
Impacts of China's agricultural policies on payment for watershed services



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Developing markets for watershed protection services and improved livelihoods

Based on evidence from a range of field sites the IIED project, 'Developing markets for watershed services and improved livelihoods' is generating debate on the potential role of markets for watershed services. Under this subset of markets for environmental services, downstream users of water compensate upstream land managers for activities that influence the quantity and quality of downstream water. The project purpose is to increase understanding of the potential role of market mechanisms in promoting the provision of watershed services for improving livelihoods in developing countries.

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Acronyms and abbreviations

DFID	Department for International Development
FRP	Farmland Retirement Programme
GDP	Gross domestic product
IIED	International Institute for Environment and Development
PES	Payment for environmental services
RMB	Renminbi ('people's money')
RRP	Rangeland Retirement Programme
SCLP	Sloping Land Conversion Programme
SEPA	State Environmental Protection Administration
WTO	World Trade Organisation

Executive summary

This paper describes the evolution of China's agricultural policies, principally those dealing with food supply, increasing farmers' incomes, and restoring degraded agricultural lands, and the policies' impacts on payments for ecological services. China has many unique environmental, demographic, social and economic features. It is the world's fourth largest country and the most populous, supporting 22% of world's human population. It is biologically diverse, containing 10% of the world's higher plant species and 14% of animal species, many of them endemic. This diversity reflects the wide variety of ecosystems and diverse climates expected for such a large area. China's large and multi-ethnic human population – much of which was, until recently, extremely poor, underdeveloped and dependent on agriculture for livelihoods – has posed many challenges in terms of governance, ensuring food security, and fostering orderly economic and social development. In recent years, China has had one of the world's fastest growing economies. Since 1990, real GDP has grown at an annual average of 9.7%. China is now the world's third largest trading economy and the fourth or fifth largest economy overall (depending on how its currency is valued).

The contribution of agriculture to the national economy, measured in terms of gross production value, has declined continuously since 1949, when the People's Republic of China was founded. In 1952, agriculture contributed over 50% to China's GDP but this had fallen to about 15% by 2004. The contribution of secondary and tertiary industries has correspondingly risen. The number of people depending on agricultural production for their livelihoods has not declined to the same extent, however, with just under half the population still engaged in agriculture in 2004. This decline in both the status and significance of agriculture was particularly marked after the implementation of free-market reforms, beginning in 1979.

Within the agricultural sector crop production, livestock rearing, and aquaculture have grown rapidly in recent decades (especially the latter two). Crop production is the main contributor to gross agricultural production, though its proportional contribution has declined. The contribution of both the livestock and aquaculture industries to China agricultural production value has gradually increased and will contribute more in the future. Within the crop production industry, food crops account for most of the production value, though the input of cash crops and others is increasing and will likely become dominant in the future.

There have been four main stages in the evolution of China's agricultural policies since 1949. From 1949 to 1978 China's macro economic policy was geared to industrialisation. The primary goal of agriculture was to increase grain yields so as to eliminate grain shortages and provide enough food and raw materials for the cities and industrial sectors. In essence, the policy was 'Development with grain production as priority' – though in practice it was implemented in a way that became 'Forest should be cleared for grain production'. Forests were destroyed, wetlands were drained to become farmland, and grasslands were overgrazed. Excessive reclamation and over-fertilization damaged and polluted the environment without any significant compensating gains in grain yield. Instead, it made subsequent ecological restoration difficult and costly.

From 1978 to 1989 the government changed its strategy on agricultural development. The new policy became 'Vigorously develop mixed farming without reducing efforts for grain production'. The emphasis on diversified production reflected the growth in population and the gradual improvement of people's living standards. This change in emphasis was mirrored in the promulgation in the 1980s of the first laws dealing with management of natural resources. The structure of agriculture was substantially adjusted, so that by 1990 crop production was contributing only 64.7% to the total value of agricultural output, down from 79.3% in 1978. The contributions of the other agricultural sub-sectors rose accordingly

(agriculture, 15.5% to 25.8%; forestry, 3.6% to 4.3%; and aquaculture, 1.6% to 5.4%). Nevertheless, the conflicting policies of resource protection and resource utilisation meant that the environment continued to deteriorate despite notional protection.

The third stage lasted from 1989 to 2003 and was characterised by a policy of 'High yield, good quality and high efficiency'. By the end of the 1980s, agricultural reform in China had achieved remarkable success, with the result that most peasants could live a hunger-free life. Total agricultural output exceeded demand, though there was an imbalance in variety. This success was based on an over-exploitation of natural resources with resulting environmental degradation. With the gradual expansion of the economy, agriculture needed to become more closely integrated into the broader economic system. The government therefore launched a policy designed to achieve high yields, improve quality, and increase agricultural efficiency. This policy nevertheless focused more on economic results than on ecological benefits.

The latest stage, from 2003 to the present, extended the previous policy of high yield, good quality and high efficiency to include ecological security. With the establishment of a market economy in the 1990s and continued rapid macro-economic growth, the goals of economic development started to shift to the construction of a wealthier and more harmonious society. This further reduced the importance of agriculture in the national economy, with higher output no longer being the primary or sole objective for agriculture. The environmental degradation caused by previous misdirected development strategies became more apparent with the outbreak of a range of ecological problems in the 1990s. This led to a nationwide reflection on questions of environmental integrity. Ecological security was highlighted as a goal in agricultural policy, and led to a series of ecological reconstruction projects such as the conversion of agricultural land to forest. Nonetheless, agricultural policies continue to be significantly affected by concerns for grain security and questions about the stability and sustainability of the ecological projects.

Given the changes in agricultural policies over time, the authors analysed the impacts of these changes on payments for environmental services from the perspectives of government and the private sector as purchasers of these services. The policies of rigorously protecting arable land (aimed at guaranteeing grain output), and of direct subsidies for grain production, both negatively affected the establishment of mechanisms for the purchase of environmental services by government and the development of markets for these services. Therefore, in addition to estimating the real value of environmental services, government needs to push forward with supporting reform measures that will help build environmental service markets.

The major policies for raising incomes include restructuring agriculture, relocating surplus rural labour, and developing secondary and tertiary industries in towns and villages. Promoting the relocation of surplus rural labour helps by reducing pressure on the environment, but the dual nature of the Chinese economy impedes the assimilation of surplus rural labour into the urban economy, leading to the creation of a huge migrant labour force. Though the development of secondary and tertiary industries is raising incomes, the resulting environmental pollution in rural areas is hampering the supply of environmental services and their purchase by government.

The influence of agricultural restructuring on government-purchased environmental services is complicated. The goal of high yields, high quality and high efficiency conflicts with that of environmental protection, though the policy is favouring the supply of environmental services at a farm level and the purchase of those services by the government. With the optimisation of regional agriculture, modes of production are being developed that are more in line with the natural resource endowments of the regions, especially the ecologically vulnerable middle and western areas. This is reducing environmental pressures and fostering a demand for environmental services. The commercialisation of agricultural management introduces

the modern enterprise as the link between agriculture and market, which serves to improve the ecological environment and to set up the substitution mechanism for payment for environmental services.

The impact of policies to enhance farmers' incomes by setting up compensation payments for environmental services purchased in the market is quite complicated. Some of the policies, such as the transfer of surplus rural labour, stimulate the growth of the environmental services market, while the development of secondary and tertiary industries in urban areas is polluting and damaging the environment and severely restricting the market demands for – and the supply of – environmental services. Meanwhile, the 'absence' of the government in the policy designed to increase farmers' income is curbing the development of the environmental service market. Generally, this policy has not led to a proportionate rise in incomes, so supply capacity is inadequate in the service market.

Since their implementation in the mid 1990s, the 'ecological agricultural' construction policies have had a positive impact on the establishment of the compensation mechanism of environmental services purchased by the government, as well as on the compensation mechanism of the government-led market purchase of environmental services. But those policies have had a negative effect on the purely market-based purchase of environmental services, and have checked its development and growth.

In conclusion, we argue that future agricultural policies should place equal emphasis on ecological and economic benefits, and that the government should take steps to set up and improve the market mechanism for compensating the suppliers of environmental services, gradually encouraging the market participants – rather than the government – to become the major buyers of environmental services.

1. Introduction

Payments for environmental services are mechanisms that recognise the failure of markets to fully reflect the value of many ecosystem services. Thus, whilst many of these services are declining in both quantity and quality, this is not reflected in their 'market price.' Consequently, land managers frequently do not consider the effects of their actions on the consumers of environmental services.

The quantity and quality of water is directly affected by the land-use systems in a catchment or drainage basin. Payments for watershed services are an emerging tool to provide incentives to land managers to maintain or adopt agreed land-use practices that directly affect the characteristics of water used further downstream (Wunder 2005). In any one location however, the way land is used is determined by a wide range of complex factors including: the agricultural ecological environment, agricultural policy, environmental policy, and by-laws on land use, as well as the farmers' own skills and resources.

China is a massive country with the world's largest population and fastest growing economy. For these and other historical reasons China is also facing some severe environmental problems such as the loss of biodiversity, soil erosion, and air and water pollution. There are reasons to believe that these are causally linked to the increasing scale and frequency of environmental disasters (Diamond et al. 2005). The Chinese government has been very aware of these problems for over twenty years now and is using a range of policies to address environmental problems (see Changjin Sun and Chen Liqiao 2005). This paper specifically considers the interaction of agricultural and environmental policies, especially where state-financed payments are used as incentives for farmers to change their land-use systems.

China's agricultural development is increasingly intertwined with environmental issues. The Sloping Land Conversion Programme (SLCP) and the Rangeland Retirement Programme (RRP), set up in 2000, tried to combine the goals of ecological restoration and improving farmers' livelihoods. Since 2004, however, fears of grain shortages have led to changes in China's strategic plan, with commitments to the SLCP and RRP beginning to shrink greatly. Such fluctuations in policy indicate that the Central Government has not yet found the point of balance between grain security and environmental security (Li Xiaoyun 2004). China's agricultural policy in different historical periods has had a variety of impacts on the complex problem of agricultural development and sustainable development. Policies of agro-ecological restoration have long been separated from agricultural development, and general ecological rehabilitation policies have had no lasting effects because of concerns over grain security and farmers' incomes. How to develop a market-oriented ecological compensation mechanism and put in place marketing mechanisms for ecological services is a profoundly important question for ecological rehabilitation in China. Up to now, little research has been done on how agricultural policies influence ecological compensation and the development of an ecological service market. This review describes the evolution of China's agricultural policies and assesses their impacts on the potential for payments for ecological services.

2. An overview of China's agricultural development

2.1 Basic facts of China's agriculture

China has a land area about 9.6 million square kilometres, 7% of the world total, supporting 22% of the world's human population. Of the 1,292,270,000 people in China (2003 figures), 768,510,000 (59.5%) live in rural areas. About 130,040,000 hectares or 13.5% of China's total land area is arable. Grasslands, most of which are suitable for grazing, cover about 400,000,000 ha (41.7% of the total area), while forest covers 158,940,000 ha (16.6%).

