

Tourism's Impacts on Natural Resources: A Positive Case from China

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Abstract Tourism development may result in negative impacts on natural resources owing to overuse and mismanagement. However, tourism may also play positive roles in natural resource conservation, which has rarely been verified in practice, although some researchers have demonstrated this in theory. In this article, taking the Jiuzhaigou Biosphere Reserve as a case study area, we conducted an analysis for the environmental impacts from tourism development based on social survey and interpretation of remote sensing images. The results show that the natural environment was not degraded and some indicators are even improving because all the residents have participated in tourism and given up farming and hunting. It is concluded that it is possible to use tourism as a way to balance natural resource conservation and economic development under the preconditions of making effective policies to encourage and help local people participate in tourism business and to benefit from it.

Keywords Tourism · Natural resources · Local participation · Jiuzhaigou Biosphere Reserve

Introduction

Currently, tourism is booming in China, and nature reserves are becoming visiting hotspots for tourists because of their intact ecosystems and beautiful land-

scape (Li and Han 2001). In addition to negative impacts on the environment (Kuvan 2005; Mbaiwa 2003; Laiolo 2003; Van der Duim and Caalders 2002; Kousis 2000; Nepal 2000; Collins 1998; Ross and Wall 1999; Lukashina and others 1996), tourism development may also bring positive influences through being used as an alternative livelihood instead of original unsustainable natural resource utilization such as farming, hunting and mining. Nevertheless, few practical cases have been presented as positive evidence in the literature.

According to Butler (1980), Prosser (1994), and Ceballos-Lascurain (1996), tourism contains the seeds of its own destruction, destroying the environmental attractions that visitors come to a location to experience. Sun and Walsh (1998) conducted a good review of study methods used for environmental impacts assessment of recreation and tourism in Australia, in which they listed some negative impacts caused by tourism, such as physical and biological deterioration and destruction of ground vegetation (Whinam and Comfort 1996; Sun and Liddle 1993; Sun and Liddle 1991; Hawes 1992). Physical effects include track formation, soil loss and/or compaction, and an increase in fire frequency. Littering and water pollution are also seen as associated with bush walking and camping (Hawes 1992). Biological effects include causing damage to vegetation, increasing risk of myrtle wilt disease and the spread of the soil pathogen (Hawes 1992), assisting weed dispersal (North 1991; Lonsdale and Lane 1994) as well as decreasing species abundance and diversity with consequent effects on wilderness values (Hawes 1992). In a recent study, Laiolo (2003) pointed out that the forest birds and habitats are severely threatened in the study area, and the deforestation is the consequence of the tourist pressure for

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fuel wood along the trekking route. Mbaiwa (2003) stated “Despite its positive socio-economic impacts, the industry is beginning to have negative environmental impacts in the area such as the destruction of area’s ecology.” In his study, Kuvan (2005) also concluded that the rapid emergence of mass tourism development in Turkey has resulted in serious problems in forest areas, without considering protection and sustainable use of natural and cultural resources.

However, besides these negative impacts, tourism may also play positive roles in natural resource conservation, which has rarely been verified in practice although some researchers have demonstrated this in theory. As Ross and Wall (1999) suggested, tourism has the potential to contribute to both conservation and development and it involves the creation of positive synergetic relationships among tourism, biodiversity, and local people through the application of appropriate management strategies. Collins (1998) listed some research relating to the notion of sustainable tourism development, including Nash and Butler (1990), Weaver (1991), Jarvilouma (1992), Klemm (1992), Cater (1993), Wight (1993), McKercher (1993), Dearden and Harron (1994), Stewart and Sekartjarkrarini (1994), Lindberg and others (1996), Wallace and Pierce (1996), Driml and Common (1996), and Brown and others (1997). Recently, Burger (2000) explored three examples of the interface between humans and ecosystem integrity on the landscape scale, and concluded that tourism/recreation can theoretically play a major role in preserving biodiversity. Nevertheless, there are few practical cases to show the positive environmental impacts caused by tourism. In other words, sustainable tourism theory has often not

been successfully put into practice (Ross and Wall 1999).

