

# Distribution of Economic Benefits from Ecotourism: A Case Study of Wolong Nature Reserve for Giant Pandas in China

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**Abstract** Ecotourism is widely promoted as a conservation tool and actively practiced in protected areas worldwide. Theoretically, support for conservation from the various types of stakeholder inside and outside protected areas is maximized if stakeholders benefit proportionally to the opportunity costs they bear. The disproportional benefit distribution among stakeholders can erode their support for or lead to the failure of ecotourism and conservation. Using Wolong Nature Reserve for Giant Pandas (China) as an example, we demonstrate two types of uneven distribution of economic benefits among four major groups of stakeholders. First, a significant inequality exists between the local rural residents and the other types of stakeholder. The rural residents are the primary bearers of the cost of conservation, but the majority of economic

benefits (investment, employment, and goods) in three key ecotourism sectors (infrastructural construction, hotels/restaurants, and souvenir sales) go to other stakeholders. Second, results show that the distribution of economic benefits is unequal among the rural residents inside the reserve. Most rural households that benefit from ecotourism are located near the main road and potentially have less impact on panda habitat than households far from the road and closer to panda habitats. This distribution gap is likely to discourage conservation support from the latter households, whose activities are the main forces degrading panda habitats. We suggest that the unequal distribution of the benefits from ecotourism can be lessened by enhancing local participation, increasing the use of local goods, and encouraging relocation of rural households closer to ecotourism facilities.

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## Introduction

Worldwide, many countries and regions rich in biodiversity and poor in economy have been vigorously promoting ecotourism as a conservation tool in their protected areas (PAs) since the 1990s. These include Nepal (Bookbinder and others 1998), Indonesia (Walpole and Goodwin 2000, 2001), Uganda (Adams and Infield 2003; Archabald and Naughton-Treves 2001), Central Africa Republic (Blom 2000), and Costa Rica (Stem and others 2003). China, with a fast-growing economy, has also advocated ecotourism to improve the economic status of reserve administrations and local communities (Han and Ren 2001; Liu and others

2003). Approximately 80% of China's nature reserves have developed ecotourism programs and nearly 16% host more than 100,000 visitors annually (Li and Han 2001). A study of 11 nature reserves in China indicates that the total number of visitors almost doubled from 942,000 to 1,770,000 between 1995 and 1998 (Lindberg and others 2003).

Although ecotourism might mean different things to different people, it is generally accepted that it should have low impacts on nature, with a goal of benefiting both conservation and the well-being of local communities (Kiss 2004). Proponents of ecotourism for conservation often advocate that the benefits would spur support for conservation from local communities (Archabald and Naughton-Treves 2001; Gossling 1999, 2002; Maikhuri and others 2000; Mehta and Heinen 2001; Sekhar 2003). However, ecotourism operations usually involve multiple stakeholders from inside and outside the PAs (Adams and Infield 2003). These stakeholders bear different levels of costs of conservation and likely expect relevant levels of benefits from ecotourism development (Naidoo and Ricketts 2006; Wunder 2000). If the benefits to local stakeholders are not proportional to their costs of conservation or as expected, the anticipated support for conservation might not be realized (Chen and others 2005; Jim and Xu 2002; Kiss 2004; Lai and Nepal 2006; Walpole and Goodwin 2001; Walpole and Leader-Williams 2002). If the benefits to outside investors do not reflect their investments or expectations, they might withdraw support. Activities, such as farming, gathering fuelwood, and ecotourism conducted by different stakeholders will have varying degrees of impact on biodiversity. Therefore, distribution of benefits to offset costs and sacrifices among stakeholders is important and needs special attention (Spiteri and Nepal 2006).

Stakeholders might benefit economically from ecotourism through investment, employment, and selling products. Several factors can affect how much they can benefit. Ecotourism usually needs a large investment from national governments and/or foreign sources because of the poor local economy in PAs (Stem and others 2003; Tosun 1998). As a relatively new industry to local residents (often farmers), special skills necessary for ecotourism are not available (Jim and Xu 2002; Lai and Nepal 2006). Ecotourism might also require farmer stakeholders to adjust their often traditional production systems and techniques to maximize the potential benefits from ecotourism (Lu and others 2006). Appropriate institutional design can facilitate the process of spreading the benefits among stakeholders. Wunder (2000) reported the effectiveness of different modes of tourism participation in indigenous groups of Ecuador's Cuyabeno Reserve. Participation modes from autonomous operations to pure salary employment were

combined with tourism specialization and local organization to improve local economic benefits and boost conservation support.

