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Limits of State-Led Programs of Payment for Ecosystem Services: Field Evidence from the Sloping Land Conversion Program in Southwest China

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Abstract The Chinese government is currently implementing its Sloping Land Conversion Program (SLCP), the world's largest Payments for Ecosystem Services (PES) program. Few studies have comprehensively assessed both its environmental and its social outcomes; in particular, issues of effectiveness, efficiency and social fairness are rarely addressed in the literature. Adopting an interdisciplinary approach, this research presents extensive field evidence of the effects of the SLCP. It also reveals the gap between the policy's objectives and the actual results of implementation. Less marginal land included, poor tree species selection and undifferentiated household selection for participation have limited the positive outcomes of the SLCP. We argue that the state-led PES program's bureaucratic modality and top-down implementation neglects local participation and pro-poor considerations. A more decentralized approach with more local participation is an important requirement in policy development and implementation for PES programs.

Keywords Forest governance · Payments for ecosystem services · Effectiveness · Fairness · Efficiency · Sloping land conversion program · Southwest China

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Introduction

The devastating floods that swept through the Yangtze Basin in 1998 drew the Chinese government's attention to environmental degradation in the Yangtze River's upper watersheds. Apart from deforestation, it is commonly believed that farming on the steep slopes of the upper watersheds ultimately leads to human-induced natural disasters (Xu *et al.* 2006; Liu *et al.* 2008). Poverty has been identified as a factor in the expansion of cultivation to steeper slopes and the clearance of forest for agricultural purposes, leading to unsustainable land conditions upstream (SFA 2002). In 1999, immediately after the flooding, the Chinese government initiated the Sloping Land Conversion Program (SLCP), proposing to invest 430 billion CNY[1] by 2020 in the ecological restoration of 14.67 million ha of land involving over a million farmers (SFA 2002).

The initial goal of the SLCP is to increase forest cover and prevent soil erosion on cropland on hill slopes by converting marginal agricultural land into forest, simultaneously improving the livelihoods of poor communities by providing subsidies so that participating farmers can gradually shift to more environmentally and economically sustainable activities (SFA 2002). The SLCP contains the key characteristics of payments for ecosystem services (PES) (Pagiola *et al.* 2005; Wunder 2005; Engel *et al.* 2008), as it attempts to provide a monetary incentive for farmers in exchange for their protection of the environment. A growing body of literature recognizes the SLCP as the world's largest PES program (e.g., Yin and Zhao 2012; Yin *et al.* 2014; He and Sikor 2015).

Many studies document its top-down approach to implementation and characterize SLCP as a state-led PES program

[1] 1 USD was equivalent to 6.5 CNY when the research was carried out in 2011.

(Xu *et al.* 2006; Bennett 2008). Others examine its environmental outcomes with a focus on forest recovery (He *et al.* 2014) and tree survival (Bennett *et al.* 2014), highlighting the influence of local variations and contexts. Some studies concentrate on the program's socioeconomic impacts, particularly the participating farmers' economic outlook and options after the program ends (Chen *et al.* 2009; Ma *et al.* 2009) and the implications for rural incomes and inequality (Liu *et al.* 2010; Li *et al.* 2011). Pro-poor considerations in the implementation of the SLCP, however, have attracted less attention (cf. Uchida *et al.* 2007). A comprehensive assessment of both the environmental and the social outcomes of the SLCP is hence urgently required to augment the existing literature.

At the global level, the debate on the environmental and social aspects of PES is a prime consideration in PES research (Muradian *et al.* 2010; Fisher *et al.* 2013). Scholars conceptualize both as indicative of efficiency and fairness. The former is composed of both environmental effectiveness and economic cost, while the latter considers the social dimension of equity in the scheme (van Noordwijk *et al.* 2012). On the one hand scholars believe efficiency to be the key to PES, stating that PES are superior to traditional approaches to effective environmental protection and conservation because they can be more effective and economically efficient (Pattanayak *et al.* 2010; Kinzig *et al.* 2011). Other scholars highlight the importance of social fairness in PES and argue that conservation initiatives should consider a range of social equity issues (Corbera *et al.* 2007; Muradian *et al.* 2010; Pascual *et al.* 2014; Sikor *et al.* 2014). More empirical questions typically focus on the emerging practice of balancing social fairness with efficiency. This is substantively different from widely-quoted PES theory emphasizing either efficiency or fairness alone (van Noordwijk and Leimona 2010). However, empirical analysis and methodological development of studying the combination of social fairness and efficiency are limited (Gross-Camp *et al.* 2012; Martin *et al.* 2014). Investment in improving empirical systems analysis is therefore required by both practitioners and academic researchers in order to document the experience of PES programs around the world. Better international and holistic understanding of the SLCP is also required, particularly as it is the world's largest PES program and hence a rich source to add significant theoretical and practical contributions to the PES debate.

