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Abstract:

With over a billion people in China, the issue of cultivated land conversion is extremely important both in terms of food security and environmental sustainability. This paper investigates the relationship between cultivated land, environment, and food security in China; and seeks to identity the main challenges facing China in terms of arable land protection. It further discusses the concept and practical implications of land governance in relation to food and environmental security, and suggests that comprehensive, human-centred and sustainable land governance is required to enhance China's food security and environmental sustainability.

Keywords: Cultivated land conversion in China, food security, environmental sustainability, land governance

Introduction

Security, environment and development are increasingly inter-connected and nowhere is this more true than in China. Since the beginning of its economic reform policy in 1978, China has undergone rapid economic and social transformation, and in general living standards have improved significantly. At the same time, however, rapid socio-economic development has brought about some challenges, including environmental insecurity. International pressure has been growing on China in recent years, to adopt more environmentally sustainable policies. The main focus of international negotiations has pertained to carbon emissions and energy security. The issue of cultivated land conversion in China is critical to food security and environmental sustainability. The 2007/08 global food price crisis, followed by the 2008-2009 economic down turn, has already pushed more than one billion people into hunger and poverty; that is about one-sixth of all human beings do not have enough food to eat.[1] Since China is the world's most populous nation with a population of 1.3 billion, the global food situation brings enormous pressure on its food sufficiency.

If China were to face food insecurity or failed to provide adequate protection to the environment, it would directly impact worldwide food and environmental security. Research into China's cultivated land conversion is limited and this paper aims to understand some of the relevant issues. We attempt to discuss China's cultivated land conversion in the context of food security and sustainability. To this end, we consider, first, Chinese approaches to cultivated land and food security. An appreciation of how these issues are currently understood provides a context for the subsequent discussions. We then examine the issue of cultivated land conversion in the context of food security and environmental sustainability, and show why the issue has become a security issue. Finally, we discuss the concept of land governance and its policy implications.

[1] '1.02 billion people hungry: One sixth of humanity undernourished – more than ever before', FAO Media Centre, http://www.fao.org/news/story/0/item/20568/icode/en/.

Cultivated Land and Food Security in China: Discourses and Securitisations

Famine and security

> 'Security-insecurity is defined in relation to vulnerabilities – *both internal and external* – that threaten or have the potential to bring down or weaken state structures, both territorial and institutional, and governing regimes'.[2]

Hunger and famine constitute recurring socio-political issues in China, not least because, over the ages, the country has been afflicted with recurrent famines and related uprisings.[3] Thus the country is vulnerable to food insecurity, which has the potential to undermine governing regimes. Even after the establishment of People's Republic of China (PRC) in 1949, food security was a major preoccupation for policy makers and occupied centre stage in national socio-economic planning. In 1954, rationing was introduced to reduce food insecurity, continuing for forty years until 1994.

One of the most devastating famines in Chinese history occurred during the Great Leap Forward of 1958-1960 and the memories of those tragic years are still strong. The Great Leap Forward was an extreme case of the adoption of an unsustainable and counterproductive development model. Paradoxically, eagerness to catch up with the industrialised countries and to improve living standards, led China to undermine its agriculture, while mobilising the whole nation to develop heavy industry – especially iron.[4] The result was that in two years (1958-1959), 7.25 million hectares (mha) of farmland was lost, and by 1962 the area under cultivation was smaller than at any time since 1950.[5] In 1956 before the Great Leap Forward, China's population was 628 million and national gross grain output was 193 million tonnes (mt), or 306 kg per capita. However, four years later, grain production had dropped by 50 mt to 143mt, account for only 216 kg per person (see, Appendix 1). Between 27 and 30 million people are estimated to have died in the famine, casting a lasting psychological shadow over Chinese security thinking. This human suffering was followed by a further and lengthy period of political upheaval, that of the Cultural Revelation (1966-1976).

[2] Ayoob 1995, 9.
[3] Fan and Cai et al. (eds.) 2009, Vo.5 (4).
[4] Bo 2008, Vo.2, especially chapter 26.
[5] Ash and Edmonds 1998, 837.

Consequently many Chinese were in a state of chronic food insecurity for about twenty years (1958-1978).

The rural reform and grain outputs

China's economic reform began in the agricultural sector in 1978, as a response to the vital need to lift the nation from chronic food shortages and massive malnutrition. It is estimated that more than 100 million people suffered from recurrent food shortages resulting in severe stunting, diminished capacity for work and higher incidence of morbidity. Thus, food security became a precursor of market-oriented reforms.

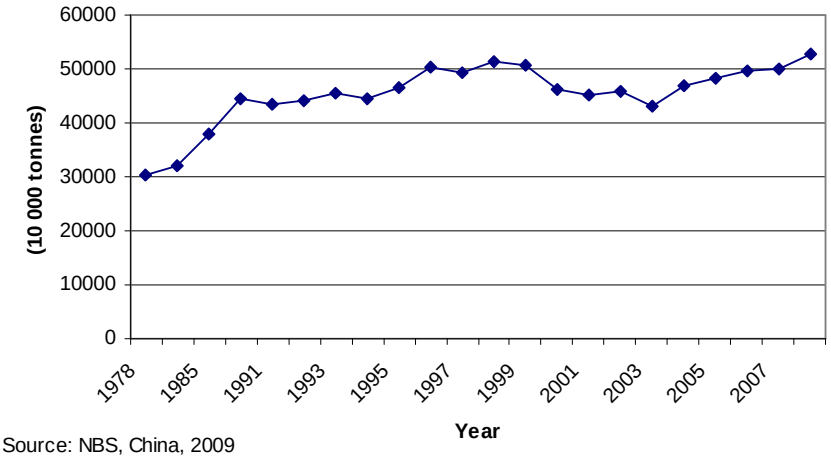
In the early 1980s, the household responsibility system (HRS) was widely adopted as a replacement for the previous system of the people's commune. HRS was first created by a group of devastated hungry peasants (see Photo 1) but spread nationwide with the support of the central government; by 1983 more than 93% of production teams had adopted the system. Under HRS, households were allowed to lease land, and hire machinery and other facilities from collective organisations.[6] In other words, farmland remained owned by village collectives, but the collectives offered leases and contracts to individual households. Individual households could take independent operating decisions within the limits of their lease or contract. After paying a fixed amount to the government, they could freely dispose of surplus production to the market.

Picture 1: In 1978, hungry villagers from Xiaogang village, Anhui Province, China, began their way of 'household responsibility system'. Source: http://www.tstv.cn/guoqing/daguo/200908/86696.html.

[6] '1983: Household Responsibility System', *China.org.cn*, 16 September 2009, accessed at: http://www.china.org.cn/features/60years/2009-09/16/content_18534697.htm.