It is generally believed that tourism presents a double-edged sword for natural resource conservation. Making clear these negative/positive effects is helpful to a better and more comprehensive understanding of the relationship between tourism, local community and natural resources, and will also provide a valuable guide in natural resource management.

In this article, taking Jiuzhaigou Biosphere Reserve (JBR) as a case study area, based on social survey, on-site field survey, and the interpretation of the remote sensing images, we present a positive case where the environment is not degraded as tourism is increasingly developing, and some ecological indicators such as vegetation coverage are even improving. The relationship between tourism, natural resources, and local community is analyzed in order to identify the roots behind the positive story.

Methods

Case Study Area

JBR is located at E 103°46′–104°05′ and N 32°55′–33°16′ within Sichuan Province, China (Figure 1). It is a “Y”-shaped valley with a length of 40 km and a total area of 720 km². The elevation ranges from 2000 m to 4764 m. The temperature is from –8.7°C (average in January) to 16.8°C (average in July), and annual precipitation is 700–800 mm with more than 150 rain days per year. The humidity is about 70% all year and thus is very comfortable.

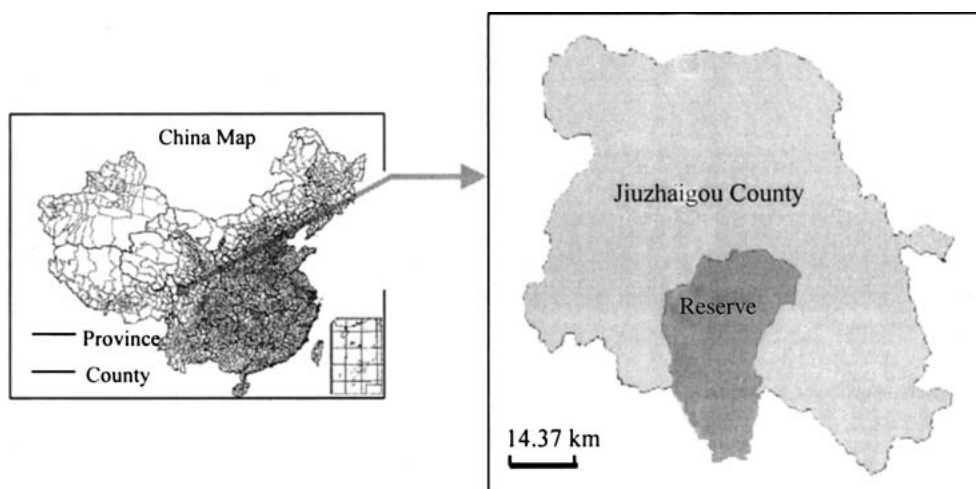


Fig. 1 Case study area: Jiuzhaigou Biosphere Reserve

Because of its primary forest and rich biodiversity, Jiuzhaigou was protected as a nature reserve in 1978, listed as a World Heritage Site by UNESCO in 1992, and approved as a UNESCO Biosphere Reserve in 1997. There are as many as 4000 species of plants, 123 species of vertebrates (including more than 50 kinds of rare animals), 4 species of amphibians, 93 species of birds, and 21 species of mammal in JBR.

The tourism resources are very rich in Jiuzhaigou and thus are attracting many visitors every year. Tens of snow-topped peaks, including modern glaciers, are distributed along the valley. The geological basis of Jiuzhaigou lies in dissolvable carbonate layers that are famous for their well-known travertine phenomena. These sediments adhere to the beds of lakes and rivers, forming colorful and superb beauty. The scenic spots and glorious views include majestic and unrivaled emerald lakes, layer upon layer of waterfalls, colorful forests, and snow-topped peaks. Besides the natural scenic spots, traditional culture is also one of the attractions for tourists. Of the total population of 1021 within the reserve in 1999, Tibetans account for over more than 80%.

