Rural household income and inequality under the Sloping Land Conversion Program in western China

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As payment for ecosystem services (PES) programs proliferate globally, assessing their impact upon households' income and livelihood patterns is critical. The Sloping Land Conversion Program (SLCP) is an exceptional PES program, in terms of its ambitious biophysical and socioeconomic objectives, large geographic scale, numbers of people directly affected, and duration of operation. The SLCP has now operated in the poor mountainous areas in China for 10 y and offers a unique opportunity for policy evaluation. Using survey data on rural households' livelihoods in the southern mountain area in Zhouzhi County, Shaanxi Province, we carry out a statistical analysis of the effects of PES and other factors on rural household income. We analyze the extent of income inequality and compare the socio-demographic features and household income of households participating in the SLCP with those that did not. Our statistical analysis shows that participation in SLCP has significant positive impacts upon household income, especially for low- and medium-income households; however, participation also has some negative impacts on the low- and medium-income households. Overall, income inequality is less among households participating in the SLCP than among those that do not after 7 y of the PES program. Different income sources have different effects on Gini statistics; in particular, wage income has opposite effects on income inequality for the participating and nonparticipating households. We find, however, that the SLCP has not increased the transfer of labor toward nonfarming activities in the survey site, as the government expected.

conservation and development | Gini coefficient decomposition | livelihood strategies | nonfarm labor

Worldwide, there is a major thrust to design and implement policies that harmonize environmental conservation with human development (1, 2). Ecosystems are increasingly recognized by governments as natural capital assets that provide benefits to society ("ecosystem services"): the production of goods (e.g., seafood and timber), regulating services (climate stability and water purification), cultural values (beauty and inspiration), and options (genetic diversity for future use) (3, 4). "Payment for ecosystem services" (PES) programs are key policy mechanisms for aligning individual economic incentives with protection and restoration of natural capital. A major objective of PES programs is to foster transitions to livelihoods that are sustainable in the long term (5–7).

Following severe droughts in 1997 and massive flooding in 1998, China implemented several large-scale forestry and environmental conservation projects that are unique in scale, duration, and investment (>700 billion yuan over the current decade) (8). These programs include enlarging existing and establishing new conservation areas, specifically for ecosystem service provision, as well as two national PES programs: the Sloping Land Conversion Program (SLCP) and the Natural Forest Conservation Program (NFCP). The SLCP provides farmers with grain and cash subsidies in exchange for converting cropland on steep slopes to much less erodible forest and grassland. We focus on the SLCP because it is the largest, has been implemented for the longest time, and offers an opportunity to evaluate policy efficacy with respect to impacts on household income and equality across households. PES programs have produced a wide range of positive biophysical and socioeconomic outcomes, and also some negative consequences, and have been well summarized at an aggregate level (8). Here, through household interviews, we evaluate the microscale socioeconomic and demographic impacts of the SLCP. This evaluation is needed to inform refinements to the program and aid in planning its potential spatial expansion and temporal extension. Recipients of SLCP subsidies are mostly poor farmers in the rural mountainous areas in China whose traditional livelihoods depend on such natural resources as forests. However, the SLCP, the NFCP, and other environmental policies have restricted household use of these natural resources and have had major impacts on the livelihoods of rural people.

These large-scale forestry and environmental protection policies have dual goals. The Chinese government aims to reduce the loss of soil, improve water retention, and generally protect biodiversity and ecosystems in the west of the country for flood control, hydropower production efficiency, and ecotourism. In addition, it wants to change the economic structure in mountainous areas to increase local household income while simultaneously making local households' patterns of land utilization and agricultural production more sustainable. Systematic assessment of the SLCP's success in increasing rural household income and adjusting the economic structure is necessary and valuable.

