CHAPTER 11

Social Capital and Social Norms Shape Human–Nature Interactions

Xiaodong Chen, Wu Yang, Vanessa Hull, Li An, Thomas Dietz, Ken Frank, Frank Lupi, and Jianguo Liu

11.1 Introduction

Humans affect the natural environment through a variety of activities, including the overuse of natural resources, which results in ecosystem degradation worldwide (Millennium Ecosystem Assessment, 2005, Vitousek et al., 1997). Conservation efforts such as payments for ecosystem services (PES) have been implemented to recover some of these degraded ecosystems (Chen et al., 2009a, OECD, 1997). However, current conservation resources are still far less than what is required globally (James et al., 1999, 2001). Therefore, it is important to understand complex interactions in coupled human and natural systems (CHANS) that affect the consumption of environmentally significant resources and human responses to conservation policies. One emerging area of research in coupled systems involves appreciation for the fact that human actions are embedded in a social context (Dietz and Henry, 2008). Such research recognizes that human activities are often affected by social capital and social norms (Dietz et al., 2003, Ostrom, 2000).

One key debate in the sustainability of coupled systems is the degree of substitutability between natural capital and human capital (Daly and Cobb, 1989, Dasgupta, 2010, Neumayer, 2010). Natural capital is defined as the stock of goods and services that humans derive from the natural environment (Costanza et al., 1997, Daily et al., 2000). Human capital refers to the stock of knowledge, education, and abilities humans possess to produce economic values. In environmental economics, advocates of weak sustainability assume that long-term sustainability can still be achieved with a loss of natural capital, as long as human capital is available as a substitute. In contrast, advocates of strong sustainability assume limited or no substitutability between natural and human capitals. Thus, they emphasize that the amount of each type of capital should be maintained for future generations in order to achieve sustainability (Dasgupta, 2010, Solow, 1993). This debate has been expanded to include social capital, which is defined as the resources that people access through social ties and relations (Arrow et al., 2004, Lin, 2001). [We are aware that there are various definitions of social capital and some scholars define social networks and norms together as social capital (Lyon, 2000, Pretty and Ward, 2001).]

In addition to social capital, social norms are also important factors that may affect human–nature interactions. Social norms are shared understanding in a community about what actions are proper or correct, or improper or incorrect, and actors enforce norms to perpetuate the social systems to which they are committed (Bendor and Swistak, 2001, Coleman, 1990). Social norms may be sustained through internalized social–psychological values such as reputation, fairness, and self-esteem. Members in the community reward or punish people who follow or break the norms (Elster, 1989, Fehr and Gintis, 2007, Goldstein et al., 2008). More generally, social norms can also be simply what

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most people do in a given situation. Social norms may even result from an equilibrium in which economically rational agents choose actions based on the expected behaviors of others (Young, 1996). Past studies have shown that social norms can substantially influence human behavior (Elster, 1989, Fehr and Gintis, 2007, Goldstein et al., 2008), such as collective actions in natural resources management (Dietz et al., 2003, Ostrom, 2000, Pretty, 2003) or decisions about environmentally significant consumption (Schultz et al., 2007). Under the influence of social norms, trust and reciprocity among community members encourage the engagement of collective activities in natural resources extraction. Formal or informal sanctions prevent the detachment from norms.

Despite the advances in research on both social norms and social capital, most studies on coupled systems do not account for either. We hypothesize that it is essential to incorporate social norms and social capital with demographic, economic, and environmental factors in order to fully understand the complexity of coupled systems. In this chapter, we outline our research efforts aimed at testing this hypothesis. We first provide a brief overview of how social norms and social capital affect human–nature interactions in our model coupled system—Wolong Nature Reserve (Chapter 3). Next, we discuss our research on the intersection of social capital, labor migration, and environmental impacts. We then discuss our findings on the impact of social norms on participation in PES programs, including both the Grain to Green Program (GTGP) and the Natural Forest Conservation Program (NFCP). We close the chapter with some implications of using social norms and social capital to shape human activities for sustainability.

11.2 Overview of social norms, social capital, and human–nature interactions in Wolong

The human system in Wolong is a dynamic rural community with nuanced cultural traditions and a rich history (Chapter 3). People living in Wolong interact with their environment in many complex ways. Examples include fuelwood collection (Chapters 7 and 10), farming and tourism (Chapters 4 and 13), and participation in PES programs such as NFCP and GTGP (Chapters 5 and 13). During these activities, inhabitants in Wolong have developed social capital and established social norms. For instance, during planting and harvesting seasons, groups of households often work together supporting different households at different times in order to improve the efficiency of labor use. Exchanges of labor are also common in fuelwood collection and raising livestock, for when groups of households work together and share facilities.

