

Positive influence of traditional culture and socioeconomic activity on conservation: A case study from the black-and-white snub-nosed monkey (*Rhinopithecus bieti*) in Tibet

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Abstract: Found in the Trans-Himalayas of north-west Yunnan and south-east Tibet, the black-and-white snub-nosed monkey (*Rhinopithecus bieti*) is one of the world's most endangered primates. A recent survey indicates that only 15 groups with 2500 individuals remain in the wild. However, the Tibetan Xiaochangdu group may be the only equilibrium group in the field since the last investigation in 1988. To evaluate the effects of traditional culture and socioeconomic activity on biodiversity conservation of *R. bieti*, we conducted a case study in the Honglaxueshan National Nature Reserve in southeast Tibet from June 2003 to May 2005. Interviews, direct observations, and analysis of socioeconomic data indicated major advantages to the conservation of *R. bieti*, which included that: 1) traditional culture mainly depended on raising livestock and collecting non-timber products rather than forest planting of Tibetan highland barley; 2) religious beliefs, against to kill any wildlife living on the sacred mountain, were mainly influenced by Tibetan Buddhism; and 3) bigger household numbers were induced by the polyandrous marriage system, which resulted in lower per capita resource consumption than smaller ones.

Key words: Conservation implications; *Rhinopithecus bieti*; Socio-economic activity; Traditional culture

传统文化和社会经济活动对生物保护的正面影响： 来自西藏黑白仰鼻猴的实例研究

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摘要: 黑白仰鼻猴(*Rhinopithecus bieti*)是仅存于滇西北和藏东南的横断山脉的濒危灵长类动物, 目前仅有野外15群约2500个个体, 并且西藏红拉雪山自然保护区的小昌都群也许是自1988年调查以来唯一数量保持稳定的种群。通过调查访问、以及分析社会经济数据中隐含的保护信息, 该文通过实例研究探讨了传统文化和社会经济发展模式对红拉雪山自然保护区小昌都猴群的影响, 试图探讨传统文化和人类活动对该猴种群保持稳定的正面影响: 1) 研究表明传统的生产方式对黑白仰鼻猴的生境保护有益, 例如主要依靠畜牧业和非木材的林产品而不是毁林开荒种植青稞; 2) 受印度教和佛教影响的藏传佛教对生灵的敬畏, 避免当地村民对黑白仰鼻猴的猎杀; 3) 一妻多夫的大家庭, 其人均资源消耗(特别是薪柴, 建房木材等)明显比一夫一妻的小家庭少, 这种婚俗也许可以缓解人类索取相应自然资源时对黑白仰鼻猴的生境破坏。因此, 考虑到小昌都是唯一一种群稳定的群, 我们认为是当地的社会生产方式、宗教文化以及婚俗习惯让小昌都群长期维持在该生境的最大容纳量。

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Exponential human population growth in the last few centuries has influenced massive alteration of habitats, and associated biological changes threaten the existence of millions of species and basic ecosystem processes (cf. Miller, 1994). Countering these impacts to varying extents are cultural and religious traditions, conservation activities, and the adaptive qualities of the species themselves. Traditional cultural has a close relationship with biodiversity and its importance in conservation has received increasing attention (Berkes, 1995; Dasman, 1995; Arizpe, 1996; Augustine, 1999; Liu et al, 2002; Caillon & Degeorges, 2007). Additionally, many major religions are sensitive to the importance of biodiversity and the natural environment (Hamilton, 1993; David & Joy, 1998; McNeely, 2000).

Conversely, however, human overpopulation has played a crucial role in habitat decline and is regarded as an ultimate factor causing habitat loss (cf. Miller, 1994). This impact is enhanced due to the trend of increasingly smaller households. Household dynamics influence per capita resource consumption (Kaul & Liu, 1992; Sandiford et al, 1990) and biodiversity through, for example, consumption of wood for fuel and habitat alteration for construction of houses (Friesen et al, 1995; Nilcon et al, 1995; Kulza et al, 2000). While households have become smaller in recent decades, household numbers have actually increased due to population growth (Keilman, 2003). Moreover, rapid increase in household numbers and the associated urban sprawl result in the higher per capita resource consumption of smaller households and pose a serious challenge to biodiversity conservation (Liu et al, 2003; Keilman, 2003).

