Analysis of Biodiversity Offset for Road Projects in Japan

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Abstract: In Japan, Environmental Impact Assessment Law was enforced in 1999. This law required developers to consider how to avoid, reduce, and compensate the adverse impacts on natural environment under the purview of mitigation hierarchy. However, whether biodiversity offset projects are implemented or not depends on developers. In addition, various biodiversity offset projects have been conducted by developers through trial and error because the assessment and planning method of biodiversity offset has not been established in Japan. Therefore, the purpose of this research is to analyze the current situation regarding biodiversity offset projects focusing on road projects that was applied Environmental Impact Assessment Law all over Japan from various viewpoints such as maintenance, monitoring, cost, and public involvement as well as the planning methods of biodiversity offset projects. The analysis was performed through a questionnaire administered to developers and field surveys were conducted at some offset sites. The reason why authors focused on road projects is because there are many biodiversity offset cases among development projects. Consequently, this research could clarify the recent implementation method of biodiversity offset projects for road projects and highlights the issues and future tasks.

Keywords: *Biodiversity Offset, Road Projects, Mitigation,*

1. INTRODUCTION

The Environmental Impact Assessment Law enacted in 1999 in Japan made it obligatory to predict and evaluate potential environmental impacts resulting from the implementation of development projects and to consider possible mitigation measures in the order of priority as follows: avoiding, reducing, and compensating for adverse impacts. Compensation, which is recently called biodiversity offset, refers to a conservation activity such as creation of an artificial environment, transplanting, and other actions to compensate for the adverse environmental impacts that remain even after steps have been taken to avoid or reduce them. Since the enactment of this law, biodiversity offsets have been implemented across the country as a part of environmental conservation measures, but the current status of these activities is not yet well understood. Given this situation, we focused on biodiversity offsets in road projects to which the Environmental Impact Assessment Law has been applied so as to identify significant issues and future tasks.

2. LITERATURE REVIEW

Among past research activities on biodiversity offset, many existing studies (e.g., Hasegawa and Hayashi, 2014; Tanaka, 2012; Tanaka and Isoyama, 2011; Tanaka, 2010; Fukuda et al., 2003, Okada et al., 2001) have clarified current approaches to mitigation hierarchies, policy, and projects, including biodiversity offset in the United States and Australia. Moreover, Ito and Fukuda (2005), Tanaka (1999), and Tanaka and Ohtaguro (2010) tried to examine introducing biodiversity offset policy and biodiversity bank that can be carried out biodiversity offset smoothly in Japan, and then indicated some issues and future tasks. A few prior studies have investigated actual environmental conservation projects, including similar biodiversity offset projects, in Japan. For example, Ashi et al. (2013) defined compensation in the context of the Environmental Impact Assessment Law and related bylaws and reported the trend of activities similar to biodiversity offsets in Japan. Shishikura et al. (2005) researched compensation activities in Shiki city, Saitama prefecture and identified steps to improve the compensation activities implemented in Japan. Ito et al. (2004) conducted a field survey and interviews to clarify the implementation status of roadside ecosystem conservation projects all over Japan. However, few studies have focused on the current situation of biodiversity offset in road projects to which the Environmental Impact Assessment Law has been applied.

3. METHODOLOGY

3.1 Selection of Road Development Projects

We focused on road development projects because many of them have involved an environmental assessment and also because they can have a potentially significant negative impact on fauna and the ecosystem by fragmenting the area through which the roads pass, since the roads are constructed linearly as opposed to other types of projects that entail areawide development. The methodology to select road projects in our research is as follows. First, we accessed the website of a project search service provided by the Environmental Impact Assessment Network within the Ministry of the Environment and searched for road projects across Japan in which an environmental assessment was carried out. After examining the environmental protection measures in each project, we identified 51 projects in which a biodiversity offset may have been carried out. We then excluded projects on which construction had not yet started, narrowing the sample to 18 projects that were subject to the Environmental Impact Assessment Law and involved a biodiversity offset.

3.2 Analysis of Implementation of Biodiversity Offsets

We asked these 18 project proponents to answer our questionnaire by mail in order to examine the implementation of biodiversity offsets in road projects. We received valid responses from 8 project proponents. The questions on the survey covered names of species to be protected; detailed actions for avoiding, reducing, and compensating (via biodiversity offsets) for the potential environmental impacts; planning and evaluation methods; implementation of follow-up work at the compensated sites; and costs. After conducting the written survey, we followed up with phone interviews to ask further questions about the replies provided. Furthermore, we visited some of the sites where a biodiversity offset had been undertaken and interviewed persons responsible for the projects in order to examine the circumstances of the affected sites and their surrounding environment as well as the progress of the compensatory activities.

