

An Approach to Introduce Biodiversity Components for the EIA System in Korea

Younghan Kwon*

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ABSTRACT ■

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국문 요약

환경평가에 생물다양성 손실을 최소화하기 위한 가이드라인을 적용하고자 하는 노력이 외국에서 진행 중이지만 국내에서는 고려의 대상이 거의 되지 못하고 있다. 이러한 상황이 지속되면 우리나라의 생물다양성이 급격히 감소할 것이다. 따라서 우리도 생물다양성의 손실을 최소화하도록 지침을 준비하는 것이 시급한 실정이다. 본 연구에서는 현재 환경영향평가 시스템의 잠재적인 문제를 평가하고, 현재 시스템에 생물다양성/생태계 항목을 어떻게 도입할 것인가에 대한 정보를 제공하기 위해 고속도로 건설사업에 대한 32개의 환경영향평가서를 분석하였다. 평가서의 분석에서 서식지 및 생물다양성을 다루는 경우는 드물었고 생물다양성 이슈들의 평가가 거의 없는 것으로 나타났다. 따라서 현재 시스템의 현황조사와 영향예측 및 대응하는 저감대책에 생물다양성 이슈들을 고려하도록 개선할 필요가 있다.

Abstract

In foreign countries, efforts are in progress to apply guidelines to minimize the loss of biodiversity within environmental assessment, yet those efforts have not been considered in Korea. If this continues, biodiversity in our nation will quickly diminish. Therefore, Korea needs to urgently prepare guidelines that minimize the loss of biodiversity. In this study 32 environmental impact assessment statements on express-highway construction projects were analyzed to evaluate potential problems with the current EIA system and to provide ideas on how to introduce a biodiversity/ecosystem item into the system. In the analyses of the 32 statements, few contents that deal with habitat/biodiversity were found and a lack of assessment of biodiversity issues was noticed in the EIA system in Korea. The system, therefore, should be improved to consider biodiversity issues in the survey, to predict impacts on biodiversity, and to establish corresponding mitigation measures.

Keywords | Biodiversity, Environmental Impact Assessment, Highway Construction

I Introduction

Why do we consider issues of biodiversity in environmental assessment?

Due to developmental activities in Korea over the last two decades, 2.1% of forest, 15.9% of farmland, and 20.4% of seashore have declined, respectively (5). Changes to the ecosystem are a threat to biodiversity due to the degradation of eco-corridors and food sources as well as the destruction of floral and faunal habitats. Developmental demands for urban land are expected to increase from 5.8% in 2002 to 9.1% in 2020 (ca. 3,846 km² of additional land will be developed) (4). Degradation of habitat conditions will negatively affect component, structure, and function of biodiversity and can lead to extinction of environmentally sensitive species.

Since our environmental impact assessment (EIA) system is more or less regulatory, people want to get through it quickly and do not consider biodiversity related issues. Therefore, EIA has focused on regulations for legally protected species and sites. According to the regulatory EIA system, domestic species which maintain the structure and function of the ecosystem have decreased continuously, and the spatial structure of the ecosystem has been fragmented to a level that cannot maintain the population of the species. Current environmental impact assessment statements (EIAs) only calculate the index of species diversity of a certain group without evaluating and monitoring potential alterations after project execution. A sound ecosystem could have been maintained if we had considered ecosystem and biodiversity issues as legal guidelines to prepare the EIAs.

Currently, international conventions such as the Convention of Biological Diversity (CBD) have suggested some guidelines for biodiversity-inclusive impact assessment¹⁾ (CBD guideline, 2006) (3). We need make efforts to recover the

1) Convention on Biological Diversity. 2006. Voluntary guidelines on biodiversity-inclusive impact assessment. 39pp.

systematic function of the degraded ecosystem and to maintain the sustainability of biological resources by introducing biodiversity/ecosystem considerations into our EIA system. The purpose of a biodiversity assessment has been often misunderstood to increase species richness. Although r-type species have been introduced and the number of these species tends to increase temporarily, they degrade the habitat of endangered species and eventually reduce the number of overall species. Biodiversity assessment will not simply deal with the list of species or the rate of extinction, but rather, focus on changes of population and the surrounding ecosystem.

