# BIODIVERSITY ASSESSMENT TO SUPPORT STRATEGIC ENVIRONMENTAL ASSESSMENT (SEA) OF SMALL ISLANDS' SPATIAL PLANNING CASE STUDY: SABANG MUNICIPALITY, INDONESIA

**THESIS**

A thesis submitted in partial fulfilment of the requirements for
the Master Degree from Institut Teknologi Bandung and
the Master Degree from University of Groningen


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**DOUBLE MASTER DEGREE PROGRAMME**
**DEVELOPMENT PLANNING AND INFRASTRUCTURE MANAGEMENT**


**REGIONAL AND CITY PLANNING**
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**ENVIRONMENTAL AND INFRASTRUCTURE PLANNING**
**FACULTY OF SPATIAL SCIENCES**
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## ABSTRACT

Small islands are expected to face many challenges and constraints in developing their regions and pursuing sustainable development due to the need to protect biodiversity richness, increase society welfare, and escalate economic development. The increasing competition of space for land use and physical development affects the environmental and biodiversity condition in small islands. Man-made modifications on land cover and land use are the main trigger of biodiversity loss and damaging ecosystem services. Biophysical transformation disturb biodiversity at genetic, species, or ecosystem level, also affect the composition, structure, and function of biodiversity.

In that situation, strategic environmental assessment (SEA) is generally recognized as to be an appropriate environmental tool to the need for further environmental consideration in strategic level for improvement spatial planning decision-making. However, information about biodiversity to support SEA in spatial planning decision-making is very limited due to some data are available only for conservation or protection areas, and less value information about biodiversity. In fact, integration of biodiversity issues into decision-making process requires information of biodiversity aspects comprehensively.

This research aims to search the proper biodiversity assessment methods for supporting environmental consideration in decision making process of small islands' spatial planning. Further, this research also explores the potential of biodiversity assessment to be integrated in the SEA processes. This research also identifies some added values of SEA approach regarding biodiversity issues. Therefore, this research grounded on literature review and case study approach in searching the biodiversity assessment and exploring the potential of integration. Ultimately, a guideline for identifying the suitable approach of biodiversity assessment that could be integrated into SEA process of small islands' spatial planning is presented.

The findings of the research denote that through several factors the proper biodiversity assessment method which fit with decision-making process of small islands' spatial planning can be chosen selectively. The factors are (1) the concept of method, (2) area characteristics, (3) biodiversity/environmental objectives, (4) spatial planning system, (5) the link of methods to spatial planning, (6) possible involvement of methods in SEA processes, (7) focus of methods, (8) data requirement by the method, (9) approach requirement by the method, and (10) advantages and disadvantages of the method. A guideline for identifying the biodiversity assessment that could be integrated into SEA process of small islands' spatial planning is presented.


*Keywords:* biodiversity assessments, strategic environmental assessment, small islands, spatial planning

# PREFACE

As a new environmental tool in Indonesia, implementation of strategic environmental assessment (SEA) is a challenge. Local government has to deal with complex understanding about SEA processes and context, since SEA is mandatory for every level of spatial plan and medium term development. It should be acknowledged that SEA implementation is not a simple process. It requires a comprehensive approach encompassing complete understanding about SEA concept, technical understanding and capability of SEA implementation, institutional and human resource competence, as well as financial provision.

Another story, small islands is, sometime, ignored that they have several limitation to accomplish sustainable development. Small islands development tends to focus on escalating economic development which could be a sacrifice of environmental value of the island. Nevertheless, small islands have fragile environmental and ecological characteristics. These complexity characteristics need to be addressed by environmental and sustainable development policies and strategies.

Combining SEA and small islands as a way to understand SEA comprehensively and to find a problem solving for small islands issues give the impression to research about those issues. Having interested with coastal and environmental issues leads to concern on biodiversity of small islands and environmental assessments in my research thesis. Further, as a witness of growing development and continuous environmental degradation in Sabang Municipality trigger me to choose Sabang as an empirical study of small islands. This is also as a contribution to scientific literatures about Sabang and small islands in Indonesia.

This thesis would not have been possible without the support of special people. First of all, I would like to present my highest gratefulness to Allah SWT. Then, I would like to convey my great tribute to my supervisor Dr. Femke Niekerk and Djoko Santoso Abi Suroso, Ph.D for their supervision. Moreover, I would like to dedicate my gratitude to my family in Indonesia; my mother, my beloved husband, my handsome son, my sister, and my brother, who always provide abundant spirit for me. Further I am grateful to my friends, the membership of Double Degree Program ITB-RuG 2012, for all kinds of support, moments, and friendship. Every people are able to be independent, but not necessarily a guarantee that they can be together with others. I also express the greatest thank to all my friends in EAP TOEFL Group for all moments and stories during our course. Besides, I would like to thank to Government of Sabang Municipality, BAPPENAS, and NESO for awarding me a chance to pursue my study at ITB and University of Groningen. Finally, I would like to thank to interviewees who their opinion being findings of this research.

Groningen, Augustus 2013
Surika Wati

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# CHAPTER 1 INTRODUCTION

## 1.1 Background

Environmental degradation occurs day by day in every region, but gains less attention compared with economic ambition in many development goals. In most developing countries, environment is often excluded in development consideration, while rapid economic and industrial development is pursued by the sacrifice of environmental value (Lo, Fryxell and Wong 2006). Moreover, in economic perspective improved results on conservation of the environment and on prevention of future damage have been achieved, although the pursuing of sustainable development is "low hanging fruits" (Jansen 2003). In fact, the policy supporting economic development seems to consider less environmental aspects. The policy loots the precious stocks of natural capital that are necessary for improving the quality of life over the long run (Lo, Fryxell and Wong 2006). In addition, the economic policy tends to trigger economic inequalities causing uneven distribution of economic development benefits. Thus, it needs a proper and effective solution to deal with greater economic development and environmental protection.

In the context of today, even though much of analysis and discussion of sustainability contains ambiguities in terminological and conceptual, as well as disagreements about facts and practical implication (Holdren, Daily and Ehrlich 1995), sustainable development comes as an answer of many development problems. The concept of sustainability development has been arisen due to escalating awareness that certain characteristic of developments have environmental consequences, including exploitation of natural resources, pollution, habitat/biodiversity loss and global climate change (Cluskey and Joao 2011). Agenda 21, a wide-ranging action plan for sustainable development, emphasizes the implementation of sustainability strategies will depend on: a better understanding of land, oceans, atmosphere and their interlocking water, nutrient and biogeochemical cycles and energy flows. This dependency condition is induced owing to all of them are part of the Earth system. Further, those factors of sustainability strategies highlight the need for maintaining the harmony of earth system.

Moreover, sustainable development and spatial planning have a strong connection. For the promotion of a sustainable development, planning is directed to concern with rational use of land and resources. Land-use planning demonstrated to be one of the most important arenas in which concept of sustainable development are contested (Owens and Cowel 2002 in Godschalk 2004). However, McDonald (1996) in Suroso (2010) states that planning is not the only essential tool to achieve sustainable development, but sustainable development itself is "what good planning is about". Furthermore, the potential of regions to pursue sustainable development relies on maintaining the quality of certain, necessarily limited, natural resources of those regions (Bass and Dalal-Clayton 1995). Hence, it can be underlined that planning and sustainable planning is closely related to biodiversity issues. Changes and

transformation of land use is a core trigger of biodiversity changes at every scale (Haines-Young 2009). Thereafter human activities are the major menace of biodiversity existence causing habitat loss and damage (Geneletti 2003; Treweek, et al. 2005; Gontier, Balfors and Mortberg 2006). Then it requires deeper consideration and understanding how development deals with land use change and biodiversity preservation due to sustain ecosystems. Relating to spatial planning, if the land-use and development activities can be supported by a scientific and valuable data of biodiversity, the decision-making process regarding sustainable development goals could be obtained more easily by development actors (government and private sectors) and relevant stakeholders.

Facing the divergence target between economic development and environmental protection especially in developing regions, various environmental assessment tools exist with the intention to bring more environmental rationality into decision making arena. The need of environmental assessment as one of approaches to support process of formulating better planning has been increasing. Strategic environmental assessment (SEA) is one of the assessment tools which are believed as an effective environmental assessment tool at decision making level. If implemented in earnest, SEA will provide a high level of environmental protection and integrate environmental considerations into the planning process. SEA constitutes "a potential tool for the articulation of individual projects into complementary design, implementation, and management to meet the idealistic goal of development, which improves social, quality of life, and environmental conditions in the present without compromising those in the future" (Arce and Gullon 2000). SEA affords an opportunity to involve biodiversity at higher tiers of decision-making process and planning (Treweek, et al. 2005).

In the form of spatial planning, SEA is a decision-support instrument aimed at providing as detailed a picture as possible of the environmental impacts related to the implementation of spatial planning. The SEA study must contain sufficient information in order to analyse the predicted consequences of proposed development, and consequently to propose suitable modifications and mitigations. Most of the information has to has a spatial component because geographical distribution of impacts plays an important role in determining how they are perceived by decision-makers, as well as by the affected stakeholders and the general public (Geneletti, et al. 2007). However, how SEA can provide sufficient information regarding biodiversity components in spatial planning process is an essential question to be addressed. It is caused results and recommendation of SEA look like only partly considered in decision making or recognizable in the final decision (Runhaar and Driessen 2007). SEA is therefore undeniable part of the political system (Jones, et al. 2005). Then the detail of information about potential biodiversity impacts from a spatial planning implementation will assist decision makers in taking biodiversity issues into account during the process of spatial planning.

Focus on smaller areas, small islands are predicted to face many challenges and constraints in developing their regions as well as pursuing sustainable development. The challenges encompass limited physical size, proneness to natural disaster and climate extremes, extreme openness of their economies as well as low adaptive capacity which make them especially vulnerable to the effects of climate change, sea-level rise, and extreme events (Mimura et al. 2007). Further, biodiversity conservation is also complicated challenges on small islands (Deidun 2010; www.cbd.int 2013). In one hand, an essential element of food security in many small islands is highly relating to the existence of biodiversity (www.cbd.int 2013). In addition, marine and coastal area provides a high potential livelihood for islanders. On the other, utilization of biodiversity can generate over-exploitation and habitat changes. The losses of biodiversity components are hidden costs to society (Webber 2004).

Hereafter, with the aim to increase economic growth, small islands carry out many development activities which requires wider areas for expansion and infrastructures provision. This requirement will lead to a high exploitation on the remaining areas of landscape in small islands. Numbers of implemented planning decision stressing on infrastructures and other developments concerns cause fragmentation on biodiversity (Gontier, Balfors and Mortberg 2006). Whereas planning for sustainable land-use needs design of future land-use that maintains the substantial ecological process in the environment. Hence the consequences of expansion development areas need to be examined in advance of any decision process which accounts environmental impacts of exploitation green areas, specifically coastal areas (Mortberga, Balforsa and Knolb 2007; Balfors, Mortberg and Geneletti 2010).

Those challenges require specific strategic action, particularly in spatial planning, for resolving conflicts between development activities and natural system, as well as protecting environment. Then, land use arrangement through the consideration of biodiversity components aiming to preserve natural resources and control the process of economic development is proper as an approach towards development of small islands. The fundamental thought of prioritizing biodiversity is to guarantee that ecological capital is sufficient enough to support the predicted population in particular time at satisfactory of living standard within development framework (Treweek, et al. 2005; Deidun 2010). In the improvement of spatial planning content, the conservation of nature and biodiversity has been taken into consideration on spatial planning gradually (Theobald, et al. 2000). The need to discontinuing biodiversity loss enforces integration of biodiversity issues in planning comprehensively (Mortberg, Zetterberg and Balfors 2012). Besides, impacts of land use changes on biodiversity have to be considered in strategic decision-making process. It is definitely indispensable to obtain integration between landscape and environment within ecological sound instead of planning of land use pattern which may look qualify for particular years, yet shows no clear connection to the ecological processes in the environmental system (Opdam, Foppen and Vos 2002).

However, information about biodiversity to support spatial planning is very limited due to some data are available only for areas already designed for conservation or protection areas and even data are accessible, it describes only the characteristics rather than the value of biodiversity (Geneletti 2008). Environmental impact statement is often unsatisfactory due to presenting quantitative analysis only regarding nature conservation and biodiversity (Treweek, et al. 2005). Furthermore, availability of biodiversity data for integrating environmental issue into decision-making process typically consist of a very glance description of features, such as vegetation maps, land cover maps, and species inventories, which less emphasis on an assessment of their value into the environment (Geneletti, 2008). In fact, integration of biodiversity issues into decision-making process requires information of biodiversity aspects comprehensively. Definitely, biodiversity assessment is demanded. Biodiversity can be assessed in numerous ways (Haines-Young 2009). There is no well-developed accepted framework for biodiversity assessment has been formulated, yet the reasonable one looks like an approach based on development discourse of guiding principles for regional and global biodiversity protection (Broring and Wiegleb 2005).

In accordance with small islands, biodiversity in small islands has high richness of species, including endemic species (Deidun 2010). Most of islanders also rely on the presence of biodiversity linking to variety of economic activities, including fisheries and aquaculture, tourism, and recreation. However, the demand for improving small islands development pushes the emergence of anthropogenic factors to the loss of biodiversity (Bijlsma, et al. 1995). Commonly, biodiversity tends to be more affected by spatial planning implemented than by any other plans, such as waste management plan, due to land use change and development of spatial networks (Kolhoff 2005). The decreasing of natural habitat due to infrastructure provision is believed as the crucial point of intimidation to the existence of biodiversity (Geneletti, 2003). Many strategic actions on various political levels also influence the survival rate of biodiversity. For this reason, it requires understanding the causal and functional relationships of biodiversity, especially for decision-making process (Broring and Wiegleb 2005). Thus, the intention of this research primarily focuses on the exploring of biodiversity assessment methods which has priority to provide valuable biodiversity consideration for the SEA process of small islands spatial planning, particularly in Sabang Municipality.

Biodiversity inclusiveness in decision-making process is "not only dependent on good information about flora and fauna, but also on the concepts and processes associated with biodiversity" (Wegner, Moore and Bailey 2005). Comprehensive information can be achieved by an effective assessment of biodiversity. The assessment has to be proper with decision-making context in order to integrate the result into SEA process of small islands spatial planning. This research puts emphasis on investigating biodiversity assessment methods for supporting SEA process of small island spatial planning, particularly biodiversity assets assessment (BAA) (Geneletti, 2008), landscape ecological assessment (LEA) (Mortberga, Balforsa and Knolb 2007), and multi-criteria cost benefit analysis (MCCBA) (Sijtsma, Heide

and Hinsberg 2011). Each assessment has different emphasis which links to the goal to be achieved. BAA and LEA are very specific method for biodiversity assessment. BAA focuses on mapping biodiversity assets in order to figure out the biodiversity variety in detail in such area. LEA concentrates on effects caused by human intervention to biodiversity and other ecosystem services on landscape scale. In contrast MCCBA is a general assessment method which huge variation of application. MCCBA connects the two concepts of monetary value, which are multi-criteria analysis and cost benefit analysis.

## 1.2 Problem Statement

According to the issue describing previously, encouraging biodiversity issues of small islands in SEA and spatial planning is crucially essential in order to integrate environmental issues into decision-making process. However, explanation about the fundamental relationship between effective biodiversity assessment and spatial planning of small islands is not well appreciated. Meanwhile, SEA implementation in numerous developing countries is mainly as a mean of minimizing the adverse environmental effects of strategic actions implementation. Nevertheless, it is recognised that SEA implementation can play an essential role in dealing with biodiversity, prioritizing environmental planning and achieving sustainable development. Moreover small islands circumstance in one hand has physical, natural resources and valuable biodiversity limitation. On the other, with those limitations small islands are forced to increase their development, including spatial planning. The negative impacts of spatial planning implementation are also difficult to be noticed in short time that puts more efforts to consider environmental substance in a spatial planning. Therefore, it needs a tool to achieve sustainable spatial planning which is more concern on biodiversity issues and rational use of land.

SEA literatures mostly write about taking environmental consideration in a strategic action in general condition, not in a specific condition such as small islands. In addition, the high level of concept of plans, programs, and policies results in major methodological problems for the prediction of impacts (Hilden et al. 1998 in Mortberga, Balforsa and Knolb 2007). Thus, new approaches are really needed due to a special characteristic of small islands. Thereafter, SEA concept seems to be theoretically well explained in literatures only, but practically the concept which is promising integrating environmental consideration into the highest level of decision making is limited. Hence, the concept that has to be matched in real condition, especially in small islands is obviously required. The concept is also demanded to engage relevant knowledge about the impact of land use changes on biodiversity components.

## 1.3 Research Objectives

This study is initiated due to the awareness of environmental consideration significance in decision-making process of spatial planning which has not been satisfying enough with evolving approach in the recent context. Due to that fact, it is essential to discover various ways of including biodiversity issues, through the elaboration of biodiversity assessment

methods. This research aims to identify biodiversity assessment methods (in the frame of international experiences) which are considered suitable for integrating biodiversity issues into decision making process of small islands spatial planning. Selected assessment methods which are already implemented in Trentino (Italy), Stockholm (Sweden) and the Netherlands will be explored. The exploration is intended to gain some principal points of prioritizing biodiversity substance in development planning, and acquire understanding of the connection of biodiversity existence and side effect of development.

Furthermore, the research tries to observe the opportunity of SEA approach improvement concerning on how to integrate biodiversity assessment method into the SEA process of spatial planning of small islands. In line with SEA development for Sabang Municipality context, this research explores lessons learned from the integration of biodiversity assessment with the SEA processes in Trentino, Stockholm, and the Netherlands. Therefore the exploration of biodiversity assessment methods and lesson learned from three different cases will be used as guideline to formulate the SEA processes in Sabang Municipality. As a final point, this research will identify several added values from the findings of biodiversity assessment methods and the integration of this method to the SEA process. The added values will give particular remarks about the importance of the use of biodiversity assessment in the SEA processes owing to provide more comprehensive consideration in decision-making process.

### 1.4 Research Questions

The general question of this research is to what extent spatial planning of small islands can be improved by the implementation of SEA, in particularly through the use of biodiversity assessment methods? Thereafter, three specific questions are developed due to elaborate the general question, which are:

1. What are the proper biodiversity assessment methods for supporting environmental consideration in decision making process of small islands' spatial planning?
2. How to integrate the method(s) of biodiversity assessment into SEA for small islands spatial planning?
3. What is the added value of SEA approach regarding biodiversity issues for improvement of small islands spatial planning?

### 1.5 Research Significant

With the intention of encouraging environmental values in the earliest stages of decision-making, this research will contribute to understanding of the strong connection between biodiversity elements, spatial planning, and decision-making process in small islands development. It cannot be denied that small islands have special characteristics that should be considered in early phases of any decision-making processes. Further, this study will portray the significance of biodiversity information in order to support the spatial planning process. It also will offer reasonable biodiversity assessment methods which fit with SEA consideration in small islands circumstances. Thereafter, this research will contribute to

identify suitable SEA approach related to integrating biodiversity issues in spatial planning for breaking conflicts among development activities, natural system, and conserving environment, particularly in small islands circumstance. Besides, this research will provide empirical data regarding spatial planning, biodiversity issues, and proper biodiversity assessment methods for SEA implementation in small islands that can augment SEA literatures.

### 1.6 Theoretical Framework

The theoretical framework formulates the principal knowledge as a reference for finding the applicable biodiversity assessment methods to be implemented in SEA approach for small islands spatial planning case. The development of the framework is grounded on linkage of three theories, namely biodiversity assessment, strategic environmental assessment (SEA), and spatial planning for small islands. Subsequently, these theories will be the basis of conceptual model of this research.

Before conducting the assessment, definition of biodiversity and description of indicators for biodiversity needs to be clearly defined first. The proper methods then of biodiversity assessment will result in reliable data which figures comprehensive information rather than describing merely vegetation distribution and biodiversity list. The reliable biodiversity data can plays significant role of influencing decision-making regarding spatial development. Besides, data of impacts prediction on biodiversity have a tendency to convince the direction of development.

SEA theory provides knowledge how to promote sustainable development by incorporation of environmental thought into strategic level through its various definition and principles. SEA has various approaches in terms of kind of priority to be achieved. One of them is biodiversity assessment. However, biodiversity assessments itself have to be match with SEA procedures. Therefore, comprehensive understanding around this relationship is needed to be formulated. Criteria for SEA indicators should be well-defined owing to obtain SEA effectiveness for small islands spatial planning.

Small islands have special characteristics. In one hand, it has a huge potential to increase economic growth due to its productive resources (mangroves and coral reefs) and variety of economic activities (fisheries, aquaculture, tourism, and transportation). However, it cannot be denied that many kinds of development in small islands lead to environmental degradation, habitat loss and fragmentation. Small islands definition in this research refers to the definition from UNESCO and Ministerial Decree No. 27 Year 2007 of the Department of Marine and Fisheries, Indonesia. Moreover, characteristics of small islands that take into account are around biodiversity, physical condition, and its physical consequences of development activities. Hence, information about biodiversity and physical characteristics can be the baseline data of small islands environment that to be considered in decision-making processes of spatial planning in small islands.

Moreover, those theoretical views will be used to develop a guideline that purposes to be applied in Sabang Municipality, as one of many small islands in Indonesia. The empirical examination will present how theoretical context of biodiversity assessment, SEA concept and principle, and spatial planning for small islands can contribute to the improvement of SEA approach in Sabang Municipality. The theoretical framework of this research is pictured in more understandable by Figure 1.1.

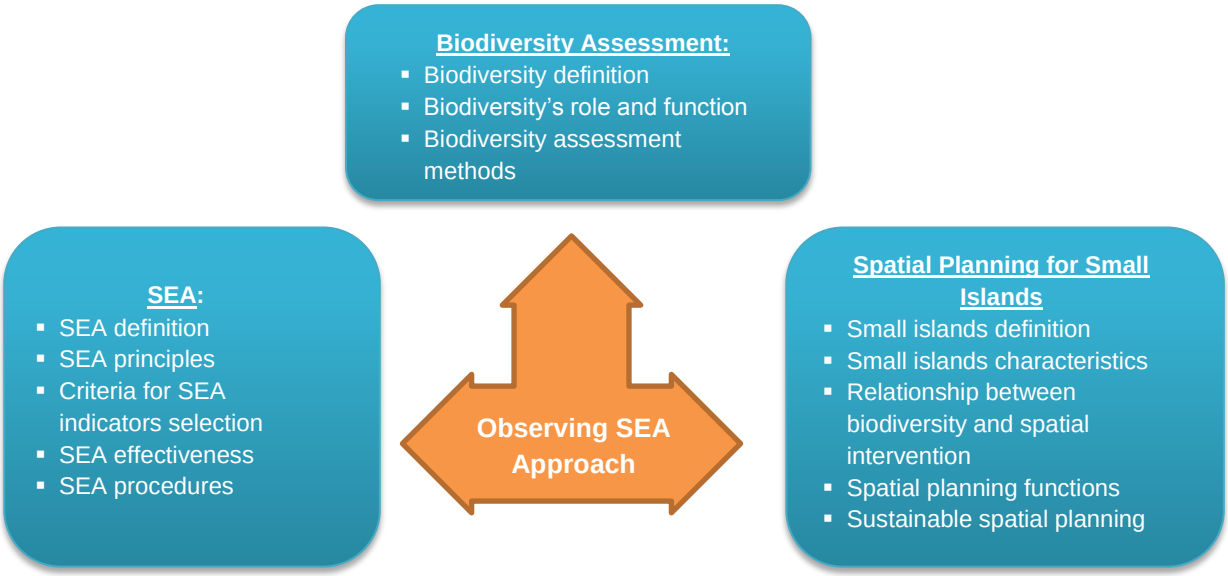



Figure 1.1 Theoretical Frameworks

## 1.7 Thesis Structure

This thesis is structured into six chapters (Figure 1.2). The first chapter is introduction part. It presents background, problem statement, research objectives, research questions, research significance, theoretical framework, and thesis structure. Following this chapter is theoretical review for the foundation of research which will describe in chapter two. This chapter discovers theories related to biodiversity assessment, strategic environmental assessment (SEA), and spatial planning for small islands, and then come with a conceptual model of the research.

Next to that is chapter three explains about research methodology. How the research to be conducted, what kind of data demanded, what is the correct method for gain better result are elaborated within this chapter. The fourth chapter is one of the essential parts of this research. This chapter analyses the international review concerned biodiversity assessment implementation in Trentino, Italy, Stockholm, Sweden, and the Netherlands. This chapter also portray the connection of biodiversity assessment and SEA development in those cities as well. Practical knowledge will be acquired in this chapter by means of international experiences.

Another essential chapter is chapter five which expresses about guidelines development to achieve one of research objectives. The chapter will explore state of the art of Sabang Municipality. Comparison of key factors will be examined. The guidelines therefore for biodiversity assessment and SEA approach are constructed base on international review and lessons learned from comparison experiences between Trentino, Stockholm, the Netherlands, and Sabang Municipality.

The last chapter presents conclusions of the research as well as answers the research questions. Reflections also will be presented aiming to express how the research was conducted. Thereafter, some recommendations are formulated to be offered to Government of Sabang Municipality as suggestions and to future research in SEA approach improvement of small islands' spatial planning.

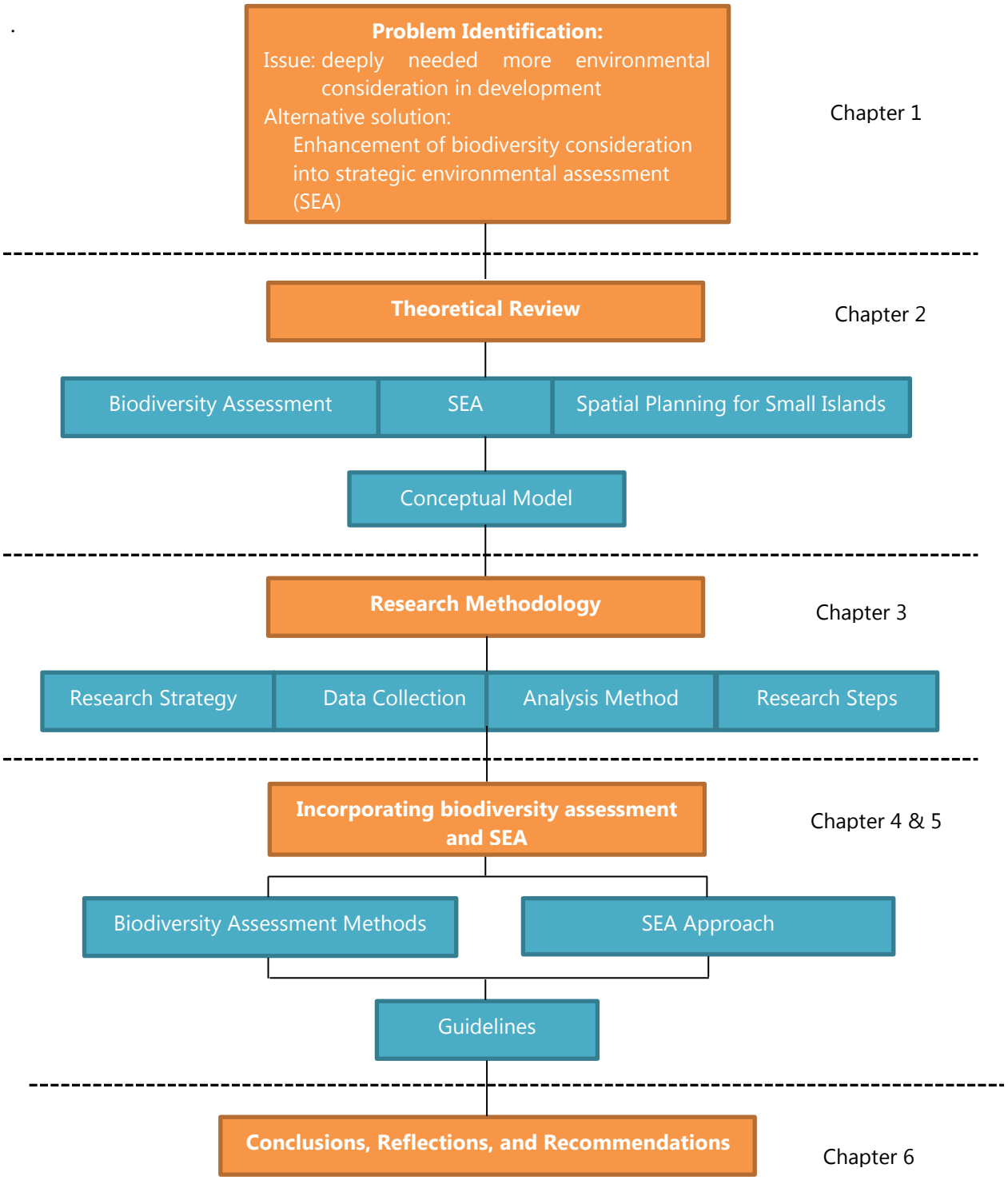



Figure 1.2 Research Design

# CHAPTER 2 THEORETICAL REVIEW

This chapter elaborates the theoretical foundation of integrating biodiversity issues into decision-making process of small islands spatial planning through the implementation of SEA. Theoretical foundation is explored in order to observe the finest approach of answering the research questions. The theoretical sources of this review are obtained by studying literature and best practices of incorporating environmental aspects in development goals.

Four sections are elucidated within this chapter. The first section discusses about biodiversity in general concept and the role of biodiversity assessments as one of ways to consider environmental in decision-making. The next section conveys knowledge covering the potential of SEA as an approach to influence decision-making process by providing reliable data of environment, particularly on biodiversity aspect. Furthermore, the following sections of theoretic study looks at spatial planning and small islands concept which present the function of spatial planning to control the direction of small islands development. It also tries to figure out how spatial planning could influence the preservation of biodiversity in small islands. Besides, this section also communicates small islands definition, its substantial characteristics, and biodiversity richness and function to the existence of small islands. The last section presents the conceptual model of research by synthesizing the fundamental points of each previous section. The intention of this section is providing analytical framework to scrutinise the empirical case.

## 2.1 Biodiversity Assessment

Biodiversity is an essential part of the natural infrastructure supporting the society, as well an immense cultural and social value. Biodiversity has been given more concern on environmental issues since the Conference of Sustainable Development held in Rio de Janeiro in 1992. Then it was rose simultaneously by the impact of growing civilisation extensively to natural environment. The fact that biodiversity takes vital role in particular aspects such as food sustainability and pharmacological generate further awareness of biodiversity. It arises understanding that biodiversity has to be conserved in order to give future generations the same opportunity to meets their own needs. For this reason, biodiversity turn out to be the priority agenda for many consideration and discussion relating to the relationship between human, species, and natural environment. Thereafter understanding, assessing, and integrating biodiversity within spatial planning or other planning processes is a challenging and complex task.

The term of biodiversity is interpreted variously depending on the interest of people. Biodiversity is abbreviation of biological diversity. However the meaning of biodiversity is more than explanation of number of species or species richness only. Biodiversity has two fundamental elements, which are the variability of life on Earth and ecological integrity. The variability element refers to number and differences of biological objects on Earth presenting the composition of species in this planet. The integrity element signifies the linkage of

biological objects and its role on various scale of ecological system. Hence, biodiversity in this research points to both the fundamental elements. Generally, biodiversity is identified within three distinct levels, which are genetic diversity, species diversity, and ecosystem diversity. Genetic diversity concerns with the variety of genetic figure of the individual plants, animals and micro-organism which populate on earth, while species diversity relates to species diversity on earth. Last of all, ecosystem diversity focuses on the variety of habitats, biotic communities and ecological processes.

To be more precise, biodiversity definition used in this research refers to the Convention on Biological Diversity (1992), which is:

> "*The variability among living organisms from all sources including, inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems"* (Convention on Biological Diversity (1992), Article 2).

