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The role of ecosystem services in park–people relationships: The case of Gaoligongshan Nature Reserve in southwest China

T.D. Allendorf [a,*], J. Yang [b]

[a] Department of Forest and Wildlife Ecology, University of Wisconsin-Madison, 1630 Linden Drive, Madison, WI 53706, USA
[b] College of Ecotourism, Southwest Forestry University, Kunming, Bailingsi, Bailong Road, Kunming, Yunnan 650224, China

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ABSTRACT

Finding common ground between local residents' livelihoods and the conservation of protected areas in developing countries has been considered a challenge. Recently, ecosystem services have been used as a framework to understand the benefits that protected areas provide local residents. In this study, we explore the role of ecosystem services in residents' relationships with Gaoligongshan Nature Reserve (GNR) in Yunnan, China. GNR is located in a biodiversity hotspot and in an area that has been affected severe droughts. Results show that the majority of people recognize ecosystem services as benefits from GNR, particularly regulating services such as the provision of water. Respondents who perceived regulating services were more likely to be older, male, of Yi ethnicity, more educated, and grow sugarcane but not corn. However, controlling for residents' knowledge about GNR, the effects of gender, age, and education decrease or disappear, while ethnicity and agricultural crops grown remain significant. This study demonstrates that people recognize common ground between their livelihoods and GNR and suggests that people's knowledge about GNR, cultural context, and agricultural experiences influence their appreciation of ecosystem services from GNR. This study highlights that protected area conservation, if conducted with awareness of people's already-existing perceptions of benefits, can begin with a discussion of win–win scenarios.

1. Introduction

Finding common ground between local residents' livelihoods and the conservation of protected areas in developing countries has been considered a challenge. Many of the approaches to creating positive park–people relationships have relied on the provision of direct economic benefits to local residents. Recently, however, ecosystem services, such as the provision of food, pollination of plants, and climate regulation, are being used as a framework to understand the benefits that protected areas may provide to local residents. For example, Turner et al. (2012) found a high correlation between hotspots of biodiversity and the potential for ecosystem service benefits to local people.

Much of the discussion on how to incorporate ecosystem services into biodiversity conservation is focused on discussions of whether win–win situations exist that can achieve conservation and development goals (Tallis et al., 2008; Vira and Adams, 2009). To a large extent, a major assumption underlying the discussion is that people need to be convinced of the benefits of biodiversity and ecosystems. Often, there is an underlying assumption that ecosystem services must be quantified and monetized, for example, through payments for ecosystem services, in order to create people's appreciation of them (Tallis et al., 2008).

Wallace (2007) emphasizes the importance of understanding ecosystem services in terms of how they are experienced at the individual human level, which may not correspond to the way scientists or policy-makers categorize them. Studies on park–people relationships have found that people value biodiversity conservation and ecosystem services. In protected areas in Myanmar and Nepal, many people appreciate biodiversity conservation and ecosystem services (Allendorf, 2007; Allendorf et al., 2006). Sodhi et al. (2010) found that a majority of people living near five protected areas in Southeast Asia valued a diversity of ecosystem services. Hartter and Goldman (2011) found that 73% of respondents in their study perceived improved local rainfall and air quality as a benefit of Kibale National Park. Other studies have also qualitatively described local residents' recognition and appreciation for ecosystem services from protected areas as a benefit of protected areas in the Dominican Republic (Schelhas et al., 2002), Cameroon (Abbot et al., 2001), Costa Rica (Moorman, 2006), and India (Mukherjee and Borad, 2004).

Combining an ecosystem services framework with an understanding of how communities around protected areas perceive and value protected areas may help elucidate the potential from

* Corresponding author. Tel.: +1 608 262 3946.
E-mail addresses: allendorf@wisc.edu, allendorf@wisc.com (T.D. Allendorf), yangjm21@gmail.com (J. Yang).

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residents' perspectives for win–win situations in terms of benefits for biodiversity and for people's livelihoods (Christie et al., 2012). The goal of this paper is to understand people's relationship with a protected area, in this case, the Gaoligongshan Nature Reserve, in Yunnan, China, within the framework of ecosystem services. The goals are to understand people's relationship with the reserve and what role ecosystem services play in that relationship.