The black-and-white snub-nosed monkey (*Rhinopithecus bieti* (Colobinae)) is categorized as endangered on the IUCN Red List (IUCN 2007) and is endemic to the Trans-Himalayas (the Hengduan Mountains) in north-west Yunnan and south-east Tibet, China. Its geographical distribution lies between 26°14'N and 29°22'N, and is bordered by the Mekong River to the west and Yangtze River to the east (Long et al, 1994, 1996; Xiang et al, 2007). An earlier survey conducted between 1987 and 1992 covered almost the whole distribution range of the species (Long et al, 1994, 1996). The results of this thorough investigation showed that <

1,500 individuals lived in 13 isolated groups, of which about 80% of the population was distributed in northwestern Yunnan and 20% in southeastern Tibet (Long et al, 1996). A more recent survey indicated that that only 15 groups with 2500 individuals remain in the wild (Long YC, personal communication), with the Xiaochangdu group appearing to be the only stable group since the last investigation in 1988 (Long et al, 1994). This indicates that while the Xiaochangdu sub-population is being well conserved, other groups remain unstable due to external human pressures. As the Xiaochangdu group is at maximum capacity for its available habitat, group size has remained stable for many years. Therefore, the effect of tradition culture (including socioeconomic status and religious beliefs) and population growth on the biodiversity conservation of the Tibetan black-and-white snub-nosed monkey requires evaluation. The aim of this paper was to investigate the conservation advantages to *R. bieti* resulting from cultural traditions, such as religion, population growth, and socioeconomic activity by interviewing local people and analyzing socioeconomic and vital statistics data of the last 20 years.

1 Materials and Methods

Our study was conducted in the Honglaxueshan National Nature Reserve (HNNR; 98°20'~98°59'E, 28°48'~29°40'N), southeast Tibet. The reserve was founded in 1993 to protect black-and-white snub-nosed monkeys and their habitat and marks the northernmost distribution of this species. It is located in the Hengduan Mountains (Trans-himalayas), which are one of 25 designated global "biodiversity hotspots" (Cincotta et al, 2000). The Mekong River acts as a boundary to the west and the Heiqu River to the east. Most of the range is higher than 3500 m above sea level (*asl*). The area is approximately 185300 hectare in size, and contains a mosaic of dark-conifer forest, larch forest, and evergreen broad-leaf forest between 3500 and 4300 m *asl*, and some deciduous broad-leaf between 3200 and 3600 m *asl* (Xiang, 2005).

The study area encompasses more than 60 villages, 2269 households, and 12000 inhabitants of mostly Tibetan or Naxi nationality with strong belief in Tibetan Buddhism. Villagers depend on a subsistence economy

dominated by planting Tibetan highland barley below 3800 m *asl*, grazing yak and sheep on alpine meadows or in coniferous forests, and collecting non-timber forest products, such as *Yangdujun* (a mushroom, *Morchella esculenta*), *Songrong* (a mushroom, *Tricholoma matsutake*), *Chongcao* (a Chinese medicinal plant, *Cordyceps sinensis*), and *Beimu* (a Chinese medicinal plant, *Fritillaria cirrhosa*) from mid-May to early October (Xiang et al, 2007).

We provide a detailed evaluation of conservation advantages to *R. bieti* based on: 1) interviews with local officials, guides, and villagers; 2) direct observations, such as human activities in the forest and religious activity in the area; and 3) conservation implications of the statistical data.

We recorded economic activities of the local people in the forest in different seasons. The intensity of economic activities was estimated by counting the numbers of villagers who entered the forest from our main camping site (at Xiaochangdu). Observations were conducted for at least three days, which were assigned to different periods of every month.