4. RESULTS

Table 1 shows the results of the questionnaire. The survey found that, on some projects, compensation was undertaken in conjunction with some actions to avoid or reduce negative impacts on the environment. In several cases, a reduction of the project size and a routing change were considered at earlier stages of planning as ways to mitigate environmental impacts. In fact, we found only one project that adopted bridge and tunnel structures at the detailed design stage after the route had been

decided in an attempt to reduce the potential environmental impacts.
Figure 1 shows a classification of flora and fauna that were identified for protection. Many of these identified flora and fauna are listed in the Red Data Book.
Figure 2 shows the implementation of the follow-up work and public involvement after a biodiversity offset. For the follow-up work, project proponents who transplanted vegetation were found to be maintaining the environment of the transplanted sites and making sure that individual vegetation took root in the new environments. In addition, maintenance and monitoring were conducted in road projects of more than 62.5%, but there are not many road projects public participated.

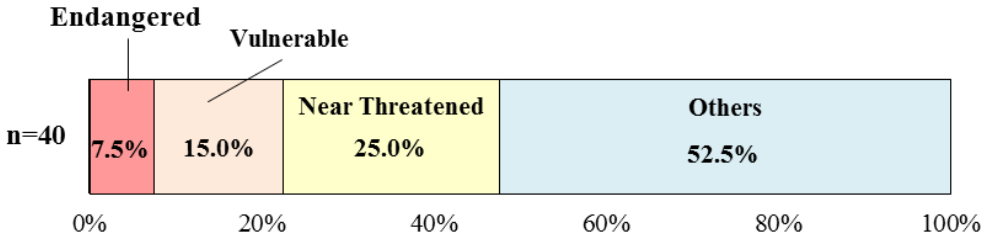

Figure 1. Classification of flora and fauna targeted in similar biodiversity offset for protection

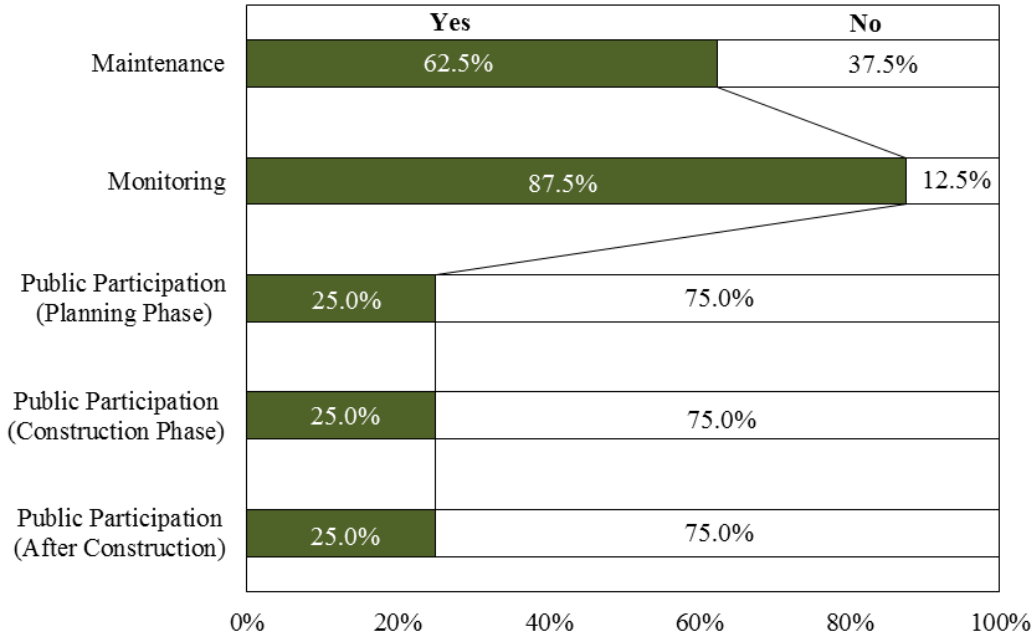

Figure 2. Implementation of follow-up work and public involvement

Regarding the movement of animals and their habitats, the project proponents were found to be proactively checking the population of the animals and their habitats. Although some projects offered opportunities to discuss the biodiversity offset activities with local delegates and experts and to present information to local residents, these were not the majority. Generally, there were not many opportunities for local residents to become involved in the projects. This could be explained by the project proponents' concern that such public involvement might enable the local people to identify the locations of the sites to which the precious flora and fauna were relocated. Because there is a possibility that causes illegal capture of endangered species. Planning and evaluation methods appeared to differ from one proponent to the next. We found only one case in which the ecosystem evaluation method known as "Habitat Evaluation Procedure" was adopted. In the future, it will be necessary to establish an assessment method for planning of mitigation and biodiversity offset activities and for evaluating the potential environmental impacts in Japan.