The continuity of population growth leads to extensively demanding area for residential, industrial, business activities, agriculture, as well as other commercial activities, which are consequently creating land use changes and disturbing biodiversity composition. Strong pressure on landscape from urbanization and development steers to environment problems, changes in landscape, and loss and fragmentation of ecosystem. These problems intimidate the existence of biodiversity within environmental system. Substantially, in particular time, human intervention on natural resources causes changes in the functioning of environment and impacting to the loss of biodiversity component, such as genes, species, and ecosystem. Further, to some extent spatial planning which consists of determination of land uses and land-based activities could be a kind of human intervention to biodiversity. Spatial planning takes into account of existing land uses and development, new area development, and new spatial structure. Those spatial planning activities can disturb the composition, structure and function of biodiversity. The effect of humankind factors on the existence of biodiversity is figured out in Figure 2.1.

In general, it can be assumed that there are three kinds of biodiversity problems associated with spatial planning implementation. First is lack of biodiversity valuable data. Even data are available it is very general description about biodiversity. Data is characteristically complete enough in protection and conservation area, which is only number and variety of biodiversity. Moreover, the present data is merely description of vegetation maps and species stock which is obviously has less influence for taking into consideration in decision-making arena.

Second problem is impacts of development into biodiversity. The continuous intensification urbanisation and following by demanding various infrastructure provisions generate land use changes. This land changes is susceptible to be fragmented and loss of habitat quality constantly. Furthermore, the pressures to improve small islands development tends to generate urbanizing landscape, where human dominate the landscape and land use

functions compete each other for gaining space. Nature including the existence of biodiversity and landscape values is the emerging important component in the competition of space.

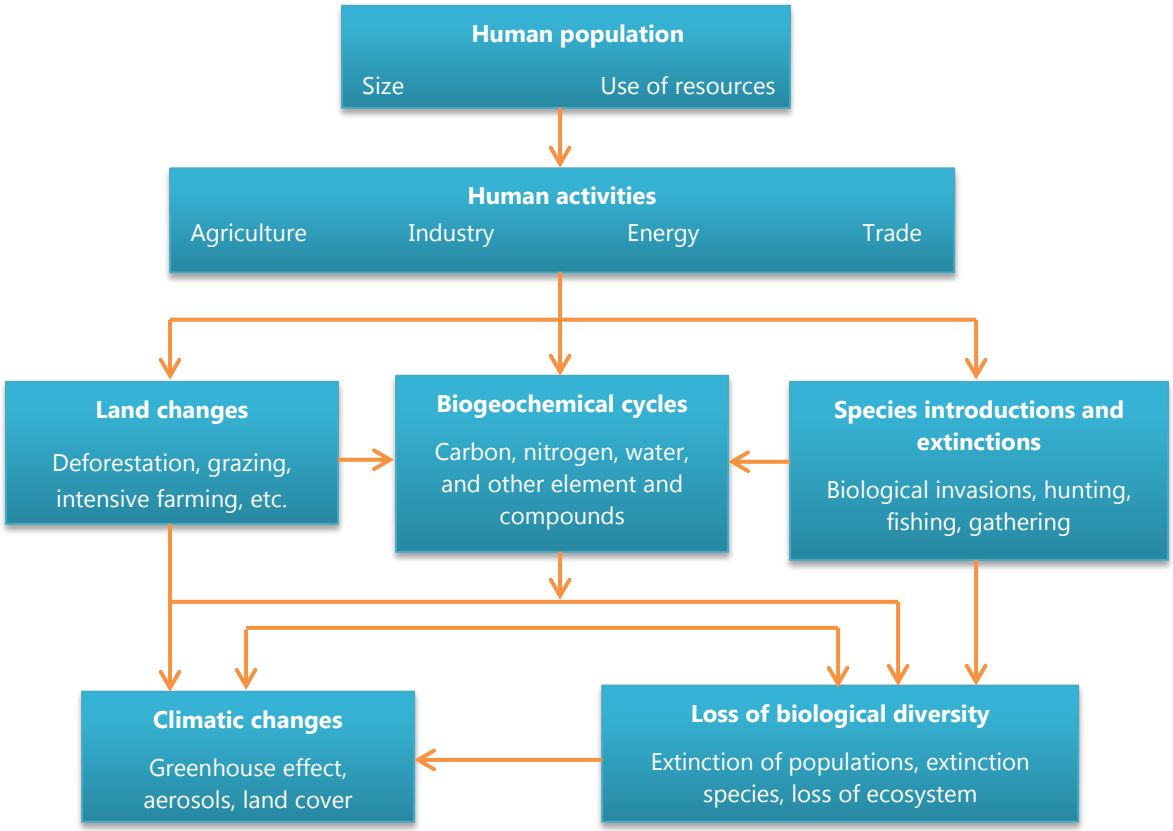



Figure 2.1 an illustration of direct and indirect effects on biodiversity

Source: Leveque and Mounolou (2003) p.151

The last problem in this context is assuming that economic development is more beneficial than the protection of biodiversity. Serious global problems arise as the combination of interaction among ecological, economic, and social problems. Even biodiversity-related problems usually stick to those three contexts, problem-solving often concerns merely on one of the context due to unequal approach and narrow view to problems. Improvement of biodiversity conservation is thus fragmented and lacks of comprehensive understanding in decision-making process. So as to satisfy completely about the fundamental need of sustainability, decision which potentially affects the existence of biodiversity must be made in a different and better way.

Due to that fact, numbers of regulation have been requiring environmental assessment, especially for development that tends to create significant impact to the environment. However, the idea of environmental assessment could decrease and prevent environmental degradation has not fully achieve yet. Typically general biodiversity assessment offers only biodiversity information which characterizes the configuration of biodiversity quantity.

Unfortunately, this information cannot go further to conserve and protect biodiversity from many kinds human interference. Beside, another essential information needs is the development effect on biodiversity which is occurred due to human intervention to the environment.

The growing understanding of biodiversity's function in life support system has been complemented by progressively sophisticated biodiversity assessment methods. Definitely, biodiversity can be assessed at genetic, species, as well as landscape and ecosystem level (Figure 2.2). On each level, biodiversity assessment deals with its composition, structure, and function. Composition focuses on the variety of biodiversity both quantity and quality, yet it can be carried out only for past and present time frame. Structure examines the formation of biological units in time and space. Then function of biodiversity concerns on biological units that perform in sustaining natural processes and dynamics. Importantly, the potential effects of numerous planning and forthcoming impacts, specifically on function of biodiversity, have to be assessed comprehensively. Changes accumulation of certain mutually dependent landscape can trigger changes in the overall landscape pattern substantially. Thus, the fundamental step to be arranged is finding the proper method of biodiversity assessment due to bridge biodiversity issue and development issue within spatial planning context.

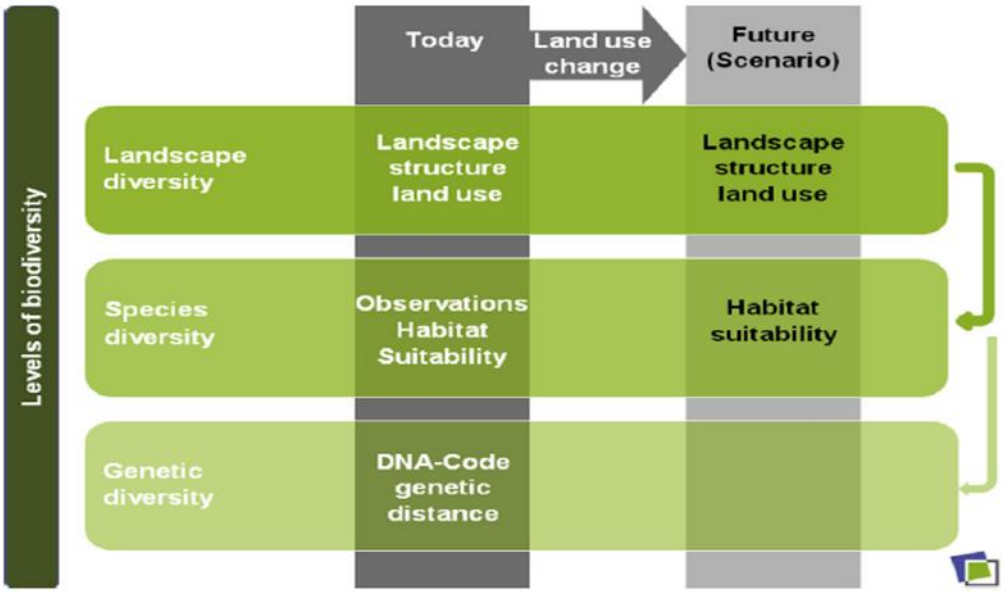



Figure 2.2 the connection between three levels of biodiversity and characteristics for their assessment of recent and future states

Source: Syrbe, Michel in Syrbe, Michel, and Walz (2013) p.90

Choosing proper biodiversity assessment methods are also a challenge. There is numerous methods exist in academic literatures which represent interesting approach dealing with biodiversity issues. It needs thus selection criteria for choosing the right method which fits with SEA implementation and spatial planning of small islands. Hereinafter methods that will be implicated within this research are investigated based on several criteria (Bijlsma, et al.

1995; Slootweg and Kolhoff 2003; Treweek, et al. 2005; Donnelly, et al. 2007). First, biodiversity should be major priority of the assessment approach. Second is the application of method. It means that the method should be applicable within small islands circumstances. Beside the method should have clear link between biodiversity and small islands development. The last criteria are the method should be easy to be executed but still covers comprehensive and integrated model of biodiversity assessment. These three selection criteria are expected to be a window opportunity to find the answers of biodiversity problems that have been described previously.

After reviewing many literatures related to biodiversity, SEA and small islands spatial planning, I culminate in methods that fulfil those three criteria which are biodiversity assets assessment (BAA) (Geneletti, 2008), landscape ecological assessment (LEA) (Mortberga, Balforsa and Knolb 2007), and Multi-Criteria Cost Benefit Analysis (MCCBA) (Sijtsma, Heide and Hinsberg 2011). Unfortunately, there is no single method that matches with the problems especially as an answer to all biodiversity problems. However the selected methods are comprehensive enough to solve the problems. BAA can be a problem solving for producing valuable data. Consideration of development impact into biodiversity can be accomplished through LEA, and conflicting goals between economy and biodiversity can be broke via MCCBA approach.

In addition the selection relies on those criteria, the selected method are also divided into specific and general assessment of biodiversity. Specific assessment indicates major attention to biodiversity issues, while general assessment implies the application of method also can be used for many assessment purposes aside from biodiversity. BAA and LEA are the specific biodiversity assessment methods, while MCCBA is the general assessment method.

In terms of specific biodiversity assessment, the methods are chosen because of each method represent assessment on level of biodiversity. BAA stands for genetic and species level, while LEA denotes to the ecosystem level. In addition BAA concerns on composition and structure assessment, whereas LEA applies to functioning matter. On the other hand, MCCBA presents different perspectives. MCCBA is a consensus-based assessment approach for achieving sustainability and accountability. MCCBA is a comprehensive model, incorporating monetary value and assigning weights. MCCBA allows including biodiversity impacts within its assessment.

Table 2.1 General summary of selection criteria of choosing biodiversity assessment methods

| Review of Biodiversity Assessment Method | BAA | LEA | MCCBA |
|---|---|---|---|
| **Fulfil the criteria** | ✓ | ✓ | ✓ |
| **Solve the problems** | Mainly related to problem number 1 | Mainly related to problem number 1 and 2 | Mainly related to problem number 1 and 3 |
| **Type of assessment** | Specific assessment | Specific assessment | General assessment |
| **Focus of assessment** | - Genetic and species level<br>- Focuses on composition and structure assessment | - Ecosystem level<br>- Focuses on structure and function assessment | Mixing of monetary value and assigning weight |

### A. Biodiversity Assets Assessment (BAA)

Biodiversity assets assessment (BAA) tries to counter the weakness of current data availability by comprehensively identification and mapping biodiversity assets, and involving Geographic Information System (GIS) approach, in particular planning support system (PPS) (Geneletti 2008). Comprehensive means that biodiversity will be assessed on the overall biodiversity assets of a region, through classified biodiversity into numerous themes which are in line with biodiversity levels (genetic, species, and ecosystem). Expert panels will involve giving their evaluation judgment about the result of assessment. The information generated during the assessment will overlay with several maps in order to make it more valuable. Hence, data which are pure description of biodiversity characteristic can be transformed into more valuable data. Subsequently, valuable data will be able to deliver effective support for spatial planning processes (Geneletti 2008). Noticeably, BAA has an approach to complete one of biodiversity problems related to lack of valuable data.

Moreover, BAA obviously has a main concern on biodiversity issues which fills the first criteria. BAA attempts to defined biodiversity characteristics into specific themes so as to produce and figure out the biodiversity into number of value and classified into several levels (including warning levels) for the whole area/region (Geneletti 2008). Warning level especially is declared to protected areas, which puts non-protected areas less attention compare to protected areas. This assessment thus promotes wide-ranging consideration of biodiversity issues in spatial planning not only for protected areas, but also to non-protected areas.

Through prioritizing assessment on all levels of biodiversity, and then integrate the assessment into broad environmental and sustainability strategies, BAA tries to avoid single focus assessment. According to Spangenberg (2007) biodiversity plays insignificant role in

current political context is caused by its single focus orientation. The analysing of species number and abundance as well as spatial configuration is not helpful enough to gain policy priorities (Spangenberg 2007). BAA thus offers scientific biodiversity analysis that can be useful also for development and political reasons.

With regard to small islands spatial planning, this assessment provides more informative biodiversity data rather than the conventional assessment which points only on vegetation maps and species inventories. BAA thus has an ability to convey the value of biodiversity to support spatial planning decision-making process trough transfiguring descriptive data into value-based information. Further, BAA also emphasizes the use of data which is usually regularly obtained by governmental agency. It makes the data are easily updateable and then more useful for supporting spatial planning processes. BAA tries to consider biodiversity and ecological assets in spatial planning without really highlights on descriptive data, for instance land cover information. But the descriptive data will be reanalysed due to produce more beneficial data. Furthermore, small islands which typically have a wide range of biodiversity assets, but it is exposed to high development would be suitable to be assessed by BAA approach. It is caused that BAA proposes an approach to map and assess biodiversity assets within the whole area of region, and give value to the biodiversity which is based on warning level (Geneletti 2008).

In terms of method, BAA has not involved really complicated steps. The general steps of BAA are identification and mapping of biodiversity assets (which can be obtained by current available data as well as generating those data), evaluation of biodiversity through expert panel instead of single expert, and integration result into a planning support system (PSS). PSS enable to organize the data which makes data are easy to be retrieved, understood, and applied. Moreover, BAA utilizes the existing sources, both human resources and data resources. BAA method encourages paying attention to transparency, quality and the applicability of data through collaboration various experts, planners, and governmental agency. Collaboration of experts is an approach to guide informed decision-making and ensure the outcome of BAA will be formally taken into account of spatial planning decision-making process.

**B. Landscape Ecological Assessment (LEA)**

Landscape ecological assessment (LEA) covers impact measurement of long-term development processes on biodiversity units. According to Mortberga, Balforsa and Knol (2007, p.468) LEA is

> "*a systematic procedure that encourages the exploration of data and priority settings that aims to quantitatively address landscape and ecosystem levels of biodiversity issues in an area*".

LEA is able to predict the impacts of land use changes on the fauna and flora populating on the area through habitat modelling. This assessment implicates forecasting the expected

impacts of developments and connecting those to biodiversity or environmental objectives and targets of the region (Mortberg, Zetterberg and Balfors 2012). The evaluation of LEAs' result could lead to adjustment of the development and its alternatives so as to diminish the negatives impacts of development. LEA approach also assists the region to meet their objectives and target. Thus it seems clear that LEA could solve the second problems of biodiversity, namely continuous impact of development on biodiversity.

Furthermore, following review relates to first selection criteria. The application of LEA contributes to recognise the essential structures in landscape to support biodiversity preservation. LEA is based on principles of landscape ecology, preservation and conservation of biodiversity. LEA provides a consistent approach to evaluate development, which mainly relates to urbanisation. In order to apply this assessment, LEA requires a region to have biodiversity or environmental objectives and targets. The impact of urban development, for instance habitat loss and fragmentation will be linked to the objectives and targets. LEA hence offers clear, understandable, and spatially explicit evaluation on different development alternatives.

Hereinafter, corresponding to small islands development, LEA is an instrument that helps to measure the potential impacts of spatial planning, and other planning options. This biodiversity assessment enable to choose the less ecological risk of the spatial planning options, and to design the approach for the mitigation of expected unfavourable impacts. Spangenberg (2007) have been identified the main anthropogenic disturbance factors, which might be resulting from urban development for the three levels of biodiversity, explained in Table 2.2. Therefore, it is believed that LEA could contribute to better decision-making and achieve sustainable planning through impact prediction of anthropogenic factors and integration the prediction into planning process (Mortberga, Balforsa and Knolb 2007). In addition GIS approach delivers images of environmental impacts of alternatives urban development scenarios. The image then is expected will improve the process of spatial planning and decision-making. It is clear that LEA implementation could be beneficial for small islands development.

In accordance with method, the working processes of LEA involve a combination of ecological and GIS approach. This assessment aims to integrate biodiversity issues in spatial planning by way of investigation and modelling biodiversity effects in the LEA processes. It cannot be pointed that the operation of LEA method is simple. Maps of biodiversity habitat networks and table of effects and impacts are valuable results of LEA process that can be very beneficial to be used as a decision support. The sophisticated result surely is produced by an advanced method. However, it does not indicate the steps, particularly on the predictive modelling by GIS cannot be followed easily. The only need is learning by practicing.

Table 2.2 Anthropogenic pressures for the three levels of biodiversity

| | |
|---|---|
| **for the ecosystem level** | 1. Human interference by overexploitation (logging, hunting, gathering, farming, grazing), from habitat disturbance and fragmentation all the way down to full habitat destruction;<br>2. Disturbed hydrological regimes from water logging, reduction of forest cover and changed precipitation patterns, and<br>3. Changing geo-chemical and climatic framework conditions through climate change and pollution. Climate change has already produced numerous shifts in the distribution and abundance of species and will have even more significant impacts in the future. |
| **for organism/ species level** | 1. System fragmentation impeding selectively on the reproductive capacities of species with a larger habitat, thus shifting the balance of species and the state of the system.<br>2. Competition with deliberately or unconsciously anthropogenically introduced foreign species ('biological pollution'). As they are 'unknown' to the ecosystems and the domestic species they may thrive without natural enemies, alter the species and product composition of ecological systems, and tend to reduce their productivity. Through competition, they may suppress native species down to ultimate extinction.<br>3. The effects of ecotoxics. Accumulating heavy metals are a long-established problem. |
| **for genetic level** | 1. Selective pressures on the gene pool from changing environmental conditions.<br>2. 'Genetic pollution' from the increasing number of deliberate releases of genetically modified organisms with traits which might, e.g., penetrate the natural population and reduce its viability, or which could outcompete natural varieties in particular in anthropogenically shaped environments.<br>3. Reduction of biotope size and thus of population numbers, threatening genetic diversity through the stochastic processes of genetic drift. |

Sources: Spangenberg (2007)

### C. Multi-Criteria Cost Benefit Analysis (MCCBA)

Multi-criteria cost benefit analysis (MCCBA) is a tailor-made approach based on the principle of multi-criteria analysis (MCA) and cost benefit analysis (CBA) which aims assessing sustainability in more accountable ways. MCA and CBA are general evaluation tools that have been improved and extended for use in environmental decision-making. Numerous implementations of CBA and MCA had success to lead decision-making.

CBA play an essential function in advocacy and decision-making on environmental impacts by means of representing financial and economic value of integrating environmental impacts and planning (Barfod, Salling and Leleur 2011). Application of CBA basically based on preferences in actual markets, while biodiversity assets are not dealt in official market. However, CBA disregard that all cannot be put into monetary terms.

Multi-criteria analysis (MCA) can overcome the limitation of CBA performance. MCA allows the inclusion of political objectives in the assessment that cannot be monetised with sufficient confidence, such as environmental quality criteria. MCA enable greater arrangement by allowing impacts that cannot be articulated in simple financial calculation (Guhnemann, Laird and Pearman 2012). It also acknowledges the explicit exploration of different perspective of stakeholders involved. Nonetheless, the shortcoming of MCA is less effective process due to long lists of criteria. Then each criterion has interdependence with other criteria causing hard to be accounted.

Both CBA and MCA have advantages and disadvantages on their application. In term of biodiversity inclusiveness in decision-making process, these evaluation methods have a potential to bring biodiversity as the first consideration. The widely known of CBA and MCA application within decision-makers generates greater possibility of biodiversity consideration. Hence the integration of both approaches in the form of MCCBA will enhance the possibility of biodiversity inclusiveness, which stimulates the equal portion of consideration between economic and biodiversity

MCCBA has ability to bring transparency, equity and efficiency in decision-making process for the inclusiveness of biodiversity. MCCBA involves both judgement and measurement to be reasonable for wide range group of stakeholders. The engagement of technical and non-technical knowledge and values into the assessment of biodiversity will improve the quality of the assessment. It provides accesses to a flexible and robust decision-making process in the same time. MCCBA proves to be tools that can integrate the multidisciplinary field to support decision-making process associated with pursue sustainability. The application of MCCBA could reduce the assuming that economic development has more benefits compare with biodiversity conservation.

In order to support MCCBA for biodiversity consideration, widely applicable indicators for biodiversity impacts are needed. A nature value indicator is developed, namely T-EQA: threat weighted-ecological quality area (Sijtsma, Heide and Hinsberg 2011). Ecological quality area (EQA) is the main foundation of T-EQA. EQA lays on the amalgamation of two ecological concepts, which are area size of an ecosystem or the combination of ecosystems and the ecological quality of the ecosystem. By operating this indicator, reasonable explanation about status, tendency, and causes of biodiversity loss could be informed in an understandable way. Even though MCCBA is more universal method, MCCBA meets the first selection criteria.

Small islands development involves conflict on prioritizing objectives mostly between social economic and social environment. MCCBA could facilitate the conflict through providing scientific and valuable information about biodiversity. Monetisation of biodiversity has been suggested as a possible solution to those conflicting issues. Giving monetary value into biodiversity allows selecting between efficient preservation and adaptation strategies (Perrings 2005). Moreover, concerning about value, costs and capital stocks are familiar with

decision-makers in decision-making processes. Unfortunately, this is not really enough as a policy steering. Hence the combination CBA with MCA enables aggregation monetary and non-monetary value in consensus based (Sijtsma, Heide and Hinsberg 2011).

Even though MCCBA is the integration method, the execution of method is not too complicated. But obviously it requires time and experiences to be familiar with the steps of method due to involve economic and ecological terms in the same time. However the main challenge is application of MCCBA demands much time as it is mostly consensus based approach.

### 2.2 Strategic Environmental Assessment (SEA)

Since the establishment of environmental movements, there are various tools promoting environmental aspect due to pursue sustainable development. Before strategic environmental assessment (SEA), environmental impact assessment (EIA) is developed. EIA is a mainly quantified and local assessment tool that is applied to projects. In regard with those limitations, incorporating environmental considerations into the highest levels of development decision making is necessitated. SEA has a potential to reduce the limitation of EIA. SEA considers environmental impacts in strategic decision-making, analyse environmental change induced by superposition and cooperation of some projects, and assess fully alternative schemes at the early stage of plan. The fundamental goal of SEA is protection of environment and promotion of sustainable development through integration of environment and sustainability in decision-making (Partidario 2003, Therivel 2004). However, understanding SEA concept as the tool to make better development recognizes many acknowledgements. The implementation of SEA will differ both geographically and jurisdictionally, with regard to the levels and sectors of decision making covered (Sadler 1996). According to Sadler and Verheem (1996) in Therivel (2004 p.7) SEA is:

> *"a systematic process for evaluating the environmental consequences of proposed policy, plan or program initiatives in order to ensure they are fully included and appropriately addressed at the earliest appropriate stage of decision making on par with economic and social considerations"*.

SEA offers a potential approach for stimulating environmental augmentation, especially for preventing biodiversity and habitat loss (Gontier, Balfors and Mortberg 2006; Mortberg, Zetterberg and Balfors 2012). Obviously SEA is an important instrument for encouraging conservation and sustainable use of biodiversity. SEA offers opportunities to encourage mainstreaming biodiversity into the planning and development implementation, which is in precise (Treweek, et al. 2005):

- Helping to implement biodiversity policy
- Helping to ensure that requirements of protected areas, habitat and species are met
- Building biodiversity enhancement into plans
- Encouraging an ecosystem approach

- Ensuring active participation and consultation with people who need and use biodiversity

However, the effectiveness of SEA implementation depends on how the assessments will match into the planning context. SEA then should examine biodiversity impacts at an appropriate biodiversity level in order to recognise key threats and opportunities for mitigation alternatives (Treweek, et al. 2005). Input for assigning which level of biodiversity should be examined in SEA is presented in Table 2.3.

Table 2.3 Input of biodiversity level to be examined in SEA

| | |
|---|---|
| **1** | ***Genetic level***<br>Will the proposal:<br>▪ Reduce genetic diversity, particularly for already rare and declining species, endemic species and populations and those with Species Action Plans?<br>▪ Reduce opportunities for species populations to interact, e.g., by increasing habitat fragmentation and isolation?<br>▪ Increase risk of extinction?<br>▪ Affect locally adapted populations?<br>▪ Affect important ecosystem services that depend directly on genetic diversity, e.g., pollination of crops? |
| **2** | ***Species level***<br>Will the proposal:<br>▪ Alter the species-richness or species-composition of communities in the study area?<br>▪ Cause some species to be lost from the area?<br>▪ Affect the success of Species Action Plans or objectives in National Biodiversity Strategies and Action Plans (NBSAPs)?<br>▪ Increase the risk of invasion by alien species?<br>▪ Change the amount, quality or spatial organization of habitat?<br>▪ Affect plans to enhance habitat availability or quality?<br>▪ If habitats will be lost or altered, is alternative habitat available to support associated species populations and are there opportunities to consolidate or connect habitats? |
| **3** | ***Ecosystem level***<br>Will the proposal:<br>▪ Change critical ecosystem processes, for example, hydrological processes, levels of predation?<br>▪ Reduce the overall productivity of the area?<br>▪ Affect the provision of ecosystem services?<br>▪ Affect overall biodiversity values? |

Source: Treweek, et al. 2005

In order to maximize SEA's role, beside consideration of an appropriate biodiversity level, criteria for environmental indicator selection are demanded. The criteria is fundamental due to an indicator functions as an indication that environmental changes had occurred causing

by execution of plans or programs. The indicator has to be a representation of area impacted and proposed development. Additionally, while practicing SEA, chosen indicators should be confirmed and acknowledged by stakeholders and participants. The indicator then can facilitate identifying suitable biodiversity assessment method for SEA implementation. Some criteria which are used in this research for selection the appropriate biodiversity assessment methods are grounded on Donnelly, et al. 2007 (Table 2.4).

Table 2.4 List of criteria for environmental indicator selection

| No | Criteria | Brief Description |
|---|---|---|
| 1 | Policy relevant | Consistent with significant legislation already in existence |
| 2 | Cover a range of environmental Receptors | The data gathered should provide information that extends beyond that which is being measured |
| 3 | Relevant to the plan | Plan specific environmental impacts should be detectable |
| 4 | Shows trends | Responsive to change, measurable, capable of being updated regularly, demonstrates progress towards a target |
| 5 | Understandable | Ability to communicate information to a level appropriate for making policy decisions and to the general public |
| 6 | Well founded in technical and scientific terms | Data should be supported by sound collection methodologies, clearly defined, easily reproduced, and cost effective. Identifies areas most at risk of damage |
| 7 | Prioritise key issues and provide early warning | Identifies areas most at risk of damage. Provide early warning of potential problems before it is too late |
| 8 | Adaptable | Emphasis can change at different stages of the plan |
| 9 | Identify conflict | With plan objectives in order that alternatives may be explored |

Source: Donnelly, et al. 2007

SEA should begin in the start of planning processes. It is intended to look forward all potential environmental impacts of strategic development, long before single projects are executed. Some biodiversity issues to be considered for deciding the requirement of SEA implementation are explained in Table 2.5. SEA process proceeds parallel with plan-making. SEA then concludes in the provision of an environmental report due to inform decision-making. SEA implementation should emphasis on processes rather on a product (Brown and Thérivel 2000). Further SEA procedures are diverse depend on the condition and requirement. Thus, key consideration in choosing SEA procedure is fundamental. SEA is a flexible approach, which can be tailored to the context to be applied. There is no specific procedure which can be applied to all different concern of SEA. SEA procedures need to be flexible to the emerging various agendas, actors, discourses, knowledge requirement, and negotiating styles within different policy-making sectors (Brown and Thérivel 2000).

Table 2.5 Biodiversity issues for deciding the requirement of SEA

| No | Key issues to consider | Will the proposed plan: |
|---|---|---|
| 1 | Influence of the plan in terms of sustainable development goals | 1. Affect achievement of goals or objectives for biodiversity in other policies, plans and programmes?<br>2. Change levels or rates of use of biodiversity? |
| 2 | Influence of the plan on values and uses of biodiversity | 1. Damage or destroy biodiversity on which people depend for their livelihoods?<br>2. Damage or destroy biodiversity valued by people?<br>3. Reduce access to biodiversity for current or potential future users? |
| 3 | Influence of plan in terms of environmental quality/health | 1. Exacerbate existing threats to biodiversity, e.g., by involving activities already posing a threat to biodiversity in the study area?<br>2. Cause critical impact thresholds (e.g., levels of pollution of a wetland) to be exceeded? |
| 4 | The probability, magnitude, duration, frequency and reversibility of effects | 1. Have relatively certain impacts on biodiversity?<br>2. Have large impacts on biodiversity?<br>3. Have long-term effects in relation to biological lifecycles?<br>4. Have repeated impacts on the same biodiversity resources at such a frequency that their recovery might be compromised?<br>5. Have irreversible impacts on biodiversity, i.e., impacts from which spontaneous recovery is impossible and there are no known effective mitigation techniques? |
| 5 | Cumulative effects | 1. Affect areas where biodiversity is already exposed to significant threat, e.g., through habitat loss or fragmentation?<br>2. Exacerbate space-crowding with significant effects on certain components of biodiversity or on a high proportion of the resource within the study area?<br>3. Exacerbate environmental deterioration such that critical thresholds may be reached?<br>4. Make a significant contribution to "in-combination" or cumulative effects on biodiversity? |
| 6 | The magnitude and spatial extent of the effects | Lead to projects that are space- or resource-hungry, e.g., occupy large areas or use large volumes of water? |
| 7 | The value and vulnerability of the area likely to be affected | 1. Affect protected areas or areas of important, threatened or vulnerable biodiversity?<br>2. Affect areas of high biodiversity, whether protected or not?<br>3. Affect areas covered by National Biodiversity Strategies and Action Plans (NBSAPs)? |

Source: Treweek, et al. 2005

In some condition, SEA starts with general standard of EIA, which is screening and scooping (Therivel 2004). This condition usually happens while SEA is part of a hierarchy of a regulation. In contrast, other cases, SEA begins with reshape objective to include environmental and sustainability issues, following by identify targets and indicators. Even though there is no single accepted procedure to conduct SEA, general steps of process exist in many literatures of SEA (Therivel and Partidario 1996; Therivel 2004; Jones, et al. 2005). SEA stage of this research will be based on by McCluskey and Joao (2011) due to its detail steps ensuring biodiversity issues takes into account of decision-making. The stage containts of:

- Objectives;
- Describing the baseline information;
- Relevance and implications to other strategic actions policies;
- Alternatives;
- Identification and evaluation of key effects;
- Mitigation and monitoring of effects;
- Consultation and decision-making.

Therefore proper SEA procedure, which includes biodiversity assessment should be formed in line with the PPP formulation and decision-making context. The means, processes, framework and administrative requirements for implementing SEA need to be tailored closely to the particular circumstances of the PPP under consideration (Brown and Thérivel 2000).

