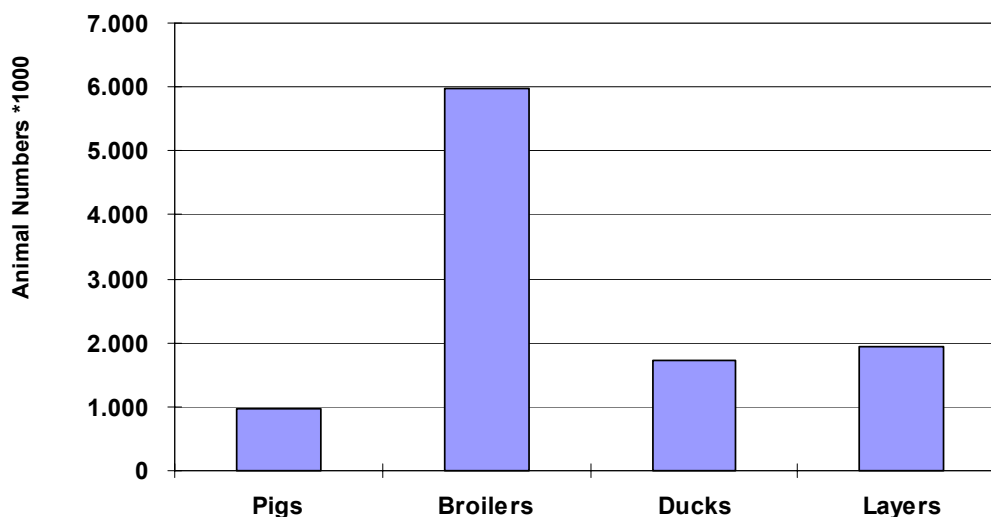


Fig. 4.2. Overview of major monogastric animals in Shunyi in 2003

### ***Pigs***

In total 1.67 million pigs are produced annually, mostly on the 141 large farms (more than 1,000 pigs per farm per year), which produce 80% of the total number of pigs. Pigs are mainly produced in four townships: Da Sungezhuang, with 10 large farms with a total of 200,000-210,000 pigs that represent 80% of the big farms. In this township, there are two associations for pig production; Zhao Qun Ying, with 170,000-180,000 pigs, mainly produced on eight large-scale farms. In this township is one association for pig production, and there are two manure processing factories; Zhang Zhen with 180,000-190,000 pigs; here are 10 large-scale farms that produce 80% of the total production; and Longwantun having 80,000 pigs and 7-8 large-scale farms; here also 80% of the pig production is from large farms. On most farms, there are both breeding sows and growing-finishing pigs.

Pigs are mostly fed diets mixed on the farm, consisting of approximately 70% maize, and furthermore fishmeal and wheat bran together with vitamins and minerals. There are three types of diets: piglet diets (pelleted; ad libitum fed), growing-finishing diets (dry feed; ad libitum fed), and breeding sow diets (offered wet and ground; restricted-fed). Lactating sows receive 5 kg of the diet (3 times daily) and pregnant sows are restrictedly fed 3.5 kg daily in three portions.

In the farm, faeces are collected separately from urine, (roughly 80% of the total). The remainder of the manure is flushed to the concrete manure pit next to the pig house. This manure is separated in a solid and a liquid phase. The solid phase is used for fertilization of the crops. The liquid manure is used for vegetables, other crops and fruit trees. In the past, each pig used 25 kg of water for drinking and flushing the faeces. However, this amount of water has been reduced to 15 kg. Manure treatment is also carried out at the farm now: first separation, then anaerobic and finally aerobic treatment. The treated manure can attain the second grade of the national water quality standard. There are four manure-processing factories in Shunyi, the largest one in Yang township, with a capacity of 300 tons per day for predominantly pig manure.

### ***Broilers***

Per year, in total over 38 million broilers are produced (Table 4.1). There are 21 large broiler farms each producing more than 0.5 million broilers annually, which cover 50% of the total broiler production. In addition, there are a number of smaller broiler farms, but no individual smallholder farms. Broiler production is mainly located in Da Sungezhuang township with 33% and Zhangzhen township with 25% of the total production. Broiler droppings are collected manually.

*Table 4.1 Distribution and number of broilers produced in (Shunyi 2002)*

Broilers		million birds
Total number slaughtered		38.42
Distribution (main townships)	Yangzhen	4.5
	Liqiao	3.0
	Da Sungezhuang	4.0
	Zhangzhen	7.1
	Zhaoquanying	6.2

### ***Layers***

In total, 1.9 million layers are kept in Shunyi. There are six big farms (more than 55 000 hens) covering about one third. The most important township for layers is Mulin. Droppings fall on the belt and are occasionally transported outside the henhouse.

### ***Ducks***

Per year, 14.5 million meat ducks are produced, of which 60% in Bei Xiao Ying township. There are 10 enterprises with special equipment for processing the ducks. Droppings of ducks are manually collected from the land, and are either used for fertilizing own land or sold outside.

## **4.2 Animal production and water quality**

Pig production is one of the major causes of water pollution. In this context, it should be kept in mind that 70% of the feed for animals is bought from outside Shunyi. Shunyi Agricultural Committee wants to reduce the pollution associated with pig production by:

1. manure processing: separation of manure into a solid and liquid phase and fermentation of the manure on the farm;
2. industrial manure processing;
3. improving the genetic potential of the pigs, optimizing nutrition and management;
4. reducing the number of pigs and stimulating ruminant production.

A reduction in the total number of animals is foreseen, especially around the rivers. The major reason is that in the year 2008 part of the Olympic Games will be held in the area around the river north of Shunyi. An increasing number of livestock is expected in the area with mainly grass cultivation.

## 5 Farming systems at village level

### 5.1 Introduction

As part of the Rapid Diagnostic Appraisal three townships in Shunyi (Figure 5.1) were visited to meet with local leaders and farmers, to discuss with them the farming structure in the respective township or village, the existing farming systems, the relations with water resources and water quality, and their view on future developments. Each of these three days, the fieldwork started with a meeting with officials of the local government, whereupon several farmers were visited. During the official meetings and the farm visits, the research group split up in three or four teams that interviewed different officials or farmers. The results of the interviews are summarized in short reports, which are included in the following sections.

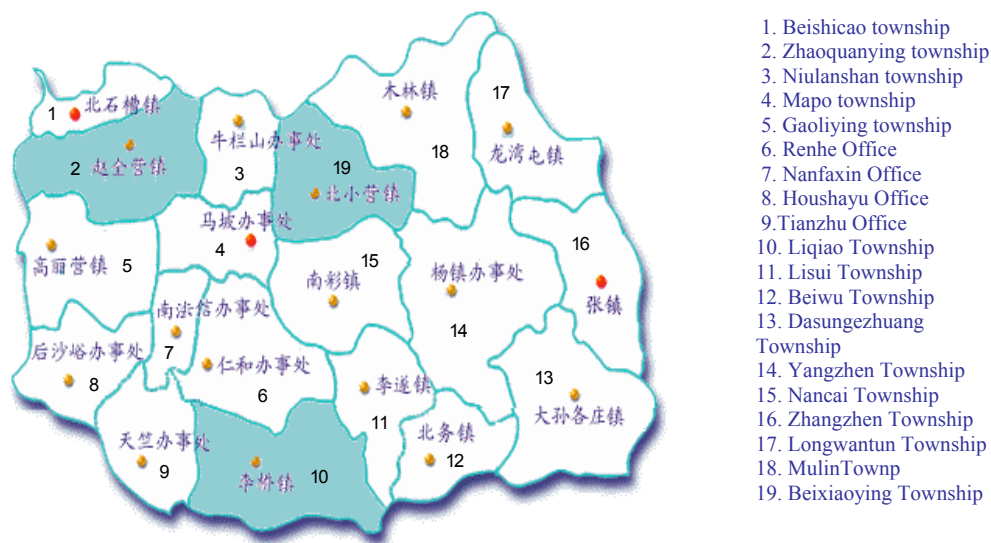


Figure 5.1 Townships in Shunyi visited during the RDA

### 5.2 Zhaoquanying Township (November 6, 2003)

#### 5.2.1 General information on Beilongzhong Village

*Interview with Mr. Yan Zhongshen, Vice director of Beilongzhong Village*

*Place: Beilongzhong Village*

*Time: morning, 2003-11-6*

*Interviewers: Lu Changbe, Hu Yanxia, Yu Bohua*

Beilongzhong is the key village of Zhaoquanying Township, and located in the northwestern part of Shunyi district, with 500 households and a population of 1,500. It has a farmland area of 4,800 mu, allocated to four farming systems: 1,000 mu for

ecological mixed pig-vegetable farming, 3,000 mu for ornamental trees (tree nursery), 500 mu for asparagus (*Asparagus officinalis*), and 300 mu for open field vegetables. Large-scale pig rearing and the production of ornamental trees are the most important agricultural activities in this village. The pig industry is the major source of the village's income, targeted at producing piglets and pork. The breeding piglet farm, well known in North China, can supply about 25,000 piglets to the market per year, representing a net income of 6 million Yuan. The piglets include four breeds that have all been introduced from abroad: Great Yorkshire, Piétrain, Duroc and French Landrace.

### ***Ecological mixed pig-vegetable farms***

The ecological pig-vegetable mixed farms were designed with support of researchers from China Agricultural University. Construction started in 1998, and the system was put in operation in 2000. The raising plots comprise 304 units, each with an area of 3 mu and managed by an individual household. Each unit comprises two parts, i.e., a pigsty with a capacity of raising 300 pigs, and a field for growing vegetables (normally Chinese cabbage). In each vegetable field, a manure pit is built for collecting faeces and urine, and for generating biogas, that is used for cooking. The residues are applied to the vegetable fields. A large part of the faeces is manually collected in the pigsty and is used for producing organic fertilizers in the village factory. The village supplies the households with training, extension services and marketing free of charge. Each year, the farm units produce about 80,000 head of slaughter pigs. Buyers come to the farm to collect them.



The piglet raising industry was set up in 1994, and is managed as a company. As a model agricultural company in Beijing, it comprises a complete system and is well managed. A sewage-processing factory was built for processing the waste of faeces and urine from the piglet farm and for generating biogas, with a total investment of about 8 million Yuan. At present, the generated biogas can supply about 40% of the village households' demand for energy for cooking. The residues are used for producing organic fertilizers in the village plant.

### ***The biogas installation***

The investment in the station is 800,000 RMB, and the unit can provide enough biogas for 80 households. The pig-breeding unit produces about 50 thousand tons of polluted water annually, from 20,000 pigs. The processing capacity of the station is 150 m<sup>3</sup> per day. Before disposal, the polluted water has a Chemical Oxygen Demand (COD) of 700, Biological Oxygen Demand (BOD) of 5000, and SS of 4000. Following purification, the water has a COD 300, BOD 150 and SS of 200. Annually, the station provides 225,000 m<sup>3</sup> biogas, 40,000 m<sup>3</sup> liquid and 400 ton organic manure.



### ***The vegetable processing unit***

The factory that the research team visited was built in 2003; its processing capacity is 10,000 kg/day, with 30 employees. The vegetables are supplied from about 1,000 local farmers. One of the questions of the RDA team is, whether this approach is also feasible for other villages, because this ‘model village’ requires high investments.

## **5.2.2 Farming system 1: Ecological mixed pig-vegetable farm**

*Interview with: Mr. Wang Xi-gui, married, with two children.*

*Place: Bailangzhong, Zhaoquanying township*

*Time: morning, 2003-11-6*

*Interviewers: Chai Weizhong, Zhu Wanbin and Chen Junhong*

***Farm:*** The family shifted from crop farming to pig rearing in 1995. There were 150 pigs in the unit: 15 breeding sows and 135 growing-finishing pigs: 20 pigs of 80 kg, 80 pigs of 40 kg and 20 pigs of 25 kg live weight. Weaning and finishing weights for the pigs were 15 and 90-100 kg, respectively. Annual sales for the market are about 300 head. Gestation of the sows is evenly distributed over the 12 months of the year, with two litters per month. Each sow with a farrowing rate of 2.2, produces about 22.6 piglets annually. The total period from birth to final weight is 155 days, and total feed consumption 550 kg per head/year, i.e. 1.5 kg per day. Average daily weight gain for the growing pigs was 650-700 g, representing a feed conversion ratio (1500/650) of 2.7.

***Feed:*** The growing-finishing pigs were fed three times daily (five times daily for the weaned piglets). The complete diet for the piglets was bought from the feed factory, while the farmer himself prepared the diets for the pigs from 25 kg onwards, with raw materials also from the feed factory. The finishing diet was composed of 60% maize, 30% wheat bran and 10% concentrates (protein, minerals and vitamins). During the gestation period of 115 days, sows were given 2.25-2.50 kg of feed per head per day.

***Manure:*** The faeces are first collected for biogas production, and the remainder of the excreta is drained to a ditch and transported to the biogas pond. The material from the pond is separated into solid and liquid parts. The liquid part is used for irrigation, and the solid material as organic fertilizer. Because of practicing the ‘ecological farming unit system’ and manure processing, environmental pollution has strongly decreased.

Labour: The couple works mainly on the pig farm and sometimes their children help.

Economy: The family started pig rearing in 1995 with an initial output of 20-30 pigs per year, generating a net income of 100 Yuan. In the year 2000, the family moved pig rearing to the ecologic farming unit and expanded the operation to an output of 350 head in 2003. Pigs are sold to both the slaughterhouse and to traders (50:50), with a net income of 150 Yuan per head, which is the main source of income of the family (90%).

The Chinese cabbage fetches about 0.2 Yuan/kg; with a total production of 50,000-75,000 kg/mu, the total income from the vegetable field is about 1,000-1,500 Yuan/mu.

### 5.2.3 Farming system 2: Geese farm

*Interviewee:* Mr. Yan-Xi-Qi, manager of the centre.

*Place:* Bailangzhong village, Zhaoquanying township

*Time interview:* morning, 2003-11-6

*Interviewers:* Chai Weizhong, Chen Junhong, Qiu Huajiao

Farm: The geese farm is located in the centre of the Beilangzhong flower and tree nursery in Bailangzhong village, Zhaoquanying township. This nursery occupies a total area of 1,800 mu, of which 20 mu is used as geese rearing plot, 500 mu for the purple asparagus plantation, 6 mu for greenhouses and the rest for ornamental seedlings and flowers. The geese farm contributes roughly 35% and the tree and flower plantation 65% to the profit of the centre.

The farm has a total population of 3,000 geese, consisting of 2,000 females and 1,000 males, of which 300 are breeding birds. A total of 3,000 birds are bred annually, of which 1,000 are sold. Geese are herbivorous waterfowls. There are three genetic breeds: red, grey and bean geese. In February, the geese start to lay eggs. Each goose produces 20-25 eggs on the farm, while in nature they only lay 6-7 eggs. Each group of one male and two females can produce 40 eggs and 32 young birds (80% hatching rate). Hatching starts in March and is completed in April. In July, the young ones turn into juvenile geese, weighing 2-3 kg, and they complete sexual maturation from August to the following January. They then start a new reproduction cycle, while in a natural environment it takes one year to reach maturity.

Feed: The green feed from maize, sorghum, weeds and silage is ground and mixed (60:40) with concentrates (composed of maize, bean meal, wheat bran, additives and shell-powder) offered at an average rate of 0.15-0.2 kg/d for a goose from birth to maturation. In addition, fresh residues of purple asparagus and alfalfa can be directly fed to geese, while the remainder is dried and ensiled for later use.

Excreta: droppings are collected by hand for biogas production and partly for making organic fertilizer.



Labour: Three persons work on the geese farming, one technician and two workers. The technician earns a salary of 1,500 RMB/month, the workers each 650 RMB/month.