China is also topographically diverse. A third of the country is mountainous, with plateaus (26.0%), basins (18.6%), plains (12.0%) and highlands (9.9%) making up the other main landforms. With a coastline of more than 18,000 km and inland waters, including rivers and lakes, covering 17,470,000 ha, China has abundant aquatic resources. It is one of the richest countries in terms of the output of freshwater products.

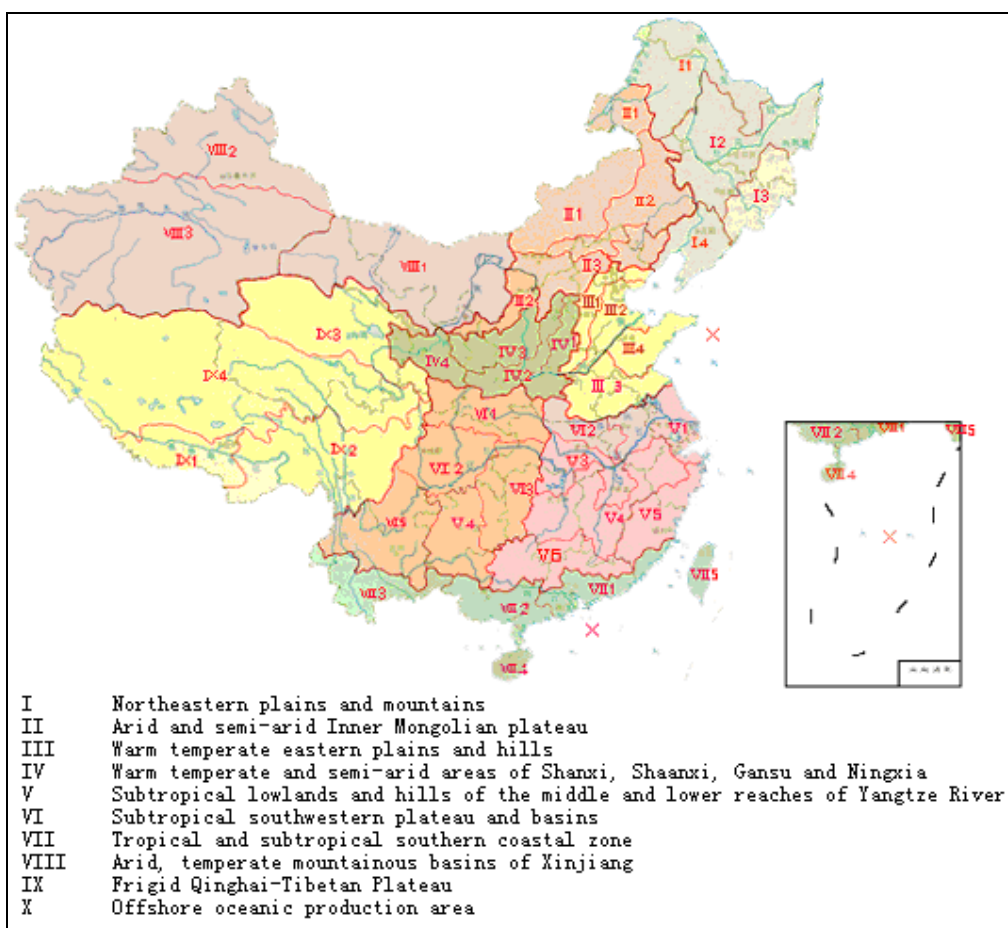
From north to south, the country extends over 5,500 km, from a southern tropical zone to a frigid northern one. Much of the country lies in the middle temperate zone, suitable for the development of farming, forestry, animal husbandry, and fishing. The country can be divided into 10 major agricultural zones based on climate and terrain (Table 1).

Table 1: Major agricultural zones of China (derived from Xu Xuegong and Hou Lisheng 2002)

Zone	Geographic region	Major forms of natural resource use
I	North-eastern plains and mountains	Farming; forestry
II	Arid and semi-arid Inner Mongolian plateau	Animal husbandry; farming; forestry
III	Warm temperate eastern plains and hills	Farming; forestry; fishing
IV	Warm temperate and semi-arid areas of Shanxi, Shaanxi, Gansu and Ningxia	Farming; animal husbandry; forestry
V	Subtropical lowlands and hills of the middle and lower reaches of Yangtze River	Farming; forestry; fishing
VI	Subtropical south-western plateau and basins	Farming; forestry
VII	Tropical and subtropical southern coastal zone	Farming; forestry; fishing
VIII	Arid, temperate mountainous basins of Xinjiang	Oasis farming; animal husbandry; forestry
IX	Frigid Qinghai-Tibetan Plateau	Animal husbandry; farming; forestry
X	Offshore oceanic production area	Fishing

China is one of the ten most biologically diverse countries in the world, with about 32,000 species of higher plants and 6,300 species of vertebrate animals, accounting for 10% and 14% respectively of the world's totals. China also abounds in a variety of cultivated plants and their wild relatives. Both rice and soy bean originated in China, with up to 50,000 and 20,000 varieties respectively now present worldwide. More than 2,238 varieties of ornamental flowers have their origins in China. Along with more than 11,000 kinds of medicinal herbs and 4,215 species of grazing grass, the country currently has an estimated 1,938 breeds of domesticated animals, making it the richest in the world in this regard.

Figure 1: Map of China's agricultural zones (Source: Agricultural Natural Resources Zones in China website)



2.2 Changes in agricultural output and composition since 1949

Agricultural output in China mainly comprises food crops, meat, and aquatic products. Estimates of food supply can be defined in one of two ways: the first, used by the World Bank and US Department of Agriculture, is limited to cereal crops – wheat, rice, corn, jowar (sorghum), barley and oats; the second, used in China and in this paper, includes cereals, beans and tubers.

Agricultural output in China has risen dramatically since 1949, particularly in respect of meat and aquatic products (Table 2). Between 1949 and 2004, the output of aquatic products increased 109 times, while meat production increased 33 times. The growth in grain production was more modest, only just over 4 times, most of it occurring between 1949 and 1996, after which growth stagnated. Grain output actually declined between 1999 and 2003, before a series of agricultural policy changes designed benefit grain producers were introduced. These contributed to a recovery in production back to the year 2000 level (see Table 2).

Table 2: Changes in output in the farming, animal husbandry and fishing sectors from 1949 to 2004 (in 10,000 tons) (Sources: *China Statistical Yearbook 2005*; *China Statistical Yearbook 1990*)

Year	Total grain output	Base index	Total meat output	Base index	Total aquatic product output	Base index
1949	11,318.0	100.0	220.0	100.0	45.0	100.0
1957	19,505.0	172.3	398.5	181.1	312.0	693.3
1978	30,477.0	269.3	856.3	389.2	466.0	1,035.6
1984	40,731.0	359.9	1,402.0	637.3	619.0	1,375.6
1996	50,454.0	445.8	4,584.0	2,083.6	3,288.0	7,306.7
1997	49,417.0	436.6	5,269.0	2,395.0	3,602.0	8,004.4
1998	51,230.0	452.6	5,724.0	2,601.8	3,907.0	8,682.2
1999	50,839.0	449.2	5,949.0	2,704.1	4,122.0	9,160.0
2000	46,218.0	408.4	6,125.0	2,784.1	4,299.0	9,553.3
2001	45,264.0	399.9	6,334.0	2,879.1	4,381.0	9,735.6
2002	45,706.0	403.8	6,587.0	2,994.1	4,565.0	10,144.4
2003	43,070.0	380.5	6,933.0	3,151.4	4,705.0	10,455.6
2004	46,947.0	414.8	7,245.0	3,293.2	4,902.0	10,893.3

Note: 'grain' mainly comprises paddy rice, wheat and corn; 'beans' refers to soybean and green beans, etc. and 'tubers' includes sweet potato and potato. (These two latter food types are not included in the grain output figures above but are included in the food output in the *China Statistical Yearbook 2005*.)

With the overall growth and development of agriculture, marked changes also occurred in the relative contribution of the different sectors to the total value of agricultural production (Table 3). The contribution of agricultural crops declined from almost 87% in 1952 to only just over 50% in 2004. Meanwhile, the contributions from animal husbandry, fisheries, and forestry all increased substantially (Table 3).

Changes also occurred within the crop production sector, with the contribution of food crops to the total value of crop production declining from 89% in 1952 to 66% in 2004, while that of both economic crops (9% in 1952) and other crops (just under 2% in 1952) rose sharply, to 16% and almost 19% respectively in 2004. Nevertheless, crop production, particularly of grains, still dominates China's agricultural output, particularly in the vast middle and western region.

Table 3: The value changes in the composing parts of China's agriculture from 1952 to 2004 (Sources: Planning Department of Ministry of Agriculture 1992; *China Statistical Yearbook 2005*; *China Statistical Yearbook 1990*)

year	% Composition of agriculture				% Composition of crop production		
	Crop production	Animal husbandry	Fishery	Forestry	Food crops	Economic crops	Other crops
1952	86.9	12.0	0.7	0.4	89.2	9.0	1.8
1965	81.0	15.0	2.2	1.8	86.8	8.9	4.3
1978	79.3	15.5	3.6	1.6	80.4	9.6	4.0
1985	69.3	22.1	5.2	3.5	75.8	15.6	8.6
1990	64.7	25.8	4.3	5.4	76.5	14.4	9.1
1995	63.6	23.5	4.3	8.5	73.4	15.0	11.6
2000	60.7	25.8	4.1	9.4	69.4	14.8	15.8
2003	50.1	32.1	10.6	4.2	65.2	16.2	18.6
2004	50.1	33.6	9.9	3.7	66.2	16.0	17.8

Note: composition of agriculture refers to the proportion of production by the value of different sectors.

2.3 China's land system since 1949

Since 1949, several major transformations, centred on changes in land ownership and the rights to use land, have taken place in the land-use system of China. Overall, these changes can be characterised as ones of de-centralisation to centralisation, and then back again to de-centralisation in terms of land-use rights.

- A. The first stage was one of land reform and extended from 1949, when the new republic was founded, to 1953, when the first agricultural cooperatives were formed. The purpose of the reform was to give peasants land title and use rights. It ended the monopoly over land by the feudal landlord class, and distributed land to peasants on a per capita basis. This fundamental change in the land-use system played a significant role in stimulating the peasants' production initiative and the overall growth of agriculture.
- B. The second stage lasted from 1953, when the first cooperative was founded, to 1958 when the people's commune system was launched. This land system reform centred on transferring ownership from private hands to collectives. Correspondingly, land-use rights were transferred gradually from the peasants to mutual assistance teams and cooperatives.
- C. The third stage started in 1958, when the people's commune system was launched, and lasted until 1978, when the Cultural Revolution ended. The essence of the land system during this period was highly centralised ownership and use rights vested in the collective. A three-tier system of ownership came into being consisting of the commune, the production brigade, and the production team. Meanwhile, a policy of state-monopolised purchasing and selling was implemented.
- D. The fourth stage began in 1978 when the family-contracted land use system, with remuneration linked to production, was introduced (and still persists today). The basis of this system is that land is owned by the collective but the individual farms have the right to use the land and benefit according to their output. By granting peasants free use of the land, this reform has promoted the agricultural development of China. On March 1st, 2003, the Land Contract Law was promulgated and legally confirmed this land contract system. It legalises the transfer of use rights on contracted land in rural areas, and provides for the land contract system to remain unchanged for 30 years.