Two environmental systems currently exist in Korea; EIA and prior environmental review (PER). But how should biodiversity issues in EIA and PER systems be introduced? Will it be regulated or recommended? Because the current guidelines for EIA preparation are regulated by the law, biodiversity issues must be incorporated in to the legal status which is mandatory for EIA preparation. However, as in most countries, biodiversity issues are considered recommended guidelines to prepare PER reports. The legal guidelines will be superior to biodiversity issues in the former case, but vice versa in the latter case.

In this study, 32 EIAs on express-highway construction projects were analyzed to evaluate potential problems in Korea's current EIA system and potential guidelines are suggested in order to introduce biodiversity issues into the system.

II Methods

Contents regarding biodiversity in the 32 highway construction EIA statements between 1997 and 2005 were reviewed and analyzed <Fig. 1> to identify how many biodiversity issues were considered based on 47 questionnaires (refer to appendix).

Published papers (2,7,8) were used to ask questions and to analyze results. The assessment was divided into three classes; "satisfactorily addressed" if a report scores more than 80%, "partially satisfactorily addressed" if a report scores between 30 and 80%, and "un-satisfactorily addressed" if a report scores below 30%. The ecological and biodiversity assessment index (EBI) (1) was calculated based on the number of questions which were checked with both "satisfactorily addressed" and "partially satisfactorily addressed". The EBI reflects the overall quality of EIA statements and is calculated as follows:

$$EBI = (1.0*A + 0.5*B)/N, (N=47)$$

In here, 'A' denominates the number of environmental impact assessment statements (EIAs) that were assessed as "satisfactory" among questions, 'B' denominates the number of EIAs that were assessed as "partially satisfactory" among questions. The number '47' indicates the total number of questions (refer to the appendix). This approach has some limitations due to analyses by three simplified classes when the results are interpreted.

III Results and discussion

Half of the environmental impact assessment statements (EIAs) deal with 20-40km projects <Fig. 2>. <Fig. 3> shows the yearly distribution of the number of EISs according to the ecological and biological assessment index (EBI) groupings. The figure, where about 87% of EIAs show below 0.5 of EBI, generally suggest that ecosystem/biodiversity related issues were poorly considered in the EIAs. An interesting point suggests that the EBI (below 0.4) of EIAs before 2002 were lower than that of EIAs after 2002. The results may reflect the fact that recent EIAs may deal with ecosystem/biodiversity issues more than those prepared in the past (refer to the tendency line in figure 3).

Field surveys <Fig. 4> were generally well described in the EIAs, with more than 70% being assessed as "satisfactory". However, most EIAs rarely considered ecosystem/biodiversity. The EIAs neither describe ecosystem/biodiversity perspectives at the regional and national level, nor interaction between biotic and abiotic components, although composition, structure, and function of the ecosystem were partially treated with satisfaction.

Describing ecosystem/biodiversity with regard to a map is quite difficult. About 36% described potential impacts to the ecosystem/biodiversity, but the actual rate that described the impacts satisfactorily was 7%. Most of the contents in the impact assessment considered changes to vegetation and loss of trees. In addition, general impacts were not correlated. The rate of assessments that did not consider ecosystem/biodiversity impacts was over 90% <Fig. 4>.

In addition, the cumulative impact assessment was seldom described as part of the ecosystem because the impact of surrounding projects was rarely considered or reviewed.

Most mitigation measures, including landscape, transplanting, planting, corridor construction plans, etc. were suggested with satisfaction. However, mitigation measures relevant to ecosystem/biodiversity, such as the restoration/rehabilitation of habitat were not carried out as well as they should have been <Fig. 4>.

Ecosystem/biodiversity related issues were not suggested though the comparison of alternatives <Fig. 4>. Monitoring of the ecosystem/biodiversity was not provided with satisfaction because ecosystem/biodiversity related descriptions suggested in the mitigation measures were somewhat insufficient. Also, information on how to specifically monitor was not provided properly (69%) <Fig. 4>.