Unlike existing research, this study examines effectiveness, efficiency and social fairness in PES via a case study of the SLCP in Yunnan Province, Southwest China. The study explores SLCP implementation and its impact on two villages. To understand its environmental efficiency and effectiveness the research compares the types of converted land patches and planted species with the policy's objective of converting land with a slope of over 25° by planting trees of which 80 % are species deemed to be of ecological value. The social fairness[2] issue is examined through an analysis of the households targeted for the SLCP and their economic status, which helps to answer the question of whether the policy is sufficiently supporting pro-poor in its implementation.

Thus, this study seeks to make three contributions to knowledge about PES: first, it is one of only a few comprehensive and empirical grounded analyses of effectiveness, efficiency and social fairness in a state-led PES program in a developing country, as other research examines only one or two of these three key components; second, it employs a combination of quantitative and qualitative strategies using spatial analysis, village surveys and interviews to obtain robust field data from which to examine the effects of state-led PES, as conventional approaches often ignore this interdisciplinary approach and these techniques; third, it is expected to contribute to the policy debate on PES and provide timely information to Chinese policymakers in order that they may improve the second round of the SLCP, which is expected to be launched later in 2015 or in 2016.

The paper contains six sections. We briefly review the international literature on state-led PES programs before describing the research methodology, including the study site and data collection and analysis. We then discuss the results in terms of land zoning, tree species selection and the targeted households at the study site, followed by an analytical discussion of the results and the implications of our findings for policy.

International Experience of State-Led PES

PES are dominated by Coasean and Pigouvian conceptualizations. The former sees the key role of market mechanisms for environmental conservation as emphasizing user-financed programs, while the latter is commonly referred to as a governmental payment or state-led program (Vatn 2010; Schomers and Matzdorf 2013). Governmental financial incentive programs for environmental conservation are growing across both developing and developed countries globally (Wunder *et al.* 2008; Schomers and Matzdorf 2013), including monetary payments, subsidies, tax reductions, the granting of use rights, development projects, in-kind materials, and a mixture of these instruments. The financing of state-led PES programs mostly relies on annual allocation through normal central-government budgetary processes, although some programs have dedicated funding sources such as earmarked user

[2] This study focuses on social fairness in the distributive dimension. Other aspects such as participation and recognition are beyond the scope of this research. More explicit discussion of equity in ecosystem management can be found in Sikor *et al.* (2014).

fees or funding from donor agencies. The key governance characteristic of government payment programs is that a state and its agencies lead in the design and implementation of PES. Within this framework the typically important questions of effectiveness, efficiency and social fairness need to be addressed, particularly in developing countries, where PES serve the aims of both environmental conservation and poverty alleviation.

At the global level state-led PES may result in a mixed outcome in terms of their effectiveness and efficiency. In China, afforestation programs have fostered significant improvement in forest cover for better-off communities with strong local institutions, but have failed to do so in low-income communities with weak governance (He 2014). The environmental outcomes of national afforestation programs vary based on local factors and a diversity of contexts, including the local implementation regime, the availability of labor, forestors' experience, etc. (Bennett *et al.* 2014). Costa Rica's national PES, Pago por Servicios Ambientales (PAS), has been criticized for its lack of targeting, distribution of undifferentiated payments that do not consider opportunity costs, and lack of additionality, i.e., failing to target high-value water service areas and paying for services that would anyway be provided (Pagiola 2008; Daniels *et al.* 2010). In Vietnam, Decision 380 foresees payment for watershed services based on enrolled forest area of household rather than forest protection performance, failing to achieve additionality, effectiveness and efficiency (Kolinjivadi and Sunderland 2012). In Mexico, the national PES has enrolled less overexploited watersheds, leaving the most overexploited out of the program (Schomers and Matzdorf 2013). In many state-led programs payments are not sufficient to cover the conservation opportunity costs, resulting in a lack of targeting (Wunder *et al.* 2008; Schomers and Matzdorf 2013). In summary, state-led PES appear to be failing to achieve expected effectiveness and efficiency because their bureaucratic implementation lacks targeting.

