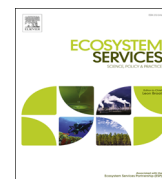




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Perceived landscape values in the Ogasawara Islands

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ABSTRACT

The ecologies, economies and societies of remote islands are characterized by their vulnerability to external shocks. This vulnerability stems from the limited available resources on these islands. For this reason, it is important to have a careful balance between the use and protection of remote island resources. Understanding the needs and values of all stakeholders in development and protection policy making is vital for a robust outcome. Citizen participation has been underrepresented in Japanese remote island policies, and this study displays a method for collecting and sharing quantitative and spatial information on values that residents perceive in their environment. Landscape values are used in quantifying residents perceived values. The results of this study show how residents of Ogasawara value their environment, how these values have changed in the past five years and what places are especially important in each landscape value category. Quantitative information on values, and spatial distribution of values on different land use zones form a potential knowledge base for better informed policy decision making. The method used in this study is a promising methodology to mapping and quantifying cultural ecosystem services that are often underrepresented in ecosystem services assessments.

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1. Introduction

1.1. Background

Islands are naturally bound by their geography. Due to their detached natures, perhaps the most common denominator for remote islands and small island states is their vulnerability to external changes. These changes come in many forms, such as natural disasters or upheavals in economic markets (Adrianto and Matsuda, 2004; Briguglio, 1995). In the case of economic disturbances, the tendency of island economies to rely on small-scale and often specialized production of goods is their main cause of economic vulnerability. Especially in Japan, the residents' main income sources on remote islands are often directly (fishing, agriculture) or indirectly (tourism, service sector) dependent on those islands' natural environments.

Dependency on local resources and finding a balance between use and conservation has been previously studied (Ma et al., 2013, 2012; Wang et al., 2013; Zhang et al., 2012) and is highly sensitive, especially on remote islands. The case of economic growth leading to environmental destruction on the Galapagos Islands is a typical

example of natural resource overuse (Taylor et al., 2008). Environmental changes related to climate change are projected to further increase remote islands' vulnerability (Hills et al., 2013; Rubis and Nakashima, 2014). Environmental vulnerability is apparent in the case of Ogasawara in that it is hit by 5.4 typhoons per year on average, which is second only to the Okinawa prefecture (7.4 per year) in Japan (Japan Meteorological Agency, 2010).

Economic and ecological sustainability have been studied in island settings, especially in the case of tourism activities (Martínez-Iglesias et al., 2014; Saito, 2013). Similar to the Galapagos Islands study by Taylor et al. (2008), finding a balance between a thriving economy and resource use is argued to be the key to economic and environmental sustainability. Studies that examine cultural and societal ecosystem service values on islands do exist (Smith, 2014), but they are few, especially in Japan.

Because remote islands' resources are limited, their use and protection need to be carefully balanced. It is therefore important to know which resources remote island residents can find in their environment. We assume that conflicts in resource use and protection can be avoided by incorporating residents' values into decision making. Furthermore, the ability of all stakeholders to work together for sustainable outcomes in environmental protection and resource use on remote islands is of paramount importance.

To this end, the aim of this study is to "make environmental protection and land use policies in Ogasawara more sustainable by

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incorporating residents' values better into these policies." This aim is based on the argument that considering the residents' opinions in policymaking is a means to more robust and successful outcomes (Kasemir et al., 2003) and can therefore serve as a fundamental method to achieve sustainable policy outcomes (Innes and Booher, 2004; Reed, 2008). By examining what the residents of Ogasawara value in their environment, particularly in their natural environment, this study introduces a method for collecting and disseminating information on the residents' values regarding their natural environment to enable better-informed policymaking.

1.2. Sense of place and landscape values

Sense of place is used here as the governing concept in the collection of information on residents' values regarding the natural environment. Sense of place can be defined as a collection of meanings, beliefs, symbols, values, and feelings associated with a place (Williams and Stewart, 1998). This concept has been posited as having the potential to close the gap between ecosystems' assessment and their management by recognizing people as part of ecosystems (Mitchell et al., 1993; Williams and Stewart, 1998). Brown (2004) argued that qualitative data, which is widely used for studying sense of place, is insufficient in spatial analyzes, which are needed for efficient resource management and, in the case of this study, for discussing land use and environmental protection in spatial terms. Hence, this study represents sense of place quantitatively in the form of landscape values.

The concept of landscape values is used to link places with a certain trait or quality to the underlying reasons why these places have value. The concept of landscape values was first introduced by Rolston and Coufal (1991), and the set of values was further expanded by Brown (2004). The concept of landscape values has come to be used in several other studies mapping social-ecological and community values (Alessa et al., 2008; Hashimoto et al., 2015; Raymond et al., 2009; van Riper et al., 2012).