Social Survey

In order to collect information on economic influences and environmental changes caused by tourism, we conducted social surveys during 2000–2003.

In order to assess the local community's benefits from tourism development and their changes on life and production styles due to tourism development, a questionnaire survey was conducted with Jiuzhaigou's residents in July 2000. In JBR, there were 3 administrative villages (consisting of 6 natural villages) with a total of 221 households, and the population was 1021 (of which there were 460 residents of labor age 18–55 years old). The average family size was 5.6 members. The questionnaire was designed in Chinese because most of the Tibetan residents in JBR could understand and speak Chinese in JBR. The surveys were conducted face to face, and all the questionnaires were filled out by ourselves when they answered. Some of the residents are illiterate, and many of the others (who could read) felt nervous if they were asked to fill out the questionnaire using pen. We always conducted our questionnaire survey in a chatting style, so those indigenous people could be relaxed and then be willing to speak with us about everything as well as our concerned questions. Most of the questionnaires were answered by the head of household, sometimes the wife and sometimes the husband.

Three aspects were considered when designing the questionnaire: economic, social, and environmental. The economic indicators included how many people were involved and got benefits from tourism, how they were involved, and how much of their income was from tourism. The social assessment was conducted through asking residents to rank their perceptions about interference due to tourism (including noise, social safety, culture changing, and commodity prices). The interviewed residents were asked to check one answer in the questionnaire according to their feeling about the interference from tourism: (1) No Interference, (2) Slight, (3) Strong, and (4) Extreme. The environmental assessment was conducted through ranked perceptions of nature environmental changing (on wildlife species, natural landscape, noise, water, air, etc.) since the tourism developed. There were four choices designed in the questionnaire for selection: (1) No Degradation, (2) Slight, (3) Strong, and (4) Extreme. The local people have lived there for generations, so they are most sensitive to environmental changes.

In the summer of 2001 and 2002, open-ended interviews were conducted with senior managers of JBR to understand the policies implemented for encouraging the local community and indigenous people involved in the tourism business, and the measures taken for tourism management for sustainable development.

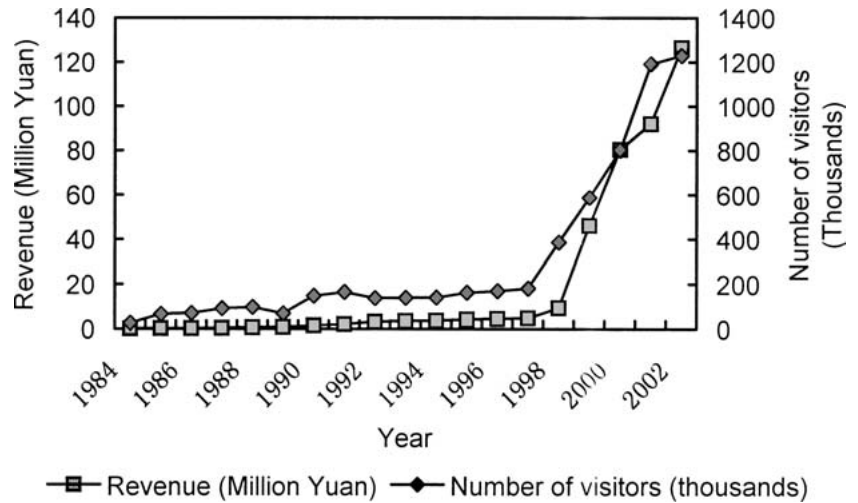
Besides the above on-site surveys, the following secondary data were collected from the management administration and local statistic authority: tourism revenue and contribution to the income of local people, economic sector structure changes, and employment structure changes.

