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An Approach to Introduce Biodiversity Components in the Environmental Assessment System in Korea

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I. Introduction

Environmental assessment is a tool to preserve natural resources in our country and to minimize undesirable impacts that occur when an administrative plan is established or an individual project is executed. Although the system of assessment was introduced in Korea more than 30 years ago, habitat conditions of biotics have been degraded because the system has been seldom practiced in developmental policy and sustainability.

Although impacts on flora and fauna are assessed by the preparation guidelines of environmental impact assessment statements, the assessment mainly focuses on the species or protected species and general techniques on how to record vegetation. However, issues of survey, prediction, and mitigation of habitats and ecosystems regarding biodiversity have not been treated specifically. Because of species-dependent regulations in the current law, indigenous species that maintain structure and function of the ecosystem have been gradually diminished, and spatial structures of the ecosystem have been fragmented to the level beyond capability of maintaining the population of the species.

Efforts are in progress to apply a guideline to minimize loss of biodiversity in environmental assessment in foreign countries, but these efforts are seldom considered in Korea. If this situation continues, the biodiversity in our nation will quickly diminish. Therefore, we need to urgently prepare a guideline which can lead to minimizing loss of biodiversity.

In this study we suggest a direction of application when biodiversity issues are introduced in the current system, and provide the reason why we must introduce biodiversity issues in the environmental assessment system that consists a preliminary environmental review(PER) system and an environmental impact assessment(EIA) system, based on examples of other countries and the results of analysis of environmental impact assessment statements(EIFAS) prepared in Korea previously.
II. Theoretical review

1. Definition of biodiversity

Article 2 of the Convention on Biological Diversity (CBD) defines biodiversity as: The variability among living organisms from all sources including, inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complex of which they are part; this includes diversity within species, between species and of ecosystems.

Biodiversity, originally referred to in full as biological diversity, describes variation at different levels of biological organization, from genes to whole ecosystems. More recently, definitions have also incorporated structural and functional dimensions and relationships, emphasizing the role of diversity in maintaining the integrity and productivity of biological systems (after Noss, 1990).

Impact assessment practitioners need to decide which aspects of biodiversity they will measure and what standards will be used to evaluate any changes. Lack of consensus about exactly what constitutes biodiversity results in inefficient allocation of scarce resources and in impact assessments that fail to address important biodiversity issues (Treweek, 2001).

2. The integration of biodiversity concerns with impact assessment

Generally, some components of biodiversity, such as endangered species and protected wildlife, have been better addressed in impact assessment than those of genes and ecosystems. Environmental impact statements rarely address diversity of non-threatened species, diversity within species, or the functional components of biodiversity. Components of biodiversity which are already protected areas or species are more likely to be included in impact
assessments than those which hold less popular status but may be important in the long-term productivity of ecosystems and maintenance of biodiversity. Impact assessment practice needs to be adjusted to encompass the full range of biodiversity impacts (Bagri et al., 1998).

In order to achieve this, it is important to consider:
* What aspects of biodiversity should be addressed in impact assessment?
* At what stages in the impact assessment process should biodiversity be addressed and what is the appropriate amount of detail for their consideration at each stage?

A. Aspects of biodiversity to address in environmental impact assessment (EIA)

There has been considerable debate about what measures of biodiversity are suitable for inclusion in impact assessment. Some of those commonly used include (Treweek, 2001):
* species diversity,
* habitat diversity,
* phylogenetic relatedness,
* genetic or taxonomic distinctiveness.
* endemism

In environmental impact assessment (EIA), with time and resource limitations, the key issue is to ensure that appropriate data are collected to answer clearly defined questions about impacts (Byron, 2000). Various attempts have been made to derive frameworks for analysis, the majority of which have been based on ‘levels’ and ‘components’ of biodiversity. Noss (1990) derived questions relating to assessment of biodiversity for EIA. His framework recognizes three components of biodiversity (composition, structure and function) each of which can be represented at four levels (genes; species or populations; communities, habitats or ecosystems and finally landscapes). Le Maitre et al. (1997) used this to produce a checklist for deriving Terms of Reference (TORs) for EIA.
B. Integrating biodiversity considerations with project EIA (Treweek, 2001)

EIA has commonly different stages in which biodiversity information could be included at each of stage. EIA procedural stages can vary between the different systems used in different countries.