2. Methods

2.1. Study area

The Gaoligongshan Nature Reserve (GNR) is located in western Yunnan, China (Fig. 1). It is in the central area of the Gaoligong mountains, which comprise the western-most part of the Hengduan Mountain Range, and includes the contiguous ridges west of the Nujiang River and east of the Irrawadi-Nmai Rivers (Chaplin, 2005). GNR is 1240 sq km and was established in 1983 as a provincial nature reserve and became a national nature reserve in 1986. The elevation of GNR ranges from 1800 to 3000 m and is mainly sub-tropical, with predominantly monsoonal broadleaf evergreen forests (Shilai et al., 1995). The area has mean annual temperatures of 15 °C and a mean yearly precipitation of 1260 mm (Shilai et al., 1995). GNR was protected primarily for rare species such as the takin (*Budorcas taxicolor*), hoolock gibbon (*Hylobates hoolock*), red panda (*Ailurus fulgens*), and Temminck's tragopan (*Tragopan temminckii*) (Lan and Dunbar, 2000). The reserve is in one of the most biodiverse areas outside of the tropics and is part of the Indo-Burma biodiversity hotspot (Chaplin, 2005). The Gaoligong mountains contain more than 27% of amphibian, 36% of reptile, and 61% of mammal and bird species known from Yunnan (Shilai et al., 1995).

Communities were moved out of the mountains that are now part of the reserve in the 1950s, three decades before it became a reserve, as part of the nationwide collectivization that occurred at the time. More recently, this area has benefited from government-sponsored rural poverty alleviation programs. For example, within the past ten years, villages in the study area have been electrified, with subsidized access, and linked by new and improved roads. Extraction is illegal from the reserve, but much of the forest in the slopes and foot hills below the reserve is collective forest, managed by communities, from which extraction is allowed.

From 1962 onwards, Yunnan has been suffering from a dry period that is the most severe and long-lasting drought in the study area since A. D. 1795 (Li et al., 2011). Droughts in the province are not a new phenomenon (Qiu, 2010). However, severe droughts increased from once every 9.6 years between 1470 and 1950 to once every 3.2 years between 1950 and 1978 (Smil, 1983). Impacts on the south central part of Yunnan around Baoshan, where GNR is located, have been particularly hard especially in 2010, the year prior to when we conducted this study (Lü et al., 2012).

2.2. Survey

We conducted standardized open-ended interviews of both men and women over 18 years of age from villages along the eastern side of the NR. Of 568 surveys, 45 were not used in the analysis due to errors, such as incompleteness. Due to the size of the NR and the large number of villages surrounding it, we limited the survey to the eastern side. Interviews were conducted by four undergraduate students from the Southwest Forestry University. They were all from areas in western Yunnan, near the study area, and were from ethnic minority groups.

Fig. 1. Map of Gaoligongshan Nature Reserve.

The survey was conducted in 20 villages that were randomly chosen from 62 villages in the study area. The number of villages sampled was based on the number of surveys we could conduct within the time period and funding available for the survey. Within a village, we randomly selected 30 households by starting from the center of the village and assigning the four students to a quadrant of the village. We were unable to get a list of total number of households within each village, and so relied on a local person to tell us how many households there were. Each student then sampled every *n*th house of the total number of houses to ensure a minimum of 30 interviews in each village. In villages with fewer than 30 households, all households were sampled where someone was at home.

To ensure representation of the perspectives of different residents, the sample was roughly stratified by age, gender, and household position. At the first house in a village, the male head of household was interviewed, the wife at the second, the grandfather at the third, the grandmother at the fourth, the eldest child 18 years or older at the fifth, and the youngest child 18 years or older at the sixth. If the appropriate person was not available, the interviewer proceeded through the sequence until a respondent was identified. The response rate was very high, with only a handful of people refusing to do the survey due to time constraints or, in some cases, old age. Interviews lasted about fifteen minutes and were conducted to the extent possible without others present.