Remote Sensing Image Interpretations

Because the sightseeing sites are located within a natural reserve, many activities of natural resource utilization are prohibited. In order to identify whether the pressures from local residents who live directly on natural resources are transferred from inside of the JBR to outside, we selected 3 years of Landsat TM images: July 1987, September 1997, and September 2003, to interpret the land cover changes in Jiuzhaigou County, where the JBR is located. The image of 1987 indicated the land cover situation at the beginning of tourism development; 1997 was the transit point from which the visitor number increased dramatically (Figure 2), and the current land cover could be determined from the image of 2003.

Considering the Jiuzhaigou geological, physiognomic, and biological characteristics, the TM bands 5,

Fig. 2 Number of visitors and tourism revenue in Jiuzhaigou in different years



4, and 3 were selected to compose the false color image used for the interpretation. First, the non-supervised classification method was used to obtain a draft interpretation image, which included seven classes covering forest, shrubbery, grassland, bare land, waters, farmland, and residential land. Then an on-site field validation was conducted in July 2003, and a total of 121 sites covering the above seven classes were located using GPS. Combining these on-site field training samples, the maximum likelihood method of supervised classification was applied to further improve the accuracy of the interpretation.

Results

Tourism Development and Benefit to Local Community

Jiuzhaigou initiated its tourism in 1981 and stepped into the development stage in 1986. Since 1984, the number of visitors has increased dramatically, from 27,000 in 1984 to 1,220,000 in 2002 (Figure 2). Especially in 1998, there was a sharp increase of the number of visitors because the road from Chengdu City (the capital of Sichuan Province) to Jiuzhaigou was constructed and available for visitors, which saved the time spent in journey for those visitors departing from Chengdu from the original 2 days and 1 night to 1 day. As the number of visitors increased, the revenue from tourism to the JBR administration also increased, from US\$33,000 in 1984 to US\$15.2 million in 2002 (Figure 2).

The questionnaire survey showed that all of the households have been involved in tourism business or employed in relevant jobs. Some 80% of households own family hotels, 70% operate souvenir shops, 65% of fam-

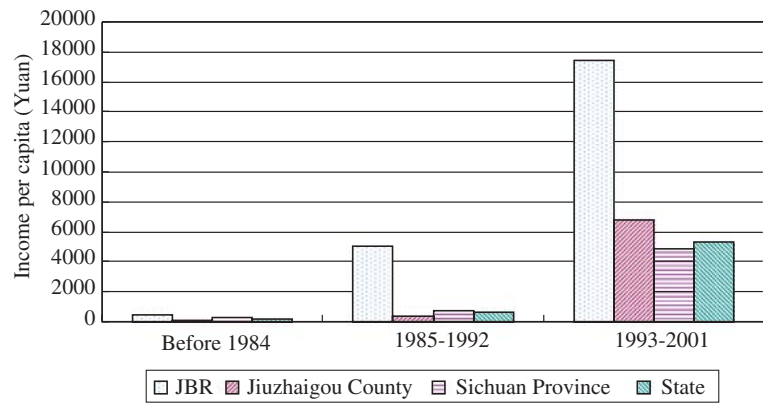
ilies have members employed in tourism services (working for the hotels, restaurants, tour companies, or collecting garbage in the tour areas), and 25% rent yaks, sheep, and traditional ethnic dresses to visitors for taking pictures. The income from tourism was mostly from family hotels. For all of the households, the average percentage from hotel business accounted for 69% of the total income annually; the second-largest income was from working as an employee in tourism services, which accounted for 17%; the third largest was from gift shop business, which accounted for 11%; and 3% was from renting special props to visitors for taking photos.

The interference questionnaire survey results showed that 99% of the households selected *No Interference*. This result showed that the local residents had a high tolerance for the impacts of tourism, which reflected indirectly that they were involved extensively in tourism and received the expected benefits.

