Chapter 4
Farmers' Compensation

Abstract This chapter looks at the level of farmers' compensation for all three plant types: economic trees, ecological trees, and grassland. Grain for Green regulations stipulate that compensation should only be paid if a large number of planted trees and grasses survive (initially 70 % in the Yellow River watershed and north China, and 85 % in the Yangtze River watershed and south China, later standardized to 75 % nation-wide). We show, however, that often compensation was also given if a smaller number of trees survived. The chapter also looks at the extent to which the funds are actually delivered to the farmers, which was a concern to the farmers when the program was introduced. Finally, the chapter reviews the total incomes of the farmers, comparing pre-Grain for Green incomes to post-Grain for Green incomes from the same land. In more cases than not, the post-Grain for Green incomes are higher than the pre-Grain for Green incomes from crop cultivation, which means that the program raised farmers' incomes. However, the Grain for Green could have converted more land with the same budget, or the same amount of land with a lower budget.

Keywords Payment delivery • Income • Opportunity cost • Cost-effectiveness • Ecological trees • Economic trees

Introduction

As a Payment for Ecosystem Services (PES) program, the GfG compensates farmers for setting aside land. This chapter discusses various aspects related to that compensation. First, we look at the level of compensation paid to farmers, and the conditions the farmers need to fulfil to receive that compensation. Second, we look at the extent to which the payments due to the farmers were actually made, and the reforms that were undertaken to improve the payment system. Third, we discuss the relationship between the level of compensation and the incomes that farmers were able to obtain from the converted land.

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Overview of the Compensation Level

The total budget of the GfG has been very large, and much of it is directly used to compensate the farmers. This is unlike most other "rural development" programs, whose funds do not end up in the rural villages. By the end of 2008, the central government had invested a cumulative total of Yuan 191.8 billion in the GfG. The plans are for further investments of Yuan 240 billion, bringing the total investment to no less than Yuan 431.8 billion by 2016, when the program is set to end (Zhang 2010).

Farmers are given three kinds of subsidies for converting their land: cash, grain (which later was converted to cash compensation), and seedlings (Table 4.1). Initially, the government subsidized 150 kg of grain per year to farmers for retiring 1 mu[1] (0.07 ha) of cropland in the upper reaches of the Yangtze River, and 100 kg in the upper and middle reaches of the Yellow River. The government offered two levels of grain compensation in these two watersheds because of the soils' different fertility, which results in higher yield levels in the Yangtze River basin compared to the Yellow River basin. In 2004, the government changed the grain compensation to cash, given at Yuan 1.4 per kilo of grain, because of a shortage of grain (Cui 2009) and fear of corruption, with local officers buying cheap grain, and then billing better quality, more expensive grain to the provincial government.[2] The cash was distributed to provinces and autonomous regions where the conversion policy was adopted, and then forwarded to the participants (Li and Lu 2004). In 2004, this cash amount corresponded to the price of the grain it replaced. However, this shift from grain to cash became a problem, as this payment remained unchanged, while the price of rice increased (from an average of Yuan 1.5 per kg in 2002 to an average of Yuan 2.2 per kg in 2012). Thus, in real terms, the payment has been decreasing.

Table 4.1 Amount of subsidies for reforestation on cropland per mu and hectare, per year

Location of farmland	Cash (Yuan)		Grain or cash						Seedlings (Yuan)	
			1999–2003 (kg)		2004–2006 (Yuan)		2007–2015 (Yuan)			
	Mu	Ha	Mu	Ha	Mu	Ha	Mu	Ha	Mu	Ha
Yangtze River watershed	20	300	150	2,250	210	3,150	105	1,575	50	750
Yellow River watershed	20	300	100	1,500	140	2,100	70	1,050	50	750

Source: SFA (2000d); State Council of China (2004, 2007)

[1] *Mu* (one *mu* corresponds to 1/15 of a hectare) is the common unit of measurement for land area in China. We use hectares in this book because most authors reviewed use hectares rather than *mu*. However, all official documents mention *mu*.

[2] The provincial government was in charge of the distribution of grain subsidies, which it had to purchase from local state-owned food companies. The cost of distribution was borne by the provincial government, which was a great drain on the finances of the poorest provinces.

The farmers also receive a cash payment of Yuan 20 (for living subsidies) per mu of set-aside land per year for the duration of grain subsidies, for tending the land and miscellaneous expenses. Finally, forestry agencies supply a one-time cash subsidy to farmers for purchasing seedlings at the beginning of the conversion program. On average, the seedlings are worth approximately Yuan 50 per mu (Yuan 750 per ha) (State Council of China 2002b). In total the three types of compensation amount equal to Yuan 210 per mu (Yuan 3,150 per ha) in the middle and upper reaches of Yellow River for the first year of conversion and Yuan 160 per mu (Yuan 2,400 per ha) per year from the second year on (Table 4.1). For the Yangtze River watershed, the total amount paid was Yuan 280 per mu during the first year, and Yuan 230 from the second year on.