Table 1. Survey results of biodiversity offset in road projects

	Case1 (Hokkaido)	Case2 (Hokkaido)	Case3 (Tohoku)	Case4 (Kanto)	Case5 (Kanto)	Case6 (Kanto)	Case7 (Kanto)	Case8 (Kyushu)
Avoid	Avoiding & Minimizing land form (vegetation change)	Avoiding & Minimizing land form (vegetation change)	Avoiding & Minimizing land form (vegetation change)	Construction with avoiding breeding season	–	–	Instllation of invasion prevention fence, slope of water drain gutter	–
Minimize				–	–	–	–	Instllation of temporary fences & culverts for crossing for animals
Compensation (Plants)	Transplanting *Adonis ramosa*	Transplanting *Dryopteris laeta*	Transplanting *Vallisneria natans* & *Tipularia japonica Matsum*	-Transplanting *Goodyera schlechtendaliana, Acer ginnala Maxim, Disporum viridescens* . -Moving the larva of *Sasakia charonda* to other *Celtis sinensis*	Transplanting *Gastrodia gracilis*	–	Transplanting *Salix bakko, L. greatrexii, Senecio pierotii* & *Bletilla striata*	Transplanting *Thelypteris cystopteroides, Senecio pierotii* & *Sceptridium ternatum*
Compensation (Animals)	–	Installation of nesting boxes for *Sciurus vulgaris orientis* & *Pteromys volans orii*	–		Installation of nesting boxes for *Accipiter gentilis*	Installation of nesting boxes for *Accipiter gentilis*	Developing artificial reed field for rare marshy birds	Development of artificial ponds for *Hynobius nebulosus*
Plannning & Assessment Method for Biodiversity Offset	–	Plannning & assessment by roundtable committee for environmental conservation	-Comparative examination of environmental conservation projects after literature review and field survey -Evaluation of appropriateness based on results of monitoring survey & situation of environmental conservation projects with advices by experts	-Implemention of transplant based on advices from experts in review meeting -Assessment of growth condition by monitoring survey for 3 years after transplant	-Assessment of transplanted area after road construction -Assessment of breeding and flying situation of *Gastrodia gracilis*	-Selectiion of appropriate compensation area to install nest boxes for after field survey of behavioral range of *Accipiter gentilis* and forest near roadside -Survey of usage status of installed nesting boxes by video camera	Plannning & assessment by Habitat Evaluation Procedure (HEP). Developer aimed to compensate reed field by twice value	Field survey of breeding area of Hynobius nebulosus before road construction Selection of appropriate compesation area near roadside under advices from experts
Maintenance	–	-Pruning around offset area -Maintenance of nesting boxes	–	–	Mowing at compensation area every year	Cutting down trees for securing flying route of Accipiter gentilis	Removement of *Solidago altissima* and *Salicaceae*	Removal of soil deposited at developed artificial ponds
Monitoring	–	-Checking Vegetation Growth Condition -Survey of usage status of nesting boxes	-Checking rooting situation of transplant, bloom condition and fruition condition	-Checking rooting situation of transplant, bloom condition and fruition condition by monitoring survey -Counting number of overwintering larva by monitoring survey	Monitoring survey of transplannted vegetation	Monitoring survey of usage status of artificial nesting boxes by CCD camera	-Monitoring & field survey of rooting situation of developed reed field by -Field survey of water quality &aquatic organism that becomes prey for rare marshy birds every year	-I10Monitoring survey of *Hynobius nebulosus* using individual body-identifying tool by microchip. -Monitoring soil's deposition state
Public Participation (Planning Phase)	Advice from roundtable committee members of neighborhood area for landscaping	Implementation of explanation meetings to residents & public hearing at DEIS phase	–	–	–	–	–	–
Public Participation (Construction Phase)	–	Discussion among roundtable committee members including the mayor, academics, residents' representatives, well-informed persons for environmental conservation	–	–	–	–	Planting *Phragmites australis* with local boy scouts	–
Public Participation (After Construction)	–	Discussing results of monitoring survey among roundtable committee members including the mayor, academics, residents' representatives, well-informed persons for environmental conservation	–	-Maintance by Mowing at compensation area by developers with NPO organization	–	–	Developer conducts biological survey every year	–

5. CONCLUSION

In this study, we examined the current status of the implementation of recent biodiversity offsets on projects to which the Environmental Impact Assessment Law was applied, and we then identified some issues and future tasks. To plan and assess the mitigation project and biodiversity offset appropriately, it is necessary to develop a quantitative ecosystem assessment method in Japan and collect data on many biodiversity offset cases because how to design these mitigation and biodiversity offset is not established in Japan.

Future research should include comparative analysis of similar biodiversity offset activities completed voluntarily on road projects prior to the introduction of the Environmental Impact Assessment Law.

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