Economic analysis: The 32 young geese grow up to a mature body weight of ca. 5 kg and can be sold at a price of 20 RMB per kg (i.e. 3200 RMB in total). The feeding costs consist of 386 RMB for the breeder birds (128.6 x 3) and 531 RMB for the 32 young birds (including health care); hence net income from the group is 2,283 RMB (3,200 – 531 - 385), i.e. 761 RMB per breeding geese, not including labour costs. At present, a breeding goose can be sold at a price of 300 RMB and 40 RMB per kg body weight.

Future: This geese rearing farm is the only one in Shunyi, and is in its initial stage to gain experience and knowledge on the farming system. In view of its possible contribution to the wild geese population and as a human food resource and the wide use of geese products, geese farming could have a very bright future, considering its profitability as an ecological farming system.

### 5.2.4 Farming system 3: Purple asparagus

*Place:* Bailangzhong village

Farm: It is the largest production unit of Asparagus (*Asparagus officinalis*) in Shunyi, with an area of 500 mu, run by a commercial company that rents the field from the village committee at a price of 150-200 RMB/mu per year. The former farmers are now rearing pigs.

Planting information: 1,200 plants per mu; the crop attains full productivity from the third year after and is expected to remain productive for about 15-20 years; it can be harvested two times per year, namely April –June and August –October. Pest control is done manually. The selenium (an essential micro-nutrient in human nutrition) content of purple asparagus is about 27% higher than of most common vegetables.

Inputs: imported from America, planting material 2,000 RMB/mu, manure 160-200 RMB/mu, water 80-120 m<sup>3</sup>/mu/year, labour 15-20 RMB/day/person; power: 15-20 RMB/mu.

Revenues: Gross revenue: 20 RMB/kg, yield: 1,000 kg/mu, resulting in total gross revenues of about 20,000 RMB/mu. Net income: 4,000-5,000 RMB/mu.



### **5.2.5 Farming system 4: Alfalfa**

*Place: Bailangzhong village*

Grown for sale as raw material for animal feed factory. Productive lifetime about 5 years. Manure: 5,000 kg/mu, fertilizer: 15 kg/mu. Average net income per mu is 350 RMB.

### **5.2.6 Farming system 5: Protected rose production**

*Interviewees: several workers*

*Place: Bailangzhong village, Zhao-quan-ying township*

*Time: morning, 2003-11-6*

*Interviewers: Lu Changhe, Guo Shumin, Ben Kamphuis,*

Following the integrated pig-vegetables farm, we visited a greenhouse complex, partly abandoned. The complex consisted of 20 Chinese "sunlight" greenhouses. About one third of the greenhouses were abandoned, only remnants of the walls and in some cases the roof constructions were left. In the functioning greenhouses, the farmers grow roses. All these greenhouses had new plastic; probably the restoration is a joint action of a few farmers. The people we met could not tell much about the complex. They were workers from elsewhere. One farmer's wife told that three greenhouses were rented out and that the operation had just started. The entrepreneurs originated from another province and saw opportunities in growing roses. They pay 200/300 RMB rent to the village that owns the greenhouses, and have invested in renovating the greenhouses and the rose cuttings. The roses in the different greenhouses, planted in three double rows per greenhouse, with furrow irrigation, were in different growth stages, from just planted till flowering. Further investigation is required to establish whether this activity is sustainable/more profitable than growing vegetables.

## **5.3 Liqiao Township (November 7, 2003)**

### **5.3.1 General information on Liqiao Township**

The township is located just south of Shunyi city, close to the airport. The total area of Liqiao township is 76 km<sup>2</sup>, which can be divided into two parts: the former Liqiao township and the former Yanhe township. In the former Liqiao township industries and residential estates are concentrated, while Yanhe township is a centre for the cultivation of special vegetables, melons and fruits. The area of special vegetables and melons is 1,200 mu, and that of special fruits is 5,000 mu. The total agricultural area is 49,458 mu (3,297 ha). The current land use pattern in the township has been approved by the Beijing Municipal Administrative Bureau of State Land Resources and Housing in 1998. The total population of Liqiao township is 29,440, representing a labour force of about 13,000, of which 4,000 are employed in agriculture. Within

the township, vegetable production is by far the most important agricultural activity, with a labour force of 3,000.

Two major areas for vegetable production can be distinguished, in the northeast, where a commercial company, renting land from a village, has set up a vegetable production unit, in addition to a unit run by a farmers' association, and in the southeast, where mainly smallholder farmers are active. In the southeast, where many smallholder vegetable farms are located, serious problems have been reported with respect to nitrate pollution, concentrations in the groundwater far exceeding the WHO standard (50 mg nitrate/l, equivalent to 11.3 mg nitrogen/l). The impression is that the high application rates of animal (mainly pig and cattle) manure on these relatively sandy soils are the reason for these pollution problems. Further research is needed.

The 'high-tech' enterprises in the northeast, covering about 2,000 mu, grow 'special' vegetables and 'special' sweet melon, aiming at specific niches in the market; they have concluded contracts with restaurants in Beijing City. In 1994, Liqiao introduced a new type of pear from Taiwan. Now, its total area is 120,000 mu, with 600 households involved. The products are mainly sold to supermarkets and hotels, and also exported to Hong Kong and Southeast Asia. In 2002, the company has been granted the ISO9001 and UKAS (UK) certificates.

The township leadership is encouraging environmentally friendly vegetable production systems. Two certification systems are operational:

- '*Green food*'-label, issued by the Ministry of Agriculture; enforcement by the Ministry of Agriculture, through at least annual checks. Currently two companies certified.
- '*Safe-food*'-label, issued by the Municipal Government; currently six companies certified, while two more applications are under consideration. Up to the end of 2002, a total area of 10,000 mu of vegetable producing plots has been awarded the 'Safe-food'-label. Enforcement system is not clear.

In addition, the township has set up so-called 'standardized production plots', where environmentally friendly crop management practices are demonstrated. In addition to nutrients, particularly nitrogen, application of biocides is very high in vegetable production systems. A number of very toxic agents have been banned, but enforcement of these regulations is problematic in smallholder farms selling their products mainly at local markets, due to difficulty in checking the products. Small-scale individual farmers cultivate about 10,000 mu, mainly for the 'local', including Municipal market. The smallholder farmers partly sell their products to intermediaries, for transport to the capital (complaints are heard that the position of these intermediaries is too powerful, and that they control the price), partly market the products individually on village and township markets (12 days per month).

### 5.3.2 General information on Wuzhuang village

*Interviewees: Mr. Zhang Guobui and Mr. Wu Jianjun*

*Place: Liqiao township*

*Time: 2003-11-7, morning*

*Interviewers: Hu Yanxia and Yu Bobua*

Wuzhuang village is located in the east part of Liqiao County with about 200 families or 800 persons. The farmers grow here common vegetables, such as white radish, watermelon, cucumber, Chinese watermelon, lettuce, fennel, and celery. The total area of vegetables is 400 mu. About one third is sunlight greenhouses, which were introduced in the Wuzhuang at the end of the 1980's and became more and more popular during the early 1990's. The number of sunlight greenhouses is about 100. There are 100 water wells in the village, each sufficient for irrigation of about 60 mu. The investment costs for one well are about 13,000 RMB.

The seasonal schedule of planting is as follows: seedlings of melons are planted in early March, harvest is at the end of May, and after that, common vegetables are planted in early June, in particular, leafy vegetables, such as lettuce, harvesting till the end of October. In the beginning, farmers realized a return of several hundreds RMB per household, increasing to about 10,000 in the 1990's, with a maximal of return in 1993-1994. After 1995, the return decreased, because of the decreasing market price of melons. In the middle of the 1990s, about 80% of the farmers' income originated from melon and 20% from cabbage; in 2002 these figures were 60-70% respectively 30-40%.



Flood irrigation is popular in Wuzhuang. Farmers irrigate each vegetable crop about 5 times, i.e. in total ten times annually. The total cost of using water for a sunlight greenhouse is 50 RMB per year.

### 5.3.3 Farming system 1: Vegetable Farm

*Interviewee: Mr. Wang Huisan, about fifty years old, married, with one child*

*Place: Beibe Village of Liqiao township, Shunyi*

*Time: 2003-11-7 morning*

*Interviewers: Zhu Wanbin, Chen Junhong, Herman van Keulen*

The village: Most inhabitants are vegetable farmers, with five mu for each farm on average, mostly managed by the family. The largest farm is about eight mu. Generally, low doses of chemical fertilizers are used in this village; the highest level is 10 kg compound fertilizer per mu for the cultivation of one crop.

The farmer: As worker in the factory, he had a salary of 5,000 - 6,000 RMB per year. After bankruptcy of the factory, he rented the farm and started growing vegetables.

The farm: Wang's farm covers an area of three mu, including four plastic tunnels and two sunlight greenhouses. The farm started in 1992; the unit with the plastic shed started in 1993, and earnings increased with increasing number of greenhouses. Now net income is about 20,000 RMB per year. During the recent snowfall, in the night of November 6/7 two plastic tunnels have been damaged. Many greenhouses in the area were damaged, and at noon, most of the greenhouses were still (partly) covered with snow.

Cropping system: All types of vegetables are cultivated; the actual choice in a given season depends on the market. Sweet melon, cucumber, tomato, leek, etc. are cultivated in spring, and eggplant, spinach, celery, a type of cabbage, lettuce, etc. in winter. Generally, lettuce and celery generate half of the income.

Fertilizer: Mainly organic fertilizer is used, mostly in the form of pig manure. Total cost of organic fertilizers is about 2,000 RMB per year. Chemical fertilizers (mainly compound fertilizers) cost about 700 RMB per year.

Other chemicals: Pesticides and herbicides are hardly used, but if so are mainly applied in August and September; total costs are about 60-70 RMB per year.

Irrigation: Flood irrigation, 5-6 times per year, each time 100 RMB, mainly for power cost, no payment for water. Groundwater, however, is over-used; the pump well is about 100 m deep.

Marketing: Directly to market, 10% by themselves and 90% to intermediaries.

Future: No specific plans, just has to repair the damaged shed and greenhouse.

### **5.3.4 Farming system 2: Vegetable Farm**

*Interviewee: Mr. Li Bing-Hu, a household comprising husband and wife*

*Place: Yanhe village, Liqiao township*

*Time: 7 November 2003, morning*

*Interviewer: Chai Weizhong*

The farm: The holding consists of 15 mu of land, of which one mu for housing, 4 mu for 4 'cold' greenhouses, 1 mu for one 'warm' greenhouse, and 8-9 mu for outdoor horticulture. About 94% of the 15 mu is used for horticulture and ca. 6% for the homestead. This is a medium-sized farm, a common enterprise in Yanhe village.

Management general: With regard to the greenhouse rotation pattern, 4-5 mu is used for Chinese cabbage, 2 mu for tomatoes, 2 mu for cucumbers, 2 mu for peppers and fresh beanstalks, 0.6-0.8 mu for sweet maize and potherb mustard, 4-5 mu for water

melons and 1 mu for other vegetables, such as celery, fennel, caraway, cauliflower, etc. The family purchases fertilizers and pesticides. Organic compound fertilizer is used as basal fertilizer for all vegetable land. A small amount of chemical fertilizer is used during the seedling stages. Small doses of toxic pesticides are applied.

Management of the 'cold' greenhouse: Cucumbers and tomatoes were planted in the cold greenhouse for the first time during the last ten days of February. Harvest started in April for the cucumbers and for the tomatoes in May. Harvest was completed in the middle of June. Seedlings of cucumbers and tomatoes were grown in the warm greenhouse in May and transplanted in the cold greenhouse in the last weeks of June for a second crop. In August, harvest of cucumbers started and in September that of tomatoes, which was completed in October. Chinese cabbage was planted in some of the cold greenhouses in August and harvested completely in November. Preparation and maintenance of the cold greenhouses was carried out from December to February.

Management of the heated greenhouse: The heated greenhouse was mainly used for growing seedlings for the cold greenhouses from December to February, and for the production of sweet melon and bell pepper for the remainder of the time. Sweet melon cultivation started in February and was completed in the middle of May. Cultivation of bell pepper started in June and continued till the end of November. In August, 400 broilers were raised in one fifth of the warm greenhouse and they were sold in January. Outdoors mostly watermelon was produced from March until June.

Marketing: Vegetable cultivation is the only source of family income, most of which was generated from tomatoes and cucumbers. The family sold the vegetables to a middleman and sometimes to wholesale markets.

Government support: The family constructed a well for vegetable irrigation and is charged for the electricity used. The township organizes technical training lectures once or twice each year. The family hopes that the government will organize the vegetable quality evaluation and issue licenses for high quality products and initiate subsidy measures, and will control vegetable seed quality as well.



### 5.3.5 Farming system 3: Vegetable farm

*Interviewee: Ma Zhong*

*Place: Beibe Village of Liqiao township, Shunyi*

*Time: 2003-11-7, morning*

*Interviewer: Qiu Huajiao*

General: The holding is seven mu, for a family of three persons. The son is now working independently. The vegetables are sold directly from the field to traders.

#### Cropping pattern

March: watermelon, 6 mu; June- August: tomatoes.

#### Economic analysis

Sunlight greenhouse: 2,000 RMB/mu

Heated greenhouse: 15-20,000 RMB/mu.

Pig manure: 5,000 RMB/year.

Power fee: 100 RMB/mu.

Water: 50-60 m<sup>3</sup>/ mu.

Labour: Two or three workers (from other provinces) are hired for 3 to 7 months, 500 RMB/person/month.

Taxes: 100 RMB/mu.

Net income: 5,000 RMB/mu.

#### Developments:

The farmer told that water pollution is not serious, but that the quantity is declining and that the groundwater level is now below 30 m. Moreover, a land reform is planned that will reduce the available land to 1.1 mu per person, at the same time, the taxes will be reduced to 50 RMB per mu per year. He also said that he did not want to grow new varieties and/or use new technologies, because he now feels good and does not want to make too many efforts.

### 5.3.6 Farming system 4: Pig farm

*Interviewee: Mr. Cao Baolu, 46 years old, married and one child*

*Place: Touerying Village of Liqiao township, Shunyi*

*Time: 2003-11-7, morning*

*Interviewers: Zhu Wanbin, Chen Junhong, Age Jongbloed*

Village: The farm is located in Touerying Village of Liqiao township, Shunyi. Most villagers work at factories, so few depend on agriculture for their income. Each household basically breeds some pigs, so that the total number of pigs is around 2,000 in the whole village.

The farm: Before 2000, Cao worked in a feedstuff factory, with a salary of 7,000-8,000 RMB/year. In 2000, Cao came to manage the pig farm, which was established in 1988, bought 120 reproductive sows, bred piglets and raised them. Cao's pig farm is the largest in the village, with an area of 10 mu (including 12 piggeries); about half a mu is vegetable land, where cucumbers, tomatoes, beans, Chinese cabbage, turnips, etc. are cultivated. These vegetables are all for the farm workers and the farmer. The total number of animals at the farm is about 1,200, and the output of pigs is 1,400-1,500 per year. Each sow produces 24 piglets, in about two farrows per year. Total herd size was 800 in 2001, but 1,200 in 2003 including 200 sows, 200 small piglets and 700 young pigs. The farm will be closed before 2008, because Cao will retire.

Labour: Five workers are hired from other provinces, and their salary is 550 RMB/month.

Animal nutrition: The feed is mixed at the farm, and consists of corn (60%), leguminous species (15%), bran (15%), rapeseed meal extracted (2%), minerals and other (7%), with 1% concentrate feed, which is of high quality. Average feed conversion ratio is 3.7:1.

Manure disposal: About 80% of the faeces are collected and sold to vegetable farmers nearby; the remainder together with urine is flushed into a lagoon which is 50 x 10 x 2 m (depth), without any watertight structure. The farmer had developed a water-saving method to clean the pig house, so that he collected only 7.5 kg of manure (liquid and solid) per pig a day, while this was 25 kg following the traditional method.