The survey was standardized and open-ended and included sections that covered the following topics in this order: socio-economic characteristics; use of GNR; knowledge about GNR; their perceptions of benefits and problems of GNR; and their attitude toward GNR.

2.3. Measures

2.3.1. Socio-economic characteristics

Socio-economic measures included in the analysis are age, ethnicity, gender, and education. Age is divided into four groups: those under 30, 30–39, 40–49 and 50 or older. Ethnicity is divided into five categories: Han, Lisu, Yi, Dai, and Other. Other includes Bai, as well as small numbers of Muslim, Miao, Man, and Zhuang people. Gender is a dichotomous variable with a one indicating that the respondent is a woman and a zero indicating a man. Education is divided into three categories: none, 1–6 years, and 7 or more years.

Household-level measures included in the analysis are landholding, number of durables, whether the respondent owned a business, and the types of crops grown. Landholding is divided into three categories: 0–12 mu, 12–16 mu, and17 or more mu (a mu is equal to 1/15 Ha). Durables are divided into three categories: 0–3, 4–5, and six or more. Owning a business is a dichotomous variable with a one indicating they own a business and a zero indicating they do not. We include crop type as a measure of wealth due to the importance of cash crops in this area. The crops are dichotomous variables for sugarcane, coffee, corn, tobacco, and rice, with a one indicating they grow that crop and a zero indicating they do not.

2.3.2. Use

Variables to describe people's use of the area include if the respondent enters and, if yes, their reasons for entering. For entry, one indicates the respondent enters and zero indicates that they do not. Based on the open-ended responses to why they enter, reasons for entering were coded into categories.

2.3.3. Knowledge

Variables used to measure people's knowledge about the protected area include knowing the official name of the protected area, protected area rules, the creator of the protected area, and reasons for its creation. Knowing the official name of the protected area was categorized as correct, other, or do not know. The creator response was dichotomous with a one indicating they gave an answer and a zero if they did not know. This variable was made dichotomous because there is not necessarily a correct answer for the question about who created GNR since the province and the national government have both designated it at different times and the forest department manages it. Knowing the rules is a dichotomous variable with a one indicating that the respondent self-reported that they knew the rules and a zero indicating they did not. Two dichotomous variables were used to describe the reasons for creation of the area. We define creation reasons similar to conservation and ecosystem service benefits. If they perceived the area was created for conservation reasons, such as general protection of forest and wildlife, they received a one; a zero indicated they did not report a conservation reason. If they perceived the area was created for ecosystem service reasons, such as water or climate, they received a one; if they did not, they received a zero. Small numbers of people mentioned other reasons for creation, such as tourism, economic benefits, for society's benefit, for future generations, and for the benefit of local people. However, only a handful mentioned each one so we did not include these in the analysis.

2.3.4. Perceptions and attitude

We define attitude as a psychological tendency expressed by evaluating a particular object with favor or disfavor (Ajzen and Fishbein, 1980). In this case, we define it as like or dislike of a protected area. Attitudes consist of beliefs, or perceptions, which are associations people establish between the attitude object and positive and negative attributes of the object.

People's perceptions of the NR and their attitude were generated by asking people the benefits that the areas provide, the problems the area caused, and, finally, whether they liked or disliked the area and why. Specifically, respondents were asked the following open-ended questions, "Does the area provide benefits?", and, if so, "What are they?" and "Does the area cause any problems?" and, if so, "What are they?" Next, respondents were asked, "Do you like or dislike the area?" followed by, "Why?" or "Why not?" to solicit additional positive and negative perceptions.

Perceptions are measured using dichotomous variables. Perception categories were created by sorting people's perceptions of benefits and problems and reasons for liking or disliking the areas into categories.