Compensation was conditional on the growth of the forest. Officers from the Forest Bureau verified the survival rate of the trees. To ensure that farmers planted and cared for the seedlings, only 50 % of the grain and cash subsidies were given to the farmers upon entering the program (while obviously they received 100 % of the seedlings) (Uchida et al. 2005). The farmers had to achieve a survival rate of 70–85 % of the trees to receive compensation (SFA 2001a). The remaining 50 % of the grain and cash subsidies were given when they passed the first-year inspection carried out by the local GfG implementation office (Uchida et al. 2005).[3] Farmers who did not achieve a survival rate of 70–85 % were allowed to replant the seedlings, and if the seedlings had survived when the officers from the Forestry Bureau inspected the fields again the following year, the farmers were paid retroactively (for the previous year and the present one) (State Council 2007). Because the farmer could replant every tree that had died and receive compensation retroactively, the success rate was usually officially very high, around 90–100 %.

Making compensation conditional on the survival of the seedlings is essential to guarantee that the farmers will plant the seedlings and take care of them when they are still young and need attention. However, it also has negative consequences. In some cases, farmers planted trees at a higher density than optimal, to make sure that enough survived to satisfy the government's standard of the number of seedlings per mu necessary to claim government subsidies (Yin et al. 2005).[4] If most of the trees planted survived, tree density was too high, which meant that it would take a longer time for the trees to grow and for the canopy to close, while the forest quality and ecosystem functionality were not very high. Also, forest vulnerability was increased, as were the risks of future fire and pest attacks.

Long et al. (2010) argued that forest management activities following tree planting, such as competition control and thinning, were poorly incorporated into the program, because many rural workers migrated to urban areas. Most of those who remain in the rural areas are old people, sick or disabled men or women, and children, who are unable to manage large forest areas.

[3] Xu and Cao found (2002) that this advance payment system had not been adopted in some areas.

[4] According to Trac et al. (2007), in 2003, the average density for the monitored counties was reported as 148 seedlings per mu (2,220 seedlings per hectare or about one seedling for every 4.5 m^2).

Payment Delivery to Farmers

A number of researchers have addressed the question of whether the payments were actually delivered to the farmers. Zuo et al. (2003) found several cases during the pilot phase where full compensation did not reach participating farmers. Similarly, Xu and Cao (2001) found that in a group of 1,026 households, fully 49.5 % had received only partial compensation, 8.5 % had received only grain and 17.6 % had received no compensation at the time of the survey.

Bennett (2008)[5] also looked at whether the compensation was actually delivered to the farmers and concluded that there was some evidence of significant shortfalls in subsidies actually delivered (Table 4.2). In some cases, shortfalls may have been the result of plots that have been converted but have not yet been fully certified

Table 4.2 Average shortfalls in grain and cash compensation, 2002

Province	County	Township	Grain (kg/ha)[a]		Cash (Yuan/ha)		Total shortfall (Yuan/ha)[b]
			GfG standard	Actual delivery	GfG standard	Actual delivery	
Shaanxi (n=103)	Yanchuan	Yanshuiguan	1,500	506	300	25	1,269
		Majiahe		466		59	1,276
		Yuju		94		8	1,698
	Liquan	Yanxia		1,074		112	614
		Jianling		1,500		48	252
		Chigen		1,471		78	251
Gansu (n=85)	Jingning	Zhiping	1,500	574	300	104	1,122
		Gangou		957		137	707
		Lingzhi		1,170		201	429
	Linxia	Zhangzigou		499		86	1,215
		Tiezhai		0		5	1,795
		Hexi		588		36	1,176
Sichuan (n=76)	Chaotian	Datan	2,250	1,849	300	87	614
		Zhongzi		2,050		0	500
		Shahe		2,177		39	334
	Li	Shangmeng		2,160		107	284
		Puxi		2,250		231	69
		Guergou		618		50	1,882
Average:				856		70	1,021

Source: Bennett (2008)

[a]This is a sum of corn, wheat, white and paddy rice, and wheat flour subsidies. Both white rice and wheat flour were converted to unhusked weight equivalents at a factor of 1:1.4

[b]This values grain at the national price of Yuan 1/kg

[5] Bennett (2008) rests his analysis upon a 2003 household and village-level survey conducted by the Center for Chinese Agricultural Policy, Chinese Academy of Sciences, and another survey in Hunan Province.