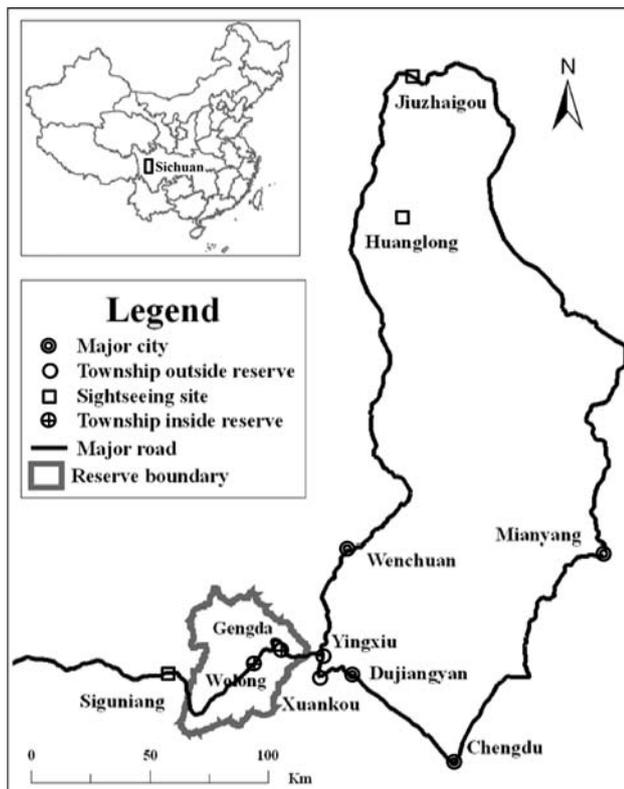
In a recent review of community-based ecotourism, Kiss (2004) highlighted that better data and more rigorous analyses of economic impacts are needed. Thus, this article presents a case study using data about the recent ecotourism development in the Wolong Nature Reserve, China. Our major goal was to examine distribution of economic benefits among different stakeholders. The importance of the study is that the development of ecotourism at the site, a "flagship" for biodiversity conservation in China (Liu and others 2001), might be imitated by many other nature reserves in the country (1998 in 2005; Liu and Diamond 2005) in the context of the recent national campaign for ecotourism development in PAs (Bramwell and Lane 2004; Han and Ren 2001). Understanding the distribution of economic benefits can assist reserve managers in making more informed and balanced decisions and in adjusting policies on ecotourism development and biodiversity conservation.

## Methods

### Study Site

Wolong Nature Reserve was established in 1963 with an area of 200 km<sup>2</sup> and expanded to its current size of 2000 km<sup>2</sup> in 1975 (He and others 1996). It is located in Sichuan Province, southwestern China (latitude 30°45'–31°25'N, longitude 103°52'–103°24'E; Fig. 1), between the Sichuan Basin and the Qinghai-Tibet Plateau and is characterized by high mountains and deep valleys. The reserve has nearly 4000 plant species and more than 2200 insect and animal species, including the endangered giant pandas (*Ailuropoda melanoleuca*), one of the most charismatic animals in the world and the main attraction for domestic and foreign tourists. In 1980, Wolong Nature Reserve became a member of the Man and Biosphere Programme's World Network of Biosphere Reserves and, in 2006, it was inscribed on the World Heritage List (UNESCO World Heritage Centre 2006).