Data on socioeconomic aspects were collected in various ways: 1) cash income of the 60 households at Bazhugong village was estimated from the economic value of the forest to the villagers; 2) basic socioeconomic data about the HNNR society over the last 20 years was collected from the Statistics Bureau of Mangkang County; and 3) vital statistics on the dynamics and variations of HNNR households were obtained from the Mangkang County census bulletin to determine the possible effect of the polyandrous marriage system on household size.

2 Results

Interviews, direct observations, and analysis of socioeconomic data indicated major advantages to the conservation of *R. bieti*, which included that; 1) traditional culture mainly depended on raising livestock and collecting non-timber products rather than forest planting Tibetan highland barley; 2) religious beliefs, against to kill any wildlife living on the sacred mountain, were mainly influenced by Tibetan Buddhism; and 3) bigger household numbers were induced by the polyandrous marriage system, which resulted in lower per capita resource consumption than smaller ones.

Traditional culture positively affected forest conservation. Tibetans usually build their farmhouse beside the forest and herd livestock in the forest or on

alpine meadows. The summer grassland, which means cutover the forest for foraging livestock, was rarely observed in HNNR. Slash-and-burn agriculture and shifting cultivation was also rarely applied as successful planting and harvesting of barley never occurred above 3800 m *asl*.

Economic activities, such as stock grazing, non-timber product collection, and picking oak fruit, usually occurred in the forest every year. Their variations of intensity are shown in Fig 1. More than 100 people per day were recorded entering the forest from the study station (at Bazhugong village) to collect *Songrong*, whose price reached 20-30 \$ USD per kilogram and comprised 64% of total cash income per household in 2004 (Fig. 2). Generally speaking, these activities did not directly impact the monkeys. Analyzing the cash income of the 60 households indicated that villagers mainly depended on non-timber forest products, which comprised 80% of total cash income (Fig. 2), and on raising livestock.

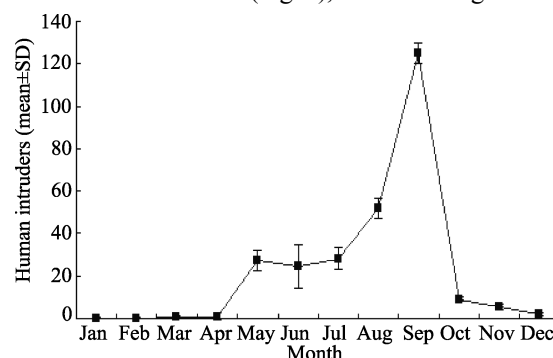


Fig. 1 Human intruders in the home range of *Rhinopithecus bieti* at Xiaochangdu (example for one path cross our study camp)

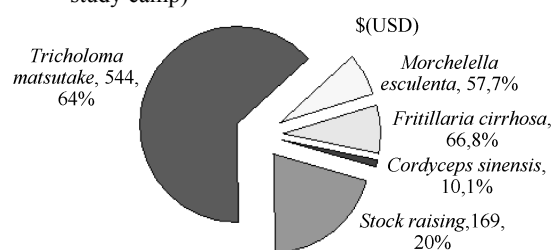


Fig. 2 Cash income per household from economic activities other than agriculture in 2003 ($n = 60$, sample from Bazhugong village)

Every village has its own sacred mountain (SM) declared by “Living Buddha” (a senior monk in Tibetan Buddhism) and it is against their religious belief to kill any wildlife living on the SM. The Xiaochangdu group ranges in the local village’s SM and it is easier to approach these monkeys compared to those not on or near a SM (Xiang et al, 2007). These facts embody the importance of religion and SMs in the conservation of

this species.

We obtained socioeconomic data on households, human population, farmland area, and livestock number (i.e., yak, sheep, and goat) between 1983 and 2003 from the Statistics Bureau of Mangkang County. We chose four administrative villages (Huola, Maoning, Xiaochangdu, and Milaka), which had not experienced any boundary changes within the last 20 years, as the representative data of HNNR. The household number

(Fig. 3A), the human population (Fig. 3B), and farmland area (Fig. 3C, except for Xiaochangdu) increased slowly during the last 20 years, but livestock number (Fig. 3D) increased quickly. Analyses of the socioeconomic data indicated that Tibetans in HNNR are highly dependent on raising livestock for income, as the numbers of livestock increased faster than farmland area and human population growth [Fig. 4, slope comparison (Zar 1999), $t = -5.99$, $df = 6$, $p < 0.01$].