under the GfG. However, Bennett (2008) argued that, in general, these shortfalls did not appear to be the result of program lag time, since the maximum average shortfall (Yuan 1,507.5/ha) was in Yanchuan county in Shaanxi Province, where implementation generally started earliest in the sample, while the minimum (Yuan 480/ha) was found in Chaotian county in Sichuan Province, where implementation generally occurred latest. Bennett (2008) argued that these shortfalls could have been due to different reasons, not all related to poor program budgeting. In some cases, shortfalls may have been the result of plots that were converted but had not yet been fully certified under the GfG. In other cases, shortfalls may have been due to deductions by village governments to either pay laborers to plant trees on the farmer's converted land, to pay for other administrative costs, or to pay back-taxes owed by the farmer (Zuo et al. 2003; Xu and Cao 2001). Also, program coordination, inspection and compensation delivery for millions of plots is burdensome and costly for local governments, yet the GfG plan dictates that local governments bear their own implementation costs (Bennett 2008).[6] Thus, the delayed payments were partially a result of the fast expansion of the program, which created even greater administrative needs, and shortfalls in required administrative funds. These, in turn, led to problems in implementation and subsidy delivery (Bennett 2008). For example, Bennett and Xu (2005) pointed out that "in a township in a key project county in Shaanxi Province, half of the participating plots were not inspected and compensated on time. In another township in the same county, many participating plots had yet to be inspected even 3 years after they had joined the GfG. Though the county government recruited 30 additional staff to deal with these problems, manpower was still far short of that required to inspect some 67,000 ha of converted land" (Bennett and Xu 2005: 12).

In 2004, after the central government became aware that local authorities were siphoning off the compensation they should have paid to the farmers, the method of compensation was changed (Delang and Wang 2013). From that point, the money was paid through the Rural Credit Cooperative and recorded in a passbook, so the farmers could verify how much they received. In some cases, farmers realized that not all money due to them was paid, and sued the Forest Bureau.[7] By transferring funds directly into the bank account of the farmer, the government could ensure that the farmer received the funds. While this was done to address the risk of corruption, this problem does not seem to have completely disappeared. Du (2012) argued that abuse of power by forestry officers increased because of the GfG.

Payments through the Rural Credit Cooperative increased the transparency of the system (FDOGX 2006). Another factor that increased the transparency of the GfG was the increasing use of the Internet. Since 2000, the central government has been encouraging all levels of government (at the national, provincial and county levels) and

[6] Since 2002 the central government has allocated some administrative fees to provincial governments for GfG implementation, but these have been insufficient and a significant percentage are often diverted by higher levels of government before reaching the townships.

[7] The legal cases have increased since 2006, as the farmers understand better how the GfG payments work.

government departments to make official websites in order to keep the public informed and announce policies. In 2007, this was codified as part of the obligations of all levels of government and all departments. By the end of 2007, more than 30,000 websites by all provinces and national-level government departments, 98.5 % of city-level authorities, and 85 % of county-level governments had established their own websites to announce their most important policies, including those concerning forestry (Yuan 2010; State Council of China 2007; Wang et al. 2005). Almost all villages in China have access to the Internet through mobile phones and farmers unable to access the Internet can obtain information from children, relatives, or friends. By learning about the policies not only from forestry officers, but also directly from the MOF or other government websites, farmers can fully inform themselves of their rights and obligations (Delang and Wang 2013).

Total Incomes of Farmers

Central to the realization of the long-term goals of the GfG is whether it generates the right financial incentives for the participants. When the program was introduced, the subsidies needed to at least offset the participants' opportunity cost of the set-aside land. Once the subsidies end, the farmers should earn from their new timber forests, orchards or pastures (in addition to off-farm incomes they may now be earning) more than they would from pre-GfG land uses, or they would revert their land back to pre-GfG land uses. Since, in most cases, subsidies cannot be paid indefinitely, post-program land use decisions of participating farmers have been one of the biggest concerns in conservation set-aside programs elsewhere (Cooper and Osborn 1998).

A number of researchers have looked at how the subsidies compare to the pre-GfG incomes from farming land. Uchida et al. (2005) found that around 24 % of their sample households in Ningxia Province, and 77 % of their sample households in Guizhou Province, received payments which corresponded to less than the pre-program net revenue from the plots. However, their study was based on a 2,000 dataset, collected only a few months after the program had been implemented, and when the full economic benefits of land conversion could not yet have been realized. The same dataset informed the study published by Uchida et al. (2007) and the same concerns can therefore be raised. Uchida et al. (2007) used propensity scoring matching to evaluate the social and economic impacts of the program. Overall, they found evidence of a significant negative impact on cropping income. However, they also looked at other sources of income, and found a significant positive impact on husbandry income and inventories, and a significant positive impact on productive and housing assets (Xu et al. 2010). Altogether, they estimated the impact on total household per capita income to be small and statistically insignificant.