Economy: The pigs are sold to the slaughterhouse (50%) and to intermediaries (50%). Since 2001, the income of the pig farm is about 70,000 – 80,000 RMB per year (the farmer's income is about 50,000 RMB per year and his wife's income is around 20,000 RMB per year).

### **5.3.7 Farming system 5: Vegetable farm**

*Interviewee: Mr. Wang Baosheng*

*Place: Beibe village of Liqiao township*

*Date: 7 November afternoon*

*Interviewers: Guo Shumin and Qiu Huajiao*

General information and history: From 1985-1988, the farmer rented 20 mu where he planted wheat and corn, with a net income of 100-150 RMB per mu. Then from 1988, he rented 170 mu for vegetables (with a subsidy of 300 RMB per mu from the government), while now the area has been reduced to 13 mu, which are all under vegetable greenhouses.

Cropping pattern: He is planting vegetables in a fixed rotation. He is cultivating leafy vegetables in spring, which cover 1/3 of the area, while melon occupies about half of



the area. In summer, all common vegetables are grown, in winter, lettuce, and some other special vegetables.

Inputs and outputs:

- The cost of greenhouses: 15,000-20,000 RMB per mu.
- Manure: 600-800 RMB per mu per year; mainly pig faeces from other districts.
- Fertilizers: compound fertilizers (15% N, 15% P, 15% K); 200 RMB per mu per year.
- Seedlings: 30 RMB per mu.
- Pesticides: 10 RMB per mu.
- Power: 200 RMB per year.
- Water: 400 m<sup>3</sup> per mu per year.
- Labour: 500 RMB/month/person, about 1/4 of gross income.
- Gross income: 15,000 RMB/mu
- Net income: 8,000-10,000 RMB/mu, about 60% of gross income.
- Expenses for living: 15-20 thousand RMB per year, it accounts for 1/4 of the consumption.

Experiences and problems:

The farmer investigated many other places in China on his own account to get to know the market. Opportunities: Planting vegetables out-of-season, planting inter-seasonal.

Problems, for vegetable production:

1. Lack of technical information.
2. Lack of technology.
3. No special government office to support them.

Marketing:

A middleman collects vegetables from the fields. He usually buys 250 kg/day, and his net income is 20 thousand RMB per year.



## 5.4 Beixiaoying Township (November 8, 2003)

### 5.4.1 General Information on Beixiaoying Township

*Interviewee: Governor of Beixiaoying Township*

*Place: Beixiaoying Township*

*Time: 2003, November 8, morning*

*Interviewers: Herman van Keulen, Lu Changbe, Guo Shemin*

The township is located in the north of Shunyi district. It has a total population of 27 584 and a total labour force of 10764, of which 28% (2 921) is employed in agriculture. The land use is shown in Figure 5.2.

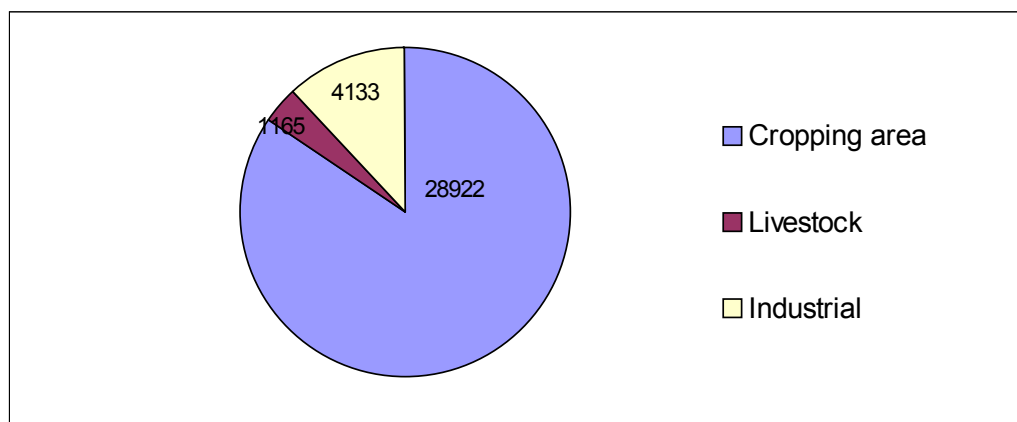


Fig. 5.2. Area (mu) used for different activities in Beixiaoying Township

The major environmental issue of importance for the township is that of water availability. The township is the site for extraction of the annual two Mm<sup>3</sup> water to be delivered from Shunyi district to Beijing. In the last year, the groundwater table depth has increased with between 5 and 10 m, resulting in drying up of the wells of the local inhabitants.

#### ***Agricultural activities***

The township is the centre of diverse agricultural activities, mainly carried out by smallholder (5-6 mu) enterprises, including:

- open-field vegetables
- fruit trees: apple, peach, pear (and grapes)
- fish ponds, including crab production
- tree nurseries
- alfalfa: about 5000 mu, which is sold outside the town for feed production
- wheat/maize rotation
- sheep
- pigs (1-2 sows per household for piglet production; household waste converters)
- sheep
- dairy/beef cattle
- chicken
- ducks

Although the agricultural activities in the township are very divers (See Figure 5.3 for cropping pattern), it can truly be called "DUCK VILLAGE", as it produces 8.5 million ducks annually. A duck farmers association has recently been established, organizing the approximately 1,400 households and 10 (private) companies involved in duck production in the township. The association has the leadership in an

integrated supply chain for ducks, covering the complete process from egg to slaughtered animals.

***Town planning***

The town has been designated as one of 33 key small towns to be expanded in the Greater Beijing area. According to the plans, the population should increase to 50 – 150,000 in the not too distant future. The consequences for the agricultural sector in the town have not really been analyzed, but it is envisaged to establish also associations for other commodities, similar to the duck farmers association. It is likely that agricultural activities, currently taking place within the town boundaries will have to be moved to the outskirts. Planning for such re-location is the responsibility of the Municipal Planning Office, whose final plan might be ready soon.

***Social aspect***

When farmers are forced to leave their land following designation as residential area, they are compensated according to a government scheme, comprising two components, (i) membership of a public fund that provides social and health insurance, etc., (ii) direct payment in the form of a lifetime monthly allowance. The current regulation provides for a 30/70-partitioning of the proceeds (not quite clear what these proceeds really represent) between categories (i) and (ii). However, the issue is under hot debate at the moment.

***Challenges for the future***

The governor ends the interview by declaring that the main challenges are, (i) promoting an increase in income for the population, (ii) creating employment for the population.

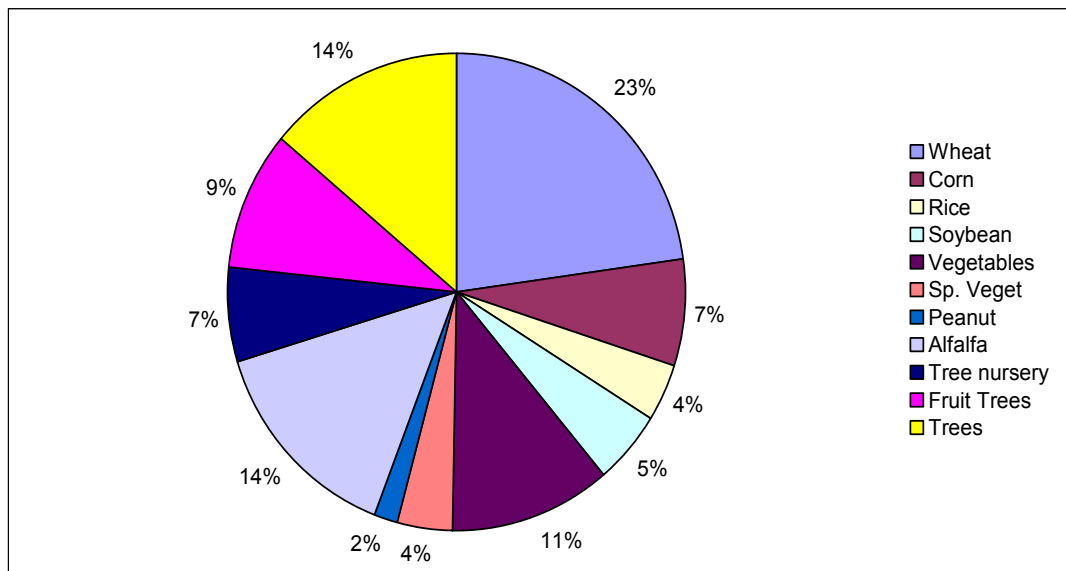


Figure 5.3. Cropping pattern in Beixiaoying Township (from Wheat (23%) top right clock-wise to trees (14%) top left)

#### 5.4.2 Duck supply chain Beixiaoying Township

The duck supply to Beijing restaurants from Beixiaoying Township is organized according to an integrated supply chain covering the complete chain from egg production to the delivery of the final product to the consumer under control of a company in Beixiaoying township.

Duck breeding stock, kept under favourable conditions at the central premises of the organization, produces eggs. These are collected and in batches of 3,000 entered in the hatchery, producing one-day ducklings after a hatching period of 28 days. According to the received information, hatching percentage exceeds 95. The young ducklings are then transferred to fattening units, mainly smallholder farms. There are hundreds of these duck-fattening farms in the village. Apparently, several age classes are present at a particular fattening unit at the same time. Fattening period is about 40 days, during which the animals are fed concentrate feed. Forced feeding is practiced during the last ten days of the fattening period.

Feed supply is also organized through the central company. Feed rations are produced at local level. No information is available on veterinary care.

The finished ducks are delivered to the slaughterhouse at the central premises, with a slaughtering capacity of 3,000 animals per day. In the slaughterhouse, the animals are cleaned, and sorted in weight classes. These batches are delivered the same day to the clients, restaurants in Beijing.

For the smallholder farmers, two systems to be involved in the chain are available:

1. they can buy the ducklings from the central unit and after fattening, sell the finished animals to that unit for the market price at that moment;
2. alternatively, they can opt for a fixed payment for taking care of the animals, the risk being carried by the central unit.



### 5.4.3 Farming system 1: Duck farm

*Interviewee: Mr. Yang Debao*

*Place: Fenghua village*

*Time: Saturday, November 08, 2003*

*Interviewer: Yu Bobua*

General: Fenghua Duck farm was built in 1972. At that time, it could breed thousands of ducks, especially for individual farmers and realized partly a cooperative production after 1984. Its production comprised 100,000 ducks in 1985, 1 million in 1990, and 1.7 million in 2002.

Farm: Fenghua Duck farm is one of the four leading private duck farms of Beixiaoying township. It owns about 50 million RMB real estate and employs about 260 workers. It buys 1.7 million adult ducks per year and at the same time it breeds about 0.1 million ducks per year for their own. The facility consists of several main buildings, namely a laying duck house, an aquatic plot for breeders, a fodder preparing sub-industry, wastewater disposal, and a slaughterhouse. It can supply fodder, one-day old ducklings, technical knowledge, disease prevention, and purchase ducks. Ducks grows faster in spring and autumn than in summer and winter, and thus at lower costs.

Feed: During the different phases of the growth of ducks, different types of feed are supplied. The main components of the feed are corn, fishmeal, wheat bran, etc... It costs 28 days to hatch, and 33 days for a duck to reach slaughter weight. Every 2.3-2.8 kg fodder is converted into 1 kg of meat. The price of the feed is 0.8 RMB/kg and that of a slaughter duck more than 8 RMB/kg.

Manure: The duck farm is equipped with wastewater equipment and the water is re-used as circulating water in the cooling tower and toilet.

Economy: In winter, ducks can easily catch a cold and the veterinary costs are 0.2-0.3 RMB per duck. The cost of electricity is 0.4 million RMB. The farm has its own well; water was free in the past, but now the farm has to pay 10,000 RMB per year.

Problems: The main problems confronted by the duck farm are:

1. centralisation of duck breeding in order to prevent epidemics,
2. economising on water use and other costs.
3. shortage of funds for further development.
4. shortage of science and technology.
5. out-dated breeding method and equipment.

### 5.4.4 Farming system 2: Duck farm

*Interviewee: Mrs. Zou Shufen wife of a family of four*

*Place: Dong-Fu village*

*Time: 2003-11-8 morning,*

*Interviewer: Chai Weizhong*

Farm: This is a duck farm with six mu farming area. The duck farm is integrated in a production chain, where approximately every 8 days the birds are moved. In January, the first flock of 1,500 ducklings comes into the farm for the first 8 days. They are moved to a small duck area from day 8 – day 21, and next to the middle duck area from day 21 - day 33. Finally, the ducks are moved to the force-feeding area from day 33 to day 42, the final age to be sent to slaughter. In total, approximately 4,500 ducks are produced each month and 35,000 in a year (4500 x 10 months, minus some deaths, cleaning and emptying pens).

The breeding ducks of the Beijing Nan-kou breeding duck farm start laying at an age of 183 days; eggs need a 28 days' hatching period with a 4 days' cycle. Each breeding duck produces 180-210 eggs annually with 80-90% hatching rate.

Feed: Duck feeds are classified into duckling feed, middle duck feed and force-feeding feed. The first two types of feed are purchased from factories. The force-feeding feed is mixed at the farm, using 55% maize, 15% soybean meal extracted, 15% wheat bran and 10% mixed components of mineral limestone powder and pre-mixed concentrates. The amount of feed consumed is 0.5 - 1.0 kg, 5.0 - 5.5 kg and 4.0 - 4.5 kg per animal, for the duckling, middle and forced-feeding stages, respectively. The whole quantity of feed used is 9-10 kg for each duck and 350,000 kg (35 000 x 10 kg) to finish the production cycle.

The chemical composition of the duck feed is as follows:

Nutrient	g/kg of diet
Crude protein	160
Albumin amino acid	> 3.5
Crude fibre	70
Crude ash	100
Calcium	8.0 – 14.0
Phosphorus	>6.0
NaCl	3.0 – 8.0
Water	< 130

Labour: The wife works full-time on the duck farm and hires 2 - 3 persons. The family dug a well to supply duck drinking water by automatic drinking facilities. Droppings are collected manually and sold at a price of 40-50 RMB per day.

Economy: One finished duck can be sold for 26 RMB; after deducting the costs of 22 RMB, a profit of 2.5 – 3.0 RMB remains. The farm can make ca. 100,000 RMB from duck farming. Taking into account the costs of wages, water, electricity, construction and repair, the farm realizes a net income of 50,000-60,000 RMB a year. In addition, the husband earns about 10,000 RMB per year in transport.

#### 5.4.5 Farming system 3: Duck farm

*Interviewee: Mr. Wang Kebua*

*Place: Dong-Fu village*

*Date: 8 November, 2003, morning*

*Interviewer: Qiu Huajiao*

General information: Mr. Wang has a wife and two sons, one of which is in middle school. He retired from the army, and then went back home to work in agriculture. He planted 10 mu of wheat and corn from 1985, at a net income per mu of 200-300 RMB.

Farm: In 1987, he began rearing ducks. Each duck costs 0.5 RMB, and can be sold at a price of 2 RMB/kg; net income is 1 RMB/bird. He now has one mu of land for duck rearing. Currently, the price of the feed is rising, from 1.6 to 2.0 RMB/kg.

Inputs:

- Housing charge: 10,000 RMB/year
- Rearing size: 12,000 birds annually; the ducks are sold every 40 days. There are always three different, successive groups of ducks at the farm at the same time.
- Feed input: 8.5 kg/bird, price 1.6 RMB/kg.
- Birds: 4 RMB/bird.
- Water: unclear.
- Power: 200 RMB yearly.
- Land rent charge: 300 RMB/mu per year

Revenues:

Faeces are sold for 1,000 RMB per year.