In addition to the gradual liberalisation and de-collectivisation, both the central and local governments invested in research designed to produce higher yielding varieties of crops. The twin impacts of de-collectivisation and productivity improvements associated with institutional reforms unleashed the untapped potential of the peasantry and offered incentives to produce more. These resulted in a significant increase in gross agricultural production. For example, in 1984, only six years after the start of the agricultural reforms, the grain harvest reached 407mt (390 kg per capita), that was more than 100mt increase on the 1978 level; and finally peaked in 1998 at 512mt (see Figure 1).[7] Per capita grain availability reached 400kg between 1996 and 1999 and all food rationing was abolished in 1994. Although there were some decline in grain production between 1999 and 2003, thereafter output resumed its upward path. In fact after 2004 China's grain production increased for six consecutive years, and in the last three years production has exceeded 500mt (see Figure 1 and Appendix 1). However, despite the remarkable achievement of increased food production and poverty reduction, China's cultivated land area began to decline since the 1980s, and the speed of decline being rapid after 1995, especially between 1999 and 2003 (see Figure 2 in page 14 and Appendix 2). The loss of arable land has increasingly become a central concern for China's food security. Thus the question of whether the country can feed its growing population has become an important consideration.

Figure 1: **China: Grain Output (Cereals, Beans, Tubers) 1978-2008**



Source: NBS, China, 2009

[7] Chinese definition of grain includes cereals, beans and tubers, while other sources like FAO grain does not include beans and tubers.

Contending views on China's food security

Is China's food security a matter of concern, or can China continue to feed its population? Should China enforce strict land policies to protect its cultivated land? Perhaps significantly the first major wake-up call came from outside of China. In 1994, Lester Brown, President of Washington's Worldwatch Institute, published an article, 'Who Will Feed China', expanded into a book with the same title in 1995.[8] Brown argued that if China lost its capacity to feed its population, it would seek supplies from global markets, resulting in steep increases in the price of all major food throughout the world. He believed that China's grain production had already peaked and was set to decline, while its population would go on increasing. Further, China's economic growth and rising living standards would result in more people abandoning their traditional dietary patterns in favour of higher meat consumption – inherently less efficient and using up more food grain. Arable land was being lost and irrigation water running out. In short, Brown suggested, Malthusian like, that China's domestic food production in the mid-1990's was inadequate to feed its population for long.

Brown's warnings produced a variety of responses in China. Some, especially 'netizens' (internet citizens), were offended, arguing that Brown was really evoking a 'China threat' thesis by exaggerating the country's problems. Within academic circles, however, Brown's analysis was perceived as a constructive warning. While some of Brown's predictions underestimated the capacity of Chinese agriculture to increase output above 1990s levels, he had certainly shaken the optimism of those who had simply assumed – without serious reflection – that China would be able to feed its population indefinitely.[9] Consequently Chen Baiming, Commission for Integrated Survey of Natural Resources and Chinese Academy of Sciences, has suggested that China should accept the essential arguments of Brown's case.[10] That is, China must accept that it faces a crisis in its agricultural development, which is essential for it to take the requisite steps to feed itself and to develop its economy in a sustainable and stable way.

Around the turn of the century, especially after 2004 – when global food prices began to rise – concerns over China's food security became more evident and generated more

[8] L.R. Brown 1994; 1995.
[9] Xie, Ru 1996.
[10] Chen, Baiming 1996.

open debates. The central focus has been on whether China should have stringent land policy, by which the so-called 120 million ha (1.8 billion mu) 'basic land' would be strictly protected. There is a broad consensus, including many central government officials, who believe that if China is to secure food sufficiency it is essential that the 120mha basic farmland should be protected – and that without compromise.[11] Consequently food security lies at the centre of national security and strategy. China simply cannot afford to depend on food imports; since if food becomes scarce exporting countries can easily cut off supplies. The largest exporter of grain in the world is the US and four huge American companies – Archer Daniels Midland (ADM), Bunge, Cargill, and Louis Dreyfus (known as 'ABCD') control 80 per cent of world food market.[12] The over dependence on importing food for its 1.3 billion population can pose some risks for the country. As the Minister of Chinese Agriculture, Han Changfu, argues, the global food market is simply too small and too risky for China to depend on.[13] In addition, adding transport costs, dependence on food imports would risk pushing domestic food prices up, potentially causing millions of Chinese to be unable to afford to eat. Thus, food sufficiency is regarded as a crucial element in national security and strategy in China.

Some experts reject what they see as rigid and inflexible policies of farmland protection. Mao Yushi, an influential Chinese economist, is among the strongest proponents of the belief that food security should be left to market mechanisms.[14] While this is probably not the majority view, there are certainly people in local government and business circles who agree with it – at least in private. The main arguments are as follows. First and foremost, rigid and inflexible policies of protecting farmland undermine China's modernisation and urbanisation processes, and thus must have negative economic consequences. While China is at an important stage of industrialisation and urbanisation, it is inappropriate to secure cultivated land at the expense of the modernisation

[11] State Council 2008; 'Wen Jiabao emphasises that the 1.8 billion mu basic farmland must be defended' *XinhuaNet*, 5 March 2007; 'The red line of 1.8 million mu of arable land is the lifeline of China s food security', *Xinhua News Online* 12 December 2010.

[12] Zhong and Li 2009, 1-8; 'Minister of China's Ministry of Land and Resources talks about [China's] food cannot depending on world market', *Global Times*, 24 September 2009.

[13] While China's grain output in 2008 was about 528 million tonnes (mt), the entire volume of global food market in the same year was about 240 mt. See, 'Depending on the international market cannot guarantee China's food security: an interview of the Minister of Agriculture, Han Changfu', *Global Times*, 9 July 2010.

[14] Mao, Yushi 2010; also see, Liu, Xiaomei 2004; Qu, Shang 2004.

programme. Secondly, it is held that the problem of food security does not arise from a shortage of food but from lack of proper mechanisms of famine preparedness. It is also argued that the biggest threat to current world food security would be a 'policy of self-sufficiency'; reliance on free trade both domestically and internationally is sufficient to guarantee the safety of food supplies. Indeed, rather than practising excessive caution and securitising food, the central government should abolish its mandatory restrictions on cultivated land change and allow some leniency in the markets to work out the best outcome.

In addition, there are calculations of cost; the protection of farmland may prove too expensive (for monitoring and regulating) and is unlikely to be very efficient. So under current conditions, China should adopt a different and more effective strategy. The best way to solve China's water and land resources problems is to import food. Since grain growth needs more land and water resources, importing grain equates to importing land and water resources. Opponents of land protection are clearly concerned by the unhealthy explosion of housing prices in China, believing that the property boom has been caused by mandatory restrictions on land, the man-made 120mha 'red-line'. Thus, the securitisation of national food could actually cause other security problems and even threaten the Chinese 'economic miracle'.