Bennett (2008) looked at the same issue using a 2003 household and village-level survey conducted by the Center for Chinese Agricultural Policy, Chinese Academy of Sciences, and an additional survey in Hunan Province. He found that for many participants, GfG compensation standards were significantly below the 1999 (pre-GfG) net incomes of the enrolled plots. The results are summarized in Table 4.3, which compares annual net income of enrolled plots in 1999 (i.e. before

Table 4.3 Participant 1999 net income from enrolled land versus GfG compensation standards (2003 survey data)

	Net losing households			Net gaining households			All participants		
	Shaanxi (n=103)	Gansu (n=85)	Sichuan (n=76)	Shaanxi (n=103)	Gansu (n=85)	Sichuan (n=76)	Shaanxi (n=103)	Gansu (n=85)	Sichuan (n=76)
Number of households	7	42	23	96	43	53	103	85	76
1999 average net income from enrolled land (Yuan/ha)	4,833	3,485	5,371	181	940	1,031	507	2,026	2,457
Total converted land (ha)	5.13	8.52	7.47	68.11	11.44	15.26	73.24	19.97	22.73
Average difference between GfG standard and 1999 net income (Yuan/ha)[a]	−3,033	−1,685	−2,821	1,619	860	1,519	1,293	−226	93

Source: Bennett (2008)

[a]Subsidy grain was converted to cash based on the national market price of Yuan 1/kg

they were enrolled) with the amount of subsidies that they should have received for these plots in 2002 according to the program standards (in reality payments were below that level in 2002, as mentioned in Chap. 3). In Gansu, almost 50 % of the participants in the sample experienced a shortfall, which averaged 8 % of the 1999 (pre-GfG) incomes. In Sichuan, about 29 % of the participants in the sample experienced a drop of income, with shortfalls for these households averaging 11 % of the 1999 net income. In Shaanxi 7 % of participants experienced an average shortfall of almost 33 % of the average 1999 net household income. Furthermore, many households reported that the 1999 harvest was poor, which means that the losses experienced by the farmers would on average be higher.

Xu et al. (2010) looked at the restructuring of agricultural production initiated to the GfG in Shaanxi, Gansu and Sichuan provinces, and found that the GfG has indeed induced a restructuring of agricultural production, whereby participants shifted relatively more of their inputs out of cropping and into husbandry. In Shaanxi Province, growth rates for cropping income were 35 % for non-participants compared to only 12 % for participants (including subsidies received). In Gansu, these were −26 % and −32 %, respectively, and in Sichuan cropping income declined by 30 % for both groups (Xu et al. 2010). Table 4.4 presents the 1999 and 2002 components of total income for participant and non-participant households, by province.[8] Conversely, growth rates for husbandry were higher for participants than for non-participants. In Shaanxi, average per capita household husbandry income for participants increased more than ten-fold, compared to only 175 % for non-participants (Xu et al. 2010). In Gansu, participants' husbandry income grew by 1,744 %, compared to 586 % for non-participants, and in Sichuan these numbers were 845 % and 514 %, respectively. Differences in change of total income between participants and non-participants are less systematic across regions. In Shaanxi, total income (including subsidies received) increased by 41 % and 42 % for participants and non-participants, respectively. For Gansu these numbers were 2.3 % and 12 %, respectively, and for Sichuan they were 26 % and 17 %, respectively (Xu et al. 2010).

The analysis of Xu et al. (2010) was done using the results of a 2003 survey, only 2–4 years after the program was implemented in the villages surveyed. It is likely that, as time went by, the incomes from the program's land use changes (including off-farm work they may have engaged in) would have increased even further. Furthermore, Xu et al. (2010) stated that "the GfG subsidy is calculated as the subsidy received by the household for 2002", while Bennett (2008) (using the same

[8] Xu et al. (2010) considered cropping income to consist in total crop production valued at average village market price, net of materials and hired labor costs. Husbandry income includes both sales income and own consumption, valued at market prices. Off-farm income includes all nonagricultural production activities, comprised mainly of sideline activities and wage labor income. Income from sideline activities is net of production costs and other business related expenditures. Wage income includes both cash and in-kind income, valued at market prices. Other income consists of aquaculture, rental and interest income, gifts, pension income, and government subsidies and transfer payments. The GfG subsidy is calculated as the subsidy received by the household for 2002 (Xu et al. 2010).