- Screening: Are there important biodiversity concerns which indicate the need for EIA?
  Include biodiversity considerations in screening procedures.
  The need for EIA might be indicated if the proposed project affects:
  * designated or protected areas, areas of cultural importance (eg sacred groves),
  * areas used by protected species,
  * watercourses or wetlands,
  * large continuous areas of ‘pristine’ habitat, even if not protected.

- Scoping: Derive terms of reference (ToRs) for the EIA
  * Ensure EIA takes account of potential impacts on biodiversity: include assessment of biodiversity in ToRs.
  * Consult widely and early with all stakeholders, especially people with cultural dependence on biodiversity in the affected area.

- Focusing: Refine the ToR on the basis of biodiversity values which will be used in decision-making.
  Select biodiversity components for more detailed study, for example, focus on:
  * indicators (eg of disturbance or pollution),
  * species valued for hunting, medicinal purposes, ecotourism,
  * keystone species (on which others depend),
  * important ecosystem functions (eg flood attenuation caused by wetlands,
  * key breeding or feeding sites, especially for protected species,
  * migratory routes and stop-over sites etc.

- Impact identification or prediction
Predict impacts: identify, describe and provide the data necessary to quantify the effects of proposal(s) on measures of biodiversity. Specify magnitude, duration and range of impacts, eg for:

- areas of habitat to be lost (include breeding, feeding, refuge areas),
- habitual routes to be severed (number and relative importance to maintenance of mobility in the landscape),
- number of individuals likely to be killed,
- proportion of population to be disturbed,
- quality of remaining habitat for key species,
- ecosystem functions lost or impaired etc.

- Impact significance: Rank impacts, taking into account biodiversity values and the reversibility of impacts. Consider:

  - magnitude, duration, timing and reversibility of impacts,
  - effectiveness of mitigation measures,
  - post-development carrying capacity of remaining habitat,
  - viability of remaining populations,
  - ‘utility’ and sustainability of valued biodiversity components,
  - ability of affected habitats, populations or species to recover using known techniques, or to relocate elsewhere.

- Impact mitigation: Most EIA law requires proponents to suggest measures to avoid, reduce or remedy adverse impacts.

  - Ensure mitigation is recommended for significant adverse impacts on biodiversity. Avoidance is always the best form of mitigation.
  - To what extent will proposed mitigation measures reduce impacts? Demonstrate whether they have been successful elsewhere.
  - Mitigation for biodiversity may require land acquisition for compensation.
  - Assign responsibilities for implementing mitigation and following up the results.
  - Consider use of mitigation bonds.

- Impact Evaluation: Are the identified impacts important or significant? How important or significant are residual impacts on biodiversity,
allowing for implementation of mitigation measures?

- Environmental Impact Statement (EIS)
  * Explain biodiversity impacts clearly.
  * Provide detailed, practical advice concerning measures to protect biodiversity during construction or to mitigate for operational impacts. Provide a schedule for activities and a contingency plan in the event of mitigation failure.

- Review and monitoring
  * Did impacts on biodiversity happen as predicted?
  * Were mitigation measures effective and implemented successfully?

- What really happened?
  * What was the outcome of biodiversity?

Byron (2000) suggested a guideline principle to consider biodiversity in road EIA through the research of road projects in England. The guideline provides methods of systematic approach to deal with biodiversity in the road EIA and biodiversity issues which need to be considered in each step of EIA according to systematic approach.