Two human activities driven by social norms and social capital that have particular relevance for sustainability in Wolong are labor migration and PES programs (both GTGP and NFCP). Below we explore each in detail with the goal of better understanding the role of social norms and social capital in mediating human–nature interactions and how this knowledge can improve management measures for sustainability.

11.3 The intersection of social capital, labor migration, and environmental impacts

Labor migration is a global phenomenon that is particularly prevalent in developing countries, where employment opportunities in distant areas spur individuals to move away from their homes in search for jobs. The impacts of social capital on labor migration are well understood. Social capital is important in gaining access to employment information and influential persons for employment (Bian, 1997, Granovetter, 1995, Lin et al., 1981, Yakubovich, 2005). It also plays a key role in making migration decisions (Hugo, 1998, Massey, 1990, Palloni et al., 2001) and reducing costs and risks of migration (Korinek et al., 2005). Studies on the impacts of social capital on labor migration often differentiate the strength of social ties because social ties with different strengths may affect labor migration in different ways. Among different types of social ties, relatives have stronger social ties than friends, and friends have stronger social ties than acquaintances (Bian, 1997, Granovetter, 1995). Strong social ties are often more reliable than weak social ties, and hence have stronger impacts on migration processes such as transportation and settlement (Massey and Espinosa, 1997, Wilson, 1998). Weak social ties are especially helpful for migrants in obtaining information about employment opportunities, and providing direct access to influential persons for employment (Bian, 1997, Granovetter, 1995, Yakubovich, 2005).

Many farmers in Wolong relocate to cities for short periods of time as labor migrants. This phenomenon is also very common in many other rural regions in China as a result of increasingly available employment opportunities from the rapid economic growth in cities (Johnson, 2000, Li and Zahniser, 2002). Most of the labor migrants from Wolong only work in cities temporarily and return to their home villages whenever needed. Labor migration is important to study in Wolong because it may affect the local environment (Chen et al., 2012a). First, remittances from labor migration may be used for electricity, hence reducing fuelwood use (see also Chapter 10). Second, reduced human population due to migration may reduce both the demand for fuelwood use and the labor supply for fuelwood collection. Third, other human activities negatively affecting the environment may also be reduced (e.g., medicinal herb collection or poaching). Moreover, labor migrants may help other local residents find employment opportunities and migrate to cities via social capital, so the cumulative effects of labor migration on the environment could be substantial in the long run.

Despite the well-established links between migration and social capital, their impact on the environment is not well understood. We set out to establish the relationship between social capital, labor migration, and the environment using our model system of Wolong. To do so, we followed the causal chain from social capital to labor migration by estimating the effects of social capital, human capital, and economic conditions on labor migration. We then followed the chain from labor migration to fuelwood consumption by estimating the effects of labor migration on fuelwood consumption. We conducted household interviews in 2005 with households that had (n = 129) and did not have (n = 215) labor migrants. During the interviews, we collected information on households' fuelwood consumption, human capital factors and economic status, social ties with people living or working in cities, and the amount of remittances that labor migrants sent back home (Chen et al., 2012a). We recorded the availability of different types of social ties. We considered social ties with relatives as strong ties, with acquaintances as weak ties, and with friends as ties of moderate strength.

Labor migration can be confounded with fuelwood consumption because labor migration is a process of self-selection rather than a process of controlled random assignment. Under such circumstances, any estimated causal effect can be spurious unless the process of self-selection is taken into account (Hirano and Imbens, 2002, Winship and Morgan, 1999). We adjusted for the confounding of labor migration with fuelwood consumption using the propensity score weighting method (Hirano and Imbens, 2002, Robins and Rotnitzky, 1995, Rosenbaum and Rubin, 1983). Propensity score techniques compare individuals in the treatment group (i.e., households with migrants) to individuals in the control group (i.e., households without migrants) with a similar propensity score (i.e., likelihood of being in the treatment group). This procedure allows the random assignment of treatment to be approximated (Rosenbaum and Rubin, 1983). The propensity score is defined as:

$$p(S) = \Pr(M = 1 | S) \qquad \text{(Equation 11.1)}$$

where M is a dummy variable of treatment, S is a group of covariates, and $p(S)$ is the probability of receiving the treatment, which can be estimated using a logistic regression model.