Net income: 8 RMB/kg of duck, the weight of each duck is 6.5 kg, resulting in a net income 2.5 RMB/bird. Total expenditures are 10,000 RMB.

#### 5.4.6 Farming system 4: Duck farm

*Interviewee: Zhu shuqin*

*Place: Xiaohuying village*

*Date: 8 November 2003, afternoon*

*Interviewer: Ben Kamphuis, Qiu Huajiao, Yu Bobua, Hu Yanxia*

General information: the family consist of three persons, the man works in the duck rearing company we visited, his wife is responsible for duck fattening on the farm and their daughter attend the middle school. Ms Shu is engaged in this work since 1998.

Farm: The production is about 12,000 ducks per year, each month they start with a new shift of about 1000 ducks.

Inputs:

Ducklings: 2.5 RMB/bird, 3,000 RMB per year.

Feed: 150 kg/month, 1,800 kg/year, 1,350 RMB/year.

Veterinary costs: 0.5 RMB/bird, 6,000 RMB/year.

Energy: 600 RMB/year

Coal: 300 RMB/year

Land tax: 600 RMB/year for 2 mu.

The expenditures for the necessary sand in the duck shed are equal to the receipts for faeces, which are used as manure by vegetable growers.

Construction costs for duck sheds: 10,000 RMB

Total costs per year: 11,850 RMB/year

Outputs:

Net income: 2 RMB/bird, total 20,000-30,000 RMB per year

The total net income of the family, including the off-farm income is about 33,400 RMB per year

#### 5.4.7 Some impressions of Xiao Hu Ying Village

*Date: 8 November 2003*

*Ben Kamphuis*

The "duck village" we visited, Xiao Hu Ying village, was partly abandoned, the first step of total removal? There were, however, also some newly renovated houses. We talked to these people and they told us that they had a job outside agriculture, although most of them were also fattening ducks. The duck keeping system was comparable to those at the company we visited, though smaller.

Some figures of one farmer:

He kept at that moment 200 ducks; the larger part of his "duck shelter"/"stable" was empty. He fattens them in about 40 days. His year-round production is 8,000 ducks. He can keep three stocks of different ages at the same time. There is a place for the ducklings, "stables" for the following stage and a shelter for the final stage. Average stock is about 300 ducks. Average gross return per duck was 30 RMB. Net return on another farm was indicated to be two RMB per duck.



After these visits, the research team wandered around the village, and concluded that many of the inhabitants were fattening ducks. To our surprise, we came across six sunlight greenhouses that were used as duck shelter. The greenhouses were



renovated, with new plastic and reed roof coverings, so that the temperature could be regulated. The greenhouses were owned by one private farmer. Duck manure was dumped in the street, but there was also a much larger dung depot, a field of about 100 m<sup>2</sup> with manure heaps.

#### 5.4.8 Farming system 5: Beef Cattle

*Interviewee: Mr. Guojun Ding, business factory director*

*Place: Xiao Hu Ying Village of Beixiaoying Township*

*Data: November 08-2003*

*Interviewers: Guo Shimin and Age Jongbloed*

History: Before this beef farm started in 1993, there was only arable land at this site. The beef cattle farm belongs to a private company.

Beef farm: This farm operates on an area of about 400 x 200 m, which is 8 hectares of land. A substantial area was used for storage of the silage corn stalks. There were about 1,000 fattening bulls (not castrated). They were bought from the market in Inner Mongolia and transported at a body weight of about 450 kg to the site. The bulls were then already three years old. There were two major breeds: Simmentaler and Charolais, but there were also several crossbred animals. At a weight of 650 kg, the bulls were ready for slaughter, with a total production of 3,000 head per year. They were housed outside throughout the year. Part of the stalls was permanently covered, but another part was only covered in summertime. The floor was made of bricks. Part of the bulls was tied up with a rope and had direct access to a feeding trough. Others were tied up away from the feeding trough and had to be moved twice a day to the feeding trough. All the raw materials for feeding the bulls were bought from elsewhere. Growth rate was on average 1.5 kg per day and thus very high (in 4 months). Bulls were sold alive to Hong Kong (50%) and to the Chinese market.

Feed: Animals were fed a total mixed ration. This was a mix of ensiled corn stalks, fresh distiller's grains and solubles from the wine distillery factory, cotton seed cake (imported from southern China), ground corn and minerals like limestone and feed phosphates. No trace elements or vitamins were added. The feedstuffs listed except for ensiled corn stalks, were first mixed by the workers (exact ratios were not known). However, 50 g of limestone and 75 g of feed phosphate (mineral composition not known) were supplied daily to a bull of 500 kg. Subsequently, the mixture was spread over the ensiled corn stalks and mixed again. Thereafter, it was put in the troughs. In the trough, the bulls could eat as much as they wanted and here water was supplied, too. The feed did not contain anti-microbial growth promoters and injection with growth hormones was not allowed. Animals were checked on the use of these compounds when slaughtered.



Manure: The faeces of the bulls were collected and sold to farmers in the neighbourhood for the cultivation of vegetables and watermelon. A price of 15 RMB was paid for one m<sup>3</sup> of faeces. Urine, however, ran through a gutter outside the location to ditches in the arable land next to the facility and could also easily leak through the brick floor. The farmer said that he was not aware of environmental pollution caused by intensification of animal production. There was, according to him, also enough water, although he had to pay 400 RMB for water use.

Labour: There were 32 workers on this farm. The enterprise had its own veterinarian. Death rate, however, was almost zero. The major health problem was claw injuries.

Economy: Per year, 3,000 bulls were sold to the market. The costs and revenues per animal were as follows:

Purchase price of a young bull: 90 RMB; Feeding costs: 9 RMB; Veterinary costs: 15 RMB; Labour costs: 90 RMB, resulting in a net revenue of 280 RMB.

Future: The manager told that they wanted to expand, but because of shortage of land, and therefore expensive land, he expected to move elsewhere for the expansion.

## **6 Major Observations and Conclusions**

### **6.1 Introduction**

Each day, after the field visits, the team discussed the results and made the above reports. On Sunday (November 9), the research team prepared the feed back meeting that was scheduled on Monday morning (November 10). For the feedback meeting a participatory approach was followed. After a short introduction on the project, a poster session was held, followed by two presentations, one about agriculture and water and the other about land and water use developments in Shunyi. The meeting was concluded with a plenary discussion.

The aim of the poster session was to involve as much as possible participants in the discussions. The posters covered the main sectors in Shunyi: vegetables, pigs, cattle and ducks. For each sector two poster were made: one with a description of the structure, recent developments, and the environmental problems and the second one with the results of a SWOT analysis. The posters were prepared in different couples, discussed in a plenary session of the whole group and after that each couple made a poster in Chinese.

About 40 people attended the seminar: Farmers (20), Officials from Bureau of Land Layout, Public Health, Environmental Protection and Planning Committee, Science and Technology Committee of Shunyi, and researchers of China Agricultural University (CAU), Institute of Geographical Sciences and Natural Resources Research (IGSNRR), Beijing Academy of Agricultural and Forestry Sciences (BAAS), and The Netherlands.

The next section (6.2) contains a summary of the presentation by Dr. Jongbloed about "Agriculture, Environment and Water quality". The subsequent sections (6.3 to 6.6) contain the translations of the posters. The major results of the plenary discussion are given in the final section.

### **6.2 Agriculture, environment and water quality with special reference to Shunyi district**

Summary of presentation by Age W. Jongbloed during feedback meeting, November 11, 2003

#### **6.2.1 Introduction**

Livestock and crop production underwent great changes in the last decades in several countries in order to keep production costs as low as possible. This can also be seen in Shunyi district in Beijing (China). The production level per animal and the

production of animal product and crops per ha of land increased considerably. This was possible by improvement in genetic potential, better housing systems and mechanisation, the use of chemical fertilisers and pesticides, and the use of compound feeds that originate from imported feedstuffs or are transported over a long distance. Thus, many confinement systems for livestock have been developed on holdings with limited amounts of land, as well as for vegetables. However, despite the advantages of production on a large scale, these production systems may have a negative impact on the environment, especially in countries or regions with a dense animal population, e.g. in Western Europe (Jongbloed et al., 1999b). This awareness increased considerably during the last two decades and has consequences for livestock and crop production.

Environmental concerns can be divided into three categories, concerns related to the soil (accumulation of nutrients), the water (eutrophication) and the air (global warming, odours). The major objective in The Netherlands is finding an acceptable balance between the input and output of nitrogen (N) and minerals per hectare of cultivated land. Some minerals, such as phosphorus (P), copper (Cu), and zinc (Zn) accumulate in the soil and contribute via leaching and run-off to eutrophication of ground and fresh water sources. Accumulation of P in the soil, leads to eutrophication and may cause excessive growth of algae, which sometimes results in massive fish mortality (Roland et al., 1993). Because of excessive application of manure per hectare of land, also heavy metals accumulate in the top layer, with consequences for plant growth and potential risks for human and animal health (e.g., copper intoxication of sheep), and soil life (earth worms, soil microbiology). Furthermore, because of excessive application of manure and fertilisers per hectare of land, surplus precipitation and leaching, nitrate often exceeds tolerable values in fresh water (50 mg nitrate/L; EU, 1991). In case of reduced precipitation or reduced use of water, increased salinity of the soil may take place. Generally, the enrichment of the environment may lead to less biodiversity. This aspect is stressed more and more in The Netherlands.

Goal of this paper is to discuss some aspects that deal with soil and water quality. An important tool to estimate load of minerals like N, P, Cu and Zn and their uptake in crops is a nutrient balance on a farm or region. In addition, limits on application of the minerals mentioned per hectare of land in The Netherlands are presented.

### **6.2.2 Legislation on application of nitrogen and minerals**

The aims of government policies in the European Union (EU) are mainly based on the nitrate directive of the EU (1991) for the protection of water quality. Additionally each member state of the EU may impose additional legislation. As an example, a summary of the (partly proposed) Dutch legislation has been presented in Table 6.1. Table 6.1 shows clearly limitations on the amount of nutrients and heavy metals in manure that can be applied per hectare of arable land to prevent accumulation and leaching. This may mean reduced amounts of manure of a certain origin that can be

applied per hectare of land. Most of the heavy metals origin from mineral additions to the diet, e.g. cadmium in feed phosphates. This will be discussed in a next section.

*Table 6.1. Proposed maximal allowed quantity of minerals to be applied per hectare of arable land in The Netherlands*

Heavy metals	Maximal allowed quantity (g/ha)	Nutrients	Maximal allowed quantity (kg/ha)
Arsenic	30	Nitrogen	265
Cadmium	2.5	Phosphate (P <sub>2</sub> O <sub>5</sub> ) or	85
Chromium	150	Phosphorus (P)	37
Copper	150	Potassium (K <sub>2</sub> O) or	200
Mercury	1.5	Potassium (K)	166
Lead	200		
Nickel	60		
Zinc	600		

### 6.2.3 Estimation of excretion of nitrogen and minerals by livestock

Estimation of excretion of nitrogen and minerals from livestock can be calculated as the difference between dietary intake and the amounts retained in the body of the animal or in the product designated for human consumption. Also for a country as a whole or a region this can be done. For example, in The Netherlands, it was estimated that the efficiency of nitrogen input in agriculture was only 24% in the year 1985; for phosphorus, this was higher, being 37%. However, large differences can exist in the amount excreted due to factors, like animal, feed, and environment. The (compound) feed can vary considerably with regard to feedstuff composition and different mineral additions, and so its mineral content. In addition, different amounts of feed (roughage or concentrates) can be offered, which largely affect the mineral balance at farm level. Finally, environment (housing, management, health status, feeding strategy) may play an important role in the amount of minerals excreted per animal.

In general, it is rather easy to estimate the excretion per animal as such. Therefore, the basic concept for estimation of the excretion will be outlined. More details have been described by Jongbloed (2002). The example presented here is based on average conditions and production levels in The Netherlands. Calculations were done about the effect of a feed containing 15% more N and P than the average condition in The Netherlands. These higher concentrations may generally represent the practical levels of the diets offered in China. This estimation will be presented for broilers only. Additionally, it is demonstrated what excretory effects can be expected at currently applied Cu and Zn levels, and at lowered levels.

#### ***General N flow in the animal***

When considering the N flow in a growing finishing pig the following can be presented (see Figure 6.1). If the N intake is put to 100%, then approximately 20% is excreted in the faeces. This means that 80% is digested. However, due to metabolic processes and quality of the N in the diet, only 28% of the intake of N is retained in the body, while 52% is excreted in urine. Altogether, 72% of the N intake is excreted

in faeces and urine, of which the major part is in urine. This aspect needs more attention in Shunyi.

Figure 6.1. Schematic representation of the N flow in a growing-finishing pig

Intake (100%)			
Not digestible (20%)	Digestible (80%)		
	Maintenance (12%)	Not used (40%)	Animal product (28%)
Faeces (20%)	Urine (52%)		
Total Excretion (72%)			

### ***Excretion of nitrogen and minerals by broilers***

Excretion of N and minerals by broilers refers to a final weight of 2.0 kg. In the present situation, a 3-phase feeding system is applied, where 0.2, 1.9 and 1.46 kg of feed is given, respectively. The feed conversion ratio is 1.78. The amount of minerals in the body of broilers was derived from Jongbloed and Kemme (2002). Table 6.2 shows the estimated concentration of N and minerals in the feeds, the intake, retention, and excretion per broiler as well as their retention percentage. Table 6.2 shows that, as expected, large differences in excretion are obtained at the different options. It may be remarked that in broilers, the retention percentage for most nutrients is higher than for the other animal species. When the copper and zinc levels are 50 and 150 mg/kg of broiler diet, respectively, then Cu and Zn are the first limiting nutrients for the number of animals per hectare of arable land (see Tables 6.1 and 6.2). Therefore, the copper and zinc content of broiler diets should be reconsidered. Assuming that 37 million of broilers are produced in Shunyi district per year, it can be estimated that the total amount of N and P in manure will be about 3110 and 315 tons, respectively.

Table 6.2. Concentrations of nitrogen and minerals in feeds (g/kg), intake, retention and excretion for broilers at different options

Option	N		P		Cu		Zn	
	Practice NL	15% higher	Practice NL	15% higher	High	Practice NL	High	Practice NL
Diet 1 (g/kg)	34.1	39.2	6.6	7.6	0.050	0.023	0.150	0.085
Diet 2 (g/kg)	34.1	39.2	6.6	7.6	0.050	0.023	0.150	0.085
Diet 3 (g/kg)	33.6	38.6	5.6	6.4	0.050	0.023	0.150	0.085
Intake (g)	121	139	21.7	25.3	0.178	0.082	0.534	0.303
Retention (g)	54.8	54.8	8.5	8.5	0.011	0.011	0.038	0.038
Excretion (g)	65.9	83.9	13.2	16.8	0.167	0.071	0.496	0.264
Retention (%)	45	40	39	34	6	13	7	13
Broilers allowed/ha	5584	4386	2813	2204	897	2111	1210	2269

### **6.2.4 Reduction of excretion of N and P by altering nutrition and feeding**

In this section, some general aspects of altering nutrition will be discussed, because details have already been described elsewhere (Jongbloed and Henkens, 1996;

Jongbloed and Lenis, 1998; Jongbloed, 2002). Nutritional research in relation to environmental pollution has focused mainly on reducing the dietary input of N and P, and on their more efficient utilisation. To achieve this, it is important to supply dietary N and P in close accordance with the animals' requirement. This requires adequate knowledge about the digestibility of amino acids and P in the feed used, and on the requirement for these nutrients. Furthermore, it is possible to enhance the digestibility of P in feeds by using extrinsic enzymes. In addition, the excretion of N and P can be reduced further by exchanging less digestible feedstuffs by better digestible ones. In addition, by improved performance (improved types of pigs) reduction of the excretion of N and P can be achieved.