Although they do not go so far as Mao Yushi's free market views on land and food, many people still take a fairly optimistic view of China's food security. They remember and take pride in what China has achieved so far in increasing agricultural production and reducing poverty levels. They see no reason why food security should not be secured by appropriate policies. This line of argument was well expressed by Jiang Yuanming, a senior editor of *People's Daily*, in his article 'A solid answer to "who will feed China"'.[15] The article appeared in January 2006 when the UN World Food Program (WFP) ended its 26-year food aid to China. It celebrated the fact that China was able to feed over 20 percent of the world's population with less than 10 percent of the world's farmland, attributing this significant achievement to good policies, including subsidies to encourage grain production and technical innovations such as

[15] Jiang, Yuanming 2006.

hybrid rice.[16] While it has been recognised that there may be challenges in the future, some believe that the future of China's food security looks more assured and less worrying than it did a few years ago.

Cultivated Land Conversion: A Security Concern?

Over the past three decades, increasing agricultural production has helped to reduce the number of people living in poverty in China.[17] Even when world food prices started to rise in 2004, China continued to increase its agricultural output – including grain, meat, aquatic products and milk. In particular, there had been a dramatic increase in meat and aquatic products between 1990 and 2000 (Table 1). Despite these achievements, however, the question of cultivated land conversion has emerged as a critical political and security issue, largely because of food and environmental concerns. These concerns are by no means confined to experts and academics but are shared by policy-makers at large.[18] The 11th Five-Year Plan (2006-2010) insisted that it was essential to retain at least 1.8 billion mu (120 mha) of farmland by the end of 2010 to secure China's food sufficiency.[19] The 12th Five-Year Plan (2011-2015) strongly identifies safeguarding of the nation's food security as China's 'primary goal'. This commitment directly echoes Premier Wen Jiabao statement that the need to maintain agricultural production to ensure adequate food for its 1.3 billion people has become a top priority for policy.[20]

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[16] China became the first country that is capable of producing hybrid rice. Yuan Longping is the first scientist who successfully altered the self-pollinating characteristic of rice and realised large-scale farming of hybrid rice. This earned him the title 'Father of Hybrid Rice'. His pioneering work in hybrid rice breeding and production techniques has revolutionised rice cultivation in China, establishing China's world leading position in hybrid rice research. From 1976 to 1987, the total cultivated area of the hybrid rice developed by Yuan reached 1.1 billion mu (15 mu=1 hectares), and increased rice yield by 100 billion kg.

[17] China embarked on a government poverty alleviation program in 1985 and set the poverty line at 206 yuan (≈ USD 31) per capita per year; which was raised to 785 yuan (≈ USD119) in 2007. According to the government's poverty line, the number of people in absolute rural poverty, 250 million in 1978, fell to 85 million in 1990 and 14.8 million in 2007 (constituting only 1.6 percent of the total rural population). However, measured by the commonly used international poverty line of 1 USD per day, the share of China's rural population living in poverty fell from 46 percent in 1990 to 10.4 percent in 2005. See, UNDP 2010; 'China becomes first nation to halve poor population', *People's Daily*, 19 September 2008; also, the State Council of Leading Group Office of Poverty Alleviation and Development's website at: http://www.cpad.gov.cn/.

[18] Feng, Zhiming et all 2005; Wu, Zhenghong and Yan, Xincheng 2007; Han, Jun 2009.

[19] State Council 2008; 'The red line of 1.8 million mu of arable land is the lifeline of China's food security', *Xinhua News Online* 12 December 2010.

[20] Wen Jiabao 2011; 'The 12th Five-Year Plan: enhance rural modernization and national food security', *China Grain* 28 October 2010, http://www.cngrain.com/Publish/news/201010/468667_1.shtml.

Table 1:
China: Per Capita Output of Major Agricultural Products

Year	Grain (kg)	Pork, Beef and Mutton (kg)	Aquatic Products (kg)	Milk (kg)
1978	**319**	9.1	4.9	
1980	**327**	12.3	4.6	1.2
1985	**361**	16.8	6.7	2.4
1990	**393**	22.1	10.9	3.7
1995	**387**	27.4	20.9	4.6
2000	**366**	37.6	29.4	6.6
2001	**356**	38.0	29.9	8.1
2002	**357**	38.5	30.9	10.2
2003	**334**	39.5	31.6	13.6
2004	**362**	40.4	32.8	17.4
2005	**371**	42.0	33.9	21.1
2006	**380**	42.7	35.0	24.4
2007	**381**	40.1	36.0	26.7
2008	**399**	40.3	37.0	26.8

* Grain includes Cereals, Beans and Tubers.
Source: NBS, China, 2009.

Various measures have been taken to tighten control over the conversion of basic farmland to non-agricultural purposes, whether commercial, industrial or residential. However, despite the stringent policies designed to protect cultivated land, the area of good farmland fell by 12.31 million hectares between 1997 and 2008; that is, a loss of 1.03 million ha per year,[21] while population levels continued to rise at about average 7.5 rate (from 1.24 billion in 1997 to 1.33 billion in 2008) (Appendix 1 and 2).[22] What are the main problems and obstacles that make the cultivated land protection issue so critical and challenging? It is essential to appreciate three basic facts in order to gain any understanding of the issues of cultivated land protection, food security and environmental protection. The first is the inherent difficulties resulting from China's limited land resources and large population. The second is man-made and centres on China's rapid urbanisation and accompanying environmental degradation, making the loss of cultivated land more critical. The third follows from the strains resulting from

[21] The 12.31 mha was the gross loss of cultivated land, while the amount of net reduction was about 8.76 mha. See, MLR, *Communiqué of Land 2008*.
[22] NBS 2009; Feng, Zhening 2007; Li, Xiaoshun et al 2009.

the global food situation, a scenario in which globalisation makes China more sensitive and vulnerable to what is happening elsewhere.

