An evaluation of the natural environment ecosystem preservation policies in Japan

Masaya Fujino [a,*], Koichi Kuriyama [a], Kentaro Yoshida [b]

[a] *Graduate School of Agriculture, Kyoto University, Kitashirakawa-Oiwakecho, Sakyo-ku, Kyoto, Japan*
[b] *Faculty of Environmental Science, Nagasaki University, 1-14 Bunkyo-machi, Nagasaki, Japan*

ARTICLE INFO

ABSTRACT

In this study, we evaluate the Japanese biodiversity conservation policy using a set of choice experiments. We use a random parameter logit model and a latent class logit model to assess the marginal willingness to pay for environmental protection. The main results are as follows. First, we show that respondents clearly exhibit heterogeneous preferences regarding the biodiversity conservation policy. Therefore, a conditional logit model, which assumes the same parameters for all respondents, overestimates the marginal willingness to pay for biodiversity conservation. Second, using the random parameter logit model, we show that the marginal willingness to pay for a 1% improvement in forest conservation is 196 yen; 2,357 yen for farmland conservation; 85 yen for natural parks protection; 1,113 yen for wetland conservation; and −132 yen for endangered species protection. Third, using the latent class logit model, we identified 14 categories of respondents and showed that the utility parameters are significantly different across classes. Therefore, we expect a high probability of conflict in the implementation of biodiversity conservation policies due to substantial differences in the preferences of agents.

© 2017 Department of Forest Economics, Swedish University of Agricultural Sciences, Umeå. Published by Elsevier GmbH. All rights reserved.

Introduction

The importance and the value of ecosystem services are discussed in "The Economics of Ecosystem and Biodiversity" (Kumar, 2010). The value of ecosystem services is expected to be reflected in environmental conservation policies. However, the existing evaluation studies have often focused on specific areas or species (Bienabe and Hearn, 2006; Echeverria et al., 1995; Fankhauser, 1994; Garcia et al., 2009; Pouta et al., 2000). Bartkowski et al. (2015) reviewed the existing literature on biological diversity. While project evaluations often focus on specific areas, environmental policies, such as the development control and endangered species preservation, have a global impact. Therefore, being able to evaluate the environmental policy of a nation is essential for policymakers.

A possible way to assess the outcomes of environmental policies implies aggregating local results at the national level. However, this approach cannot identify the heterogeneous effects of the environmental policy across different regions, and it may overestimate its effects in cross-regional areas. Therefore, the most common way to assess the value of ecosystem services is to estimate the citizens' willingness to pay (WTP) for the national environmental policy using the contingent valuation method and the choice experiment. The environmental change to be evaluated is represented by one attribute in the contingent valuation method, and it is characterized by many attributes in the choice experiment (Louviere and Woodworth, 1983; Louviere et al., 2000). Therefore, the choice experiment seems suitable for the evaluation of the natural environment ecosystem preservation policies as those strategies contributed to many individual policies. While, in theory, the administration of a survey allows a straightforward evaluation, respondents may be not completely aware of the national environmental policy and may have heterogeneous preferences.

Many studies focused on the economic evaluation of ecosystem services. However, the application of evaluation studies is rather limited in Japan (Aizaki et al., 2006; Kuriyama, 1998; Mitani et al., 2008; Tsuge and Washida, 2003). Therefore, the country urgently needs a methodology to evaluate the importance of biodiversity preservation and reflect its value in conservation policies.

---

* Corresponding author.
E-mail address: fujino@kais.kyoto-u.ac.jp (M. Fujino).

The aim of this study is to provide the necessary conditions for assessing the Japanese environmental policy at the national level, to evaluate the existing policies taking into account the heterogeneity of preferences, and to verify the effectiveness of the current national environmental policy evaluation in Japan. The conservation of the forest, farmland, national parks, wetland, and endangered species are the focus of the national environmental policy. While the mixed logit model and the latent class model have been commonly used in recent studies, we assess the economic value of biodiversity preservation through a choice experiment to better identify the role of heterogeneous preferences.

Japanese environmental policies

In the mid-1950s, Japan entered a period of rapid growth. Throughout the 1960s, growth averaged 10%. However, in the same period, the most significant industrial pollution cases occurred, which were named the "big four"—the Kumamoto Minamata Disease case, the Niigata Minamata Disease case, the Toyama Itai-Itai Disease case, and the Yokkaichi Asthma case (Kawashima, 1994). These accidents attracted significant attention in Japan in the 1960s. As a result, a number of environmental laws have been introduced and the Environment Agency was created, in 1971 (Wallace, 1995).

