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Social challenges of spatial planning for outdoor cat management in Amami Oshima Island, Japan

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HIGHLIGHTS

- We assessed residents' attitudes toward outdoor cats and the management across areas.
- Forest was least preferred as a cat habitat among the three areas.
- Lethal options was unacceptable, whereas trapping and adoption was acceptable in all areas.
- The attitudinal differences were found between the cat-owners and non-owners.

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ABSTRACT

Outdoor cats pose substantial threats to native biodiversity, especially on islands. However, cats also provide benefits to people, such as companionship and the killing of pests. Thus, management of outdoor cats is controversial and can lead to conflicts among stakeholders. Although previous studies have examined stakeholders' preferences for outdoor cats and their management, little is known about the differences in their attitudes toward cat occurrences and management across habitats. Identifying these attitudinal differences would provide useful knowledge for policy makers about zoning management. We conducted structured interviews with residents in Amami Oshima Island, Japan, to evaluate the residents' attitudes to outdoor cats' occurrence and their management across habitats (Forest, Rural, and Town areas). Furthermore, we compared the attitudes of cat-owners and non-owners. The results show that the Forest was least preferred as an outdoor cat habitat. Lethal options as a management strategy were unacceptable to the residents, whereas adoption was acceptable in all areas. Cat-owners showed a significantly higher acceptance toward outdoor cats in Town and Rural areas than did non-owners; they also showed a lower acceptance of lethal options and a higher acceptance toward Trap, Neuter and Return (TNR) than non-owners. These findings imply that it is difficult to achieve consensus regarding outdoor cat management, especially in town and rural areas; however, outdoor cats from these areas move to the forests and pose a threat to the endangered species. Communication efforts with both cat-owners and non-owners should fill these attitudinal gaps among stakeholders and lead to effective management.

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1. Introduction

Outdoor cats (*Felis catus*), including all feral/stray cats and free-roaming owned cats, are a significant challenge to biodiversity conservation efforts worldwide (Lepczyk et al., 2004; Lohr and Lepczyk, 2014; Wald and Jacobson, 2013). One of the most serious issues is the predation of native species, which is done by cats not only in the wilderness but also in urban and rural areas. For example, May and Norton (1996) and Nogales and Medina (1996) have shown that native species are the primary food source for feral cats in the forest areas of Australia and Spain. In the UK, one cat killed 21 prey animals in two months, including five mammal and 10 bird species in urban areas (Baker et al., 2005). Lepczyk et al. (2004) have pointed out that outdoor cats are responsible for the predation of birds in rural areas, even when the population density of cats is low. They also mentioned that outdoor cats kill numerous bird species in both rural and urban areas. As a result, outdoor cats are now regarded as one of the most dangerous invasive species (Lowe et al., 2000). Particularly on islands where there are no predators, such as carnivorous mammals, and within an enclosed space, cats can cause serious disruption the ecosystem. Studies have shown that outdoor cats had a negative impact on at least 175 wildlife species in 120 islands (Bonnaud et al., 2011; Medina et al., 2011). For example, in New Zealand, it is estimated that over 16 million animals are killed each year by cats (Medina et al., 2011). About ten petrel species have gone extinct worldwide because of cats (Derenne and Mougou, 1976). It is necessary to implement management strategies, such as lethal options, for outdoor cats, to conserve biodiversity and restore native ecosystems (Bester et al., 2002). Previous studies have reported that native ecosystems and populations of endemic species (e.g., petrel species) have recovered after the elimination of outdoor cats (Bester et al., 2002; Hughes et al., 2008; Ratcliffe et al., 2009).

In addition to the above-mentioned issues, outdoor cats have a substantial negative impact on human living. For example, cats transmit diseases not only to livestock but also to people (Tenter, 2009; Torrey et al., 2007). Outdoor cats are a nuisance in urban neighborhoods because they depredate yards, cause trouble to pets, and deface property (Toukhsati et al., 2012).