State-led PES have also generated mixed impacts on livelihoods in upland communities and in most cases have failed to reach the poorest of the poor. For example, scholars have shown that afforestation programs in China can have both positive and negative effects on the net income of rural households, especially those with a low or medium income level, with variations according to geographic conditions and local context (Xu *et al.* 2004; Li *et al.* 2011). In Costa Rica and Mexico, national PES appear to generate a positive impact on participating households' income generation (Locatelli *et al.* 2008; Wunder *et al.* 2008). However, the literature also criticizes many PES programs for failing to improve social fairness through lack of pro-poor consideration in project design and implementation. In China, although the state emphasizes the pro-poor approach in the policy, research has revealed that household income is not a determinant of enrollment in the program (Uchida *et al.* 2007). Similarly, most marginal groups in critical watersheds have been excluded from PES in Mexico (Corbera *et al.* 2009) and Vietnam (To *et al.* 2012). Many of these studies conclude that centralized governance and campaign-style implementation have resulted in failure to implement a pro-poor approach and claim that PES have had little effect on social fairness (Grieg-Gran *et al.* 2005; Wunder *et al.* 2008).

This study provides a unique analysis of the SLCP's effectiveness, efficiency and social fairness. We contextualize the research to China's political conditions in which local government, placed between the state and village populations, plays a critical role in political decision-making, particularly in matters of natural resource management and distribution (e.g., O'Brien and Li 1999). This provides a social and political context from which to examine implementation of the SLCP and helps to explain the program's outcomes.

Methodology

Adopting a case-study approach, the research was carried out in two administrative villages, Pingzhang in Longyang County and Xinqi in Tengchong County, Baoshan Prefecture, Southwest China (Fig. 1). The first author has worked in the region, and particularly in the two case-study villages, since 2005, which has helped in building mutual trust and understanding regional dynamics. Intensive fieldwork was carried out from April to May 2010, March to August 2011 and June to July 2012. Both villages are typical upland communities that have practiced upland farming for centuries, managing about 87 and 228 ha of agricultural land respectively before the implementation of the SLCP. Pingzhang has a population of 1680 ethnic minority Yi and Bai living in 410 households whose net income per capita is about 360 USD per year. In Xinqi, 4276 Han-Chinese constitute 1026 households with an average net income per capita of 561 USD per year. Both villages were significantly involved in the SLCP from 2002 to 2006, when 93.60 and 487.17 ha of agricultural land were converted to forest in Pingzhang and Xinqi respectively.

Our research applied a combination of qualitative and quantitative strategies to obtain an in-depth picture of implementation and its effects on the two villages by examining three key aspects of the SLCP: 1) land zoning, i.e., which land was included in the SLCP in terms of steepness of slope, land fertility, distance to home etc.; 2) the selection of tree species for the SLCP in terms of their ecological and economic value; and 3) the targeting of households to be involved in the SLCP in terms of their income level. The data were derived from three primary sources. First, spatial databases were developed from topographic maps on a scale of 1:50 000, digitizing the contours to calculate the slopes and categorizing them as >25°, 15°–25° and ≤15° to obtain information on slope type and distribution. This information was overlaid in AcrGIS