The reserve encompasses several climate zones. It has a cool summer, with an average annual temperature of 8.9°C (data from multiyear observations in Shawan Weather Station with an elevation of 1920 m, where the reserve headquarters is located; Wolong Nature Reserve 1998). This makes it an ideal summer resort for people from two major adjacent cities, Dujiangyan and Chengdu, in Sichuan Province (Fig. 1). It is also near several nationally and internationally known tourism sites: Jiuzhaigou, Huanglong, and Siguniang (Fig. 1), which have been heavily



**Fig. 1** Location of Wolong Nature Reserve in Sichuan Province, China, and local cities, townships, and tourism sites

promoted as tourists destinations by the provincial government since 2000 (Sichuan Department of Tourism 2003). After a long debate in the 1990s, ecotourism development in the reserve was officially approved in October 2002 by the State Forestry Administration (Yang and Yang 2002).

The reserve is administrated by the Wolong Administrative Bureau. In 2000, there were more than 4400 local rural residents living in Wolong and Gengda townships (Fig. 1), and most of them were farmers. Farmers' activities, including logging for fuelwood, agriculture, collection of herbal medicinal plants, and ranching, have significantly degraded and fragmented giant panda habitat in the reserve (Schaller and others 1985). Liu and others (1999) showed distance–decay trends of these human activities' intensity and frequency and their negative impacts on panda habitat suitability; for instance, areas within 900 m of human residential sites were so strongly disturbed that they have become unsuitable for wild pandas, even to the point of eliminating all biotic and abiotic habitat characteristics that are essential for pandas. About two-thirds of the human settlements were located in the relatively flat areas of the reserve along the main road, which is their main connection to the outside world. The other households lived in the remote areas at high elevations with limited access to the

road. They are generally poorer than households living at the roadside (Wolong Nature Reserve 2005b).

Approximately 480 reserve staff (this number does not include their family members or the retired staff) inhabited the “downtown” areas of the two townships (hereafter, we call them urban residents inside the reserve) (Wolong Nature Reserve 2000b). Yearly income per capita for rural residents in 2000 was about 1400 Yuan (1 USD = 8.24 Yuan in 2000), less than one-fifth of the reserve staff's average annual income in the same year (Wolong Nature Reserve 2005a). Between 2000 and the official endorsement for ecotourism in 2002, the yearly income from tourism was estimated to account for only 2.9% of rural households' annual income (Wolong Nature Reserve 2005a).

Before 2000, little progress was made in tourism development, and ecotourism was conducted at a small scale. Many tourists just passed by and did not stay in the reserve longer than one night (Sichuan Department of Forestry and others 2002). After 2000, internal and external investment poured into the reserve for extensive infrastructure construction. The total number of tourists in 2000 was 130,000 (Sichuan Department of Forestry and others 2002). By 2005, the number had increased to 206,100 (Tourism Development Department, Wolong Administration Bureau). Pandas and the forested landscape were reported as the top two reasons people visited Wolong in a survey conducted in 2006 (Wei Liu, unpublished data).

#### Data Collection and Analysis

To study economic benefits of ecotourism in PAs, Walpole and Goodwin (2000) summarized that the traditional methods used in economics (i.e., input–output, typical for impact analysis) were not feasible because the necessary data are often unavailable and there are no accounting/tax systems in less developed regions. They suggested using proxy and indirect measures, obtained through surveys of businesses (supply side) and tourists (demand side), to estimate possible benefits from ecotourism. This method was applied in our study, as in other research reported in the literature (Chen and others 2005; Jim and Xu 2002; Wunder 2000). Employment and goods are traditional measurements of economic benefits, but without reliable accounting/tax systems, business revenue and profit data are difficult to obtain. In contrast, data for investment in ecotourism infrastructure and/or business are relatively easily obtained through interviews, and investment can serve, to some extent, as a proxy measurement of profits/revenue (Spiteri and Nepal 2006). Thus, we chose to use investment, employment, and goods as direct and indirect measurements of economic benefits from ecotourism.

We observed that in the reserve there were three primary types of ecotourism business potentially generating benefits: hotels/restaurants, souvenir shops, and infrastructural construction. The first two types are typical in ecotourism development and are often reported in the literature, whereas little attention is paid to infrastructural construction. Infrastructural construction is important because it usually occurs during the start phase in the life cycle of ecotourism development (Butler 1980) and might generate substantial benefits to various types of stakeholders during this period.