### 2.3 Spatial Planning for Small Islands

The standardization of small islands definition and area boundaries has been considered important since the Third International Hydrological Program (IHP-III) of the UNESCO in 1979. This third session of intergovernmental council formulated one of its focus programs on small islands. In the context of limitedness of freshwater resources UNESCO distinguishes between very small islands and small islands. UNESCO characterises small islands as an island with 2,000 $km^2$ area wide, and no more than 100 $km^2$ as a very small island. Moreover, the Ministerial Decree No. 27 Year 2007 of the Department of Marine and Fisheries, Indonesia defines small islands as an island of equal to or less than 2,000 $km^2$ in area. Besides the size of small islands, the number of occupant is also has to take into account. UNESCO emphasises that accordance with 50% only of small islands area that can be utilised, then small islands should be occupied by less than 20,000 of inhabitant. Hence, this research outlines small islands as area of identical with or less than 2,000 $km^2$ and inhabited by fewer than 20,000 residents.

Small islands have numbers of characteristic which is mainly due to its island environment. Following is small islands characteristic synthesised from thoughts of Bass and Dalal-Clayton (1995), Nurse, et al. (2001) and Pelling and Uitto (2001):

- Geographic remoteness, distressing economic of scale;
- Limited physical size, which affects development growth, infrastructures, and exploration of land transport;
- In most cases, it has limited natural resources generating unsustainable human activities, then trigger impact to other parts of environment owing to close linkage among island ecosystems;
- High vulnerability to natural hazards and insularity and remoteness;
- An introduction area due to ecological condition and dissimilarity proportion between coastline and land area;
- Limited human resources skills due to small population

The enormous advantage of small islands which typically small islands character is its biodiversity. Bijlsma, et al. (1995) states small islands cover some of the worlds' most diverse and productive resources. Generally, most of small islands are greatly variable in biodiversity context particularly have high terrestrial diversity and endemism. It likewise has diverse ecosystems, range from mangrove, sea grass, to coral reef ecosystem. Coral reefs are known as the greatest biodiversity among marine ecosystems. Another biodiversity includes mammals, birds, and plants. Nonetheless, small islands biodiversity is endangered by anthropogenic activities, such as overexploitation, land development, and infrastructures provision. It cannot be refuted that human rely on biodiversity for survival, but it seems that human takes benefit of biodiversity excessively. Further, the combination of local development pressures with global environmental change is the main reason of persistent environmental degradation, which puts local ecologies of small islands in risk (Pelling and Uitto 2001). Consequently, those activities could cause changes in population sizes and distribution of species, transform the species composition and boost the rate of species, and habitat loss.

The nature of islands, including their limited land availability and scarcity of natural resources cause unique challenges and special opportunities for small islands spatial planning. However, small islands oftentimes are treated by means of neglected and separated in people's mind and actions. Sustainable development becomes the trend objective of development strategies for small islands. While to pursue the objective the meaning of sustainable development for small islands has to be well defined. Sustainable development strategies for small islands spatial planning analytically rely on classifying of local island issues which have to be put extra attention on wider inter-region or island scale, involving public participation in decision-making process, supporting institutions to take on multiple and integrative functions, developing systems for investigating and monitoring the current condition and changes (Kerr 2005). Moreover, sustainable development in small islands would be achieved through enabling the coastal system to self-organize in performing its potential function devoid of harmfully affecting other natural or human systems (Bijlsma, et al. 1995).

Spatial planning is progressively viewed as one important instrument for sustainable use of space which can promote many concerning points such as biodiversity conservation, environmental protection, disaster risk reduction, and economic development. Spatial planning functions as a regulation for long term use of space. In the frame of appropriate land use allocation, environmental goals at the current and future situation can be minimised. Spatial planning encompass the process of allocation, forming, size, and synchronising space for multifunction uses, which is the basic goal is deciding the future use of space. In small island context, the most challenges are the scarcity of space and the need for continuous growing development. The increasing competition on the use of space affects the environmental condition as well the structure and the composition of biodiversity in small islands. The concern hence is discovering suitable location and proper allocation for spatial pattern and structure of small islands without neglected environmental consideration, particularly on biodiversity issue.

## 2.4 Conceptual Model

Theoretical observation derived from previous sections provide the core thought of integrating biodiversity issues into decision-making process of SEA for small islands spatial planning. In the frame of current development context, biodiversity has become one the growing environmental issue for encouraging of realising sustainable development. Land use changing is judged as part of the main threat to biodiversity conservation through conversion of wild land to urban development area, degradation quality of habitat, and fragmentation of habitat, which consequently causes habitat loss. Further, spatial planning complemented with SEA has a potential to stimulate green growth for small islands which in line with environmental and social values. SEA implementation therefore needs credible information as a baseline data for influencing decision-making of small islands spatial planning. Accordingly proper biodiversity assessment will determine the validity of SEA. To be in precisely, there are several key points that are principal to integrate biodiversity issue into decision-making process of SEA for small islands spatial planning.

### A. Biodiversity Assessment Methods

In the context of small islands, biodiversity plays significant roles. Most of islanders relies their livelihood on biodiversity, especially coastal biodiversity. Besides, ecological specific character of small islands requires deep consideration of every development within small islands. It expects that development activities do not threaten biodiversity existence. Hence, methods of biodiversity assessment emerge as the approach to provide reliable biodiversity data which can motivate plan and decision-making process.

In accordance with biodiversity assessment and SEA concept, biodiversity assessment methods will be investigated with several criteria (Treweek, et al. 2005; Donnelly, et al. 2007):

1. Focus of an assessment method which cover a range of environmental receptors;
   In line with biodiversity assessment explanation, assessment methods have its focus on the assessment. However, the focus should be consistent with impacts of plan proposed. The receptors of the impact can be on the level of genetic, species, habitat, and/or ecosystem. It thus necessitates exploring the appropriate focus for biodiversity assessment related to receptors of spatial planning.
2. Relevancy method to the plan;
   Besides the focus, the methods have to be relevant to the plan. Methods which concern on bird species might be will not fit with waste management plan since the plan will generate direct impacts on soil fertility and land transformation.
3. Implementation Method;
   Biodiversity assessments sound very scientific and understandable only for scientist and experts. Owing to decision-making SEA involves various stakeholders with different background, thus the methods should able to transfer information to reach the understanding of the stakeholders while making policy decisions. Transfer information for making decision and general public should be in simple and clear ways.
4. Well founded in technical and scientific terms;
   With the intention of supporting SEA process, biodiversity assessment has to be based on scientific approach due to gain reliable data. A biodiversity assessment method should be sufficiently supported by scientific collection methodology, data management systems and quality assurance procedures to guarantee the assessment method are accurately presented. The method should be clearly defined, scientifically acceptable, and easy to be executed.
5. Data requirement;
   Each method of biodiversity assessment has its focus and requirement data for achieving the focus. Therefore, it needs to analyse the emphasis of methods that proper with small island context, what are the methods require, and how the methods link to SEA process.

**B. Exploring SEA Approach for Integration of Biodiversity Assessment**

Generally thinking, SEA is accepted as a promising instrument to gain high level of environmental consideration through early informing decision-making. However, the important thing is how to maximize the role of SEA. Answering this question, analysing what SEA needs to take full advantages of SEA's role is needed. Thus, it needs to analyse the main components of SEA, namely technical, process, and communication then takes a look of a SEA steps in general. This means that each step of SEA involves the three SEA components.

Ideally, those three components of SEA are interdependent. Understanding and actualisation comprehensively of the three SEA components then is important. A technical aspect relates to defining the objectives, target and indicators which will be used to carry out biodiversity assessment for each critical factor for decision-making. The technical component also leads to provide reliable information to be used in decision-making.

A process component associates with an approach how to link SEA processes with decision-making of spatial planning processes. The process has to be flexible, which is really context dependent. Thereafter a communication component emphasises public participation and involvement in SEA process. Public participation and involvement assures information exchange, consideration multiple perspectives, and creating an integrated vision related to biodiversity, environment, and development.

Furthermore, any SEA process should achieve certain goals. Although the means by which they are achieved may differ, the process developed has the same characteristics. This research then utilizes SEA stages proposed by McCluskey and Joao (2011) which are:

- Objectives;
- Describing the baseline information;
- Relevance and implications to other strategic actions policies;
- Alternatives;
- Identification and evaluation of key effects;
- Mitigation and monitoring of effects;
- Consultation and decision-making.

**C. Small islands priority concerns**

Consistent with theoretical overview, biodiversity conservation, sustainable development, and sustainable use of space are the main urgency points to be fitted with spatial planning. Those points then have to be merged with biodiversity assessment methods and SEA context.

**D. Format of Biodiversity Assessment for SEA of Small Islands Spatial Planning**

Criteria for proper biodiversity assessment methods, SEA approach and small islands priority concerns are synthesised with the purpose of formatting the reasonable methods that match for small islands spatial planning circumstances.

Clear picture of this conceptual model is drawn in Figure 2.3

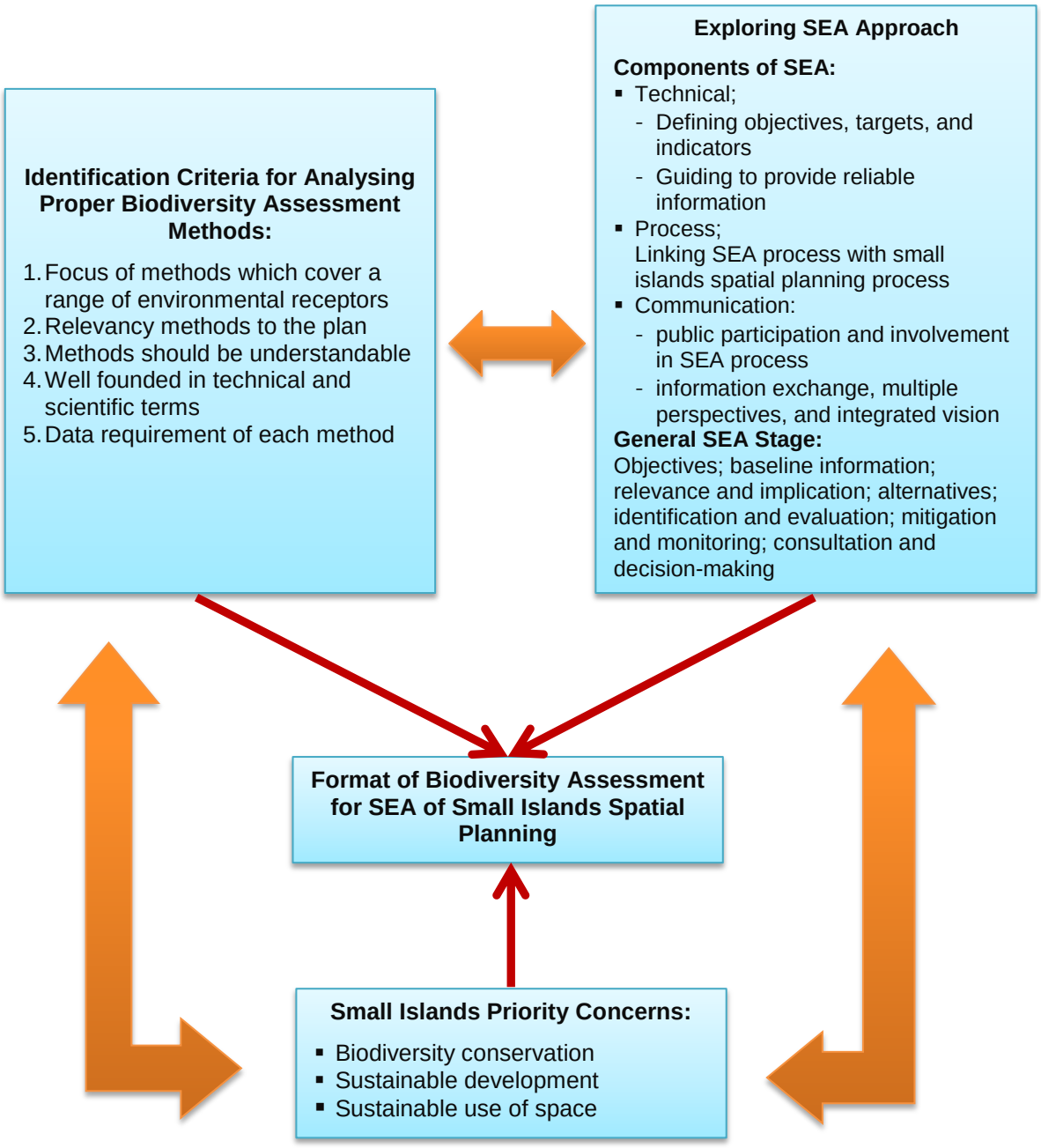



Figure 2.3 Conceptual Model of Research

# CHAPTER 3 RESEARCH METHODOLOGY

This methodology section describes the approach conducting in this research. The target of this section is giving direction to achieve the research objectives and to answer the research questions. The chapter is divided into four segments. Each segment represents a way to facilitate the research. The initial segment portrays research strategy. It details the strategy and explains why the strategy has been chosen. Data collection then follows the strategic segment. It explains data requirement, data sampling, and interview method. Next to that is discussing around how data would be analysed and what kind of method fitted to this research. Closing segment is concerning on research steps.

## 3.1 Research Strategy

The principal strategy of this research is grounded in qualitative analysis. Qualitative analysis highlights multiple points of view and the use of language in cases and context. This analysis provides a room to interpret and create a meaning in specific settings which is certainly sought of this research. Moreover, qualitative data do not present vague or lacking information, yet it is definitely highly meaningful (Neuman 2006).

In the form of qualitative analysis, this research operates two approaches, which are literature review and case study. Literature review involves a reassessment of academic references as a source of knowledge accumulation (Onwuegbuzie, Leech and Collins 2012). This review stimulates to look a knowledge gap among biodiversity, small islands, and environmental assessment. Hence, literature review builds a foundation of research framework, which subsequently resulting a conceptual model of this research. Through literature review, synthesis knowledge about biodiversity assessment, SEA and small islands context is integrated. This also accelerates new understanding combined with learning from other perspectives.

A case study approach is a strategy focusing on understanding the current dynamic within single settings. This approach allows "studying phenomenon in its natural context" (Cavaye 1996 p.229). Besides, this approach involves combining data collection methods, such as interviews, observations, archives, and questionnaires. Therefore, case study approach is categorically accurate in the context of exploring biodiversity assessment methods intended for supporting SEA that matches with small islands circumstances.

In line with biodiversity assessment selection criteria explained in chapter 2, this research operates three different case studies, which are Trentino-Italy, Stockholm-Swedia, Wateedunnen case-the Netherlands, and Sabang Municipality-Indonesia. Trentino-Italy has been chosen due to this city has an experience in incorporating biodiversity assets in spatial planning. Stockholm-Sweden then is selected owing to integration biodiversity issues in SEA and planning has been implemented in this city. The Netherlands has a comprehensive and integrated coastal and delta development. It thus is interesting to understand comprehensively how the Netherlands deals with environment protection and increasing

development. Moreover, Indonesia has been chosen as a case study due to Indonesia is struggling to develop an effectiveness of SEA processes. Indonesia also has many small islands, which needs to be developed in a sustainable way. There is many sustainable ways of development, and one of them is through the implementation of SEA. As an instance of small islands, Sabang Municipality is selected. Sabang Municipality has limited physical size and huge number of biodiversity. However, Sabang is expected to have greater development that obviously puts more stress on environment. Thus, it is essential to contribute knowledge to SEA literatures related to its implementation in Sabang Municipality as a small island.

## 3.2 Data Collection

**Data Requirement**

With the intention of answering research questions, data required for this research are derived from:

**a. Primary Data**

Primary data is conducted due to acquire data completely from first-hand opinion and experience. Primary data of this research principally focuses on interviewing relevant parties in terms of biodiversity assessment and SEA implementation and then links to assessment methods that fit to SEA process of Sabang Municipality spatial planning.

Primary data will be gathered by doing direct observation to Sabang Municipality. Direct observation consists of two activities, namely face-to-face interview and field observation. Interview intends to reach in deep about subject of this research from the perspective of biodiversity experts, local government, and key stakeholders. The interview will involve 5 respondents (Table 3.1). Besides, area observation aims to take a picture of current condition of Sabang environment and rechecks with the elaborated publication, as well as collect relevant documents associated with Sabang Spatial Plans and SEA implementation.

**b. Secondary Data**

The employment of secondary data is based on literature review of international standpoint, detail document analysis from government reports and publications, and other publications regarding the research subject. Data produced by government will be gathered while doing field observation. Facts, premises, knowledge, and all information around international perspectives are composed through books, journal articles, report, proceeding, files from website, and other publications from creditable resources. To be specified, secondary data required are listed in Table 3.3.

**Methods of Interview**

The interview was executed by using open interviewing method. This method offers broader exploration of information. The information gathered were based on several key questions which stimulated other comprehensive information (Table 3.2). The more detail questions are elaborated in Appendix 1. The interview was conducted in relaxed situation, supported by a brief background of biodiversity assessment methods, so that respondents have a comfort

condition in expressing their understanding and opinion. The transcript of interview does not provided in this thesis. However, readers can contact the author for the access to the transcript via yuyun_surika@yahoo.com.

Table 3.1 List of interviewees in the research

| No | Interviewee | The Number of Interviewee (person) |
|---|---|---|
| 1. | Lecturer of Biological Science<br>Syiah Kuala University | 2 |
| 2. | Representative from Development Planning Agency and Environmental Agency at Provincial Level<br>Aceh Province | 2 |
| 3. | Representative from Development Planning Agency at Local Level<br>Sabang Municipality | 1 |
| | **Total** | **5** |

Table 3.2 List of key questions explored

| No | Key Questions Explored |
|---|---|
| 1 | What is the appropriate biodiversity focus of biodiversity assessment method for assessing biodiversity impact from spatial planning? |
| 2 | Which biodiversity assessment methods have a relevancy with spatial planing of Sabang Municipality? |
| 3 | Is the method performance understandable for not only experts but also to general public? |
| 4 | Is the method well-founded in technical and scientific terms? |
| 5 | Will the methods cover key biodiversity issues in Sabang Municipality? |
| 6 | Are data of each method available in Sabang Municipality? |
| 7 | What are the important factors for SEA implementation on spatial planning of Sabang Municipality? |
| 8 | What are the strengths and weaknesses of SEA implementation concerning on biodiversity assessment? |
| 9 | Are there a follow-up programme establish, such as monitoring, management, and assessment guidelines for ensuring biodiversity consideration? |

### 3.3 Analysis Method

This research will exercise triangulation method and comparative method. Triangulation method is used for interview analysing. It has been preferred on account of triangulation method proposes analytical thinking from different perspectives, which are perspective from lectures, government of provincial level, and government of municipality level in order to improve its accuracy. The idea of triangulation is "better to look at something from several angels than to look at in only one angle" (Neuman 2006, p.149) . Numerous resources of information are aimed to gain reliable data scientifically from the inside of environment and development perspectives in small islands context.

Comparative method is used to examine current tendency of biodiversity assessment in order to support SEA implementation at diverse cities of diverse countries. Comparative method emphasises on the similarity and dissimilarity among components, afterward generates another term that more represent their diversity (Neuman 2006). The comparative approach improves the measurement and conceptualisation of biodiversity assessment and SEA process in small islands. The instances of biodiversity assessment integration into SEA in Trentino, Stockholm and the Netherland deliver some experiences that would be possible to be adopted in Sabang Municipality. Furthermore, the development of SEA approach for Sabang Municipality case also will be drawn by this comparative learning.

### 3.4 Research Steps

This research is accomplished by several steps as follows:

**1. Literature Review**

This step elaborates the theories with reference to biodiversity indicators, biodiversity assessment, environmental assessment, strategic environmental assessment, spatial planning, and small islands characteristics and biodiversity. That knowledge gives comprehensive understanding to conceptualize the biodiversity assessment methods which can be fit with SEA process of small islands environment. Literature observation likewise directs to decide on a proper method to scrutinise the research.

**2. The Case Study Portraying**

This research employs Sabang Municipality as the main case study. Besides, it also examines Trentino, Stockholm, and the Netherlands cases in order to give lesson learned to Sabang case.

**3. Data Collection**

Subsequent to literature review and describing the case study, data collection is taken into 2 parts. First, primary data were collected through interview and direct observation in Sabang Municipality. Then, secondary data were gained by literature review, publications, proceeding, and website.

**4. Data Analysing**

Data gathered were analysed by way of comparative method.

**5. Conclusions, Reflections and Recommendations**

The last step was proposed to produce conclusion, reflection, and recommendation for improvement the use of biodiversity assessment methods and the development of SEA in Indonesia, especially for small islands context.

Table 3.3 Secondary data of research

| No | Research Objectives | Required Data | Sources of Data | How to Obtain the Data |
|---|---|---|---|---|
| 1. | To identify biodiversity assessment methods in the frame of international experiences which are suitable for integrating biodiversity issues into decision making process of small islands spatial planning. | - Published methods of biodiversity assessment.<br>- Success stories of methods implementation.<br>- The implementation of biodiversity assessment in Trentino-Italy, Stockholm-Sweden, and the Netherlands.<br>- Biodiversity indicators in international perspective.<br>- Biodiversity assessment in Sabang Municipality.<br>- Environmental statement documents of Sabang Municipality. | - Books<br>- International journal articles.<br>- Proceedings<br>- Documents and reports.<br>- Government institutions in provincial and local level.<br>- Publications in website. | - Literature review<br>- Direct collected data in government institutions |
| 2. | To observe the possibility of SEA approach development concerning on how to induce biodiversity assessment method included into SEA process of spatial planning of small islands. | - Published SEA process<br>- Success stories of SEA implementation.<br>- The integration of biodiversity assessment and SEA in Trentino-Italy, Stockholm-Sweden, and the Netherlands.<br>- SEA implementation into spatial planning.<br>- Spatial planning for small islands development.<br>- Sabang Municipality spatial plan.<br>- Strategic development of Sabang Municipality. | - Books<br>- International journal articles.<br>- Proceedings<br>- Documents and reports.<br>- Government institutions in provincial and local level.<br>- Publications in website. | - Literature review<br>- Direct collected data in government institutions |
| 3. | To identify several values added from the findings of biodiversity assessment methods and the integration of this method to the SEA process. | - The function on biodiversity assessment methods in SEA process.<br>- The role of SEA in influencing and convincing decision-making concerning spatial planning of small islands. | - Books<br>- International journal articles.<br>- Proceedings<br>- Documents and reports.<br>- Publications in website. | - Literature review |

# CHAPTER 4 INCORPORATING BIODIVERSITY ASSESSMENT AND STRATEGIC ENVIRONMENTAL ASSESSMENT

Focussing on international review, this chapter analyses the need to biodiversity assessment and the linkage between biodiversity assessment and strategic environmental assessment. This chapter emphasises that biodiversity should be included into consideration aspects for advancing the sustainability agenda in decision-making process. The main purpose of this chapter is to gain several important points of incorporating the model of biodiversity assessment into strategic environmental assessment. The chapter begins with exploring the three different biodiversity assessment methods. Some of added values of biodiversity assessment into SEA from three case studies will be explained.

## 4.1 Biodiversity Assessment Methods on Different Case Studies

Biophysical transformation is assumed could affect biodiversity at genetic, species, or ecosystem level. However, biodiversity assessment methods should not focus only on those three levels, but also have to be examined and evaluated in term of biodiversity components, which are the composition, structure, and function (Slootweg and Kolhoff 2003). In planning context, biodiversity involves both direct and indirect assessment approaches. Direct measurement mainly focuses on measurement of species diversity, for instances population size of selected species, total species number, the whole species spectrum, and the number of rare and endangered species (Slootweg and Kolhoff 2003; Broring and Wiegleb 2005). Thereafter, indirect assessment methods could be concerned on degree of naturalness, rarity of habitat, number and size of protected areas, and presence of desired ecological processes (Broring and Wiegleb 2005). However, the application of biodiversity assessment in SEA context needs reliable and understandable methods, in order to support decision-making prioritizing on environment. Hence the attractiveness of biodiversity assessment to result reliable data is main part of exploring assessment methods.

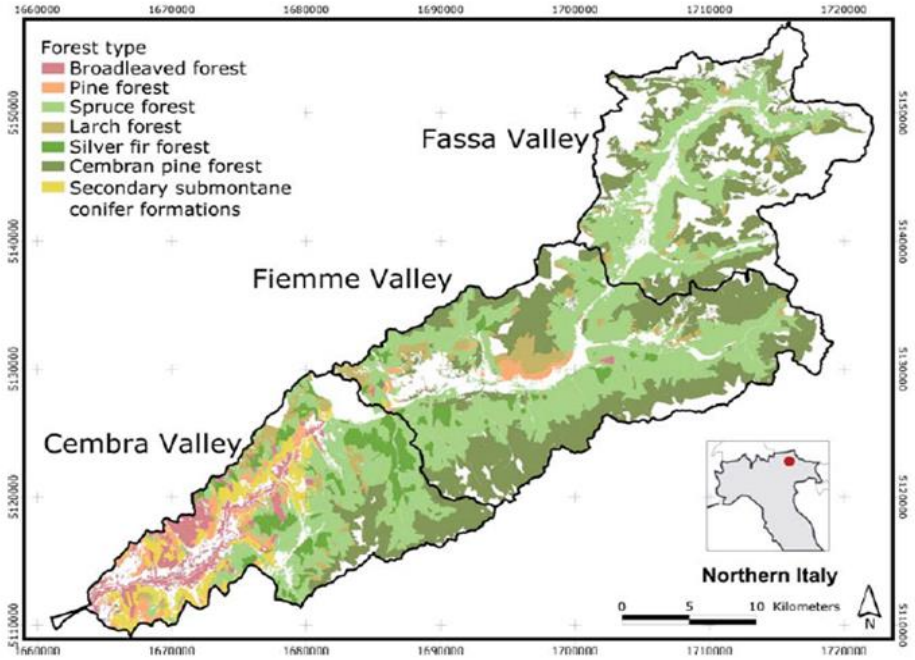
Various numbers of methods for assessing biodiversity are available. It hence needs to characterise each method in order to better understanding their interrelation and the suitability of methods in different applications. In the following section three different concerns of biodiversity assessment methods will be illustrated. Each method will demonstrate a link with planning and SEA system of a country which has applied such methods. Thereafter, consistent with a conceptual model described in chapter 2 the following assessment methods are examined also in terms of:

1. Focus of assessment methods
2. Relevancy methods to the plan
3. Methods have to be understandable
4. Well founded in technical and scientific terms
5. Data requirement of method

## 4.2. Biodiversity Assets Assessment in Trentino, Italy

### 4.2.1 Planning System in Italy

The province of Trentino is an alpine region positioned in north-eastern Italy. The region is typified by reputable environmental assets and more than half of the land area is encompassed by forest (Figure 4.1). The region is a famous destination for mountain tourism. In relation to the environmental and land management issues, forests play very important role for biodiversity protection. It also plays as buffer between intensive area of human activity and conservation areas. Current context, the province experiences various competencies in wide-ranging of sectors comprising public health, social welfare, and environmental sector. Besides, the province is exposed to development pressures from tourism activities and infrastructure provisions. The growing economic sector has generated changing behaviour on the relationship between community and environment (Diamantini and Zanon 2000). Actually, Italy has experienced significant transformation from a predominantly agricultural country to one based on industrial and services sectors (Scattoni and Falco 2011).




Source: Genelatti 2007

Figure 4.1 Map of the Trentino

The sustainable planning practice in Trentino is still in improvement. An effective control of the development impacts demands other methods which can strengthen the decision-making process of development planning, including spatial planning. Understanding biodiversity issues comprehensively can encourage also an effective control aiming resulting valuable data of environment and biodiversity. The implementation of biodiversity assessment is the opportunity to improve decision-making regarding sustainable development within spatial planning context. Italy is also among the richest European countries in biodiversity, having one-half the plant species and one third the animal species in Europe (http://annuario.isprambiente.it/).

Triggered by commitment of convention on Biological Diversity Ratification in Rio de Janeiro, Italy developed the national biodiversity strategy in 2010. This strategy is an important instrument for ensuring integration between the country's development objectives and the protection of its priceless biodiversity in national policy (http://www.minambiente.it/).
National strategic vision is:

> "*Biodiversity and ecosystem services –our natural capital- are preserved, valued and, insofar as possible, restored for their intrinsic value so that they can continue to support economic prosperity and human well-being despite the profound changes that are taking place globally and locally*" (http://www.minambiente.it/).

Furthermore, the national strategy is developed around three key issues with the intention of:

- Biodiversity and ecosystem services
- Biodiversity climate change
- Biodiversity and economic policies

Pertaining to those issues, application of biodiversity conservation will comprise preservation and restoration of ecosystem services, and their fundamental relationship with human life. Accordingly, the strategic objectives are pointed toward at confirming the toughness of ecosystem services that are essential to life, tackling environmental and economic shifting, and optimizing synergy between sectors oriented policies and environmental protection. National biodiversity strategy has three strategic objectives, which are (http://www.minambiente.it/):

1. By 2020, ensure the conservation of biodiversity, or the variety of living organism, their genetic diversity and the ecological complexes of which they are part, and ensure the protection and restoration of ecosystem services in order to guarantee their key role for life on earth and human well-being.
2. By 2020, substantially reduce the nationwide impact of climate change on biodiversity, by defining the appropriate measures to adapt to climate changes and mitigate their effects and increasing the resilience of natural and semi-natural ecosystems and habitats.
3. By 2020, integrate biodiversity conservation into economic and sectoral policies, also as potential for new employment opportunities and social development, while improving the understanding of the benefits from ecosystem services derived from biodiversity and the awareness of the costs of losing them.

Italy is categorized under the urbanism approach of spatial planning systems and policies based on the EU Compendium (Tosics et al., 2010). Rigid zoning and codes are applied strictly concerning on urban design, townscape, and building control. For this reason each proposal for development has to comply with the requirements of the plan. The legal foundation of the Italian planning systems is the Town Planning Act No 1150 of 1942, which is the basis for implementation and development in urban centres and in the territory (Scattoni and Falco 2011; Verones, et al. 2012). Interestingly, urban, environmental, and

landscape planning consider world heritage sites of great historical, cultural, and landscape value in Italy planning system (Scattoni and Falco 2011). (Tosics, Szemző, et al., National Spatial Planning Policies and Governance Typology 2010)

Italy has an established planning system with different tiers of decision making: regional, provincial, and communal (local) (Figure 4.2) (Gazzola, Caramaschi and Fischer 2004; Tosics et al., 2010; Scattoni and Falco 2011):

- The regional level represented by the *Piano Territoriale di Coordinamento* (PTC/Regional Territorial Plan) and *Piano Territoriale Paesistico* (PTP/Landscape Plan). PTC aims to provide a framework, prescription, and guidance for large areas, new large scale industry or large residential developments. PTP contains a framework and prescription related to protection and exploitation of the landscape. Both plan cover all or part of the regional territory.
- The provincial level represented by the *Piano Territoriale di Coordinamento Provinciale* (PTCP/Provincial Territorial Co-ordination Plan).
- The communal level represented by *Piano Regolatore Generale* (PRG). PRG is the basic planning instrument for the whole country. It provides prescription and guidance for land-use at the general level. It also emphasises the zoning concept and allocating specific uses and characteristics to all areas.