Before the 1980s, the residents within the JBR lived mainly by farming and hunting. Hunting reduced the wildlife population severely, and farming caused soil erosion and water loss due to cultivating on steep slopes. The residents were very poor at that time; the annual per capita income was around US\$23 in 1978. Since 1984, when tourism was initiated, the income has been increased dramatically as more and more visitors have been attracted there. Compared with 1978, the per capita income in 1988 was increased by 188% (after 10 years), and by 477% in 1999 (after 20 years).

Coupled with some data from statistical yearbooks, we conducted a comparison between income per capita (IPC) of JBR residents and Jiuzhaigou County (named Nanping County before 1998), Sichuan Province (which the county belongs to), and the state average levels, during the same periods (Figure 3). According to Figure 3, before JBR tourism development in 1984,

Fig. 3 Comparison of income per capita between JBR, Jiuzhaigou County, Sichuan Province, and the state



the annual IPC was similar among all the levels, except that the income of Jiuzhaigou Valley residents was a little bit higher, perhaps because of its rich forest resources. Then after the reserve began to develop tourism, IPC of JBR residents has dramatically increased, far exceeding average county, provincial, and state levels, both in growth rate and income level.

From the interviews with JBR managers, we know that many policies and measures have been taken to encourage participation by the local community and indigenous people in tourism, enabling them to receive enough benefits to give up the original extensive natural resource subsistence utilization. One policy was to organize the local residents to operate family hotels to host visitors, which had been the main source of income for them. The first family hotel operator told us “It was the JBR administration and local governors who encouraged and helped me to borrow money from the bank, so I could be the first person to decorate my house and host visitors in 1984.” He also said excitedly: “At the beginning, nobody in the village believed there would be visitors who liked to live in my house. Yes, they didn’t believe I could make money from tourism, but after one year every household wanted to operate a family hotel because I suddenly became a rich man through the family hotel business.” Another example is related to the Green Bus Company. In JBR, the scenic spots are distributed along a “Y”-shaped valley with a length of 40 km, which is too long to walk for most visitors. In the 1980s there were about 400 motor vehicles owned by local residents for carrying visitors touring along the valley. The noise and air pollution caused by those vehicles adversely affected the natural environment, so the JBR administration introduced Green Buses that were driven by liquid gas instead of gasoline. In order to protect the original vehicle owners’ benefits, the Green Bus Company absorbed them as shareholders. Up to 2000, around 90% of shareholders were from the local community. For

those indigenous people who did not have enough initial capital to operate a family hotel or buy into the Green Bus Company, the administration arranged work for them in the scenic spots as garbage cleaners. They receive a regular salary of 450 Yuan/month (US\$54) during the tourism period from May to October. For those residents who live relatively far away from the scenic spots (so they could not make money through family hotels), the JBR administration gives them priority if they apply for tourism service jobs. Also the administration pays every household 450 Yuan/month (US\$54) from the tourist entry fee in the name of protecting forestry.

Economic Sector Changes

The rapid tourism development in the JBR has dramatically driven the local county’s economic development and caused great changes for both the economic sector structure and employment structure. The GDP from the tourism service sector increased from 28% in 1990 to 68% in 2002, more than doubled (Figure 4). Over the same period, the agricultural GDP decreased from 28% to 11%, more than halved. The local labor employed in the tourism service sector doubled from 15% in 1982 to 32% in 2002 (Figure 5). With the local economic structure changes, the percentage of nonagricultural population increased from 18% in 1987 to 37% in 2002 (Figure 6).

As livelihood transfers from agriculture to the tourism sector, the original pressures on natural resource conservation of JBR from peripheral areas are mitigated. This will be reflected in the following environmental assessment.