Fig1 The yearly-based number of EIA statements used in the study

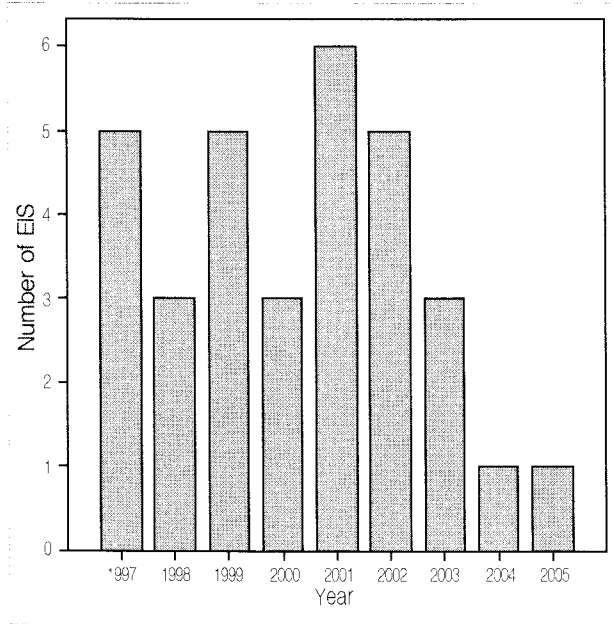


Fig2 Length of the road and the number of EIA statements (EIS) for express highway construction projects