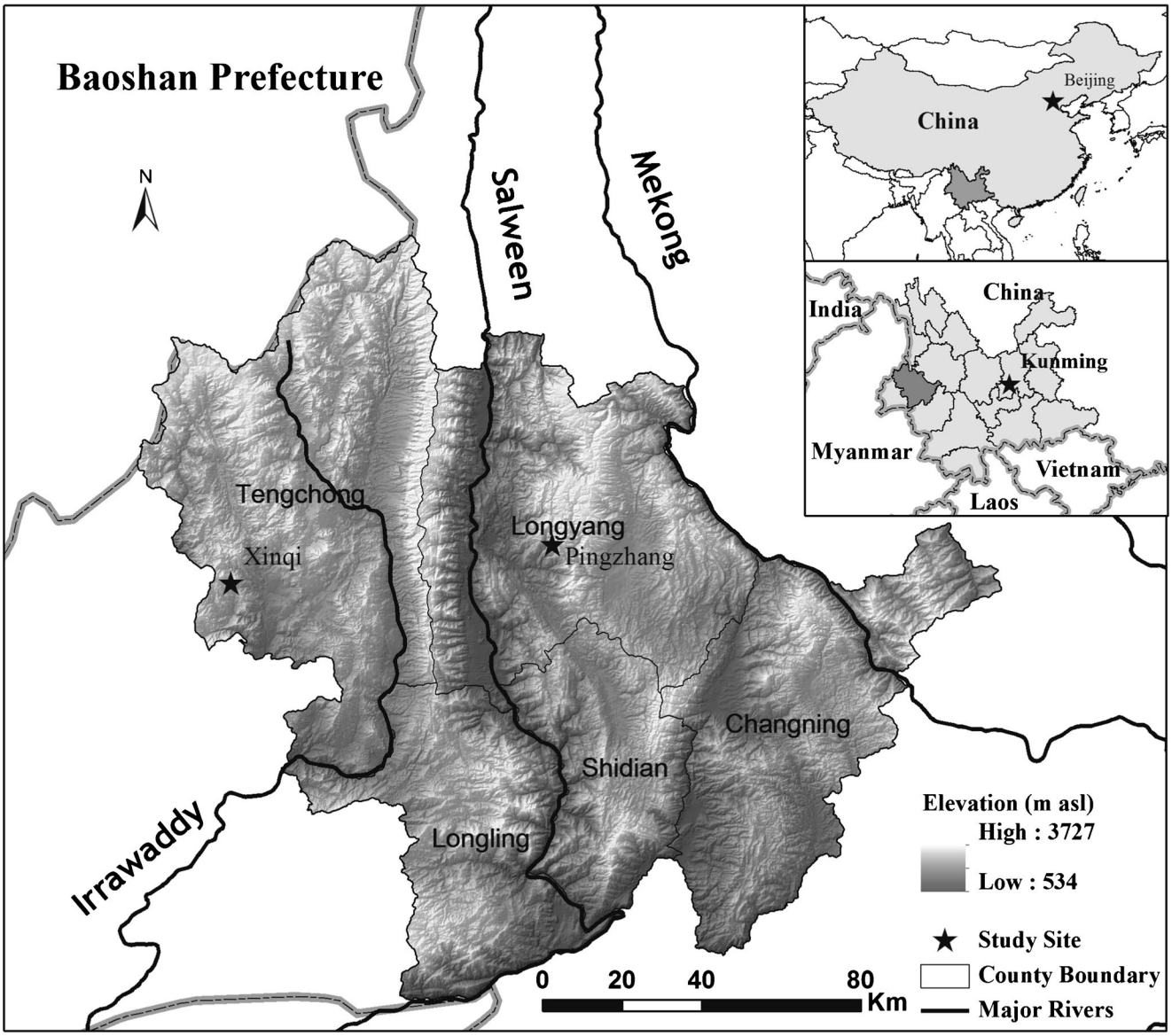

Fig. 1 Location of the study sites

with land use and the SLCP dataset from He *et al.* (2014) to calculate the area of each type of land use on the different categories of slope.

Second, to obtain qualitative information about the SLCP implementation process and narratives of land use change 38 semi-structured interviews were conducted with key informants including officials at provincial, prefectural, county and township levels and village heads, women and elders. In addition, national and provincial policy documents were extensively investigated to allow comparison of the policy's intentions with its actual implementation. This qualitative information also helped to explain the decision-making process, focusing on who made what decisions, particularly regarding tree species selection and plantation.

Third, a questionnaire survey was carried out in both villages using a random sampling approach to obtain quantitative data about local involvement in the SLCP at the household level. To ensure that the survey was statistically meaningful and keep the cost as low as possible, a total of 43 households in Pingzhang village and 60 in Xingqi village were sampled, following Bryman (2001). The survey targeted the household head to gain a better understanding of household structure and decision making. The survey was conducted face-to-face by three well-trained enumerators together with the first author. The questionnaire included two key categories of information: a) household profile, including socioeconomic and demographic data, and b) household land use and participation in the SLCP. Descriptive statistical analysis was performed for all variables. To discover whether the SLCP employs a pro-poor approach in practice, Chi-square tests were performed to reveal the correlation between involvement in the SLCP and household income, and Kruskal-Wallis tests were performed

to understand the correlation between the distribution of the SLCP area and household income.

Results

Land Zoning for the SLCP

State policy defined the criterion that land patches selected for the SLCP must be on a slope of over 25° in order to include land with the lowest productivity and most erosion. However, actual practice changed this to ensure a smooth transition phase in the implementation of the program. Local government took the lead in the patch selection process following several straightforward principles including 1) ease of implementation, for instance selecting one side of a watershed rather than the critical catchment area; 2) selecting roadside areas suffering from heavy erosion as showcases; and 3) selecting geographically-concentrated areas to make implementation easier.

Based on a topographical map analyzed using ArcGIS, less than 40 % of the land under the program in Pingzhang and Xinqi is on slopes of more than 25° (Table 1). Of the patches selected, 46.92 % in Pingzhang and 53.09 % in Xinqi are on a slope of 15–25°. Notably, over 36.99 % of land conversion in Xinqi and 14.62 % in Pingzhang is on a slope of ≤15° (Table 1). Spatial analysis shows that in Xinqi, 41.95 % of agricultural land on slopes of >25° is under the SLCP, while only 11.19 % of agricultural land on similar slopes was found to be taking part in the SLCP in Pingzhang (Table 1).