Zhi et al. (9) studied surplus labor after the SLCP in Yunnan and Guizhou provinces and found that local economic development explained the extent of surplus labor utilization. However, labor in crops and forestry (we use the term plantation for crops and forestry) and husbandry decreased, whereas the numbers of farmers who migrated out for work increased (9). Hu (10) analyzed the change in economic structure in the southern mountain area in Ningxia Province after the conversion of farmland to forest and grassland. She claimed that farmers have become less dependent on simple plantation, but that this change was not stable (10). In the Bao Ta District, An Sai County of Shaanxi Province, farmers who had more funds or certain skills changed their livelihoods to high added-value agriculture or tertiary industry, but poor farmers would be seriously negatively affected if the government subsidy ceased (11). Other scholars think that SLCP had no effects on the adjustment of local employment, on agricultural structure, or on farmers' income and that whereas the project did not increase the average number of out-migrants in a household for work, it did increase the labor time of these out-migrants; as a result the project significantly increased the income from nonfarm employment (12, 13).

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Following the SLCP, farmers changed their labor supply from agriculture to nonfarming, but this process depended on the farmers' initial human capital and assets. Because the SLCP helps to solve the liquidity constraints for the participating farmers, it is easier for them to switch to nonfarming activities than it is for nonparticipants (14). Other studies have focused on implementation of the SLCP and associated factors that limit farmers' land utilization and sustainability of the project, such as land contract security and the right to rent land (15). A comparison of the SLCP in China and PES projects in other countries found that it was difficult to assess the opportunity cost of the SLCP in China, although the project had some success in poverty reduction (16).

Income inequalities between urban and rural areas and within rural areas in China are important and growing national problems (17–20). Because of economic reform in China, income inequality in rural areas, between regions and within regions have all increased, and transformation of the structure of the rural economy is regarded as one of the main causes (21). However, most of these studies took a macroperspective and used data from statistics yearbooks, which do not provide information at the microlevel for specific rural areas.

This paper focuses on a remote rural area in western China where the SLCP has been enforced since 2000. We first introduce the study area, the sampling method, the analytical framework, and methods and then assess the impacts of SLCP on rural household incomes, and inequality among these households, using data and information from interviews and a survey. In *Results*, we present our comparison of social and demographic features, livelihood activities, income, and income sources of the households that do and do not participate in the SLCP. This analysis is followed by our findings on the impacts of local environmental policies on household net income, on income distributions of households participating and not participating in the SLCP, and on the Gini decomposition from their different income sources.

Study Site

The survey site includes four townships located in the southern mountain area in Zhouzhi County, Xi'an, Shaanxi Province, where the topography is very rough, transportation is poor, and weather conditions are unfavorable. The population is sparsely distributed with village density of 0.27/km^2 and population density of 13.66 persons/km^2. Most villages have >10 households as a group, and villages are scattered around the smoother hillsides or at the foot of a hill.

The survey site is also the watershed protection area for Xi'an city and is close to Taibai National Nature Reserve and the Provincial Zhouzhi Old County Town Nature Reserve. Some communities have collective land and forest within these nature reserves. Since the Natural Forest Conservation Program went into effect, industrial and mining activities are strictly forbidden, and poultry and livestock of the local households must be kept in enclosures. In some communities the collective forests were transferred to the state and the type of trees planted was controlled. Lumber production was banned. Implementation of these policies has restricted households' utilization of local natural resources, especially forest land and forest products.

The SLCP generally uses the administrative village as the organizational unit. In 2002 at the survey site, there were 15 villages in which most households participated in the SLCP. Surveyed households possess different areas or types of farmland. In five other villages no households participated in the SLCP. Thus, we surveyed 20 villages altogether. We define the households from the 15 villages as participating or not participating in the SLCP according to whether or not they converted farmland to forest.

Data and Sampling Procedure. Our data are from a survey of rural households' livelihoods and their environment conducted in the four townships in Zhouzhi during April 2008 by the Institute of Population and Development Studies, Xi'an Jiaotong University. The income data collected refer to the previous year, 2007. The survey included questionnaires for rural households and communities and some semistructured interviews with individuals and focus groups. Multiple-level cluster sampling was adopted as the survey method and the survey villages were selected in four mountain townships according to the villages' economic and geographical conditions. Differences among rural households' livelihood modes and population size of the villages were also considered during the sampling process. At the household level, cluster sampling was used for the questionnaires in 20 villages of the four selected towns. A total of 1,484 questionnaires were distributed, of which 1,078 were returned. Among the 1,078 returned questionnaires, 929 provided valid responses, 145 questionnaires were partially invalid because of incomplete answers, and 4 were totally invalid and were excluded from our analysis.