### ***Effect of feed conversion ratio***

A powerful tool to decrease the excretion of N and P is to aim at improvements in feed conversion ratio of pigs. The same diet can be offered to pigs with a large range in feed conversion ratio. This means also a large range in utilisation and thus excretion of N and P by a growing-finishing pig. Table 6.3 shows the effect of different feed conversion ratios on excretion of N and P by a growing-finishing pig from 25 to 117 kg live weight. A feed conversion ratio that is 10% worse (FCR + 10%) than average, results in almost 1.00 kg more N and 0.17 kg more P excretion.

*Table 6.3. Effect of different feed conversion ratios on N and P excretion by growing-finishing pigs from 25 to 117 kg live weight*

Feed conversion ratio	FCR average 2.68		FCR + 10% 3.08		FCR - 10% 2.28	
	N	P	N	P	N	P
Intake (kg)	6.36	1.16	7.32	2.23	5.41	1.36
Excretion (kg)	4.06	0.67	5.02	0.84	3.11	0.49
Excretion (relatively to average = 100)	100	100	124	125	77	73

### **6.2.5 Current status of phosphorus and nitrogen excretion by pigs in the Netherlands**

Table 6.4 summarises the P and N excretion by growing-finishing pigs in practice in The Netherlands. From 1973 to 2001, the total P content in diets for growing-finishing pigs has decreased by more than 2.5 g/kg. Meanwhile, the feed conversion ratio has improved substantially, while the health of the pigs has not been impaired. Phosphorus excretion in that period decreased by more than 1.00 kg per pig, which is almost two-thirds! With regard to N excretion only a gradual but significant decrease can be noted, amounting to -24%.

Table 6.4. Average excretion of P and N of growing-finishing pigs from 25 to 110 kg in The Netherlands (kg/pig)

Year	In diet (g/kg)		Feed conversion	Excretion	
	P	N		P	N
1973	7.4	23.8	3.37	1.62	4.74
1983	6.2	24.4	3.08	1.18	4.30
1988	6.0/5.0 <sup>a</sup>	26.9	2.94	0.85	4.64
1992	5.5/4.9	26.9	2.86	0.77	4.46
1996	5.3/4.6	26.7	2.74	0.67	4.13
2001	5.3/4.6	27.8/25.4	2.61	0.59	3.60

<sup>a</sup> 6.0/5.0 means 6.0 g/kg in the starter diet and 5.0 g/kg in the grower-finisher diet

### 6.2.6 Heavy metals in mineral additives

Although most heavy metals, like cadmium, lead, copper, zinc, mercury, chromium and arsenic largely accumulate in the soil, they may also leach to ground and surface waters. This pollution is largely determined by the solubility of the heavy metals in the soil solution, which depends on several factors like percentage of clay, percentage of organic matter, soil pH, etc. Although diets for livestock contain in general low concentrations of these heavy metals, except for copper, zinc and possibly arsenic (As), they may contribute to environmental pollution. In many countries high concentrations of copper, zinc and arsenic are used to stimulate growth performance. This should be critically considered with regard to environmental pollution and hence, these mineral additives need special attention. Various inorganic fertilisers may also contain rather high concentrations of heavy metals. Therefore, a critical evaluation of heavy metal concentrations in mineral additives and inorganic fertilizers may reduce environmental pollution and benefit water quality.

### 6.2.7 Discussion and implications for practice

At the interface of sustainable agriculture and livestock production, Honeyman (1996) indicates four levels of issues, e.g. the farm, the rural community, the society or consuming public, and the ecosystem or environment. It may be speculated that in the future animal production will have to deal with more constraints that are imposed from society. This may relate to animal well-being and health, quality of the animal product and production system, utilisation of nutrients, and last but not least environmental protection.

First of all, it should be mentioned that N and minerals in animal manure have been and still are used to maintain and improve soil fertility to produce crops for human and animal consumption. The solid manure is largely used for crop production in Shunyi district. However, the urine is generally not collected, which may be of great concern: more than 50% of ingested N is excreted in urine. This may result in substantially enhanced nitrate concentrations in surface and groundwaters.



Application of nutrients via manure and/or chemical fertilisers on the fields should be in close balance with the uptake by the crop, with minor losses via leaching or volatilisation/evaporation. This is a main objective to achieve a sustainable agriculture. Problems occur when there is an imbalance between the supply and the demand of certain nutrients, not only for crop production but also in relation to livestock production. Manure legislation can help to improve the balance between nutrient inputs and outputs. A regional approach can be recommended, too.

Nutrition management can substantially contribute to reduction in N and P excretion by pigs and poultry. Adequate knowledge is required on the digestibility of amino acids and P in the feed used and on the requirement of these nutrients at any stage and type of production. Supplementary microbial phytase can enhance the digestibility of P by 20 % or more so that feeds for growing-finishing pigs and for pregnant sows may need little or no supplementary feed phosphate. Phosphorus excretion can be lowered by 20 to 30% by using microbial phytase. The use of enzymes for hydrolysing non-starch polysaccharides seems interesting for poultry. A favourable feed conversion ratio also contributes to a lower excretion of N and P per animal. The incorporation of more free amino acids in the feeds and lowering crude protein content in the feed by 2% units can lower N excretion of growing pigs by 20%. However, special attention should be given to the accurate matching of supply and requirement of amino acids.

It is known that ruminants and pigs consume a lot of by-products and (wet) waste products as well. These by- and waste products may originate from several food-processing industries, slaughterhouses, etc. In this respect, ruminants and pigs are used to utilise products that are not or cannot be used for modern human consumption, as has been the case in past centuries (de Boer, 1980). Therefore, ruminants and pigs substantially contribute in reducing industrial wastes. In this respect, it can also be mentioned, that ruminants are able to convert roughage's of a low biological value into animal products of a high biological value.

Current knowledge concerning the possible reduction of the manure surplus has to be integrated into future feed strategies. A further integration of the nutrition research with other disciplines is necessary. In this respect, both the genetic potentials of the animals and hygienic conditions should be evaluated. An approach that is more at system level should be emphasized.

### **6.3    Poster Horticulture in Shunyi**

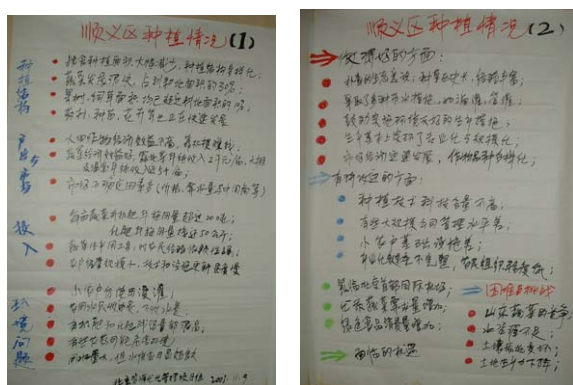
#### ***Planting structure***

- Cereal area reduced rapidly in recent years and cropping structure shows a tendency to more diversification;
- Vegetable area is increasing rapidly, comprising currently 30% of the total arable land;

- Fruit trees, fodder crops, seedlings, flowers and medicinal herbs are growing, becoming important crops.

**Inputs:**

- The use of manure on vegetable land is more than 20t per mu per year;
- The use of chemical fertilizer is about 50 kg per mu per year;
- The vegetable production needs more labour than grain production, especially experts;
- The process of modernisation (upgrading technology and facilities) is growing slowly with only few farmers involved.



**Outputs and market:**

- Profit of cereal crops is very low, only from a large area a farmer can make a living;
- Vegetables are more profitable: Net income is 2,000 RMB/mu/year from uncovered land, and 5,000 RMB/mu/year from greenhouse production;
- Too many uncertainties with regard to market factors, e.g. price, demands, intermediaries, etc.

**Environmental issues:**

- Most small farmers are still using flood irrigation;
- Farmers do not pay for the water they use, only for the electric power they need;

- The amount of manure and fertilizer used, exceeds the demand of the crops;
- Some pesticides and herbicides may cause environmental and health problems;
- Water demand is increasing, while the availability of water is declining.

**SWOT Analysis:**

**Strengths:**

- There is a traditional awareness amongst farmers with respect to ecological aspects;
- Along history and a rich experience in growing vegetables;
- Some water-saving measures are adopted, such as dripping and pipe irrigation;
- The government is encouraging environmental-friendly production technologies;
- Specialization and mass production are basically realised;
- The sector is rapidly becoming market oriented
- Cropping structure is diversifying, with emphasis on quality and niche markets

**Weaknesses:**

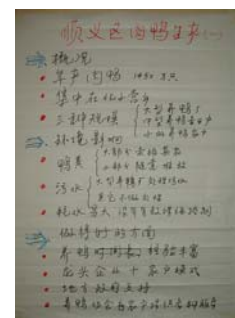
- Low level of technology in crop production;
- Poor management of some large companies;
- Small farmers are not well equipped;
- The supply chain is not well functioning
- Farmers are poorly organized.

**Opportunities:**

- Location near Beijing international airport (export opportunities);
- Increasing demand for high quality vegetables;
- More demand for green and healthy food,

**Threats:**

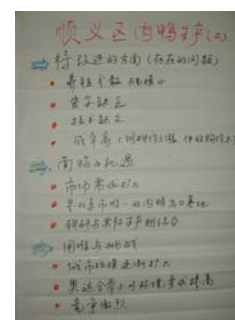
- Competition from other regions/provinces;
- Shortage of water resources;
- Deteriorating soil health condition (soil-borne diseases);
- Decreasing soil productivity.



**6.4 Poster Duck production in Shunyi**

**Structure**

- Number of ducks slaughtered is 14.5 million birds per year.
- Production is mainly concentrated in Beixiaoying township.
- There are three types of farms:
  - large duck farms (60%)
  - medium duck farms (20%)



- small duck farms (20%)

### ***Environment***

- Faeces:
  - Mainly sold to vegetable farmers;
  - A small part is heaped everywhere in the village;
- Waste water:
  - Large duck farms own wastewater treatment facilities with high quality equipment.
  - Medium and small duck farms do not treat wastewater.

### ***SWOT Analysis***

#### ***Strengths***

- Duck breeding based on extensive experience;
- Large duck industry comprises the whole chain from egg production to slaughtering and processing;
- “Leader duck company + individual farmers” model (dragon head company);
- Local government support;
- Duck farmers' association supports many services to small farmers;

#### ***Weaknesses***

- Duck breeding is separated from (small scale) fattening;
- Lack of capital;
- Lack of technology;
- Production costs are too high (feed), market price does not change

#### ***Opportunities***

- Market demand is growing;
- Shunyi has the only production base of “Beijing duck” for export to other countries;

#### ***Threats***

- Urbanization is expanding;
- The Olympics in 2008 need a high quality environment in Shunyi;
- Intensive competition.

## **6.5 Poster Dairy and Beef production in Shunyi**

### ***General information***

*Table 6.5 Number of major animals in 1994 and 2001 in Shunyi (unit: 1000 heads)*

	Cattle	Pigs	Goats	Sheep	Poultry
1994	26	1,359	170	44	23,084
2001	129	2,452	111	391	63,822
Increase (%)	+396	+80	-35	+789	+167

Table 6.6 General statistical data of cattle in Shunyi

	Total heads	Total Farms	Major townships
Dairy cattle	18,000 (annual sale of more than 200 heads)	50	Mapo, Lisui, Beiwu, Dasungezhuang
Beef cattle	85,000 (annual sale of more than 1000 heads)	8	Zhaoquanying, Beixiaoying, Nacai

### ***A case of Xiaohucun beef cattle farm, Beixiaoyin Town***

Farm size:

- land area of 18 ha
- livestock: in stock 1,000 heads and an annual sale of 3,000 heads

Supply chain:

- Adult bulls bought in Inner Mongolia at a live weight of 400-450 kg and 2-3 years of age
- Fattening within 3-4 months to reach a live weight of 600-650 kg
- Sold to Hong Kong and partly in Beijing

Indoor feeding system, with the feeds mainly bought from local farmers within Shunyi district

### ***Environmental aspects***

No processing of the manure, resulting in pollution to soil and water

### ***SWOT analysis***

#### ***Strengths***

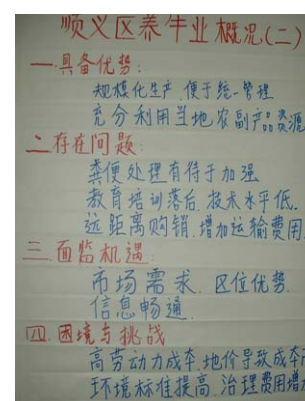
- Large scale and uniform management;
- Market-oriented;
- Use of local feed resources, e.g., crop residues, by-products and wastes of agro-industries;

#### ***Weaknesses***

- No or only simple processing of excretion;
- Low education and knowledge level of workers;
- Low technology level;
- High transportation costs: long distance of buying cattle for fattening and selling the fattened cattle;

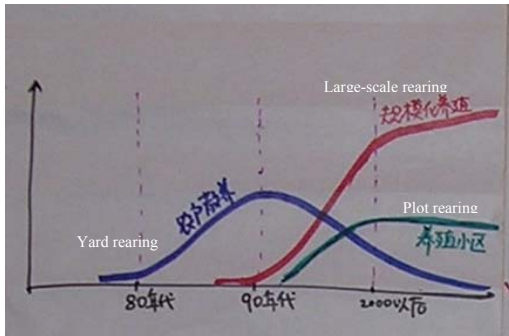
#### ***Opportunities***

- Increasing market demand;
- Location advantage: near to Beijing;
- Good communication with buyers and suppliers.



### Threats

- High and increasing prices of labour and land;
- Increasing environmental standards and thus an increase of costs for reducing the possible environmental damage;



## 6.6 Poster Pig production in Shunyi

### Farm structure

- Mostly large scale production;
- Partly "ecological farming systems", i.e. combination of pig rearing and vegetable growing;
- Rearing in the yard is decreasing.

### Farm management

- Faeces and urine are managed/processed, partly for biogas production;
- Integration of crop production and livestock rearing;
- Water used for livestock is ground water;
- Sewage water is only a little decontaminated.

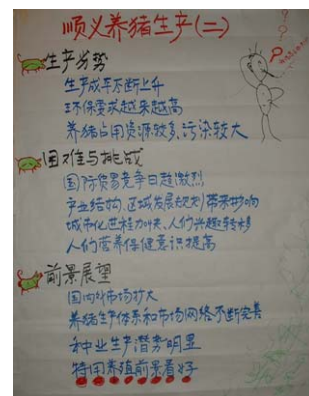
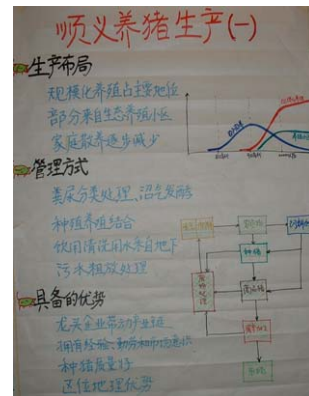
### SWOT analysis

#### Strengths

- Some big companies have the lead in the supply chain;
- Experienced and hard working farmers;
- Market oriented;
- High quality (famous) boars;
- Geographical advantage (location near Beijing).