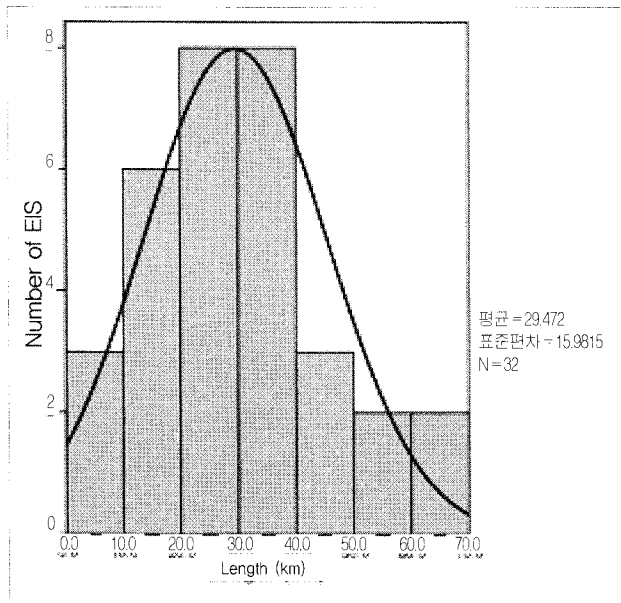


Fig3 Plots of EBI of EIA statements (EIS) prepared each year

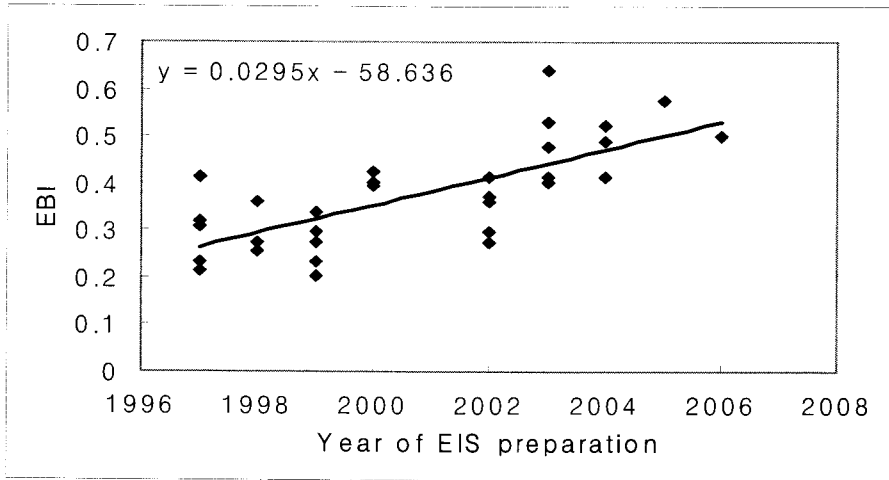
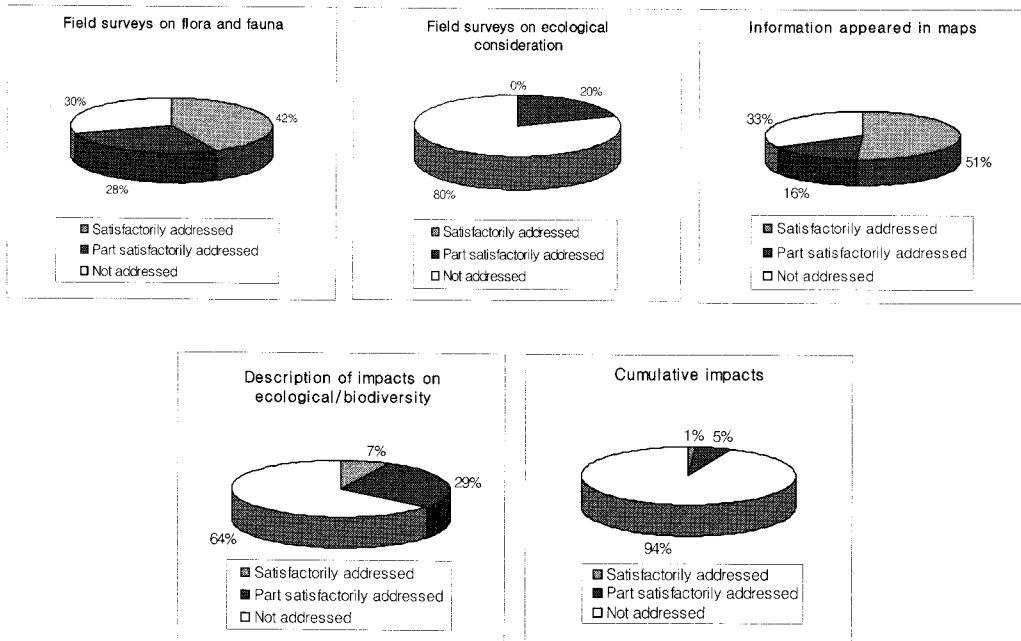
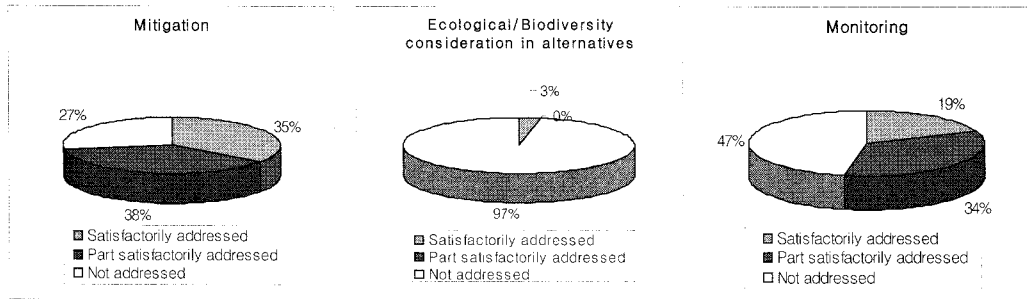


Fig4 The categorized results of the review of 32 EIA statements on the express highway construction projects





The results suggest that a number of shortcomings exist in practices related to ecosystem/biodiversity impact assessment in Korea. Basic survey results and impact assessments were irrelevant. Evaluations on important components related to ecosystem/biodiversity were poor(2,7).

Transparency of information and limitations to the survey methodology should be described. According to legal guidelines, ecosystem and species diversity should be investigated, but their impact assessment, for example "what to do" and "how to do", were uncertain. Describing biodiversity in the EIA so far was dependant simply on the estimation of the species diversity index and the species richness of certain groups. Ecosystem and genetic diversity was, for the most part, excluded. In addition, there was a lack of evaluation and monitoring after the project was initiated.

The current guidelines regarding "floral and faunal" in 「the provision regarding preparation of EIS, etc.」 (Ministry of Environment regulation) (6), should be amended for good impact predictions and for analyses of biodiversity components regarding the levels of characteristic species, community or population, and ecosystem. An example of guidelines to introduce, with regard to biodiversity issues and the preparation of environmental impact statements in Korea is suggested in Table 1.

Table 1 An example of the guideline to introduce biodiversity issues in the preparation of environmental impact assessment statements in Korea