The household questionnaire, which was distributed to household heads or spouses of household heads between 18 and 65 y old consisted of five parts: the household's social and demographic features; the household's livelihood capitals, such as natural, financial, social, physical, and human capital (22); the household's livelihood activities, such as their production activities (crops, forestry, nonfarming business, and out-migration for employment, etc.) and their labor time; the household's consumption and expenditure; and housework and gender preference (e.g., son preference). The questionnaire is available (in Chinese) online at http://ipds.xjtu.edu.cn//download.php.

Features of Households Participating or Not Participating in the SLCP. A comparison of the social and demographic features of households participating and not participating in the SLCP from our survey is shown in Table S1.

The SLCP-participating households are significantly larger than nonparticipating households in family size, number of female members, adult labor, dependency ratio, the fraction of household heads that have acquired some skills, and the proportion of the household heads who are Communist Party members. However, the heads of the nonparticipating households are significantly younger. They are also greater in numbers of male adult laborers, the proportion of household members with above junior high school education, and the household head's years of education, but these differences are not significant. The amount of per capita forestland under the control of the participating households is significantly greater than that of nonparticipating households, and the per capita farmland and per capita sloping land are significantly less.

Econometric Models. First, we propose that rural households' income depends on their endowment of livelihood capital and their livelihood activities (e.g., refs. 23 and 24) as shown in Eq. **1**,

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \beta_7 X_7 + \beta_8 X_8 + \beta_9 X_9 + \beta_{10} D_1 + \beta_{11} D_2 + u, \quad [1]$$

where u stands for random error and the β_is are parameters to be estimated. The variables in Eq. **1** are the following: Y is the natural logarithm of net household income, X_1 is total adult labor (i.e., number of working adults), X_2 is the proportion of females in the household, X_3 is the proportion of household members with education above junior high school, X_4 is telephone and cell phone cost in the last month, X_5 is area of household farmland, X_6 is area of household forestland, X_7 is household material capital, X_8 is the proportion of the household's total labor time spent on plantation, and X_9 is the total months of out-migration from the household last year. We include a dummy variable (D_1) to control for participation in the SLCP. We expect to find dif-

ferences between the social and demographic features of households participating and not participating. Because it is possible that the SLCP has affected the households' educational level, livelihood capital endowment, or livelihood activities, we include interaction terms of the SLCP with other variables in Eq. **1**, which also includes a dummy variable (D_2) to control for the impact of the nature reserve on the households' income. Statistics for these variables are in Table S2.

To obtain consistent estimators of the SLCP effects with the regression model Eq. **1**, it is necessary to assume that there is no selection bias in the model or that a household's participation was not determined by individual factors at the beginning of the project. Because the SLCP was implemented by higher levels of the Chinese government's bureaucracy according to an administrative order, households' participation in the project was not by choice but depended on the plans of the local government. From our interviews, the households in the survey had no choice in the specific tracts or size of the farmland to be converted, or in the trees to be planted on the land, and because all of the surveyed rural households live in the same area, we can assume that there are no systematic differences between the households that do or do not participate in the SLCP. Thus, self selection in the SLCP can be ignored (25).

Income Inequality and Its Decomposition. There has been little research on economic inequality after the implementation of the SLCP. The Gini coefficient is an index that estimates the extent of inequality in income or wealth. Because of its statistical properties and interpretation in terms of social welfare, the Gini coefficient has become one of the main indicators of economic inequality, and is widely applied in empirical research and policy studies.