Inherent challenges

While China has a vast land area of 9.6 million km² (960 mha), its topography is such that only about 200 million mu (13.3 mha) of land is cultivable, within which more than 60% is located in the less water and ecologically fragile areas (Table 2).[23] Experts describe the cultivated land situation as follows: the quantity is small, the quality low, and the potential for land reserve resources limited.[24] Of the total of 960 mha, plains account for only about 115 mha – or less than 12% – while mountains and high plateaus occupy nearly 60%. Hence it is very important for China to manage its land very carefully and efficiently to meet the needs of its population. In 2008, China's cultivated land was about 121.7mha – less than 13% of the total, while its population reached 1.33 billion, or more than a quarter of the world population. In China there is 0.09ha of cultivatable land per person. This represents only 38.2% of the world average (of 0.24 ha) and is less than one fifteenth of the figure for Canada, one eighth for the USA and one half for India.[25] Moreover, in about 20% of counties and districts of China, per capita arable land has already fallen below the warning line of 0.053 ha, set by FAO.[26]

[23] Han Jun, Vice Minister of DRC (Development of Research Centre of the State Council) and Director-General of DRC's Research Department of Rural Economy, interview with *People's Daily*, 'China's cultivated land protection faces critical situation, which will reduce land for construction use', *People's Daily*, 10 August 2009, can be accede at http://news.eastday.com/c/20090810/u1a4569230.html. However, some recent researches also show that the available farmland resource is about 800 mllion mu (53.3 mha). See, 'China has about 800 million mu of cultivable land resources', *sina.com*, 27 May 2010, http://finance.sina.com.cn/roll/20100527/13518013477.shtml.

[24] See among others, Gui, Xiu-e 2008, 102-103; Wu, Zhenghong and Yan Xincheng 2007.

[25] NBS 2009; Qu, Junfeng et al. 2007.

[26] Li, Yue, Lin Erda and Li Yan 2007/41.

Table 2: **Land Characteristics, China**

Item	Area	Total Area %
Total Land Area (10 000 sq.km)	**960**	**100.00**
By Topographic Feature (10 000 sq.km)		
Mountains	320	33.33
Plateaus	250	26.04
Basins	180	18.75
Plains	**115**	**11.98**
Hills	95	9.90
By Land Use (10 000 hectares)		
Cultivated Land	**12172**	**12.68**
Forests	17491	18.21
Water Area in Land	1747	1.82
Area of Grassland	40000	41.67
(Usable Area)	(31333)	(32.64)
Others	24590	25.61

Source: NBS, China 2009.

In addition to the limited amount of cultivated land, its overall quality is poor. Gui Xiuying's (2008) study shows that only about 28% of cultivated land can be described as good quality high-yielding land – and this is mainly located in the southeast region.[27] Many other studies also show that high quality land, especially irrigated land, is particularly limited. The proportions of paddy fields and dry land in cultivated land areas are about 23.1% and 76.9% respectively. Most paddy fields are located in areas with relatively high levels of rainfall, for example, about 75.7% paddy fields are in areas with precipitation levels of more than 1000 mm per year. But 79.2% of the dry land is located in areas with precipitation levels of less than 1000 mm, and irrigable dry land is also limited, only accounting for 17.2% of total cultivated land area.[28] Moreover, the potential for the development and utilisation of land that might be brought into

[27] Gui, Xiu-e 2008.
[28] Tan, Shuhao 2008; Lu, Xin-hai and Huang Shan-lin, 2010, 79-84.

cultivation is constrained by prevailing natural conditions. There is about 200 million mu (13.3 mha) of potential reserve resources for cultivation. However, of these land reserve resources, about 60% are in areas with fragile ecological conditions and insufficient water supply – and thus either not very suitable or only capable of reclamation and development at very high cost.[29] Inappropriate reclamation and land development could easily do more harm than good by causing serious ecological and environmental problems, such as the destruction of water sources and subsequent soil erosion. The experience of the former Soviet Union when it attempted to expand grain production in Central Asia in the 1960s – only to create dust bowls – offers a salutary warning.

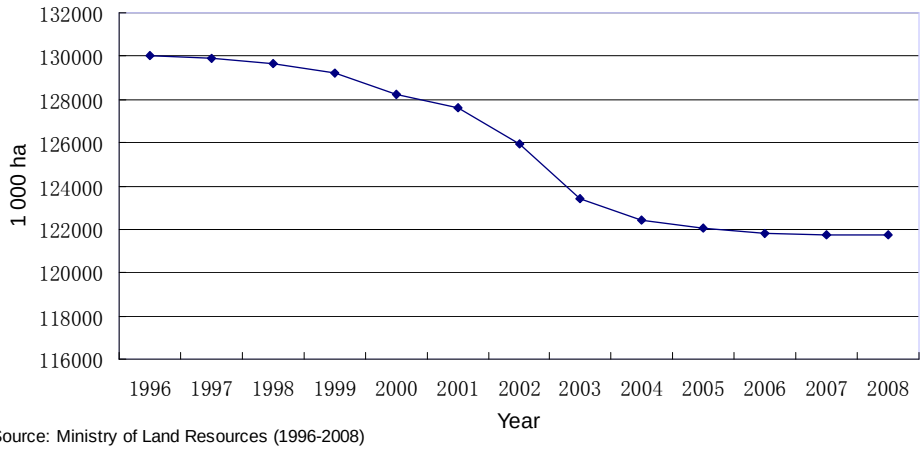
The challenge of rapid development

Since reform began in 1978, the area of China's land under cultivation has experienced a significant decline – indeed any country in the process of industrialisation and urbanisation is likely to have a similar experience. In China, the rate of contraction was relatively slow until 1995 – from 99.4 mha in 1978 to 95 mha in 1995, or about 244 thousand hectors per year. The rate of contraction accelerated sharply in the subsequent decade (see Appendix 2). According to China's National Land Use Survey, between 1996 and 2005, 120 million mu (8 mha) of arable land was lost, accounting for 6.6% of the total cultivated area (Figure 2).[30] While the pace of contraction has slowed in the last five years – largely because of the introduction of stringent land protection policies – cultivated land protection is proving extremely difficult both in terms of quantity and quality.

[29] Hu, Rong and Qiu Dao-chi 2008, 69-72.

[30] 'Report of Ministry of Land and Resources: China lost 120 million mu arable lands in ten years' *Xinhua News*, 16 March 2006, http://news.xinhuanet.com/house/2006-03/16/content_4308627.htm.

Figure 2: **China: Cultivated land Area, 1996-2008**



Source: Ministry of Land Resources (1996-2008)

Four factors may be identified as the major reasons for the loss of arable land: construction occupancy, natural disasters, ecological restoration, and agricultural structural adjustment.[31] Ecological restoration seems to have been the most important. Of the 12.3 mha of arable land lost between 1997 and 2008, 58.7% has been attributed to ecological restoration and 20% to construction and urban expansion, with agricultural structural adjustments and natural disasters accounting for 15.2% and 6.1% respectively.[32] Thus, it is clear that ecological restoration and construction occupancy are the main reasons for the loss of cultivated land. This suggests that we should think carefully about what has happened and try to determine whether existing models of economic and agricultural development are sustainable. Decades of rapid urbanisation and inappropriate development have caused serious problems for China's arable land – both in terms of quantity and, increasingly, of quality.