The current family land-contract system has evolved in four stages:

1. The initial breakthrough occurred between 1978 and 1984, when the commune system – characterised by the original 'three-tiered ownership with the production team as the basis' system – collapsed and was replaced by the household management system marked by 'household production and labour contract system'.
2. The second stage was a 'running-in' period from 1985 to 1991, during China's transition from a planned to a market economy. The household contract system underwent drastic changes, including re-organisation and re-integration. This rural economic restructuring affected the circulation of agricultural produce and the means of production, and clashed with the basic arrangement of the planned economy – the state monopolisation of buying and selling.
3. The third stage was a transitional period, from 1992 to 1996, during which the traditional rural economy gradually developed into a market economy and a corresponding array of modifications and improvements were made to the land system including: the introduction of land contracts valid for 30 years, the payment of compensation on the transfer of land-use rights, and the protection of basic farming land.
4. The fourth stage is a development and consolidation stage, which started in 1997 and extends to the present. During this period, the second round of land contracting began; agriculture is becoming more market-oriented; and the provisions for land-use transfer and compensation are being more clearly defined in relevant laws and regulations.

The land-contract system provides the solution to problems of ineffective monitoring and incentive measures, and has produced enormous economic and social benefits. But major environmental problems occurred due to imperfections in the system. Because of the instability of land management rights, the fragmentation of agricultural land, and in-flexibility of land-use rights, peasants had no incentives to invest in the land in the long-term. Consequently, land resources were over-exploited through excessive tree felling, over-grazing, and over-use of fertilizers and pesticides, all for short-term economic gains. Land productivity and the environment, both suffered. Many environmental problems emerged including the severe loss of water and soil, land desertification, climate deterioration, and the degradation of farmland.

To tackle the above problems, the government has enacted laws and regulations and put in place a series of measures in other areas so as to reverse the trend of environmental deterioration. These include rehabilitating small riverside areas under contract in certain regions, and auctioning off four different kinds of wasteland.

2.4 The value of agricultural output to the national economy

According to the current categorisation, the national economy is divided into three sectors: primary, secondary and tertiary.

- Primary industries refer to those production sectors that take materials directly from nature. They include cropping, animal husbandry, forestry, fishing, and hunting.
- Secondary industries refer to those production sectors that process materials from nature, and include manufacturing, mining and construction.
- Tertiary industries refer to the non-material production sectors, including transportation; warehousing and storage; business and trade services; finance; real estate; public administration; national defence; news, media and entertainment; tourism; hotels and catering; household services; and education and research, among others.

As the national economy has developed since 1952, the contribution of the primary industries, mostly agriculture, has declined while that of the secondary and tertiary industries has increased (Table 4). Changes in employment in the different sectors has broadly followed suit. The contribution of primary industries to GDP dropped from 50.5% in 1952 to 15.2% in 2004, while proportion of the workforce employed in the primary industries declined from 83.5% in 1952 to 46.9% in 2004.

Table 4: The proportion of agricultural GDP (a primary industry) and the rural labour force (all engaged in primary industries) in the Chinese economy, 1952-2004
(Sources: *China Statistical Yearbook 2005*; *China Statistical Yearbook 1990*)

Year	Contribution to GDP (%)			Composition of employment in each sector (%)		
	Primary industries	Secondary industries	Tertiary industries	Primary industries	Secondary industries	Tertiary industries
1952	50.5	20.9	28.6	83.5	7.4	9.1
1957	40.3	29.7	30.1	81.2	9.0	9.8
1965	37.9	35.1	27.0	81.6	8.4	10.0
1970	35.2	40.5	24.3	80.8	10.2	9.0
1978	28.1	48.2	23.7	70.5	17.3	12.2
1982	33.3	45.0	21.7	68.1	18.4	13.5
1985	28.4	43.1	28.5	62.4	20.8	16.8
1990	27.1	41.6	31.3	60.1	21.4	18.5
1995	20.5	48.8	30.7	52.2	23.0	24.8
2000	16.4	50.2	33.4	50.0	22.5	27.5
2003	14.4	52.2	33.4	49.1	21.6	29.3
2004	15.2	52.9	31.9	46.9	22.5	30.6

Note: the composite of gross production value in this table are based on nominal annual prices.

2.5 Changes in the income of urban and rural residents

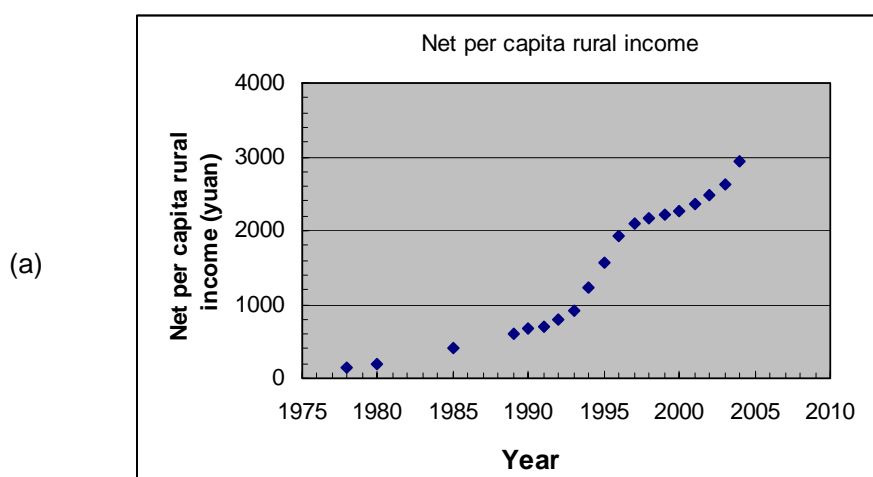
The per capita net income of urban workers is, on average, 2-3 times greater than that of rural workers, though the difference between the two groups and their respective income growth curves has fluctuated considerably over the past 26 years (Figure 2). Average incomes for both groups have been rising continuously, but especially from 1990 onwards, following the introduction of reforms to the land-use system and the opening up of markets in the mid 1980s. Initially, rural incomes rose faster than urban incomes, the annual rate of growth of rural incomes averaging 15.6% between 1978 and 1985 (Figure 2a), while urban incomes during the same period grew by only 11.0% per year (Figure 2b). As a result, the ratio of urban to rural incomes fell, from 2.6 in 1978 to 1.9 in 1985 (Figure 2c). From 1985 onwards, however, urban incomes grew rapidly, averaging 14.3% per year between 1985 and 1990, and 19.4% per year from 1990 to 1996. Average rural incomes also grew fast, but not as rapidly as for urban workers: 10.9% per year from 1985 to 1990; 17.2% per year from 1990 to 1996 (Figure 2a, b). The gap between the average incomes of urban and rural workers widened to 2.9 times in 1994 before slipping back slightly over the following three years. This corresponded with a sharp decline in the rate of growth of both rural and urban incomes between 1996 and 2000 (rural average: 3.9% per year; urban average: 6.5% per year). From 2000 onwards, the rate of growth in incomes increased again, averaging 6.6% per year for rural workers up to 2004, and 10.1% per year for urban workers in the same period. The difference between urban and rural workers once again widened, reaching 3.23 in 2003 (Figure 2c).

Table 5: The annual growth rate of the per capita net income of urban and rural household (Sources: *China Statistical Yearbook 2005*; *China Statistical Yearbook 1990*)

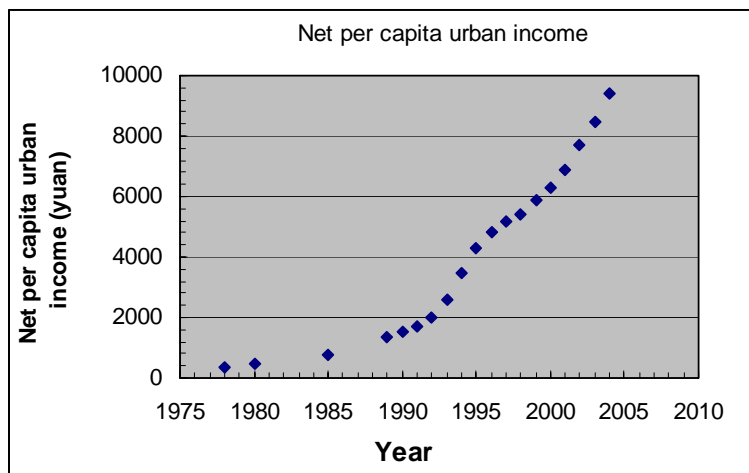
Year	Per capita net income of rural households (yuan)	Index of change in per capita net income of rural households (relative to the previous year)	Per capita net controllable income of urban households (yuan)	Index of change in per capita net controllable income of urban households (relative to the previous year)	Ratio of urban to rural household incomes
1978	134	100.0	343	100.0	2.57
1980	191	143.2	478	139.1	2.50
1985	398	207.8	739	154.8	1.86
1989	602	151.3	1,374	185.9	2.28
1990	686	114.1	1,510	109.9	2.20
1991	709	103.3	1,701	112.6	2.40
1992	784	110.6	2,027	119.2	2.58
1993	922	117.6	2,577	127.2	2.80
1994	1,221	132.5	3,496	135.7	2.86
1995	1,578	129.2	4,283	122.5	2.71
1996	1,926	122.1	4,839	113.0	2.51
1997	2,090	108.5	5,160	106.6	2.47
1998	2,162	103.4	5,425	105.1	2.51
1999	2,210	102.2	5,854	107.9	2.65
2000	2,253	102.0	6,280	107.3	2.79
2001	2,366	105.0	6,860	109.2	2.90
2002	2,476	104.6	7,703	112.3	3.11
2003	2,622	105.9	8,472	110.0	3.23
2004	2,936	112.0	9,422	111.2	3.21

Note: the net income of farmers mainly comprises wage income, family-run agricultural income (farming, forestry, animal husbandry and fishery), family-run second and third industry income, and transfer and fiscal income.