Item1	Item2	Survey item	Survey time and area	Survey method	Survey result	Impact assessment	Mitigation
Biodiversity	Level and factor of biodiversity	<ul style="list-style-type: none"> According to characteristics of locality and the project, select important assessment items that intensive surveys are demanded. Ecological diversity landscape component landscape structure landscape function Species diversity community component community structure community function Species/population component Species/population structure Species/population function 	<ul style="list-style-type: none"> Select the season that the most diverse species are observed Select the survey area that biodiversity is affected by the project directly and indirectly. ※ The area for the survey of ecological diversity ought to be much wider than expected. 	<ul style="list-style-type: none"> Ecological service Survey the value of the ecosystem through consultations with various stake holders Ecosystem diversity Use GIS data, a vegetation map, an ecological natrality map, and other maps Survey data, references, data and comments by experts, opinions of local residents, data among habitat networks Species diversity Investigate floral community where diverse communities are present A relevant expert must investigate the community, and population, and species of each group of fauna, analyze the data, obtain biodiversity, and evaluate the soundness of the ecosystem. 	<ul style="list-style-type: none"> If the data can not be quantified, submit qualitative data. Ecological service Value of current ecosystem, benefit to residents, utilization of people, etc. Ecosystem diversity Type of habitat or patch, development status in the vicinity, vegetation, pattern of bio-group or habitat distribution, habitat structure ecosystem function of large area, network between habitats Species diversity Distribution pattern of community, index of abundance Relationship between community and environment Functional role of threatened community, wetland or watershed in impact index of abundance, index of species diversity, and distribution pattern of species/population Presence of flagged species and endangered species Factors affecting distribution pattern Structure of population of rare and endangered species Mutation or variation within species/population Factors deciding structure and pattern Presence, threatening, necessity of habitat and habitat area of keystone and umbrella species Valuable species (need specific information) protective species, umbrella species, keystone species, species with limited habitat, endemic species, economically important species, culturally important species, boundary species, limited species in distribution, threatened or decreasing species, internationally protected species, indicative species Valuable habitat (need specific information) rare habitat, habitat for valuable species, habitat for important production, wetland, previously affected habitat by a similar project, entirely affected habitat by a certain plan, habitat abundant in biodiversity, vulnerable and sensitive habitat, internationally important habitat, globally threatened habitat, etc. 	<ul style="list-style-type: none"> Quality of prediction depends on the quality of data and the decision of experts. Impact area is defined according to developmental behavior. Survey area is selected within the impact area and the distribution of biodiversity. A minimum baseline is set, which is evaluated if it is changed by a development or not. Change in ecosystem service by development Change in current habitat type, distribution, pattern ecosystem function in large area, relationship between habitats Possibility of change community distribution, pattern, abundance, interaction with surrounding environment, original role of habitat function Change in abundance, index of diversity, and distribution and pattern of species/population Change in component, structure, and function of important and valuable species ※Apply technical methodologies for relative evaluation of the value of habitat, such as Habitat Suitability Index (H-SI), Habitat Evaluation Procedures (HEP), etc. 	<ul style="list-style-type: none"> Apply precautionary principle Apply "no net loss" principle Consider benefit of local stakeholder and improve sustainability Primarily select "avoid" among alternatives and proposed design or plan if necessary. If avoidance is not possible, consider mitigation, substitution, and compensation Apply opportunities to improve biodiversity Consider mitigation methods to ensure sustainable use of biodiversity Request environmental management measures for those mitigation methods

However, so far there have been no specific guidelines to prepare a prior environmental report (PER). New guidelines should primarily consider the ecosystem services to stakeholders because the PER system deals with upper level administrative plans. A modified CBD guideline which includes biodiversity issues may be applied in the PER system if the index of biodiversity can be related to siting and land planning for the proposed policy and plan.

Somehow, we need to decide whether the CBD principle and guideline is simply added into the current system or modified so that planners can utilize it in the current process. In both cases, it is necessary to identify the characteristics of the project that cause biophysical changes and biodiversity issues at the site. The current PER system mostly deals with lower level administrative plans and small developmental projects (below the size required to prepare EISs) which do not really belong to a strategic level of the plan. Therefore, the CBD guideline can be applied most likely to the administrative plans with a proper modification adjusted for the current system. Further studies are necessary to draw on creative ideas which would allow us to develop an applicable and specific guideline for our system.

Although the suggested guideline is useful to reduce biodiversity reduction due to construction, there are some limitations to our environmental assessment (EA) system. Proponents will have more to do if issues are added to the current EA guidelines. In other words, the temporal and economic costs required to get survey data will increase because there is less information on basic biodiversity status available.

Furthermore, there is a lack of transparency in survey data, public participation, and the decision making process. Also, a discrepancy is present between our system and others in terms of public participation. Therefore, for both administrative plans and small development projects, it will not be easy to apply the CBD guideline for SEA directly to the PER systems.