In terms of quantity, a combination of population growth and rapid urbanisation have been a major factor in the contraction of the area of cultivated land; what was once farmland has been taken over by growing cities. By 1978 China's population had already reached 963 million but there were only 173 million city-dwellers, accounting for 18% of the total. By 1996, however, the proportion of city-dwellers had risen to more than 30% and the total population had grown to 1.22 billion. By 2008, the urban

[31] Yu, Zhen-guo and Hu Xiao-ping 2003, 46-7; Lu and Huang 2010, 81-2; MLR *Communiqué* 2007.
[32] MLR, *Communiqué1997-2008*. In 2010, of the arable land loss, returned to ecological preservation occupies 63%, while construction occupancy accounts for 23%. 'Ministry of Land and Resource: China's Cultivated land loss is moving in a reasonable direction as the biggest portion has been used for ecological preservation', *CNR*, 27 August 2010. http://www.cnr.cn/china/gdgg/201008/t20100827_506961645.html..

population grew to 46% of the total and another 100 million had been added to the overall population (Table 3). It is estimated that by 2020 China's population will exceed 1.4 billion, while its urban population will have risen to 58%. The dual-concern of large population and shrinking cultivable land poses an enormous challenge for Chinese agriculture. Notwithstanding rising concern and growing efforts to protect farmland, in 2009 more than 319,000 ha of arable land was used for construction (including factory, commercial, residential, and others uses), according to the Ministry of Land Resources, a 44.2% increase on the previous year.[33] Other studies also suggest that as China becomes increasingly urbanised, the further loss of arable land is inevitable.[34] For instance, between 1996 and 2008, on average China's urbanisation level increased by 1.27% per annum, while arable land was lost at the rate of 728.9 thousand ha each year. If this pattern continues, it is hard to see how the strict security line of a basic 120 mha of arable land set by the Chinese government can be maintained.[35]

Table 3: **China: Population and Its Rural/Urban Composition**

10 000 persons

Year	Total Population (year-end)	Urban		Rural	
		Population	**%**	**Population**	**%**
1978	**96259**	17245	**17.92**	79014	**82.08**
1985	105851	25094	23.71	80757	76.29
1990	114333	30195	26.41	84138	73.59
1993	118517	33173	27.99	85344	72.01
1995	121121	35174	29.04	85947	70.96
1996	122389	37304	30.48	85085	69.52
2000	126743	45906	36.22	80837	63.78
2003	129227	52376	40.53	76851	59.47
2005	130756	56212	42.99	74544	57.01
2008	**132802**	60667	**45.68**	72135	**54.32**

Source: NBS, China, 2009

In addition to the loss in the amount of agricultural land; in the long run there could be an overall decline in land quality, which could prove to be even more serious. Two factors can be identified as serious challenges to arable land quality: one is the balance between land taken out of cultivation and land taken into cultivation; the second is the

[33] See 'Land resources' 2009, published by the Ministry of Land and Resources, China, http://www.mlr.gov.cn/zygk/, accessed on 20 August 2010

[34] Li, Xiaoshun et al 2009; Feng, Zhiming, Yang Yanzhao and Zhang Jing 2008; Gui, Xiu-e 2008.

[35] Lu, Xin-hai and Huang Shan-lin 2010; 81; Li, Xiaoshun et al 2009.

challenge posed by the current agricultural development model. First, most of the land taken for construction and other commercial uses is of high quality, with a good location and was once capable of producing high yields of crops, yet the land brought into cultivation through occupation/reclamation schemes tends to be of medium to poor quality, badly located and not very fertile.[36] These trends have changed overall patterns of land use. In particular, grain production has been moving from the traditional areas in the southeast towards northern regions. Even in the early 1980s, approximately 60% of grain was grown in the south but, since 2005 more grain has been grown in the north than in the south. In purely agricultural terms, this change makes little sense. Soil fertility and rainfall conditions in the south – traditionally regarded as China's granary – are far more suitable for grain than those in the northern regions, which have lower levels of rainfall and are more fragile ecologically and environmentally. Although less suitable areas can produce good crops, they cannot be relied upon to do so and hence experts fear that the overall levels of grain production may become more erratic in the near future.[37]

Secondly, the problem of land quality is much more deep rooted. It is becoming increasingly evident that for a long time China's agricultural development policies have prioritised overall output, but have given less thought to land productivity and sustainability. Some Chinese agricultural scientists point out that over the past 50 years, agricultural development and high outputs have been achieved mainly through heavy external inputs, labour intensity and high speed, but at high resource and environmental costs.[38] Such a development path poses serious problems for the future of agriculture in terms of resource scarcity, ecological depletion, and technological weakness. In other words, China's future food security is closely connected with ecological and environmental security and sustainable development.[39]

Over the past two decades, tensions between population growth, rapid urbanisation and limited arable land, have led to greater preoccupation with increased grain output in the short term. Therefore a biological pattern of agricultural intensification has been adopted, which has already resulted in some adverse consequences. In particular,

[36] Yu, Zhen-guo and Hu Xiao-ping 2003; Tan, Shuhao 2008.
[37] Tan, Shuhao 2008, 2008: 80-81.
[38] 'China's cultivated land quality: a case of alarm', *Outlook (New Weekly)*, 19 September 2010.
[39] Chen, Guishen et al. 2009; Yun, Wenju and Cheng Feng 2010.

excessive use of chemical fertilizer and pesticides has caused serious contamination of soil and water, not only undermining agricultural productivity but also affecting food safety in general.[40] China has become the most intensive user of chemical fertilizer and pesticides; 327 kg/ha of fertilizer was used in 2000, or more than three times the global average of 99.5 kg/ha (Table 4). Moreover, between 2000 and 2008 total chemical fertilizer use in China increased by 35%; and the total use of pesticides also reached 1.3 million tonnes, 2.5 times of world average.[41] The result is that China's soil erosion has been the most severe in the world, causing serious human security concerns. Soil and water pollution is not only caused by industrial discharges, but also by agricultural activities and it is becoming clear that China's agricultural sector is a major contributor to both water pollution and soil contamination. Research shows that deserts are expanding by more than 666.7 thousand ha per year, of which approximately 200 thousand ha was formerly farmland.[42] Some even argue that about 20 million hectares of farm land, or 20 percent of the total farm land in China, are threatened by pollution from heavy metals including cadmium, arsenic, chromium and lead,[43] which may reduce total crop production by 10 billion kg per year.[44] In general, a large proportion of China's land is in poor condition due to unscientific cultivation practices and the abuse of chemical fertilizer, causing about 10 percent of China's land to be more or less polluted.