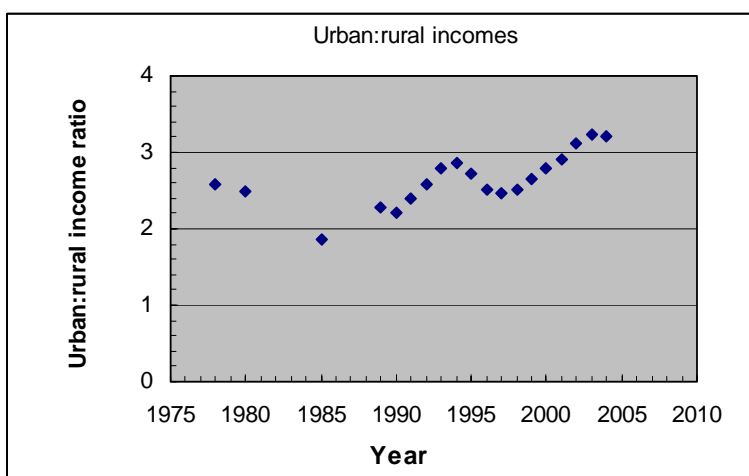
Figure 2: Changes in per capita net income of a) rural and b) urban households in China between 1978 and 2004, together with c) the urban:rural income ratio. (Source data from *China Statistical Yearbook 2005*; *China Statistical Yearbook 1990*)



(b)



(c)



2.6 The situation of agricultural trade

The scale of internal trade in China agricultural products is comparatively small and there is little market circulation of agricultural products. Most of the country's agricultural products are not particularly competitive on the world market due to the inefficiency of agricultural production. From 1992 to 2003, China had an accumulated foreign trade surplus of \$242.65 billion, with the net export of agricultural produce, worth \$51.33 billion, accounting for 21.2%, but much of the trade surplus due to agriculture was accumulated early in this period. In 1992, China's net agricultural produce export was \$26.2 billion (~60% of total national export surplus), but by 2003 this had fallen to only \$2.35 billion (9.2%). In 2004, the country experienced a \$4.64 billion deficit on a total export volume of agricultural produce worth \$23.39 billion. With China's entry into the WTO, and more active participation in the globalisation process, the general low productivity of China's agricultural sector has provoked a crisis, mainly arising from the low competitive capacity of domestic agricultural producers compared with other producers in global agricultural produce markets. This has direct or indirect negative impacts on the whole of China's agricultural production and Chinese farmers' income.

China's entry into the WTO has played an active role in developing the country's agricultural product markets. It has also helped to promote the liberalisation of agricultural produce trade, especially in the more labour-intensive industries linked to the export of vegetables, fruit, flowers, and processed agricultural products.

With increasing trade liberalisation, China's agriculture has been gradually integrated into the global market. Given the generally high productivity of the main international agricultural commodity markets, China's commitment under the WTO to relax and even remove its trade barriers on agricultural products will put tremendous pressure on agricultural production in the major crop-producing areas. To cushion this impact, China has undertaken to introduce a tariff quota system during the WTO transition period to govern the import of eight staple agriculture products (including wheat, corn and rice) which could otherwise be severely impacted by trade liberalisation. This is particularly significant for the main wheat-producing provinces of Henan, Shandong and Hebei, which produce 22%, 18% and 12% of the national wheat crop respectively; Hunan and Jiangxi, the main cereal producers (14% and 10% of China's total cereal production respectively); Hei Longjiang, the main producer of soybean, accounting for 29% of China's total; Xijiang, which produces more than a third of China's cotton; and Guang Xi, which accounts for about 40% of the country's sugar production (National Statistics Bureau 2001). Trade liberalisation will also affect farmers in Hei Longjiang, Jilin, Inner Mongolia and Xijiang provinces, where income from farming makes up a large proportion of an average family's capital income (63%, 55%, 39% and 33% respectively). In all cases, agriculture production strategies will need to be adjusted to minimise or mitigate these impacts, including through the development of region- and product-specific strategies, and streamlining the functioning of national markets.

2.7 The evolution of China's agricultural policies

There have been four main stages in the evolution of China's agricultural policies since the People's Republic of China was founded in 1949. Some themes have remained prominent throughout, such as the drive for industrialisation and the need to ensure food security. Others have appeared intermittently, such as the need to secure raw materials for factories, the management of risk through diversification, increasing the efficiency of production, and concerns about environmental degradation.

2.7.1 Stage I: Development with grain production as priority (1949 - 1978)

During this period, China's macro-economic policy was designed to promote industrialisation. The primary goal of agriculture therefore was to increase grain yields to prevent grain shortages and provide enough food and raw materials for the cities and industrial sectors. At the end of the 1960s, the policy of 'Development with grain production as priority' was proposed. Agriculture and grain production were greatly emphasised, usually at the expense of other primary producers.

The policy was implemented in such a way that it effectively became 'Forest should be cleared for grain production'. Forests were destroyed to create farmland, lakes were drained, and grasslands overgrazed, all causing considerable environmental damage. By 1978 about 32.7 million ha of new farmland had been created, mostly through conversion of meadowlands (including rangelands and other types of grasslands), woodlands, and hillsides, the last of which were not really suitable for grain crop farming (some slopes had gradients of more than 30 degrees). A further estimated 6.67 million ha of meadowland were converted to farmland, and 1.13 million ha were reclaimed from lakes (statistics for Hunan, Hubei, Jiangxi and Anhui provinces, Tang Huajun 2002). Areas affected by soil erosion resulting from these transformations amounted to more than 150 million ha, while areas subject to desertification increased by 2.7 million ha.

The use of chemical fertilizers on farms also rose, from 11.25 kg/ha in 1957 to 291 kg/ha in 1978. The increased application of chemical fertilizers and pesticides led to heavy pollution of the environment. Yet despite the widespread conversion to agricultural land and the heavy use of fertilizers and pesticides, increases in grain yields were more modest. From 1958 to

1978, the national grain yield increased from 200 million tons to 304 million tons, an annual increment of only 5 million tons, or a per capita increase of 12 kg (Tang Huajun 2002). During this stage, the huge pressures caused by agricultural expansion impacted whole ecological systems and continued to affect those environments that were already seriously degraded. The significant deterioration of ecological systems made later environment restoration problematic, and it will also seriously increase the economic and social costs underlying environmental compensation in the future.

2.7.2 Stage II: Agricultural diversification (1978-1989)

Following the end of the Cultural Revolution in 1978 and the subsequent reforms to the system of land tenure and use, together with the opening up of markets, the focus in China shifted to national economic construction. Industrialisation remained the primary macro-economic objective, but the earlier emphasis on the development of heavy industries gave way to building up light industries. Pollution continued to be an issue (Table 6).

Table 6: The discharge of pollutants from township enterprises nationwide in 1985
(Source : Zengyao He, Zhaojie Ye and W. Fangzheng 1999)

	Waste water	Exhaust gases	Industrial dust	Solid wastes
Pollutants discharge from township enterprises (10 ⁶ tons)	7,716	128	43,100	461,500
Percentage of the nationwide total industrial discharge this represents	8.5	16.4	33.0	9.5

Note: total industrial discharge comes from three types of enterprises: state enterprises, township enterprises, and other enterprises such as joint-venture enterprises.

In agriculture, implementing the household land-contract system released those productive forces formerly constrained by the people's commune system. This resulted in a breakthrough in grain production, which assured China's food self-sufficiency. In the mid-1980s, the central government implemented a policy to 'Vigorously develop mixed farming without reducing efforts for grain production' and turned its principal agriculture goal from increasing grain yields to increasing outputs from pastures – which mainly comprised an increase in animal husbandry. After 1978, with the introduction of policies of allowing families individual access to land under contract, together with linking remuneration to output and raising the purchase price of agricultural products and by-products, grain production increased significantly. During the 6-year period 1978-1984, although the land under grain crops decreased by 7,703,000 ha (6.4%), grain production increased by nearly 34% – due mainly to a 42.7% increase in grain yield, itself caused largely by a doubling of the amount of chemical fertilizers used (Table 7). (The area under irrigation for grain production remains almost the same from the year 1978 to 1984.) Incomes also increased substantially during this period, with the average per capita income of rural people increasing from 134 yuan in 1978 to 602 yuan in 1989 (see Table 5).

These gains in grain production produced an agricultural surplus that could not easily be sold and so consequently depressed prices. The contribution of crop production to the total value of agricultural production dropped from 79.3% in 1978 to 64.7% in 1990, while the contribution of animal husbandry increased up from 15.5% in 1978 to 25.8% in 1990. The value of both forestry and fisheries production also increased over the same period, from 3.6% to 4.3% and 1.6% to 5.4% (*China Statistical Yearbook 1978-1989* and Table 3).

Due to population growth and improvements in people's standard of living, agriculture was restructured to increase the diversity of production. This is reflected in laws promulgated at the time. The *Forest Act* (1984), the *Grassland Act* (1985), the *Fishery Act* (1986), the *Water and Soil Conservation Act* (1988), and the *Land Management Act* (1988) were the first sets of laws dealing with the management of natural resources. But internal conflicts existed in the policies of resource protection and resource utilisation during this period, with the result that the agro-environment deteriorated despite increasing emphasis on environmental protection.

Table 7: Changes in the grain growing area and the use of fertilizers in China (1978-1989) (Sources: *China Statistical Yearbook 2005*; *China Agricultural Statistical Materials 2005*)

Year	Total grain production (10 ⁴ tons)	Grain growing area (10 ³ ha)	Yield (kg/ha)	Irrigation rate of the grain growing area (%)	Fertilizer application (10 ⁴ tons)
1949	11,318	106,667	1,058		
1952	19,505	133,633	1,456	24.4	37
1978	30,477	120,587	2,527	45.3	884
1984	40,731	112,884	3,605	45.4	1,740
1988	39,401	110,125			2,357

Note: the data for fertilizer application in this table come from the *China Statistical Yearbook 2005* and are not the same as those given by the International Fertilizer Association. The difference may arise because the data from the International Fertilizer Association represents the total of nitrogenous fertilizer, phosphate fertilizer and potash fertilizer, whereas the data from the *China Statistical Yearbook* refer to the total of nitrogenous fertilizer, phosphate fertilizer, potash fertilizer and compound fertilizer.

2.7.3 Stage III: High yields, high quality and high efficiency (1989 - the end of 1990s)

The period of reform and openness, extending from the late 1970s to the early 1990s, was generally a great success. Most peasants in China had enough food to eat, as China's agriculture was producing sufficient food overall, though there was insufficient supply of some special products such as high quality fruits and wheat. Consequently, the national goal of food sufficiency was replaced by one of a better quality of life for all. But it is worth noting that peasants' food sufficiency was largely achieved at the cost of massively inefficient use of resources and energy, along with tremendous damage to the environment.

Macro-economic reforms during the late 1980s and early 1990s shifted the economy from one that was centrally-planned to one that comprised a mix of planned and free market elements. Agriculture underwent similar changes. In these circumstances, the traditional mode of production with high energy use and low output was out of line with the emerging commodity market economic system. So, on 18 September 1992, the State Council decided to develop 'high-yield, high-quality and high-efficiency' agriculture.

- 'High yield' refers to the better use of agricultural land. The goal was to raise outputs in the farming, forestry, stock raising, and fisheries sectors with an emphasis on increasing unit-area productivity.

- 'High quality' refers to the production of better varieties, and includes the improvement of seeds and superior quality products.
- 'High efficiency' means maximising the benefit:cost ratio of agriculture with the aim of balancing and harmonising the economic benefits and the social and economic costs.