Furthermore, the spatial distribution of the SLCP shows that most of Pingzhang's targeted patches are close to the main road leading to the township (He *et al.* 2014), providing a good showcase for the SLCP and making it easy for the forest department to monitor them, as explained by most of the forest officials interviewed. In Xinqi, the requirement of geographical concentration of the SLCP[3] has been applied to the land zoning to make the design, implementation and monitoring of the program easier for the forest department. Due to the SLCP's quota policy Xinqi has more land under the program than Pingzhang, which has a lower proportion of slopes over 25° than Pingzhang. In contrast, Pingzhang has been unable to incorporate all of its areas with heavy soil erosion in the program due to the policy's quota. This is likely to be a result of land zoning that rarely corresponds with the state's ecological goal, with the rationale for land selection justified by the provinces' own practical (and opportunistic) guidelines, which aim to accomplish the program in a timely fashion.

The village survey indicated problematic selection of land. In Pingzhang plots closer to home, about 1398 m average distance from home, and with a higher agricultural output, average of 4365 CNY/ha/year, were selected for the program (Table 2). Typically, the average gain from agricultural production is slightly higher than the state compensation, as over 57 % of production plots are terraced and the soil fertility is good on over 43.5 % of these. Terraced land controls soil erosion better than many other types of forestland exploitation and the planting of young trees.

In Xinqi, on the other hand, the program has targeted more remote, an average distance from home of about 3912 m, and marginal land whose agricultural return is less than the state's compensation, about 2625 CNY/ha/year (Table 2). The low agricultural output gives farmers a strong incentive to participate in the program and encourages their livelihood transition. Most of the targeted plots are on sloping land, and only 10.8 % are terraced.

The SLCP's national goal requires the program to target the most marginal land with low productivity on the steepest slopes to improve its ecological effectiveness and cost efficiency. However, in practice implementation is of a mixed nature. Land selection was influenced by local guidance on the SLCP implementation and as a result few remote marginal areas with low productivity were selected. Compared with Pingzhang, Xinqi more closely meets the national objectives and criteria for ecosystem conservation and the transformation of local livelihood structures and strategies for a more durable state.

Selecting Tree Species for the SLCP

The selection of tree species is another key component of the SLCP, as ecologically and economically valuable trees attract different rates of subsidy and potential benefits after the compensation period ends.[4] Furthermore, the proper selection of species directly affects the program's ecological outcome. In practice the county forest department and township government commonly decide on the species to be grown by each village. In Pingzhang, one of the poorest villages in the region, the township government has strongly promoted economic tree species to encourage economic development. In 2002, following the township's development strategy, the township leader selected pear trees for the SLCP program. The pear is an exotic species, however, and

[3] In the program implementation, the government does not allow scatter distribution of patches but requires the land enrollment to be geographically concentrated.

[4] National policy categorizes tree species as of ecological or economic value. The former refers to timber species grown for their ecological functions and services and which are eligible for subsidies for 16 years after planting; the latter includes species planted for their commercially-valuable non-timber products (e.g., fruits, edible oils, nuts, and fodder), which receive a subsidy for only 10 years after planting.

Table 1 Slope distribution across SLCP plots and agricultural land (AL)

Slope	Pingzhang					Xinqi				
	SLCP		AL		SLCP/AL	SLCP		AL		SLCP/AL
	(ha)	(%)	(ha)	(%)	(%)	(ha)	(%)	(ha)	(%)	(%)
≤15°	13.68	14.62	129.60	15.57	10.56	180.18	36.99	662.22	46.02	27.21
15–25°	43.92	46.92	381.06	45.78	11.53	258.66	53.09	661.41	45.97	39.11
>25°	36.00	38.46	321.75	38.65	11.19	48.33	9.92	115.20	8.01	41.95
Total	93.60	100	832.41	100.00	11.24	487.17	100.00	1438.83	100.00	33.86

Source: Based on analysis of a 1956 topographic map and land classification in 2002 in He *et al.* (2014). SLCP/AL stands for the proportion of SLCP out of agricultural land

its selection created a range of problems. As the township leader's successor said:

> Our ex-leader made a mistake in selecting this pear for the SLCP. Although his initial idea of promoting economic development was good, he is not a trained forester. Several problems occurred after the pear trees were planted: 1) farmers have little knowledge of the planting, management, and pruning of this pear, so the planted trees are not very healthy; 2) the pear species is not well selected; it does not taste very good and has little economic value on the market; 3) Pingzhang is a remote village with poor road access and the mature pears will lose value in transit and cannot be stored. (Pingzhang, April 24, 2011)