Assuming the relevant covariates were in the model, the average effect of labor migration on fuelwood consumption can be consistently estimated using a propensity score weighted general linear model (Hirano and Imbens, 2002, Hirano et al., 2003). The weights of the model are defined as:

$$\omega(M,S) = \frac{M}{p(S)} + \frac{1-M}{1-p(S)} \qquad \text{(Equation 11.2)}$$

That is, a household with labor migrants is weighted by $1/p(S)$ and a household without migrants is weighted by $1/(1-p(S))$. So the lower the propensity of having migrants for those households with migrants, the greater the weight would be.

Similarly, the higher the propensity of having migrants for households without migrants, the greater the weight would be. Therefore, the estimation of the average effect of labor migration on fuelwood use focuses mainly on the strongest overlap in propensity between the treatment group and the control group.

We first established a logistic regression model to estimate the propensity for labor migration based on people's human capital, economic status, and social capital. Then we estimated the average effect of labor migration on fuelwood consumption using a propensity score weighted general linear model (Chen et al., 2012a). All working-age people (18–60 years of age, 912 people) from the households that we interviewed were used to estimate the propensity for labor migration. Since the correlation in characteristics among people in the same household may result in heteroscedasticity in the regression, we used Huber's variance correction to obtain robust standard errors (Wooldridge, 2002).

We found that among social capital factors, the availability of acquaintances in cities was significantly positively correlated to labor migration, while the availabilities of relatives and friends were not statistically significant. The availability of acquaintances increased the odds of labor migration by 2.54 when other variables were held constant (Table 11.1). Our

Table 11.1 Determinants of labor migration (reproduced from Chen et al., 2012a).

Independent variables	Coefficient (adjusted standard error) [odds ratios]
Gender (male = 1; female = 0)	1.029*** (0.222) [2.798]
Age (years)	0.316** (0.117) [1.372]
Age squared	−0.005** (0.002) [0.995]
Marital status (married = 1; single = 0)	−1.725*** (0.344) [0.178]
Education (years)	0.186*** (0.043) [1.204]
Children (number of children younger than 15 years)	0.072 (0.182) [1.075]
Extended (have extended member = 1; no extended member = 0)	0.314 (0.312) [1.369]
Laborers (number of working-age people)	0.359** (0.126) [1.432]
Cropland (hectares)	−0.267 (0.870) [0.766]
Non-migration income (thousands of yuan)	−0.082*** (0.024) [0.921]
Township (Gengda Township = 1; Wolong Township = 0)	0.782*** (0.238) [2.186]
Relative (Have relatives in cities = 1; no relatives in cities = 0)	0.196 (0.217) [1.217]
Friend (Have friends in cities = 1; no friends in cities = 0)	0.197 (0.281) [1.218]
Acquaintance (Have acquaintances in cities = 1; no acquaintances in cities = 0)	0.930*** (0.244) [2.535]
Intercept	−8.003*** (1.959)
Pseudo-R^2	0.319

Notes:
**$p \leq 0.01$; ***$p \leq 0.001$; $n = 912$

results suggest that households with weak social ties (acquaintances) were more likely to have labor migrants (Chen et al., 2012a).

Some human capital and economic conditions were also significantly correlated with labor migration (Table 11.1). Men were more likely to work as labor migrants than women, which is consistent with the observation that men are usually expected to assume more economic responsibilities for households in rural China. Significant effects of age and its quadratic term on migration suggested a quadratic relationship between age and labor migration. The estimated coefficients imply that as age increased, the probability of migration increased until 30 years old and then declined. Married people were less likely to migrate, while education increased the probability of migration. The number of working-age people in the household had a significant positive effect on labor migration. We also found a significant negative effect of non-migration income on labor migration (Table 11.1). The township indicator also had a significant effect on labor migration. People in Gengda Township, which is geographically closer to cities, were more likely to work as labor migrants than people in Wolong Township.

In order to estimate the average effect of labor migration on fuelwood consumption, we used the estimated propensities to weight a standard regression (Chen et al., 2012a). We found that households with labor migrants consumed significantly less fuelwood (1788 kg less) than households without migrants (Table 11.2). Household size had a significant positive effect on fuelwood consumption, as larger households usually had a higher demand for energy than smaller ones. Households with senior members consumed more fuelwood because senior people required more fuelwood for heating in winter (An et al., 2001). Non-migration income had a significant negative effect on fuelwood consumption because households with higher non-migration income tended to have better housing conditions and could afford more electricity (Table 11.2). The amount of cropland positively affected fuelwood consumption, presumably because households with more cropland tended to rely more on natural resources while households with less cropland relied more on off-farm opportunities to meet livelihood needs. Last, people in Gengda Township

Table 11.2 Estimation of the average effect of labor migration on fuelwood consumption (reproduced from Chen et al., 2012a).