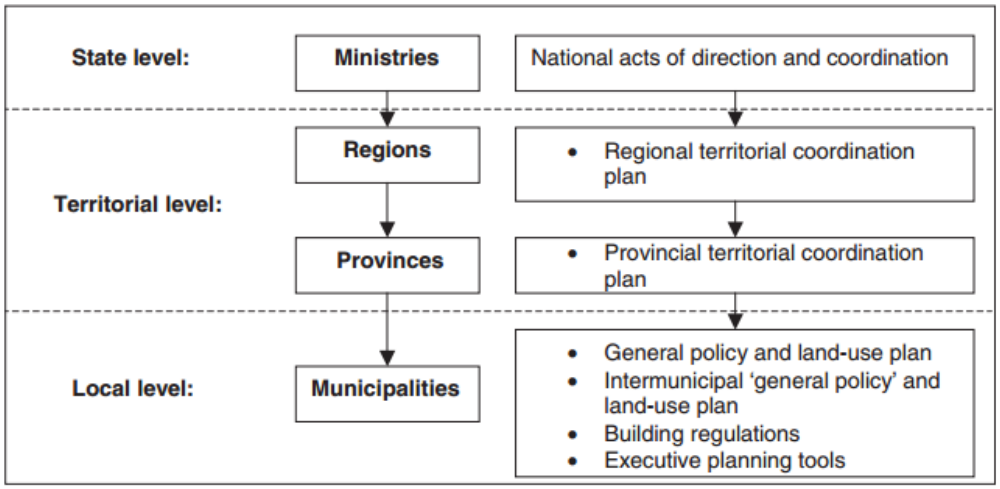



Figure 4.2 Levels and responsibilities in Italian planning system

Source: Gazzola, Caramaschi and Fischer 2004

Further the Italian planning approach performs the hierarchical bond and subsidiarity principles (Gazzola and Caramschi 2005). Each tier has planning references and defined responsibilities. The plan of a lower level tier formulates strategies and objectives stated in the plan of the upper-tier. However, decisions should be worked at the lowest level consistent with effective actions. Consequently, planning is accomplished in different ways in terms of their aims, methods, and styles relating to the region and relative regional law (Tosics et al., 2010).

Trentino, as part of the Province of Trento implements the territorial plan (*Piano Urbanistico Provinciale*). The plan addresses physical organization and socioeconomic development issues, specifically, sustainability, subsidiarity, competitiveness and territorial cooperation (Zanon 2010). The territory has been the basis for local development actions. Except infrastructure networks, the current plan does not really refer to European documents and actions. The territorial plan is mainly oriented to framing municipal land-use plans.

Implementation of sustainable planning in Trentino is still struggle requiring comprehensive and multi-efforts. The current traditional way of carrying out urban processes and infrastructure provision is not efficient approach due to ineffective use of resources and stimulating urban sprawl (Diamantini and Zanon 2000). The using of very general environmental indicators which is supported only with modest public participation obviously requires holistic approach concerning on sustainability. An improving conceptual agenda and proper environmental parameters have a potential to pursue sustainable planning. Those also have a possibility to persuade politicians to produce valuable decisions.

### 4.2.2 SEA implementation in Italy

After more a decade an establishment of the Directive 2001/42/CE regarding the Strategic Environmental Assessment (SEA), Italy has fulfilled the recognition of the Directive through a long legislative process by issuing the *Decreto Legislativo* (Legislative Decree) in 2006 as the fundamental and comprehensive environmental regulation. In 2008, SEA procedure' phases have been clearly specified through LD 4/2008 (Montis 2013). The general phases are scoping and screening, environmental report elaboration, consultation and decisions, and monitoring measures definition (Table 4.1).

Table 4.1 General SEA processes in Italy

SEA process in Italy: features of the main phases.

| N | Phase | Document issued | Objective | Leading authority |
|---|---|---|---|---|
| 1 | Nomination of the authorities | Administrative act | Setting the institutional framework | Administration |
| 2 | Screening | Administrative act | Determining if a plan is subjected to SEA | Controlling |
| 3 | Scoping | Scoping Document | Defining the scope and level of detail of the information to be included in the Environmental Report | Proceeding |
| 4 | Analysis | Environmental Report (ER), Non Technical Synthesis (NTS) | Specifying the level of environmental impact of a spatial plan | Proceeding |
| 5 | Approval | ER and NTS are published and subject to public observations | Enabling the general public to propose amendments | Proceeding |
| 6 | Consultation | Questionnaire, E-mails, Meeting Reports | Allowing broad participation of authorities, member states and public | Proceeding |
| 7 | Final decision | Synthetic declaration | Explaining how environmental concerns have been integrated within the plan | Proceeding |
| 8 | Conformity | Motivated judgment | Guaranteeing the goodness of the process | Controlling |
| 9 | Publication | All the documents produced are published | Guaranteeing full access to all citizens | Proceeding |
| 10 | Follow up | Monitoring report | Describing over time and preventing negative effects of a spatial plan on the environment | Proceeding |

Source: Montis 2013

In the case of Trentino, this city subject to Provincial Level (PL) No 5/2008 related to provincial strategic spatial plan, and PL 1/2008 and Decision of the Provincial Committee (DPC) regarded SEA implementation (Montis 2013). Unfortunately, the implementation of

SEA, specifically on the integration of SEA in the processes of construction and approval of spatial plans still result insignificant quality of decision-making process (Montis 2013). Integration SEA process into spatial plan making is one of the major issues of adopting the Directive into the local Italian regulation. It might be due to a lack of national legislation prescription, the SEA implementation thus is strictly following the directive.

Furthermore, a study by Fisher and Gazzola (2006) about SEA effectiveness criteria indicates that SEA processes in Italy seems perform ineffective in screening or scoping, and also insufficient tiering or integration in setting the framework for other activities. Policies, plans, programs, and projects making and SEA as well as EIA processes are highly affected by political power, causing little public involvement. Montis (2013) also emphasises in Italian planning, lack of effective cooperation and coordination between different actors, sectors and levels of planning and less public participation on plan making and SEA.

Owing to underdeveloped in terms of context and methodological, Fisher and Gazzola (2006) formulate SEA effectiveness criteria (Table 4.2). Beside fulfil the criteria, an effective mandatory enforcement of SEA implementation is demanded deeply.

Table 4.2 SEA effectiveness criteria for Italy

| SEA Effectiveness Criteria for Italy: |
|---|
| 1. Rigid and clear procedures and prescriptive government provision for SEA |
| 2. Accountability of those responsible for SEA through strict controls and verifications by an independent body |
| 3. Stronger environmental legislation, including project EIA |
| 4. Clearer definition of roles and responsibilities, separation of proponents and assessors |
| 5. Environmental baseline approach to SEA, with the use of "environmental compatibility criteria" based on minimum thresholds |
| 6. Formal requirements to considers various alternatives, including the do-nothing alternative in ex-ante SEA |
| 7. More resources and better training |

Source: Fisher and Gazzola (2006)

Previously, environment was only considered in terms of its cultural features, for instance landscapes, monument, and historic centres. Conversely, in current context biophysical environment obtain attention, even though it is still in little consideration in decision-making processes. In relation with biodiversity richness in Trento Province, information on biodiversity aspects oftentimes presents extremely limited support data due to only portray description of biodiversity characteristics. Opinion associated with context analysis, external references, and environmental objectives, poor interest has been derived on impact assessment, monitoring and implementation phase. Therefore valuable data are crucially needed due to provide all relevant biodiversity data for integrating SEA into spatial planning decision-making process. One of the promising supporting instruments is biodiversity assets assessment.

### 4.2.3 Method Operationalization

The general idea of biodiversity assets assessment method is mapping biodiversity assets within the whole area under consideration by paying attention to issues such quality of data and applicability (Geneletti 2008). Besides, this method intention is improvement the treatment of biodiversity assets in spatial planning. Evaluation through expert panels is executed also.

First of all, biodiversity have to be defined. With regard to Trentino case, biodiversity is divided into 6 themes based on Millennium Ecosystem Assessment (2005). Further two themes refer to species (animal and plant species) and the four left to ecosystems (forest, agriculture, aquatic, and alpine ecosystem). Relevant baseline data (Table 4.3) for each theme are needed to support other steps of method. It emphasizes to utilize current data availability and give more value to the data. Moreover, valuation of each theme connects to the first strategic objective, which is the protection of biodiversity and conservation of nature. Experts and public administration of technical offices opinion are demanded to give their perceptiveness and judgment related to assessment of the themes. Delphi surveys and/or interviews can be used for collecting opinion.

Table 4.3 the six themes and evaluation schemes

| Theme | Baseline Data | Evaluation Criteria | Method to Collect Expert Opinion |
|---|---|---|---|
| **1. Animal Species** | - Habitat map of 10 species | - Trophic level, habitat requirement, natural rarity, sensitivity, vulnerability | Delphi survey |
| **2. Forest ecosystems** | - Forest parcel inventory | - Naturalness, rarity, outstanding ecological features, disturbances | Delphi survey |
| **3. Agro-ecosystems** | - Land use map, aerial photographs | - Agriculture landscape type, vegetation remnants, open area-forest ecotones, proximity to nature reserves | Delphi survey |
| **4. Aquatic ecosystems** | - Map of water bodies | - Fluvial functioning, naturalness | Interviews |
| **5. Plant species** | - Sites of floristic interest | - Degree of threat, human disturbance | Interviews |
| **6. Alpine ecosystems** | - Land cover map, geomorphologic map, geologic map, aerial photographs | - Rarity, fragility | Interviews |

Source: Genelatti 2008

In accordance with evaluation criteria, each theme has a specific concern (Table 4.3) (Geneletti 2008). Criteria for animal species are decided based on method proposed by regional wildlife experts. The conservation substance of a species depends on trophic level,

habitat requirement, natural rarity, sensitivity, and vulnerability. Forest ecosystems pay attention to naturalness, rarity, outstanding ecological features, and disturbances. These criteria formulated by combination between literature reviews and consultation with experts. Four criteria for agro-ecosystem were selected grounded on landscape ecological indicators. The criteria are agriculture landscape type, vegetation remnants, open area-forest ecotones, and proximity to nature reserves. Fluvial functioning and naturalness index are chosen due to provide holistic status of a river and lake ecosystem. The criteria for water bodies are elected by experts of local public offices and research institutes. Afterward, biodiversity assets assessment for plant species focuses on threatened species and the potential to human disturbances. The regional of Red List are used for identified threatened species in the region. Lastly, alpine ecosystems are defined as the natural features such as permanent glaciers, glacial cirques, alpine grasslands, screes, and rocky slope which are not classified on the other themes. The criteria for evaluation hence relates to rarity and fragility.

Method for collecting and analysing the data is the combination of gathering experts' opinion, literature review, and computing through GIS (Geneletti 2008). The selection of experts was managed by appointing draft list of 15 people, encompassing widely known scientists, public institutions, and wild life associations. Thereafter, the experts were invited to introduce other qualified panellists. Consequently, 35 experts involved in a survey. They are requested to value each species and assess the forest types. In agro ecosystem and aquatic assessment, experts and relevant officers engaged on design assessment method and the criteria assessment.

In order to make more valuable data it is important to contain a concise picture of the overall distribution of ecological values. Planning support systems (PSS) can organize baseline data availability transferring into geo-information which will be valuable to planners (Geneletti 2008). The system is based on a set of ArcView 3.2. It enables calculation of the composite map, retrieving the separate themes and their data (both spatial and alphanumerical), and the relevant value judgments and descriptions. Figure 4.3 presents an example of serial queries of thematic detail of the spatial and non-spatial information that can be utilized.

Unfortunately, this biodiversity assets assessment method does not apply yet in regard with SEA implementation. This is probably due to the implementation of SEA has started only few years ago. However, PSS was examined for the screening stage of EIA of 65 dissimilar projects. Clearly, BAA which is supported by PSS also has a potential to support SEA implementation.

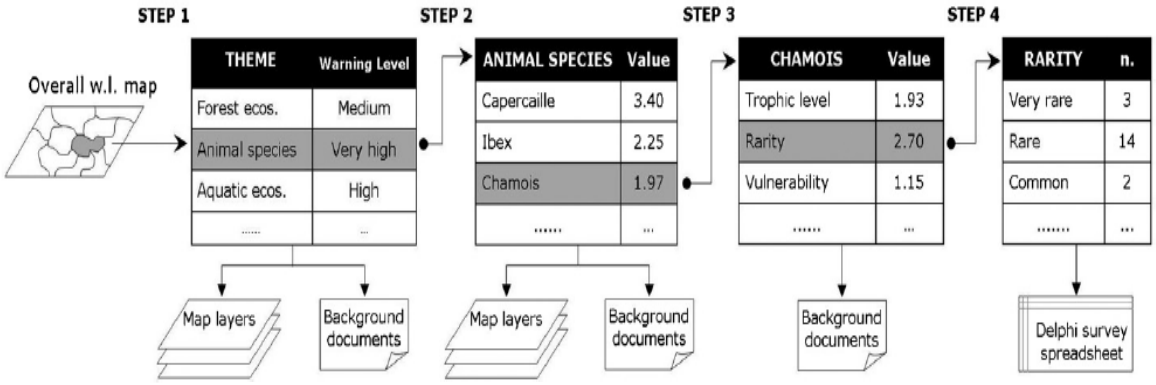



Figure 4.3 Structure of the hierarchical database and querying system

Source: Genelatti 2008

Further, concerning on exploring biodiversity assessment methods to be fit with SEA and small islands context some criteria will be observed:

**1. Focus of assessment method**

After exploring biodiversity assets assessment method, the method evidently emphasizes on both species and ecosystem level (Table 4.3). In the case of Trentino, biodiversity was divided into 6 themes, which are two refers to species, and the others mention to ecosystems. The ecosystem themes can be extended or reduced. It depends on biodiversity context to be addressed.

**2. Relevancy method to the plan**

In accordance with spatial planning, this method has quite relevancy to the process and actions of spatial planning, since it proposes an approach to map and assess biodiversity assets. From the Table 4.3 it presents also the evaluation criteria of each theme, meaning that the intention of this assessment promotes the sustainable spatial planning for protection of biodiversity and conservation of nature.

**3. Implementation Method**

After reviewing the method and even this method requires some expertise, it is clearer that BAA could be implemented in straightforward technique. For each theme, the relevant baseline data could be gathered by government agencies, other non-governmental agencies and/or could be re-analysed for such data in order to produce more functional information. Baseline data that have been obtained and/or re-analysed then are given score/weight by a panel of wildlife experts in order to assess the species/ecosystem value. Some criteria have been designed for the qualification as an expert.

**4. Well founded in technical and scientific terms**

As explained in the conceptual model, technical and scientific terms mean the collection, management, and quality of data follow scientific procedures due to prioritize an objective perspective. Hence data which will be resulted have scientific value to be offered in decision-making. Consideration of technical and scientific terms also aims to involve multidisciplinary perspective, which will add more value to the data.

The construction of this method is evaluated as properly logical in the function of scientific approach. The application of methods uses scientific concepts which foster biodiversity issues. Taking an example of animal theme (Table 4.3), evaluation criteria of habitat requirements highlight on analysing the need for availability of species resources (Geneletti 2008). This performs that the assessment takes the scientific consideration to measure the proper habitat to species examined.

**5. Data requirement of method**

With the purpose of implementing the method, current biodiversity issues have to be analysed firstly. Ecosystem themes based on local and international concerns then should represent the biodiversity issues to be addressed. So as to backing biodiversity issues and ecosystem themes, baseline data is needed. The availability of baseline data will influence the other processes of assessment. The more important element is the presence of experts to give their judgment on selected biodiversity themes. In relation with SEA for small islands spatial planning, this method enables to consider biodiversity data in proposed location of spatial planning. All data then can be processed through planning support system. The result of the assets assessment and planning support system will be most valuable information to support SEA implementation.

### 4.3 Landscape Ecological Assessment in Stockholm, Sweden

#### 4.3.1 Planning System in Sweden

Stockholm is the capital city of Sweden and the major urban region in the country. This city suffers on-going urbanization (Figure 4.4). It has experienced rapid population and economic growth than the other cities of Sweden. The city has been developed mainly along with the transportation network, which also has large areas of natural and semi-natural vegetation. It is predicted major changes in the land-use will occur due to population prediction within coming 30 years that the number of inhabitants will increase 25-30% in this region (Mortberga, Balforsa and Knolb 2007).

With the intention of sustainable development and growth, the city developed the Stockholm Vision 2030 in 2006. The three main themes of vision show the expected future of Stockholm in 2030. The vision of the future Stockholm is a strategic commitment by the City. All committees, departments and companies should work in the direction of the vision, and apply the vision in their own activities and operations. The three themes of vision are:

1. Versatile and full of unique experiences
   This highlights that Stockholm will be a multipurpose city. The city offers different characteristic of education, business occasions as well fresh nature in 2030.
2. Innovative and growing
   Knowledge-based activities, innovation and effective cooperation between education and research institutes will characterize the future of Stockholm

3. The citizens' Stockholm
   Advance accessible, safer region without social or physical constraints are the target to be achieved in 2030. Various high-level of social services will be provided for citizen.

The vision actually tries to direct the city grow inwards owing to avoid urban sprawl and to be a world-class city. The city thus has a comprehensive integrated administrative system that guarantees environmental aspects are considered in budgets, operational planning, reporting and monitoring.

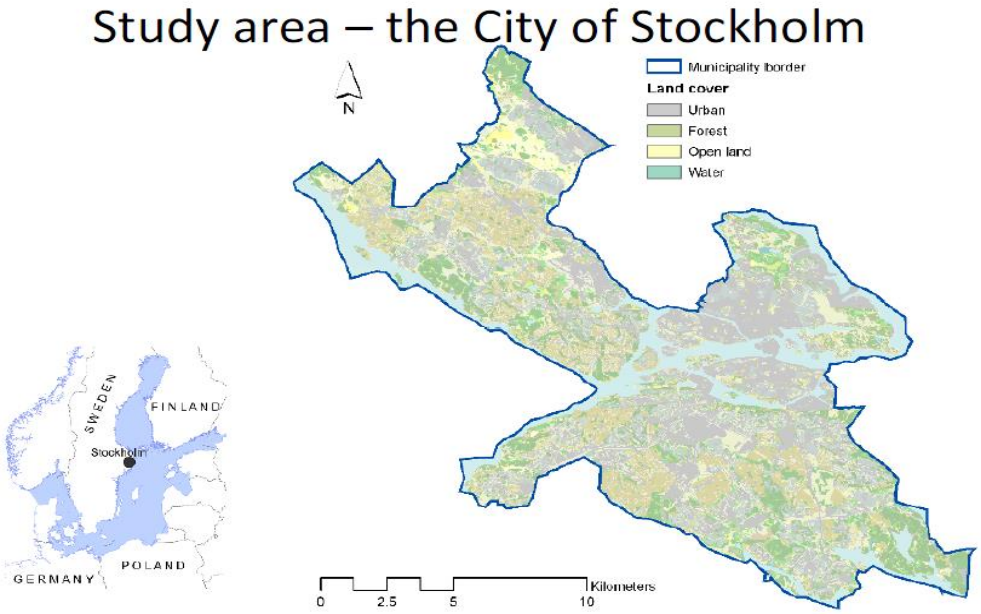



Figure 4.4 Map of the Stockholm

Source: Mörtberg, et al. 2013

Swedish is known as a self-proclaimed international leader in environmental policy. Stockholm has ambitious goals for pursuing sustainable development. In 2010 Stockholm was awarded by the European Commission as the first European Green Capital. Stockholm has been formulated Stockholm Environment Program for 2012-2015, which has five priority environmental actions. One of the actions is improve biodiversity and develop green spaces and water areas. The Environment Program is very fundamental in constructing sophisticated goals for long-term sustainable growth.

Beside, in national level Environmental Quality Objectives has been developed. The general idea of the objective is "to hand on to the next generation a society in which the major environmental problems facing Sweden have been solved" (http://www.government.se/). National Environmental Quality Objectives (EQOs) have 16 focusing areas, and one of the objectives is a rich diversity of plant and animal life.

At first, planning style of Sweden is categorized as comprehensive integrated approach. This style highlights a range of national to local level of systematic and formal hierarchical plans. Principally this planning style has a concern more on spatial planning issues than on economic development, particularly on land-use and cross-sectoral coordination. Under the

new conditions of globalization, Sweden could be considered has moved from comprehensive integrated approach towards regional economic approach (Tosics, et al. 2010). Sweden did not leave the previous style, but the planning style is expanded and modified. Sweden thus has a mix of comprehensive integrated approach and regional economic approach in its planning system.

Sweden's government has three tiers, national, regions (counties), and municipalities. However, in terms of planning system, there is no formal organization for spatial planning on the national level. Parliament and the national government only provide National Level Policy Statements as a prescription for guiding spatial planning, denoting to areas and issues of national significance (Tosics, et al. 2010).

The basic rules for leading spatial planning and building are the Planning and Building Act, the Swedish Environmental Code, and the Act on Municipal Responsibility for Housing Provision ( Ministry of Health and Social Affairs 2012). Further, three types of spatial plans can be found in Sweden, which are the regional plan, the municipal plan, and the local plan. In present, only Stockholm and Göteborg areas have regional planning, and Stockholm has a special obligation to act as a regional planning body (Tosics, et al. 2010). The regional plan basically is related to physical plans, such as plans for road network, traffic, and spatial distribution of social welfare (schools, hospitals, etc.). However, regional planning has a weak position in Sweden due to relatively weak position of the regional bodies in terms of political and administrative system (Hermelin 2009).

Moreover, municipalities have very strong position in directing spatial planning (Hermelin 2009; Tosics, et al. 2010). Cross sectoral spatial or land use planning is done by municipalities. They have planning monopoly for the development of built areas and the state can intervene only in particular cases of national interest. Local government thus has responsibilities to create spatial planning for sustainable land use. A comprehensive land use plan has to accommodate current land use and sector interest, such as nature, cultural heritage, tourism, and road infrastructures on the whole area of the municipality. The plan does not allow binding processes for either public or private development activities, but offers recommendations for suitable land to be developed (Tosics, et al. 2010). Then the second type of municipality plans is detailed development plan which has a strong legal status applying more detailed direction on land use and development.

### 4.3.2 SEA Implementation in Sweden

The government of Sweden published a bill on the legal amendments necessary for the implementation of the European SEA Directive in 2004 (Chaker, et al. 2006). A more detailed implementation ordinance was developed subsequently in order to accommodate the requirements of the European SEA Directive and the UNECE SEA Protocol. However, practical guidelines on strategic environmental assessment of plans and programs just were established in 2010. This leads to the lack to attempts at clarifying what SEA is. SEA then for plans and programmes is implemented in relation to the EC directive interpretation of SEA

and not according to the wider understanding of the SEA concept (Hoffren 2013). All plans and programmes which subject to SEA requirement are based on three basic criteria (Swedish Environmental Protection Agency 2010), namely:

1. The plan or programme must be drawn up or amended by a government agency or municipal authority
2. The plan or programme must be required in a law or another statute
3. It must be possible to consider that the implementation of the plan, programme or amendment will bring about significant environmental effects (Appendix 2)

Development and application of SEA in spatial planning has occurred in comprehensive planning in small number of municipalities. At the municipal level, SEA application mainly has been implemented on transportation sector and physical planning (Balfors and Schmidtbauer 2002). Further Emmelin and Lerman (2005) identify three types of SEA mode of implementation, namely minimalist, intentionalist, and environmentalist. Minimalist mode concerns on implementation based on formal analysis of the minimum requirements of compliance. Intentionalist highlights to making the appriate adaptation to achieve the goals and objectives of the Directive. The last, environmentalist utilizes the Directive to produce better national policy. Many of SEA application in Sweden relate to minimalist approach due to longtime of implementation, limited explanation of what SEA is, resistance in EA to spatial planning, and EA seen as a formal requirement (Emmelin and Lerman 2005).

In line with the increasing attention to SEA, a reconsideration of Swedish environmental objectives has been carried out. The focus has been altered from aiming to prevent and minimize environmental threats to actively promoting the fulfilment of environmental quality objectives (Government Bill 1998 in Balfors and Schmidtbauer 2002). Therein after, based on Swedish SEA practical guidelines, SEA processes involve among other things (Swedish Environmental Protection Agency 2010) and the full processes of SEA is explained in Appendix 3.

- Defining what the SEA report is to contain
- Drawing up a SEA report, including alternatives
- Carrying out different kinds of consultation
- Taking into consideration the SEA report and the results of the consultation before making a decision on the assumptions of the plan or programme
- Drawing up a special synopsis which includes information on the decision and the grounds for the decision

In short, urbanization in Stockholm can be looked both a warning to nature and a chance to endorse resource efficiency and an environmentally sustainable way of life. However the city experiences degradation of ecosystems, with a loss of both common and red listed species (Colding, et al. 2003). With a view to predict and assess the significances changes caused by urbanization and infrastructure, biodiversity needs to be measured. Landscape ecological presents an approach to assess the consequences of long term development processes such

as urbanization. Then, landscape ecological assessment can be a backup for improving SEA implementation for spatial planning.

### 4.3.3 Method Operationalization

The principle concept of landscape ecological assessment (LEA) is assessing environmental particularly on biodiversity impacts caused by urbanization (Mortberga, Balforsa and Knolb 2007; Mortberg, Zetterberg and Balfors 2012; Mörtberg, et al. 2013). Concerning in Stockholm, this city has developed three scenarios due to anticipate the growing demand of housing and transportation provision. The scenarios were constructed based on three different development patterns, which are dense, diffuse, or following the long-reaching transportation lines (Figure 4.5). Impacts to biodiversity thus will be assessed based on three scenarios.

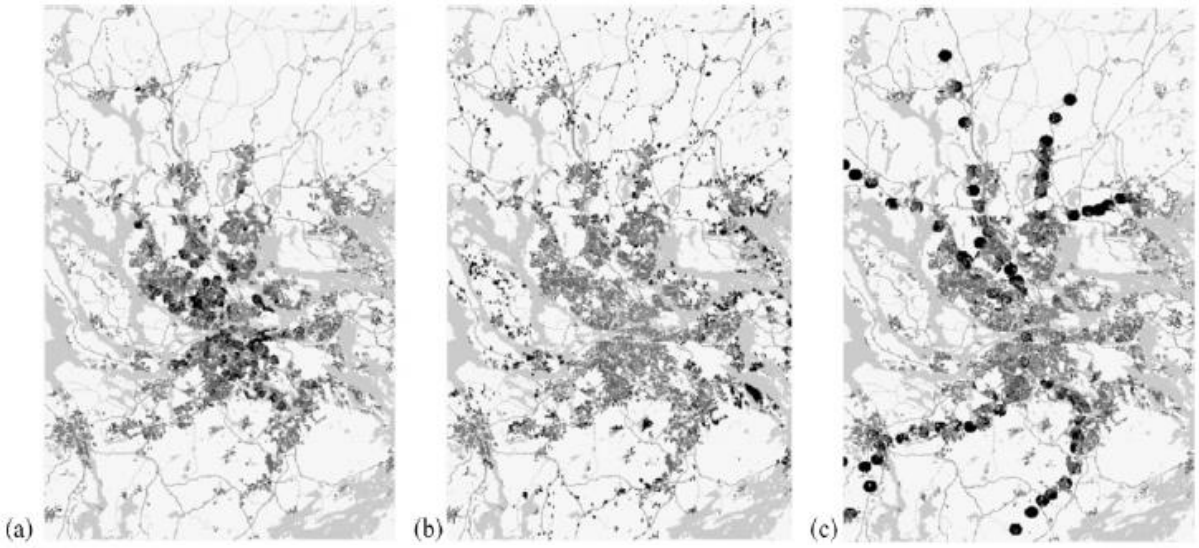



Figure 4.5 Urbanization scenarios. (a) Scenario Dense, (b) Scenario Diffuse, (c) Scenario follow infrastructure lines

Source: Mortberga, Balforsa and Knolb 2007

The first step of assessment is articulating environmental objectives into practical target assessment. In relation to biodiversity assessment, two target were formulated based on combination of Stockholm's' environmental programs and national environmental quality objectives. The first target is to preserve forest without loss of biodiversity value on landscape level. While the second target is to preserve an ecologically integrated system of forest fragments close to residential area. Continued step is formulating perception about valuable landscape target that will be exposed by urbanization or land use change and exploitation. Taking examples are forest, agriculture land, mangrove ecosystem. Thereafter is selection of focal species which are predicted will experience impacts from urbanization. Focal species have to be representative and relevant for the target assessment and for the problem to be addressed. In this case is biodiversity loss, fragmented, and disturbance to forest habitat caused by urbanization. An instance of indicators could be focal species of a region, such as birds for forest as a landscape target. It would be better result if landscape

target and indicators should be in line with certain biodiversity objectives of the region due to influence certain strategic development.

Thereafter is the estimation of effects on landscape due to alternative scenarios. The estimation will rely on a comparison of current and future scenarios of habitat networks for local species. To figure habitat networks, GIS-based predictive modelling is needed. Current information of environment, such land cover information is needed as spatial baseline data for biodiversity components potentially to be impacted by scenarios. The spatial prediction of landscape target will be resulted after modelling such changes according to alternative scenarios through ArcView Spatial Analyst. The present situation was a basis for the simulations and the scenarios provided input for changes in the abiotic conditions (Figure 4.6).

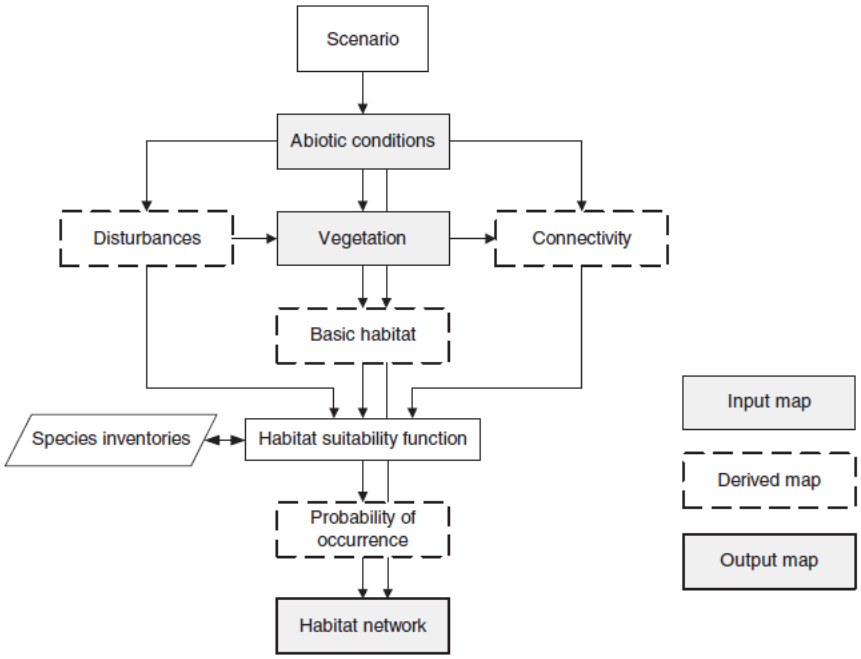



Figure 4.6 Flow charts for GIS-based predictive modelling

Source: Mortberga, Balforsa and Knolb 2007

The changes will be analysed as loss/gain of habitat area, changes in number of habitat patches, and number of splits/ joins of local habitat networks. The changes were interpreted as the predicted effects and related impacts of the scenarios. Prediction result will provide fundamental information of development consequences to the landscape, especially on biodiversity units, in particular time. Hence, the result from the assessment can be a decision support to influence development of a region. The predicted impacts could be evaluated in relation to the overall environmental and development objectives.

In order to support SEA, LEA has to be designed to insert in SEA process (Figure 4.7). Generally, in the scoping phase of SEA, decisions are made. Decision relates to on what significant issues to be assessed, which analyses to be made, and which methods are proper to be used. Connecting to Stockholm case, if loss and fragmentation of natural habitat are

likely to occur, biodiversity considerations on landscape and regional scales are required, and the LEA can be applied.