The farmers did not like the pear either; many joked that it was not even good for pig feed because of its bad taste. As a result few people cared for their trees. The majority of the farmers interviewed expressed their intention to cut them down when the compensation payments ended. In 2004 a survey conducted by the village head and township forest station showed a survival rate of only about 50 % of the trees, which is much lower than the rate of 85 % required by national SLCP standards (SFA 2002). The county forest bureau and township government had to provide another round of free seedlings to replace the dead pear trees to ensure that the tree stands met the national requirements. 'Luckily, this time it's walnut,' the village head stated. Unlike fruit, walnuts are easy to transport and store. Above all there is a good market for walnut both now and in the foreseeable future. This gave the farmers a strong incentive to plant the trees. In 2005 significant planting of walnut trees was carried out as part of the SLCP that year.

Table 2 Characteristics of sampled SLCP households' plots

Plots characteristics		Pingzhang (n=46)*	Xinqi (n=74)*
Area (ha)	Mean	0.31	0.28
	S.E.	0.04	0.03
Distance to home (m)	Mean	1398	3912
	S.E.	165	159
Pre-programme gains (CNY/ha/year)	Mean	4365	2625
	S.E.	412.5	135
Soil fertility (%)	Good	43.5	40.5
	Medium	43.5	55.4
	Poor	13	4.1
Slope (%)	≤15°	13.0	27.0
	15–25°	8.7	33.8
	>25°	21.7	28.4
	Terraced land	56.5	10.8

Source: Village survey 2011, *n=number of plots

Although walnut was planted as an economic tree for its nut harvest, farmers were paid compensation for the longer period commensurate with the standard for ecological trees. The walnut is nationally classified as a double-purpose tree species, with the plantation pattern determining its purpose in use. A plantation density of more than 2250 individual trees per ha is regarded as ecological use and is eligible for 16 years of subsidy, while trees planted less densely are considered economic trees with only a 10 year subsidy. To motivate farmers the local government designed walnut plantations for nut production with only about 525 individual superior seedlings planted per ha. To qualify for the 16-year subsidy the county forest department also provided hard-shell walnut seeds for direct sowing in fields along with the superior soft-shell walnut seedlings. The local government implied to the farmers that they would be able to cut down the hard-shell walnut trees when the program ended. This practice has been widely applied in Baoshan prefecture to provide a greater incentive for local participation, and is expected to create better economic returns. However, it will reduce the overall ecological benefit from the afforestation of walnut as ecological trees.

In Xinqi, ecological planting has been encouraged following the county forest department's promotion of ecological

species across the whole county, which has a historical preference for and practice of growing species including *Alnus nepalensis, Betula alnoides, Taiwania flousiana* and *Tsuga dumosa.* The county forest official responsible for the SLCP in the county stated:

> The selection of tree species and plantation patterns is absolutely decided by the county forest department. We promote ecological forest because: ecological trees require less management skill from farmers and produce higher economic return; ecological trees perform and grow better on converted land, where there is normally poor soil fertility; ecological trees rarely require agricultural inputs such as chemical fertilizers to ensure economic returns; and the economic benefit from ecological trees is less affected by market changes than fruit trees, as timber prices are always going up. So we promote ecological tree species that meet the national need for better ecological benefits and livelihood considerations […] we also promoted planting patterns of mixed stands of broadleaved and conifer forest to maximize ecological function and reduce additional inputs for pest and fire control […] In particular, we promote the indigenous species which are more ecologically suitable locally. (Tengchong, 14 August, 2011)

The species selected for Xinqi were welcomed by farmers, although they did not initially know how to plant mixed stands. The performance of the mixed-stand plantations improved in the second year, gaining the farmers' confidence. They particularly liked the indigenous species they have traditionally cultivated and with which they are familiar. A mixed plantation can be organized in different combinations that include not only different species but also different quantities and proportions of each species, allowing farmers to negotiate for a diverse combination patterns on their plantation. As the village head said: 'We prefer to have a larger proportion of *Taiwania flousiana* with fewer *Alnus nepalensis,* as the former's timber has a higher economic value.' Therefore, as Xinqi's SLCP documents show, *T. flousiana* accounts for 60–70 % of forest and *Alnus spp.* for only 10 %. In 2008 a survey by the county forest department reported a survival rate of over 90 % of trees, higher than the national standard.