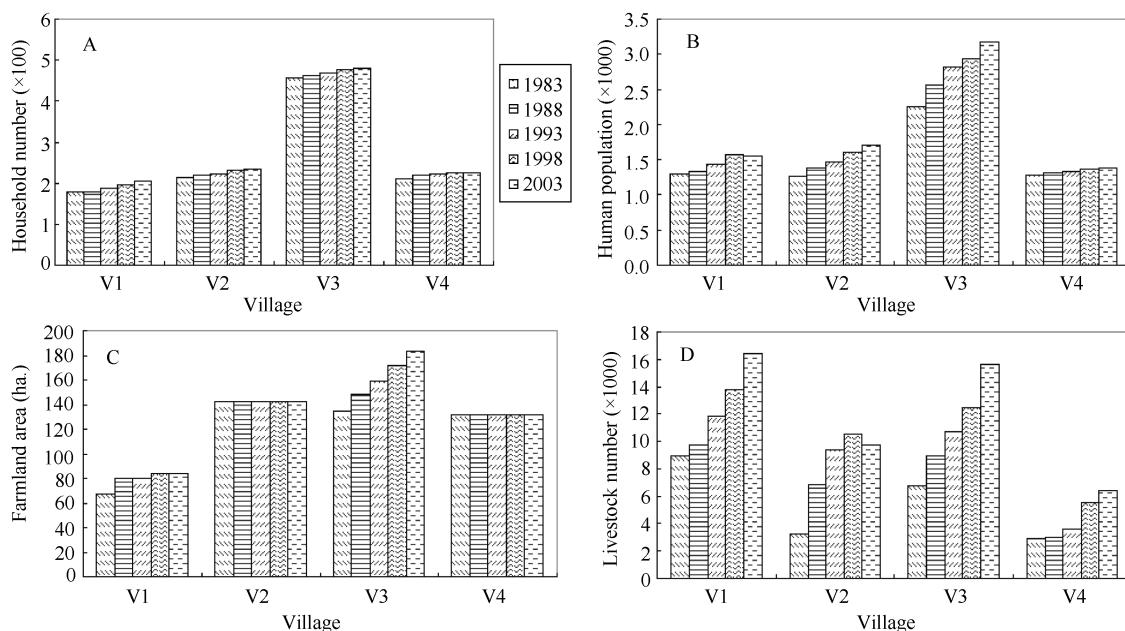


Fig. 3 Changes in the household number, human population, farmland area, and livestock number of four administrative villages in Honglaxueshan National Nature Reserve over the past 20 years

V1 = Huola, V2 = Maoning, V3 = Xiaochangdu, and V4 = Milaka.

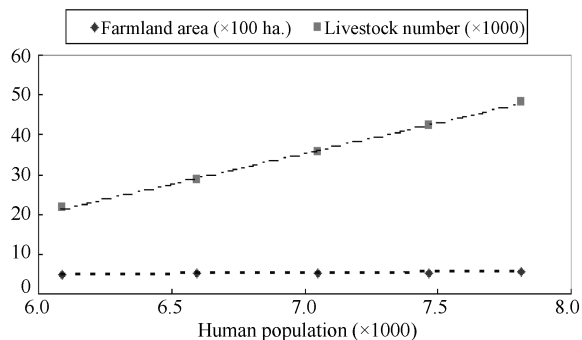


Fig. 4 The relationship of farmland area and livestock with changing human population in Honglaxueshan National Nature Reserve (represented by four administrative villages) over the past 20 years

The households of HNNR are large, and households exhibit a polyandrous structure where several brothers are usually married to one wife and live together with their parents. The average household number in HNNR is 6.11 ($SD = 2.01$, $n = 60$, range, 1 - 11), which

typically consists of grandparents (0 - 1), parents (1 - 3), son (1 - 3), daughter-in-law (1), and grandchildren (1 - 3). A comparative analysis of the household number dynamics in HNNR, Mangkang County, Tibet, and China over the last 20 years (Fig. 5) indicates that while household number in Mangkang County, Tibet, and China decreased, HNNR showed an increase.