Independent variables	Coefficient (standard error)
Migration (Have labor migrant = 1; no labor migrant = 0)	−1788*** (405)
Household size (number of people)	573** (174)
Senior (have senior member = 1; no senior member = 0)	1253** (446)
Non-migration income	−114*** (24)
Cropland	7965*** (1414)
Township	−2506*** (429)
Relative	−290 (417)
Friend	−1067* (506)
Acquaintance	78 (479)
Intercept	4576*** (985)
Adjusted R^2	0.31

Notes:
*$p \le 0.05$; **$p \le 0.01$; ***$p \le 0.001$. $n = 344$

consumed less fuelwood than people in Wolong Township. One of the main differences between the two townships is that the elevation of Gengda Township is much lower than that of Wolong Township. The weather in Gengda Township is warmer than Wolong Township, and hence residents need less fuelwood for heating and cooking.

While our results illuminate the importance of weak social ties for labor migration, we do not deny the role of strong social ties because some weak ties might develop through strong ties. However, our results support Granovetter's argument for "the strength of weak ties" (Granovetter, 1973, 1995) and suggest that strong ties alone may not be very helpful for labor migration. Compared to strong ties, weak ties are spread across wider social networks and are more likely to expand employment information in urban settings as well as gain access to influential persons in the job market directly. Furthermore, we found that having labor migrants substantially reduced household fuelwood consumption. Thus, weak social ties had a significant indirect effect on the environment in Wolong (Chen et al., 2012a). In our analysis, it is not reduced population through migration alone that mitigated human pressure on the environment. Rather, labor migration also reduced human pressures because there was a readily available, although costly, supply of electricity that could serve as a substitute for fuelwood. Through labor migration, local households were better able to afford to use electricity since labor migration complements rural agricultural income, a common phenomenon in transitional economies (Korinek et al., 2005). Our results provided evidence of partial substitutability among social capital, human capital, and natural capital.

11.4 Social capital and forest monitoring under the Natural Forest Conservation Program

Social capital also plays a crucial role in participation in PES programs. An example is NFCP, a program launched across China to protect natural forests through a series of measures, including a logging ban, artificial plantation and restoration, and forest monitoring (Liu et al., 2008, 2013; see also Chapters 5 and 13). In Wolong, NFCP officially started in 2001 and covered all the forested areas (120 500 ha). NFCP implementation in Wolong is unique compared to most other areas across China because it engaged households to participate in forest monitoring for payment incentives (Chen et al., 2014, Yang et al., 2013a). Approximately one-third of the forest areas (40 100 ha) near human settlements was assigned to a total of 1130 households for monitoring in the form of household groups. The average annual payment rate was around US$143 per household, with distant forest parcels assigned to large household groups with higher payments (Yang et al., 2013b).

Social capital comes into play via the interactions within and among monitoring groups. Group size (i.e., the number of households in each monitoring group) for each forest parcel varied from 1 to 16. The Wolong Administrative Bureau decided the household group composition, but groups had the autonomy to decide their monitoring strategies such as monitoring frequency, duration, and subdivision of group members to monitor in turns. The Bureau evaluated household-monitored forest parcels twice a year through random field assessments (e.g., inspection of illegal logging) and anonymous reporting (people who anonymously report illegal activities obtain cash rewards). If any illegal activities were detected in a household-monitored forest parcel, every group member would receive a penalty in terms of payment reduction, and legal sanctions if applicable (Yang et al., 2013b). The exception to this rule occurred if they could identify the person(s) who conducted the infraction (Yang et al., 2013b).

We expected that social capital might play an important role in affecting the collective monitoring behaviors among group members and across different monitoring groups under NFCP, and then influence the forest monitoring outcomes. On one hand, households with social ties to local leaders would have more influence on other households' monitoring and logging behaviors. Social learning literature (Henrich and Gil-White, 2001, Milinski et al., 2002, Rustagi et al., 2010) suggests that this may occur because leaders will often be disproportionally imitated by others. On the other hand, the social relationships among group members might affect their self-organization and monitoring strategies.