2.4. Analysis

First, we describe people's relationship with and attitude toward GNR by describing people's use, knowledge, and perceptions of GNR. Second, we test the factors influencing people's perceptions of ecosystem services by conducting cross-tabulations and, using the significant variables from the cross-tabulations, calculating two logistic regression models. The first model includes socio-economic indicators and people's use of GNR as predictors of a perception of ecosystem services. In the second model, we control for protected area knowledge to see its impact on the variables in the first model. Other studies have found that protected area knowledge plays a mediating role between socio-economic variables and people's attitudes toward protected areas (Allendorf and Allendorf, 2012; Gillingham and Lee, 1999; Xu et al., 2006).

3. Results

3.1. Socio-economics

Respondents were evenly divided across age groups with 45% female and 55% male (Table 1). The majority of respondents were Han and one quarter is Lisu with small numbers of Yi, Dai, and Other. About one-fourth of people had no education and one-third

had seven years or more. Two-thirds of respondents owned six or more durables. The most commonly grown crops were, in order, corn, coffee, tobacco, rice, and sugarcane.

3.2. Use and knowledge

One-fifth of respondents said they enter the reserve (Table 2). The most common reason for entry was for recreation (11%) followed by extraction (6%). Recreation included visiting the hot springs (6%), which are located in one area of GNR, and traveling in the area for fun (3%), which often referred to vising sites of old villages and homes. A few people also mentioned visiting tombs of their ancestors inside the NR. Extraction was primarily of walnuts from trees they had owned in the NR (2%), which they are still allowed to collect, and of wood (2%). Other reasons reported by 2% or less of respondents were for agricultural-related reasons, such as cultivating corn or rice in their old fields (primarily in one village which had been recently relocated from just outside the reserve due to landslides to an area next to the main road), traveling through the reserve, or entering because they work as NR guards.

Table 1
Socio-economic characteristics of all respondents in survey and of those who perceived ecosystem service benefits (only responses of more than 10% are included in table except for key variables that are significant, such as sugarcane).

Variable	All respondents (%)	Respondents who perceived ecosystem service benefits (%)	p-Value from χ^2 test
Age (years)			
18–29	22	20	0.05
30–39	23	24	
40–49	24	27	
50+	32	30	
Gender			
Female	45	37	0.00
Male	55	63	
Ethnicity			
Han	60	61	0.00
Lisu	26	23	
Yi	7	9	
Dai	3	4	
Other	5	4	
Education (years)			
0	26	20	0.00
1–6	40	42	
7+	34	38	
Land (mu)			
0–12	37	34	0.16
12–16	39	41	
16+	24	25	
Durables			
0–5	34	58	0.19
6+	66	42	
Crops			
Corn			
Grows	23	19	0.01
Does not grow	77	81	
Coffee			
Grows	21	21	0.70
Does not grow	79	79	
Tobacco			
Grows	18	20	0.21
Does not grow	82	80	
Rice			
Grows	14	12	0.14
Does not grow	86	88	
Sugarcane			
Grows	8	89	0.00
Does not grow	92	11	

More than half of the respondents knew the correct name of the area, Gaoligongshan Nature Reserve, or something very similar (Table 2). A few gave other names, such as the name of an area that was near to their village. About one-third did not know the name.

A minority of respondents said they knew who created the NR. The most common answer given for the creator was the forest department (16%), followed by an equal number of people responding that the national government (5%) or a local level authority (5%) created it. A small number thought that foreigners were responsible for creating the NR (3%).

About one-third of the respondents said the area was created for conservation reasons and nearly a third said it was created for ecosystem services. Conservation reasons included general protection of the NR, such as protecting the forest (30%), wildlife (19%), and the environment in general (10%). Ecosystem service reasons included water (13%) and ecological balance of the environment (12%). Other reasons mentioned by a few people were tourism (1%), economic benefits (1%), for society's benefit (1%), for future generations (1%), and for the benefit of local people (2%).

Over half the respondents reported that they knew the rules of the NR (54%).

3.3. Attitude and perceptions

The vast majority of people said they liked the NR (89%) (Table 3). The majority perceived that the NR provides benefits (74%) and the minority perceived it causes problems (16%). Of benefits, the most commonly perceived category of benefit was conservation (61%), followed by regulating services (57%).