C. Integrating biodiversity considerations with strategic environment assessment (SEA)

Although EIA was always intended to be an integrated decision-making tool, project-EIAs have often failed to address all relevant impacts at an appropriate scale. Some of these common shortcomings can be avoided if impact assessment is carried out sufficiently early in the development planning process to identify viable alternatives that have lower impacts on biodiversity. It is generally agreed that efficient safeguard of biodiversity is only possible if ecological constraints and possibilities are identified well in advance of individual development proposals. Biodiversity could be applied SEA, for example a national transport policy, a regional transport plan or a road-building program as shown in Table 1.
Table 1. Application of biodiversity to policies, plans and programs

<table>
<thead>
<tr>
<th>Type of proposal</th>
<th>Examples</th>
<th>Incorporation of biodiversity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Polices</td>
<td>National transport policy</td>
<td>Review proposed transport policy for potential conflicts with national biodiversity goals and objectives, e.g. as specified in the national biodiversity strategies and action plans (NBSAP). Check lists of protected species and designated wildlife sites are up to date and reliable. Review international obligations with regard to conservation of biodiversity and clarify legal obligations.</td>
</tr>
<tr>
<td>Plans</td>
<td>Regional transport plan</td>
<td>During formulation of plan, identify regional biodiversity experts and form a network. Carry out regional reviews and consultations to identify any sites of high biodiversity value that are not designated. Publicize areas important for biodiversity and explore alternative strategies for achieving both transport and biodiversity objectives. Carry out regional biodiversity accounting to set regional targets for biodiversity, e.g. for mitigation purposes.</td>
</tr>
<tr>
<td>Programs</td>
<td>Road building program</td>
<td>Use impact assessment to identify the ‘least impact’ alternatives/ corridors from a biodiversity perspective. Ensure that biodiversity constraints are included in all exploratory studies for corridor selection. Establish a biodiversity monitoring framework for main proposed route corridors. Identify potential biodiversity mitigation or enhancement options.</td>
</tr>
<tr>
<td>Projects</td>
<td>Individual road project</td>
<td>Follow a standard EIA procedure. Predict and evaluate impacts attributable to proposed project and identify suitable mitigation options consistent with international, national, regional and local targets and objectives for biodiversity.</td>
</tr>
</tbody>
</table>

Source: Treweek (2001)
D. Necessary reasons to incorporate biodiversity in SEA (Treweek, 2001)

a. Legal obligations. A reason to pay particular attention to biodiversity in SEA is a legal national, regional or international obligation to do so.

b. Facilitation of stakeholder identification. By focusing on ecosystem services in describing biodiversity, directly and indirectly affected stakeholders can be identified and, as appropriate, invited to participate in the SEA process.

c. Sound economic decision making. Ecosystem services such as erosion control, water retention and supply, and recreational potential can be valued in monetary terms, thus providing a figure on potential economic benefits and/or losses caused by the implementation of planned activities.

d. Cumulative effects on biodiversity are best anticipated at a strategic level. By applying the principles of the ecosystem approach the cumulative effects of activities on those ecosystem services which support human well-being can be addressed. At the same time, it is appropriate to define levels of acceptable change or desired levels of environmental quality at the strategic level.

e. Maintaining the genetic base of evolution for future opportunities. The conservation of biodiversity for future generations is one important aspect of sustainability. Maintaining the capacity of biodiversity to adapt to changing environments (e.g. climate change) and to continue providing viable living space for people is critical to human survival.

f. Benefiting society. By promoting/facilitating sustainable solutions to developmental needs SEA is benefiting society as a whole.

E. Biodiversity in the CBD guideline

a. In SEA, biodiversity can best be defined in terms of the ecosystem services provided by biodiversity. These services represent ecological or scientific, social (including cultural) and economic values for society and can be linked
to stakeholders. Stakeholders can represent biodiversity interests and can consequently be involved in an SEA process. Maintenance of biodiversity (or nature conservation) is an important ecosystem service for present and future generations but biodiversity provides many more ecosystem services.