To examine our hypothesized effects of social capital on households' forest monitoring behaviors, we conducted quantitative and qualitative analyses based on our long-term empirical household survey data, and focus group and personal interviews (Yang et al., 2013b). Our dependent variable (i.e., the total laborer days of input per year by each household spent on monitoring) had a censored distribution (clustered with a minimum value of zero and maximum value of 20 in our case). Therefore, we used censored regression models (i.e., Tobit models) to estimate the parameters. The general form of a Tobit model (Wooldridge, 2002) is given by:

$$y_{1i} = \begin{cases} y_{1i}^* & a < y_{1i}^* < b \\ a & y_{1i}^* \leq a \\ b & y_{1i}^* \geq b \end{cases} \quad \text{(Equation 11.3)}$$

$$y_{1i}^* = X_{1i}\beta_1 + u_i \quad \text{(Equation 11.4)}$$

where y_{1i} is the observed monitoring effort, y^*_{1i} is a latent variable that satisfies assumptions of a classic linear model, a is the minimum value, and b is the maximum value. X_{1i} is a vector of exogenous explanatory variables, β_1 is a parameter vector to be estimated, i is the ith observation, and u_i is an error term that has a normal distribution with a mean value of zero.

Our results suggest that households with strong social ties to local leaders on average spent 54% less labor on forest monitoring than those with weak social ties to local leaders (Table 11.3). We also found that households with strong social ties tended to be those whose adult members were more senior and educated (statistically significant with $p < 0.05$ and $p < 0.01$, respectively). Such findings were also confirmed by qualitative evidence from household interviewees, who admitted that they dared not and did not want to conduct illegal activities in forest parcels monitored by households with strong social ties. People behave in this manner because they do not want to impair the social relationships with those households possessing strong social ties since those are households whom they often need to ask for help. This opens the possibility that those with strong ties can leverage their informal networks to avoid sanctions. The staff members of the administrative bureau were mostly college graduates hired from outside (with few local ties), and all local people were encouraged to report illegal logging to receive a cash reward. We did not find a single case where staff members shielded households with strong ties so that those households could avoid or reduce monitoring. Therefore, this does not seem a plausible alternative explanation for our findings. We were left to conclude that in comparison to weak social ties to local leaders, strong social ties to local leaders reduced or even prevented illegal activities and saved actual monitoring efforts.

Additional causal analyses (Yang et al., 2013b) also confirmed previous claims in the literature about the conditions under which members in larger groups are more likely to free ride (i.e., do not contribute individual efforts for group benefits). In other words, people were less willing to contribute when

Table 11.3 Estimation of social ties to local leaders on households' forest monitoring efforts (reproduced from Yang et al., 2013b).

Variable	Description	Coefficients (robust S.E.)	Marginal effects
Social ties to local leaders	Binary: 0 for weak social ties; 1 for strong social ties	−5.377** (1.920)	−3.012
Quadratic term of group size	The quadratic term of group size (household^2)	−0.128** (0.041)	—
Group size	The number of households monitoring a single forest parcel (household)	1.331** (0.408)	0.767
Distance between each household and the main road	Euclidean distance between each household and the main road (km)	2.787* (1.216)	1.749
Laborers	Number of household laborers (individual)	0.296 (0.792)	0.186
Household size	Number of household members (individual)	−0.741 (0.630)	−0.465
Education	Average education of adult household members (year)	0.309 (0.369)	0.194
Household income (log)	Total household income in 2007 (yuan)	−0.011 (1.042)	−0.007
Percentage of agricultural income	Percentage of agricultural income to total household income (unitless)	−2.452 (2.760)	−1.539
Sampling weight	Sampling weight adjusting households sampled from the same monitoring groups	−1.432 (1.126)	−0.899
Intercept		8.921*** (2.360)	—

Notes:
*$p < 0.05$; **$p < 0.01$; ***$p < 0.001$. The analysis unit is the household. Dependent variable is total labor input for monitoring. The results are estimated by Tobit model. Total number of observations is 156. The left-censored and right-censored observations are 47 and 14, respectively. Standard errors are adjusted for clusters of households from the same monitoring groups. All independent variables were mean-centered before entering the model. All variance inflation factors were tested to be <5. Log pseudolikelihood is −390.962. Pseudo-R^2 is 0.035.

in larger groups compared to smaller groups. In contrast, our analyses also suggested that a household member would face higher social pressure in larger groups, which reduces free riding. This is because a member who did not participate in collective monitoring would be at the risk of damaging social relationships with only one other household in a two-member group but with nine other households if in a ten-member group. In this sense members of large groups may have quasi-ties (Frank, 2009) with each member of the group through their identification with the other members of a group. Violating a group norm may negate those quasi-ties. This argument is consistent with our finding that social capital influences a household's forest monitoring behaviors.

11.5 Social norms and enrollment in the Grain to Green Program

Another example of a PES program affected by social context is GTGP. GTGP has been implemented in Wolong since 2000 with the goal of increasing forest cover by converting cropland on steep slopes into forest (see also Chapters 5 and 13). Participants of the program receive an annual payment of 3450 yuan per ha for 8 years for planting and maintaining trees in their cropland. Almost all households in Wolong have participated in this program. Through GTGP, a total of 110 ha of cropland have been converted into forest. When most of the GTGP contracts started maturing at the end of 2008, the program was extended for another eight years at a reduced annual payment of 1875 yuan per ha.