Suppose that our rural households have K income sources. To partition the overall Gini coefficient G of total income into contributions G_k from income source k, we follow the analysis in refs. 26–30. With Cov denoting covariance, $F(.)$ the cumulative distribution function, and μ and μ_k the means of total income and income from source k, respectively, we write $S_k = \mu_k/\mu$ and

$$G = \frac{2\mathrm{Cov}[y, F(y)]}{\mu} \text{ and } G_k = \frac{2\mathrm{Cov}[y_k, F(y_k)]}{\mu_k}, \qquad [2]$$

respectively, for the Gini coefficient of total income and income source k. Then we may express G in two ways,

$$G = \sum_{k=1}^{K} C_k S_k = \sum_{k=1}^{K} R_k G_k S_k, \qquad [3]$$

where R_k is the Gini correlation of income source k with total income,

$$R_k = \frac{\mathrm{Cov}[y_k, F(y)]}{\mathrm{Cov}[y_k, F(y_k)]}, \qquad [4]$$

and

$$C_k = \frac{2\mathrm{Cov}[y_k, F(y)]}{\mu_k} \qquad [5]$$

is a centralization index of income component k. C_k is not an exact indicator of inequality for income component k, but shows the relation between the total income and income component k.

C_k is also called a pseudo-Gini coefficient. When the rankings of total income and income component k are the same, C_k is the same as G_k. Generally, there are three situations for the pseudo-Gini coefficient of income component k and the total income inequality Gini coefficient G. If C_k is positive and larger than G, then component k is more unequal than total income. In this case, component k increases the total Gini coefficient. If C_k is positive but smaller than G, then component k decreases the total Gini coefficient. If C_k is negative, then income activity k is mainly undertaken by low-income households, and high-income households have little income from this source, which decreases the Gini coefficient.

We can also use Eqs. **3** and **4** to determine the effect of a small exogenous change e_k in income component k on the overall Gini coefficient. Dividing this effect by the total Gini coefficient before the perturbation gives the relative effect of the marginal change e_k as the relative contribution of component k to the overall Gini coefficient minus the fractional contribution of source k to total income (29).

Results

Descriptive Statistics for Income and Its Structure for the SLCP Participating and Nonparticipating Households. Fig. 1 compares the net household income and income structure of households that do and do not participate in the SLCP. We can see that the net income of households participating in SLCP is higher than that of those that do not, but the difference is not significant. There are significant differences in net income from crops and government subsidy ($P < 0.01$) and forestry net income ($P < 0.1$) between the two types of households, but their net incomes from plantation, nonfarming business, wages, husbandry, and other are not significantly different. The wage income of the SLCP-participating households is higher, whereas the nonfarming business income is higher for the nonparticipating households.

Thus, the households participating in the SLCP have slightly more income, their forestry is more developed, and they are more diversified. However, there is no significant difference between them in most cases.

Multivariate Linear Regression and Quantile Regression Results for Household Income. We use six models for the multivariate linear regression analysis of the household net income (Table S3). There are no interaction terms in model 1. Model 2 includes the interaction terms of SLCP with human capital and family structure. Model 3 includes the interaction terms of SLCP with natural capital and production structure. Model 4 includes the interaction terms of SLCP with social capital (telephone and cell phone cost last month, ref. 31). Model 5 includes the interaction terms of SLCP with material capital, and model 6 includes all interaction terms.

We also use quantile regression to estimate impacts of SLCP on households at different income levels. The interaction terms of SLCP with farmland, forestland, proportion of plantation time, and proportion of out-migration months are included in the regression to estimate the different effects of the factors on households at different income levels. Typical quantiles used in such analyses are 0.10, 0.25, 0.50, 0.75, and 0.90. Using STATA 10.0 statistical software, we obtained the regression results in Table S4.

Participation in the SLCP and proximity to the nature reserve. Participation in the SLCP has a significant positive impact on a rural household's net income in the survey area. However, participation in the SLCP also has some negative impacts through the interaction with household farmland and proportion of plantation time. The interactions of SLCP with human capital, social capital, material capital, out-migration time, and household forestland are not significant. In the six models in Table S3, the joint tests for participating in the SLCP and its interaction terms give significant results, and the household's location within or near the nature reserve has a significant positive impact upon income in all models.