The most common conservation benefits were protection of trees (23%), protection of the environment generally (20%), protection of animals (13%), and forest management (13%). The most common type of ecosystem services were regulating benefits, such as protection of water (45%), no flooding or mudslides (12%), and better agriculture (i.e. more harvest from crops) (10%).

Table 2
Summary of responses to use and knowledge questions from all respondents in survey and those who perceived ecosystem service benefits.

Variable	All respondents (%)	Respondents who perceived ecosystem service benefits (%)	p-Value from χ^2 test
Respondent enters			
Yes	21	67	0.09
No	79	33	
Respondent enters for:			
Recreation			
Yes	11	12	0.37
No	89	9	
Name of area			
Correct	57	71	0.00
Other	12	11	
Does not know	31	18	
Creator			
Something	30	39	0.00
Does not know	70	61	
Created for conservation			
Mentioned	47	57	0.00
Did not mention	54	43	
Created for Ecosystem services			
Mentioned	31	43	0.00
Did not mention	69	57	
Rules			
Knows	54	67	0.00
Does not know	46	33	

Other categories of ecosystem service benefits included cultural benefits (17%) and provisioning benefits (1%). The primary cultural benefit was a "better view" (10%), followed by benefits for the next generation (4%), to relax (2%), and for the future (2%); other benefits in this category mentioned by fewer than 2% of respondents included: to travel or pass through, visit hot springs, place to relax, visit original home or tombs of ancestors.

Some benefits did not fit into the framework of conservation or ecosystem services. These were benefits from GNR management activities (6%) and agricultural benefits (1%). Management benefits included compensation for crop damage (2%) and ecotourism (2%), as well as others mentioned by fewer than 2% of respondents, such as biogas subsidies, assistance from foreigners, electricity, roads, and jobs for guards. Extraction benefits included timber, mushrooms, and fuelwood. Agricultural benefits included growing economic trees and planting corn along the edge of GNR.

The most commonly mentioned problems were that there is no extraction from the area, primarily of fuelwood (3%) and timber (2%), and no access to the NR (5%), such as to travel or visit. Small numbers of people also mentioned crop damage by bears (3%) and management problems (3%), such as no compensation for crop damage, fines for illegal activities, and lack of roads.

3.4. Predictors of perception of ecosystem service benefits

We limit our analysis to identifying predictors of a perception of regulating services because regulating services are the most-recognized ecosystem service benefit and to avoid lumping disparate categories. In order to learn more about what influences people to perceive regulating ecosystem services, we first explored significant predictors using cross-tabulations. The cross-tabulations show that socio-economic variables significantly correlated with a perception of ecosystem service benefits are age, gender, ethnicity, education, and growing sugarcane and corn (Table 1). People who entered the area were more likely to perceive regulating services (Table 2). Knowledge variables significantly associated with a perception of ecosystem service benefits were the name and creator of the area, the reason for its creation, and the rules (Table 2).

Using the significant variables from the bivariate analysis, we calculated two logistic regression models (Table 4). In the first model, which includes socio-economic variables and entry into GNR, all of the older age groups are more likely to perceive ecosystem service benefits than the youngest age group, with the 40–49 year old age group being the most likely. Women are half as likely as men to perceive ecosystem service benefits. Compared to Han people, Yi are four times as likely to perceive ecosystem service benefits. People with the highest level of education are nearly 2.5 times more likely to perceive ecosystem service benefits than those without. Wealth variables (landholding and durables) are not significant. The odds of people perceiving ecosystem service benefits are five times as great if they grew sugarcane and half as great if they grew corn. People's use of the area is not significant.

In the second model, controlling for knowledge, three variables lose their significance: gender, education, and growing corn. Only one age category remains significant: 40–49 year olds are two times more likely to perceive ecosystem service benefits than the youngest age group. The effect of ethnicity changes, with Yi even more likely than in the first model to perceive ecosystem service benefits and Dai changing from being insignificant to being four more times likely to perceive ecosystem service benefits than Han. The effect of growing sugarcane decreases slightly, but remains a significant predictor. Tobacco growing becomes significant in this model, with a tobacco grower being half as likely to perceive ecosystem service benefits.