Guiding the overall goals of 'high yield, high quality and high efficiency' for agriculture, the state issued and implemented a series of policies and measures which individually either weakened or strengthened the drive towards improved grain yield. When the emphasis of a policy was 'high yield', for example, then there would have to be some relevant measures to encourage farmers towards producing more grain. On the other hand, when the emphasis of a policy was 'high quality and high efficiency', then there would also have to be some relevant measures to make farmers produce less grain, but more alternative agricultural produce. Mostly the measures worked through a market system.

For example, a new protecting grain price (the floor price) policy was used by government from the year 1989 to 1991, which resulted in the total grain output reaching a new peak in 1990 (446.24 million tons). Nevertheless, farmers' incomes increased only marginally, due primarily to the fact that the floor prices for the main agriculture products were lower than the general market price, coupled with high prices for agricultural inputs. The purchase prices specified by the state trading enterprises were much lower than those on the open market, to which most farmers did not yet have easy access. Consequently, grain output in 1991 fell substantially, forcing the central government to reform the grain marketing system by relaxing price controls and the management of grain marketing, and introducing free-market mechanisms. As a result, the grain price increased. This caused the government once again to tighten control over grain marketing and prohibit individuals from purchasing grain except through the state-controlled grain marketing agency. A policy of 'strengthen agriculture' was introduced in 1995, which boosted the purchase price of grain and cotton, limited the high price of agriculture materials, and strengthened the overall administration of the links between purchase and sale. The provincial governors were given the responsibility of managing the production, price, purchase, and sales of grain. As a result, grain output once again increased, reaching a peak of 512 million tons in 1998 (Table 1).

The priority of the agricultural policies during this period was still national food security. The focus was on increasing and stabilising grain output. The goals of high quality and high efficiency were secondary. Faced with little capacity to increase yields further at this time, the only option was to expand the grain growing area, with the result that the clearance of forests for farming and the over-exploitation of soil fertility once again became rampant.

Inventories of the forest resource showed that 2 million ha of forests were confiscated and cleared for farming between 1989 and 1993, at an average rate of 0.4 million ha per year. As the exploitation of cultivated land increased, the area subject to soil erosion expanded, resulting in further deterioration of the environment in the Yangtze River and Yellow River basins. The Yellow River dried up for 217 days during 1998, while in August and September of the same year, catastrophic flooding occurred in the Yangtze River basin due to soil erosion, siltation of rivers and a reduced capacity to store floodwater.

During this period an all-inclusive market-oriented economic structure was established with complementary distribution and marketing mechanisms. The rights to use the "four wildernesses"— wild hills, wild hillsides, wild rivers and wild shoals — were sold by auction, while important stock reforms were initiated for firms. With the introduction of market mechanisms, and notwithstanding improvements in production efficiency, over-use and exploitation of resources surged again despite regulations put in place to try to counteract this tendency. Many of the essential factors of agricultural production (e.g. land, capital) were diverted to non-agriculture enterprises, such as setting up development zones and real

estate. Consequently, the area of cultivated land declined. Between 1986 and 1995, 1.88 million ha of agricultural land was lost. With this reduction, people had to rely more on chemical fertilizers and pesticides to increase yields. The amount of chemical fertilizer used rose from 19.7 million tons in 1984 to almost 35.5 million tons in 1996, an 80% rise in 12 years. Farmers' incomes began to rise rapidly. Nevertheless, the combination of ongoing deforestation, increasing pressure on cultivated land, and the adverse environmental effects of high soil erosion and increased fertilizer and pesticide use, all caused further environmental deterioration. Environmental protection continued to be overlooked in favour of increasing economic gains.

2.7.4 Stage IV: High-yields, high-quality, high-efficiency, environmental safety (the end of 1990s - present)

Since the late 1990s, with the deepening of reforms in China's market system, and with China's macro-economic development goals changing from those that made some of the population better off to ones aimed at extending prosperity and harmony nationwide, the previous development mode centred on growth alone was no longer appropriate. Decades of imbalanced development in China had brought to the surface and worsened such problems as widening social class differences, regional imbalances, disparities between urban and rural people, and environmental degradation. The devastating floods in 1998 were a good example of the kinds of problems brought about by imbalanced development and encouraged a nationwide reflection on the development approach of the past. This also came to represent a milestone in the whole process of agricultural policy reform from the end of 1990s to present.

China's agriculture also entered a new and complicated stage of its development from the end of 1990s. Two key issues were the increasing imbalance between quantity and quality of agriculture products, and the limited demand from the market resulting in serious structural surpluses. As a result, farmers' incomes were only rising slowly. At this time, the government began a comprehensive strategic adjustment towards agriculture from the perspective of balancing development between the urban areas and the rural ones, the agriculture and non-agriculture industries, and the different regions, as well as balancing the relationship between economic development and conservation of the environment. Whereas before, achieving production quantity had been emphasised, the focus now shifted to expanding variety and improving quality. Previous measures had focused largely on adjusting China's internal economy – now the focus was on much broader restructuring. The new or current policies have seven main thrusts:

1. To give priority to expanding the variety and quality of all agricultural products.
2. To develop processing industries for agriculture products.
3. To optimise the regional organisation of agricultural production.
4. To develop secondary and tertiary industries.
5. To expand urbanisation.
6. To reconstruct ecologically functional environments.
7. To accelerate the process of converting farmland to forestry, and pastures to grassland, as well as recovering lakes and wetlands.

The changes were aimed at comprehensive development of agriculture and the country's economy in ways that would also favour protection and reconstruction of the environment. The central government confirmed the principle of 'sustainable development of agriculture' in 1998 and introduced a target of high-yield, high-quality, high-efficiency and environmental

security. Environmental reconstruction programmes sprang up, including the Sloping Land Conversion Programme (SLCP), the Rangeland Retirement Programme (RRP) and the Farmland Retirement Programme (FRP). These environmental reconstruction programmes aim to convert the land previously planted for food crops to forestry land, grassland, and wetland.

Box 1: the Sloping Land Conversion Programme

Following the huge floods of 1998, the whole of China – but especially the central government – reflected deeply on the development approach policies of the past, and in particular the way that they failed to address impacts on the environment. Against this background, the Sloping Land Conversion Programme was launched in the three pilot provinces of Shaanxi, Gansu, and Sichuan in 1999. In 2000, the programme extended to the provinces of Yunnan, Sichuan, Guizhou, Chongqing, and Hubei (in the upper reaches of the Yangtze River), and to the provinces of Shaanxi, Gansu, Qinghai, Ningxia, Inner Mongolia, Shanxi, Henan, Xinjiang in the middle and upper reaches of the Yellow River, involving 13 provinces (or 174 counties). 2002 saw the full-scale campaign of land conversion to forests, whose scope expanded to 25 provinces (or 1,897 counties) from the previous 20 provinces. By the end of 2003 the programme covered more than 20,000 towns with over 100,000 villages and 60 million households. In 2004, the supply and demand relations of the grain market underwent great changes, shown by the climbing prices of grains. Therefore, the government made some partial adjustments to the policy of 'land to forest' by substantially reducing the land-to-forest area that had the potential for conversion, and by changing the method of subsidisation for the conversion of land to forest from grains to cash.

In regards to the implementation of the conversion of land to forestry, it is stipulated in the *Rules for the Conversion of Land to Forestry* that the government shall provide the land contractor with grain subsidies, a seedling allowance, and a living allowance based on the actual acreage of land that is converted into forests. In 2002, it was stipulated in the directive entitled the *Opinions Concerning the Further Improvement of the Policies and Measures for the Conversion of Land into Forestry* that the government provides free grain and cash subsidies to households engaged the land-to-forest conversion. The specific standards are: in the Yangtze River basin and south China, for each mu¹ of reforested land the government offers 150kg of grains; in the Yellow River basin and north China, for each mu of reforested land, the government offers 100kg of grains. For each mu of reforested land, the cash subsidy is RMB20. Grain and cash subsidies can be given over two years for the conversion of land to grassland; five years for land to cash forests; and eight years for land to ecological forests. The subsidised grains are valued at RMB1.4 per kilogram. Both grain and cash subsidies are financed by the central government.

In addition, the policy of the conversion of land to forestry stipulates that the government protects the owner's right to the grass and forests of the converted land. The contracting period of the converted land may be extended to 70 years. At the end of the contract, the contractor may renew in accordance with the relevant laws and regulations. The contracting and managing rights of the converted land may be legally inherited or transferred.

At the same time, policies on paying for environmental services were written into official documents and put into practice in some areas. Under the Sloping Land Conversion Programme, for instance, ecological reconstruction was controlled by government, while wetland rehabilitation and developing ecological agriculture were left to market forces.

¹ One mu is equivalent to 1/15th of a hectare; there are around 3,885 mu in a square mile.

The prominent features of this period were the comparatively low efficiency of agriculture and the slow growth of farmers' incomes. Many farmers migrated to the cities in search of wage-paying jobs. With the rapid growth of the economy overall, the demand for land for non-agriculture purposes increased sharply – a great deal of land therefore lay idle, having been confiscated or expropriated. Grain yields declined, falling from 512 million tons in 1998 to 462.2 million tons in 2000 and then to 430.7 million tons in 2003. Government revived the policy of assuring grain security and put in place a series of policies favouring farmers, such as abolishing the agricultural tax, and providing allowances for the purchase of improved seeds and farm machinery, all designed to encourage grain production. At the same time, government took measures to slow down the conversion of farmlands to forestry, the area of converted land declining from 20.3 million ha in 2003 to 4.1 million ha in 2004. The result of these policies was an increase in grain production to 469.5 million tons in 2004, an increase of 38.8 million tons from 2003. Per capita annual incomes of farmers rose 6.8% to an average of 2,936 yuan. All this posed a threat to ecological recovery and to the sustainability of the Sloping Land Conversion Programme. The contradictions and conflicts between achieving grain security, increasing farmers' incomes, and ensuring ecological integrity remained.

3. The influence of agricultural policies on payments for environmental services

The previous chapters of this paper reviewed the general features of China's agriculture and the evolution of its agricultural policies, and how these have led to the current situation. The size (total area, total population, and per capita land availability) and the complexity (diverse ecological regions, dynamic policy environment) of China ensure that agriculture is high on the list of national priorities. In the long pursuit of food security as a basic goal of agricultural development, the formulation and implementation of agricultural policies – and the general mode of agricultural development – have resulted in the widespread neglect of their environmental impacts.

- How did these different agricultural policies affect the environment?
- What positive and negative impacts have they had on setting up compensation mechanisms for the provision of environmental services?

In this chapter, we address these questions by considering the impacts of grain policies, policies for raising peasants' income, and policies for reconstructing the agricultural ecological environment, on payments for environmental services (PES). Until now, although the government and many other organisations have been trying to find and experiment with new approaches for PES, at the operational level PES remain closely linked to huge national programmes such as SLCP, RRP and so on. As conflicts between food security, environmental protection, and reconstruction continue to represent significant issues for China, so its agriculture policies – and especially its food policies – still impact substantially on the progress of PES.