From Table S4, participation in the SLCP has a significant positive impact upon household income, but the impact decreases from households at low income levels to those at high income levels. Furthermore, participation has a significant negative im-

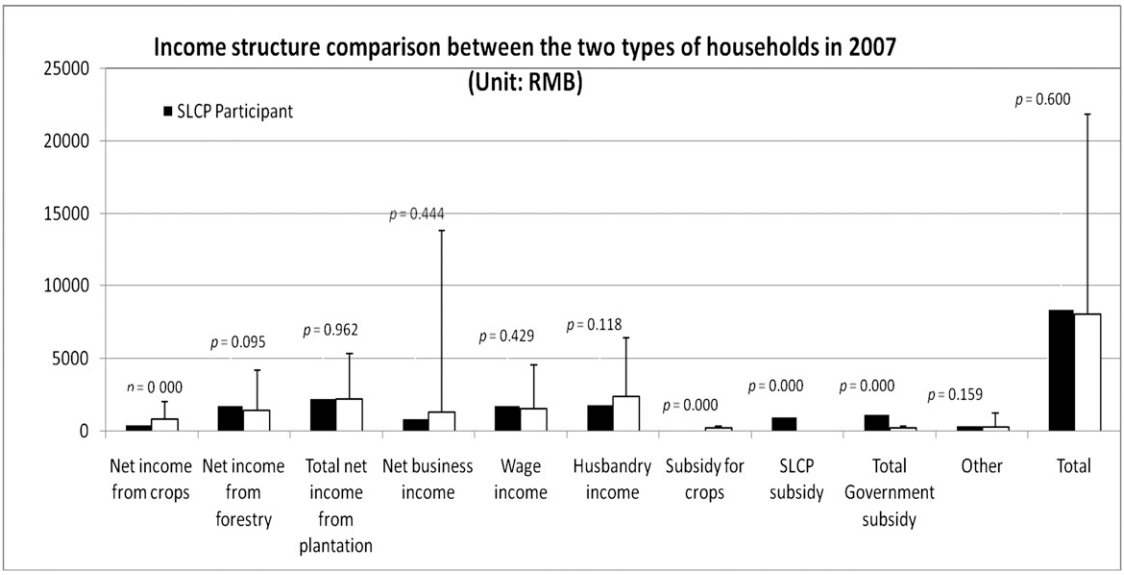

Fig. 1. Income structure comparison between households participating and not participating in the Sloping Land Conversion Program (SLCP) in 2007.

pact on households with lower income through interaction with farmland, but not at the higher income levels. Participation has a significant negative impact on households at some income levels through interaction with plantation time. Finally, location in the nature reserve has a significant positive impact upon households at low or medium income levels, but not at the higher income levels.

Households' capital endowments. From Table S3, household material capital, total adult labor and farmland all significantly increase household income. However, the proportion of members with above high school education, area of forestland, and proportion of females do not.

From Table S4, total adult labor has a significant positive effect on households at most income levels. Household material capital has a significant positive effect as well, but this effect increases from households with low income to those with high income. Household farmland has a significant positive impact on households at low or medium income levels. The proportions of females and members with above junior high school education have no significant effect at almost all income levels. Social capital, measured by family expenditure on telephone and cell phone use last month (the month preceding our survey), has a positive effect on households at the high income level, but not on those at low income levels.

Production structure. The proportion of plantation time has a negative impact on all households at all income levels. Out-migration time has significant positive effects at the low and medium income quantiles, but not at the highest income quantile.

Income Inequality and Decomposition of the SLCP-Participating and Nonparticipating Households. Table 1 shows the Gini coefficients of the income of households participating and not participating in the SLCP and the decomposition of the Gini coefficient among the income components. Table 2 shows the impact of a marginal change of income components on the Gini.

The Gini coefficient for total income of households participating in the SLCP is 0.4661. (The Gini coefficient for China was 0.472 in 2004, estimated from the Asia Development Bank; there are no official data from the Chinese government.) C_k of income from crops, husbandry, nonfarming business, and wages are all >0.4661. Husbandry contributes most to inequality of total in-

Table 1. Gini coefficients of households participating in the SLCP (upper rows) and nonparticipating (lower rows) and decomposition of the Gini coefficient from income components