Table 4.4 Per capita net incomes of participant and non-participant households (1999 and 2002)

	Nonparticipant households				Participant households			
	1999		2002		1999		2002	
Income component[a]	Mean	St. Dev.	Mean	St. Dev.	Mean	St. Dev.	Mean	St. Dev.
Shaanxi								
Total without subsidy	940	777	1,335	930	986	1,077	1,325	1,874
Total with subsidy received	–	–	–	–	–	–	1,394	1,877
Cropping without subsidy	465	521	626	429	420	672	401	622
Cropping with subsidy received	–	–	–	–	–	–	470	628
Husbandry	6	23	17	63	18	78	208	916
Off-farm	388	623	590	947	401	554	525	680
Other	82	233	101	234	147	686	191	826
Gansu								
Total without subsidy	1,803	1,681	2,021	1,741	1,287	980	1,287	942
Total with subsidy received	–	–	–	–	–	–	1,317	942
Cropping without subsidy	484	350	360	246	589	523	370	320
Cropping with subsidy received	–	–	–	–	–	–	399	345
Husbandry	17	53	119	220	6	30	113	222
Off-farm	1,192	1,570	1,346	1,624	633	679	681	647
Other	110	515	196	541	59	204	124	393
Sichuan								
Total without subsidy	1,419	1,425	1,654	1,271	1,635	1,195	1,961	1,524
Total with subsidy received	–	–	–	–	–	–	2,067	1,514
Cropping without subsidy	721	938	506	633	829	931	472	590
Cropping with subsidy received							577	583
Husbandry	33	42	202	200	49	75	459	1,187
Off-Farm	543	953	714	987	674	897	869	971
Other	122	295	232	476	83	251	161	375

Source: Data from Table 6, Xu et al. (2004)
Source: Xu et al. (2010)
[a]All units are in 1999 Yuan, adjusted using the Rural Consumer Price Index

dataset) states that in 2002 farmers received much lower payments than the amount they were due according to government regulations. If Xu et al. (2010) had used full GfG payments, which farmers tend to receive since 2004 (see Chap. 3), their incomes after joining the GfG would have been even higher.

We can conclude that existing studies (all carried out within the first 4 years of the program) show that the incomes of some participants may have dropped if animal husbandry and off-farm work are not included, but may have increased if animal husbandry and off-farm incomes are taken into consideration. It is not surprising that not all farmers have experienced a similar increase – or drop – in income. Since payments are uniform within each of the two regions (the Yangtze and the Yellow rivers watersheds), farmers who have converted very poor land are likely to have experienced an increase in income, while farmers who have converted more fertile land may have experienced a drop of income. As both on-farm and off-farm incomes are likely to have increased further over the last 10 years, we may conclude that participation in the GfG has generally been financially rewarding. On the other hand, we should also consider that 1999 was a year of poor harvest due to serious drought in the surveyed regions, which means that the 1999 cropping income was below the cropping income of an average year. This implies that using the 1999 cropping income as the opportunity cost for program participation is more likely to underestimate participant farmers' real opportunity costs. Further, the fact that government subsidies in 2002 were lower than the 1999 cropping income for a significant share of participant farmers was indeed a serious issue (Xu et al. 2010).

One also has to recognize that these payments are compensation for setting aside the land, and little work is necessary after the initial planting, weeding, and caring for the seedlings.[9] Thus, farmers are free to engage in other income-generating activities, either on the farm or elsewhere. Thus, income from GfG-subsidies does not need to be as high as income from farming for the farmers to benefit from converting their land. Furthermore, many risk-averse households might prefer a lower guaranteed subsidy over a higher but highly variable farming income. It would also be useful to compare incomes per person-day of farm work, rather than incomes per hectare. Incomes per person-day are likely to have sharply increased.

Compensation and Opportunity Cost

An important question is whether the level of compensation is suitable. Compensation that is too low increases the costs of the participating farmers, and may compromise the ability of the poorest farmers to convert their steeply sloped land, thus weakening the poverty alleviation goal, among other problems. Excessive compensation means that less land can be converted, given the limited budget. Ideally, plots with the lowest opportunity cost of the land should be converted, and households should be compensated the same amount as their loss.

[9] This of course raises the question of what will happen once the subsidies end, in 2015–2016. Whether these higher incomes will continue once the subsidies end, will be discussed in Chap. 10, which deals with the sustainability of the program.

Table 4.5 Comparison of yields and slopes from case studies in China's Grain for Green (GFG) Program, 2000

Counties in case study	Average yield before program (kg/ha)		Total area set aside (ha)	Proportion of land with slope 15° or greater (percent)		Grain payment received per hectare (kg)
	Plots set aside under GfG	Plots not set aside under GfG		Cropland set aside under GfG	Cropland not set aside under GfG	
Dingxi, Gansu	1,369	2,220	2,000[a]	83	45	1,500
Zouzi, Inner Mongolia	1,125	–	9,367[b]	16	33	1,500
Pengyang, Ningxia	1,464	2,076	5,080	93	72	1,500
Heqing, Yunnan	–	–	1,000	96	91	2,250
Dafang, Guizhou	2,329	2,731	1,333	98	69	2,250
Tianquan, Sichuan	3,106	8,646	4,600	86	65	2,250