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Appendix

Questionnaire and results of review on the environmental impact statements for express highway construction projects

Number	Component	Specific questions about the content of environmental impact statements	Satisfied	Partially satisfied	un satisfied
1	Current survey data	Is a proper seasonal survey carried out?	84.4	15.6	0
2		Are proper areas or spots selected for the survey?	87.5	12.5	0
3		Do qualified ecologists participate in the survey?	59.4	18.8	21.9
4		Are local and national plans or policies reviewed?	9.4	31.3	59.4
5		Are relevant references and data properly referred?	46.9	31.3	21.9
6		Are technological methodologies provided?	75.0	25.0	
7		Are biodiversity data of each group provided(ecological, species level)?	6.3	53.1	40.6
8		Are important species(rare, endangered, domestic, etc.) stated?	28.1	28.1	43.8
9		Are habitats of each group stated?	6.3	43.8	50.0
10		Are natural conservation areas and important habitats stated?	25.0	15.6	59.4
11	Ecosystem view	Are composition, structure, and function of ecosystem stated?	0	50.0	50.0
12		Is the relationship between biological and non-biological organism stated?	0	0	100
13		Is the relationship between local and national vision stated?	0	9.4	90.6
14	Map information	Is the developmental area localized in the map?	100	0	0
15		Are survey areas and impacted regions provided in the map?	90.6	6.3	3.1
16		Is specific information provided in the stacked maps??	78.1	21.9	0
17		Is individual area(important natural habitats, community, other ecologically important areas, etc.) localized in the enlarged-scale map?	59.4	25.0	15.6
18		Is a region of the individual area localized in the reduced-scale map?	25.0	28.1	46.9
19		Is a current status of important components of floral and faunal biodiversity provided in the map?	3.1	25.0	71.9
20		Are potential impacts of ecosystem/biodiversity provided in the map?	0	3.1	96.9
21	Ecosystem/ biodiversity impact	Is impact of ecosystem/biodiversity stated in a different section?	3.1	3.1	93.8
22		Is a direct impact of ecosystem/biodiversity stated?	6.3	34.4	59.4
23		Is an indirect impact(secondary, cumulative) of ecosystem/biodiversity stated?	3.1	59.4	37.5
24		Is a temporal period(short, medium, long) of impact stated?	0	3.1	96.9
25		Is the eternity(eternal, temporary) of impact stated?	0	6.3	93.8

(continue)

Number	Component	Specific questions about the content of environmental impact statements	Satisfied	Partially satisfied	un satisfied
26	Ecosystem/ biodiversity impact	Is the importance of impact assessed?	6.3	53.1	40.6
27		Is impacts about biodiversity(ecosystem, species, genetic level) stated specifically?	0	6.3	93.8
28		Is impact on the ecosystem/biodiversity assessed by a quantitative methodology?	0	3.1	96.9
29		Is impact on the ecosystem/biodiversity assessed by a qualitative methodology?	0	3.1	96.6
30		Is a GIS-based methodology used to assess impact of ecosystem/biodiversity?	0	0	100
31		Is a loss of habitat(degradation) stated?	28.1	68.8	3.1
32		Is fragmentation of habitat stated?	37.5	43.8	18.8
33		Is a direct death or elimination of species stated?	6.3	62.5	31.3
34		Is introduction of species stated?	6.3	53.1	40.6
35		Cumulative impact	Is information on other projects or plans in the surrounding area of the proposed region reviewed?	3.1	9.4
36	Is cumulative impact of floral/fauna and biodiversity by both proposed and other projects stated?		0	6.3	93.8
37	Is limitation and gap of information to assess cumulative impact stated?		0	0	100
38	Mitigation method	Is landscape and plantation stated?	62.5	28.1	9.4
39		Is a design alternative provided?	31.3	59.4	9.4
40		Is a corridor for animal stated?	78.1	18.8	3.1
41		Is replanting or relocation stated?	56.3	43.8	0
42		Is habitat restoration or re-creation stated?	0	25.0	75.0
43		Is mitigation to reduce impacts of ecosystem/biodiversity provided?	6.3	53.1	40.6
44		Is a specific procedure or methodology how to carry out the mitigation provided?	9.4	37.5	53.1
45	Considerati on of Biodiversity alternative	Is ecosystem/biodiversity in the comparison of alternatives considered?	3.1	0	96.9
46	Biodiversity monitoring	Is monitoring of ecosystem/biodiversity precisely stated?	31.3	43.8	25.0
47		Is specific details about how monitoring is accomplished provided?	6.3	25.0	68.8

- Questionnaire and results of review on the environmental impact statements (N=32) for express highway construction projects (1997-2005)

- The number indicates percent of each category of addressed level in the question.