In the 1970s, industrial pollution control measures have been advanced by the enforcement of these laws. With the advent of the oil crisis, new energy saving measures have been introduced. As a result, industrial pollution issues have been largely addressed in the 1980s. However, environmental issues of different magnitudes have been inherited from the previous decade. Although these problems did not represent significant health risks, they severely affected the quality of life, as in the case of waste disposal and lack of preservation of the forest area. In addition, in many cases, the source of contamination had spread widely. In the 1990s, global issues were raised, such as ozone depletion and acid rain, and these could not be solely addressed by domestic measures. Both global and domestic issues became large and complex. In particular, global warming became a pressing issue. In 1997, at the 3rd Conference of the Parties to the United Nations Framework Convention on Climate Change held in Kyoto, greenhouse gas reduction targets were set. This set of agreements is known as the Kyoto Protocol. Furthermore, in 2010, the 10th Conference of Parties to the Convention on Biological Diversity was held in Nagoya, confirming the importance that environmental conservation gained in Japan.

Until the 1980s, the environmental policy in Japan focused on pollution. Therefore, The Ministry of International Trade and Industry (MITI), the Ministry of Construction (MOC), the Ministry of Health and Welfare (MHW), and the Ministry of the Environment (MOE) have been working together. Since the 1990s, global issues were treated by the Ministry of Foreign Affairs (MOFA) and the MOE, domestic issues were addressed by the Ministry of Land, Infrastructure, Transport and Tourism (MLIT), the MOE, and other ministries. In March 2011, the Great East Japan Earthquake and the Fukushima nuclear plant disaster caused severe damage to life, industries, and natural resources.[1]

In this study, we focus on the conservation of forest, farmland, natural parks, wetland, and endangered species. These have been recognized as fundamental issues, especially in recent years, in Japan. The problems related to forest conservation are treated by the Forestry Agency (FA), farmland is addressed by the Ministry of Agriculture, Forestry and Fisheries (MAFF), and natural parks and endangered species are addressed by the MOE. Wetland is not treated by specific ministries, but the MLIT, MAFF, and MOE

Table 1
Attributes and levels used in the choice experiments.

Attributes	Levels
Forest	maintain the current situation (3%)
	double the current situation (6%)
	extend the current level five times (15%)
	reduce the current level by one-half (1.5%)
Farmland	maintain the current situation (0.2%)
	double the current situation (0.4%)
	extend the current level five times (1.0%)
	reduce the current level by one-half (0.1%)
Natural park	maintain the current situation (9%)
	double the current situation (18%)
	reduce the current level by one-half (4.5%)
Wetland	maintain the current situation (0.3%)
	double the current situation (0.6%)
	extend the current level five times (1.5%)
	reduce the current level by one-half (0.15%)
Endangered species	maintain the current situation (30%)
	improve the current situation (20%)
	worsen the current situation (40%)
Cost	0 yen, 1,000 yen, 2,000 yen, 5,000 yen, 10,000 yen, 20,000 yen

are accountable for it. However, concerns have arisen as a number of other ministries and agencies only carry out sectorial environmental protection activities (Imura, 1997). Moreover, the opinions of citizens are mostly not taken into consideration when policies are designed. Although the Basic Environmental Law and the Basic Environmental Plan have been introduced, environmental policies that comprehensively incorporate citizens' opinions are needed in Japan.

Methodology

Survey design and implementation

To assess the value of the national biodiversity preservation policy, we considered the conservation of forest, farmland, natural parks, wetland, and endangered species as the evaluation target. The selected attributes and their levels are reported in Table 1.

Forest

We used the proportion of forestry preservation area over the whole country's forest to build the variable *Forest* and to account for the biodiversity of forestry ecosystem protection zones. In 2009, the forestry preservation area was equal to 781,000 ha, corresponding to about 3% of the 25,097,000 ha of the national forest area (Forest agency, 2009). We assumed this as the current state, and we considered several scenarios: maintain the current situation, double the current area, extend the current area five times, and reduce the current level by one-half.

Farmland

To build this variable, we used the proportion of environment conservation land over the whole cultivated land throughout the country. As of April 2009, the field area certified by the organic JAS[2] system was 2810 ha of rice and 5777 ha of crop, which corresponds to 0.2% of the total area of cultivated land in Japan (MAFF, 2009). We assumed this as the current state, and we considered the following scenarios: maintain the current situation, double the current area, extend the current area five times, and reduce the current level by one-half.

---

[1] However, the impact of these events is not discussed in this paper.

[2] Japan Agricultural Standards.