Source: Uchida et al. (2005) (Adapted from Xu and Cao 2002)
[a]Data from 2001
[b]Includes areas of afforested barren hills

Uchida et al. (2005) looked at the productivity of the land, and concluded that plots that have lower opportunity cost were usually selected for the program, making the program rather cost-effective. However, they also pointed out that within the group of participating and non-participating plots, there is substantial heterogeneity (Table 4.5): nearly 40 % of the plots in their sample had yields that were usually lower than the compensation rate (1,500 kg per hectare per year in the Yellow River Basin, and 2,250 kg in the Yangtze River Basin). The owners of the lower yielding plots were in some sense being over-compensated. In Ningxia County 15 % of the program plots had higher net revenue than the compensation level (Yuan 140 per mu), while nearly 70 % of the non-program plots had lower net revenues than this level. On the other hand, in Guizhou, 40 % of the program plots had higher net revenue than the compensation level (Yuan 210 per mu), while nearly 30 % of the non-program plots had lower net revenue than this level. Despite the fact that program plots had lower net revenues on average than non-program ones, targeting was far from perfect. Having such a large portion of the plots either above or below the compensation rate is an indicator of poor efficiency. Better targeting could have reduced the cost to the government and increased the profits of participating farmers, by including non-program plots that had lower net revenues instead of the relatively more profitable program plots (Uchida et al. 2005).[10]

[10]Uchida et al. (2005) do not have precise information as to why the excluded plots were not selected for the program, but believe that it may have been partially due to some program selection strategies adopted by local officials. For example, in some regions local officials required the plots to be contiguous to each other or to be located along a road, to minimize implementation costs.

Table 4.6 Actual compensation vs. compensation based on net revenue for total area under the GfG in Ningxia and Guizhou, 2000

	Ningxia	Guizhou
	(Yuan)	
Actual compensation for program plots (A)[a]	137,942	21,364
Amount of over-compensation (B)[b]	−75,557	−1,994
Amount of under-compensation (C)[b]	24,063	6,603
Compensation based on net revenue (D = A + B + C)	86,448	25,973
	(percent)	
(A)/(C) × 100	160	82
	Ningxia	Guizhou
Actual compensation for program plots (yuan) (A)[a]	137,942	21,364
Amount of over-compensation (yuan) (B)[b]	−75,557	−1,994
Amount of under-compensation (yuan) (C)[b]	24,063	6,603
Compensation based on net revenue (D = A + B + C)	86,448	25,973
(A)/(C) × 100 (%)	160 %	82 %

Source: Uchida et al. (2005)
Data: Authors' survey
[a]To calculate the actual compensation this study assumes that the farm households in the survey were fully compensated for their program plots
[b]The amounts of over-compensation and under-compensation were derived by taking the difference between the estimated net revenue and compensation per mu for each plot and then multiplying by the plot area

The data also illustrate how the degree of over-compensation varies across the study areas and reveal the potential to improve the cost-effectiveness of China's Grain for Green program. To show this, Uchida et al. (2005) compared the program payments and the level of compensation needed to compensate the household for its lost net revenue (Table 4.6).[11] In Ningxia, 84 % of the program plots had payments (Yuan 140 per mu) that were higher than the net revenue that the plot earned during the year before it was entered into the program. The average gap between the plots' payment and their net revenue exceeded Yuan 80, a level that is nearly 58 % of the compensation level (Uchida et al. 2005). If officials had compensated farmers at levels equalling the plots' pre-program net revenues, they could have reduced expenditures by 60 %. In contrast, in Guizhou 60 % of the program plots had payments (Yuan 210 per mu) that were higher than the plots' net revenue, with an average overpayment of about 39 %. Meanwhile, the amount of under-compensation exceeds that of over-compensation, resulting in net under-compensation. Officials would have had to increase expenditures by 18 % to eliminate the under-compensation (Uchida et al. 2005).

Uchida et al. (2005) argues that targeting based on these rules is likely to lead to selection of plots that do not have high slopes. While implementation costs cannot be ignored, they need to be weighed against the benefit of selecting highly-sloped plots.

[11] The analysis requires two new variables: *over-compensation*, generated by subtracting the actual payment from the plot's net revenue when actual payment is greater than net revenue, and *under-compensation* when actual payment is smaller than net revenue (Uchida et al. 2005).