Indicators/ income source	Net income from crops	Net income from forestry	Husbandry income	Net income from nonfarming business	Wage income	Government subsidy	Other income
G_k	1.19013	0.64137	0.9953	1.87631	1.15255	0.39969	1.3235
	0.68827	0.81916	1.0382	1.82166	1.19901	0.30608	1.4633
S_k	0.05148	0.20672	0.22790	0.10545	0.21909	0.13833	0.05104
	0.10053	0.17483	0.29657	0.16453	0.19576	0.02711	0.04068
R_k	0.3933	0.56886	0.55868	0.45771	0.45577	0.32644	0.2390
	0.42135	0.46746	0.52432	0.47937	0.37477	0.32484	0.1391
C_k	0.4681	0.36485	0.5561	0.8588	0.5253	0.1305	0.3163
	0.2900	0.3829	0.5443	0.8733	0.4494	0.0994	0.2035
Source k to total income*	5.17%	16.18%	27.19%	19.43%	24.69%	3.87%	3.46%
	5.83%	13.38%	32.27%	28.73%	17.59%	0.539%	1.655%

The Gini coefficient of households participating in the SLCP (nonparticipating) is 0.4661 (0.50015). G_k, Gini coefficient of income component k; S_k, share of income component k in total income; R_k, Gini correlation; C_k, centralization index of income component k.

*The contribution of income component k to the inequality of total income = (share of income component k in total income × centralization index C_k of income component k)/Gini coefficient of total income.

Table 2. Changes in Gini coefficients when there is a 1% increase in different income sources for households participating in the SLCP (boldface type) and not participating

Income source	Absolute change of Gini coefficient	Relative change of Gini coefficient
Net income from crops	**0.00010**, –0.0211	**0.00022**, –0.04219
Net income from forestry	**–0.02093**, –0.02049	**–0.04490**, –0.04098
Husbandry income	**0.02051**, 0.01311	**0.04399**, 0.02620
Net income from nonfarming business	**0.04141**, 0.06139	**0.08885**, 0.12274
Wage income	**0.01297**, –0.00994	**0.02783**, –0.01988
Government subsidy	**–0.04642**, –0.01086	**–0.09960**, –0.02172
Other income	**–0.00764,** –0.01206	**–0.01640**, –0.02412

come, followed by wage income, income from nonfarming business, and income from forestry. Income from crops, government subsidy, and other sources makes the lowest contributions to the inequality of total income. The Gini coefficient of households not participating in the SLCP is 0.50015, higher than for those participating in the SLCP. For non-SLCP–participating households, comparing the C_k with G, there are only two income sources, husbandry and nonfarming business, whose $C_k > G$. Income from husbandry contributes most, followed by income from nonfarming business, wage labor, and forestry.

In Table 2, we report the Gini change when there is a 1% increase in the different sources of income for households participating in the SLCP. For some of the seven income sources, inequality is increased whereas for some it decreases. The details are as follows: (*i*) increase in income from nonfarming business causes the largest increase in the Gini coefficient, namely, 8.885%; (*ii*) income from husbandry causes the second largest increase in the Gini coefficient, namely 4.4%; (*iii*) wage income has a minor increasing effect; (*iv*) a 1% income change from crops has basically no impact upon the Gini coefficient; and (*v*) a 1% increase from government subsidy and income from forestry and other sources have negative impacts on the Gini coefficient. Thus, if the households participating in the SLCP in the survey site have a marginal income increase in the government subsidy, forestry, or other sources, the Gini will decrease and the income distribution will become more equal. For example, a 1% income increase from the government subsidy will reduce the Gini most, namely by 9.96%. Table 2 also reports the corresponding Gini change for different income sources of households not participating in the SLCP. We find the following: (*i*) the increase due to nonfarming business is 12.27%, but income from husbandry produces a relatively small increase; (*ii*) in contrast to those participating in the SLCP, a 1% increase in wage income will decrease the Gini coefficient, but by a small amount; and (*iii*) the marginal income increase from crops, forestry, government subsidy, and other sources decreases the Gini coefficient, with the effect of income from crops the greatest, decreasing the Gini by 4.2%.