3.1 Impacts of the Grain Policy on payments for environmental services

3.1.1 Impacts on environmental services by the government

Food security, often called 'grain security' in China, has been a central theme of Chinese agricultural policy since 1949. The official *White Paper on Grain Issues in China*, issued in 1996, set the degree of the country's self-sufficiency in grain at no less than 95%. The government has insisted on this level of self-sufficiency even though it has been questioned by academics. To ensure grain security, the government drew up policies to protect arable land, invest in the main grain production areas, and engage farmers in grain production. However, these policies adversely impacted on payment schemes for ecological services, including the Sloping Land Conversion Programme and the Rangeland Retirement Programme.

As the area of arable land declined in recent years under the SLCP and RRP, grain production fell. In 1996, there was 140 million ha of arable land in China, from which 504.54 million tons of grain were produced. By 2003, the area of arable land had shrunk to 123 million ha, a 12.1% decline in 7 years or an average annual loss of 2.5 million ha, while grain production fell to 430.70 million tons, representing a 14.6% decline. Of the arable land lost, the largest amount, 2.2 million ha, was converted to forestry or grassland (The Ministry of Land and Resource[?]s 2003) This reduction in the arable land area has been cited as one of the major reasons for the fall in grain production (General Team for Rural Investigation 2004). Meanwhile, grain consumption in China increased to about 480-490 million tons in recent years. This demand can only be met from no less than 106 million ha of arable land (Wan Baorui 2004), therefore in order to maintain enough food supply in the near future as food consumption increases, the government has to decrease the ratio of land

retired/converted. This is obviously inconsistent with the policy of land retirement (SLCP and RRP), as well as with the development of PES.

Table 8: The change in use of arable land nationwide between the years 1997-2003, unit: 10,000 ha (Sources: The State Environmental Protection Agency 1999-2002; The Ministry of the Land and Resources 2003)

Year	The real area of arable land being used in other ways	Of which								The real acreage of opened up wasteland	The pure decrease of arable land
		Non-agriculture building		Land conversion		Economic structure adjustment of agriculture		Destroyed by disaster			
		area	%	area	%	area	%	area	%		
1997	46.2	19.2	41.6	16.4	35.4	5.9	12.8	4.7	10.2	32.6	203.8
1998	57.5	17.6	22.8	16.5	28.6	7.0	12.2	16.5	28.6	31.4	391.5
1999	84.2	20.5	24.4	39.5	46.9	10.7	12.7	13.5	16.0	40.5	654.9
2000	156.6	16.3	10.4	76.3	48.7	57.8	36.9	6.2	4.0	29.1	1912.5
2001	83.0	16.4	19.7	59.0	71.2	4.5	5.4	3.0	3.7	20.3	926.0
2002	202.9	19.7	9.7	142.6	70.3	34.9	17.2	5.8	2.8	34.1	2,531.2
2003	284.8	22.9	8.5	223.7	78.6	33.1	11.6	5.0	1.8	31.1	3,806.1

The concept of regional grain self-sufficiency had a positive influence on the rigorous protection of arable land; China has for years insisted on grain self-sufficiency in each province. If large-scale land retirement took place, grain security might still be guaranteed in the more fertile eastern and coastal regions, even when a major crop failure occurred, but the remote western regions might face the “fear of grain shortage” because of transport difficulties over such long distances. In view of this, the amount of land scheduled for retirement under the SLCP was cut sharply from 3.3 million ha in 2003 to 0.7 million ha in 2004. This abrupt change surprised all those provinces in which the SLCP was being implemented. The inconsistency of the SLCP policy indicates that the government has not yet found a strategy for ensuring both grain security and ecological protection.

In 2004, a new set of policies that subsidise farmers was introduced. The measures include: direct financial support to farmers; subsidies on the purchase of seed and agricultural machinery; and reductions in, or exemptions from, agricultural taxes. The policies encouraged farmers to produce more, with the result that grain production reached more than 465 million tons in 2004. The policies also raised the opportunity costs of converting farmland under the SLCP and the RRP, and therefore discouraged farmers from converting farmland. If these policies are successful in increasing grain supply, raising the grain price, and encouraging the sustained development of the grain processing industry, it is likely that farmers who took farmland out of production will convert it back again for grain production. That will pose a big challenge to the continuity of the SLCP and RRP.

From a long-term perspective, strengthening the capacity for grain production should be conducive to payments for environmental services by the government. Grain production is being promoted according to the principle ‘Grow crops, plant forests, and raise cattle wherever land is appropriate to do so’. In addition, favourable policies and subsidies for the construction of water conservation works, agricultural extension, and agricultural infrastructure will support the production of grains. Producing top-quality, high-yielding and high-value products that are competitive in the market in these areas will also help to provide grain to those regions that are less favourably endowed with agricultural resources, such as

the western regions of China. This will allow ecological restoration to occur in these regions, though it will be hard to see any effects in the near future because the mechanism for long-term support for agriculture has not yet been set up. In addition, introducing the necessary technological innovation is complicated and takes time. New technologies will usually increase production costs, at least initially, and it is not always certain that the marginal benefits will cover or exceed the costs. If the opportunity costs are taken into account, promoting new technologies for grain production may be even more difficult. It also usually takes a decade or more to scale up an advanced production technology. For example, although 3rd generation hybrid rice was introduced in the mid 1970s, the area under hybrid rice had reached only 41.2% of the total cultivated area of rice by 1990 (Hu Xiaoping 2001).

The principle of grain security and self-sufficiency has strongly negatively affected the purchase of environmental services by government. The government has realised that grain security can be guaranteed only after the grain production capacity is enhanced. As agricultural production in China is generally carried out on tiny individual plots of land with limited mechanisation, transforming the production system to produce higher yields will take considerable time and substantial restructuring. Until then, the policies of protecting arable land and providing agricultural subsidies are holding back the ecological restoration projects proposed by the government, and threaten their sustainability. In the long term, enhancing grain security by increasing the efficiency of production will benefit ecological restoration through payments for environmental services, but it cannot bring about any positive effect in the short term.

3.1.2 Impacts on market-based payments for environmental services

The 'grain policy' has had negative impacts on the development of markets for environmental services in terms of market formation, market supply, and market demand. With the rapid and high growth of China's economy and its entry into the WTO, China's agriculture has become a part of the international market. Since China's agriculture has a low comparative advantage and is faced with threats from the international market, the country's agricultural policies are orientated toward protection. Policies on grain production are geared to guaranteeing grain security. Besides direct policy interventions, indirect market-based macro interventions have also been used to control farmers' production activities. When these market measures fall short of attaining the goals of grain security, direct interventions come to the fore.

The elimination of agricultural taxes and fees and the emergence of various government subsidies have lessened the burdens on farmers and raised the comparative advantage of agricultural production. When the economic benefits of agricultural production rise faster than the value of environmental resources, those policies aimed at expanding agricultural production undermine those policies aimed at developing environmental services. The Chinese government is – and has always been – fully aware of the value of grain production to society. After each major decline in grain production, the government has immediately instituted measures to support agricultural development. Grain production in China has fallen continuously since 2000, dropping below 450 million tons in 2003 and producing a shortage of supply in the market. The "fear of grain shortage" then reappeared, giving rise to political and economic tensions in society. The return of government support for agriculture is not consistent with free-market principles and is undermining the development of environmental services.

Inevitably, the overemphasis on grain security intensifies people's sense that livelihoods should come before the environment, making it difficult to increase national awareness of the need for environmental protection. Weak consciousness of environmental protection was a key factor interfering with transactions in this market. It is difficult to develop market purchasing power if people are not conscious of environmental services, or are only dimly aware of the need for environmental protection. Over the past few years, environmental

deterioration in areas with a fragile ecology, and the frequent occurrence of natural disasters due to this deterioration, have raised people's awareness of the need for environmental protection, though it is not yet deeply rooted in their minds.

The investments by the government in building grain production capacity in the prescribed 'Grain Production Bases' gives the public the impression that it is the government's responsibility to pay farmers to use the land in particular ways. Therefore people usually consider environmental services to be a public good and so expect government to pay for the provision of such services. To date, government has reinforced this notion by taking the responsibility of paying ecological compensation, which has had the psychological effect of curbing people's willingness to develop an environmental services market.

In short, the policy of ensuring grain security has had a negative effect on the environmental policies of the government, and has retarded the development of a market for environmental services. It will take considerable time to work out how to set up the mechanisms for achieving balanced and sustainable development of grain security and environmental protection. One option is for the government to strive to shift responsibility for paying for environmental services from itself on to the market so as to reflect to true value of these environmental services. The primary task of government should be to establish the mechanisms for a market in environmental services and to provide the necessary supportive reforms.

3.2 Impacts on PES of farmers' incomes

The major problem in rural China since the late 1990s has been the reduction in the rate of growth of the annual income of farmers. Between 1996 and 2000 the annual increase in farmers' average incomes declined from 22.1% to just under 2.0% (Table 5). Since 2000, the government has implemented a series of agriculture-friendly policies, which together with the growth of the national economy overall, has meant a minor recovery in farmers' incomes, the annual rate of growth increasing to 12.0% in 2003-2004 (but, according to the People's Daily Online, only 6.8% when adjusted for inflation).

Despite this, the income gap between urban and rural residents has continued to widen, both in absolute terms and in the rate of growth. In 2004, the average disposable income of an urban dweller was 9,422 yuan, while the average farmer's net income was only 2,936 yuan, a 3.2 times difference. The average income of farmers in the vast middle and western regions was even lower, about 2,120 yuan or almost 28% less than the national average (National Bureau of Statistics of China 2005). In 2004, an estimated 26 million people were living in absolute poverty in China, with a further 80 to 100 million living in relative poverty. Most of these impoverished people live in the vast environmentally fragile middle and western regions. The pressures of sustaining livelihoods in these regions have worsened environmental conditions through over-development and degradation of the resource base. Therefore, it is important to adopt policies and measures to increase farmers' incomes in ways that will also help to protect the general environment in the long run.

3.2.1 Impacts of government payments for environmental services

The transfer of surplus rural labour to secondary and tertiary industries in the cities is conducive to the establishment and implementation of environmental services compensation mechanisms paid by the government. From a government perspective, it helps to promote overall economic development, which in turn produces more revenue for government, putting it in a better financial position to support the compensation payments for environmental services.

The flow of rural labour out of agriculture also reduces environmental pressures as people take up new livelihoods, making progress on environmental rehabilitation projects easier and smoother. From a farmer's viewpoint, the massive movement of labour into the secondary

and tertiary industries improves the prospects of the remaining farmers who rely on agricultural production for their livelihood. This may reduce their motivation to over-exploit environmental resources, making them more able to provide environmental services to society.

In reality, because of China's dual economic structure, many specific policies are not conducive to the free flow of surplus rural labour into the secondary and tertiary industries in cities. Migrant farmer workers find it difficult to make the transition to urban life, which has resulted in the emergence of a huge migrant population that is unique to China. Though these migrant workers live in the city year in and year out, their roots stay in the countryside, where natural resources and agriculture remain as the fundamental guarantee of their livelihoods. Migrants who maintain both rural and urban homes present a challenge to the government in its efforts to set up payments for environmental services. Government therefore needs to explore new ways of paying compensation in regional and urban-rural environmental settings, and to remove the various obstacles to the transfer of surplus rural labour into the cities, including household registration, education, medical care, and social security.

