



Spatial tradeoffs between residents' preferences for brown bear conservation and the mitigation of human–bear conflicts



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ABSTRACT

The present study analyzes the preferences of residents around protected areas for brown bear conservation. We use a discrete choice experiment visualized with regional maps in order to explore preferences for bear conservation across six areas, namely three residential areas, popular tourist sites, and protected areas in Shiretoko Peninsula, Japan. The presented results show that the sampled residents have heterogeneous site-specific preferences. They prefer bear conservation in protected areas and they are more averse to conservation in residential areas. However, they support coexistence with bears in general. Moreover, residents' attitudes become more negative with closer proximity between bear habitats and their residences. In addition, the occupations of local residents also affect their preferences. Those residents that depend on agriculture and commercial fishing have more negative attitudes toward bear conservation relative to those that depend on tourism. Therefore, we conclude that integrating the preferences of residents into zoning management planning helps promote wildlife conservation and resolve potential human–wildlife conflicts.

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1. Introduction

Human–wildlife conflict is one of the largest obstacles to conservation management (Dickman, 2010). In particular, conflicts around protected areas (PAs) are typically the most serious cases. For example, attacks by tigers caused 88 deaths in the Chitwan National Park in Nepal from 1979 to 2006 (Gurung et al., 2008). Similarly, one Cameroonian community has been reported to have lost over half its annual crop and livestock income following damage by wildlife (Weladji and Tchamba, 2003). These incidents and the ensuing economic damage have led to a backlash against wildlife conservation efforts around PAs, negatively affecting the promotion of conservation management (Mishra et al., 2003; Weladji and Tchamba, 2003).

However, despite the existence of potential conflict, the presence of wildlife in the local area also offers benefits to residents (e.g. Chambers and Whitehead, 2003; Naess and Sessions, 1995). In particular, charismatic species such as bears provide

wildlife-viewing opportunities to tourists and visitors. For example, Colt and Dugan (2005) showed that the viewers to Alaska in 2004 spent \$2828 per person on watching bears, which amounted to total revenue of over \$1.5 million. Indeed, this per-capita expenditure was higher than the average amount spent by summer visitors (\$1400). Hence, direct or indirect benefits from the presence of wildlife in PAs generate tolerant attitudes and thus have positive effects on promoting conservation management (Walpole and Thouless, 2005).

Given the foregoing, the designation of PAs can increase not only the risk of conflicts for local residents but also the potential benefits. This risk–reward tradeoff makes it necessary to implement a wildlife conservation plan that is able to maximize the benefits while keeping the risk at an acceptable level for residents. One strategy to balance wildlife conservation and conflict reduction is a spatial arrangement known as zoning management (Linnell et al., 2005). Based on ecological and management knowledge, zoning management classifies habitat in order to control wildlife population and the activities of local residents, thereby improving conservation and resolving human–wildlife conflicts effectively.

The success of zoning management planning depends on the consensus of residents. If the cost of conservation for residents becomes too high compared with the potential benefits on offer, this may antagonize locals and result in increased poaching and stakeholder conflict around PAs (Linnell et al., 2005; Muth and

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Bowe, 1998; Treves et al., 2006). The need to strike a delicate balance between spending on zoning management and the benefits available from doing so suggests that it is important to understand residents' preferences for zoning management.

In this paper, we evaluate the preferences of Japanese residents for brown bear (*Ursus arctos*) zoning in and around PAs on Shiretoko Peninsula by taking account of residents' tradeoffs in bear conservation. Specifically, we examine residents' preferences for bear existence and their relative importance in several sites by using a discrete choice experiment (DCE) approach. In particular, we test the following three hypotheses.

First, we confirm that residents around PAs have tradeoffs in bear conservation, and then test whether the attitudes of residents toward bear existence are overall positive. Although Knight (2000) showed that Japanese residents had negative attitudes toward brown bears, residents around PAs should have both positive and negative impacts from the existence of brown bears. Hence, to understand the tradeoffs of the residents helps to build a successful zoning management. Given the tradeoffs, if the residents do not accept brown bears in the peninsula, it would be difficult to introduce the management strategy aiming for coexistence with brown bears even in and around PAs. Thus, we formulate H1 as follows:

H1: For residents around PAs, the positive attitudes toward bear existence outweigh the negative attitudes in the peninsula.