Conclusions and Discussion

The Chinese government and researchers in China and abroad all are very interested in the impacts of the environmental and forestry policies in China, especially the Sloping Land Conversion Program. Our research provides evidence that the SLCP has improved rural household income and has decreased income equality. The participants and nonparticipants in the SLCP live in areas with similar geographical features, and the participants live near nonparticipants, so their market convenience, transportation feasibility, infrastructure (such as water, telecommunication, and electricity), and macroeconomic environment or government policies (except participation in the SLCP) are almost the same; thus it is reasonable to compare the effects of the SLCP on their livelihood activities.

Participating in the SLCP has significant positive impacts on a rural household's net income, especially for households at low or medium income levels. However, for households at low or medium income levels, participation in the SLCP also has negative effects through its interaction with area of farmland and proportion of plantation time. A household's location within or near the nature reserve has significant positive impacts on income in all of our models.

In 2007, the Gini coefficient of the participants is lower than that of nonparticipants. Because of the SLCP policies or other forestry policies, some changes in or adjustments to livelihood activities or production structure may have occurred among the households in the survey site. However, we find that most SLCP participants are still engaged in traditional forestry or husbandry. There is no strong evidence that the participants have changed their traditional production structure to nonfarming activities. Incomes from wage labor or nonfarming business are not significantly different between participants and nonparticipants. The different income components and their contributions to the Gini coefficient differ between participants and nonparticipants. Some interesting findings are the following:

i) Generally, income from nonfarming business and husbandry, especially the former, increases the Gini coefficient.

ii) Wage income has opposite effects on income inequality for participants and nonparticipants. It causes a small increase in income inequality for participants, but a small decrease for nonparticipants. There is some livelihood differentiation among the SLCP participants. Some participants have specialized and put more labor into forestry, whereas others have out-migrated for wage employment. There is a large labor surplus in the rural areas of China, and there are also many out-migrants among the nonparticipants. We can infer that wage income is more popular among the nonparticipants than among the participants.

iii) Income from government subsidy, crops, forestry, or other sources decreases the Gini coefficient. Because the SLCP participants receive more government subsidies, such as payment for ecosystem services and food subsidies, these subsidies have a larger role in decreasing income equality among the SLCP participants. The nonparticipants receive fewer subsidies from the government, but income from crops and forestry helps to decrease their income equality.

Our study has some limitations. Unlike the panel data used by some previous researchers in this field, we used cross-sectional data 7 y after the SLCP's implementation. Although panel data allow direct comparisons of the same households before and after the SLCP, our cross-sectional approach compares the current situation of participating and nonparticipating households. Although we have carried out the Gini coefficient decomposition from different income sources and compared participants and nonparticipants, it may be possible to go farther in integrating the change of livelihood capitals or household capital endowments such as land, fixed assets, human assets, etc., after the SLCP into the Gini decomposition.

Because of differences in sampling methods and survey sites, some of our findings differ from those of previous studies in China, whereas some confirm earlier findings. For example, a study of rural households in Shaanxi, Gansu, and Sichuan from 1999 and 2002 showed that the SLCP had good poverty targeting but its goal could be achieved at lower cost, and it had little effectiveness in increasing the households' income and adjusting

economic structure (25). From a survey in 2003 in the Yan'an area, Shaanxi Province, the impacts of the SLCP on rural households' incomes were found to be relatively complicated (32). Those households that had more farmland were affected more negatively. However, geographic location also contributed to the changes in income and livelihoods of the farmers. The incomes of those households that could make active adjustments to their sources of income after the SLCP clearly increased, but incomes of those that could not make such adjustments decreased. A household survey in Wu Qi county, Shaanxi province, in 2005 showed that farmers' income from crops decreased after the SLCP, but their income from animal husbandry increased (33). Forestry did not provide farmers with more income and may even have decreased income, apart from the subsidy from the government. Li et al. (33) believed that the SLCP increased farmers' total income, which included that from crops, forestry, animal husbandry, and the government subsidy. From our study, the SLCP has significant positive impacts on the rural households in the survey site, but has different impacts for households at different income levels. Furthermore, we find that the Gini coefficient for the SLCP participants is smaller than for the nonparticipants, because most participants still engage in traditional plantation. Therefore, we conclude, contrary to what authorities expected (34), that the SLCP has not improved the transfer of labor toward nonfarming activities in the survey site.

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