Table 4:
Fertilizer Use in Agriculture in Different Regions of the World, 2000

Area	**Chemical fertilizer use** (kg/ha)
World total	**99.5**
Asia	146.8
Africa	21.4
North America	96.9
South America	78.9
Europe	82.2
Australia	51.4
China	**327.2**

Source: Tan (2008)

[40] Tang, Yuankai 2011.
[41] 'China's cultivated land quality', *Outlook* 19 September 2010.
[42] Sun, Xiaohua 2006; Lu and Huang 2010: 81-82.
[43] Heavy metals refer to toxic metals such as lead, mercury and chromium, which can be dangerous to health and the environment in excessive levels. They usually arise from purification of metals in the manufacturing process. See, 'China cracks down on heavy metal pollution', *China Daily*, 10 April 2010.
[44] 'China's one in five cultivated lands are polluted', *CNAK Net*, 21 September 2010, http://www.cnak.net/Cnak/CnakArticleDetail.aspx?param=A9F31127468F1E5C488EC565E38C3878; Hu, Rong and Qiu Dao-chi 2008.

Realising the seriousness of excessive land use, the Chinese government initiated its first soil pollution survey in 2006 with a budget of 1 billion yuan. The survey was designed to assess soil quality across the country by analysing the amount of heavy metals, pesticide residue and organic pollutants. The first report was released on 24 December 2009 and admitted that, in general, China's cultivated land quality was low; excellent quality land accounted for only 2.67% with medium and poor quality lands accounting for 50.64% and 16.71% respectively. Production capacity over 1000 kg/mu of cultivated land was achieved in only 6.09% of the total.[45] Similarly, Zhang Weili, a prominent scholar and expert at the Chinese Academy of Agricultural Sciences, expresses concern about overall soil and water pollution resulting from agricultural activities. She argues that water pollution caused by agricultural developments has become the most serious challenge to China's sustainable development. The old agricultural development model – dependent on Agrochemicals and energy inputs – has reached deadlock and hence the only way to achieve future food security is to improve basic cultivated land production capacity, by safeguarding and restoring the quality of the land itself.[46] From a legal point of view, Wang Shuyi, head of the Institute of Environmental Law at Wuhan University, urged the need for a soil protection and pollution control law. Wang said that a drafting of the country's law for soil protection and pollution control is under way now.[47] In addition, many scientific researches on detoxifying the polluted soil are underway, including using ciliate desert-grass, a type of ferny plant, to clean up arsenic-polluted land.[48] Thus, it is important for China to guarantee both the 120 mha farmland security line and the quality of its cultivated land for its future food security.

The challenge for global food security

The domestic pressure on food security raises the question of whether China can rely on world markets to cover any shortfalls in domestic food production. As discussed earlier,

[45] MLR 2009, 'Report on China's cultivated land quality level survey and assessment'.
[46] An interview of agricultural expert Zhang Weili, see 'China's cultivated land quality: a case of alarm', *Outlook (New Weekly)*, 19 September 2010.
[47] Wang Shuyi Interview with *Hubei Daily*, 19 March 2010.
[48] Dr. Chen Tongbin, a researcher at the Institute of Geographic Sciences and Natural Resources Research (IGSNRR) under Chinese Academy of Sciences, discovered ciliate desert-grass, a type of ferny plant, that has an exceptional ability to absorb heavy metals such as arsenic. In 2000, Chinese scientists set up the world's first phytoremediation project using ciliate desert-grass to clean up arsenic-polluted land in Chenzhou, Hunan Province, China. See, Tang, Yuankai. 2011.

there are some people in China who argue that this would be the best way to solve any land or food problems.[49] Yet reliance on imported food would expose China to serious risks and there must be doubts as to whether such a policy would be in the best interests of China or, indeed, of other countries. In order to appreciate the limitations of the 'world market' strategy, we need to understand the balance between supply and demand for food in China, and the situation of the global food market.

The imbalance and tension between China's growing need for grain and the limitations of the global food market portrays a major challenge. As a major food producing and consuming nation, China's grain output and consumption account for approximately one fifth of the world total. The entire volume of global food market (about 240 million tonnes (mt) per year) is less than half of China's grain output (528 mt in 2008). In other words a situation could arise in which the global market simply could not provide China with the grain it needed. This is particularly true in terms of rice, the main item of Chinese food consumption. China's rice consumption per year is about 187mt, yet rice traded in the global food market amounts to around 25-30 mt, or only 15% of China's rice consumption. This inevitably makes China's food balance an extremely sensitive issue elsewhere. As the Chinese Minister of Agriculture has noted, if China became a significant net importer of food, that would drive world food prices sharply upward, adding enormous pressure to the world food market.[50] In addition, imported food could not be sold for anything like its production costs. Prices to Chinese consumers would have to take transport costs into account. Even if it were available, imported food would be extremely expensive and that would drag domestic prices up in its wake. A scenario would develop in which millions of Chinese simply could not afford to eat. The implications for the Chinese economy and for the Chinese government would be terrifying.

In 2004, for the first time since the late 1970s, China became a net food importing country. For the time being at least, imports represent only a small fraction of overall food consumption. An overwhelming proportion of this consumption consists of food produced in China, and the authorities try to keep food self sufficiency at about 95%. The dependency rate increased to 6 per cent between 2004 and 2006 and currently

[49] Mao, Yushi 2010; Liu, Xiaomei 2004; Qu, Shang 2004.
[50] *Global Times* 9 July 2010.

remains a manageable proportion. However, there is cause for concern in the future; given the facts of population growth, urbanisation and land contraction, some experts doubt whether China can avoid higher levels of dependency in the medium to long term.[51]

Another problem arises from the global food situation. The global food price crisis of 2007/2008 triggered widespread concern over the volatility of agricultural prices. Such concern would undoubtedly be heightened if China seeks to buy more food from other countries. Population growth both in China and the world will only intensify the challenge. According official estimates, China's population will reach 1.45 billion by 2020 and 1.5 billion by 2030. If these figures are correct, China will have to produce a great deal more food if it is to feed its own people; it will need to produce 570 mt of grain in 2020 (42 mt increase on 2008); and 700 mt in 2030. Harvests will have to grow by 0.8% per year – at least 4 million tonnes annually – if food security is to be maintained.[52] The challenge is formidable.

Concluding Discussions: Land Governance: a Comprehensive, Human-Centred and Sustainable Approach

This section suggests policy options and recommendations that can be drawn from the above discussion of China's cultivated land conversion in relation to food security and sustainability. The complexity of the issues and the magnitude of challenges involved suggests that there is no simple solution. We consider the concept of security governance below, which could be helpful to tackle the pressing problems we have examined.