On a household basis, 76 % of participating households in Ningxia and 23 % in Guizhou received payments that exceeded the net revenue that they had made on the plots the year before (Uchida et al. 2005). For a majority of the program plots, farmers received more in payments after entering the GfG program than they had received from planting crops. From the household's point of view, the GfG must have been considered a lucrative program. If the results of Uchida et al.'s (2005) sample was indicative of the situation across China, their findings implied that China would have gained by reallocating resources across regions and among households. For example, Ningxia could have improved its cost-effectiveness performance considerably by targeting those plots with higher slopes and lower opportunity costs. It should be recognized, however, that perfect targeting typically cannot be achieved in practice since there are transaction costs involved in collecting information (Uchida et al. 2005). In addition, as Uchida et al. (2005) noted, one of the main problems arising from a bidding process for contracts, such as that practiced with the Conservation Reserve Program (CRP) in the US, was that the bidding process itself affected the rental rates. Hence, Uchida et al. (2005) believed that the Grain for Green program could have benefited by adopting a more flexible payment schedule, with payments better tailored to the opportunity costs of the land, or the characteristics of plots, but not necessarily a bidding process. Indeed, Uchida et al. (2005) argued that the bidding system was not a realistic option in rural China where the administrative costs to set up such a mechanism would have been prohibitive.

On the other hand, Xu et al. (2010) argued that the use of market-based voluntary mechanisms of participation is key to the efficiency gains promised by payment for environmental services programs over traditional command-and-control approaches. In the case of the GfG, since no bidding mechanism exists to optimally match payer benefits with participant costs, participation should, at minimum, be voluntary. This would have improved cost-effectiveness, by ensuring that households with the lowest opportunity costs participated, while minimizing the possibility that program participation was having negative welfare effects on some participants (Xu et al. 2010).

Before drawing final conclusions about cost-effectiveness, however, we also need to take into consideration the environmental benefits. Uchida et al. (2005) did this by accounting for both opportunity costs and environmental benefits for each group of plots, categorized by their slope.[12] Uchida et al. (2005) found that all of the plots entering the program in Guizhou had high slopes, implying that in that province the program largely targeted plots that gave maximum environmental benefits. At the same time, some plots had high net revenues before entering the program. These plots could have been replaced by those having high slope and lower net revenue. In contrast, in Ningxia the costs and benefits were unsystematically dispersed. For example, 11 set-aside plots in the sample had no slope and high net revenue, while 45 set-aside plots had moderate slopes and low to high net revenues. Based on the observation that there wee a number of plots with higher slopes and lower net revenue per mu, the figures suggest that, from the cost-effectiveness point

[12]The survey respondents classified each of their plots in three levels: those with steep slopes (over 25°), moderate slopes (15–25°) and others (less steep and flat).

of view, the site selection was not performed well in Ningxia. Ningxia could have improved its cost-effectiveness performance considerably by targeting those plots with higher slopes and lower opportunity costs (Uchida et al. 2005).

Uchida et al. (2005) concluded that China's government can improve cost-effectiveness in two ways. First, the program can decrease costs and avoid hurting farmers by reducing the cases of over-compensation and increasing the compensation for (or removing from the program) the plots that are being under-compensated. In a similar way that is done in the CRP in the United States (Babcock et al. 1996), this can be accomplished by changing the compensation schedule from a uniform rate to a more flexible payment schedule that is based on the actual opportunity costs and environmental benefits of each plot. Second, the program can maximize its cost-effectiveness by weighing both the opportunity cost and environmental benefit of each plot, and target as precisely as possible those sites that have low opportunity costs and high environmental benefits (Uchida et al. 2005).

Ecological and Economic Trees

The GfG scheme converts croplands and wasteland into two kinds of forests: ecological or economic forests. Ecological forests are defined as timber-producing forests, while economic forests are orchards or plantations with trees of medicinal value, or other trees providing non-timber forest products that may be sold by the farmers (SFA 2001c) (Chap. 6 discusses the characteristics of the two kinds of forests in more detail).

According to the GfG regulations, farmers received grain subsidies for 8 years if they converted land to ecological forest, 5 years for economic forest and 2 years if they converted land to grassland (Yin et al. 2005). Hence, the GfG was set to expire in a maximum of 8 years after it was first introduced – between 2007 and 2012 in most areas. Because of the fear that the forests did not yet generate sufficiently high incomes to compete with farmland (for example, fruit trees need a number of years before producing an income), and that farmers would cut the trees and revert the land back to pre-conversion land use, the program was extended for one additional period in 2007. That is, farmers would be compensated another 8 years for ecological trees, 5 years for economic trees, and 2 years for grassland. However, compensation was halved (grain subsidy dropped from Yuan 3,150 to Yuan 1,575 per ha of converted land in South China and the Yangtze River basin, and from Yuan 2,100 to Yuan 1,050 per ha of converted land in the Yellow River basin [Table 4.1]). As mentioned above, until 2004 the farmers received grain, which on average corresponded or exceeded the value of the agricultural produce they were able to grow on the land they had set aside. In 2004, this grain compensation was replaced with cash, which corresponded to the price of the grain. By 2007 the cash compensation was already below the potential cash incomes from the land, because the price of grain had increased. In 2008, as the government halved that (already low) cash compensation, the incomes to farmers were further drained, and the opportunity costs increased. Local governments had the option to increase the financial compensation, but most did not (Delang and Wang 2013).