**b. Direct drivers of change** are human interventions (activities) resulting in biophysical and social effects with known impacts on biodiversity and associated ecosystem services.

**c. Indirect drivers of change** are social changes, which may under certain conditions influence direct drivers of change, ultimately leading to impacts on ecosystem services.

**d. Aspects of biodiversity:** To determine potential impacts on ecosystem services, one needs to assess whether the ecosystems providing these services are significantly impacted by the policies, plans or programs under study. Impacts can best be assessed in terms of changes in composition (what is there), changes in structure (how is it organized in time and space), or changes in key processes (what physical, biological or human processes govern creation and/or maintenance of ecosystems).

**e. Three levels of biodiversity** are distinguished: genetic, species, and ecosystem diversity. In general, the ecosystem level is the most suitable level to address biodiversity in SEA. However, situations with a need to address lower levels exist.

The nature of biodiversity aspects and different levels is an important concept where, if applied as shown in Fig. 1, the regional pattern forms a foundation for the pattern of local ecosystem, in turn the local pattern affects species and genetic diversity.
Figure 1. A schematic diagram of aspects and different levels of biodiversity

F. To address biodiversity in SEA

Fig. 2 depicts the conceptual framework used in these guidelines. It integrates the Millennium Ecosystem Assessment conceptual framework with a more detailed integrated impact assessment framework, describing pathways of activities to impacts. It positions the biodiversity triggers, i.e. (1) affected ecosystem services, and activities producing direct (2) or indirect (3) drivers of change in ecosystem services.

Figure 2. A conceptual framework to address biodiversity in SEA (Commission for Environmental Assessment, CBD, 2006)
Fig. 3 provides a summarized overview of the way in which potential biodiversity impacts of a policy, plan or program can be identified. It starts with the identification of potential biodiversity triggers in the policy, plan or program to be analyzed, including: (1) an area with valued ecosystem services; (2) activities affecting direct drivers of change; (3) activities affecting indirect drivers of change; or a combination of (1) and (2) where activities with known drivers of change influence a known area with valued ecosystem services. If one of these triggers is present in the policy, plan or program, the flow chart shows the type of information that can and should be obtained in the SEA process. The link between indirect and direct drivers of change is characterized by complex interactions, many of which are presently subject to intense research efforts worldwide.

**Figure 3.** Summarized overview of procedure to define biodiversity impacts starting with one or a combination of biodiversity triggers

*(Commission for Environmental Assessment, CBD, 2006)*
III. Analysis of environmental impact statements

In this study, 32 EISs on the highway construction were analyzed to evaluate potential problems of the current EA system and to help how to introduce a biodiversity/ecosystem item into the system.

1. Methods

Contents regarding biodiversity in the 32 EISs on the highway construction between 1997 and 2005 (Fig. 4) were reviewed and analyzed to identify how much the ecosystem/biodiversity issues were considered based on 47 questionnaires. Considerations to check were 1) present data of investigation sites, 2) perspective of ecosystem/biodiversity, 3) impacts on ecosystem/biodiversity, 4) measures of mitigation, 5) monitoring, etc.

Published papers (Söderman, 2005; Byron, 1999; Treweek, 1995) were referred to ask questions and to analyze results. The assessment was divided simply into three classes which include “satisfactory addressed” if a report treats the issue more than 80 %, “partially satisfactory addressed” if a report treats the issue between 30 to 80%, and “not addressed” if a report treats the issue below 30%. An index (Atkinson et al., 2000) was applied to compare the reports readily. The Ecological and Biodiversity Assessment Index (EBI) was calculated based on the number of questions which were checked with both “satisfactory addressed” and “partially satisfactory addressed”. The EBI reflects the overall quality of EA reports and is calculated as followed;

\[ EBI = \frac{1.0A + 0.5B}{47} \]

In here, ‘A’ denominates the number EISs that were assessed as “satisfactory” among questions, ‘B’ denominates the number of EISs that were assessed as “partially satisfactory” among questions. The number ‘47’ indicates the total number of questions. This approach has some limitations to
be remembered when the result is interpreted.