The national objective of improving watershed function seeks the planting of more ecological trees. In practice species selection and tree-planting patterns are mainly determined by the township government and county forest bureau. Their knowledge, experience and expertise further determine both the local incentives and the potential for the program's success. Clearly recognizing both indigenous species and local preferences can help to meet local needs.

Targeting Farmers for the SLCP

Typically, the distribution of participating households and area of the SLCP reflect the distribution of household income in both villages (Fig. 2). Pingzhang, with an average per capita income of 2340 CNY, is classified as a poor village by the township government. About 60 % of the households participating in the SLCP are classed as poor or very poor while another 40 % are classed as of above-medium income (Fig. 2). This distribution is similar to the distribution of household income. Land under the SLCP belonging to poor and very poor households accounts for about 60 % the total sampled households' SLCP area. In Xinqi, a better-off village with an average income of 3640 CNY, over 60 % of households involved in the SLCP are classed as better-off or rich and the rest as of medium income or poor. This distribution is also similar to the distribution of household income. The area under the SLCP belonging to better-off and rich families accounts for about 60 % of the sampled households' total SLCP area. Therefore in both villages, neither the rich households nor the low-income households were disproportionately included or excluded from the SLCP.

The result of a Chi-square test of correlation between household income range and participating households and a Kruskal-Wallis test of correlation between household income range and SLCP area (Table 3) shows no significant correlation among those factors in either village ($p>0.05$): in neither Pingzhang or Xinqi is there significant correlation between income and household participation ($\chi^2=3.2914$, $p=0.5103$ in Pingzhang; $\chi^2=5.3026$, $p=0.5827$ in Xinqi) or between income and SLCP area ($\chi^2=23.882$, $p=0.5827$ in Pingzhang; $\chi^2=42.83$, $p=0.3102$ in Xinqi). These results show that the criteria for who can participate in the SLCP and how much area can be included in it do not depend on household income level.

Both villages are significantly involved in the SLCP, with over 80 % of households in Pingzhang and over 85 % in Xinqi participating. While Xinqi has a higher average income than Pingzhang there is no clear evidence that more SLCP land has been allocated to the poorer village than to the richer village; in fact the opposite is the case. As also noted by Weyerhaeuser *et al.* (2005), the poorest prefecture in Yunnan, Nu Jiang, with its fragile ecosystem, was allocated very little SLCP land. Thus the allocation of SLCP land across geographic location is not influenced by regional economic conditions.

In summary, the SLCP policy aimed to target poor families in upland watersheds. However, in practice income status is not the criterion used to select households for involvement in the SLCP, and neither are regional differences in income considered in the allocation of SLCP quotas across the province, (see Weyerhaeuser *et al.* 2005). The pro-poor consideration appears only in the policy document and not in practice.

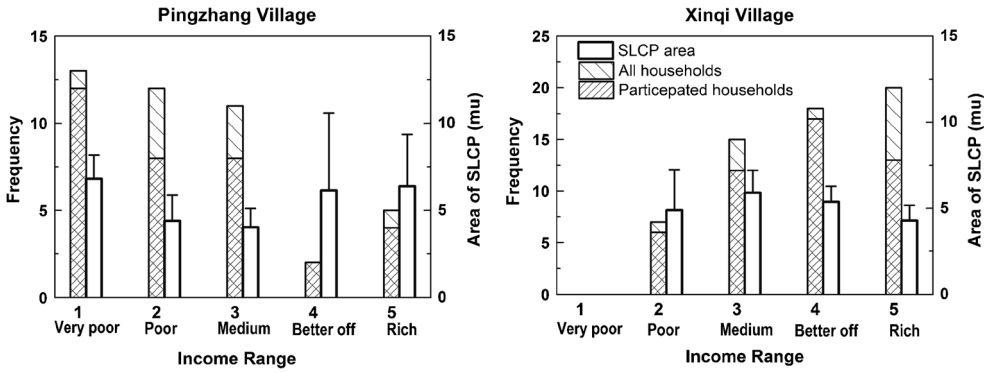

Fig. 2 Distribution of households, participating households and SLCP area by income

Discussion

This research differs from previous studies of the SLCP in China in that it provides a comprehensive assessment of the program's effectiveness, efficiency and social fairness. It is supported by a combination of quantitative and qualitative data that explain the limits of the state-led PES program. In general there is a gap between the policy objectives and actual implementation of the SLCP. There are three theoretical and empirical implications that can be drawn from our findings.