GTGP has had a number of positive impacts on the natural environment in Wolong (Chen et al., 2009a). First, part of the labor force that was released from agriculture has been attracted to off-farm employment in more developed urban areas. This pattern was also found in other places that have adopted GTGP (Bao et al., 2005, Ge et al., 2006, Hu et al., 2006, Liu, 2005). As a result, human pressure on the natural environment has been reduced (Liu et al., 2007). Second, substantial fuelwood can be produced on GTGP land, which may alleviate the further degradation of panda habitat due to fuelwood collection in natural forests.

As with any policy or program, there is always uncertainty. We do not know whether the program will be continued in perpetuity and what will happen to the farmland that has already been converted to forest if the program were to end at some point. An important question that we have grappled with is, "If the program were to end, would farmers choose to convert the planted forestland back to agriculture?" The answer to this question may differ from household to household and may ultimately have a profound effect on the landscape and the sustainability of the coupled system. We hypothesized that social norms would affect people's decisions about whether to convert forest plantations back to agriculture. This prediction is based on our observations that local farmers made decisions that take substantially into account the behaviors of others in the community.

To test this hypothesis, we conducted interviews with 304 households in 2006. We collected information on households' socioeconomic conditions, characteristics of GTGP land plots, and land-use plans regarding GTGP land after the payment ends (Chen et al., 2009b). For those households that planned to convert some of their GTGP land back to agriculture, we further asked them to indicate their re-enrollment plan under different policy scenarios. The policy scenarios included payment level, duration of the program, and neighbors' behavior (i.e., percentage of neighbors reconverting at least one of their GTGP plots). We set the payment level at three possible values: 1500, 3000, and 4500 yuan per ha. The highest value was adjusted to 3750 yuan per ha after the first quarter of the survey. This revision allowed for more variation in responses. The three possible duration values were 3, 6, and 10 years. For neighbors' behavior, respondents were told that 25%, 50%, or 75% of their neighbors would convert at least part of their GTGP plots back to agriculture. We defined neighbors as those households who lived in the same group as the respondent. Group is an administrative unit within a village in rural China. Households in the same group tend to live closer geographically and have more interactions among one another.

Among a total of 735 GTGP plots that were enrolled by our interviewed households, only 166 plots were planned to be converted back to agriculture if the payment ended. We used stated-choice methods (Louviere et al., 2000) to evaluate the effects of social norms and other policy attributes on land re-enrollment. In order to more efficiently understand the main effect of each of the policy attributes, a main-effects design was used where policy attribute values were designed to be mutually orthogonal. We estimated the effects of policy attributes and the characteristics of households and GTGP plots on the land re-enrollment using a random-effects probit model (Wooldridge, 2002). The regression analyses were conducted based on those 166 GTGP plots that were planned to be reconverted after the payment ended.

We found that neighbors' behavior had a significant effect on respondents' plans of re-enrolling their GTGP plots in a new PES program (Table 11.4). We estimated that an additional 10% of neighbors' converting at least part of their GTGP plots back to agriculture reduced the respondents' re-enrollment intention by an average of 6.4%. Respondents indicated a higher likelihood of re-enrolling their GTGP plots when the program was to offer a higher payment. On average, an additional one yuan of payment increased the respondents' re-enrollment intention by 0.8%. These estimates contrast the effects of formal incentives versus informal norms. The effect of social norms on respondents' re-enrollment plans was non-linear at different levels of payments. The effect of social norms was largest at an intermediate payment and was smallest at the highest and lowest payments (Figure 11.1). In addition, the effect of program duration on respondents' re-enrollment plan was also non-linear. Respondents planned to re-enroll 23% more GTGP plots under a 6-year program than under a 3-year program. The planned re-enrollment under a 10-year program was not significantly different from a 6-year program (Table 11.4).

Some socioeconomic conditions and characteristics of GTGP plots also had significant effects on the planned re-enrollment of respondents (Table 11.4). We found that females and older respondents were more likely to re-enroll their GTGP plots than males and young respondents, probably due to less labor supply for crop production. Farming income had a significant negative effect on the planned re-enrollment, while off-farm income from employment outside of Wolong had a significant positive effect on re-enrollment. In comparison, income from off-farm employment within Wolong, including tourism employment, temporary off-farm employment, and permanent employment, did not have significant effects. Households with more cropland were more likely to re-enroll their GTGP plots. The respondents' expected fuelwood production from a GTGP plot had a significant positive effect on re-enrollment. The average distance from each household to its corresponding GTGP plots had a significant negative effect on re-enrollment. This result was probably because average distance was correlated to some unmeasured variables that negatively affect re-enrollment.