2. Results and discussion

Half of the EISs are dealt with 20-40km projects (Fig. 5). Fig. 6 shows the yearly distribution of the number of environmental impact assessment statements (EISs) according to EBI groupings. The figure generally shows lack of EISs and contents which deal with ecosystem/biodiversity related issue (ca. 87% of EISs shows below 0.5 of EBI). However, the data varies according to each EIS. An interesting point suggests that the EBI (below 0.4) of EISs before 2002 is lower than that of the EISs after 2002. The result may reflect the fact that recent EISs may deal with more ecosystem/biodiversity issues than those prepared in the past (refer to the tendency line in Fig. 6).

Field surveys were generally well described in the EISs with more than 70% of “satisfactory” (Fig. 7). The remnant 30% did not treat relating categories, such as the relationship with regional and national planning, biodiversity of each classified group, important habitats, current data of important species, etc. However, most EISs rarely dealt with considerations of ecosystem/biodiversity. The EISs neither describe ecosystem/biodiversity
perspectives in the regional and national level, nor interaction between biotic and abiotic components. However, composition, structure, and function of the ecosystem were partially treated with satisfaction.

Describing ecosystem/biodiversity related data in the map is quite a difficult task that it has not been accomplished well enough. The rate in which potential impacts of ecosystem/biodiversity were not described in the map was 97%. About 36% described the potential impact on ecosystem/biodiversity, but the actual rate in which the description was treated with satisfaction was 7%. Most contents treated in the impact assessment were change of vegetation, loss of trees, and description on the general impacts with which survey results are not correlated. The rate in which the ecosystem/biodiversity impact was not treated would be over 90% (Fig. 7).

So far, cumulative impact assessment had been seldom described in the ecosystem because impacts by surrounding projects have been rarely considered and reviewed.

Most mitigation measures including landscape, transplanting, planting, corridor construction plans, etc., were dealt with satisfaction and general measures which include textbook contents, without any relationship with survey results, were mostly described. Mitigation measures relevant to ecosystem/biodiversity, such as restoration of habitat or rehabilitation, those to diminish impacts of ecosystem/biodiversity, and detailed description to carry out mitigations properly, should be suggested with satisfaction over 40% (Fig. 7).

Ecosystem/biodiversity related issues were not considered in the comparison of alternatives (Fig. 7). Monitoring on the ecosystem/biodiversity was not provided with satisfaction because ecosystem/biodiversity related description suggested in the mitigation measures were somewhat insufficient. Also information on how to monitor specifically was not well provided (69%) (Fig. 7). However, most EISs established monitoring plans after animal corridors were constructed.
Figure 5. Length of the road and the number of EISs for highway projects

Figure 6. Plots of EBI of EISs prepared each year
Figure 7. The categorized results of the review of 32 EISs on the highway construction projects
3. Conclusion

In conclusion, the results suggest that a number of shortcomings existed in the practices of ecosystem/biodiversity impact assessment in Korea. Basic survey results and impact assessment were not really related to each other. A weak evaluation on the component of important ecosystem/biodiversity which was negatively affected by development projects comes from lack of an adequate scoping stage. Transparency of information and limitation of survey methodology should be described. According to the regal guideline to prepare the floral and faunal item, ecosystem and species diversity should be investigated, but their impact assessment, for example what and how to do, were uncertain.

Describing biodiversity in the EA so far was dependant simply on the estimation of species diversity index and species richness of certain groups. Ecosystem and genetic diversity was excluded and there is lack of evaluation and monitoring on how basic survey data will be changed. Therefore, practitioners ought to decide which aspects of biodiversity have to be evaluated and which guideline be utilized in order to assess changing biodiversity. Considering effectiveness of operation in both systems, a review procedure of biodiversity issues can be most properly applied in the process of PER rather than EIA.