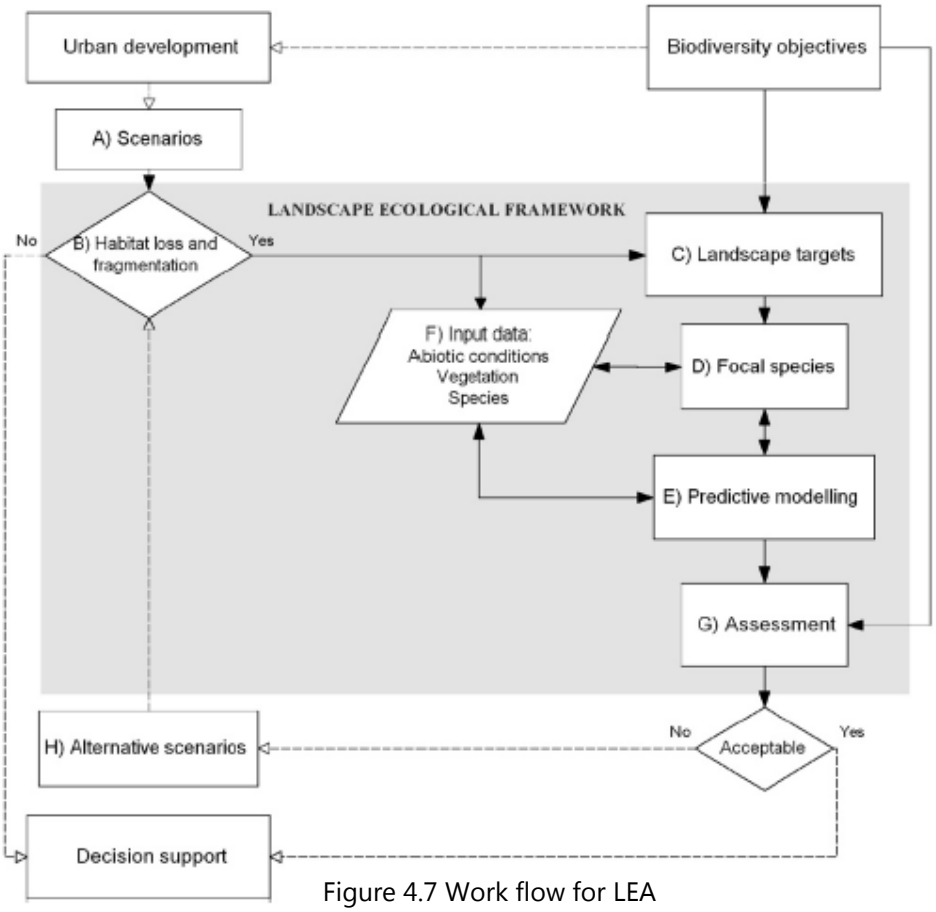



Figure 4.7 Work flow for LEA

Source: Mortberga, Balforsa and Knolb 2007

**1. Focus of assessment method**

As like the previous biodiversity assessment method, landscape ecological assessment (LEA) put emphasis on species and ecosystem level. A difference lays on the concerning of biodiversity component, which mostly points up the spatial structure and function of the process. LEA stresses on possible impacts on biodiversity without detailed knowledge of the species composition and abundance in the ecosystem. The assessment thus contains predicting the expected impacts of the proposed development and connecting the impacts to the relevant objective and targets.

**2. Relevancy method to the plan**

As LEA concerns on development impact into biodiversity, LEA is formulated for impact prediction and then integration into planning and decision-making. This method enables identification of important structures in the landscape to support biodiversity preservation. LEA thus has strong relevance with spatial planning, which typically contain long development programs.

**3. Method have to be understandable**

LEA provides a structured method to assess the impacts of planning alternatives on biodiversity. The method seems convenient and applicable to be implemented. Moreover, biological experts and GIS expertise are demanded to define valuable landscape and focal species which has to be in line with current biodiversity objective of particular region.

**4. Well founded in technical and scientific terms**

Many scholars state the advantages of LEA in promoting biodiversity conservation within the pressure of growing various developments. A landscape ecological indicator which actually based on requirements of sensitive species indicates that LEA formulates consistent with scientific literatures.

**5. Data requirement of method**

In terms of execution the method, landscape targets and biodiversity indicators are require initially. The indicators should reflect the land-scape targets and threatening processes in the particular planning situation. In the case of Stockholm, three resident forest bird species were selected as focal species for the assessment of consequences of the urbanization scenarios (Mortberga, Balforsa and Knolb 2007). For the predictive modelling, habitat network for focal species, between the present and the scenario is demanded.

### 4.4 Multi-Criteria Cost Benefit Analysis in the Netherlands

#### 4.4.1 Planning System in the Netherlands

A delta country is the characteristic of the Netherlands, which is mainly encompassed by the sea and four major European rivers: the Rhine, Meuse, Scheldt and Ems (Figure 4.8). Around twenty-six per cent of the country is positioned below sea level, meaning some areas will experience flooded if it is not supported by technical measures. As delta country, urbanization cannot be blocked. Rapid population and economic growth accompany development in the Netherlands. Consequently, the type of spatial planning in the Netherlands is influenced by some important Netherland characteristics, namely a low lying country, fight against water, increasing population density, and growing demand of space for new area development from various sectors of society.

The main law of spatial planning in the Netherlands is the Spatial Planning Act 1965 (Biemans and Snethlage 2008). The Spatial Planning Act (SPA) directs how spatial plans should be developed, carried out and revised. The SPA specifies the distribution of tasks and responsibilities of the spatial planning territory for the various tiers of government (Figure 4.9). It also portrays the rights and duties of citizens, companies and institutions in the spatial planning process. Furthermore, the new Spatial Planning Act in 2008 exchanges the first one. The new Act pays a great consideration on decentralization of spatial planning activities and responsibilities, and planning by development as a contrasting point to planning by control in the previous planning act. The act actually offers more responsibilities to provinces and municipalities in planning and implementation of the plans, making the planning procedure less complex (Biemans and Snethlage 2008). However, provincial and municipality level have

to follow the framework developed by national level. In some cases, provinces and municipalities require more flexibility in one hand, and the national government would like to take more power in the case of large projects of national importance. The new Spatial Planning Act seems poses flexibility and also has requirement for specific cases (Tosics, et al.2010).

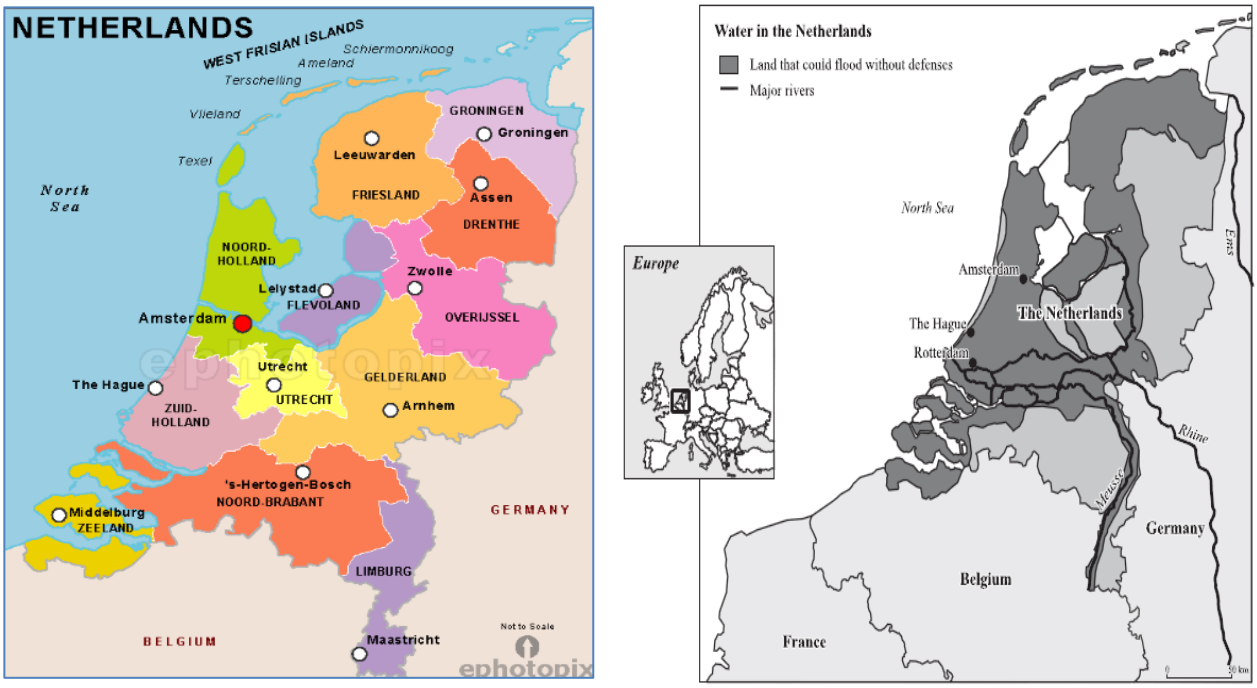



Figure 4.8 Map of the Netherlands and water in the Netherlands

Source: www.ephotopix.com; Woltjer and Al 2007

Furthermore, very high densities of population and intensiveness of economic activities have led to very intense pressures on the country's environment. Then the government has increased consideration on preservation of the natural environment. The government has made substantial progress in decoupling environmental pressures from economic growth. This progress indicates the restructuring of the Netherland economy and the strengthening of environmental policies, including in the EU context. Current urgency of environmental issues stresses on loss of biodiversity, climate change, over-exploitation of natural resources, threats to human health and external safety, damage to the quality of life, and possible unmanageable risks.

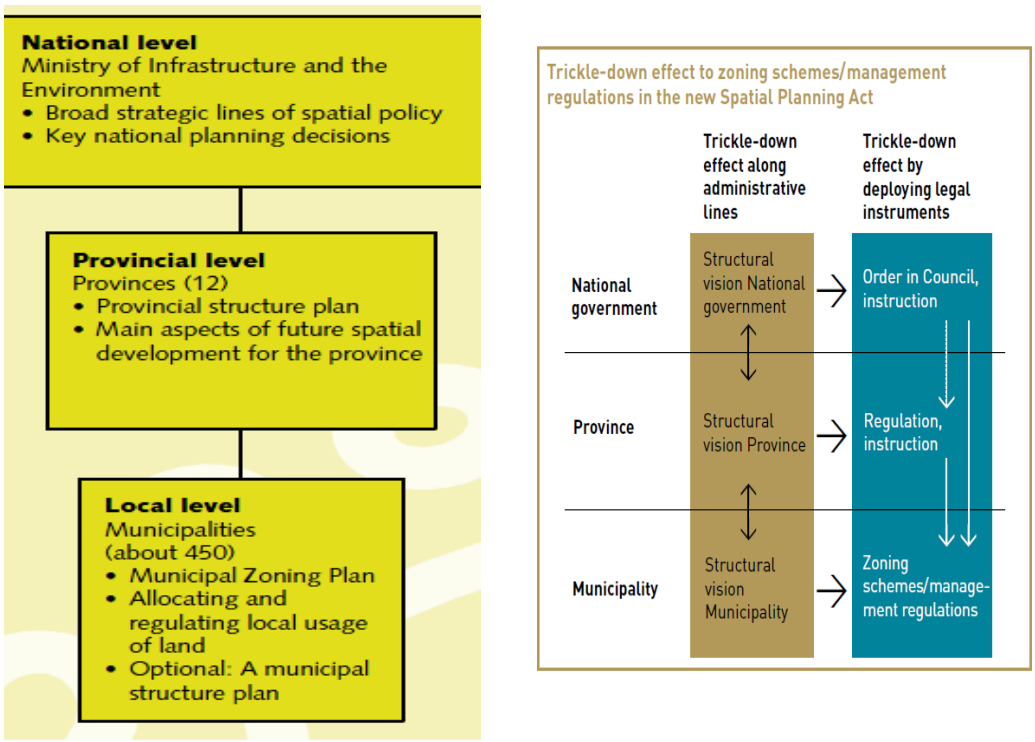



Figure 4.9 Spatial planning systems in the Netherland

Source: Woltjer and Al 2007; www.vrom.nl

Beside, in 2008-2011 The Netherland had a program related to biodiversity, called Biodiversity Works: for nature, for people, for ever (Ministry of Agriculture, Nature and Food Quality 2009). The program concerned on addressing the biodiversity loss and promoting the sustainable use of biodiversity and natural resources. Several substantive priorities areas that needed to be resolve were:

1. Trade chains and biodiversity
2. Payment for biodiversity and ecosystem services
3. Biodiversity works
4. Ecological networks
5. Marine biodiversity and sustainable fishery

Likewise, there were three support priorities:

1. New coalitions for biodiversity
2. Knowledge of biodiversity
3. Communication on biodiversity

The need to preserve and sustain biodiversity for future generations remains significant tasks. The Netherlands government therefore desires to play an active role on biodiversity issues in Europe and wider international context.

In relation with spatial plan and biodiversity issues, three case studies are generally described (Sijtsma, Heide and Hinsberg 2011). The first is *Waterdunnen*, an innovative project of coastal defense. *Waterdunnen* is a special plan in which public parties, private parties, and non-governmental organizations work together. Three government bodies are involved in the project: the province of Zeeland, the municipality of Sluis and the Water Board of Zeeuws-Vlaanderen. *Waterdunnen* is designed as a coherent development of coastal design, recreation and nature development in order to obtain a pure estuarine nature area which can reduce tides consequences. The plan will consist 250 hectares of salty nature, including 400 of homes, 300 of camping sites, a hotel, walking site, 250 acres of recreational nature (www.waterdunen.com). Obviously, the plan will have significant impacts to biodiversity existence.

The second is *Veenweidegebied*, a project in lowlands peat area. This project is predicted to create effects in groundwater levels, which consequently affect the structure, composition, and function of biodiversity in the ecosystem of peat land. The last case study is highway project of airport Schiphol–Amsterdam–Almere. This project has three alternative scenarios to reduce traffic congestion. However, the alternatives across main nature conservation are in the Netherlands. Obviously this project tends to disrupt the existence of biodiversity in that area.

### 4.4.2 SEA in the Netherlands

It is clear that the Netherland has kind of an innovative and leading-edge environmental policy. SEA was part of the EA legislation since 1987, especially for plans in which site selection decisions were made. Due to SEA is mandatory in Europe for certain plans and programmes through the directive, the new legislation for SEA had developed in 2006. SEA in the Netherland is mandatory for agriculture, forestry, fisheries, energy, transport, waste management, water management, telecommunications, tourism, town and country planning or land use (Eck and Verheem 2013). The new legislation also requires an independent assessment of the SEA in plans which likely have significant impact on protected nature area (Appendix 4).

It is commonly known that the Netherland has consensus-oriented planning culture. Citizens perspectives have been acknowledge in the democratic context. The government then has been forced to organize decision-making processes related to large projects. In this case, SEA can be used structure the public discussion about policy actions and to develop a range of supported decision. SEA contributes to the general consensus within a controversial planning process by mutual learning between stakeholders with different perceptions, society, and experts.

In most direction, the Netherlands SEA legislation follows the EU Directive. Nonetheless, the Netherlands legislation puts more emphasis on mandatory publication on the start of SEA and Plan processes and also an independent assessment for protected nature area). The general steps of SEA in the Dutch planning process (www.eia.nl):

1. Establishing context:
   - Screening process
2. Implementing the SEA:
   - Scooping process
   - Baseline data
   - Alternatives
   - SEA review
3. Informing and influencing decision-making:
   - Recommendation for decision-making
   - Justification of decision
4. Monitoring and evaluation

Moreover, according to Buuren and Nooteboom (2010) who studied about the success of SEA in the Dutch planning practice, SEA can contribute to the success of collaborative governance processes. Through SEA processes a convincing understanding could facilitate the process of selecting ambitions. However, the effectiveness of SEA would highly depend on the time of its commissioning, the degree to which it will integrate with the decision-making process, and the openness of its application (Buuren and Nooteboom 2009).

### 4.4.3 Method Operationalization

As a systematic assessment tool for integrating environmental sustainability into spatial planning and policy projects, credibility of environmental impact assessment (EIA) has been criticized. Dealing with the impacts only on a given project cannot maintain the future impact of human activities beyond the project. Combining approach of CBA and MCA assists to predict impact in the frame of flexible monetary valuation and weighing up the criteria.

CBA and MCA are widely known as part of policy evaluation approaches. CBA is a kind of economic approach of evaluation and offers framework associated with costs of a policy intervention, while MCA is an approach for weighing up alternative policy action due to search the best alternative in difficult policy context (Crabe and Leroy 2008). Then the concept behind merging CBA and MCA is a combination of existing elements of CBA and MCA, meaning that the strict monetary evaluation can be formulated in communicative way, while a wide range of criteria can be reduce through quantify relevant impacts (Sijtsma, Heide and Hinsberg 2011).

The application of CBA and MCA generally use for policy evaluation concerning on the relevance policy to the environmental aspect. In spite of that fact, the combination of CBA and MCA could be used to assure an enhanced assessment of biodiversity impacts, through assessing impacts at different spatial levels (the global level and the decision-making level) and finding a consensus based aggregation of different impacts (Sijtsma, Heide and Hinsberg 2011). A widely utilisation of CBA and MCA on various application could be a solution for current biodiversity assessment which commonly results highly ecological

information. MCCBA could cover a comprehensive result, including ecology, economy, and social, which will be descriptively understood by decision-makers.

With the intention of highlighting biodiversity impact assessment within MCCBA frame, indicators are necessitated. The nature value indicator, which calls T-EQA, is formulated (Sijtsma, Heide and Hinsberg 2011). T-EQA emphasises on threat weighted, ecological, and quality area. T-EQA applies the concept of ecological quality area (EQA). Ecological quality can be measured through mean species abundance (MSA). MSA then is defined as an indicator of biodiversity intactness. One-hundred per cent (100%) of MSA-value of an area signifies that biodiversity on this area is similar with the natural ecosystem. Conversely, the smaller MSA-value indicates less similar characteristic with its natural ecosystem. The detailed steps to analyse the T-EQA within an MCCBA is describe in Table 4.4.

Table 4.4 the steps to analyse T-EQA

| Step | Description |
|---|---|
| 1 | Specify the hectares of the different ecosystem types in the project alternatives (A=Area) |
| 2 | Calculate the locale intactness of these ecosystems based on the presence of characteristic species relative to the number that would be present in an intact ecosystem. This gives a % score ranging generally from 0-100% as ecological quality percentage. |
| 3 | Rescale the ecological quality (EQ) from 0 to 1 and multiply the scores for the different ecosystems with their area A. It will give the EQA per ecosystem. |
| 4 | Multiply the calculated intactness of the ecosystem with the weight factor, which indicates how much the ecosystem types contribute to the national MSA, and more specific how important is to threatened biodiversity (T=Threat weighted). The relative number of red list species within this ecosystem might be used as a first proxy. |

Source: Sijtsma, Heide and Hinsberg 2011

Sijtsma, Heide and Hinsberg (2011) acknowledge the steps for analysing T-EQA seems not familiar with non-ecologists. Nonetheless, the used of indicator units, such as hectares are recognizable, especially for decision-makers.

With the purpose of conducting MCCBA, the stage of MCCBA can be divided into eight stages within 4 main parts (Figure 4.10). The stages are the combination of equivalent stages of CBA and MCA. Investigation on the equivalent stages formulates the new stages of MCCBA.

| | MCCBA | CBA | MCA |
|---|---|---|---|
| **I: Providing the basic evaluation structure** | Stage 1: Identify function, project alternatives and scale of the evaluation<br>Stage 2: Involve a broad group of stakeholders<br>Stage 3: Organise judgement criteria on sustainability impacts | Stage 1: Define the project and impact population<br>Stage 2: Identify project impacts | Stage 1: Identify objects and function(s) of the evaluation<br>Stage 2: Identify stakeholders<br>Stage 3: Elicit and organise value dimensions / attributes<br>Stage 4: Assess the relative importance of value dimensions / attributes |
| **II: Fact finding on physical impacts** | Stage 4: Quantify impacts physically | Stage 3: Quantify relevant impacts physically | Stage 5: Estimate scores of alternatives on low level dimensions |
| **III: Aggregation of impacts to a compact format** | Stage 5: Aggregate monetary scores consensus based<br>Stage 6: Aggregate non-monetary scores consensus based | Stage 4: Monetary valuation of relevant effects<br>Stage 5: Discount costs and benefits<br>Stage 6: Apply the Net Present Value test | Stage 6: Aggregate scores with importance values |
| **IV: Communication of problem understanding** | Stage 7: Interpret trade-offs<br>Stage 8: Perform sensitivity analysis and reconsider project alternatives | Stage 7: Perform sensitivity analysis | Stage 7: Perform sensitivity analysis |

Figure 4.10 MCCBA approach compared to the stages of CBA and MCA

Source: Sijtsma, Heide and Hinsberg 2011

**Part I: Providing the basic evaluation**

Owing to biodiversity impacts hit on various spatial levels, then the basic evaluation of MCCBA has to be analysed at local to global scales. Clear definition of impact at these various levels help decision-makers and stakeholders to share and exchange information regarding biodiversity issues and avoid pointless and insubstantial perception among them.

**Stage 1**: Identify function, project alternatives and scale of the evaluation. The stage thus consists of three elements:

- Identify function of the evaluation;
  This element aims to deal with the lack of objective in order to determine the best alternative. Judgment approach can be implemented, which are inevitably limited, yet have to be acceptable and clear for many stakeholders. MCCBA indicates that style of evaluation both CBA and MCA can be utilised for structuring judgement information and framing the problem situation.
- Define preliminary project alternatives;
  The specifications of a null-alternative against which the project alternatives are assessed have to be standardised.
- Determine the spatial organisational scale of the analysis;
  Strictness in the evaluation at different spatial levels will assist clarify impacts in biodiversity context and prevent unnecessary perceptions among stakeholders. Biodiversity impacts have to access at least two spatial levels, due to result better analysing.

**Stage 2:** Involve a broad group of stakeholders

Involvement of stakeholders aims exploring consensus among stakeholders, focusing on achieving a broad range of perspectives on the evaluation of biodiversity issues related to the policy or program that will be implemented.

**Stage 3:** Organise judgement criteria on sustainability impacts.

In this stage, judgement criteria are formulated. This stage combines MCA procedure of organising criteria with CBA concept, and avoidance double counting. Two organising criteria for judgement criteria are:

1. Define separate Triple E (economic, environment, and social equity) criteria without redundancy and double counting
2. Analyse short and medium-term impacts separately from long term-impacts

**Part 2: Fact finding on physical impacts**

**Stage 4:** Quantify impacts physically

The measurement of impacts in their natural dimension is investigated. The quality of the evaluation depends heavily on the particular facts of the case. Matrix performance will result in the end of this stage. Matrix will contain the scores of the project alternatives on different criteria.

**Part 3: Aggregation of impacts to a compact format**

Greater standardisation of biodiversity measurement relies on the use of widely available data and procedures. Yet the measurement has to be simple and reasonable to understand. In this part analysing biodiversity impacts should be selected, whether would be better analysed in monetary term or in physical dimension only. The consideration to make a choice is not rely on knowledge about financial valuation only, but also lay on consensus and understanding of decision-makers and stakeholders. They will negotiate about what kind biodiversity impacts have to be judged in monetary value. Furthermore, T-EQA will have function in this part to assist decision-makers and stakeholders to make decision related to assessment impacts selection.

**Stage 5:** Aggregate monetary scores consensus based

This stage uses CBA approach. Due to CBA is mostly relates to economic notions, biodiversity impacts are quantified in monetary terms. Impacts considered are not only technically to biodiversity, but also politically.

**Stage 6:** Aggregate non-monetary scores consensus based

Within this stage, a MCA consensus based is performed to examine the non-monetary impacts. The main tasks in this stage are:

- reduce the number of biodiversity impacts criteria to a minimum;
  MCCBA will reduce the number of criteria through combining causality and evading double counting criteria. It also tries to find the very fundamental criteria.
- use consensus based judgement criteria and measures;

**Part 4: Communication of problem understanding**

**Stage 7:** Interpret trade-offs

The main purpose of seventh stage is to interpret the consensus-based aggregation of the performance matrix in several ways, such as ratio-analysis and stakeholders perspectives analysis.

**Stage 8:** Perform sensitivity analysis and reconsider project alternatives

Sensitivity analysis is the important function for accountability. Stakeholder has an understanding about individual assumptions. MCCBA also requires a reconsideration of the project alternatives for better consideration of biodiversity impacts.

### 4.4.4 MCCBA performance on biodiversity consideration in the Netherlands case studies

With the purpose of understanding the application of MCCBA on biodiversity issues, three case studies in the Netherlands are observed in briefly. Each case study has specific approach to include biodiversity impacts in their CBA assessment (Figure 4.11).

| Case study | Biodiversity impact in CBA end results | Measurement in | Occurrence in CBAs | Meaning | Source |
|---|---|---|---|---|---|
| 'Waterdunen' | PM (Pro Memory) | +PM or –PM | Often | *'There is a (positive or negative) biodiversity impact: do not forget.'* | Information from the Environmental Impact Assessment |
| 'Veenweide' | Monetarized | Euros | Often | *'The impact population is willing to pay … euro to establish this specific biodiversity situation.'* | 'Benefit transfer' from former CBA studies or Contingent Valuation studies |
| 'Airport Schiphol-Amsterdam-Almere' | Ordinal score | + and – and 0 scores | Incidentally | *'The one alternative has a better biodiversity impact than the other.'* | End result from the Environmental Impact Assessment |

Figure 4.11 Three case studies and how they deal with biodiversity

Source: Sijtsma, Heide and Hinsberg 2011

In Waterdunnen case, CBA only shows a positive PM-post for biodiversity for each alternative scenario. This type of data has limited information due to it is difficult to give comparison analysis related to biodiversity among alternative scenarios. Even though detailed explanation about scenarios is provided by EIA, decision-makers and stakeholders were offered only the result of assessment by PM-post. In contrast, MCCBA approach with the T-EQA indicator enable to examine different project alternative which result different nature

scores. Hence the alternative scenarios could be compared one to another. In terms of analysing changes via T-EQA, *Waterdunnen* has quite large impacts to biodiversity (Figure 4.12).

| Case study | Change in T-EQA (for different project alternatives) | Net Present Value (NPV) of the monetarised impacts (Euro million) |
|---|---|---|
| 'Waterdunen' | +180 to +450 | -14 to -27 |
| 'Veenweide' | +808 to +1,751 | +18 to + 42 |
| 'Airport Schiphol-Amsterdam-Almere' | -12 to + 40 | Not available* |

* A new Environmental Impact Assessment (EIA) for this case study has just been finished, but the NPV results, based on this new EIA, were not available yet.

Figure 4.12 Three case studies outcomes impacts

Source: Sijtsma, Heide and Hinsberg 2011

The second case study is *Veenweide*. This case study applies monetary approach, which means all biodiversity impacts were put in financial term. However, the cost-benefit analysis involves using monetary value from other studies or projects. Obviously other situation cannot be used for existing condition, especially for biodiversity impact assessment. Therefore through MCCBA, *Veenweide* can apply T-EQA for measuring the biodiversity impact in the current situation with current variable also. T-EQA allows cardinal measure based on generally available data, without borrowing other data.

The last case is Airport Schiphol–Amsterdam–Almere-project. This case utilises plus and minus signs as ordinal ranking approach to examine external effects on biodiversity, for instance loss of habitat, disturbance, dehydration, and fragmentation. The disadvantage of this approach is the weight enclosed to the criteria cannot be differentiated between alternatives. Nonetheless, the application of T-EQA within MCCBA frame enables developing various form of ratio-analysis. The identification of huge variation of biodiversity impacts of Airport Schiphol–Amsterdam–Almere-project change to quite small impacts (Figure 4.12).

Furthermore, summarising from MCCBA operationalization, some understanding points are identified.

**1. Focus of assessment methods**

The principal concept of MCCBA is ensuring the strategic proposals (policies/programs/plans) options under consideration are environmentally and socially sound and sustainable both with monetary and non-monetary valuation. MCCBA calls attention on identifying, predicting and evaluating the predictable impacts, both valuable and undesirable. Besides, this method targets to eliminate as well as minimise drawback impacts and augments positive impacts. According to level of biodiversity, MCCBA places its focus on three levels flexibility which relies on the receptors of impacts. MCCBA also applies T-EQA approach, which stimulate knowledge and provide opportunity to enlightenment perspectives of biodiversity impacts (Sijtsma, Heide and Hinsberg 2011).

**2. Relevancy methods to the plan**

MCCBA has tight relevancy to strategic arena. Concerning on impacts assessment on biodiversity, MCCBA connects two different evaluation tools due to give more optimal evaluation which supports each limitation. MCCBA provides an opportunity to improve the quality of plan through developing new ways of thinking and decision making regarding environmental and biological data into the strategic plans. T-EQA enables to achieve same portion consideration nature and spatial-economic development.

**3. Methods have to be understandable**

In accordance with spatial planning, the link between the domain of ecology and planning has to be bridge due to avoid different use of biodiversity terminology in ecology and planning context. MCCBA approach thus offers finding fact as the way of measurement impacts on biophysical condition, and detects losses of or threats to biodiversity. Even though the method involves many economical term, the implementation of method is relatively understandable. The stage of method also can fit with decision making process due to encourage comprehensive understanding, and the causal and functional relationships between biodiversity and planning. Ecological experts are required to participate in this assessment, especially in the aggregation part and in the calculation of T-EQA.

**4. Well founded in technical and scientific terms**

The concept of MMCBA method is developed and supported by various social, technical and scientific works. The method is reasonably addresses the points of assessing impacts on biodiversity, and key impacts of development activities.

**5. Data requirement of method**

Scientific base line data are needed. Past-present-future human activities that would affect the region need to be determined, and the impacts of all possible strategic development need to pre-analyse firstly.

The clear picture of three different types of biodiversity assessment method is presented in Table 4.5

### 4.5 Summarizing the Case Studies

To summarize the three case studies, in general, there are four key factors that are typically took place in those countries.

- The first is high awareness among population and government to conserve and preserve their environment and biodiversity. Understanding the role of environment to support their life has being a consideration before the ecological system collapse. Maintained environment has been proven to have positive influences on the state development. The states thus construct objectives and various instruments to guarantee the sustainability of environment.
- Second, planning tradition. Each state has their planning culture which affects their approach to consider environment in their planning system. The planning culture provides direction on how to place environment, specifically biodiversity in their system.

- The third is EU atmosphere influence the development of state institutions. EU political circumstance shapes the state situation. Establishment of EU Directive imposes EU members to actively implement SEA on their plans.
- The last is environmental assessment instrument. Due to their environmental characteristics, each state focuses the assessment on their priority. Trentino, as having richness biodiversity, pays much attention to sustain the existence of biodiversity. Development activities should not be a disturbance to biodiversity.
  - Italy is considered has biodiversity hot spots that are important at the planetary level. Trentino province as the part of Italy gives high concern to biodiversity preservation. However, many critical items threaten biodiversity directly, but also indirectly. Urban development and tourism activities pose many menaces. Legal instruments at the national and international levels, both indirect and direct, pursue to prevent and reduce the loss of biodiversity. However, SEA as one of strategic instruments does not practically implement. SEA application has not proven yet will result substantial quality in decision making process. Hence many supporting tools for supporting SEA implementation are presence.
  - Stockholm experiences increasing urbanisation activities. Urbanisation which is continuously intensifying built-up areas and infrastructure in this city causes significant impacts on biodiversity. In addition, ecology system seems not really takes into account of urban planning for sustainable urban development. The late issuing practical guidelines for SEA implementation caused the emergence of implementation mode in Sweden, which are minimalist, intentionalist, and environmentalist. Minimalist mode is more widely applied. Consequently numerous supporting tools are developed in order to provide valuable information as well as to make SEA process simple as possible.
  - As low-laying country, the Netherland government consciously recognise the importance of environment in order to sustain the present and future society's life. The long practice of environmental assessment provides various instruments to identify and calculate impacts into environment. The Netherlands has been already implemented kind of SEA since 1987, before it is subject of mandatory by EU Directive. Sophisticated biodiversity assessment hence pops to strengthen the application of SEA. The combination of monetary value and weighing criteria give a positive point to MCCBA in order to influence decision-making related to biodiversity.