Natural Environmental Changes

The natural environmental impacts within the JBR and in the entire Jiuzhaigou County are analyzed,

Fig. 4 GDP changes in different economic sectors from 1990 to 2002, Jiuzhaigou County

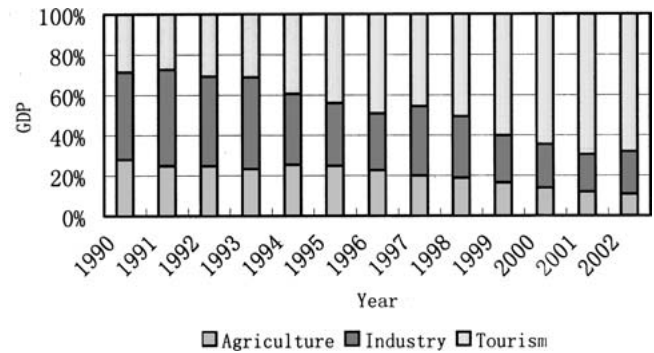


Fig. 5 Employment structure changes from 1982 to 2002, Jiuzhaigou County

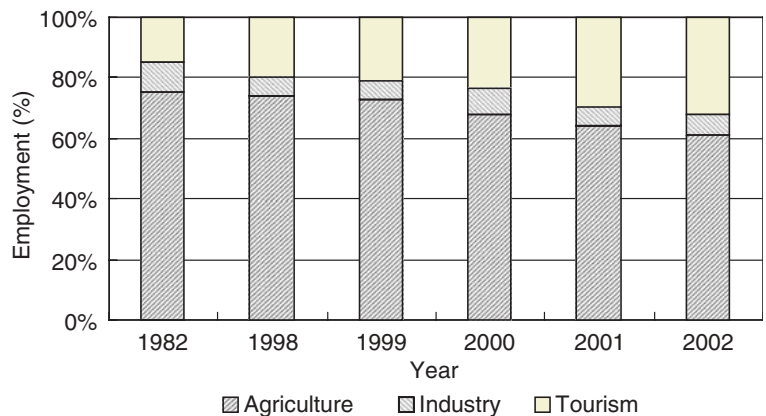
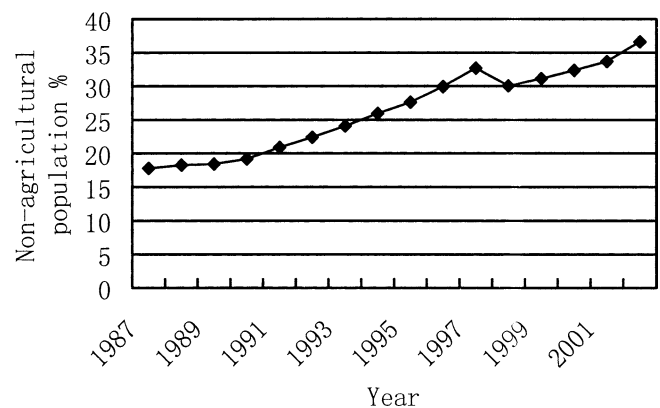


Fig. 6 Proportion of population employed in non-agricultural activities, 1987–2002, Jiuzhaigou County



respectively. The environment quality within the JBR is tourism attractiveness, and is directly affected by tourist activities. The local people have lived there for generations, so they are most sensitive to any environmental changes. Therefore, we designed a questionnaire to obtain the information to assess environmental changes within the reserve since tourism was developed. Furthermore, the landscape changes in the entire Jiuzhaigou County from interpretation of remote sensing images will reflect whether the pressures from local

residents who lived directly on natural resources are transferred from inside of JBR to the peripheral areas.

From the questionnaire survey with the indigenous residents on environmental changes, 90% of interviewees selected *No Degradation* for environmental changes within the JBR, and some of them even thought the natural landscape has become better since the 1990s. This is especially true since 1997, when all the villagers stopped agricultural activities as they received sufficient income from tourism. As the

Table 1 The percentage changes of land use coverage of 1987, 1997, and 2002, Jiuzhaigou County