The Commission on Global Governance defines governance as 'the sum of the many ways individuals and institutions, public and private, manage their common affairs.'[53] Security Governance describes new modes of security policy that differ from traditional approaches to national and international security. Traditional security policy was the exclusive domain of states and aimed at military defence; security governance is performed by multiple actors and is intended to create a global environment of security

[51] Zhong, Shuiying and Li Kui 2009, 8.
[52] *Global Times*, 24 September 2009.
[53] *Our Global Neighbourhood* 1995, 4.

for states, social groups, and individuals.[54] Security governance is also seen as *managing capacities* purposefully directed towards particular policy outcomes.[55] In this approach, co-ordination or co-ordinated management is essential, so that multilevel actors can be involved and diverse resources drawn together for desired security ends. From this perspective, China's cultivated land issue must be approached in a comprehensive, humane and sustainable manner.

Land governance: a comprehensive approach

Land resources are essential for the survival and development of human beings. Cultivated land protection in China is crucial to its food security and environmental sustainability. Problems arising from cultivated land conversion relate closely to other issues, such as desertification, water pollution, population growth, urbanisation and food sufficiency. To address such a multitude of interconnected problems, all aspects of land governance must be addressed.

First, different sectoral co-ordination is necessary to make land governance effective. In other words, in addition to land protection measures, appropriate urban planning, agricultural reforms and environmental restoration efforts must be taken into account, so as to support and strengthen land protection policy. For example, in the process of urban planning, the idea of 'intensive use of urban land' should be strictly implemented to avoid unnecessary land waste. When considered comprehensively, the treatment of polluted soil also requires multi-sectoral approaches – such as examining soil quality, building appropriate legal systems to prevent and control soil contamination, and scientific research on detoxification. It is clear that some degree of information disclosure and public participation are essential if pollution control targets are to be met. Furthermore, as proposed in the 12th Five-Year Plan, technological innovation and the promotion of agricultural science must play an important role in achieving agricultural modernization.

Secondly, effective land governance also requires enhanced co-operation on different levels, including international and regional organisations and civil society activists. China's cultivated land area is gradually moving from the southeast towards the

[54] Krahmann 2003; Webber et al. 2004.
[55] Cui, Shunji and Yu Xiaofeng 2010.

northern and north-western regions, and water shortage is becoming the major problem for cultivated land and food security. Thus, joint efforts to create and strengthen international water regimes are becoming an urgent priority for land governance.[56] In addition, information gathering and sharing on land, including its physical, social and economic conditions, are important parts of land governance. The Chinese government has already launched a survey of cultivated land quality and this project should be taken further at various levels; associated measures are required for the dissemination and proper use of this information for policy guidance.

To make such comprehensive land governance effective, it is important to forge what Mrs Tibaijuka of UN Habitat describes as 'new partnerships' between government and grassroots, and between private and professional sectors to bridge the gap between formal and informal institutions.[57] Yet, in these efforts, an effective and humane government is needed as a facilitator to create a viable and inclusive system of land governance. In other words, good land governance is more likely to be achieved 'through governments' than 'without government'.

Land governance: a human centred approach

Despite the importance of the state's role in managing the process, land governance is not state-centric in the neorealist sense.[58] Here it is important to address two crucial questions in security studies: security for whom? And who provides security and how? In terms of security provision, we must expect the state, with large resources at its disposal, to play an important facilitating role. However in terms of referent object – that is security for whom – we must put people and especially the vulnerable at the centre of our security concern.[59] As demonstrated in the world food crisis, if there is any crisis over food or environment, it is always the poor and vulnerable who are most affected. Thus, it is not enough to treat issues of land and food security merely as matters of national strategy. In practical terms, appropriate land governance should encompass policies that clarify rural and urban land use rights – so it may result in

[56] See similar argument, Yu, Xiaofeng and Zhou Zhanggui 2009, 29.
[57] 'There is no sustainable development without sustainable urbanization', Statement by Mrs. Anna Kajumulo Tibaijuka, Under-Secretary-General and Executive Director, UN-Habitat, New York: 13 May 2009.
[58] Neorealists are particularly emphasise the centrality of states in the international affairs, see Waltz 1979; Mearsheimer 2001.
[59] Cui, Shunji 2009; Cui, Shunji and Jia Li 2011 (forthcoming).

sustainable use of property and make it easier to protect rural land users from improper actions by local governments in land requisitions.[60]

More positively, government can increase agricultural subsidies and take other measures to make farmers more content with their way of life and more eager to protect their farmland. Currently because of the low returns from farming, some farmers abandon their farmland to move to cities in search of higher wages. At the 4th Session of the 11th National People's Congress (NPC) held in March 2011, some deputies, such as Cui Fuhua from Sichuan – who studies corn technology – raised the concerns felt by many farmers. The prices they received for their products were too low, while the cost of agricultural inputs was too high.[61] Thus, Badgley is right to argue that farmers should be compensated for their contribution to the environment, not least because they are the ultimate conservationists of cultivated land and environment.[62]

In addition, it is important to establish and improve land rights registration systems in rural areas and to strengthen farmers' and officials' legal literacy. Similarly, raising public awareness of land issues as well as consciousness of environmental protection and sustainability are also essential. For example, as early as 1991 China set the date, 25 June, as National Land Day, and since then it targets specific issues each year to raise public awareness. 'Change developing models; legally and intensively use land' became the slogan of 2010. While this is a good start, it would be beneficial for China to make greater efforts to turn these slogans into reality. Perhaps it is in these contexts that agricultural and rural issues were given much higher priority at the 2011 NPC annual meeting than at earlier meetings. Premier Wen Jiabao pledged that about 988 billion yuan, or 18 per cent, of the central government's 2011 budget would go to agriculture, rural areas and farmers; and safeguarding food security has become China's national primary goal. Of course, it remains to be seen whether there is sufficient political will and power to achieve the desired objectives but at least there is a clear road map. China is prepared to modernise its agriculture and to take the issue of food and environmental security very seriously.

[60] See similar view, Wu, Zhenghong and Yan Xincheng 2007.
[61] *Chinese Farmer* 6 March 2011.
[62] Badgley 2003.

Land governance: a sustainable approach

Proper land governance would require China to change its development model, as well as forcing people to change their lifestyles to attune to sustainable development. The concept of 'scientific development', proposed by the Chinese government as its guiding socio-economic ideology, does contain strong elements of sustainable development. It aims at a people-centred and environmentally friendly development path. However, as can be seen in the cultivated land conversion issue, there is still a wide gap between official aspirations and reality. While the Chinese government is increasingly aware of the importance of cultivated land protection, since the 1990s, its policies on land conversion, including the 'total cultivated land dynamic balance', have focused more on total output than on land quality and sustainability. The implication for food and environmental security is critical. Above all, there is a danger that the 120 mha security line may not mean very much unless China takes the issue of land quality and agricultural productivity really seriously.