### 4.6 Added Value Biodiversity Assessment into SEA from three case studies

Biodiversity is a vital element of environment by reason of the variety of relationship between biodiversity and sustainability. Biodiversity is the source for evaluation and adaptation to a quickly changing environment. It is also a key component of performing environment for future generations. Intense pressure on environment, particularly on landscape from urbanisation, induces various environmental problems, changes in landscape character and quality, and loss as well as fragmentation of land. Intimidation to biodiversity at genetic, species, and ecosystem levels is one of the examples. All circumstances can be

identified in Trentino, Stockholm, and the project studied in the Netherlands. As stated by Haines-Young (2009), human behaviours are recorded have greater effect seriously to biodiversity and the foremost pressure is derived by expansion of infrastructure. Precisely, certain implementations of spatial plans have excessive impact to biodiversity due to spatial plans implicates the expansion and distribution of different land use functions. Each case study has their own perspective and approach to reduce biodiversity problems and to raise biodiversity awareness on their strategic development. It signifies that biodiversity has to be acknowledged first as the major element of development, biodiversity then could plays as a magnet of development. Through biodiversity focus, development goals could be greater achieved, as found in Trentino and Stockholm cases.

With the intention to account biodiversity issues into development considerations, valuable biodiversity information is deeply necessitated. The three case studies demonstrated the sophisticated method of biodiversity assessment to yield valuable biodiversity data. It also shows that biodiversity assessment demands certain methods to assess impacts on biodiversity that present relevant and dependable data for SEA processes. Even though only LEA which practiced in Stockholm perform clear link to SEA process, other two methods similarly has possibility to connect with SEA and decision-making processes. Thus there is growing need to establish appropriate biodiversity assessment methods to offer decision-makers with valuable information to make knowledgeable judgement regarding policies, programs, and plans. Selecting which methods to be used will depend on the aim and the context of policies, programs, and plans to be proposed, and lies on the extent to which biodiversity preservation and sustainable development are focused in their planning system. The methods therefore should boost up scientific information of both biodiversity significance and sensitivity to the proposed development. It aims to clearly detect and evaluate the environmental implication of intended development plans. Hence through biodiversity assessment included in SEA processes, SEA has a fundamental function bridging the gap between environmental and economy that usually emerges in development.

SEA involves a greater level of uncertainty due to most issues are addressed in more general terms. With the meaning of reducing uncertainty and complex situation, SEA needs reliable and valid baseline information. Moreover, it would be impossible to have a generic biodiversity assessment that could be applied to all biodiversity and development contexts. Then context dependent is valid to biodiversity assessment and SEA processes. Understanding comprehensively the context of biodiversity assessment will result credible environmental data augmenting the role of SEA in decision-making process. SEA and biodiversity therefore could be reinforced each other. In the form of biodiversity assessment thus, SEA is an indispensable instrument to measure development impacts on landscape, particularly associated with biodiversity and environmental issues.

Table 4.5 Synthesising Biodiversity Assessment Methods (BAM)

| | Biodiversity Assessment Assets | Landscape Ecological Assessment | Multi-Criteria Analysis |
|---|---|---|---|
| **General concept** | Comprehensively identification and mapping biodiversity assets | Exploration data and priority setting due to assess the potential impacts of planning through predictive modelling | Integrating monetary value and judgment for wide group of stakeholders (general) |
| **Focus of method** | Species and ecosystem level | Landscape and ecosystem level | Monetary and non-monetary impacts to all level of biodiversity |
| **Data requirement** | - Habitat map of species<br>- Sites of floristic species<br>- Forest parcel inventory<br>- Land-use map<br>- Map of water bodies<br>- Land cover map, geomorphologic map, and geologic map | - Focal species as biodiversity indicators: birds<br>- Abiotic condition: topography, land use, building, etc.<br>- Vegetation<br>- Habitat quality for local species | - Type of ecosystem<br>- Area wide of ecosystem<br>- Numbers of threatened species<br>- Maps distribution of species<br>- Map of land use and nature types<br>- List of characteristics species per nature type |
| **Approach requirement** | - GIS and Delphi survey<br>- Biological experts | - GIS and statistical analysis<br>- Biological experts | - Multi-agency approach<br>- Economists |
| **Possible involvement in SEA process** | Problem diagnosis, data collection and organisation, stakeholder consultation, scenario generation and visualisation. | Mainly on describing the baseline; identifying options/ alternatives; and impact identification, prediction and evaluation; | Concern on identifying options/ alternatives; and impact identification, prediction and evaluation; |
| **Advantages** | - Assessing the overall biodiversity assets of a region | - Cover environmental information for current and future context | - Emphasis monetary and non-monetary impacts<br>- Potential to convince decision-makers |
| **Disadvantages** | Unaccounted impacts both present and future | Limited, only area development accounted, while impacts can spread intentionally or unintentionally | More complex techniques |

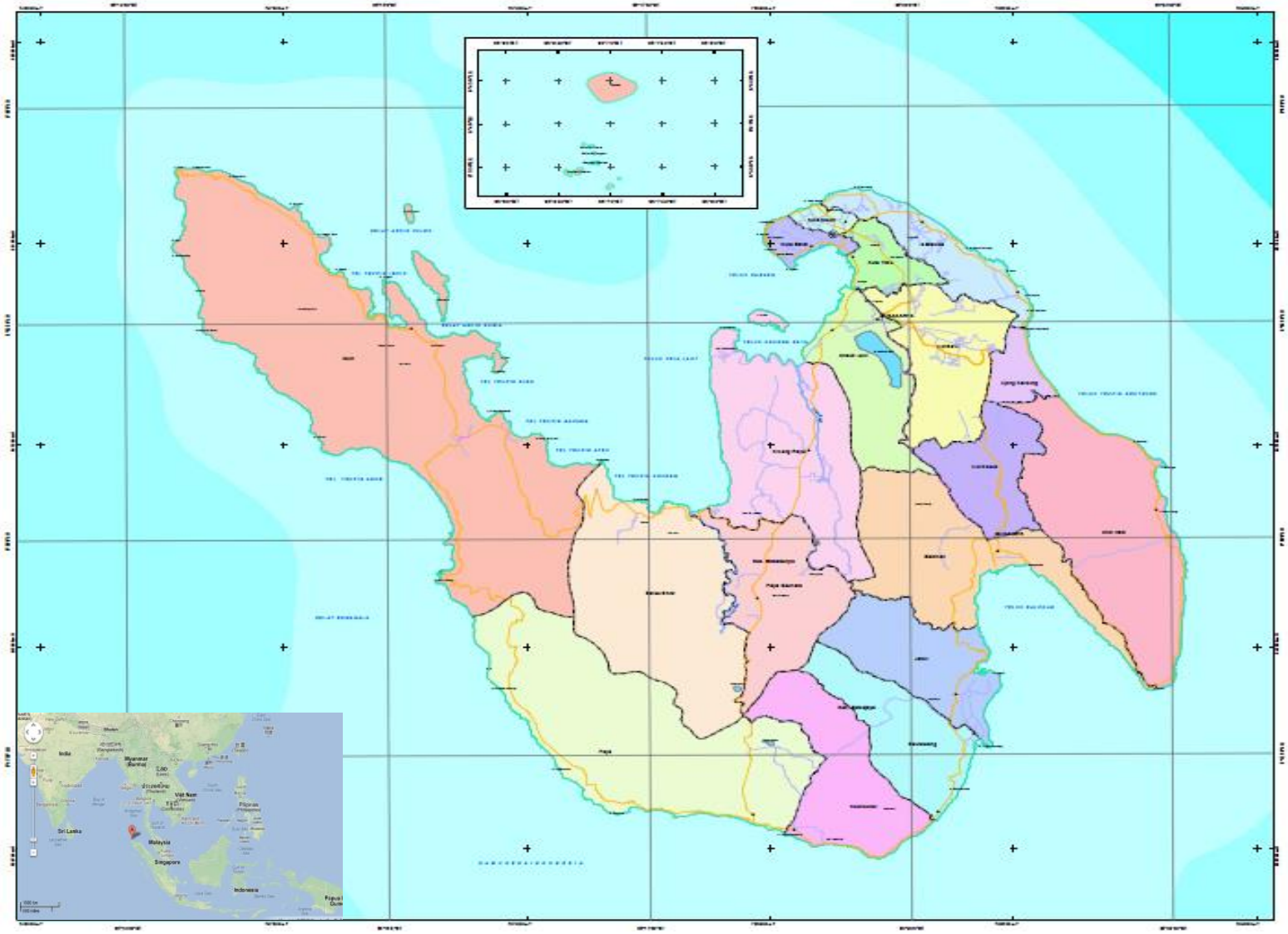
# CHAPTER 5 DEVELOPMENT OF GUIDELINES

The fifth chapter explores the current circumstances of Sabang Municipality in order to discover a possible approach to integrate biodiversity assessment and SEA processes. The discussion aims to obtain some guidelines that could be applied in Sabang Municipality context. The exploration firstly covers descriptive information about Sabang Municipality condition, including its natural, spatial planning system, SEA implementation, and the consideration of SEA and spatial planning processes. The second session explores the proper biodiversity assessment method for the SEA approach. Final session of this chapter develops guidelines for Sabang Municpality in terms of biodiversity assessment and SEA. The developing starts with lessons learned from three case studies and the potential implemented barriers. Following this part is defining fundamental factors for formulating guidelines.

## 5.1 State of the Art of Sabang Municipality

Sabang Municipality (in short calls as Sabang) is one of many small islands in Indonesia and locates in the most western part of Indonesia (Figure 5.1). This city is part of Aceh Province. Sabang is also known as Weh Island due to Weh Island is the main island among the other four islands, which are Kla Island, Rubiah Island, Seulako Island, and Rondo Island. Those four islands do not exist as a citizen settlement area. Sabang has total land area about 153 $km^2$. In line with its narrow land area and number of only two sub districts, obviously Sabang has smaller population number compared with other regencies/municipalities within Aceh Province. However, its population increases gradually year by year. The distribution of population is not spread equally. Some areas have high density, while others have low density of inhabitants.

Fortunately, owing to its strategic position which connects South Asian to East Asia and Australia, especially for shipping lane, Sabang is issued as Indonesian free port and trade zone since 2000. Sabang is a gateway for international trade activities, such as the distribution channels of goods from Europe and Africa to America and Australia. In this regard, Sabang improves its development continuously, particularly on provision of area for development and infrastructure. However, as a small island, Sabang has many limitations due to its area wide and vulnerabilities. In accordance with geomorphologic condition, the land area is dominated by about 65% of hills (BAPPEDA and WCSIP 2010). It means that the flat area, which locates in coastal area, is limited. Consequently, areas for development are limited also. Moreover, in terms of geological aspect, Sabang is a subject to avalanche, earthquake, tsunami, and coastal erosion (BAPPEDA and WCSIP 2010).



Source: Sabang Local Development Planning Agency 2012
maps.google.nl

Figure 5.1 Map of Sabang Municipality

Biodiversity characteristics in Sabang relate to its typical of a volcanic island and the position of the island at the intersection of Indian and Pacific oceans. Coastal biodiversity, particularly on coral reef ecosystem is more well-known than land biodiversity. Coral reef biodiversity attract various kinds of tourism activity in this city. A combination of coral reef ecosystem, volcanic rock and deep water provides great number of marine biodiversity. Sabang waters are the home for 133 coral reef species, and five of them are potentially new species (www.antaranews.com 2012). Coral reef biodiversity in Sabang, particularly in Weh Island is one of the best biodiversity hotspot in western region Indonesia (BAPPEDA and WCSIP 2010). The species composition of Sabang coral reef ecosystem is the combination of Indo-Pasific and Indian Ocean. Based on Wildlife Conservation Society Indonesia Program (WCS-IP) survey during 2005-2009, Sabang water has around 56 genera of hard coral and around 589 genera of coral fish (BAPPEDA and WCSIP 2010). In 2004, a rare megamouth shark was found stranded in Sabang's shoreline. Since discovered in 1976, only 36 individual have been found in the Pacific, Indian, and Atlantic oceans.

Moreover, tropical region is known as a place with vast tropical rain forests, unique formations, and having great number of plant and animal species. This type of richness forest can be found in Sabang. Likewise, a threatened species of toad, *Bufo valhallae*, is only found in Sabang to this point (www.wcs.org 2013). The character of volcanic soil plays significant role in species composition. Their abundance is related to plants. The study about flora composition in Sabang states that 325 species of plants, where 247 are woody and 78 are non-woody, are discovered (Asyraf, et al. 2012). The study has report also two most common of non-woody species that can be a key indicator of degraded habitats, which means that the area has experience of disturbances.

Nevertheless, biodiversity issues have not being main priority in Sabang current development. Concern on biodiversity only gives on natural protected areas. It is in line with opinion of the official of Sabang Planning Agency who explained that "*…in conservation and protected area, biodiversity are the main consideration of planning. However, in the cultivation area, biodiversity are not parts of planning priority*". The same view was also stated by a lecturer of Marine Science "*…biodiversity issues have not been a major concern in our current development, although now there is beginning to promote biodiversity issues in the development goals*". Instead biodiversity has an essential role in environmental system. Understanding the function of biodiversity in our system would lead to realize sustainable development.

A comprehensive development has to consider all development issues, including biodiversity issues. In the context of Aceh and Sabang, current biodiversity issues associates with endangered species and mammalian, invasive species, and on-going increasing development which affects biodiversity existence. These issues are explained by lecturer perspective.

*"…in our region context, this relates to illegal logging, infrastructure provision and land clearing. These activities affect the existence of those species, such as elephants, tigers, and orang utans. The activities disturb the habitat of species making habitat fragmentation, and then increasing threats to the species. Water areas have different issues. Coastal biodiversity, including mangroves, sea grass, seaweed, and coral reefs are threatened also by anthropogenic activities. Development around coastal areas has an effect to structures and composition of coastal biodiversity species" (*Biological Science Lecturer).

*"... the first is environmental degradation, both land and sea. In the case of land, deforestation is the example. Due to land and sea are connected each other, forest degradation will affect the quality of water. All destructive activities in forest consequently will have impact in sea particularly on coastal areas. Coastal areas have rich biodiversity. Then environmental degradation interfere not only forest biodiversity but also coastal biodiversity. Second is an invasive of stranger species from other regions as well as regions outside Indonesia. Stranger species attacks not only on land but also on sea which would threaten local species, especially endemic species and species which high economic value"* (Marine Science Lecturer)

Obviously, with the intention to develop the regions, Sabang faces various serious tasks. The task encompasses the need for continuous development, increasing economic development, providing a convenient place for the community, as well as preserving its richness biodiversity and environment. Additionally, most settlements and infrastructure in Sabang Municipality are located closely to coastal areas, which are vulnerable not only to geological disasters and sea-level rise, but also to high-energy waves and storm (Mimura, et al., 2007). This fact requires special attention on Sabang development orientation. Hence the fundamental task is integration of environmental priority within economic development.

Realizing of those tasks, Sabang government makes various effort in order to deal with the need of environmental planning and accomplishing sustainable development. Since the issue of Law No 37/2000 about the establishment of Sabang as a free port and free trade zone, Sabang Government tries to implement development strategies based on spatial approach and community approach (Planning Agency of Sabang Municipality 2011). Spatial approach aims to generate economic growth by multiplier effect focussing on two main components, which are urban and rural areas. Community approach targets to encourage acceleration of development through community capacity building improvement. This approach focuses on preparing community to have high quality knowledge and skills.

### 5.1.1 Planning System and Spatial Plan of Sabang Municipality

Indonesian planning system firstly influence by Dutch planning culture, which is integrated and comprehensive approach. However, incomplete adoption of this approach is displaced by land-use management of American planning (Hudalah and Woltjer 2007). The fundamental transformation of planning system in Indonesia occurred while the fall of the

New Order regime. The old Planning Law 24/1992 was changed with the Spatial Planning Law 26/2007, which emphasises some approaches that are not included in the old law. The Law 24/1992 specified integrity, sustainability, effectiveness, efficiency, compatibility, harmony, openness, equality, justice, and legal protection have to be the core of spatial planning. Society has right to know and to participate in spatial planning process.

The new Spatial Planning Law 26/2007 instructs explicitly the authority of each tier of government, which actually did not mentioned in the previous law (Figure 5.2). Principle of accountability is the new principle introduced. Besides, the new law requires at least 30% for open spaces in urban area. Obviously, the new law offers more detailed rules than the earlier law consisting of rights, obligations and the forms of public participation in spatial planning.

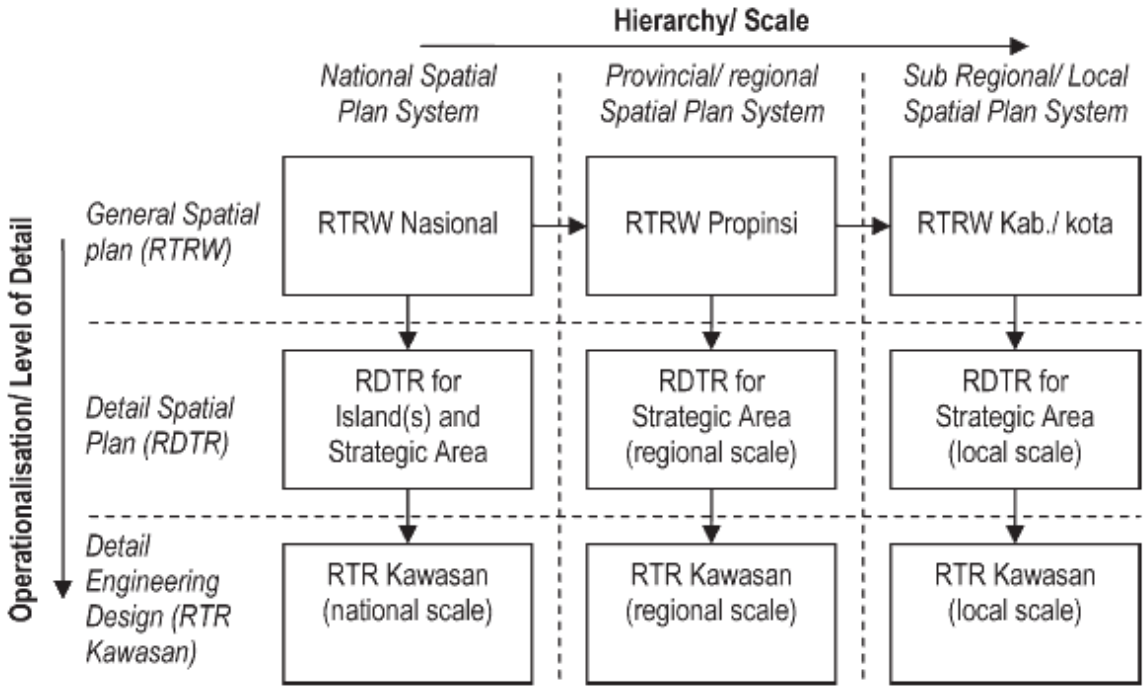



Figure 5.2 Spatial planning systems in Indonesia

Source: Hudalah and Woltjer (2007)

In general, spatial planning is a key instrument for development to promote a more rational arrangement of activities and to resolve competing policy goals among economic development, environmental and social policy. Spatial planning involves identifying long and/or medium term objectives and strategies for regions, dealing with land use and physical development, and coordinating sectoral policies. As stated in the first chapter, sustainable development and spatial planning has a strong correlation. For the promotion of sustainable development, spatial planning has numerous important functions. Trough spatial planning efficient use of resources and protection of environmental system will be obtained. Sustainable spatial planning should consider biodiversity function as a part of environmental system. Biodiversity has own function which must be respected in long-term human development. If greater sustainable development and lesser environmental degradation desire to be achieved, then biodiversity needs to be a priority.

In line with Sabang environmental characteristic, spatial planning of Sabang should encourage sustainable spatial planning to pursue sustainable development and improving quality of life. However, in some parts the direction of Sabang spatial plan cannot be separated with the status of free port and free trade zone of Sabang. Particular areas already designs for infrastructures demanded for supporting the status which is undeniable will interrupt environmental balance. Yet, there is still allocation for protected and conservation areas. The official of Sabang Planning Agency explained "*in terms of current spatial plan of Sabang Municipality we allocate wide area for marine conservation area. It indicates that Sabang government concern to environment, including biodiversity*".

Sabang Spatial Plan is the spatial development policy that will be a reference of Sabang development for the period of 20 years, since 2012-2032. The spatial plan emphasises the development of new service/activity centres. It also attempts to balance demand between protection of environmental objectives and achievement of social and economic development objectives. Sabang spatial plan mainly consists of information of future distribution activities about:

1. Objectives, policies, and strategies of spatial planning
2. Plan for spatial structures
3. Plan for spatial patterns
4. Plan for strategic areas
5. Regulations for land utilisation
6. Regulation for land utilisation control
7. Institutions, and
8. The role of the community in the implementation of spatial planning

In the implementation of this spatial plan, plan for spatial structures, spatial patterns, and strategic areas are predicted will generate impacts on biodiversity. Plan for spatial structure includes plan for service/activity centre system and plan for infrastructure network system (Appendix 5). This plan will utilise the existing area as well try to expand it. Moreover, plan for spatial pattern highlights spatial pattern for protected area and cultivated area (Appendix 6). Likewise, plan for strategic area exposes about strategic areas for national and province, and strategic areas for Sabang Municipality (Appendix 7). Unfortunately impacts of those plans on biodiversity are not well accounted by strategic developments. This may occur due to two opinions. Firstly, basically land use in Sabang is utilization from the existing activities. For instance, area for port has been established since colonial era. At that area, biodiversity especially high value biodiversity is not well exist. Biodiversity only considers their existence in conservation and protected area, which is these areas are not subject as area development. Another opinion as below:

> *Natural characteristic of a region direct or indirect will influence how biodiversity taken into consideration. A region that has high economic value of biodiversity will surely get a full close attention of the government. On the other hand a region that has high ecological value will put more concern on biodiversity conservation. This situation will*

> *create two groups which have different development purpose. Moreover, another important thing is political situation. How biodiversity issues taken into consideration highly depends on the regime of government. Thus, spatial planning which will priority to biodiversity seems have to be struggle* (Biological Science Lecturer).

From above explanation, it is clearer that in order to make biodiversity is taken into consideration in strategic development it needs not only acknowledgement of biodiversity richness and high value of environment, but also supports from political parties. In current political situation, it seems that attention to general condition of environment is sufficient enough to perform full consideration to the environment, while the fact is environment consists of many aspects. Meaning that, consideration on pollution and waste does not really direct to preserve and protect biodiversity. Biodiversity issues needs comprehensive attention to be solved.

Moving to biodiversity in Indonesia context, Indonesian Government formulates Indonesian Biodiversity Strategic and Action Plan (IBSAP) in 2003 and to be implemented until 2030 in responding on international concern on biodiversity as well management crisis on Indonesian biodiversity. Indonesian Government realizes that biodiversity play significant role on sustainability of the nation. Biodiversity can be utilised to improve the wealth of nation for current and future generations (BAPPENAS 2003). The general purpose of IBSAP is to have a strategy and tangible action plan in order to manage the stock of resources due to meet development goals.

The national vision for biodiversity management in Indonesia is:

> "*An Indonesian society, who is concerned, empowered, independent, intelligent in conserving and utilizing biodiversity in optimum, fair and sustainable manners through responsible management with the ultimate purpose of enhancing its community welfare*" (BAPPENAS 2003).

To accomplish the vision, numerous missions are constructed:

1. To encourage changes in attitude and behaviour of the Indonesian individuals and society, as well as, the existing institutions and legal instruments, to be more concerned with conservation and utilization of biodiversity for the welfare of the community, in harmony with national laws and international conventions.
2. To apply scientific and technological inputs, and local wisdom.
3. To implement a balanced conservation and sustainable use of biodiversity.
4. To strengthen institutions and law enforcement.

In line with national context, Sabang government has a development vision, which is:

> *The realization of modern society in which have basic rights, independent, and prosperous life in harmony based on religious morals* (Sabang Government 2013)

With the purpose to fulfil the development vision, one of the missions is improvement of environment and society welfare. Unfortunately, Sabang government does not have yet a

specific biodiversity and/or environmental vision for its development. Instead the existence of the specific biodiversity vision will direct to the achievement of sustainable planning.

### 5.1.2 SEA Implementation in Indonesia

It is assumed that environmental degradation commonly occurs due to less consideration in decision-making processes in strategic level. Therefore, it needs an effective environmental assessment tool at decision-making level to complete the less effectiveness of an assessment tool in a project level. In order to ensure environment has been taken into account comprehensively in Sabang spatial plan, it requires an environmental assessment as a decision-support tool providing relevant information. Strategic environmental assessment (SEA) is believed as suitable approach conveying more environmental rationality and dialogue into decision-making process. Conducting SEA on Sabang Spatial Plan is an effort of integrating environmental consideration into strategic decision-making level aiming to realize sustainable development. SEA implementation in Sabang is subject to Indonesian SEA regulation.

New Indonesian environmental law (Act No.32 Year 2009) promotes thirteen new environmental instruments for prevention pollution and environmental damage. One of them is SEA. SEA has been a mandatory instrument for assessing environmental consequences of spatial plan (*RTRW*) and medium-term development plan (*RPJM*). It applies to all levels government. In the context of Indonesia, SEA is a series of systematic, comprehensive, and participatory analysis to ensure that principles of sustainable development has been the basis of and integrated to the development in a region and/or policies, plans, and/or programs (Act No.32 Year 2009). Some aspects that have to be assessed within SEA are estimation of impacts and risks to environment, performance of ecosystem services, and level of biodiversity resistance and potential biodiversity. Afterward Indonesians' SEA promotes six principles, which are (1) self-assessment; (2) improvement in policy, plan, and program; (3) capacity building and social learning; (4) influence the decision making; (5) accountable; and (6) participative.

In accordance with SEA stages, Environment Ministerial Decree No 9 Year 2011 describes four stages for SEA implementation in Indonesia.

1. Screening;
2. Policy/Plan/Program (PPP) impact assessment into environmental condition;
   - Identification stakeholders
   - Identification sustainable development issues
   - Identification PPP which to be prepared and to be evaluated
   - Examine the impacts of PPP to environment
3. Alternative formulation of PPP improvement;
4. Recommendation for improvement PPP and integration of SEA result.

In exploring the proper approach of SEA implementation in Sabang, there are several legal aspects that could be an entrance gate to SEA implementation, namely Law No 32/2004

about the Local Government, Law No. 32/2009 about protection and environmental management, and Ministerial Decree of Environmental No 9/2011 about General Guidance of SEA. Generally, those regulations give support as well as strengthen the possibility of SEA implementation in all regions. However, SEA is fairly a new instrument. Even though general guidance already exists since the end of 2011, SEA is still not easy to be applied. Unfamiliar contents that have to be examined, long process of decision-making, and requirement of participative decision-makers actively are several challenges of SEA implementation in Sabang.

### 5.1.3 SEA and Spatial Plan in Sabang

Based on those several elements of spatial plan, if there is no comprehensive environmental understanding and consideration in their strategies decision-making process, Sabang environment is predicted to experience biodiversity degradation. In the context of today, Sabang Government already applied SEA for its spatial plan. However, interviewee from government official both provincial and local level agree that the application of SEA for today implementation is only for fulfil the mandatory requirement of legislation. It is not only happen in Sabang context, but also for other cities and regencies in Aceh Province.

> *"SEA is an environmental instrument that recently is obligated for spatial planning and medium-term development plan. So we just start to learn how to operate the processes of SEA effectively and efficiently"* (the official of Sabang Local Development Planning Agency).

Sabang Government needs to apply SEA comprehensively in its strategic development. Nonetheless, as stated before, SEA implementation is not a simple process. It requires an integrated approach encompassing complete understanding of SEA concept, technical understanding and capability of SEA implementation, institutional and human resource competence, and financial provision. The all official agree that SEA has many benefits for spatial planning, especially for encouraging ecological principles for guiding development and land use, ensuring selective and efficient use of resources, as well as guaranteeing public participation in decision making process.

Furthermore, in encouraging SEA practice in Sabang spatial plan, understanding a small island resources, characteristics, and vulnerability completely is essential. Sabang as a small island has their own focus to develop the region and to increase economic development which seems that economic development gains more attention from decision-makers. Sabang offers various strategies to promote its economic development. Nevertheless continuous economic development could make resources are frequently massive exploited. Sabang has high sensibility to environmental problems, including natural resources and biodiversity. Thereafter, it is assumed that the capability of most small islands government to cope with the economic and environmental issues and to respond correctly is limited. Consequently, it affects cumulative environmental problems. It is certainly that Sabang

environment does not need only environmental assessment in the strategic level, but also needs other assessment to support the successfulness of SEA implementation. This is also supported by argumentation below:

> *"SEA is macro study meaning that does not provide detail environmental assessment like EIA. Then SEA will be issued until 20 years later in line with spatial plan. In my understanding SEA implementation cannot really protect Sabang environment. The important thing is SEA implementation has to be followed by other assessment in order to raise biodiversity issues in spatial planning process. …. SEA implementation surely has benefit to reach sustainable development. Prioritizing biodiversity always associates with providing better economy situation for communities. Even though, the opposite understanding is perceived by the community. On the other hand, the role of biodiversity in our system is not really recognized by many people, including decision makers and community who has economic orientation on utilization of biodiversity"* (The official of Provincial Environmental Agency).

Focusing on spatial plan and biodiversity, various literatures (Webber 2004; Kolhoff 2005; Mortberga, Balforsa and Knolb 2007; Geneletti 2008; Haines-Young 2009) claim that some aspects of spatial plan implementation will create impacts on biodiversity, such as land fragmentation and biodiversity losses. Then, through SEA application the impacts have possibility to fully consider in strategic level, yet it should be backed by a proper biodiversity assessment method. Since Sabang has biodiversity richness, biodiversity assessment has a chance to promote environmental awareness in various level of society. Raising local issues has greater impact rather than global issues. Inducing biodiversity issues stimulate more environmental awareness then introducing clean energy in small islands situation. The official of Sabang Local Development Planning Agency emphasizes that in general, planning and development of Sabang government is based on mitigation principles due to vulnerability of Sabang on natural disasters. Hence various data regarding natural disasters and mitigation are needed to support development. The same treatment would be applied if biodiversity needs to be a priority. The valuable data have to be conveyed by not only descriptive number which is hard to be understood the meaning of the number, but data have to have direct link to development. Thus, biodiversity have possibility to be easily understood by decision-makers. The official of Provincial Development Planning Agency adds that "the possibility of biodiversity involvement in SEA processes will rely on actors involved. Even though there is increasing environmental awareness within community, biodiversity cannot be a major concern instantly. But the important thing is the possibility is always there."

To put in brief, Sabang faces some key development trends that pose critical challenges for its spatial planning. The issues of the need to increase economic development and social welfare, achieving national sustainable development goals, free port and free trade zone status, and also biodiversity preservation continue to have profound implication on pattern of Sabang development. Sabang spatial planning ideally should be complement with a SEA

approach. Further SEA for Sabang should be applied with specific approach. Due to one of the main characteristic of Sabang is its biodiversity richness, biodiversity assessment and SEA has great possibility to support each other to encourage sustainable spatial planning. It is also in line with argument by Treweek, et al. (2005) that SEA particularly is suited to protecting and enhancing biodiversity. Similarly, through biodiversity assessment, SEA has more added values to decision-making process via providing more valuable data.

## 5.2 Exploring the Proper Biodiversity Assessment Method for SEA Approach

In order to search the proper method of biodiversity assessment that could be integrated into SEA processes of Sabang spatial planning, it needs to explore particular factors that fit to Sabang context. The exploration is based on three case studies that presented in Chapter 4 and the circumstances of Indonesian systems both spatial planning and SEA, and Sabang characteristic. The conceptual model is operated as guidance for exploring the method.