During the summer of 2003, we interviewed the proprietors or managers of all 45 hotels/restaurants, 74 souvenir shops (36 permanent sites and 38 temporary sites or street vendors), and 28 infrastructural construction projects. Only those projects related to ecotourism, such as hotels/restaurants, souvenir shops, and entertainment facilities, were surveyed. We asked questions about investment, employment, and goods involved within the previous year (between the summers of 2002 and 2003) and some relevant basic information (e.g., location, years of construction and management, ownership, and accommodation capability).

We were interested in the distribution of benefits from these three sectors to different groups of stakeholders, so we focused on the locations of the sources and quantities of investment, employment, and goods involved. We identified four major types of stakeholder: rural residents or farmers, urban residents or the reserve staff with their family members, Wolong Administrative Bureau or the reserve government, and outsiders, including enterprises or individuals from outside the reserve. The first three are inside stakeholders, whereas the outsiders are temporary residents and treated as outside stakeholders. We also identified the connections of the outsiders to the inside stakeholders. The first type of stakeholder, restricted to only the local residents, bears much of the social and economic costs of the conservation in the reserve and should be the major beneficiaries. Previous research has shown that their activities (e.g., fuelwood collection, timber harvesting, agriculture) were the primary driving factors directly and indirectly affecting wildlife habitats in the reserve (Liu and others 1999).

We considered two types of investment: asset and operation. Asset investment includes the monetary value for the materials of hotels/restaurants buildings, salaries of construction workers, and building design fees. Operation investment means the cost to run an ecotourism business, including lease fees, workers' salaries, and maintenance costs. We did not consider the value of the occupied land as investment, because the land is not yet commercialized in the reserve. For employment, we asked for the number of employees by type of stakeholder and their skills. For

goods, we considered construction materials such as sand, steel, and cement for ecotourism infrastructure, food consumed in hotels/restaurants by tourists, and souvenirs sold to tourists. Timber, a common material in construction, was not considered in this study because most timber used was recycled from old buildings or substituted with cement/steel and the percentage of the total timber expenditure was small. One notable, significant source of income to the rural residents in the reserve was the payments to farmers for collecting and transporting sand from riverbanks for infrastructure construction (outsiders were not allowed to do this). We focused on the monetary value of goods consumed for hotels/restaurants and souvenir shops or goods used for the infrastructure construction projects in 2002.

We summarized and reported descriptive statistics and results from relevant statistic tests. We also did spatial analyses on the distances between local rural households (with/without ecotourism benefits) and roads and the distances between these households and the closest highly suitable and moderately suitable panda habitat patches classified following the methodology in Liu and others (2001). For this spatial analysis, we only examined the benefits distribution among rural households with direct investment or family member(s) employed in hotels/restaurants or souvenir shops. Because the infrastructure construction positions were temporary and the number of workers needed for construction was usually large, the locations of the employees could not be recalled accurately by the project managers, and we did not analyze this sector. The number of households considered was 94, about 9% of all rural households (1082) in 2003.

## Results

### Infrastructural Development

Since the beginning of the official application for ecotourism development in 2000, tremendous infrastructural development has taken place in the reserve. Immediately after the official approval in October 2002, 11 new hotels/restaurants sprang up, constructed or converted from residential houses owned by local farmers; five large-scale projects for ecotourism development (building remodeling and decoration and utility facility upgrades) were initiated to expand a government-owned hotel/restaurant and its associated entertainment facilities. Prior to that, only two, three, and eight hotels/restaurants were constructed or converted from residential houses in 2000, 2001, and before October 2002, respectively. Among the 45 hotels/restaurants, 1 was under construction and considered only for the analysis of investment and employment for its construction. Of the other 44 hotels/restaurants operating at

that time, 2 provided food only and the others provided both food and lodging. Thirty-nine were inexpensive, small-scale establishments with fewer than 10 employees (charging 2–5 USD daily for both meal and lodging), and three were expensive facilities with entertainment, air conditioning, sanitation systems, and 10 or more employees (charging 15–100 USD per night for lodging only). The 45 hotels/restaurants occupied a total of 24,060 m<sup>2</sup>, and total accommodation capacity was 3068 people daily. These accommodation facilities were located near the main road inside the reserve (Fig. 2).