Government policies that develop township and village enterprises in secondary and tertiary industries are important alternative sources of off-farm income to farmers and therefore should be positive factors in the development of environmental services. However these enterprises are characterised by poor technology and are often a major source of pollution. Therefore to some extent, the environmental benefits brought about by government-purchased environmental services are compromised by the pollution from village and township industries. For example, discharges of "the three wastes" (wastewater, gas emissions, and solid waste) from township industries accounted for one-fifth to one-third of that of all industrial enterprises in the year 1995, of which:

- The discharge of industrial waste water (5.9 billion tons) was 21% of the national total.
- The discharge of sulphur dioxide (4.41 million tons) was 24% of the national total.
- The production of industrial solid wastes (0.18 billion tons) was 89% of the national total.

(Source: SEPA 1997)

China's development strategy during the period of economic reform has produced marked regional imbalances. A huge economic gap, in terms of both income and its rate of growth, has been created between the richer eastern provinces, and the vast middle and western regions – particularly the environmentally vulnerable areas within them. A major task for the government has been to narrow this gap. As economic growth figures are important appraisal criteria in the evaluation of officials' administrative performance, local officials try to attract investment and enterprises. Many of these are highly polluting and have been moved from the eastern region or some cities because of this. As a result, pollution has been transferred from urban to rural areas and from the east to western regions. Reasons for this widespread transfer include: environmental effects not being given enough attention during the process; environmental indicators are often not included when evaluating official performance; and legislation on environmental protection and evaluation is inadequate. These heavy industries, set up to employ surplus labour, are operating at a considerable cost to the environment and natural resources. In addition they are often nullifying, to some degree, the gains being made through government-purchased environmental services.

3.2.2 Impacts on markets for environmental services

The policy of raising farmers' income has mixed impacts on the development of an environmental services market. Township enterprises and conventional agricultural production seriously pollute the environment in rural areas and reduce the supply and quality of environmental services, such as the production of clean water. Rather than enhancing people's awareness of the need for environmental protection, this pollution produced in pursuit of private economic interests is creating social inequalities. People are trying everything to maximise their interests at the expense of resources and the environment, showing that they are only dimly aware of the importance of environmental protection and do not recognise the value and function of environmental services – much less that they are prepared to pay for them. Awareness of the need for environmental protection is a precondition for developing environmental service markets, and the government is trying to improve awareness by:

- Setting up an environmental accounting system linked to GDP.
- Making environmental protection one of the achievements of cadres in their official careers.
- Imposing ecological taxes.

The government's participation and promotion is an important warranty for the formation of the environmental service market. Public departments can promote the development of the environmental service market by means of financial transfer payments and the imposition of environmental taxes, or by formulating rules, policies and regulations. With regards to the policies for encouraging farmers to increase their income, the government has failed to issue enough policies on investment, technology, and markets. Where there are policies, some of these cannot be implemented because there is either no law, regulation, or rule that has detailed and specific provisions for the implementation of such policies, or there are no organisations or personnel responsible for implementation of such policies who fully understand their implications. Consequently, this greatly restricts the development of the environmental service market.

The policies aimed at raising farmers' income did not ultimately increase the income ratio of farmers in the long run, and they in fact restrained farmers' capacity to supply environmental services. For more than 20 years, the incomes of urban and rural residents have been increasing but the gap between them has widened (see Table 5 and Figure 2, previously). Until the end of the year 2004, there were almost 26.1 million 'absolutely poor' people in China (according to the absolute poverty line of RMB 668 yuan per person per year set by central government). But in reality there are far more people living in poverty if the standard of US\$1 per person, per day is applied. With respect to the distribution of poverty in China, most of the poor are in the rural and remote areas, with the most degraded environments and resources to be found in the southwest and northwest of China. Conversely, the livelihood vulnerability of people living in these regions has made them strongly dependent on natural resources and the environment for their livelihoods. [0]With such a low level of income, farmers are unable to invest in the supply of environmental services if they have no access to compensations or related benefits.

To conclude, the policy of raising farmers' incomes has had mixed impacts on payments for environmental services purchased by the government and the market. Some of these policies contribute to the development of markets for environmental services, while others restrain that development. Farmers' incomes are even lower in the vast middle and western regions, particularly in environmentally vulnerable areas where important environmental resources are being used to supply basic livelihood needs. Environmental services can only be provided when the value of the payments for environmental services in the market is higher than the livelihood value of these environmental resources.

3.3 Impacts of economic restructuring of agriculture on PES

Changes in the economic structure of agriculture have also had mixed impacts on payments for environmental services purchased by the government. Three particular aspects will be discussed in this section:

1. The incompatibility of current production goals with those of environmental conservation and sustainability.
2. The necessity for better alignment between agricultural practice, natural resource endowments, and market demand.
3. The need to develop more appropriate secondary and tertiary industries linked to agriculture in the rural areas of China.

3.3.1 Incompatibility of production and conservation goals

The current agriculture policy of 'high yield, high quality and high efficiency' aims at increasing the output of per unit area, upgrading product quality, and enhancing the comprehensive benefits of agriculture – especially the economic ones – with highly intensified production as the major means of achieving these objectives. This requires the use of large amounts of fertilizers and pesticides, which conflicts with environmental and safety goals. The 'environmentally-friendly' goal requires ecological balance and sustainable development in agricultural production; the 'safety' goal highlights food safety standards in agricultural products.

Currently, fertilizer-use efficiency is only 30% to 40% in comparison with 50% to 60% in developed countries (with the EU nations achieving 70% to 80% efficiency in their use of nitrogen fertilizer). In 2004, China produced and consumed about 33 million tons of nitrogen fertilizer domestically. If China could achieve a 70% efficiency in the use of nitrogen fertilizer, it would save 20 million tons of nitrogenous fertilisers (equivalent to 40 million of urea). Because of the large amounts of energy used to produce nitrogenous fertilisers, this would also save up to 60 million tons of coal from being burnt each year. The inefficiency of fertilizer use causes great economic loss. The leaching of nitrogenous fertilizer pollutes rivers, lakes and groundwater, threatening aquatic life and damaging the health of human beings. Likewise, the use of large quantities of pesticides may contaminate air, water, soil, and foodstuffs as well as being toxic to those that apply them. Serious damage to agricultural environments interferes with the implementation of environmental rehabilitation projects run by the government in rural areas.

The damage caused to the environment by agricultural intensification is not only contrary to the environmental and safety goals, but also acts against the purchase of environmental services by government. The advantages of intensification are that, in addition to raising farmers' incomes, it rapidly increases China's overall agricultural productivity, and reduces excessive exploitation of natural resources in more marginal agricultural conditions. This could benefit the farmers in these regions by improving their ability to provide environmental services, and the government, by increasing the opportunity to purchase environmental services.

3.3.2 Reforms to agricultural planning

Better planning of regional agriculture would help farmers in the environmentally vulnerable areas of the middle and western regions to orientate their agriculture towards those production systems best aligned with the regions' natural endowment of resources and corresponding market demands. This would reduce environmental pressures and facilitate the establishment of mechanisms for the purchase of environmental services by government. In areas of naturally low productivity, crop production and animal husbandry often involve extensive production systems, which in turn can cause great pressure on the environment. Increased soil erosion, sedimentation, ever-intensifying sandstorms, and increased flooding in recent years in China are all the direct results of environmental degradation. Optimising regional agricultural planning could lead to the selection of primary industries on the basis of resources and market demands instead of an all-embracing single agricultural mode. Realising economic benefits should run parallel to maximising environmental benefits.

3.3.3. Development of secondary and tertiary agribusinesses

Agribusiness should be focused on attracting social forces to invest in secondary and tertiary industries. Leading enterprises, farmers' organisations and big agribusinesses can help set up networks such as 'Company + Households' to facilitate bringing farmers to the marketplace. If this proves to be effective, the agricultural production structure in China – especially in the fragile ecological areas in the western regions – would be fundamentally changed, and a mechanism would be built for establishing substitute industries aimed at ecological compensation. Reforming the structure of agriculture is an enormous task, the success of which depends on two key elements.

1. Firstly, whether or not farmers can play a key role in the structural adjustment.
2. Secondly, whether or not the farmers' performance of their role in the structural adjustment is supported and guaranteed by external conditions.

In reality, the key role of farmers in structural adjustment has not been put fully into play. The local governments in many regions have no detailed information about markets and the changes in demand. Instead, the government makes decisions on behalf of the farmers, including issuing administrative orders to force the farmers to 'become prosperous' in terms of certain indices. External conditions needed to support the readjustment of agricultural structures – including financial support by the government, scientific and technological progress, improvements to the market system, and creating farmers' organisations – are not widely available, so it is difficult to achieve effective results. This is why, after farmlands were converted to forestry and rangelands were retired, setting up substitute industries in these fragile ecological areas failed.

Further investment in the development of agriculture and rural areas will improve the prospects for compensation based on financial transfer payments. The economic and social divisions between urban and rural society are a basic factor restricting farmers' abilities to increase income. In the future, efforts should be made to adjust the distribution of national income and the structure of financial expenditures. The mechanism of financial transfer payments should be more quantitative, detailed, practical, specific and legitimate. Specific regulations should be provided relating to: financial support to agriculture, the proportion of investment in research in agricultural science and technology, and the proportion invested in education, health, and medical services in rural areas. Laws and regulations should be formulated concerning the system of rural taxes and administrative charges, the rural financial system, and the social security system, otherwise the planned investments in agriculture and rural infrastructure will be not secured, and there will be insufficient or no investment at all.

3.4 Policies on land rehabilitation

3.4.1 Main features

Since the mid 1990s, China's policies on land rehabilitation or restoration have comprised three main elements:

- Environmental projects.
- Promotion of environmentally-friendly agriculture.
- Resettlement.

Converting farmland to forestry is one example of a successful scheme of compensation payments made by government for the supply of an environmental service. The policy has consistently given priority to environmental rehabilitation. Instead of issuing orders, the government has offered incentives to farmers in the form of grain, cash, and seedling subsidies. The contents of these subsidies are simple and transparent. The policy has displayed some unprecedented characteristics: the responsibilities of various departments are clearly defined, and the practice is under the legal protection of the *Rules for the Conversion of Farmlands into Forestry*.

Some farmers welcomed the changes in land use from agriculture to forestry, especially where livelihoods were poor. But attention needs to be given to the sustainability of this policy. There are three major problems.

1. Firstly, the levels of compensation are being reduced and the duration of compensation is being shortened due to tighter government budgets.
2. Secondly, further conversions have been stopped due to concerns about food security. In some cases, converted land has been changed back to farmland.
3. Thirdly, when the period of compensation is over, the farmer is not given any farmland to cultivate.

Table 9: Area of converted farmland, and grain subsidies paid by the state from 1999 to 2003 (Source: Tao Ran, Xu Zhigang and Xu Jintao).