#### Weaknesses

- Rising costs;
- Increasing environmental requirements;



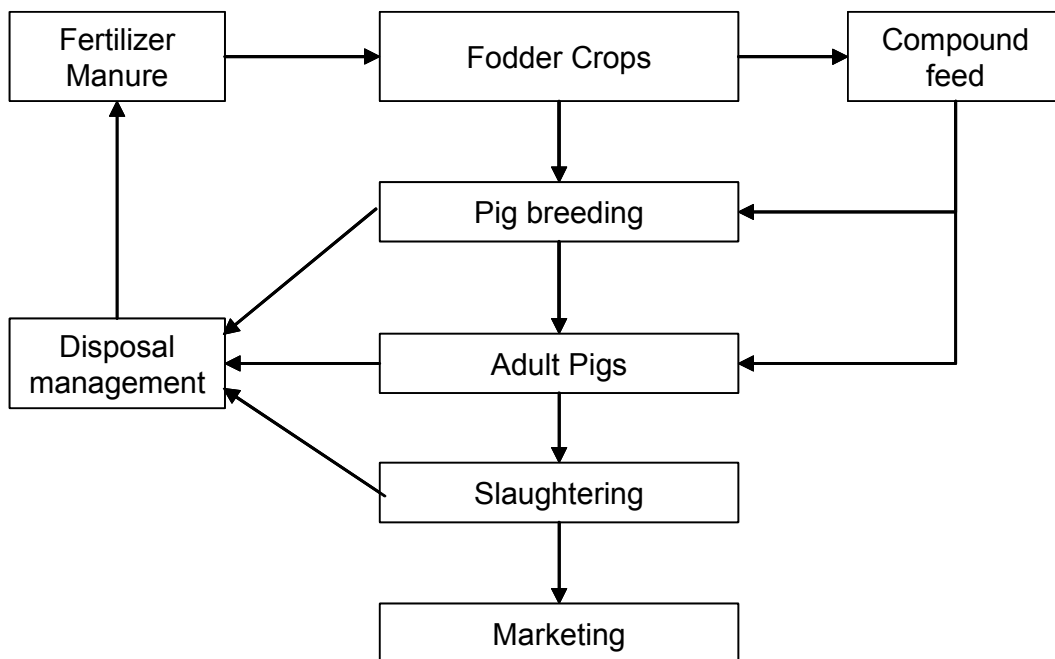
- Increasing use of (water) resources.

**Opportunities**

- Increasing market demand from China and overseas countries;
- Strengthening the pig supply chain (production and market network);
- Pig breeding has potential advantages;
- Development of special-purpose pigs (for pet, antibiotic-production, etc.).

**Threats**

- Increasing international competition;
- Impact of industrial structure adjustment and regional development plan;
- Urbanization;
- Increasing consumers' concern with respect to nutrition and health.



## 6.7 Summary of discussions at the Stakeholder Meeting in Shunyi

*Prof. Wen Hua, Beijing Academy of Agricultural Sciences*

He remarked that he had performed an extensive study on changes in this area during the last five years. At the end of 2003, the results will be available of this study. Some major points are:

1. Agricultural mechanization level in Shunyi has been decreasing in recent years, being 75% in 1999, while it was 62% in 2002. The main reason is that the area of vegetables, flowers and ornamentals has substantially increased, while the area of cereals has decreased. In addition, the development of S&T stayed behind the production in the labour-intensive sectors;
2. Area of food crops has decreased by half in recent years, but the area of vegetables, fruits and flowers has increased substantially;
3. Fertilizer and biocide use is decreasing: total fertilizers use was 90 000 ton in 1999, and 60.000 ton now, biocide use was more than 500 ton in 1999 and now about 440 ton (both fertilizers and biocides all in commercial formulation);
4. Farmland is decreasing very rapidly, from more than 0.77 million mu (51,300 ha) in 1999 to 0.54 million mu (36,000) now;
5. Current density of animals per ha of agricultural land is 9.6 livestock units (1 LSU equals 400 kg), increasing from only 5.9 LSU in 1999;
6. According to him, there is no accumulation of minerals in the soil of Shunyi, because soil organic matter content is as low as 1.6%. Maybe, there is accumulation of some heavy metals in the soil. Application of more organic fertilizer (manure) is required to increase soil fertility;
7. He would be happy to learn from the water saving technologies that are used in pig houses in The Netherlands, because flushing of manure is quite often applied in China, which needs a lot of water;
8. Small animal farms will disappear in the future.

*Officers from Science & Technology Committee of Shunyi:*

1. The key issue for agriculture is how to increase income for farmers;
2. Efficiency of the available resources need to be increased;
3. Restructuring of agriculture is required;
4. Development of secondary and tertiary industries is necessary to increase employment opportunities, particularly for (surplus) rural labour;
5. Land is limited in Shunyi, so, agriculture in Shunyi should focus on high value commodities, such as developing breeding animals (pigs and sheep) and seed/seedling production (vegetables, melon and flowers);
6. Rural tourism should be stimulated; leisure, sightseeing, fruit picking by consumers;
7. More funds should be made available for changing farmers, to educate them and to create an information platform;
8. Growing vegetables and alfalfa should be stimulated, although this will require a lot of water.



*Officers from Water Resources Bureau (already included in Chapter 2):*

1. Only 50% of the water demand in Shunyi district can be covered by surface water, because of the high demand of Beijing;
2. Reducing runoff loss. Several 100's of million Yuan have been invested in Chaobei He for building a plastic dams, to reduce runoff and thus to increase recharge of the groundwater;
3. Introduction of new irrigation systems (e.g., drip irrigation) is recommended;
4. All enterprises are encouraged to collect rainfall (in summer) and to re-use industrial water;
5. About 1.2 billion m<sup>3</sup> (on an annual basis) will be diverted (from south China) to Beijing (mainly for industries), probably before 2008.

*Public Health Bureau:*

1. The RMO-Beijing project team should pay more attention to the quality of the resident's drinking water, and if possible add some indexes of drinking water to the research.

*Officer from the Planning Committee (already included in Chapter 2):*

1. The Capital Airport will be expanded with an area of 19,700 mu, 9 villages will be affected but the farmers will find employment in the industry;
2. Around the sites of the Olympic Games, a circle of 2 km is foreseen to be free of livestock (animal quarantine);
3. The car production area "Auto City" will be increased with an area of 6.3 km<sup>2</sup>;
4. A new city of Shunyi with a planned area of 12 km<sup>2</sup> may be built in the future (now under discussion);
5. Of the 19 towns in Shunyi District, 17 towns have town development plans;
6. Approval of the Governor is required for building residential estates in the rural area.

*Medium-term development goals of Shunyi agriculture:*

1. In the tenth "five-year" plan of Shunyi's economy, the Shunyi leaders are planning to further develop livestock breeding and production, high value seed production and agricultural processing. Some agri-processing factories have been established in the townships of Beixiaoying, Niushan, Zhaoquanying, Gaoliying, and Beilangzhong;
2. Tourism farms will be set up in townships of Yangzhen, Longwantun, and along the Chaobai River;
3. It has been decided to maintain large scale production units of pigs, broilers, duck and aqua culture and to foster the expansion of herbivores such as dairy cattle, beef cattle and sheep, so as to further increase the share of livestock production value in the total agricultural production value, e.g. from the current 50% up to 65%;

4. At the same time, the area of grains is expected to decrease, while the area with cash crops and forage will increase;
5. A “fruit belt” is planned to be established in the plain along the Chaobai River;
6. Plant nurseries and grassland will be expanded along the main roads;
7. Cultivation of high-quality vegetables will be concentrated in the southeast townships;
8. The “Hi-tech zone of agriculture” should be further expanded;
9. Water-saving irrigation will cover 95 percent of the total irrigated land;
10. Farmers and companies will be promoted to organize themselves in associations.

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## Appendix 1 Some extracts from land use regulations

Some regulations on land use and transformation from four land management and utilization laws of the Peoples Republic of China are given in the following.

### 1. *Land management law of PRC (practiced from 1 Jan.1999)*

#### *Chapter 2*

- Item 8. the land of city belongs to the nation, land of village and suburb belongs to the collectivity except for the land belongs to the nation that commanded by the law.
- Item 14. the land of collectivity can be managed by its own people in the form of contract with a time limit of 30 years for planting, forestry, livestock, and fishery.
- Item 15. the land of the nation can be managed by unit or individual for agricultural production.  
Land of the collectivity can be managed by individual not belonging to it by contract, and should be approved by more than 2/3 people of it and the township government.

#### *Chapter 3 land utilizing layout*

- Item 17. land utilizing layout of low level should according as the high government' layout, the arable land area should not under the control index of the high administrator.
- Item 25. the land utilizing plan of every year of the province should be reported to the people's congress of the same level.

#### *Chapter 4 protection of the arable land*

- Item 31. protection the arable land, strictly control the conversion of arable land to non-agricultural use, and should compensate for it.
- Item 33. the arable land area of the province should be kept. when there has decrease, the province should reclaim same amount of land.
- Item 34. the nation practice Basic Farm Protection policy.  
the Basic Farm (land for grain, cotton, and oil production base approved by government higher than county level or State Department; land with favourable irrigation works and water and soil holding facility; middle or low productivity land that are being under reconstruction or can be reconstructed; vegetable production base; field for research and teaching; other land that should be part of Basic Farm regulated by State Department. should take up more than 80% of the arable land of the province.
- Item 36. the Basic Farm should not be changed for forestry, fruit tree, and fishery.
- Item 39. reclaim the unused land should be scientifically evaluated.  
Destroy the forestry, grassland, lake and river bottomland are forbidden.  
When the reclaim have damage to the environment, the land should be returned to forestry, grassland and lake.

#### *Chapter 5 construction land*

- Item 44. the conversion of land to non-agriculture use of the city, village and town confirmed in the land utilization layout should be approved yearly by the municipality and county government.
- Item 45. the expropriate of Basic Farm, arable land more than 35ha. not belonging to the Basic Farm, other land more than 70 ha. should be approved by the State Department.
- Item 53. when using the land of the nation for construction, land use application should be hand over to the land management bureau high than county level for examination, and should be approved by the government of the same level.
- Item 60. construction or corporation using the land of collectivity, should be hand over to the land management bureau high than county level for examination, and should be approved by the government of the same level in its purview regulated by the law.
- Item 61 land using for commonweal facility and enterprise, should be examined by township government, and be approved by the government higher than the county level.

### ***2. Implement byelaw of Land management law of PRC (practiced from 1 Jan.1999)***

#### *Chapter 3*

- Item 8. the land utilization layout of the province should be approved by the State Department.  
the land utilization layout of the township should be approved by the province government. The land using time limit is 15years.

#### *Chapter 4 protection of the arable land*

- Item 17. Exploitation of land belonging to the nation that has undetermined use in the reclaim land area of the land utilization layout for agricultural use: when the area is below 600 ha, it should be approved by government high than county level; more than 600ha, should be approved by the State Department.

### ***3. Basic Farm protection regulation by State Department (1 Jan.,1999, No.257)***

#### *Chapter 2*

- Item 8. When doing land utilization layout, the governments should conclude the distribution, area, and quality of the Basic Farm that is appointed by high level government.
- Item 10. The lands adjacent to railway, freeway, city and village, construction field should be preferential transferred into Basic Farm, lands return for forestry, grassland, and lake should not be included.

*Chapter 3*

- Item 15. when it is necessary for some big projects of the country to use the Basic Farm, should be approved by the State Department, and should be complemented by same size land by the local government.
- Item 17. the Basic Farm should not be transformed into forestry, fruit, and fishery.
- Item 18. when the Basic Farm that was transformed into construction field hasn't been constructed for 1 year after approval, it should be cultured by the former farmers or the land use unit; more than 2 years, the lands should be callback by county government or higher approved by the State Department for Basic Farm again.

***4. Notice on strictly management of the transfer of land by the State Department. (1999, No.39)***

- A. Strictly control the land amount for construction, prohibit land to non-agricultural use unapproved by the law.  
Village inhabitant should control its scale and range, centralize to bigger village or town.  
Strictly control the land use area of the freeway, the land beside it should be confirmed as Basic Farm.
- B. Developing real estate on the collective land lawlessly is prohibit.
- C. Developing "fruit garden" or "fazenda" project on the collective land is prohibited.
- D. Examining and regulate bargaining of national land, prohibit auction of land lawlessly.





## **Appendix 2 Organisation of the Rapid Diagnostic Appraisal in Shunyi District**

**Ben Kamphuis**



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# 1 General Project Outline

## ***Problem definition:***

Water resources in Beijing Municipality are declining in quantity and quality, partly caused by agriculture.

## ***General project objectives:***

- To raise awareness among city planners, policy makers, farmers and other stakeholders in peri-urban Beijing about the impact of different agricultural production systems and technologies on environmental quality, in particular water quality
- To identify, in consultation with these stakeholders, options for sustainable agricultural land use and production systems that lead to a reduction in the pressure on water resources.

## ***Project activities:***

The project activities are grouped in five working packages (WP):

WP1: Problem definition and project design

WP2: Resource evaluation and mapping

- a) analysis of land use changes
- b) land evaluation

WP3: Estimation input-output for current and future crop & livestock systems

- a) data collection/farm survey (NUTMON)
- b) technical coefficient generation for future alternatives

WP4: Multiple Goal Linear Programming (MGLP) model development and application

WP5: Stakeholder interaction and Communication of project results

## ***State of the art:***

The first phase of the project focused on problem definition. Information has been collected on the agricultural production systems and land use, and on water use and water resources (both quality and quantity) in Beijing Municipality. The results have been published in an Alterra report and an article (Environment & Urbanization Vol. 15 (2) October 2003) under the title "Urban and peri-urban agricultural production in Beijing municipality and its impact on water quality".

The following phases of the project will focus on a specific area in Beijing Municipality. For this case study, one of the most interesting districts of Beijing Municipality, ***Shunyi District***, was selected, because it strongly shows the effects of

intensification of agricultural production systems on environmental quality. In order to get acquainted with the specific situation in that district, a Rapid Diagnostic Appraisal has been carried out in November 2003. This activity is part of WP2 and WP5.



## **2 Rapid Diagnostic Appraisal in Shunyi district**

### **2.1 RDA Goals and Expected Results**

The main goals of the RDA are:

1. To identify the main stakeholders in agricultural production and water quality management and to establish an effective stakeholder dialogue.
2. To identify the major problems in the research area concerning the relation between agricultural activities and water resources.
3. To identify policy plans and views of local government and other stakeholders with respect to agricultural developments, land use and water management.
4. To identify representative farms for collecting reliable data for land use modelling (through farm monitoring).

In order to achieve these goals the RDA is also aimed at:

5. Strengthening the cohesion in the research team and developing a common vision on the project.

Expected results are:

- a. Report with the results of the RDA, including
  - A list of major stakeholders and their position with respect to agriculture and water resource management,
  - A (mainly qualitative) description of the agricultural situation in Shunyi district in relation to water quantity and quality,
  - A qualitative description of the stakeholders' perceptions of agriculture-water related problems and possible solutions
- b. A proposal for the selection of farms that will be monitored following the NUTMON methodology
- c. A research team that has a shared vision on the project, with clear descriptions of tasks and responsibilities and good contacts with the major stakeholders in Shunyi district.



## 2.2 RDA team

The RDA team consisted of Dutch and Chinese researchers (Table A2.1). The Dutch researchers work at different institutes of Wageningen University and Research Centre (WUR). Mr. Kamphuis was responsible for the RDA training and implementation. The Chinese RMO project team of last year was enlarged with a number of PhD students, so that the total RDA team consisted of 12 persons. During the RDA implementation, the team was split up in three or four teams, depending on the situation.