On the other hand, cats are one of the most popular companion animals worldwide and have several positive roles in human lifestyles (Hall et al., 2016). Cats comfort people, and interactions with cats, including outdoor ones, relieve people from stress and improve human health (Brickel, 1979; Siegel, 1990; Wood et al., 2007). Wald et al. (2013) have reported that cats provide significant benefits to humans; they kill mice and other pests, thus reducing the risk of disease spread. As a result, many people tend to have a positive feeling about cats. In addition, pet cats provide their owners with opportunities to build social connections among themselves (Brickel, 1979; Siegel, 1990; Wood et al., 2007), and to helping children learn about responsibilities (Melson, 2003; O'Haire, 2010, 2013).

Therefore, in order to promote biodiversity conservation by managing outdoor cat populations, it is important to consider the positive and negative aspects involved; otherwise, it could pose conservation conflicts among stakeholders (Stokes et al., 2006). Area-specific, tailor-made outdoor cat management strategies should be developed, considering the ecological aspects as well as sociological situations. For instance, in New Zealand, lethal control of cats is a common approach to conserve island ecosystems (Bloomer and Bester, 1992). By contrast, Trap-Neuter-Return strategy (hereafter, "TNR") is often used in the United States (Levy et al., 2003; Loyd and Miller, 2010). Trapping and adoption of outdoor cats (i.e., finding new cat owners after live-capturing outdoor cats; hereafter, "adoption") is a common approach to conserve sea birds in Ogasawara and Teuri Islands in Japan. The ecology of cats in an area can be affected by the human behavior and customs of the place (Gramza et al., 2016; Shionosaki et al., 2016); for example, Shionosaki et al. (2016) indicated that feeding outdoor cats can change their actions and habitats in Amami Oshima Island; thus, it is necessary to obtain public support for managing outdoor cats and attitudinal gaps for the successful conservation of biodiversity.

Taking into account awareness of the aforementioned issues, some previous studies have investigated public attitudes toward cats and their management. Loyd and Miller (2010) showed that people living in rural areas preferred lethal options when compared to people living in urban areas, and women were less accepting of the lethal option than men. There have been many studies that involve comparisons between cat-owners and non-owners. Hall et al. (2016) and Thomas et al. (2012) evaluated the public attitude with respect to cats' interactions with wildlife. Their results showed that non-owners tended to affirm that pet cats were problematic if they killed wildlife species, something that the cat-owners generally did not agree with. Levy et al. (2003) investigated the proportion of people who fed free-roaming cats; they reported that about three-quarters of people fed outdoor cats and half of those that fed free-roaming cats were non-owners. Dabritz et al. (2006), Lepczyk et al. (2004), and Wald et al. (2013) found that cat-owners preferred TNR more than did non-owners. Cat-owners also tended to have a more negative opinion regarding the introduction of regulations on how to keep cats, especially people living in rural areas (Calver et al., 2007; Lord, 2008). However, very little attention has been paid to public attitudes about managing outdoor cats in different habitats.

The purpose of this study was to understand residents' preferences for management of outdoor cats in Amami Oshima Island, Japan. This island is a biodiversity hotspot; there are more than one thousand endemic species in the Amami Islands, including Amami rabbits (*Pentalagus furnessi*), which are listed as "Endangered" on the IUCN Red List of Threatened Species (Amami Oshima Island, 2015; Yamada and Sugimura, 2008). Moreover, there are no predators or carnivorous mammals in Amami Oshima Island, excluding alien species. The Japanese government will register the island as a national park in 2017 and aims for it to obtain the status of a World Natural Heritage Site in the future (Ministry of the Environment, 2016). However, so far, outdoor cats have threatened the endemic species, especially in the forest areas, and undermine the native biodiversity. Shionosaki et al. (2015) showed that cats were predators of Amami rabbits and Amami spiny rats, both endangered endemic species. Furthermore, it has been estimated by the Ministry of the Environment (2016) that there

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