Year	Converted farmland area (10,000 ha)	Accumulated converted farmland area (10,000 ha)	Food subsidy (10,000 tons)	Money spent on food subsidy (100 million yuan)
1999	38.1	38.1	69.8	9.8
2000	40.5	78.6	143.9	20.1
2001	42.0	120.6	220.7	30.9
2002	264.7	385.3	705.1	98.7
2003	333.8	719.1	1,316.0	184.2
1999-2003	719.1		2,455.5	343.7

Note: in this table, it is assumed that the converted area in the north of China is 56% of the total, while 44% is in the south, and that this ratio remains constant over all years. The calculations of the quantities of grains handed out as food subsidy, and the monetary value of that subsidy, are based on that assumption.

The promotion of environmental awareness started in the late 1970s and early 1980s. By 2000 it had been popularised nationwide and had produced many economic, ecological and social benefits. Environmentally-friendly agriculture in China can also be thought of as 'ecological agriculture'. Ecological agriculture means a sustainable producing system through which energy is recycled between people, biology and the environment; in this system, each stakeholder would be a key net point. For example, a very typical mode of ecological agriculture in south China is made up of animal rearing and marsh gas utilisation. In this mode, marsh gas is the key element that makes all the others function together: the animal rearing (pig, chicken, duck, fish and so on) and growing support the raw materials to produce marsh gas, in other way, the marsh gas is the energy of daily life, and the waste of marsh gas would be the fertilizer for growing. So in the long run, besides the economic benefit of farmers, the environment are be protected and benefits the whole social.

With regards to environmentally-friendly agriculture, under the unique development background of China – which has less arable land per capita than many countries, a large population and a tradition of intensive cultivation – the country's ecological agriculture has followed its own unique development model. This can be conceptualised as a sustainable agricultural development model which is a combination of industrial agriculture and organic agriculture. It absorbs elements of traditional organic agriculture, but does not reject industrial technologies, unlike the western organic agriculture model. In support of this approach, China has build up 528 ecological agriculture integration demonstration areas, of which 166 are national ones.

Box 2: Ecological agriculture integration demonstration areas

An ecological agriculture integration demonstration area is an open, complex, ecological model designed with the aim of building a sustainable social, economic and environmental development system. The principle underpinning this is the theory of sustainable development and the size of the area can be small (like a local community) or large (like a regional area).

The functions of ecological agriculture integration demonstration areas in China now are chiefly:

1. Experimenting in order to identify some new forms of sustainable development modes, especially in the field of agriculture.
2. Testing forms of new technology and innovative skills in order to assess their strengths and weaknesses and develop them further.
3. Using these areas as living laboratories, for example, for a college or university, as well as providing huge economic and social benefits for farmers and the society as a whole.

In terms of ecological resettlement, farmers living in the fragile ecological areas have been resettled to areas where living conditions are better so as to promote conservation and environmental restoration. Where resettlement is carried out to support environmental objectives, compensation is fully funded by the government. The compensation amount is directly related to the future life of these migrants.

Resettlement improves the environment in the vulnerable areas by reducing the pressure on these areas by farmers and herdsmen. After resettlement, however, the farmers and herdsmen experience massive changes in respect to their living and employment circumstances. Therefore, the government needs to assist the farmers and herdsmen to find new and substitutable sources of livelihoods so as to ensure that the migrants do not return to the areas that they left and continue damaging them.

3.4.2 Impacts on payments for environmental services by the government

The policy of rehabilitating degraded agricultural environments is, in general, conducive to setting up mechanisms for the purchase of environmental services by government. On the one hand, the process of rehabilitation improves and protects the environment, especially in environmentally vulnerable regions. On the other hand, reconstruction helps to increase farmers' incomes, as they are paid to undertake much of the work, and diversifies their means of livelihood, thereby helping to reduce their dependence on environmental resources for a living. Thus the policy helps create the right external conditions for establishing environmental service mechanisms paid for by the government.

There are a number of problems, however, which can hamper the establishment and improvement of these compensation schemes. Take the farmland-to-forest conversion programme as an example:

- A. Firstly, the government uses a financial value of output from the land – instead of its full economic value – as the yardstick for compensation, which makes farmers disinclined to, and less able to, provide environmental services. Furthermore, many farmers and herdsmen chose seedlings of commercially valuable species by way of compensation in expectation of eventual higher economic returns when the trees are harvested. This goes against the national policy, which stipulates that no less than 80% of the restored forests should revert to a natural state as “ecological forests” (Huang He et al. 2004)
- B. The second major problem is the lack of active participation of the service providers and the beneficiaries in these government-planned schemes. As a result, many people have an incomplete understanding of the significance of environmental services and the need to maintain them. The official documents of the conversion programme require a combination of policy guidance and farmers' voluntary participation. But an investigation by Tao Ran (2003) in Sichuan, Gansu, and Shaanxi provinces indicates that at the preliminary stage of conversion most farmers (about 79%) said that although the government did some mobilising, the farmers were not asked their opinions about the implementation of the programme. In the sampled households, most had no choice in deciding which plots or areas were to be converted, or the kinds of trees to be planted afterwards.
- C. Thirdly, at present, compensation payments for environmental services by the government in China are effectively purchases of environment services between regions and between urban and rural areas. For instance, implementation of the Tianbao Project mainly benefits people in the middle and lower reaches of the Yangtze River and the Yellow River. But the environmental services are being provided from areas in the upper reaches of the Yangtze and Yellow rivers, so this represents a purchase of environmental services by one region from another. The conversion of farmland to forest is more beneficial to people in the cities than to those in the countryside, though the environmental services being purchased are being supplied by those living in the countryside and the amount that they are being paid is not commensurate. As mentioned above, because the payment for land conversion is made according to yield value (as opposed to the full economic and ecological value) this means the payment to rural areas from urban ones is not the full value that the urban beneficiaries should pay for the environment service they consume. Therefore, it is necessary to improve the mechanism of transfer payments between regions and between urban and rural areas so as to ensure the sustainability of the compensation for environmental services being paid by the government.

3.4.3 The impacts on the development of markets for environmental services

The policies on the rehabilitation of the agricultural environment are carried out under the direction of government departments, and the government is the main purchaser of the resulting environmental services. Government also sets the price to be paid for these services, without the participation of the environmental service providers – those who use the land, i.e. there is no negotiation in the price-setting process. This greatly affects the payment of compensation for the provision of environmental services as purchased in the open market.

From the perspective of the buyers of environmental services on the open market, the implementation of policies on rehabilitating the agricultural environment helps to maintain ecological balance, promote sustainable development and use of environment resources, and lessen the environmental pressures arising from the farmers' pursuit of their livelihoods. Improvements to the environment reduce the need for environmental service markets. Moreover, as the economy develops and people's awareness of the environment grows, prices for environmental services may rise. Therefore, implementing a policy of environmental rehabilitation does not always support the establishment of a purely market-driven compensation mechanism for environmental services.

Nonetheless, as compensation payments for environmental services in China are made mainly between regions or between urban and rural areas, the service providers and the buyers are mainly the regions and cities respectively. In nearly all cases the national or provincial government is the buyer. Consequently, implementing the policy – to some extent – favours the establishment of compensation mechanisms for the supply of environmental services in open markets with the government initially being the leading buyer.

To sum up, projects under the Sloping Land Conversion Programme (SLCP), as well as other ecological projects paid for by the government, appeal to the farmers. Noticeable achievements have been made in these, but they restrain the development of free markets for ecological services. The policies promoting ecological agriculture have had positive impacts on payments for environmental services purchased by both the government and the market. And finally, as resettlement for environmental reasons in China is small and implemented solely by the government, it has no obvious significant impacts on the development of compensation mechanisms for the purchase of ecological services in open markets as yet.

4. Summary and the future of payments for environmental services

Since the founding of the People's Republic of China more than 50 years ago, the country's agricultural policies have evolved through four distinct stages, but with a common stress on attaining the primary goals of national food security and making agriculture the sound basis for China's industrialisation. The latter goal was more apparent during the stages before reform and the opening up of China's economy, changes that released the productive forces fettered by the old rigid structures. As a result, food security is no longer the primary aim of China's agricultural policies, and more consideration is being given to the social and environmental benefits that agricultural policies can bring about.

Since the 1990s, as China's national economy has been surging ahead, agriculture has been losing importance in the national economy, with its proportional contribution to total GDP declining sharply. Moreover, with the widespread application of modern technologies, agricultural productivity has risen considerably and surplus rural labour has appeared. Nevertheless, despite the reforms and opening up of markets, the urban-rural economic divide has persisted and is still exerting a profound impact on many aspects of social and economic development. Because of this divide, assimilation of rural people into the cities has been slow, and many migrant workers in the cities retain their links to the countryside. At present, the proportional contribution of the value of agricultural production to the national economy is much lower than the proportion of the population living in rural areas, suggesting that there is a huge surplus or quasi-surplus of labour in the agricultural sector.

Much of China's agriculture remains locked in small-scale production where the role of markets is insignificant. The chief aim of this subsistence agricultural production, especially in the middle and western regions, is to provide for a family's living needs. The scarcity of resources and low productivity keep most of these farmers and their families always on the brink of hunger. The pressures of making a livelihood under such circumstances in turn compel these farmers to over-exploit their resources, which degrades the environment.

With China's entry into the WTO, China's agricultural products market is being integrated into international markets. In the face of the acute competition in these markets, where developed countries can take advantage of their intensified agricultural modes, China's agriculture is confronted with a big challenge. The same is true of farmers in China's middle and western regions, who cannot remain detached from the waves of globalisation. Consequently, with the adoption of new technologies in agricultural production and management, the excessive development of resources for the purpose of increasing competitiveness puts immense pressure on the environment. The use of large amounts of fertilizers and pesticides, a feature of modern agricultural technology, causes great damage to the environment too.

Under these circumstances, China's agricultural policies are gradually taking environmental effects into account, with the concept of compensation payment mechanisms for the provision and maintenance of environmental services beginning to emerge. The current environmental compensation mechanism is characterised by the government's purchase of environmental services. But environmental service providers are currently not involved in the process of deciding on the kinds and levels of compensation. Government, as the agent of the beneficiaries of these environmental services, is setting the levels of compensation too low. As a result, most providers of these services are not able to cover the cost of lost opportunities, a factor which is acting as a disincentive to provide the services.

There is no doubt that environmental services and the environmental services market actually exist, but there is also no doubt that these services and their market are far from perfect. For quite complex reasons – such as poor regulations, political blocks, benefit conflicts between different stakeholders and so on – this market has not been an open market until now.

The establishment of compensation mechanisms for environmental services should proceed from the policymaking of agricultural development. In formulating future agricultural policies, equal emphasis should be placed on environmental safety and food security. Meanwhile, the state should legislate to regulate the standards and contents of environmental services compensation packages. The mechanism for making these compensation payments for environmental services should change gradually from one that is led by the government to one that is driven by market forces, with market-based purchases of environmental services eventually becoming the primary form of compensation. The government's role in turn would be one of the standard-setter and regulator, drawing up and enforcing relevant rules governing the functioning of the market for environmental services.

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[MK1]Needs adding