Second, we test whether residents become more tolerant to bears as the distance between the residence and the bear habitat increases. Although previous studies have found that distances positively affect residents' attitudes toward wildlife (e.g. Karlsson and Sjöström, 2007), few researchers have thus far shown whether the attitudes of residents depend on where the bear habitats are located. Thus, in order to test residents' attitudes using a DCE approach, we formulate H2 as follows:

H2: Residents are more averse to the existence of bears in their own towns compared with the existence of bears in other areas.

The third hypothesis examines whether livelihood also shapes the attitudes of residents. Specifically, if residents live in the gateway city of a national park and depend on tourism to generate local revenue, bears could be an important tourism resource despite the potential for human–bear conflicts. However, to our knowledge, no studies have thus far taken into account this tradeoff from a sociological perspective. Thus:

H3: Residents that directly benefit from the presence of bears through tourism are more tolerant to living in close proximity to bears than others.

Through these research questions, we propose a sociological evaluation method to develop a more effective zoning management model. Furthermore, in this analysis, we discuss the spatial arrangement of both bear habitats and human residences. By testing these hypotheses, we find that the preferences of residents are affected not only by the distance between their residences and bear habitats, but also by the manner in which they earn their livelihoods.

2. Materials and methods

2.1. Study area

Shiretoko Peninsula, our study area, is located at the northeastern edge of Hokkaido, northern Japan (Fig. 1). The peninsula

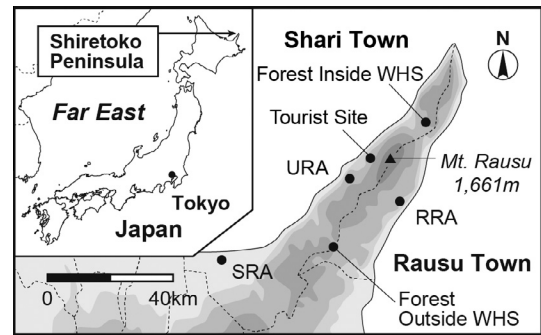


Fig. 1. Location of Shiretoko Peninsula in Japan and the six potential bear habitats in the peninsula (WHS: World Heritage Site, SRA: Shari residential area, RRA: Rausu residential area, URA: Utoro residential area).

consists of two administrative regions: Shari Town (12,636 inhabitants) and Rausu Town (5954 inhabitants).

As a result of the peninsula having rich marine and terrestrial ecosystems, its northeastern part comprises Shiretoko National Park, the core area of which is a World Heritage Site. A subpopulation of brown bears lives in high density in the peninsula (Itoh et al., 2013; Sato et al., 2008). Shiretoko National Park, as a bear habitat, attracts many visitors, making this wildlife one of the most important tourism resources in the peninsula. Indeed, Yamanaka (2007) estimated that bear-related tourism revenue in the peninsula surpasses 300 million yen (approximately \$3 million) every year.

However, conflicts between bears and local residents often occur. Although the peninsula has suffered only two fatal accidents since 1970 (both victims were hunters; unpublished data), the frequency of encounters between bears and human in the peninsula is extremely high compared with other areas in Japan. In 2011, for example, there were approximately 1000 bear encounters in the peninsula (unpublished data). Thus, residents face a common risk of injury. Additionally, agricultural and fishery damage poses serious problems in the peninsula. For example, the annual cost of agricultural damage was estimated to be over 24 million yen (\$240,000) in 2005.

Because bears appear randomly across the whole peninsula, from the World Heritage Site to residential areas, the managers involved in wildlife and park management are considering zoning management schemes. For zoning management planning, the peninsula can be divided into six areas: the Shari residential area (SRA hereafter), the Rausu residential area (RRA hereafter), the Utoro residential area (URA hereafter), popular tourist sites (primarily represented by Shiretoko Five Lakes), the forest in the World Heritage Site, and the forest outside the World Heritage Site (Fig. 1).

SRA and RRA have a concentration of residents in both Shari Town and Rausu Town, respectively. The main industry in SRA is agriculture since this area has a larger amount of flatlands composed of many agricultural lands compared with the other areas studies herein. In RRA, the main industry is commercial fishing, which employs over 60% of the workers in the region. URA, located in Shari Town, is the gateway city that receives most park visitors and has 80% of the visitor accommodation capacity in Shiretoko Peninsula. In addition, URA supplies approximately 900 bear-viewing cruises every year (Ministry of the Environment, Government of Japan, 2010). Thus, its main industry is tourism. Tourist sites, notably the popular Shiretoko Five Lakes attraction, are located across the national park and these received approximately 1.7 million visitors in 2011. The forest in the World Heritage Site is located in the northeastern part of the peninsula and the forest outside the World Heritage Site is located in the

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