**A. Small Islands Context**

- **Natural Circumstances**

Exploring the three case studies shows that each case study has different circumstances. Biodiversity richness (characterised by Trentino-Italy), urbanization which creates physical development around the natural areas (characterised by Stockholm-Sweden), and area surrounded by water (characterised by the Netherlands) are the typical circumstances which can be found also in Sabang context. Therefore, several points are possible to be considered.

The given characteristics of each city seem shape the development direction of the city. Trentino lies in the heart of the Alps. This province is typified by variation of biogeographic, geomorphological, and climatic conditions, which appoints Trentino as an amazing space of huge composition both species and habitats. Most important biodiversity existence has been recognised in Trentino development. Understanding the importance of wonderful environment, the government put high attention to the preservation of biodiversity. Keeping biodiversity and environment on high quality is the way of government attracts investment.

As the first European green capital in 2010, Stockholm has an ambitious to be a world-class city. Green environment has influence the government to generate green development and green lifestyle for society. High awareness of society keeps environmental in great quality.

Positioned in delta area and also as low-lying country, the Netherlands is subject to water related problems. The government hence commits to make water management as an integral part of spatial planning and strategic land areas.

Relative different story is presented in Sabang case. Having astonishing nature, combining tropical forest and coastal ecosystem, does not supported with green development strategies. Government and society do not really give actions to the importance of sustainable environment. Government puts their priority to economic development and increasing society welfare mainly through tourism sector. Only on certain aspect, environment, especially biodiversity takes into account.

Based on explanation on chapter 4 and also the previous sub-chapter, it is clear that each country has awesome objectives concern on environmental, particularly on biodiversity. This indicates that biodiversity is acknowledged as the fundamental elements for sustainable life of current and future generation. However, the different performances of countries management and maintenance of biodiversity really rely on the countries' appreciation on biodiversity. Obviously, Sabang can obtain a lesson learned from the three case studies that Sabang should have clear objectives about environment, particularly biodiversity as part of the major development direction. The national vision of biodiversity does not enough to encourage Sabang government to concern on biodiversity. Indeed, by having clear objectives either environmental or biodiversity would stimulate numerous environmental actions. Without local environmental/biodiversity objectives, the selection of a proper biodiversity assessment method would be rather difficult.

- **Planning System**

Actually, planning system does not directly relate to the selection of a proper method. However, planning system provide a link to the inclusiveness of SEA in spatial planning. Planning system portrays how flexibility as well as robustness of a spatial planning is executed in a country, which also illustrates how SEA is being implemented. Generally, planning system of the studied countries can be categorized as medium controlled of spatial policies.

Trentino Province as part of Italy applies urbanism approach with strictly rigid zoning and codes. Each level of government has a planning responsibility which results different way of planning practices. In Sweden, national government provides regulation for directing spatial planning. Municipality is a key actor on conducting spatial planning. National can only interrupt in certain cases of national concentration, such as health.

The Netherland conducts spatial planning through comprehensive integrated approach. It means that a more strategic approach through coordinative and communicative intelligence of the regional planning bodies. The Netherlands also focuses on development-oriented, protection of individual interest, and strong public administration. The new Indonesian spatial planning law specifies the hierarchical spatial planning from national, provincial, and district spatial plan. All tiers of government are required to make spatial plans for leading their area development.

Accordance to SEA Directive, spatial plan is required to be assessed by SEA for EU members. Also in the context of Indonesia, every level of government has to conduct SEA for their spatial plan. Hence the planning system indirectly asks the government to conduct SEA. This condition emphasises an opportunity that biodiversity assessment can be integrated into SEA implementation. The official of Sabang Local Development Planning Agency agrees that biodiversity focus and SEA implementation will has benefits to Sabang spatial plan. He explains that:

*"Even though spatial planning processes look like have the same principle for sustainable development with SEA, SEA implementation will cover the consideration that not really examine within spatial planning process. Concerning on biodiversity I think will add more benefit to SEA. Biodiversity data will give more information about our environment which has to be preserved and protected" (*The official of Sabang Local Development Planning Agency).

**B. Biodiversity Assessment Methods**

This is the fundamental part of exploring the proper biodiversity assessment method for SEA implementation on small islands' spatial planning, particularly in the context of Sabang. Biodiversity assessment methods which pictured in chapter 2 and 4 described the relation between natural context and the focus of method. Italy and Sweden which concern the value of green environment, then promote assessing biodiversity in ecological context. It is also clear that Trentino-Italy which has reputable environmental assets, biodiversity assets assessment (BAA) can promote the achievement of national biodiversity strategic visions. BAA has focus on species and ecosystem level. In terms of Stockholm-Sweden, assessment which highlights on landscape and ecosystem level tends to represent the environmental characteristic of the city. Various landscape assessments have been developed in Stockholm, one of them is landscape ecological level (LEA). On the other hand, the Netherlands which has more experience on environmental assessment creates more sophisticated approach, integrating ecological context into economical perspective to be possibly applied into SEA, which call MCCBA. MCCBA could be an answer of the lack of economic value on the two previous biodiversity assessments.

With the intention of exploring the methods which match with small islands and Sabang condition, argumentations and perspectives of interviewee are considered. As biodiversity has two fundamental elements, which are variability of life and ecological integrity, assessment in various level of biodiversity are important for the existence of biodiversity, both variability and integrity. Nevertheless, Biological Science lecturer explains that a proper focus of biodiversity assessment which could cover a range of environmental impacts from spatial plan implemented will depend on types of spatial planning and area implemented. Both species and ecosystem can be receptors of spatial planning implemented. Another perception is derived from Marine Science lecturer. He adds that if the goal of development is conservation, then biodiversity assessment that focuses on species will be proper to reach the goal. However, in order to do more comprehensive assessment, biodiversity assessment on the level of habitat or ecosystem will be accurate. Hence, it can be noticed that generally, spatial plan implementation could affect both species and ecosystem level of biodiversity. Besides, it is noted that specific environmental goals are needed in order to select the suitable biodiversity assessment method.

Furthermore, all biodiversity assessment methods have a relevance to spatial plan content. Both lecturer reach agreement that all methods will be suitable to encourage environmental

consideration into spatial planning. Thereafter, spatial planning consists of various land utilization. Hence the assessment has to fit with land utilization. Before conducting the landscape assessment, biodiversity assets is required. So all methods are related and have their own function but complementary each other. The reason for chosen the method is only determined by development goals, capability to conduct the assessment, and supported resources, such as human and financial resources. In the perspective of government, the most fundamental thing of selection the method is is how the result of the assessment can affect the way of decision-makers make decisions. The results have to convince decision-makers that certain development will create impacts, and the impacts will trigger other impacts.

Even though the methods are not really well known in research's respondents, the respondent concur the implementation of methods are based on knowledge. All methods consider the existence and the importance of biodiversity level in their assessment technique, which are based on science both theoretical and practical knowledge. Moreover the method takes into account the value of biodiversity in the environmental system and the close relation between development and impacts to species and habitat or ecosystem. The advance concept and technique of all methods will fulfil the lack of biodiversity study in Sabang. The method will contribute to result valuable and understandable data. However, the lecturers suggest for conducting the assessment it requires such kind of training to understand comprehensively the operationalization and requirement data of method. It also needs a leader who really knows the all steps and concept of the method. Then the leader can direct the implementation of method to reach the goal of assessment.

In a few words, it can be articulated that it cannot directly judge which method has greater appropriateness with spatial plan of small islands due to each method is complementary each other. Further each method has its own appropriateness with specific planning of spatial plan. To conclude, all biodiversity assessment method have connection with spatial planning, which potentially raise biodiversity issue into decision-making.

**C. SEA Implementation**

This part tries to explore biodiversity assessment methods for SEA implementation, especially SEA for Sabang spatial plan as one of small islands. The exploration encompasses how to integrate biodiversity assessment into SEA components (technical, process, and communication) and stages.

By reason of the SEA Directive, Italy issued their SEA regulation in 2006. Only in 2008 the regulation is supported by SEA procedures' phases. In the context of today implementation of SEA for making greater quality of decision-making are still exploring. Various environmental tools arise due to provide more qualified information for decision-making on SEA processes. Sweden's response to SEA directive in 2004 was quite fast compared with Italy. However, the practical guideline to conduct SEA was established in 2010. This induced

to the shortage of SEA application in Sweden and utilised minimalist approach. Only small number of municipalities applied SEA into their plans.

Contrasted with Italy and Sweden, the Netherlands has long practices with environmental assessment. The Netherland has comprehensive SEA processes and detailed mandatory for many sectors, and promotes totally citizens participatory. Indonesia experience with SEA can be said just view years ago, precisely in 2009. At this moment Indonesia continuously explore the best approach to conduct SEA. Currently SEA is only mandatory for spatial plans and medium-term development plan to all levels government.

Based on short explanation of SEA stories from above case studies, SEA as a function of an environmental instrument is still being developed. Biodiversity assessment is part of added value to SEA development. The relation between biodiversity assessment and SEA can be seen from two points of view. The first view is biodiversity perspective. Biodiversity stimulate more important role of SEA as a potential environmental tool in strategic level. Then the second view is SEA perspective. SEA aims to ensure biodiversity considerations are appropriately addressed in SEA processes.

In terms of technical component, all assessment methods could help SEA to define the objectives, target, and indicators of SEA process to assess the spatial planning. As mentioned in previous chapters, spatial planning tends to trigger more biodiversity problems. Hence, within biodiversity perspective, objectives of SEA will be formulated. BAA assist to define objectives related to the biodiversity assets of a region, while LEA will help to identify objectives in the form of landscape integrity. In more general, MCCBA will aid to formulate objectives in combination of economic and ecological benefits. Thereafter, all methods allow the necessary data and sufficient information to be collected from within the available data which also still prioritizing accountability of data. In the context of Sabang, current SEA application is conducted by a consultant, which indicates objectives of SEA implementation were not comprehensively formulated. However the official of Sabang Local Development Planning Agency conveys that Even though Sabang spatial plan is handled by a consultant, the consultant searched and explored all relevant environmental data. The consultant fetched data from relevant agency.

Furthermore, a process signifies the linking of SEA processes and spatial planning. All biodiversity assessments allow a flexible process of SEA that is adaptable to each case. It can be observed from the three case studies. Take Stockholm as the example, the absence of SEA general guidance for approximately 6 years generates the emergence of various approaches to support SEA application, namely minimalist, intentionalist, and environmentalist. The approach promotes flexibility assessment and robust analysis such as landscape ecological assessment, which can link SEA processes and spatial planning processes.

A communication component highlights public participation and involvement. Communication in SEA processes prioritises exchange information and cross-referencing of

the multiple points of views. This component clearly can be found in all biodiversity assessment methods. In specific, BAA and MCCBA need experts and stakeholders perspectives on the assessment. Further, Sabang government also needs an assessment that can involve the community in spatial planning processes: "*We invited community and other relevant stakeholders and NGOs to participate in focus group discussion session due to provide arena for society to give their opinion about the planning and development programs. We contemplate what they thought about the programs*" (the official of Sabang Local Development Planning Agency).

Coming to SEA stages, biodiversity assessment usually is involved in the couple first stages, namely defining objectives and providing baseline information. However it is also possible to integrate in all stages of SEA processes. This is in line with judgment from the official of Sabang government. Biodiversity assessment can be included in the first step of planning process. The first step is crucial due to all relevant information are identified, including all impacts of development planned.

The case studies, Trentino-Italy and the Netherlands do not have clear link between the assessment and SEA process. Conversely, Stockholm case offers straight link to the SEA processes. However, in terms of SEA components and stages, all biodiversity assessment has great possibility to be integrated in SEA processes. Quoting from Jones et al. (2005) point of view, in fact SEA is part of political system. Then the other perspective of integrating biodiversity assessment into SEA processes in depends on political situation.

Table 5.1 Comparison of the three Case Studies

| Comparison Factors | Trentino-Italy | Stockholm-Sweden | The Netherlands Projects |
|---|---|---|---|
| Natural Context | Forest | Green landscape | Delta |
| Planning system | Rigid zoning and codes on urban design, townscape, and building control | Mix between comprehensive integrated approach and economic development | Comprehensive integrated approach |
| SEA Implementation | 2006, guidance in 2008 | 2004, guidance in 2010 | a kind of SEA in 1987, renewal in 2006 |
| Biodiversity/ Environmental Objectives | Clear biodiversity concern | Clear environmental concern | Clear Biodiversity concern |
| Biodiversity Assessment Methods | Biodiversity assets assessment | Landscape ecological assessment | Multi-criteria cost benefit analysis |

Source: Author

Table 5.2 Analysis of exploring the proper biodiversity assessment method

| No | Dimension | Sabang Condition |
|---|---|---|
| 1 | Small islands context | |
| | Natural circumstance | - Richness biodiversity<br>- Urbanization<br>- Area surrounded by water |
| | Spatial planning | - Mix between comprehensive integrated approach and land use management |
| 2 | Biodiversity assessment methods (BAM) | - Does not have specific environmental and/or biodiversity objectives |
| | | - Possible to apply BAM with focus both species and landscape/ecosystem level |
| | | - Each planning in spatial plan seems require different methods |
| | | - Needs assessment that can result valuable data as well as easy to understand |
| | | - Lack of biodiversity study |
| | | - Lack of sophisticated data |
| 3 | Strategic environmental assessment | - SEA is implemented due to legislation mandatory |
| | | - Concerns on process rather than context |

Source: Author

## 5.3 Development of guidelines

### 5.3.1 Lessons Learned from the Three Case Studies

Analysing the biodiversity assessment methods, SEA practices, spatial planning systems, and small islands context from current practice in Sabang (chapter 5), linking to the case studies (chapter 4), and then comparing to the ideal practice in theoretical review (chapter 2), there are several lessons learned that are essential for implementing biodiversity assessment method for supporting SEA of small islands' spatial planning. The lessons learned are:

1. Local environmental and biodiversity both vision and strategies that are formally formulated by government are needed to direct development of small islands as part of richness biodiversity regions. The vision and strategic is believed will create balances between environmental protection and economic development, which is not the opposite, undermining economic. Thus, Sabang Government should formulate local environmental and biodiversity vision and strategies as a guidance of its development, including spatial planning.
2. Each case study has different story about spatial planning system and SEA implementation. However, the obligation to carry out SEA through the SEA Directive (although a general guidance of SEA established later) stimulates creativity to examine various environmental tools that can support SEA implementation. It elucidates that in international arena, the absence of general guidance still offers some approaches to implement SEA.

3. The advanced experiences around biodiversity preservation and conservation make the three countries innovative in developing biodiversity assessment methods. The advanced experiences might be resulted from high awareness of biodiversity function in environmental systems. The emergence methods could be applied in Indonesia and Sabang context.
4. The selection of a proper biodiversity assessment method will depend on the natural characteristic of area, on development and economic pattern, as well as on government commitment on environment and biodiversity. Moreover, the selection could be influenced by data requirement and understandable application method.
5. The integration of biodiversity assessment into SEA process seems rely on the SEA processes. SEA processes involve some stages, which each stage requires specific information and approaches. Biodiversity could be involved on early stage of SEA processes (screening process), involved only in a particular stage (providing baseline data), or involved in all processes of SEA.

### 5.3.2 Implementation Barriers

Base on scrutinizing the three case studies as well as Sabang Municipality as an empirical case, it is important to identify the suspected barriers that hamper the implementation biodiversity assessment method in assisting SEA process. Implementation barriers can be classified into six issues (Stinchcombe and Gibson 2001):

**1. Limited information and unavoidable uncertainties**

The realisation of biodiversity assessment relies on the availability of accessible and appropriate information which required by the methods. It is feared critical data needed are not available. The available data might be incompatible, secret, and/or inapplicable to the need of policies, programs, or plan under study. This relates to the statement that mainly biodiversity study in Sabang is carried out through inventory approach. Unreliable data and unclear estimation can decrease stakeholders and public support to the existence of biodiversity assessment and SEA. Thus, it seems the implementation of methods, which most of methods require the baseline data to be regenerated, faces data limitation.

**2. Institutional Resistance**

Politics actually is the important arena of biodiversity assessment has to enter. Numerous issues exist in the society range from economic, health, welfare, employment, education. Yet biodiversity has only a small value for the subject of politics. Only international influences will stimulates biodiversity being a political concern. Biodiversity assessment thus is hard to be an attention without political support. Moreover, politics generate situation that strategic assessment will affect delayed the agenda, raised costs, and also decreased traditional competencies of the policies/programs/plans. Applying biodiversity assessment and SEA simultaneously demands amount of financial support from government agency. Lastly,

consist of numerous stages either assessment methods and SEA, and necessity to include the community seems make government ignore to apply biodiversity assessment and SEA.

In the form of formal institution, the absence of specific environmental/biodiversity objectives in local level is the indicator of government resistance to impress the importance of biodiversity and recording the biodiversity assets. Indeed, legal objectives will direct to protect environment and preserve biodiversity. Taken into account of current context, the proportion of ecological study in Sabang will depend on the diversity of the group involved. If the majority of the group is concern with environmental issues then the proportion of biodiversity will be higher. However, if the majority of the group has economy orientation then the proportion will be smaller. Surely, institutional resistance will hamper the consideration of biodiversity assessment.

**3. Boundary-setting complexities**

The point of boundary-setting is examination of options and possible implications of policies/programs/plans. Accurate boundary-setting is important for directing an assessment on the right issues and concerns. Three types of boundary are usually are taken into consideration, namely spatial, temporal, and substantive. Biodiversity can support SEA implementation if there is clear boundary-setting that will inform government, political actors, and society about the impacts, options, and possible implications of policies/programs/plans. Spatial relates to involvement of huge geographic area and encompass many different ecosystems. It is important to define the area of biodiversity assessment. Temporal concerns with time allocation and interval time between the process of biodiversity assessment, SEA, and spatial planning itself. Substantive, including biodiversity assessment and SEA process associate with determination of potential impacts, enhancement, mitigation, compensation, and other responses that should include in strategic options.

**4. Methodological Aspect**

In international fields, SEA methodological and biodiversity assessment has been developing in various approaches and received great attention. Sophisticated approaches, both practical and technology arise. However, in some parts local situation cannot follow the development approach due to still struggle with other local priority issues. Simple and flexible approaches with an emphasis on qualitative data may be preferable because they can allow practitioners to concentrate on the range of values. Yet, simple and flexible approaches are questioned about reasonable and valuable data for supporting decision-making. A simple way of biodiversity assessment method does not prove really significant result. Nevertheless sophisticated approach cannot be applied due to lack of information about the method. Advanced approaches typically require high-quality and up-to-date data which are rarely available in local level.

Moreover, in reality, policy formulation usually involves incremental processes, particularly on complex matters that might be nearly lacking of the order stages that biodiversity

assessment and SEA process generally follow. The establishment of either sophisticated or simple SEA process and biodiversity assessment methods does not ensure creating benefit to decision-making

**5. Human resource and financial barriers**

In order to conduct a comprehensive method, it necessitates human resources and financial supports to execute the method. Human resources are needed to give their perspective on choosing an assessment method which match with the actual condition. If there are limited human resources needed, it can be assumed the method will face difficulty. Moreover, the method requires amount of money to finance the assessment. On account of indirect beneficial, biodiversity assessment is hardly to access government fund. Even though there is always opportunity to joint with other biodiversity assessment from other parties, consequently the real goal biodiversity itself will be partly achieved due to the merging goal.

### 5.3.3 Developing Guidelines

After exploring the proper biodiversity assessment method, gaining several lessons learned from three case studies, and recognising implementation barriers of biodiversity assessment and SEA, some important points can be highlighted. The points are the basic of guidelines for selecting a more suitable method of biodiversity assessment. The general purpose of the guideline is identifying the suitable approach of biodiversity assessment that could be integrated into SEA process of small islands' spatial planning. It is expected that the guidelines will assist planners to select the method to organise biodiversity assessment and SEA processes. The guidelines mainly relates to Sabang circumstances as a small island characteristics. The guidelines are explored as below:

**1. Identify biodiversity problems, especially related to spatial planning**

Less attention to biodiversity may be caused by no information about the actual condition of biodiversity itself. Condition and problems around biodiversity are only recognised by community who involve directly on biodiversity preservation. Finding and exposing the problem will contribute to biodiversity preservation. Moreover, problem can be identified through gathering information from many parties, such as local communities, society who already facing the biodiversity problems, relevant experts, NGOs, international perspectives, and ecologist, both formal and informal meeting. Besides asking about the problem, it should also find out about a solution that should be done from their perspective. The same thing is confirmed by the official of Provincial Development Planning Agency who states that

> "*In term of spatial planning, biodiversity would gain negative impact from development. Then biodiversity has to put in the first consideration. Simple assessment, such as biodiversity inventory and assessing impacts might be not enough for decision-making of spatial planning. But identifying biodiversity issues and conducting inventory can give general information of region environment, and then provide such a windows opportunity to biodiversity to be considered in spatial planning*".

**2. Setting biodiversity objectives**

Gaining problem and expected solutions from the previous guideline directs to the importance of formulating biodiversity objectives. It is clear from the case studies analysed that biodiversity objectives are crucially needed to maintain the biodiversity, not only for the current context but also for the future. Biodiversity objectives will give direction on how to utilise, manage, and preserve it. Setting the objectives can be started with combining problems, expected solutions, and the biodiversity characteristic itself. Then it should lead to narrow focus of the main problem to be solved. Biodiversity objectives thus should be formulated based on local biodiversity characteristic, problem identification, and expected solutions.

**3. Scaling up biodiversity assessment**

Obviously, biodiversity objectives have to be pursued. One of ways is through conducting various biodiversity assessments. Therefore scaling up biodiversity assessment is highly required. Conducting biodiversity assessment needs to be encouraged. This is an action to control and up-date the figure of biodiversity. Data from assessment can be a composite biodiversity characteristic of an area which is positively has value to be part of decision-making consideration. Scaling up the assessment is associated with less consideration of biodiversity assessment as a tool to support decision-making. Then through scaling up biodiversity assessment it would lead to gain great attention on biodiversity.

**4. Selection the proper biodiversity assessment method**

Case studies examined describe that biodiversity characteristic and type of planning system influence the use of an assessment method. Proper biodiversity assessment method can be useful not only for enhancing biodiversity value, but also for integrating biodiversity in every single decision-making processes, especially related to spatial planning. There are several factors that can be considerations for selecting the methods, and guidance for selecting the method is conveyed in Table 5.3 and Table 5.4.

**5. The Integration Assessment Method into SEA Process**

The selected method then needs to integrate into SEA process. Result from biodiversity assessment can be an influence factor of decision-making regarding spatial planning. Implementation of SEA for spatial planning seem require many baseline data. The way to integrate assessment methods into SEA process are:

1. Identify key issues to consider spatial planning which have impacts on biodiversity (Table 5.5).
2. Links the issues with biodiversity assessment methods
3. Assess the biodiversity issues with the suitable method
4. Involve the process/result of the assessment method into the SEA process

The clear picture of the integration is figure out in Figure 5.3

## 6. Implementing the SEA

SEA implementation is the important part of ensuring biodiversity is taken into a consideration. The integration of biodiversity assessment into SEA process has to perform better quality of decision-making. The fundamental element that has to be considered while implementing SEA in the frame of spatial planning is undertaken SEA should be an integral part of plan development, which allows feedback from the SEA process into the design of the plan. Carried out SEA should involve various participation, including community that will be impacted by the plan, stakeholders, several experts from many expertise, parties, and NGOs. Biodiversity consideration should not be addressed in separation. Biodiversity has to be account as essential element to actualise sustainable development goals.

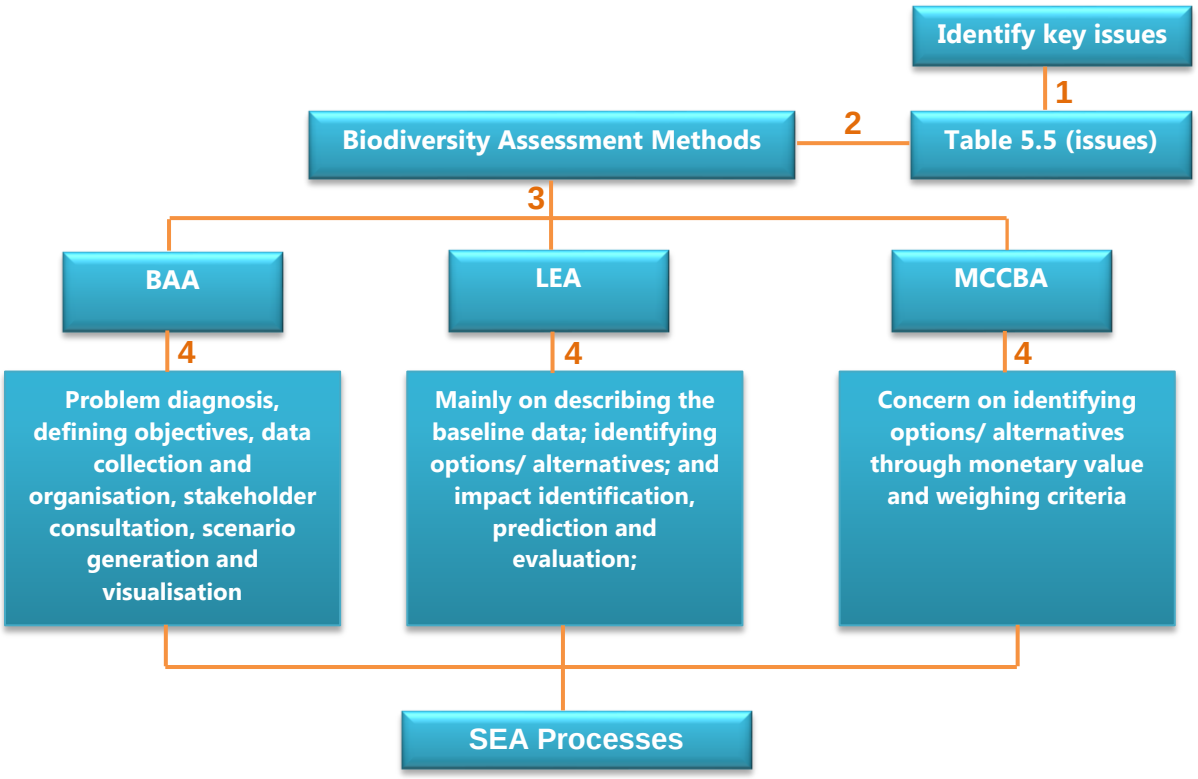



Figure 5.3 Scheme for the integration of assessment method into SEA process

Table 5.3 the guidance for selection the proper biodiversity assessment method

| Factor for selection | Biodiversity Assets Assessment (BAA) | Landscape Ecological Assessment (LEA) | Multi-criteria Cost Benefit Analysis (MCCBA) |
|---|---|---|---|
| **1. Biodiversity concept (specific/general)** | Comprehensively identification and mapping biodiversity assets (specific) | Exploration data and priority setting due to assess the potential impacts of planning through predictive modelling (specific) | Integrating monetary value and judgment for wide group of stakeholders (general) |
| **2. Type of natural characteristic** | Forest, richness biodiversity | Green landscape | General, does not specific to certain characteristic |
| **3. Biodiversity/Environmental objectives** | Clear biodiversity concern | Clear environmental concern | Clear biodiversity concern |
| **4. Spatial planning system** | Rigid zoning and codes on urban design, townscape, and building control | Mix between comprehensive integrated approach and economic development | Comprehensive integrated approach |
| **5. Links to spatial planning** | Provide maps of biodiversity assets to be integrated with planning support systems | Predict and assess the impacts on focal species | Combining economic and environmental perspective into decision-making |
| **6. Possible involvement in SEA process** | Problem diagnosis, data collection and organisation, stakeholder consultation, scenario generation and visualisation. | Mainly on describing the baseline; identifying options/ alternatives; and impact identification, prediction and evaluation; | Concern on identifying options/ alternatives through monetary value and weighing criteria |
| **7. Focus of method** | Species and ecosystem level | Landscape and ecosystem level | Monetary and non-monetary impacts to all level of biodiversity |
| **8. Data requirement** | - Habitat map of species<br>- Sites of floristic species<br>- Forest parcel inventory<br>- Land-use map<br>- Map of water bodies<br>- Land cover map, geomorphologic map, and geologic map | - Focal species as biodiversity indicators: birds<br>- Abiotic condition: topography, land use, building, etc.<br>- Vegetation<br>- Habitat quality for local species | - Type of ecosystem<br>- Area wide of ecosystem<br>- Numbers of threatened species<br>- Maps distribution of species<br>- Map of land use and nature types<br>- List of characteristics species per nature type |
| **9. Approach requirement** | - GIS and Delphi survey<br>- Biological experts | - GIS and statistical analysis<br>- Biological experts | - Multi-agency approach<br>- Economists |
| **10. Advantages** | - Assessing the overall biodiversity assets of a region | - Cover environmental information for current and future context | - Emphasis monetary and non-monetary impacts<br>- Potential to convince decision-makers |
| **11. Disadvantages** | Unaccounted impacts both present and future | Limited, only area development accounted, while impacts can spread intentionally or unintentionally | More complex techniques |

Source: Author

Table 5.4 Guidance for selection the proper assessment for biodiversity level

| | |
|---|---|
| **1** | ***Genetic level***<br>Will spatial planning:<br>▪ Reduce genetic diversity, particularly for already rare and declining species, endemic species and populations and those with Species Action Plans?<br>▪ Reduce opportunities for species populations to interact, e.g., by increasing habitat fragmentation and isolation?<br>▪ Increase risk of extinction?<br>▪ Affect locally adapted populations?<br>▪ Affect important ecosystem services that depend directly on genetic diversity, e.g., pollination of crops? |
| **2** | ***Species level***<br>Will spatial planning:<br>▪ Alter the species-richness or species-composition of communities in the study area?<br>▪ Cause some species to be lost from the area?<br>▪ Affect the success of Species Action Plans or objectives in National Biodiversity Strategies and Action Plans (NBSAPs)?<br>▪ Increase the risk of invasion by alien species?<br>▪ Change the amount, quality or spatial organization of habitat?<br>▪ Affect plans to enhance habitat availability or quality?<br>▪ If habitats will be lost or altered, is alternative habitat available to support associated species populations and are there opportunities to consolidate or connect habitats? |
| **3** | ***Ecosystem level***<br>Will spatial planning:<br>▪ Change critical ecosystem processes, for example, hydrological processes, levels of predation?<br>▪ Reduce the overall productivity of the area?<br>▪ Affect the provision of ecosystem services?<br>▪ Affect overall biodiversity values? |

Source: Treweek, et al. 2005

Table 5.5 Key issues for considering spatial planning impacts on biodiversity

| No | Key issues to consider | Will the proposed plan: |
|---|---|---|
| 1 | Influence of the plan in terms of sustainable development goals | 1. Affect achievement of goals or objectives for biodiversity in other policies, plans and programmes?<br>2. Change levels or rates of use of biodiversity? |
| 2 | Influence of the plan on values and uses of biodiversity | 1. Damage or destroy biodiversity on which people depend for their livelihoods?<br>2. Damage or destroy biodiversity valued by people?<br>3. Reduce access to biodiversity for current or potential future users? |
| 3 | Influence of plan in terms of environmental quality/health | 1. Exacerbate existing threats to biodiversity, e.g., by involving activities already posing a threat to biodiversity in the study area?<br>2. Cause critical impact thresholds (e.g., levels of pollution of a wetland) to be exceeded? |
| 4 | The probability, magnitude, duration, frequency and reversibility of effects | 1. Have relatively certain impacts on biodiversity?<br>2. Have large impacts on biodiversity?<br>3. Have long-term effects in relation to biological lifecycles?<br>4. Have repeated impacts on the same biodiversity resources at such a frequency that their recovery might be compromised?<br>5. Have irreversible impacts on biodiversity, i.e., impacts from which spontaneous recovery is impossible and there are no known effective mitigation techniques? |
| 5 | Cumulative effects | 1. Affect areas where biodiversity is already exposed to significant threat, e.g., through habitat loss or fragmentation?<br>2. Exacerbate space-crowding with significant effects on certain components of biodiversity or on a high proportion of the resource within the study area?<br>3. Exacerbate environmental deterioration such that critical thresholds may be reached?<br>4. Make a significant contribution to "in-combination" or cumulative effects on biodiversity? |
| 6 | The magnitude and spatial extent of the effects | Lead to projects that are space- or resource-hungry, e.g., occupy large areas or use large volumes of water? |
| 7 | The value and vulnerability of the area likely to be affected | 1. Affect protected areas or areas of important, threatened or vulnerable biodiversity?<br>2. Affect areas of high biodiversity, whether protected or not?<br>3. Affect areas covered by National Biodiversity Strategies and Action Plans (NBSAPs)? |

Source: Treweek, et al. 2005

# CHAPTER 6 CONCLUSIONS, REFLECTIONS, AND RECOMMENDATIONS

The focus of this final chapter is to review central concepts and findings of the research. The chapter consists of three sub-chapters, namely conclusions, reflections and recommendations. The conclusion highlights the important elements of biodiversity assessment on SEA implementation. It also tries to draw the proper biodiversity assessment method for SEA implementation in small islands context. Reflections part portray about the contemplation of the whole research. The end of the chapter provides some recommendations especially for Sabang Government for encouraging SEA implementation and biodiversity assessment in order to achieve sustainable planning in small Islands. Recommendation for future research is also conveyed with the intention to add more literature about the importance of relation between biodiversity and SEA.