Thus, when implementing land policies, cultivated land conversion and land development should be approached with special care, and greater attention given to the ecological system. It is important for China to alter what Wen Jiabao has described as an 'unbalanced, uncoordinated and unsustainable' development model and system.[63] Chemical fertilizer and pesticide use must be strictly controlled, because in the long-run they will seriously undermine land production capacity. At the same time, China should actively support and promote activities to restore eroded land and polluted water. In particular, the promotion of innovation and development of water saving agriculture are extremely important. As Professor Li Guoxiang, of the Chinese Academy of Social Sciences, admits, 'water infrastructure in rural areas is mostly outdated',[64] while climate change presents a dire threat to the country's water resources and food security. At the same time, government should establish more detailed and more comprehensive policies and laws to regulate agricultural non-point source pollution.

The road to developing ecological safety and high-efficiency agriculture is not impossible. There are already some promising initiatives that suggest what could be

[63] *New Century China* 1 March 2007; 'China Prepares to End GDP Obsession, *Xinhua News* 6 March 2011.
[64] *South China Morning Post* 06 Mar, 2011.

achieved on a wider scale. For example, in Siyang County, Jiangshu Province, the planting of poplars has transformed once sandy flood plains into agro-forestry areas – which combine forestry with arable or animal husbandry (Picture 2). Assisted by the UN Food and Agriculture Organization's International Poplar Commission (IPC), over the past 30 years China has become a world leader in poplar genomics and biotechnology to improve resistance to biotic agents, improve wood quality and increase productivity. The area of planted poplar forests and agro-forestry in China is now about 8 million hectares, 30 times greater than the area under poplars in France, the second largest poplar planted country.[65] Thus existing methods to restore and improve land quality and develop agriculture in a sustainable manner should be used more extensively.

Picture 2

* Integration of poplar wheat-based and poultry in agro-forestry. Siyang County, China. Photo by Alberto Del Lungo/FAO.

On the whole, in order to achieve a comprehensive, human centred and sustainable land governance, Chinese people need to continue to develop innovative ideas and technologies, reform institutions, and adjust lifestyles, so as to attune toward environmentally friendly and sustainable methods. It is encouraging that China is

[65] 'Growing poplars for food security: Millions benefit from poplar forests in China' FAO Media Centre, 4 August 2010, http://www.fao.org/news/story/en/item/44518/icode/.

committed to modernising its agriculture by developing high-yield, high-quality and high-efficiency agriculture, and by considering ecological safety.[66] In the process, it is important to remember that land governance is not only for today's citizen but also for future generations. Hence, even in a situation of competing or conflicting needs for land, it is essential to avoid over competition and actively search for maximum benefit even when minimising conflicts; and that environmental protection has to be ensured and not compromised for long term security.

[66] 'The 12th Five-Year Plan: enhance rural modernization and national food security', *China Grain* 28 October 2010, http://www.cngrain.com/Publish/news/201010/468667_1.shtml; Wen, Jiabao. 2011.

Appendix 1: **China: Population, Grain Outputs, Grain Outputs Per Capita, 1950-2008**

Year	Population 10 000 persons	Grain (Total) 10 000 tonnes	Grain (per capita) kg	Year	Population 10 000 persons	Grain (Total) 10 000 tonnes	Grain (per capita) kg
1947				1978	96,259	30477	317
1948				1979	97,542	33212	340
1949	54,100			1980	98,705	32056	324
1950	55,196	13213	239	1981	100,072	32502	325
1951	56,300	14369	255	1982	101,654	35450	349
1952	57,482	16392	285	1983	103,008	38728	376
1953	58,796	16683	284	1984	104,357	40731	390
1954	60,266	16952	281	1985	105,851	37911	358
1955	61,465	18394	299	1986	107,507	39151	364
1956	62,828	19275	306	1987	109,300	40298	369
1957	64,653	19505	302	1988	111,026	39408	354
1958	65,994	20000	303	1989	112,704	40755	362
1959	67,207	17000	253	1990	114,333	44624	390
1960	**66,207**	**14350**	**216**	1991	115,823	43529	376
1961	65,859	14750	224	1992	117,171	44266	377
1962	67,295	16000	238	1993	118,517	45649	385
1963	69,172	17000	246	1994	119,850	44510	371
1964	70,499	18750	265	1995	121,121	46662	385
1965	72,538	19453	268	1996	122,389	50453	412
1966	74,542	21400	287	1997	123,626	49417	400
1967	76,368	21782	285	1998	**124,761**	**51230**	**411**
1968	78,534	20906	266	1999	125,786	50839	404
1969	80,671	21097	262	2000	126,743	46217	364
1970	82,992	23996	289	2001	127,627	45264	355
1971	85,229	25014	293	2002	128,453	45706	356
1972	87,177	24048	275	2003	129,227	43070	333
1973	89,211	26494	297	2004	129,988	46947	361
1974	90,859	27527	303	2005	130,756	48402	370
1975	92,420	28452	308	2006	131,448	49746	378
1976	93,717	28631	305	2007	132,129	50150	380
1977	94,974	28273	298	2008	132,802	52850	398

* Grain includes Cereals, Beans and Tubers.
Source: NBS, China, 1997, 2005, 2009.

Appendix 2: **China: Trends in Cultivated Land Area, 1978-2008**

Year	Total 1 000 ha	Year	Total 1 000 ha
1978	99,389.50	1996	130,039.20
1979	99,498.00	1997	129,903.10
1980	99,305.20	1998	129,642.10
1981	99,037.00	1999	129,205.50
1982	98,606.00	2000	128,243.10
1983	98,359.60	2001	127,615.80
1984	97,853.70	2002	125,929.60
1985	96,846.30	2003	123,392.20
1986	96,229.90	2004	122,444.30
1987	95,888.70	2005	122,082.70
1988	95,721.80	2006	121,775.90
1989	95,656.00	2007	121,735.20
1990	95,672.90	2008	121,715.90
1991	95,653.60		
1992	95,425.80		
1993	95,101.40		
1994	94,906.70		
1995	94,973.90		

Source: Data 1978-1995, from Zhongguo Nongye Fazhan Baogao (China Agricultural Development Report), 1995-1996;
data 1996-2008, from Zhongguo Guotu Ziyuan Gongbao (China Communiqué of Land and Resources), 1996-2008.

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