Halving the compensation paid to the farmers does not mean that government expenditure fell. While the compensation paid directly to the farmers was approximately halved after 2007, a similar amount was used to strengthen the overall results of the program through government investment in different areas. One area the government invested in was to improve the quality of the grain fields. This was done through water conservancy work, such as levelling the ground and constructing irrigation ditches to improve the efficiency of water utilization, so as to improve the productivity of flatland and reduce the dependence of farmers on slope land (Li 2007). The government also invested in research to select the trees used for reforestation and to improve seedlings. It supported agricultural extension work to improve the quality of the soil (and seedlings) and to provide training to plant and manage ecological and economic trees. Finally, the government invested through the GfG to increase the availability of alternative energy sources to replace firewood, since people's needs for wood to cook and heat the house was one of the causes of forestland degradation.[13] The government addressed the energy needs of villagers in a targeted way by promoting energy-saving stoves, biogas digesters and liquefied gas, or through projects such as establishing firewood forests and setting up small hydropower plants. Lastly, when villages were located in areas that were ecologically fragile, funds were used to resettle villages to a more desirable location. Hence, overall subsidy levels have not dropped but have increased somewhat (Li 2007; Delang and Wang 2013).

Table 4.7 breaks down in different categories the available data on levels of government expenditure from 2000 to 2010. The data are only indicative, as total government investment in the GfG was much larger than the figures reported in the table. However, the table may give the reader an idea of the different kinds of expenditures, and the proportion of each category in relation to the others during the period under consideration.

As mentioned, in 2007 the GfG was extended for another 8 years. By 2012, 60 % of the land that had been converted was receiving subsidies from the second phase subsidy scheme (SFA 2013c).[14] In 2012, in the counties sampled, the areas of converted cropland that were receiving their first round and second round of subsidies was 30.02 % and 64.3 %, respectively, while 5.68 % of the land set-aside through the GfG was no longer subsidized because the subsidy period for that land had already ended (SFA 2013c).

[13] For example, in Yunnan Province, at the end of 1998, 76 % of administrative villages used brushwood as an energy resource (Meng et al. 2000: 27–32), while in Lijiang Prefecture, Nujiang Prefecture, and Diqing Prefecture in the northwest of China, 40.3 % of peasant households still did not have a power line, and 100 % of the energy used came from burning brushwood (Meng et al. 2000: 27–32). If the resource models in these three prefectures had not changed and they had continued cutting wood, as much as 690,000 ha of woodland could have been lost every year in these three prefectures alone, and forest resources could have been preserved for only 57 years, after which there would have been no wood to burn (Meng et al. 2000: 27–32) (Delang and Wang 2013).

[14] First phase refers to the subsidy scheme from 1999 to 2007, second phase refers to the subsidy scheme from 2008 to 2015.

Table 4.7 Statistics of GfG subsidies

Year	Cash subsidy (billion Yuan)	Government investment (billion Yuan)					Subsidized household (million)
		Grain subsidy	Seedling	Technology input	Others	Total	
2000			0.333			1.541	
2001	0.35	2.036	0.737	0.012	0.441	3.214	
2002	0.458	6.308	3.307	0.032	1.446	11.061	10.31
2003	2.818	942.8[a]	5.481			22.599	18.85
2004		16.824	2.981			23.574	23.28
2005	2.533	284.18[a]				26.812	
2006	2.574	22.390				25.810	>28
2007	2.703	22.671				23.514	approx. 30
2008	3.184	21.448					approx. 30
2009	3.102	20.651					28.38
2010			1.328		10.572	32.205	27.53

Source: Ke (2007), SFA (2002–2011)
[a]The unit for these 2 years is kg

Conclusions

This chapter has reviewed the level of compensation paid to the farmers and how this compensation changed over time. In many cases, the program paid more to the farmers than the income they received from farming. This means that either the program could have saved money by paying the opportunity cost of the land, or more farmland could have been converted using the same amount of funding. It is worth noting that farmers may still benefit from joining the GfG even if the payments they receive are below the opportunity cost of the land, because after joining the GfG they are free to engage in other income-generating activities, either in the village or elsewhere.

One of the advantages of the GfG, in contrast to other programs, is that most of the money allocated to the GfG by the central and provincial governments directly ends up in farmers' pockets. This, of course, contributes to the popularity of the program and to the fact that in many places more farmers wanted to join the program than were eventually allowed to, because of budgetary constraints (Chap. 7). The next chapter discusses GfG's process of land selection.