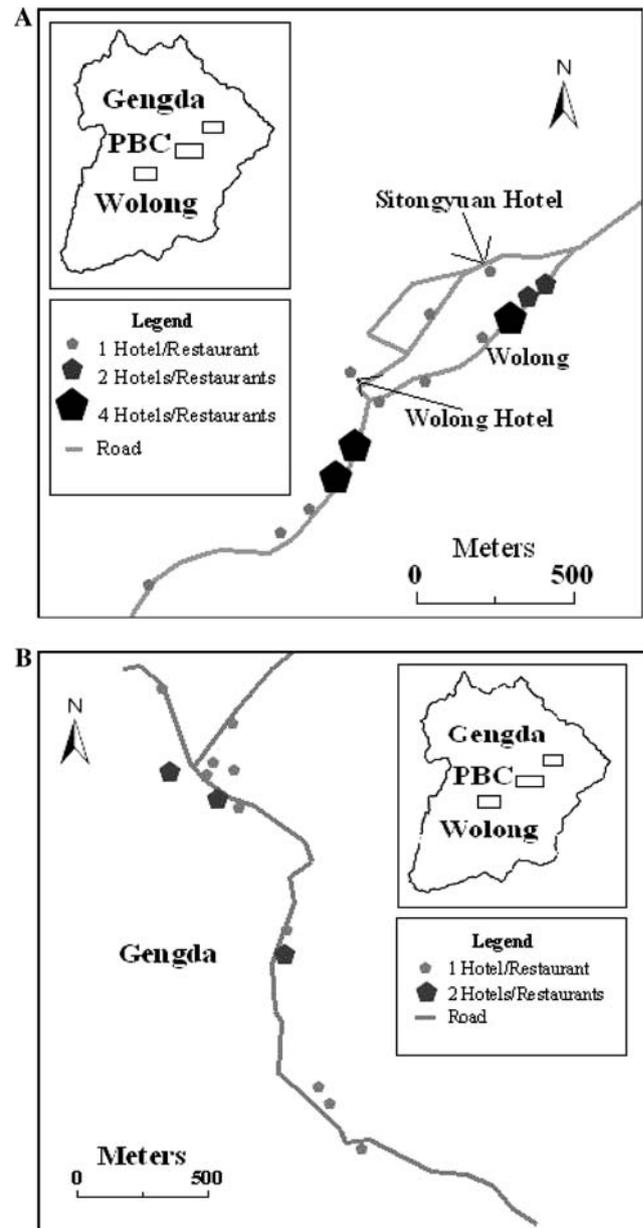
In addition to accommodation facilities, there were 36 souvenir shops with fixed sites. Five of them existed before 2000 and were owned by the government. Among 38 street vendors, the majority (24, or 63%) opened for business after 2000. None of the shops was located in Gengda Township (see Fig. 1 for its location), although this township provided 35% of the total accommodation capability inside the reserve.

A large number of domestic and foreign tourists were attracted to the reserve. In 2002, according to the Tourism Department of Wolong Nature Reserve, 82,348 tourists, one-fourth of whom were foreigners, visited the reserve. This number certainly underestimated the total tourists, because it was based on the number of visitors to the Panda Breeding Center (PBC), where all captive pandas are bred (see Fig. 2 for its location). A substantial number of domestic tourists visited the reserve during the hot summer months for the cool weather and stayed in Gengda Township without visiting the PBC and, therefore, were not likely recorded by the official Tourism Department (Jian Yang, Manager of Wolong Tourism Development Company, personal communications).

#### Distribution of Economic Benefits Between Stakeholders Inside and Outside the Reserve

##### Investment

We found that the majority of investment in hotels/restaurants and souvenir shops was from the reserve government, reserve staff, and outsiders. The largest hotel/restaurant investor was Luneng Group from Shandong Province in eastern China, which had invested 6 million USD to remodel and expand the then largest hotel/restaurant (Wolong Hotel, Fig. 2a), and planned to invest more (~48.5 million USD) in developing scenic spots and advertising ecotourism in the near future (Sichuan Department of Tourism 2004). Although the rural residents invested in more hotels/restaurants ( $n = 39$ ) than others ( $n = 6$ ), the amount of the asset investment from them was only 9.5% of the total asset investment of 8 million USD. The cost of building a new hotel/restaurant or converting a