For the knowledge variables, people who gave an incorrect name for GNR or said they did not know the name are one-third to one half as likely to perceive ecosystem service benefits. People who reported knowing the rules are more than twice as likely to perceive ecosystem service benefits. People who think the area was created for conservation reasons are 1.5 times more likely to perceive ecosystem service benefits and those who think the area was created for ecosystem service reasons are nearly 3.5 times more likely to perceive ecosystem services.

Table 3
Residents' attitude and perceptions of Gaoligongshan Nature Reserve (only those with 2% or more are included).

	%
Like	**89**
Benefits	**74**
Biodiversity conservation:[a]	**61**
Trees	23
Protect environment	20
Protect wildlife	13
Forest management	13
General protection	5
No logging	5
Protect Gaoli	5
Like forest	2
No fire	2
Regulating ecosystem services:	**57**
Water	45
No flood	12
Better agriculture	10
Air	9
Climate	7
Fewer natural disasters	3
Health	3
Cultural:	**17**
View	10
Next generation	4
Relax	2
Future	2
Management:	6
Compensation	2
Ecotourism	2
Problems	**16**
Extraction:	**10**
No logging	2
No timber	2
No fuelwood	3
No access	**5**
Management	**3**
Wildlife damage (bears eat crops)	**3**

[a] Bold headings within benefits and problems represent major categories by which responses were summarized for analysis.

4. Discussion

Our results show that conservation and ecosystem services play important roles in people's relationship with GNR. The majority of people perceive that biodiversity conservation and ecosystem services are benefits of GNR. Water is the most often-mentioned specific benefit, mentioned twice as often as any other benefit, in this drought-prone area. These results suggest that, from local residents' perspectives, win–win solutions are possible for conservation and livelihoods in terms of protected areas.

What factors influence people to perceive ecosystem service benefits? In GNR, ethnicity, age, gender, education, and crops grown all significantly predict that people will perceive ecosystem services, specifically regulating services, as benefits of protected areas. However, when we control for protected area knowledge, only ethnicity and crops grown remain significant predictors. Thus, in the case of GNR, three factors that influence people's appreciation of ecosystem services are protected area knowledge, culture, and agricultural experience.

Table 4
Odds ratios from logistic regression models of perceiving regulating ecosystem service benefits from Gaoligongshan Nature Reserve (n = 523).

	Model 1	Model 2
Socio-economics		
Age (years)		
18–29 (ref)	1.00	1.00
30–39	1.84†	1.37
40–49	3.03**	2.18*
50+	1.77†	1.37
Female	0.50**	0.85
Ethnicity		
Han (ref)	1.00	1.00
Lisu	0.70	0.71
Yi	4.40**	5.42**
Dai	1.97	4.18†
Other	0.60	0.74
Education (years)		
0 (ref)	1.00	1.00
1–6	1.51	0.88
7+	2.41**	1.09
Land (mu)		
0–12 (ref)	1.00	1.00
12–16	1.32	1.32
17+	1.22	1.05
Durables		
0–5 (ref)	1.00	1.00
6+	1.32	1.01
Crops		
Corn	0.56*	0.66
Sugarcane	4.21**	3.58*
Tobacco	0.87	0.55†
Rice	0.63	0.68
Use		
Respondent enters	1.28	1.04
Knowledge		
Name of area		
Correct (ref)		1.00
Other		0.61
Does not know		0.34**
Creator		1.27
Reason for creation		
Conservation		1.63*
Ecosystem services		3.41**
Knows rules		2.28**
Log likelihood	−310.16	−263.05
Model χ^2	77.40	171.62

† $p < 0.10$.
* $p < 0.05$.
** $p < 0.01$.