Firstly, in term of effectiveness and efficiency our data show that the SLCP has failed to target the most critical and most eroded areas and that regional coordination in the allocation of SLCP land is lacking. In Pingzhang much of the converted land slopes by less than 25°, limiting the potential for maximizing the positive environmental outcome of preventing soil erosion. In Xinqi, after the conversion of most of the slopes with a gradient steeper than 25° the government did not allocate the surplus land quota to the other village, most of whose steep slopes are not included in the program, but to other land in Xinqi, mainly in areas with less soil erosion and shallower slopes. As also observed by other studies (Pagiola 2008; Wunder *et al.* 2008; Daniels *et al.* 2010; Schomers and Matzdorf 2013), failure to target the most critical ecosystems is common in state-led PES and impacts their effectiveness and efficiency.

Secondly, this study reveals another common limit to state-led PES: top-down implementation, as also observed in other countries (Wunder *et al.* 2008; To *et al.* 2012; Suhardiman *et al.* 2013). Like the land zoning, the tree species are selected via a top-down approach. In Pingzhang the local township leader, who had no basic forestry knowledge, selected an exotic species with a low market value, creating a disincentive for forest management and a low tree survival rate. To encourage farmers to continue to participate, the local government subsequently manipulated the species selection to claim economic walnut planting for ecological purposes, minimizing the environmental effectiveness and cost efficiency intended by the SLCP. In Xinqi, species selection was imposed on the local context; however, it ultimately came closer to the state's objectives. Typically, centralized planning restricts the possibility of local participation and causes PES to overlook the most important components of voluntarism (Wunder 2005).

Thirdly, while the policy document contains pro-poor considerations its implementation is insufficiently pro-poor. Our research shows that household involvement was determined by geographic location of their land rather than their economic status (see also Uchida *et al.* 2007). There is no significant difference between the participation of poor, medium and rich households. At the regional level the results support Weyerhaeuser *et al.* (2005) observation that Pingzhang, the poorer village, did not have more SLCP land allocated to it than better-off Xinqi. The policy's pro-poor intentions have thus been ignored at both the village and the regional level. Social fairness needs to be fostered far more and should go beyond the single aim of poverty alleviation, as many scholars have argued (e.g., Grieg-Gran *et al.* 2005; Corbera *et al.* 2009; van Noordwijk *et al.* 2012; Fisher *et al.* 2013).

Table 3 Chi-square test of household income range and participating households and Kruskal-Wallis test of household income range and SLCP

Villages		Household Income Range		
		X-squared (χ^2)	*p*-value	df
Pingzhang (*n*=43)	Participating households	3.2914	0.5103	4
	Area of SLCP	23.882	0.5827	26
Xinqi (*n*=60)	Participating households	5.3026	0.1509	3
	Area of SLCP	42.83	0.3102	39

Source: Village survey 2011, type of variable including "Area of SLCP" (continuous), "House income range"(category), "participation of household" (binary, 1=participated, 0=non-participation)

In summary, the implementation of the state-led program significantly limits its ability to achieve its stated objectives. Its linear bureaucratic implementation fails to target the poorest households; the top-down approach does not take different local conditions into account; and centralized planning rules out the possibility of local participation. In conjunction with existing socioeconomic and cultural land-use practices on the ground these bureaucratic modalities strongly obstruct the achievement of effectiveness, efficiency and social fairness in PES programs.

Conclusion

Although limits to state-led PES programs have been noted in a number of studies (e.g., Grieg-Gran *et al.* 2005; Wunder *et al.* 2008; Schomers and Matzdorf 2013), it is widely accepted that the magnitude of state-led PES has great potential and that it may create significant economies of scale and cost efficiency compared to other types of PES, including user-financed PES and co-investment (cf. Wunder *et al.* 2008). Many researchers have observed that state-led PES can achieve environmental effectiveness and poverty reduction to some extent where there is strong state capacity, sufficient funding for its implementation, and recognition of the local context (cf. Kolinjivadi and Sunderland 2012). Clearly, the outcomes of state-led PES programs can differ as substantially as the local context and variations (e.g., Bennett *et al.* 2014; He 2014). However, the key weakness of state-led programs is that they attempt to use one-size-fits-all solutions to simplify social diversity. For balanced effectiveness, efficiency and social fairness, this research pinpoints three implications for policy: first, at the local level and beyond the voluntarism principle in PES, government policy should ensure meaningful local decision-making via democratic decentralization; second, at the regional level, government policy should develop more flexible and differentiated payment standards and schemes across regions; third, at the national level government policy should ensure that sufficient time is allowed for local interaction and consider the implementation of a pro-poor approach. These measures will ensure that specific paid land use is much more closely targeted to local conditions and employs a more inclusive approach that involves poor people.

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