**Fig. 2** Spatial distribution of the Panda Breeding Center (PBC) and hotels and restaurants in Wolong (a) and Gengda (b) townships within the reserve. Two townships and the PBC are shown as boxes in the inset maps. All street vendors were located in Wolong and PBC; they are not shown on the map because their locations were not fixed. The souvenir shops with permanent sites were clustered in a small area of the PBC and are not mapped

residential house was usually higher than that of running the business. More than half of the hotels/restaurants owned by farmers (21 out of 39) were operated by outside investors or by reserve staff's family members. The percentage of operational investment in hotels/restaurants was 8%, 15%, 19%, and 58% of the total by urban residents, rural residents, the reserve government, and outsiders, respectively.

For souvenir shops, investment distribution among stakeholders was similar. All permanent sites were owned by the reserve government and contracted to the managers. Those sites can be classified into two categories by location: 6 inside the PBC and 30 outside the PBC. All 6 shops inside the PBC and 10 outside the PBC were run by the elites [reserve staff's family members ( $n = 9$ ) and outsiders who were relatives of the reserve staff ( $n = 7$ )]. None of the elites had nonpermanent souvenir shops on the street, whereas 36 of 55 local rural operators and 2 outsiders (both relatives of the rural residents) traded souvenirs on the street (Table 1). During most political events, such as when high-level governmental officials and international dignitaries visited the reserve, street vendors were not allowed to run their businesses. A *t*-test shows that the elites invested significantly more than the farmers in souvenir shops ( $t = 5.3$ ,  $p < 0.001$ ). In fact, the mean operational investment in the farmer-run shops (80 USD) was  $\sim 6\%$  of the elites' investment (1337 USD), and the total investment from the rural residents (4636 USD) was only 18.8% of the total investment of 24,697 USD from all investors.

### Employment

Most rural residents took only low-skilled and temporary jobs in small businesses (i.e., with low investment levels) and earned a relatively lower salary (Table 2). It is estimated that the ecotourism industry had generated a total of 1540 temporary (shorter than 3 months) and permanent jobs, an equivalent of 60% of the rural labor force (2547 individuals between 18 and 60 years old in 2000; Wolong Nature Reserve 2000b). At the same time, some people might have taken two or more temporary jobs during a year. Only 389 (25%) of these jobs were taken by farmers. About 65% of the 389 jobs were related to infrastructural

construction and were typically temporary. On average, construction projects provided most of the work opportunities (44.7 jobs per project), much more than hotels/restaurants (4.7 jobs per hotel/restaurant) and souvenir shops (usually 1 job per shop) (Table 2).

Approximately 80% of jobs in infrastructural construction went to outsiders. The local farmers occupied only 21, or one-sixth, of 126 higher-paid positions. Outsiders took the majority (895 of 1126 jobs, or 79%) of the lower-paid jobs as well. Hotels/restaurants provided only 215 positions, but these were relatively permanent. A relatively larger percentage of farmers (38%, or 82 out of 215) were seen in this sector, but 67% (57 of 82) of the jobs were low-skilled positions (e.g., dining or kitchen staff) with lower wages. Although locals and outsiders held a similar number of low-skilled jobs (55 vs. 60), the outsiders dominated the high-skilled positions (e.g., cooks, managers; 66 out of 98). Souvenir-selling provided 75 positions, or a little less than 5%, of the total jobs created from ecotourism, but the percentage of the local rural laborers employed was the highest (74%, or 55 out of 74) in the three ecotourism sectors.

Table 2 shows that urban residents did not benefit significantly from ecotourism development through employment; only 16 were employed in hotels/restaurants and souvenir shops. Their benefits came mainly from investment.

### Goods

Construction materials for the ecotourism infrastructure, such as steel, cement, and bricks, were purchased from outside, except for river sand sold by the rural villagers. Their small benefit from these sales accounted for only  $\sim 6.5\%$  of the total commercial value of construction materials.