The current EA system can not respond properly to prevent biodiversity reduction, and needs to be amended either by introduction of the biodiversity issues into the current system or by incorporation of the current guidelines of the faunal and floral item into the complex of biodiversity considerations which include physical, biological, and social impacts. In either case, shortcomings should be overcome and a proper guideline should be prepared. The guideline of “the floral and faunal item” in the provision regarding preparation of EIS, etc. (Ministry of Environment regulation), should include a scoping stage for good impact predictions and require to analyze biodiversity components in the level of characteristic species, community or population, and ecosystem.
IV. Approach to introduce in EA systems in Korea

Why do we consider issues of biodiversity in environmental assessment?

Due to development activities during the last two decades in Korea, 2.1% of forest, 15.9% of farmland, and 20.4% of seashore has declined, respectively. The change in the ecosystem has caused threat to biodiversity due to degradation of eco-corridors and food sources as well as destruction of floral and faunal habitat. Developmental demands for urban land are expected to increase from 5.8% in 2002 to 9.1% in 2020 (ca. 3,846 ㎢ of additional land will be developed). Degradation of habitat conditions will negatively affect component, structure, and function of biodiversity and can lead to extinction of environmentally sensitive species while we do not notice it.

Since our Environmental Assessment (EA) system is regulatory, people just want to get through the guideline that do not really consider biodiversity related issues, but only satisfy certain standards. Therefore, the EA has focused on the regulation for legally protected species and sites. According to the regulatory EA system, domestic species which maintain the structure and function of the ecosystem have been decreased continuously, and the spatial structure of the ecosystem has been fragmented to the level that cannot maintain the population of the species. Current Environmental Impact Statements (EISs) only calculate the index of species diversity of a certain group without evaluating and monitoring potential alterations by project execution. A sound ecosystem would have been maintained and also the loss of species which have disappeared without recognition would have been prevented if we had considered ecosystem and biodiversity issues specifically as a legal guideline to prepare the EIS.

Currently international conventions, such as the Convention of Biological Diversity, sensitively respond to the reduction of biodiversity. We need to put an effort to recover systematic functions of degraded ecosystems and to maintain sustainability of biological resources by introducing biodiversity/ecosystem considerations into our EA system. The purpose of biodiversity assessment has been often misunderstood to increase species
richness. Although r-type species (often foreigners) are introduced and the number of these species tends to increase temporarily, they rather degrade the habitat of endangered species and eventually reduce the number of species. Biodiversity assessment will not simply deal with the list of species or the rate of extinction, but rather focus on the change of population and the surrounding ecosystem.

Two EA systems, Environmental Impact Assessment (EIA) and Preliminary Environmental Review (PER), are currently in Korea. A question of the moment would be how to introduce biodiversity issues in EIA and PER systems. Will it be regulated or recommended? Because the current guideline for EIA preparation is regulated by the law, biodiversity issues must be incorporated in the legal status which is mandatory for EIA preparation. However, as in most countries, the biodiversity issues can be considered as a recommended guideline to prepare EA reports. The legal guideline will be superior to biodiversity issues in the former case, but vice versa in the latter case.

1. Possible approaches to introduce biodiversity considerations in the EIA system in Korea

There are two approaches to think: 1) add biodiversity components(aspects and levels) to the regulatory guideline to prepare EIS, 2) to provide a voluntary guideline which a proponent can apply in the EIA process as in other examples. In the first case, aspects and levels of biodiversity need to be identified, principles of screening and scoping on the project of the specific site be selected and noticed, and then definition and impacts on ecosystem services of stakeholders need to be prepared. The current guideline of fauna and flora is composed of survey, impact evaluation, mitigation, and monitoring. A study regarding a new guideline is necessary to add an extra criterion which includes these biodiversity considerations at each stage of scoping, basic survey, impact evaluation, mitigation, and monitoring.