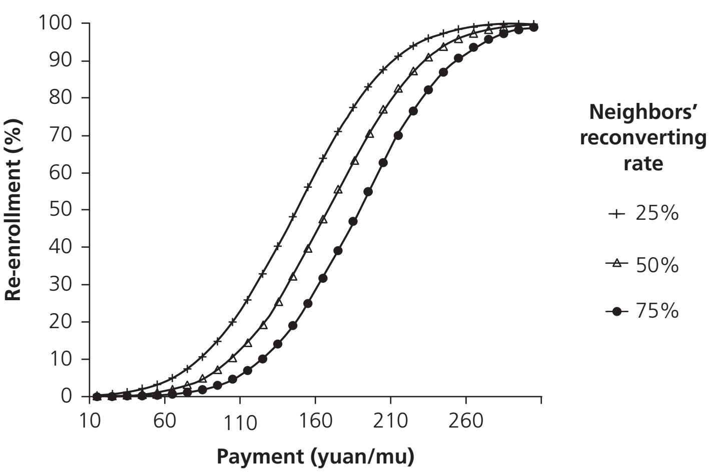

Figure 11.1 Estimated program re-enrollment under different levels of payment and neighbors' reconversion behavior (reproduced from Chen et al., 2009b).

Table 11.4 Estimation of policy attributes and other characteristics and their marginal effects on program re-enrollment (reproduced from Chen et al., 2009b).

Independent variables	Parameters (standard error)	Marginal effects
Neighbors' behavior	−1.662** (0.581)	−0.636
Conservation payment (yuan)	0.020** (0.003)	0.008
3-year duration (dummy, reference = 6 years)	−0.598* (0.277)	−0.230
10-year duration (dummy, reference = 6 years)	−0.270 (0.281)	−0.104
Gender (reference = female)	−0.841† (0.474)	−0.300
Age (years)	0.077** (0.023)	0.030
Education (years)	−0.049 (0.072)	−0.019
Farming income (1000 yuan)	−0.075† (0.042)	−0.029
Off-farm income from outside Wolong (1000 yuan)	0.253* (0.127)	0.097
Off-farm income from tourism employment in Wolong (1000 yuan)	0.046 (0.071)	0.018
Off-farm income from temporary employment in Wolong (1000 yuan)	0.063 (0.062)	0.024
Off-farm income from permanent employment in Wolong (1000 yuan)	0.054 (0.047)	0.021
Cropland after GTGP (mu)	0.361** (0.127)	0.138
Livestock (dummy)	0.406 (0.520)	0.157
Household size	−0.127 (0.176)	−0.049
Total land enrolled in GTGP (mu)	0.025 (0.085)	0.010
Area of land plot (mu)	−0.110 (0.246)	−0.042
Fuelwood production (kg)	0.003† (0.002)	0.001
Average walking distance from each household to its land plots (minutes)	−0.038** (0.012)	−0.015
Deviation of plot–household distance from the average distance (minutes)	0.015 (0.013)	0.006
Elevation (1000 m ASL)	0.050 (2.099)	0.019
Slope (degrees)	−0.038 (0.024)	−0.015
Aspect (180 = north-facing; 0 = south-facing)	−0.007 (0.006)	−0.003
Labor cost of reconversion (persons*days)	0.002 (0.003)	0.001
Geographic location (dummy)	0.498 (0.816)	0.185
Constant	−3.812 (4.902)	

Notes:
† $p \leq 0.1$; * $p \leq 0.05$; ** $p \leq 0.01$.
Observations = 498; Number of plots = 166; Log likelihood = −219.209
Significant parameters for $\sigma_\mu = 1.836$ ($p < 0.01$) and $p = 0.771$ ($p < 0.01$) suggest the random-effects model is appropriate, and the test statistic $\chi^2 = 80.59$ ($p < 0.01$) indicates the random-effects model is preferred to the model without random effects.

11.6 Using social norms and social capital to shape human activities toward sustainability

The significance of social norms and social capital in influencing human–nature interactions in Wolong is informative not only for understanding coupled systems, but also for informing management of coupled systems worldwide for sustainability. If managers are aware of how human behavior is influenced by social context, this information can be harnessed for more efficient and effective policy making.