**Table 1** Number of souvenir shops by types of operator

Type	Rural residents	Urban residents	Outsiders		Total
			Farmers' relatives	Reserve staff's relatives	
Permanent sites					
Inside the PBC	0	2	0	4	6
Outside the PBC	19	7	1	3	30
Temporary street vendors	36	0	2	0	38

Note: PBC: Panda Breeding Center; see Fig. 2 for its location

**Table 2** Number of jobs in three ecotourism sectors

Ecotourism sectors	Rural residents	Urban residents	Outsiders	Total
Construction projects	252 (21 <sup>a</sup> + 231 <sup>b</sup> )	0	10,00 (105 <sup>a</sup> + 895 <sup>b</sup> )	1252
Hotels/restaurants	82 (27 <sup>a</sup> + 55 <sup>b</sup> )	7 (5 <sup>a</sup> + 2 <sup>b</sup> )	126 (66 <sup>a</sup> + 60 <sup>b</sup> )	215
Souvenir shops	55	9	10	74
Total	389	16	1,136	1541

<sup>a</sup> Number of high-skilled jobs

<sup>b</sup> Number of low-skilled jobs

Souvenirs sold in the reserve, such as toys, books, postcards, Chinese herbal medicines, paintings, and T-shirts, demonstrated a pattern similar to patterns of other goods. Most of the souvenirs were labeled with or related to giant pandas and purchased from the markets in Chengdu. Only panda toys were assembled by a small local factory, but the materials used were purchased from outside the reserve. Some shops sold Chinese herbal medicines (e.g., Tall *Gastrodia*; *Gastrodia elata* Bl.) collected by local farmers, whereas many other shops purchased them from outside markets, often at a lower price. The average percentage of goods purchased from outside in the total consumption of each shop was 88.9% ( $\pm 4.0\%$ ).

Although the rural residents produced about 7000 tons of cabbage and 500 tons of potatoes in 2000 (Wolong Nature Reserve 2005a), most of the produce was sold to adjacent cities. On the other hand, most hotels/restaurants purchased a variety of vegetables from nearby markets such as Yingxiu, Dujangyan, and Chengdu (Fig. 1). Even though most rural households raised two or more pigs yearly (Wolong Nature Reserve 2005a), they did not supply enough pork for tourists, especially in peak tourism seasons (May to October). Hotels/restaurants purchased more than 90% of their pork from outside. The mean percentage of spending for food from outside in the total purchase by hotels/restaurants was 78.8% ( $\pm 17.2\%$ ).

#### Spatial Inequality of Benefits Distribution Among Rural Residents

Spatial analyses show that the average distance between households with ecotourism benefits and the main road was  $140.7 \pm 291.2$  m, significantly shorter than the distance between households without benefits and the main road ( $577.9 \pm 720.1$  m;  $t = 9.6$ ,  $p < 0.001$ ). However, households without an employment or business connection to ecotourism were significantly closer than connected households to both suitable and highly suitable panda habitat ( $181.8 \pm 113.4$  m vs.  $241.6 \pm 125.6$  m,  $t = 4.2$ ,  $p < 0.001$  for suitable;  $237.6 \pm 148.9$  m vs.  $341.6 \pm 120.7$  m,  $t = 4.7$ ,  $p < 0.001$  for highly suitable).

#### Conclusions and Discussion

Our study shows that the distribution of economic benefits was characterized by a manifest inequality among different stakeholders involved in ecotourism development. Most investments were from external operators, most laborers were employed from outside, and most goods were purchased from outside cities. The benefits flowing to the rural residents were substantially minimal and even those realized were confined to a much smaller percentage of rural

households, usually those far from panda habitat with potentially less impact on it. These situations warrant improvements, including enhancement of local participation, more use of local products, and relocation of rural households.