In this study, landscape values closely follow those of Brown (2004), in a set of fourteen values representing the ways in which people perceive benefits, or ecosystem services in their surroundings. The concept of landscape values is thus used to represent ecosystem services and other societal values. Social values are rarely mapped using Geographic Information System (GIS) (Ryan, 2011), and there is a need for improved quantitative assessment, especially in the case of cultural ecosystem services (Norton et al., 2012; Plieninger et al., 2013). This study displays the potential of landscape values for use in assessing values that people perceive in their environment, including ecosystem services.

Especially, in the local context of Ogasawara, introducing a new public participation method for assessing environment is timely. Improving public participation in decision making and finding methods to enable public participation have been explicitly mentioned in the Ogasawara Village Comprehensive Plan (OVCP) (Ogasawara Village, 2014). OVCP is built upon the Act on Special Measures concerning the Development of Ogasawara Islands (Tanaka, 2014). The Act concentrates on infrastructure development, but it mentions the need for adequate consideration of environmental protection as well (Ministry of Internal Affairs and Communications, 2014). Landscape values based environmental assessment is a method that addresses the need for a new public participation method and has potential to contribute to environmental protection as well.

2. Methods

2.1. Case study site: Ogasawara Islands

The Ogasawara Islands are a group of over 30 sub-tropical islands approximately 1000 km to the south of Tokyo in the western Pacific Ocean (IUCN, 2011). The islands consist of four archipelagos and a number of isolated islands. This study focuses on three of the four archipelagos: Mukojima, Chichijima, and Hahajima. These archipelagos form a sub-category of *Ogasawara Shoto* (the name for all of Ogasawara's islands) called *Ogasawara Gunto*. Both *Ogasawara Gunto* and *Ogasawara Shoto* are translated as Ogasawara Islands, but in this study, the term Ogasawara Islands are used exclusively to indicate the sub-categorization *Ogasawara Gunto*. The definitions for the Ogasawara Islands are displayed in Fig. 1.

Ogasawara Islands' natural environment is unique, featuring a wide variety of endemic species. This fact was acknowledged by UNESCO when it nominated the islands as a World Heritage Site in 2010 based on criterion (x) (IUCN, 2011). The islands have enjoyed a status as national parks since 1972 (Ministry of the Environment, 2014a). National Park-protected areas and significant locations is shown in Fig. 2 (Biodiversity Center of Japan, 2014; Esri Japan, 2011; Geospatial Information Authority of Japan, 2014; Ogasawara Islands Nature Information Center, 2014). The total area of the *Ogasawara Shoto* is 104.41 km² (Tokyo Metropolitan Government, 2014a), of which 63% is designated as Ogasawara National Park (Ministry of the Environment, 2014a). The UNESCO World Heritage site covers 6358 ha on land and 1581 ha of the sea (IUCN, 2011). The terrestrial World Heritage land area accounts for 56% of the total land area. The climate in Ogasawara is maritime subtropical with small temperature fluctuations throughout the year.

Only two of the islands, Chichijima and Hahajima, are inhabited, with the total population being 2538 (Tokyo Metropolitan Government, 2014b). The population has been growing with an 11% year on year rate 2005–2012. The share of population of over 65 years old is 12.7%, which is approximately half of the Japanese average of 25.1%, explained partly by a high birthrate (2.1 in 2012) in the Japanese context (national average 1.4 in 2012) (Ministry of the Environment, 2012). The service sector in Ogasawara supports 75% of the workforce, which shows the importance of tourism to the islands' economy (Ministry of Land, Infrastructure, Transport and Tourism, 2006).

2.2. Questionnaire survey

The primary method used to collect landscape value information in this study was a questionnaire survey. The survey was conducted during May 15–24, 2014 among persons aged 20 years or older. The survey was conducted with the help of four residents of the islands utilizing the snowball sampling method (Goodman, 1961). The number of returned questionnaires was 199, which corresponds to 8.7% of the adult population of Ogasawara (Statistics Japan, 2010). Of the respondents, 101 (52%) were men and 95 (48%) were women. The most frequent respondent age group was 40–49 years of age. Of the respondents, 16 were born in Ogasawara and 182 were born elsewhere, while 160 (80%) respondents lived on Chichijima and 39 (20%) respondents lived on Hahajima. This accurately reflects the population ratio of residents living on Chichijima and Hahajima (Ogasawara Village, 2012). The average number of years the residents lived in Ogasawara was 15.4. The number of respondents living in a household with minors (under 18 years of age) was 98 (49%), and 101 lived in households without minors (51%). The number of households with minors was 548 (41%), and 786 households did not include minors (59%). Of the respondents, 46 (23%) were high school graduates, 37 (19%) were vocational school graduates, 84 (42%) were university

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