For instance, our study on social capital and labor migration demonstrated the significance of social ties for promoting rural–urban migration and in turn improving the rural environment. This phenomenon is common throughout the world, as the rapid economic development in urban regions has generated more employment opportunities. Greatly improved transportation and communications infrastructure facilitates the interactions between rural and urban areas and thus for building new social relations and the flow of rural labor to cities. While some parts of the world have formal government institutions to facilitate seeking employment in urban areas, these are absent in many rural areas such as our study area. As an alternative, rural migrants seek such information through their social ties to people in urban settings. Our study suggests an important opportunity for policy intervention lies in weak social ties in transitional economies. Compared to human capital, weak social ties to people in urban settings are relatively easy and inexpensive to develop. Policies that aim to shape labor migration for sustainability should provide employment information to rural people and facilitate communications between rural and urban settings.

We also found that social capital influences PES program behaviors. In our coupled system, social capital influenced households' forest monitoring behaviors under NFCP in many ways. Our findings provide empirical evidence that it is possible to manage collective action and resource outcomes through regulating social capital and factors interacting with social capital. For instance, policy makers may improve collective action and resource outcomes by improving social capital among group members and across different groups. This goal can be accomplished through education, enhancing interactions of local leaders from different groups, and helping groups with weak social ties to build social ties to local leaders. Policy makers can also allow members with good social relationships to self-organize (e.g., forming their own groups and deciding their own monitoring strategies). This approach may improve the efficiency and efficacy of the PES program.

We also found that social norms influenced PES program participation. In our coupled system, farmers' participation in GTGP was influenced by the participation decisions of their neighbors and people tended to conform to the majority. Under pro-PES social norms where most people would be willing to enroll their agricultural land in GTGP, the extra cost of enrolling an additional piece of land would be low due to the effects of social norms. In aggregate, the total costs of GTGP can be substantially reduced due to the effects of social norms. Even in regions where most people would initially be unwilling to participate, increased payments can move social norms toward participation. We also found that off-farm employment through labor migration increased people's willingness to participate in GTGP. As the economy continues to develop in urban China, the demand for labor also increases. This demand creates opportunities to reduce rural people's reliance on crop production and leverages the social norms of people in ecologically significant regions toward participation in GTGP.

As GTGP participation increases under pro-PES social norms, pro-PES social norms can be further enhanced via a positive feedback (Chen et al., 2012b). In order to take advantage of the effects of pro-PES social norms to obtain the targeted environmental benefits at the lowest cost, frequent social interactions among landholders are needed. Such interactions would facilitate the diffusion of information on social norms (Cialdini, 2003, Goldstein et al., 2008). However, most of the existing PES programs are implemented for a relatively long time frame, some over 20 years (Claassen et al., 2008, Liu et al., 2008, Pagiola, 2008). Therefore, landholders may not have frequent interactions regarding PES participation because they do not make PES enrollment decisions frequently. One approach to facilitating more frequent interactions about the decisions on PES participation is to divide landholders into multiple waves for enrollment. In this way, landholders who made the participation decisions at a later time can receive information on social norms from those who made participation decisions at earlier times. Our simulation study found that 11% additional land can be obtained at the same payment for enrollment in a PES program when this method is used (Chen et al., 2012b). Therefore, PES program designs that increase the diffusion of information on landholders' participation decisions can leverage pro-PES social norms to improve the efficiency of PES programs.

11.7 Summary

Social factors can play a major role in human–nature interactions, but are understudied. In this chapter, we explored the role of social norms and social capital in human–nature interactions in Wolong Nature Reserve. We focused on labor migration and payments for ecosystem services (PES) programs. Results show that weak social ties of local residents to people in urban settings had a significant positive effect on labor migration. The availability of acquaintances increased the odds of labor migration by 2.54. Further, labor migration substantially reduced households' use of fuelwood. Results also indicate partial substitutability among social capital, human capital, and natural capital. Regarding PES programs, social capital played a role in households' collective action in forest monitoring of the Natural Forest Conservation Program. Social capital prevented or reduced illegal activities in one's forest parcel and thus saved monitoring efforts. Households with strong social ties to local leaders spent an average of 54% less labor on forest monitoring than those with weak social ties. Farmers' decisions about the enrollment of their land in the Grain to Green Program (GTGP) was significantly influenced by social norms (the decisions of other community members). An additional 10% of their neighbors intending to convert part of their GTGP plots back to agriculture reduced the respondents' intention to re-enroll by 6.4%. In addition, the effect of social norms was highest at an intermediate payment level. Our findings suggest that as economies develop and conservation policies are implemented, social factors should be leveraged to shape human–nature interactions toward sustainability.

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