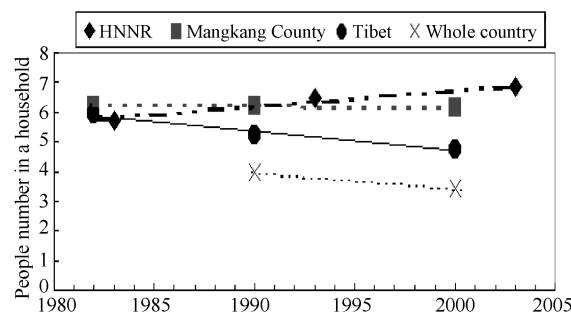


Fig. 5 Data on household size at the Honglaxueshan National Nature Reserve, Mangkang County, Tibet, and China over the last 20 years

3 Discussion

Due to its topography, Tibet is characterized by a high altitude plateau and a distinct culture based on Tibetan Buddhism. The cultural tradition of the Tibetan people is mainly influenced by Hinduism and Buddhism, which share a similar creed (Ara, 1983) revolving around compassion, respect, and tolerance of every living thing sharing the planet (Kablingsingh, 1987). Moreover, there are many sacred mountains and lakes, where it is forbidden to hunt or poach wildlife (Zou et al, 2005). Our findings show that religious beliefs in Tibet positively affect the conservation of black-and-white snub-nosed monkey.

Tibetans inhabiting the study region earn a living mainly from grazing livestock (i.e., yak and sheep) on alpine meadows or in coniferous forest and from planting Tibetan highland barley. Traditional culture can influence natural resource management and conservation (Yang et al, 2004; Berks et al, 2000). Slash-and-burn agriculture or shifting cultivation is commonly used by people living in other regions where primates occur (China: east slope of Mt. Baimaxueshan, Zhao, 1996, Xiao et al, 2003; Mt. Huanglian, Xiang et al, 2004; Madagascar: Vargas et al, 2002); however, this agricultural method was not applied in HNNR. As the Tibetan economy is highly dependent on raising livestock, the introduction of slash-and-burn agriculture or shifting cultivation has no impact on increasing income. This, in turn, significantly benefits biodiversity conservation. Additionally, it is likely the Xiaochangdu group will remain stable for many years as their main home range is distributed above 3800 m *asl* (Xiang, 2005) and is located on a local SM.

As the global human population has risen, so too has the prevalence of smaller households. Conversely, however, this has led to a larger number of households and a higher demand for natural resources (Keilman, 2003) resulting from population growth. Larger households, as found for Tibetans, have comparatively less effect on natural resources. Large Tibetan households result mainly from their polyandrous

marriage system, in which several brothers marry the same woman and live together with their parents. Even though population is rapidly increasing (possibly related to no family planning programs in Tibet and increased life-span from economic development and improved medical treatment), the household number is increasing slowly. This, in turn, mitigates the consumption of natural resources, such as extraction wood extraction for house building, cooking, and heating, and benefits conservation.

4 Conclusion

Human cultural diversity has a positive effect on biodiversity conservation. Traditional livelihood strategies of indigenous villagers determine the pattern of natural resource use, which often protects parts of the natural landscape they occupy. For example, Tibetans have to conserve their local forests for livestock breeding and non-timber product collection; and local communities have sacred areas in which most human activities are prohibited. Therefore, traditional culture (including religious belief) has played an important role in the conservation of biodiversity. While increasing household number increases resource consumption from population growth, the special marriage system in HNNR has resulted in fewer households and a resulting increase in conservation. This paper has demonstrated that the Tibetan culture has had a positive effect on biodiversity conservation, especially for snub-nosed monkeys.

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