	Percentage of changes	
	1987–1997	1997–2003
Forest	-8	+2
Shrubbery	+131	+11
Grassland	+22	0
Waters	+33	+229
Farm land	-26	-61
Residential land	-28	+119
Bare land	+5	-15

environment recover, the number of wild animals is increasing. A forest ranger, who had worked in Jiuzhaigou for a state forest cutting sector in the 1970s and has been working in a protection state since the Jiuzhaigou nature reserve was approved in 1979, told us “the chance we meet wildlife when we patrol in the core area in recent years is obviously more than in the 1970s when we conducted clearing cutting there.” This questionnaire survey results coincide with the report of SPAFS (2004), which conducted a comprehensive scientific survey in the JBR in 2002–2003, and reported “Currently, the forest, shrubbery and alm are during the normal and natural dynamic evolutionary process.”

The interpretation results of remote sensing images of 1987, 1997, and 2003 are shown in Table 1. From Table 1, it can be seen that the forest area was decreased by 8% from 1987 to 1997, whereas it increased by 2% thereafter; the shrubbery area increased continuously from 1987 to 2003; grassland was increased by 131% from 1987 to 1997, and almost remained stable since then. Generally, the vegetation (forest, shrubbery, and grassland) is getting restored. Meanwhile, the bare lands have decreased, although an increased trend was found initially from 1987 to 1997. The residential land was first decreased and then increased, owing to the indigenous residents’ large-scale migration in 1992 from high elevation of the mountain where they traditionally lived to low land near sightseeing sites where the family hotels could be operated easily to attract visitors. When they lived in the high land, their houses were widely dispersed. After the residents moved down to the low land to operate tourism, they were required by the JBR administration to dwell more closely to ensure the least influence on sightseeing. Actually, their traditional Tibetan buildings have been one of the attractions for tourism. Regarding the reasons why the area of waters increased so dramatically, we could not give a convincing explanation until now. Unlike vegetation coverage and residential land that change gradually, waters vary greatly with rainfall. Because the satellite monitoring

time of three images are all during the annual rich rainfall period (May–October), the big changes might result from the great difference between the 3-year regional rainfalls. Unfortunately, we failed to find the relevant regional rainfall data.

Discussion and Conclusion

From Table 1, we can see the forest degraded at the beginning of tourism development, and then after a certain point the forest coverage percentage has kept increasing. That means Jiuzhaigou overcame the environmental decline in a very short time, and then has stepped into the ecological restoration and improvement stage. The area of shrubbery and grassland has increased, while the farmland bare land has decreased, which also means the natural environment of Jiuzhaigou is getting better.

It is concluded that the main cause resulting in the positive environmental impacts of the Jiuzhaigou tourism is that the local community and indigenous residents fully participating in the tourism business and benefiting from it is ensured, as shown in our social survey. Only when the local people are involved extensively in the tourism business can their original natural resource exploitation be substituted and the environment be restored.

From this study, we can see that tourism does not necessitate bringing negative impacts to the environment. If indigenous residents could benefit enough from tourism, it is possible to use tourism as a way to balance natural resource conservation and economic development. Of course, in this case effective policies to encourage and help local people participating in the tourism business and benefiting from it are obviously very important.

However, we could not simply conclude that everything in the JBR is good and that tourism development will be definitely sustainable in the long term. As shown in Table 1, the residential land is increasing as more hotels are needed, which will occupy more wild land, influence the natural landscape, and bring environmental pollution. In order to prevent the emergence of these negative impacts, since the end of 2002, all the family hotels have been prohibited within the reserve by the JBR administration. Although some alternative subsistence sources are supplied, such as allocating some proportion of the entry fee to each indigenous people to make sure their average income level is not lower than before, and encouraging them to move and operate their family hotels outside the reserve, the indigenous people are

not so satisfied with this reform, according to our recent survey in March 2005. The other aspect that might hamper current tourism sustainability is the weakness of local community participation in decisionmaking (Li 2006), which might not be a key issue at the initial stage of tourism development when local people are only concerned that their income increase, but might be a necessary requirement when they want to guarantee their quality of life in the future.

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