Many studies have found that education, gender, and age are often significant predictors of attitudes toward protected areas (e.g., Hartter, 2010; Xu et al., 2006). However, other studies have demonstrated that these associations may be mediated by the amount of knowledge an individual has about the protected area (Allendorf et al., 2012; Xu et al., 2006). This study supports this idea. Thus, for example, it is not formal education per se that causes people to have more positive attitudes about protected areas. Instead, formal education is associated with an individual having knowledge about the protected area and it is this knowledge that is directly associated with being more likely to perceive ecosystem service benefits. In the case of gender, women have been shown to be less likely to perceive certain benefits because they have less access to information about the protected areas because of social structures that usually pass information through the male head of household (Allendorf and Allendorf, 2012; Gillingham and Lee, 1999; Xu et al., 2006).

The fact that in GNR older people are more likely to perceive ecosystem service benefits contrasts somewhat with other studies in China, which have found being younger is associated with environmental concern (Bi et al., 2010; Cao et al., 2009; Feng and Reisner, 2011). However, because the age effect is mediated by knowledge, this indicates that much of the effect of age is caused by older people knowing more about the protected area. Given the current economic context of China, where young people are migrating to urban areas and leaving farming behind, this age-effect may mean that young people are less likely to gain knowledge than their elders about protected areas they live near as they grow older. This will have implications for their future relationship with the NR if they return in their later years to their natal area.

The impact of ethnicity reflects a long tradition that some ethnic groups in Yunnan have of valuing and conserving biodiversity (Pei, 2010). Yi people view forests and water as a primary indicator of a village's wealth (Jinlong et al., 2012) and are more positive toward wildlife than some other ethnic groups (Yang et al., 2010). Dai people view forests as the most component of the environment because forests are the source of water that irrigates land and provides food (Wu et al., 2001).

The correlation between ecosystem services and the crops grown highlights the specific mechanisms that can lead people to appreciate certain benefits. Sugarcane growers are probably more likely to perceive ecosystem service benefits because water is very important for growing sugarcane (Su et al., 2009). In Yunnan, during the time of the drought the previous year and during other droughts, one of the most significantly impacted crops was sugarcane. While sugarcane is often grown on rain-fed land, the benefit of water from the protected area may not be as important for other crops. For example, coffee and tobacco are grown on irrigated land, while corn has traditionally been grown where there is little water (Su et al., 2009). The links between protected areas and the crops grown around them is interesting and warrants further investigation. In Nepal, for example, there are on-going attempts to decrease crop damage by wildlife by planting certain crops that wildlife do not like to eat, such as menthe and chamomile. Incorporating an understanding of the pros and cons of different crops for communities living adjacent to protected areas would be an interesting area to incorporate into protected area planning.

4.1. Management implications

This study demonstrates that protected area conservation, if conducted with awareness of people's already-existing perceptions of the protected area benefits, can begin with a discussion of win–win scenarios for conservation and livelihoods. This study suggests that it is not necessary to assign monetary value to biodiversity or ecosystem services through, for example, programs such as payments for ecosystem services, in order for people to value these benefits. In fact, commodification may override existing value systems and diminish the rich set of values that that people already hold toward protected areas (Kosoy et al., 2008). Instead, a participatory approach, as described and suggested by Christie et al. (2012), that allows communities to participate in valuation of biodiversity and ecosystem services is important because it can recognize local context and values.

Understanding the factors influencing people's perceptions of a protected area can shed light on potential areas of linkage between conservation and livelihoods. In GNR, three potential mechanisms for collaborating with people on win–win scenarios for conservation and livelihoods are: increasing people's access to information about GNR, incorporating cultural values, and strengthening links between the protected area and agriculture. People's knowledge

about a protected area is a key mechanism to increase people's appreciation of protected areas, particularly groups such as women who do not have as much access to information in the community (Allendorf and Allendorf, 2012; Gillingham and Lee, 1999; Xu et al., 2006). Increasing people's knowledge about protected areas can also provide an avenue for management to build constructive relationships and trust with local communities, which are foundational aspects of a positive park–people relationship (Stern, 2008).

Tallis et al. (2008) predict that at some point ecosystem service projects will have to prove to people that their well-being has been enhanced by conservation. While this may be true in some cases and places, we suggest that projects will be more effective if they are initiated with an understanding of how people already value protected areas and use these values as jumping off points for collaborative dialogs about win–win scenarios and ways to maximize benefits for people and biodiversity.

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