#### Enhancing Local Participation

The major obstacles to investment by and employment of rural households might be the lack of local involvement in the process of ecotourism policy design and implementation, shortage of financial resources, and poor education. The ecotourism development was designed and implemented in a top-down style typical in China (Lin 1992; Wolong Nature Reserve 2000a). Therefore, farmers rarely have enough detailed and timely information to make sound decisions, such as whether to convert their houses into family hotels/restaurants, how much to invest in souvenir shops, and whether to adjust their crop structure to provide appropriate goods for ecotourists. This might also well explain why the elite group could earn the rights of running souvenir shops in the most profitable locations inside the PBC. During the interviews, some street vendors expressed their discontent with the reserve authority, suggesting that there was possible corruption in the process of bidding for the profitable locations of souvenir shops and showing their desire for more transparency in such processes. A bottom-up design and implementation of such policies can favor local participation (Chen and others 2005; Gatzweiler 2005; Jim and Xu 2002; Stone and Wall 2004). Although local workers had skills necessary for construction, most of the jobs still went to outsiders. Providing tax incentives for construction companies might encourage them to hire more local rural laborers; for example, if the employers were to hire a specified percentage of rural residents, they could receive a certain amount of refunded tax.

Most rural households were poor and had no extra funds to invest in ecotourism. For those who did have some money to invest, they still needed help to guide their investments because of their low educational levels and meager business experience. The low operational investment from the local rural residents in hotels/restaurants and the apparent overinvestment in souvenir shops in one place (Wolong Township, where we observed that some shops barely sold one item a day) suggest the importance of involving government agencies to provide business consulting services.

In addition to the lack of incentive for employees, poor education of local farmers can be responsible for the low rate of local employment. Ecotourism requires skills different from farming. The reserve government could also provide vocational training programs in hospitality,

entertainment, tourism, and other relevant businesses, resulting in a trained labor force that could be more competitive for ecotourism jobs.

### Increasing Use of Local Goods

Crop structure adjustment in labor-intensive agriculture might also increase economic benefits to rural residents by reducing the high proportion of purchased goods, such as vegetables, from outside for tourist consumption in the reserve. If tourists consume more locally produced vegetables, the costs for both transportation by local farmers and external purchases by hotels/restaurants would be reduced. This arrangement would not only benefit them economically but also reduce air pollution from transportation.

Currently, cabbage and potatoes take up most of the cropland and are primarily available for a relatively short period of time. A greater variety of vegetables available in different seasons to match tourism peaks could be introduced with some technical guidance from appropriate government departments, similar to the successful introduction of cabbage as a local cash crop in the 1990s (Wolong Nature Reserve 2005a); for example, greenhouse techniques could be introduced to change the production time to match the needs of ecotourism. Potentially, such needs from ecotourism might drive farmers to convert forests to cropland, so close monitoring and law enforcement would have to be implemented at the same time.

### Encouraging Relocation of Rural Households Closer to Ecotourism Facilities

From the perspective of panda conservation (the ultimate goal of ecotourism development), the benefit distribution in rural households needs more deliberate consideration. Households closer to the main road gain more benefits, but they are farther from the panda habitat, thus potentially having less detrimental impact than households near the panda habitat. With better access to ecotourism facilities and other locational advantages, residents close to the road benefit from ecotourism in several ways: for example, converting their houses into hotels/restaurants, starting souvenir shops on the main road with small investments, being closer to the transportation routes for goods and products, and gaining timely information related to ecotourism. It also is more convenient for them to sell agricultural products to the buyers (restaurants and tourists). However, households far from the main road and closer to the panda habitat receive less benefit from ecotourism and must subsist by using forest products, possibly harming the habitat.

Creative policy instruments can attract those remote households to relocate closer to the main road. One possibility is to provide some financial subsidies and lands closer to the main road as incentives for remote farmers to relocate. By relocating closer to the main road, usually where elevation is lower and temperature is higher, households might need less fuelwood for heating in winters. With more income from ecotourism, those households might consume more electricity and extract less fuelwood. Collectively, relocated households could greatly reduce their impact on panda habitat (An and others, 2002, 2005).

In conclusion, our study indicates a very uneven distribution of ecotourism benefits among different stakeholders. The large gap can be reduced by appropriate management adjustment, policy incentives, and government services. If the local rural residents benefit economically more from ecotourism development, they might likely increase their support to conservation and reduce their impact on panda habitat (such as collecting less fuelwood), thus achieving the goal of ecotourism development and biodiversity conservation. The lessons drawn from this study can benefit other places worldwide, including many of the other 1997 nature reserves in China now being intensively promoted for ecotourism development (Liu and Diamond 2005; Liu and others 2007).

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