Table A2.1 The RDA Team

	Name	Background	Institute
1	Mr. Ben KAMPHUIS	Agro-economist	Wageningen University and Research Centre Agricultural Economics Research Institute
2	Mr. Herman VAN KEULEN	Agronomist	Wageningen University and Research Centre Plant Research International
3	Mr. Age JONGBLOED	Livestock nutritionist	Wageningen University and Research Centre Animal Sciences Group
4	Mr. CHENG Xu	Agronomist	China Agricultural University College of Agronomy and Bio-tech
5	Ms. GUO Shumin	Agronomist	China Agricultural University
6	Mr. ZHU Wanbin	Agronomist	China Agricultural University PhD student
7	Mr. QIU Huajiao	Agronomist	China Agricultural University PhD student
8	Mr. LU Changhe	Geographer	Chinese Academy of Sciences (CAS) Institute of Geographical Sciences and Natural Resources Research (IGSNRR)
9	Mr. YU Bohua	Geographer	Chinese Academy of Sciences (CAS) IGSNRR, PhD student
10	Mr. CHAI Wei Zhong	Nutritionist	Peking University, School of Public Health, Dept. of Nutrition and Food Hygiene
11	Ms. CHEN Junhong	Agro-economist	Chinese Academy of Agriculture Science PhD student
12	Ms. HU Yanxia	Agro-ecologist	Beijing Academy of Agriculture and Forestry Sciences, Institute of Integrated Development of Agriculture



## 2.3 RDA Activities and Planning

### *Activities*

The following activities have been undertaken during the workshop:

1. Team building.
2. Focusing the project problem and goals.
3. Making a checklist of research questions/topics for investigation.
4. Determining the possible sources for getting the required information.
5. Determining the methodology and tools for the investigation.
6. Training of researchers in RDA principles and tools.
7. Forming RDA teams, including tasks and responsibilities.
8. Implementing a stakeholders analysis.
9. Designing a detailed planning for the RDA implementation, including reporting.
10. Implementing the RDA interviews.
11. Planning and organising a stakeholder feedback session.

### *Planning*

Before starting the RDA, a draft planning was made. The final programme has been set up during the workshop taking into account the information of governmental institutions in the first days, the information collected in the course of the workshop, the logistics and, last but not least, the commitment and enthusiasm of the team.

#### ***Monday, November 3, Arrival and Acquaintance Meeting***

Sun/Monday	Delegates arrive at different times at Beijing Airport CAU provides transport to Guesthouse of China Agricultural University
15.00 - 18.00	Acquaintance meeting RMO Project: goals, activities and expected results RDA workshop: goals, planning and logistics

#### ***Tuesday, November 4, Problem analysis and RDA training***

08.30 - 12.00	RDA: Introduction on RDA methodology RDA: Semi-Structured Interviewing
12.00 - 14.00	Lunch
14.00 - 17.00	RDA: Mapping and Diagramming RDA: Stakeholders Analysis
18.00 - 20.00	Dinner
20.00 -	Transfer to Shunyi Hotel Preparation of institutional stakeholders meeting on Wednesday

***Wednesday, November 5, Institutional Stakeholders Meeting***

08.30 - 09.30	Plenary meeting with Shunyi institutional stakeholders (presentations by officials of Livestock Production Centre, Crop Production Centre and Water Resources Bureau)
09.30 - 10.00	RDA: Guidelines for interviewing institutional stakeholders on agricultural development and water resource management
10.00 - 12.00	Interviewing Shunyi institutional stakeholders in separate groups: - Livestock production, - Plant/Crop production - Water resources and pollution
12.00 - 14.00	Lunch
14.00 - 16.00	Plenary session: Feedback on group interviews
16.00 - 18.00	Preparing field visit on Thursday RDA: Guidelines for interviewing farmers
18.00 - 20.00	Dinner
20.00 -	Reporting

***Thursday, November 6, RDA fieldwork in Zhaoquanying Township, Beilongzhong Village***

09.00 - 10.30	Plenary meeting in Beilongzhong village, followed by group interviews of farmers and village officials
10.30 - 12.30	Visit to ecological mixed pig-vegetable farms Visit to large-scale integrated pig farms
12.30 - 13.30	Lunch
13.30 - 15.30	Visit to manure processing unit, slaughterhouse, vegetable processing unit and geese farm
16.30- 18.00	Plenary meeting on experiences and results (feedback)
18.00 - 20.00	Dinner
20.00 -	Reporting (each RDA team)

***Friday, November 7, RDA fieldwork in Liqiao Township***

09.00 - 10.30	Plenary meeting with Liqiao township government officials, followed by group interviews of farmers and village officials.
10.30 - 12.30	Visit to township vegetable complex (in the snow) Visit to new complex of sunlight greenhouses, including interviewing growers
12.30 - 13.30	Lunch
13.30 - 15.30	Visit to vegetables growers

	Visit (separately) to Environmental Protection Bureau and Planning Bureau
16.30- 18.00	Plenary meeting on experiences and results (feedback) Contents of RDA report
18.00 - 20.00	Dinner
20.00 -	Reporting (each RDA team)

***Saturday, November 8, RDA fieldwork in Beixiaoying Township***

09.00 - 10.30	Plenary meeting with Liqiao township government officials followed by group interviews of farmers and village officials
10.30 - 12.30	Visit to duck company that leads the duck supply chain from egg to table: breeding, fattening, slaughtering
12.30 - 13.30	Lunch
13.30 - 15.30	Visit to individual duck growers and other farmers in the village, including a beef cattle farm Visit to dairy farm, followed by visits to sites for the Olympic Games 2008 and water reservoir
16.00- 18.00	Plenary meeting on experiences and results (feedback)
18.00 - 20.00	Dinner
20.00 -	Reporting (each RDA team)

***Sunday, November 9, RDA reporting and organizing stakeholders feedback meeting***

09.00 - 12.00	Plenary meeting on experiences and results Preparation of RDA reports
12.00 - 14.00	Lunch
14.00 - 15.00	Preparation of Stakeholders feedback meeting (agenda, etc.) RDA: introduction on SWOT analysis
15.00 - 16.00	Preparation of draft posters by four research teams
16.00 - 18.00	Plenary meeting on the draft posters
18.00 - 20.00	Dinner
20.00 - 02.30	Preparing posters and presentations for the feedback meeting

***Monday, November 10, Stakeholders feedback meeting & wrapping up***

09.00 - 12.00	Stakeholders feedback meeting - Welcome by prof. CHENG Xu - Introduction to project by Ben Kamphuis
---------------	---

	<ul style="list-style-type: none"> <li>- Poster Session</li> <li>- Presentation on Agriculture and Environment by Age Jongbloed</li> <li>- Presentation on Land Use and Water Resources in Shunyi by Lu Changhe</li> <li>- Plenary discussion</li> </ul>
12.00 - 14.00	Lunch
14.00 - 16.00	RDA wrapping up: <ul style="list-style-type: none"> <li>- Arrangements on reporting</li> <li>- Approach for NUTMON farm selection</li> <li>- Evaluation</li> </ul>
16.00 - 18.00	Departure to Beijing

### 3 RDA Approach

The general purpose of the RDA in Shunyi district was to acquire information/knowledge on the relationship between agriculture and water. For that purpose the team would like to collect a wide variety of data:

#### ***Geography***

- Rural-urban land use (towns/villages/agricultural land/forestry/fallow land)
- Infrastructure (roads, rivers, canals, ponds)
- Soil (quality)
- Water sources (annual rainfall, groundwater and surface water)
- Water quality, chemical and biological

#### ***Agricultural activities***

- Land use: cereals, vegetables, pastures, etc.
- Animal husbandry: cattle, sheep, pigs, poultry, ducks, fisheries, etc.

#### ***Farming systems***

- Farm types
- Farm size

#### ***Common agricultural practices***

- Water use, use of ground- and surface water for irrigation and other agricultural purposes
- Fertilisation: organic and inorganic fertilisers, the use of waste water and urban waste
- Pests and pest management practices, use of biocides

#### ***Marketing***

- Marketing flow and structure,
- Food quality control

#### ***Farm inputs***

- Farm input supply: seed, seedlings, fertilisers, bio-chemicals, etc.

#### ***Income and investments***

- farm income
- household income
- financial services
- taxes,
- etc.

Because the major goal of the project is to investigate the possible environmental problems caused by agriculture, the focus of the RDA was to find out, what farm

type is causing the major pressure on the environment and where the problems are most manifest.

The required information can partly be collected from available documentation, such as:

- Maps
- Statistics
- Policy reports
- Research reports
- Articles in (scientific) journals
- Articles in newspapers.

The purpose of the RDA was to collect additional information by interviewing stakeholders in Shunyi District.

## 4 Stakeholders

### *Who are stakeholders in this project?:*

Generally speaking, stakeholders are those who have an interest in a particular decision, project or programme, either as an individual or as a representative of a group; this includes people

- who (may) influence the decision making processes,
- who are affected by these decisions, positively or negatively.

### *In this project, the stakeholders are those people*

1. who are directly involved in agriculture in Shunyi district, i.e. the farmers, growers and agricultural workers.
2. who are involved in the decision making processes in Shunyi district on:
  - agricultural development
  - land use development/planning
  - agricultural policy formulation
  - water resource management

### *What information did the project team like to get from the stakeholders?*

Ad 1. Farmers and growers in Shunyi:

- a. Agricultural activities, land use and animal husbandry
- b. Farming structure
- c. Farming systems
- d. Common agricultural practices
- e. Farm inputs
- f. Water use
- g. Marketing
- h. Income and investments

The RMO project is about the future of land use, and therefore the project team is not only interested in the current situation, but also in the farmers' expectations for the near future (5-10 years), the problems they face and their options for solving these problems.

Ad 2. Institutional stakeholders:

- a. Perception of current situation and problems related to agriculture, land use and water resources
- b. Their view/plans on future developments

## 4.1 Stakeholders analysis

The first step in the RDA was to identify the main institutional stakeholders. A two step approach was followed, first all (possible) stakeholders were listed and after that they were clustered.

The most relevant institutional organisations with respect to peri-urban agriculture are:

- a. Government departments at city and district level
- b. Agencies, organizations, companies in the area
  - farmers' organizations,
  - producers and suppliers of agricultural inputs
  - extension services
  - real estate development agencies

The inventory by the RDA team led to a long list of official bureaus and offices that may have an influence on the water-agriculture development (see Figure A2.1).

After having made the list of stakeholders, further investigation was done to identify the most important stakeholders. For that purpose, criteria need to be determined for the importance and influence of each of the institutions that make it possible to rank the institutions. Table A2.2 gives an example.

*Table A2.2 Example of an "Importance and Influence Matrix"*

Institutional stakeholders	Knowledge of agriculture (a)	Knowledge of water resources (b)	Knowledge of land use planning (c)	Total knowledge score (d=a+b+c)	Influence on policy decisions (e)	Status in local community (f)	Total influence score (g=e+f)	Total importance score (h=d+g)
Stakeholder 1								
Stakeholder 2								
Stakeholder 3								
etc.								

Marks: 0 = not important; 1 = a little bit important; 2 = important; 3 = very important

Based on the importance/influence score, the potential stakeholders can be ranked. They can also be clustered in groups, for instance on the similarities in field of interest, influence or location. Clustering by location helps to organise the logistics of the stakeholders' interviews.

The project team did not follow this procedure in detail. The main stakeholders to be interviewed have been selected before the RDA workshop, by the Chinese project partners in consultation with the Science and Technology Bureau of Shunyi. Based on the discussions during the workshops some institutions were added. The most important stakeholders identified are the Shunyi District Government, the District Planning Committee, the District Agricultural Committee, the District Committee of Science and Technology, the Water Resource Bureau, the Land Resource and Housing Bureau, the Environmental Protection Bureau, the Financial Bureau, the Goods Pricing Bureau, the Quality & Technology Monitoring Bureau, the Taxation



Bureau, the Livestock Production Centre and the Crop Production Centre (see Figure A2.1).

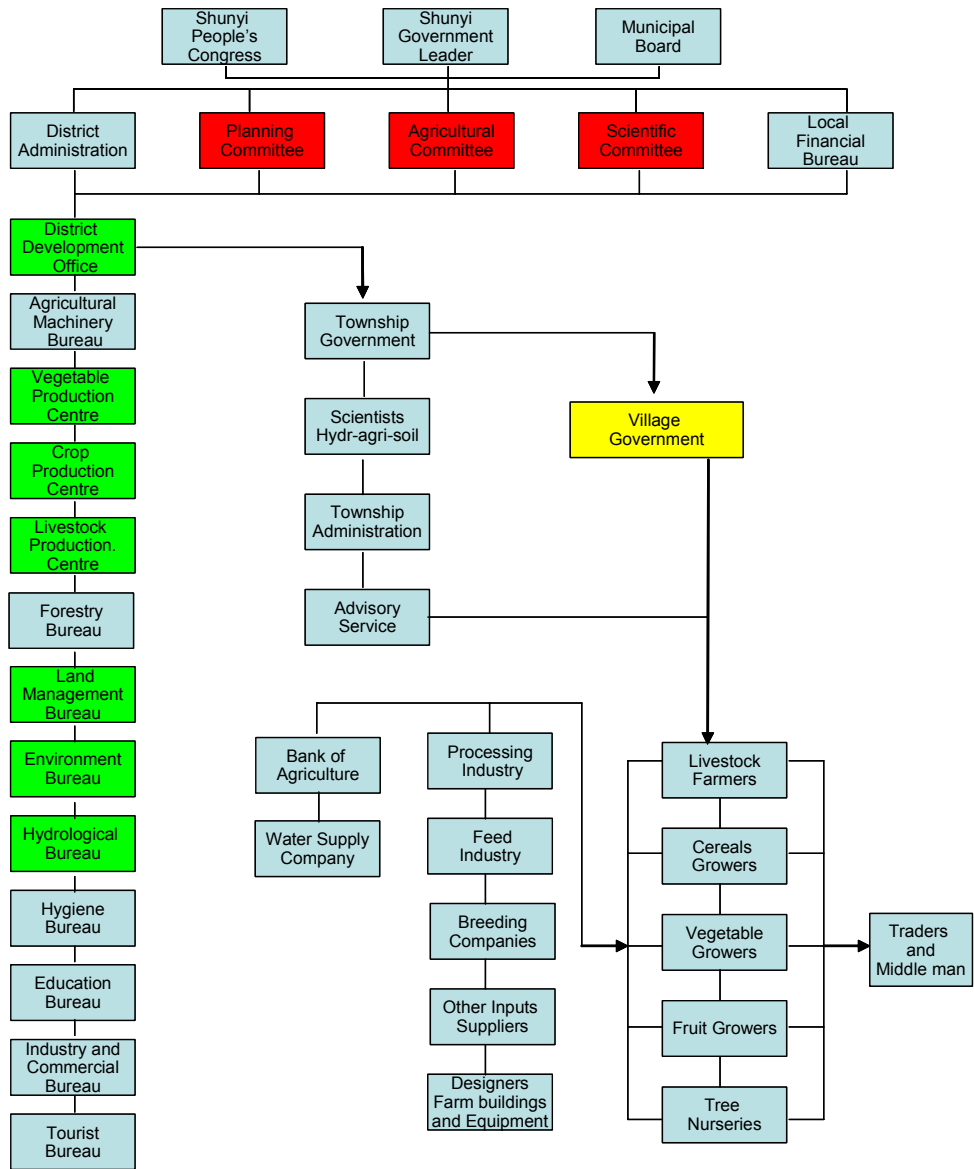
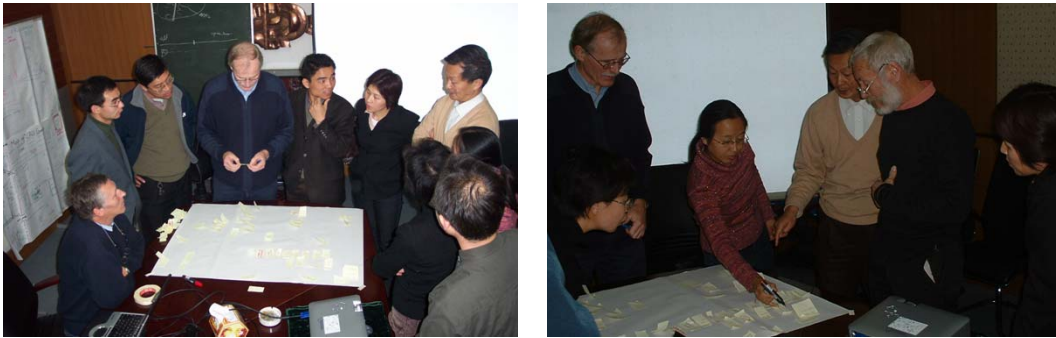


Figure A2.1 Organisation Chart of institutional stakeholders in Shunyi

## 4.2 Institutional Stakeholders Interviews

The RDA team in Shunyi had two possibilities to get the required information from the institutional stakeholders:

- a. Individual interviews with key persons
- b. Stakeholders meetings

During the training course, some guidelines for interviews and stakeholders meetings have been discussed. These are summarised in the following sub-sections.