In the second case, it is necessary to prepare selection criteria of different
aspects and levels of biodiversity at each EIA stage as well as a relevant guideline. For example, the guideline can be applied primarily to the area that has been less degraded than the place where interrupted much and where ecosystem services may be considered instead to concern biodiversity issues.

2. Possible approaches to introduce biodiversity considerations in the PER system in Korea

There has been no specific guideline to prepare PER reports so far. A new guideline may primarily consider ecosystem services of stakeholders because PER system deals with some of upper level's administrative plans. A modified CBD guideline which includes biodiversity issues may be applied if specific projects or sites or both are not decided yet.

One thing to decide would be to add CBD principle and guideline to a current system or to prepare a modified guideline which planners can utilize in the current process. In both cases, it is necessary to identify characteristics of the project that causes biophysical changes as well as biodiversity issues of the site that is interested. The current PER system mostly deals with lower level's of administrative plans and also small developmental projects(below sizes or amounts which need to prepare EISs) which do not really belong to SEA. Therefore, the CBD guideline can be applied most likely to the administrative plans with proper modification adjusted for the current system. Further studies are necessary to draw a creative idea which allows us to develop an applicable, specific guideline in our system.

3. Problems to introduce biodiversity considerations in the EA system in Korea

There are few examples of a typical model how biodiversity guidelines have been specifically applied in EA.

Proponents will have much more burdens if biodiversity issues are added
in the current EA guideline than before. In other words, temporal and economical costs to get survey data will be increased because there are much less information of basic biodiversity status.

There is lack of transparency of survey data, public participation and decision making process.

A discrepancy is present between our system and others in term of public participation in EIA.

It would not be easy to apply the CBD guideline for SEA directly to the PER system which includes both administrative plans and small developmental projects.
V. Summary

Biodiversity should be considered in the EIA because conservation of biodiversity is a key factor of sustainable development. In the analyses of the EISs of highway construction, there are few contents that deal habitat/biodiversity and moreover lack of assessment. The system, therefore, should be improved to consider biodiversity and ecosystem in survey and also should establish assessment of impacts on the biodiversity issues and relevant minimization measures specifically.

In the PER, although it would not be easy to decide a suitable site and a plan, especially in higher level plans, biodiversity can be used as a criterion to decide a proper site or plan or select the best alternative. In addition, stakeholder finding and public opinions are facilitated due to focusing on biodiversity and biodiversity services. This can lead to protecting livelihood and economic profit of the stakeholder, to succeed a goal of sustainable development and to maintain a basis for conservation of natural resources, which are genetic foundations of survival for future opportunity.

In the EIA, biodiversity components can be introduced in each step of the current procedure. In the PER, the components can be introduced in planning or programming procedure, focusing on biodiversity and biodiversity services. At present a method would be an addition of a biodiversity item in the current guideline of preparation of the EIS. Another method will follow examples of other countries where biodiversity components are applied in each procedure of the EIA, from scoping to monitoring. In this study an example of the former was presented for the EIA while general principles were provided in case of introduction of biodiversity in the PER.

Possible problems and future works were stated in case biodiversity is introduced in the current system. If we are incorporating foreign guidelines or criteria in our regulatory system, we have lots of work and correction to do. We may also need principles of screening and scoping adjusted in the region and project character in which biodiversity can be applied to minimize burden of a proponent. The system of public participation should be used to communicate information of biodiversity and biodiversity services. Because
the PER system includes administrative planning and small projects, it would not be so easy to apply foreign guidelines, which follow a strategic environmental assessment concept, in our system directly. Thus, individual guideline is needed for administrative planning and small projects, respectively. According to amended law for the PER, because opportunity of public participation is given only in the draft of the PER, the method and detailed contents should be reviewed whether the public participation regarding biodiversity and ecosystem services is proper or not.
References


Convention on Biological Diversity, Article 14 and Decision VI/7.