### 4.2.1 Guide for individual institutional stakeholders interviews

The following list includes mainly the general aspects with respect to the relation agriculture and water.



In case the stakeholder has a specific orientation, the interview should then be focused on that specialization. See the interview guidelines in the following section, for (1) Agriculture, (2) Water resources and (3) Land use development.

#### *General interview guide*

1. Introduction of persons
2. Introduction of project
  - a. General objective: seeking solutions for water pollution caused by agricultural activities
  - b. Purpose of visit: getting information on the situation in Shunyi
  - c. Information on: Anonymity, communication, feedback meeting
3. Question: What are the major tasks of the institution?  
Tool: In case they have several tasks, ask him/her to write it on a card, and put it on the table, so that everyone can see it.
4. Question: What is the most important task?  
Tool: ordering the cards according to the ranking
5. Question: Who is responsible for these tasks?  
Tool: Write name on card, so that he can be invited, if not attending the meeting

6. Question: What are the major problems they perceive with respect to the relation agriculture and water in Shunyi district?  
Tool: Problem tree/cause-effect diagram
7. Question: What is their position in the problem tree (in order to identify their relation, involvement, role in Shunyi)?  
Tool: Problem tree
8. Question: What other organisations are involved in the problem?  
Tool: Position these organisations in the problem tree
9. Questions: To what extent are these organisations involved in solving these problems?  
Tool: Venn diagram
10. Question: Where are the identified problems most evident?  
Tool: Mapping
11. Question: How do they see these problems to be solved?  
Tool: Brainstorming
12. Wrapping up: Thanks, Anonymity, Feedback (meeting)

#### **4.2.2 Guide for a plenary meeting of key stakeholders**

1. Getting acquainted with each other  
Tool: a regular round or a special familiarization round (game)
2. Introduction to the project  
Tool: Power point or on flip-over
3. Perception/Identification of problems related to agriculture and water in Shunyi  
Tool: tree/ranking in groups, feedback in plenary session or using the open space technology
4. Geographic localization of problem areas  
Mapping in groups, feedback in plenary session
5. Perception of solutions  
Tool: brainstorming sessions in groups or plenary
6. The involvement of the institutions in Shunyi  
Tool: Venn diagrams in groups and feedback in plenary session (overlays)
7. Conclusion  
How to continue communication?

In case the stakeholders meeting is also aimed at selecting the villages for the RDA, step 4 should be used for that. See the following guides for interviewing stakeholders on specific topics.



#### 4.2.3 Guide for an agricultural sector diagnosis

1. What are currently the main agricultural activities in Shunyi?  
Tool: pie chart
2. Where are they located in Shunyi?  
Tool: mapping
3. What type of farms can be identified for each agricultural activity?  
Tool: listing, ranking, pie chart
4. Where are the main farm types located (including small and large farms)?  
Tool: mapping
5. Which inputs and outputs do these different farm types use?  
Tool: resource flow chart
6. What are the biggest challenges for the different agricultural activities in the coming 10 years?  
Tool: brainstorming, open space.
7. What are plans of large agricultural companies in Shunyi?  
Tool: brainstorming, open interview.

#### 4.2.4 Guide for a water resource diagnosis

1. For which activities in Shunyi is water used?  
Tool: Listing and pie chart
2. From which sources does the water used in Shunyi for the different activities currently originate?  
Tool: Listing and pie chart
3. Where are these sources located?  
Tool: mapping
4. What is the quality of the water of the different sources?  
Tool: identification of criteria and matrix ranking
5. What are the most polluting agricultural activities?  
Tool: listing and pie chart
6. Where are the most polluting agricultural activities located?  
Tool: mapping
7. What were the most influential changes in agricultural water use in the past?  
Tool: time line, combined with cause - effect description

8. Which measures have been taken to improve the situation?  
Tool: listing and ranking on most important measures
9. What institution is mainly responsible for these measures?  
Tool: Venn diagram
10. What are the expectations for the near future?  
Tool: brainstorming, open space



## 5 Farmers and growers in Shunyi

### 5.1 Selection of farmers to be interviewed

The selection of villages for the RDA was partly based on the information acquired by the Chinese project partners before the RDA workshop. For that purpose, they made arrangements with the Science and Technology Bureau of Shunyi and consulted some key stakeholders in Shunyi. In addition, visits were organised based on the project team's interests and findings, before and during the field visits. Alongside the interviews with stakeholders on the second day, maps with detailed information were drawn, which formed a perfect basis for further discussion in the RDA team on how to proceed and what stakeholders further to interview.

The following criteria have been used for selecting of the villages and farmers:

- Representation of major farm types.
- Impact on water quality.
- Geographical distribution.
- Available staff for interviewing and logistics.

The following guides have been used for interviewing the farmers.



### 5.2 Guide for interviewing farmers

#### *All farmers*

1. Introduction of persons
2. Introduction of project
  - a. General objective (seeking solutions for water pollution caused by agricultural activities)
  - b. Purpose of visit: getting information on the situation in Shunyi
  - c. Anonymity, communication, feedback meeting
3. Historical analysis of agricultural activities, crops and animals  
Tool: Time line and pie charts, let them choose the major crops and animals and the milestones
4. Farming systems, type and size of farms, specialization, etc., depending on the group of farmers



Tool: matrix ranking, pie chart

### ***Crop farmers***

5. Crop rotation  
Tool: seasonal calendar
6. Organic and chemical fertiliser use  
Tool: seasonal calendar, pie chart
7. Pests and pest management  
Tool: seasonal calendar

### ***Livestock farmers***

8. Seasonality in animal husbandry, from birth to slaughtering  
Tool: seasonal calendar
9. Feed management  
Tool: seasonal calendar
10. Manure management  
Tool: mapping

### ***All farmers***

11. Productivity per ha/animal  
Tool: table
12. Profitability per crop/animal  
Tool: matrix ranking
13. Marketing structure  
Tool: flow chart, pie chart, mapping
14. Labour input  
Tool: seasonal calendar
15. Income sources  
Tool: pie chart  
Income differences
16. Tool: pie chart, wealth ranking

### ***Water resources***

17. Water resources and water management  
Tool: seasonal calendar
18. Problem identification, in particular concerning water management (quantity and quality)  
Tool: listing, problem tree and matrix ranking
19. Problem solutions  
Tool: listing and matrix ranking
20. Institutions involved in solving these problems

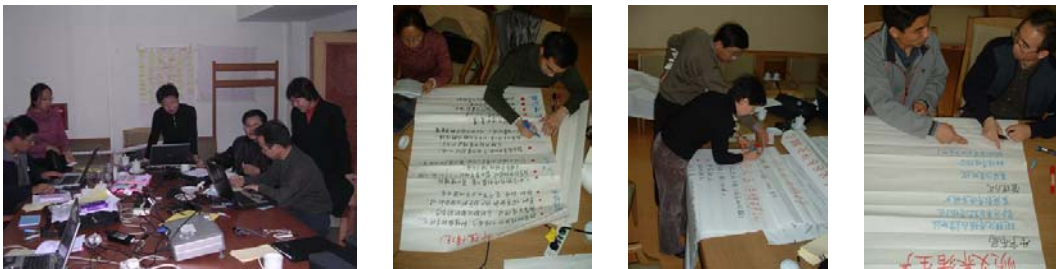
- Tool: Venn diagram
21. Expectations for the future  
Tool: Venn diagram
  22. Wrapping up: Thanks, further communication and feedback (meeting)



## 6 Stakeholders Feedback Meeting

Each day, after the field visits, the team briefly discussed the results and made short reports, which formed the basis of the agricultural report on Shunyi. It was decided to organise a stakeholders' feedback meeting on Monday morning (November 10), in order to share and to discuss the results with the stakeholders. Because of the field visits on Saturday it was necessary to work on Sunday in order to prepare the stakeholders feedback meeting. For the feedback meeting a participatory approach was followed. After a short introduction on the project, a poster session was held, followed by two presentations, one about agriculture and water and the other about land and use developments in Shunyi. The meeting was concluded with a plenary discussion.

The aim of the poster session was to involve as much as possible participants in the discussions. The posters covered the main sectors in Shunyi: vegetables, pigs, cattle and ducks. For each sector two poster were made: one with a description of the structure, recent developments, and the environmental problems and the second one with the results of a SWOT (Strengths, Weaknesses, Opportunities, Threats) analysis. This approach was presented by the Dutch experts and discussed in detail.



The posters were prepared in different couples, discussed in a plenary session of the whole group and after that, each couple made a poster in Chinese. Some of them completed the posters in the small hours of the night.

About 40 people attended the feedback meeting: Farmers (20), Officials from Bureau of Land Layout, Public Health, Environmental Protection and Planning Committee, Science and Technology Committee of Shunyi, and researchers of China Agricultural University (CAU), Institute of Geographical Sciences and Natural Resources Research (IGSNRR), Beijing Academy of Agricultural and Forestry Sciences (BAAS), and The Netherlands. The meeting was chaired by prof. Cheng Xu, who performed this task perfectly. He has extensive expertise on the issues discussed and knows the represented institutions and people.

The participants were very interested in the results. Before the meeting and the poster session there was showed a lively atmosphere with animated discussions. The officials of Shunyi government bureaus told that the results of this very rapid diagnostic appraisal were surprisingly realistic and they were interested in a follow-up,

in particular to discuss options for future development of Shunyi. The available time (it was a morning session only), however, was too short to go into detail. Although the attendant farmers were interested in the results, they did not much take part in the discussions.



## 7 Project team Evaluation

At the end of the RDA workshop, on Monday afternoon, the team members were asked to answer a series of questions. Not all team members were present, so that only 7 evaluations are available. They show, however, a consistent view. The team members were asked to give a score from 1 - 10 for 15 aspects of the week. Almost all scores were 7 or higher, except a few 5 and 6 marks, resulting in very high scores (See Table A2.3). The high work pressure caused shortage of sleep, and this is mentioned as the most unpleasant part of the week.

Table A2.3 Results of evaluation

No	Question	Score	Comments
1	Did you ever visit Shunyi district before this RDA?	yes: 4	no: 3
2	How many farmers did you meet before this RDA?	0 - 10	some had not met any before
3	How many RDA team members did you meet before this RDA?	average: 5	from zero to almost all
4	How many hours per day did you spent to the RDA on average?	15	
	<b>How do you value (marks from 1 - 10, lowest - highest value):</b>		
5	The training meetings on the first days?	8	
6	The meetings with farmers?	8	
7	The meetings with officials?	8	
8	The daily reporting meetings after the field trips?	8.5	
9	The preparation of the feedback meeting?	8.5	
10	The presented posters?	8.5	
11	The feedback meeting?	7.5	one 5
12	The teamwork/co-operation in the team?	9	
13	The working pace/pressure?	8	question was biased
14	The efficiency of the RDA approach to collect information?	8	
15	The contribution of the Chinese colleagues?	8.5	indispensable
16	The contribution of the Dutch colleagues?	8.5	stimulating
17	How much of the Dutch English did you understand at the beginning of the workshop?	20 - 95 %	very divers
18	How much at the end of the workshop?	20 - 95 %	some improvement
	<b>How do you value</b>		
19	The organisation of the RDA activities?	8.5	
20	The atmosphere in the team?	8.5	
21	Will you advise your colleagues to apply RDA methods?		Mainly yes or possible
22	What is your overall score for the RDA workshop?	7.5	variation 6-9
23	What did you enjoy most?		-visits to the farms (4) -hearing officials -positive atmosphere in the team -enthusiasm of the Chinese team members -take part in an RDA
24	What did you not like at all?		-not enough sleep -working too hard -training costs



## 8 Some Observations and conclusions

- The RDA was not well prepared from the Dutch side; consequently, it was not possible for the Chinese partners to anticipate on the RDA implementation. Some meetings had been arranged already, but others needed to be organised during the week. Thanks to the untiring efforts of the organising team members and the flexibility of authorities and farmers, it was possible to implement the RDA with success.
- Not only the preparation had shortcomings, but also the training given before and during the whole week was rather limited, because there only two days had been planned for the RDA training. Actually, the time for training was even more limited, because a stakeholders meeting was arranged on the second day already. That made it necessary to provide only the minimum set of guidelines, such as described above, instead of a real training in semi-structured interviewing. The flexibility and capacities of the team, however, made this first part of the RDA a success.
- Alongside the interviews with the stakeholders on the second day, maps with detailed information were drawn, which formed a perfect basis for further discussion in the RDA team on how to proceed and what stakeholders further to interview.
- The original plan was to visit only one village a day and spent the rest of the time on reporting and analysing, but it was agreed to have two field visits a day, followed by a short debriefing meeting and separate reporting in the evening. The advantage was that additional information could be collected, the disadvantage, shortage of sleep.
- Following the normal procedures with meetings at township government and village offices, the field visits started all three days with a plenary session, but it appeared possible to break up the meetings after a short introduction of the major representative into smaller groups. In that way, many more stakeholders, present at the meeting, could be interviewed, including the farmers who accompanied the RDA team to their farms later on.
- Also during the farm visits, the RDA team splitted up into separate sub-teams, in order to get more information. In that way, the team got a broader picture of the agricultural sector and the related water issues.
- Because of the decision to have field visits also on Saturday it was also necessary to work on Sunday in order to complete the reports, at least in draft versions, and to prepare the stakeholders feedback meeting.

- For the feedback meeting, a participatory approach was followed. After a short introduction on the project, a poster session was held, followed by two presentations. The meeting was concluded with a plenary discussion.
- Preparation of the posters took quite some time. It was decided to present the results of the RDA team on four agricultural sectors: pigs, ducks, cattle and vegetables. For each sector, two posters were prepared: one with a description of the structure, recent developments, and the environmental burden/reasons/problems and the second one with the result of a SWOT (Strengths, Weaknesses, Opportunities, Threats) analysis. It was necessary to discuss this approach in detail.
- The posters were prepared in different couples, discussed in a plenary session of the whole group and after that each couple made a poster in Chinese. Some of them completed the posters in the small hours of the night, but the results were worthwhile, as may be concluded from the intensive discussion with the stakeholders during the poster session. Quite an effort, quite a success!
- However, although the poster session and the plenary discussion provided possibilities for intensive interaction, some people considered the meeting to be too short for a good discussion. Another option, instead of organising a whole day meeting, might have been to split up the participants in different (working) groups. It is expected that this approach should also have stimulated the farmers in joining the discussions.
- After the feedback meeting and the following lunch, some of the RDA team were almost too tired to continue with an evaluation and a discussion on how to proceed. The team succeeded, however, to make agreements on the following steps and to join a final evaluation.
- The results of this evaluation are shown in the Table A2.3. The overall conclusion can be that the RDA was successful, but that a less compact workshop, with more time for discussions, personal meetings and relaxation is recommendable. However, in a high pressure cooker the best ingredients are not wasted, on the contrary, they deliver the best results ... is n't it?