## 6.1 Conclusions

With the purpose of recapitulating all explanation described earlier, this sub-chapter answer the research questions. Besides, discovering the answer is grounded on the research conceptual model.

**What are the proper biodiversity assessment methods for supporting environmental consideration in decision making process of small islands spatial planning?**

Spatial planning has a fundamental role as a stimulator for sustainable development through rational use of land and resources, rational arrangement of development activities, and reconciling competing policy goals, between economic development, environmental protection and social cohesion policies. According to Bass and Dalal-Clayton (1995) one of the potential of regions to realise sustainable development rest on maintaining the quality of certain, necessarily limited, natural resources of those regions. In current globalisation context, small islands have to deal with intensification of economic development, demand to increase society welfare, and protection of environment as well as richness biodiversity. The increasing competition of space for land use and physical development affects the environmental condition as well the structure and the composition of biodiversity in small islands. Environmental consideration in project level has not played a significant role in reducing the serious global and regional environmental problems caused by economic development. Besides, undertaking biodiversity consideration at the project level is inherently too late and too localised for certain environmental considerations to be addressed. Hence, in needs higher level for biodiversity consideration. Strategic environmental assessment (SEA) is believed as an effective environmental assessment tool at decision making level. SEA requires accounting of environment effects on all levels of applying plan, integrating socio-economic development and environmental protection of land resources organically, assessing and weighing social-economic value and environmental impacts on every land-use strategy objectively. Unfortunately, information about biodiversity to ensure biodiversity consideration is taken into account in decision-making is very limited.

In fact, integration of biodiversity issues into decision-making process requires information of biodiversity aspects comprehensively.

Definitely, biodiversity assessment is essential to provide valuable data for decision-making. In conformity with the three case studies, this research found three sophisticated biodiversity assessment methods, based on current biodiversity problems and the content as well technical approach of the methods in result the valuable data. The methods are biodiversity assets assessment (BAA), landscape ecological assessment (LEA), and multi-criteria cost benefit analysis (MCCBA). BAA underlines on the variability of species and ecological integrity. BAA has applied in Trentino-Italy. LEA points out to landscape character of urbanism area. Stockholm-Sweden is an example of city that implemented for LEA. The last method which is MCCBA combines cost benefit analysis with multi-criteria analysis which gives consideration on biodiversity impacts based on monetary value and weighing criteria.

A small island which is represented by Sabang has specific natural characteristics, which seems lead to its spatial planning and development. Various condition of Sabang need particular requirement in order to be addressed by biodiversity assessment. The really proper assessment method for Sabang context is hard to be decided, due to each method address particular condition only. Generally BAA is accurate for the government who has clear biodiversity objectives and strategies. The objectives and strategies will lead to the function of assessment result. LEA is also fitting with small islands circumstances which are predicted to have rapid population and development in the coming years. Both BAA and LEA utilise the available baseline data, and then process the data through GIS approach. MCCBA will be appropriate with small islands that have vision on green economic city. However, with the intention to investigate the highly proper biodiversity assessment method for small islands context, there are several factors to guide for the selection of the proper method. The factors encompass:

- General concept promoted by the method
- Type of natural characteristic which want to be emphasised by the method,
- Biodiversity/Environmental objectives of the area
- Spatial planning system the area
- Links methods to spatial planning
- Possible involvement of methods in SEA processes
- Focus of methods
- Data requirement of methods
- Approach requirement by methods
- Advantages of methods
- Disadvantages of methods

Through those factors, the proper biodiversity assessment method which matches with decision-making process of small islands' spatial planning will be selected comprehensively.

**How to integrate the method of biodiversity assessment into SEA for small islands spatial planning?**

In small islands development, there is continuous demand for new urban and development areas with significant impact on biodiversity. Biodiversity tends to be more distressed by spatial plans than by any other type of plans, for instance waste management plans (Kolhoff and Slootweg 2005).The main pressure is the expansion of infrastructure (Haines-Young 2009). Man-made modifications on land cover and land use are main trigger of biodiversity loss and damaging ecosystem services. Biophysical transformation could disturb biodiversity at genetic, species, or ecosystem level, also affect the composition, structure, and function of biodiversity.

Biodiversity can be assessed in many ways, at genetic, species, landscape and ecosystem level. On each level, biodiversity assessment deals with its composition, structure, and function. In theoretical literature, various biodiversity assessment methods can be reviewed. This research employs two categories of methods, which are specific and general assessment. Specific assessment indicates major attention to biodiversity issues, while general assessment implies the application of method also can be used for many assessment purposes aside from biodiversity. BAA and LEA are the specific biodiversity assessment methods, while MCCBA is the general assessment method.

SEA for spatial plans is an effective tool for considered environment and well-informed decision-making with regard to land use changes. SEA plays a role to ensure that the principles of sustainable development are considered in spatial planning process. The development of SEA will also trigger a development of other assessment methods. The supporting methods are another challenge for SEA in practice because it needs sustainable indicators which are the ultimate indicator has not been found yet. Hence, biodiversity assessment could be an alternative. Biodiversity assessment and SEA are iterative process which should be undertaken in parallel with the process of spatial planning, and should be used to inform decisions on options, the content of spatial planning itself. The effectiveness of SEA implementation depends on how the assessments will match into spatial planning context. SEA then should examine biodiversity impacts at an appropriate biodiversity level in order to recognise key threats and opportunities for mitigation alternatives.

Reviewing the case studies, SEA implementation in three countries is still being developed. Various approaches emerge to support the effectiveness of SEA to prioritize environment, especially biodiversity. Clear connection to incorporate biodiversity assessment into SEA process is continuously explored. The application of LEA in Stockholm provides an example the incorporation LEA within SEA process. SEA utilises the application of LEA for screening the plans. If the plans are predicted to generate impact on biodiversity, then LEA approach should be conducted parallel with SEA process. Principally, each biodiversity assessment method has its connection to each SEA processes. The connection is mostly on first couple of SEA process, such as screening and scooping (in the context of SEA processes in most SEA literatures), and on defining objective and providing baseline data (in the context of SEA

processes in this research). In accordance with Sabang context as a small island, integration of biodiversity assessment in SEA process can be executed in the earlier process of SEA and spatial planning. Earlier involvement of community, stakeholders, and NGOs are important to exchange information and cross check information, especially about biodiversity and the selection of assessment method.

General procedure to integrate biodiversity assessment into SEA of small islands' spatial planning is begun with identification of biodiversity problems due to spatial plan implementation. Then, impacts to biodiversity resulted from spatial plan are investigated within biodiversity assessment guidance for selection the appropriate assessment method. Each method has its link to integrate with SEA processes which ensures biodiversity is taken into account of decision-making related to biodiversity problems.

**What is the added value of the SEA approach regarding biodiversity issues for small islands' spatial planning?**

It cannot be refuted that spatial planning is fundamental for delivering economic, social and environmental benefits. In small islands case, spatial planning is stressed to be more powerful in encouraging sustainable development and improving quality of life of community due to many challenges have to be dealt. Concerning on environmental principle, spatial planning should promote sustainable use of land and natural resources for development. In the perspective of social cohesion, spatial planning should increase community benefits. Then in the form of economic development, spatial planning should create more steady and predictable circumstances for investment and development.

With the purpose to achieve sustainable spatial planning, particularly in small islands, environmental consideration should signify as connected part of spatial planning processes. This is a role that SEA involves. SEA considers environmental impacts in strategic decision-making, analyses environmental change, and assesses fully alternative schemes at the early stage of plan. Reviewing case studies and Sabang, SEA has important role in considering biodiversity impacts caused by spatial planning development. SEA promotes involving biodiversity assessment methods to raise biodiversity awareness, decrease biodiversity loss and habitat fragmentation. SEA is flexible approach allowing various aspects, such as ecological and economical aspects to be considered. SEA enables current institutional system to be a part of protection and preserving biodiversity.

SEA implementation on spatial planning in small islands, which has huge biodiversity elements, has a possibility to strengthen the existence of biodiversity, ensuring maintaining and preserving the biodiversity. Within the SEA process, biodiversity awareness of stakeholders and decision-making can be enhanced. Knowledge about biodiversity can be distributed within the process. SEA promotes coalition and collaborative which will –direct or indirect- encourage the increasing consideration of biodiversity in decision-making process of spatial planning. Hence through biodiversity assessment included in SEA processes, SEA

has a fundamental function bridging the gap between environmental and economy that usually emerges in development.

The case studies indicate that SEA and biodiversity is reinforced each other. In the form of biodiversity assessment thus, SEA is an indispensable instrument to measure development impacts on landscape, particularly associated with biodiversity and environmental issues. Thereafter, in the view of SEA, biodiversity assessment provides valuable data of biodiversity, which breaks the problem of lack biodiversity valuable data in decision-making. Hence, both SEA and biodiversity assessment encourages biodiversity consideration in spatial planning, guarantees the existence of richness biodiversity in small islands, controls the impacts of urban development into biodiversity, and delivers ecological and economical value of development impact into biodiversity.

### 6.2 Reflections

Finding finest way to find greater outcome of research is more challenge than imagined. The challenge includes research strategy and data collection. The main strategy of this research is qualitative research, which concentrates on literature review and case study approach. As a qualitative research, this research explores many environmental issues related to the research topic in order to gain an in-depth understanding of the phenomena.

In conducting literature review, strategic environmental assessment (SEA) becomes a famous topic in scientific literatures as a tool to control and solve environmental problems in strategic level. However environmental issues between developed and developing countries are extremely different. Most of issues in developed countries are rarely found in developing countries, and vice versa. Moreover, most information around developed countries is accessible compared with developing countries, which causes difficulties to find a best practices study that can be applied in one of developing country. As this research also employs comparative analysis, it was quite problematic to find adequate information that can be comparable. Although SEA Directive as the highest institutional and regulatory decree for SEA implementation has been mandatory since 2004, some EU countries have not yet implemented SEA comprehensively. Consequently, some fundamental information about the application of SEA is hard to be compared between the three case studies. Besides, government documentation related to SEA and biodiversity are available on native language, such as Italy. Hence important information about the country was difficult to be delivered.

In relation with case study approach, scientific information related to integration between SEA and biodiversity assessment in small islands was hard to be obtained. Most literatures write about small islands in the context of small islands developing countries, which is quite different comparing with Sabang circumstances. Then, literatures around Sabang were obtained from reports and documents from Sabang Government. Reviewing SEA in Sabang context is also quite problematic due to SEA has introduced only in couple years ago. This condition is further exacerbated by minimum information about SEA implementation in Indonesia.

Due to recently introduced, SEA discourse in Aceh Province and Sabang is still around the SEA process. In contrast this research concern on the SEA content. Hence, regarding data collection through interview, opinion about SEA process was more expressed compared with SEA content by interviewee. The interviewee tends to convey their opinion about the mandatory of SEA for spatial planning. Further, the interviewee tends to view biodiversity as the separation part from SEA process, which feared result a different interpretation of the question.

As part of qualitative analysis, this research has benefits and shortcomings. On one hand, qualitative research highlights that each research is approached independently through complete and detailed description related to the research topic. This circumstance allows researcher to has own frame work about the direction of research. Through qualitative research, researcher can obtain information as much as possible which creates authenticity of this research. In the form of qualitative, theory and data of this research are fused which give this research unfold naturally. Thus, gaining more detailed and rich of data this research looks at context and social meaning as an interactive process of the integration biodiversity assessment and SEA in small islands. On the other hand, this research involves stressing on meanings, experiences, and descriptions which underlines on a subjective view of researcher. Subjectivity tends to lead to procedural problems. Consequently research bias is also unavoidable.

### 6.3 Recommendations

Based on findings, this research develops several recommendations that can be proposed to Sabang Government and for future research. Recommendations around the significance of integration biodiversity and SEA through biodiversity assessment are presented to Sabang Government. Besides, recommendations which are related to development of biodiversity assessment and SEA implementation are offered to future research.

#### 6.3.1 Recommendations for Sabang Government

There are several recommendations for Sabang Government:

1. Sabang has richness biodiversity, particularly on coastal biodiversity. However biodiversity have not being a main priority in Sabang development which causes biodiversity threatened by many development activities, including spatial plan. Hence Sabang Government has to develop specific biodiversity vision and strategies as guidance for local development.
2. Protection of biodiversity is one of the most pressing concerns in international context. Local government must prioritize biodiversity protection, or face disastrous consequences in the future. The great numbers of biodiversity in Sabang needs to be assessed owing to convince decision-makers related to spatial development of Sabang. Therefore Sabang government should encourage various biodiversity assessments which have scientific, valuable, and reasonable result in order to enhance biodiversity value in decision-making arena.

3. It is clearly that spatial planning will give impacts to biodiversity, and then SEA is believed can bring significant consideration of biodiversity in decision-making level. I believe prioritizing biodiversity on Sabang spatial plan does not mean less financial benefits. Thus conducting biodiversity assessments parallel with SEA application for evaluation Sabang spatial plan which is mandated to be evaluated each 5 years is suggested for Sabang Government.
4. In decision-making process government should ensure that stakeholder involvement represents all parties that have same mission of balancing environmental protection and achieving greater development. Involving relevant parties also can encourage collaborative approach and create exchange information arena. Hence it will enlarge the opportunity to increase learning capacity of government and stakeholders involved.

### 6.3.2 Recommendations for Future Research

This research focuses on exploring the proper biodiversity assessment method for supporting the SEA implementation in small islands' spatial planning. Nevertheless, this research does not test the finding of the proper biodiversity assessment method in small islands context. Hence further research in needed to experiment the guidance of selection proper biodiversity assessment method. Furthermore, this research observes some ways of integration biodiversity assessment methods into the SEA processes. Then, further research is required to confirm the finding of integration between biodiversity assessment and the SEA processes in more comprehensive way, for instance the full application of biodiversity assets assessment method into SEA processes of small islands' spatial planning.

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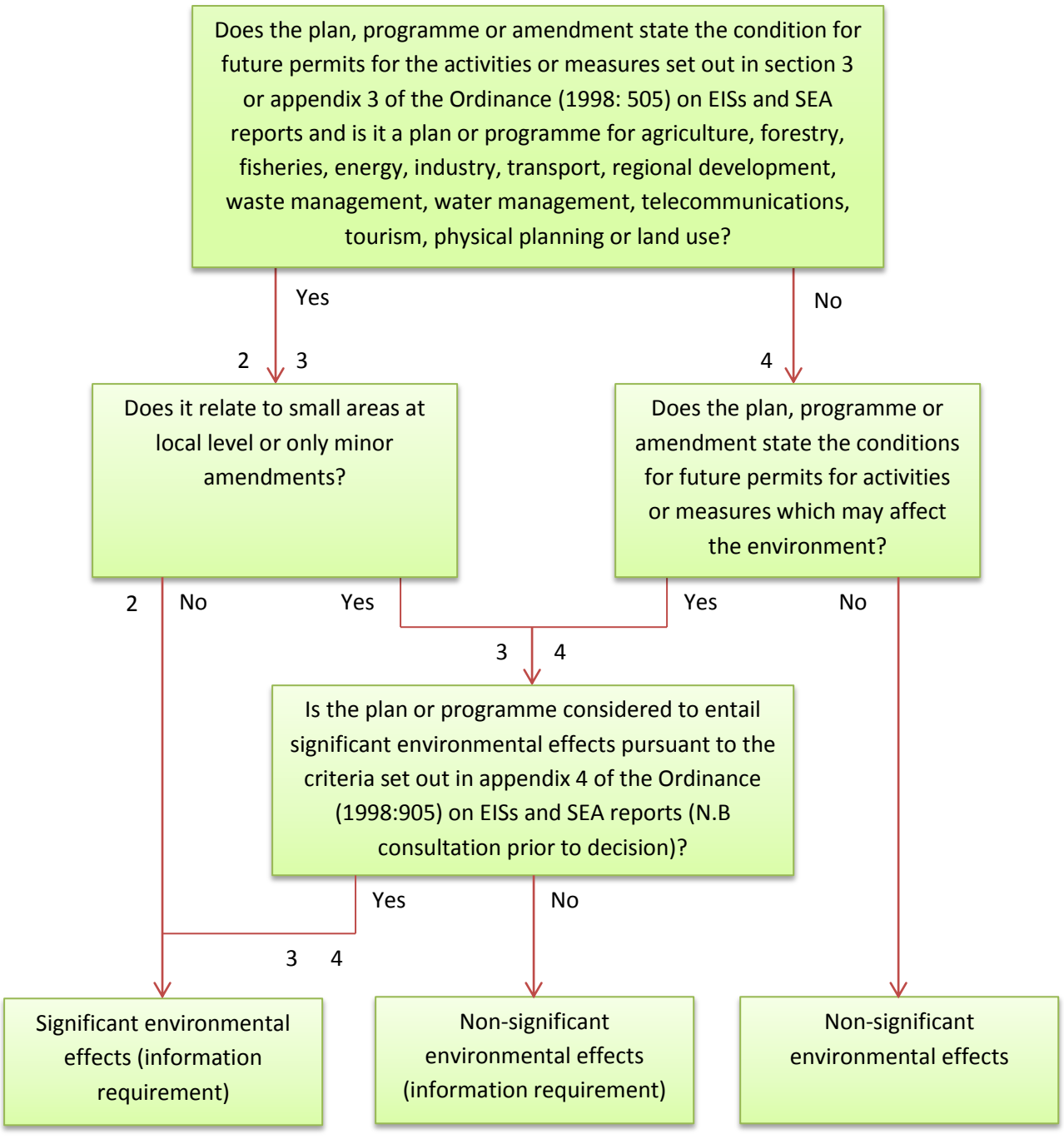
## Appendix 1 List of Questions

| Interviewee | Key Questions |
|---|---|
| Lecturer from Syiah Kuala University (2 persons) | 1. What are biodiversity issues in the current development context?<br>2. How biodiversity issues are considered in spatial planning process in current context?<br>3. What kind of biodiversity focus (species, ecosystem and/or landscape) that could cover a range of environmental receptors impacted from spatial planning implemented?<br>4. From selected biodiversity assessment methods in this research, which biodiversity assessment methods have a relevancy with spatial planning of Sabang Municipality?<br>5. Does each method show the ability to figure out the trend of biodiversity?<br>6. Does the methods well-founded in technical and scientific terms?<br>7. Does the method performance understandable for not only experts but also to general public? |
| Representative from Development Planning Agency and Environmental Agency at Provincial Level (2 persons) | 1. What are the typical biodiversity baseline studies in local spatial planning?<br>2. What is the proportion of ecological studies of all studies carried out in local spatial planning?<br>3. What biodiversity elements are studied?<br>4. How are the biodiversity elements to be studied chosen?<br>5. Are biodiversity elements evaluated?<br>6. What are important factors for SEA implementation on spatial planning of Sabang Municipality?<br>7. How are the possibilities of the use biodiversity assessment in SEA implementation on spatial planning?<br>8. What are the strengths and weaknesses of SEA implementation concerning on biodiversity assessment?<br>9. Are there a follow-up programme establish, such as monitoring, management, and assessment guidelines for ensuring biodiversity consideration? |
| A representative from Local Development Planning Agency (1 person) | 1. What are biodiversity issues in Sabang development?<br>2. What are typical biodiversity baseline studies in Sabang spatial planning?<br>3. What is the proportion of ecological studies, especially biodiversity assessment, of all studies carried out in spatial planning?<br>4. How are the biodiversity elements to be studied chosen?<br>5. In what phase of planning the consideration of biodiversity are assessed?<br>6. In what phase of planning the impacts on biodiversity elements are assessed?<br>7. How do planners, ecologists and environmental authorities collaborate in considering biodiversity issues? |

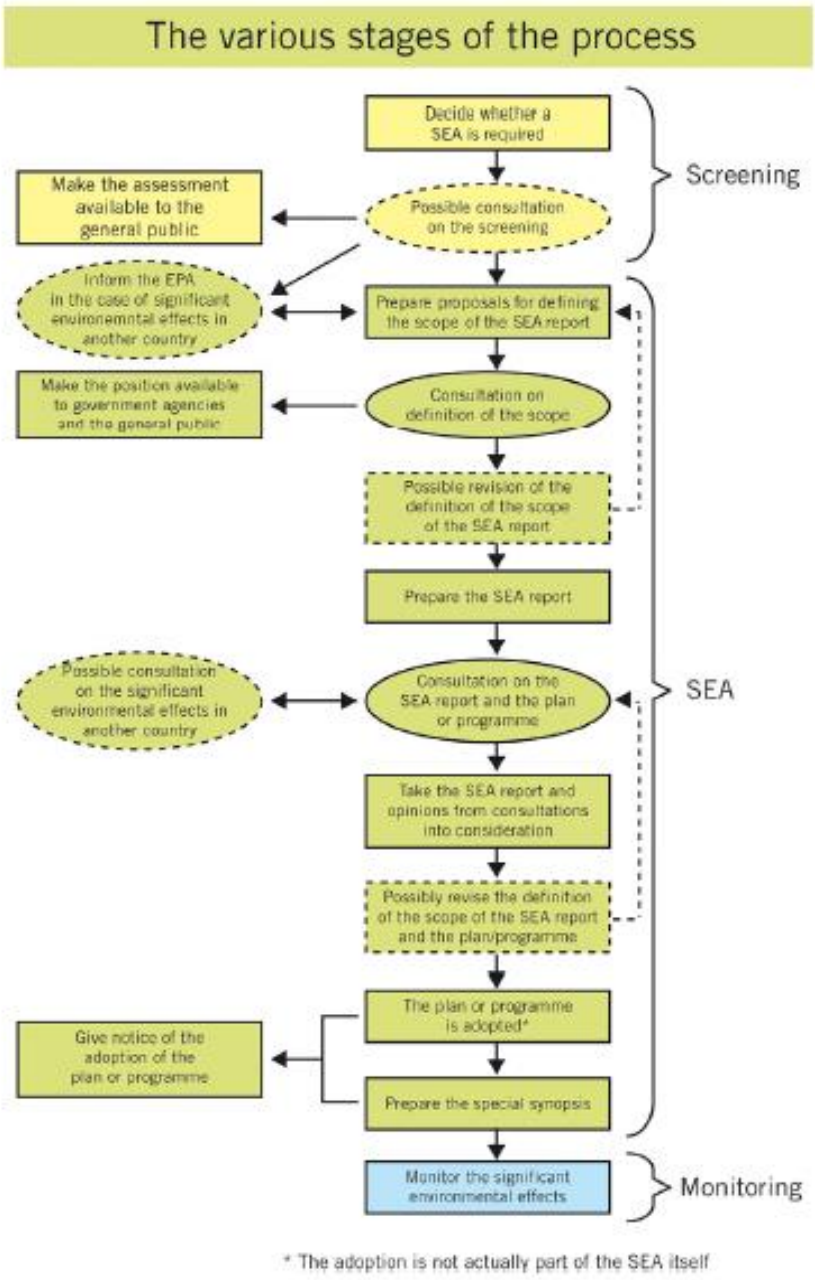
| | |
|---|---|
| | 8. How are the results of ecological studies used in spatial planning?<br>9. Does impact assessment improve consideration of biodiversity in spatial planning?<br>10. According to this research, do the selected biodiversity assessment methods will cover key biodiversity issues in Sabang Municipality?<br>11. Does data requirement of each method available in Sabang Municipality?<br>12. What are important factors for SEA implementation on spatial planning of Sabang Municipality?<br>13. How are the possibilities of the use biodiversity assessment in SEA implementation on spatial planning?<br>14. What are the strengths and weaknesses of SEA implementation concerning on biodiversity assessment?<br>15. Are there a follow-up programme establish, such as monitoring, management, and assessment guidelines for ensuring biodiversity consideration? |

## Appendix 2 Assessment of significant environmental effects in Sweden




Source: Swedish Environmental Protection Agency 2010

**Appendix 3 the various stages of the SEA process in Sweden**




Source: Swedish Environmental Protection Agency 2010

## Appendix 4 Checklist of environmental aspects in SEA for spatial plans in the Netherlands

**Soil and water:**

- Influence on the (chemical and ecological) surface and ground water quality
- Influence on drainage and water retention, risk of flooding
- Influence on desiccation in nature area, too high water level in agricultural area, soil compaction, subsidence
- Influence on soil and ground water protection areas
- Opportunities for win-win-situations (including compensating new housing areas by the construction of new water areas)

**Nature:**

- Influence on existing nature and potential nature
- Adverse impact on characteristics of protected nature area (including area protected under the EU Birds and Habitat Directives)
- (Risk of) adverse impact on legally protected species
- Opportunities for the development of wet and dry nature
- Opportunities for win-win-situations (compensating new housing areas by the construction of new green areas)

**Landscape en cultural heritage:**

- Land occupation in/ Influence on valuable landscape area or cultural heritage
- (Risk of) adverse impact on archeologically valuable area (including other criteria relevant under the Valetta Treaty (Malta Treaty)
- Adverse impact on geomorphologic values
- To be considered: visual qualities such as openness, panoramas, contrasts
- To be considered: historic structures, patterns and artefacts

**Effects on Mobility (only in the case of significant impact on traffic):**

- Increase in private car mobility (including the impact of changing housing areabusiness area-balance)
- Effect on modal split (choice in transportation mode)
- Impact on efficient use of road network (intensity/capacity-ratio /overloading the existing road network (as related to suitability6 and capacity)
- Need to construct new roads

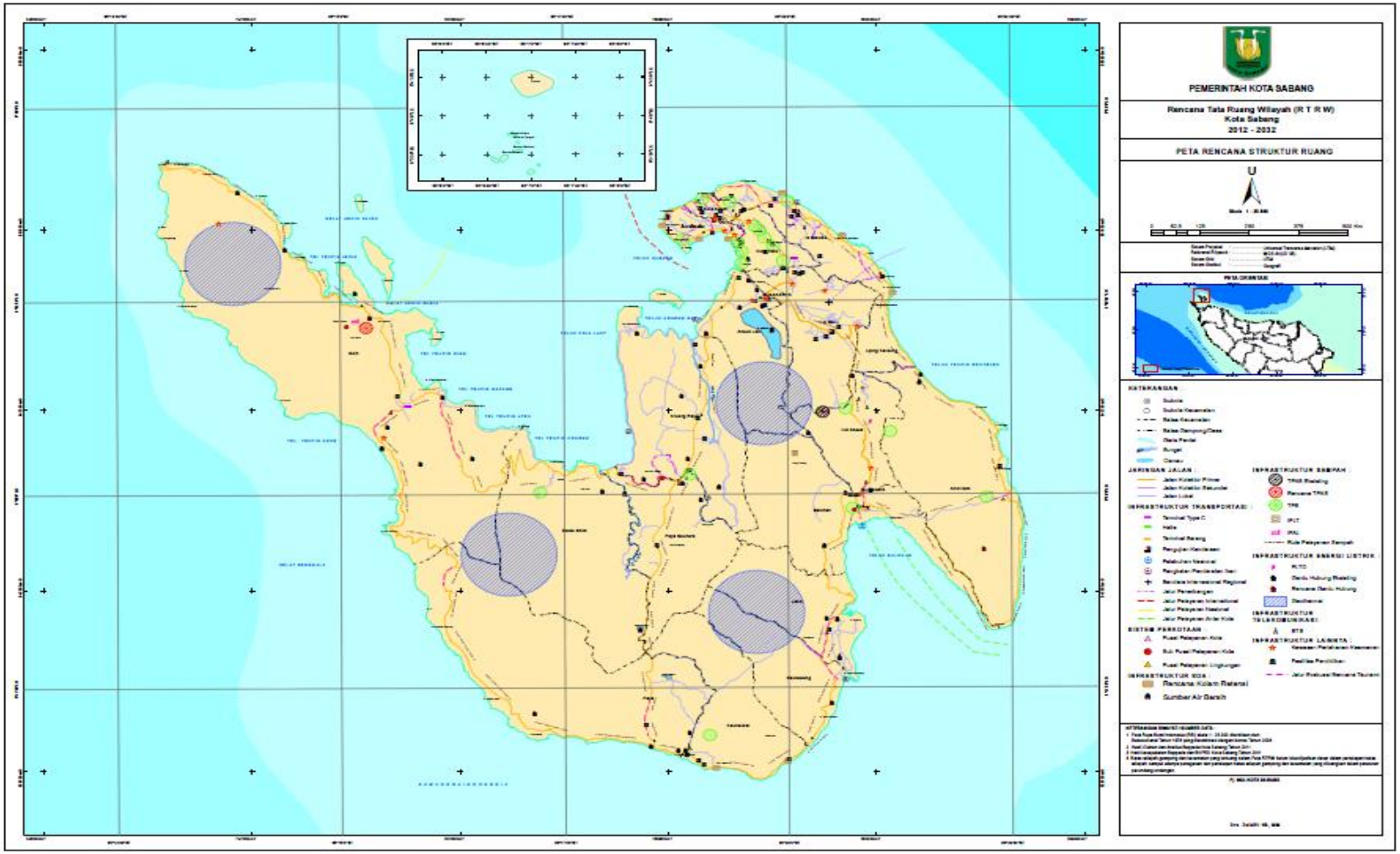
**Quality of urban environment:**

- Influence on (perceived) hindrance: integrated assessment of the noise, air quality, safety, hindrance by traffic/accessibility and road safety)
- To be considered: influence on living and industrial area, recreation, quiet and silent area
- To be considered: accessibility to /basis for services (shops, medical, cultural, public transport, recreation)
- Possibility to concentrate possible sources of hindrance
- Impact on 'spatial quality

| |
|---|
| **Climate impacts** (only in the case of clear differences between alternatives as to emissions) |
| **Natural resources** (only in the case of clear differences between alternatives as to use of scarce (construction or energy) resources |
| *Below aspects only in the case of integral assessments* |
| **Regional economy, employment:**<br>▪ Influence on agriculture<br>▪ Influence on tourist and recreation sector<br>▪ Influence on industrial activity<br>▪ Balance between living and industrial area |
| **Financial costs and investments:**<br>▪ Construction and maintenance costs<br>▪ Costs of compensation<br>▪ (Need for construction of new infrastructure and utilities |
| **Social cultural aspects:**<br>▪ lagging social development in big cities<br>▪ diminishing services in small cities and villages<br>▪ insufficient level of services for the elderly<br>▪ segregation, differing chances and opportunities for specific segments of society (e.g. lower income or immigrants) |
| **Institutional aspects:**<br>▪ Extent to which the plan reaches the objectives of different stakeholders<br>▪ Social basis/public support of plan elements, feasibility<br>▪ Manageability (certainty that implementation will lead to the desired results)<br>▪ Flexibility, level of no-regret (hoe vulnerable is the implementation of the plan for new insights or developments) |

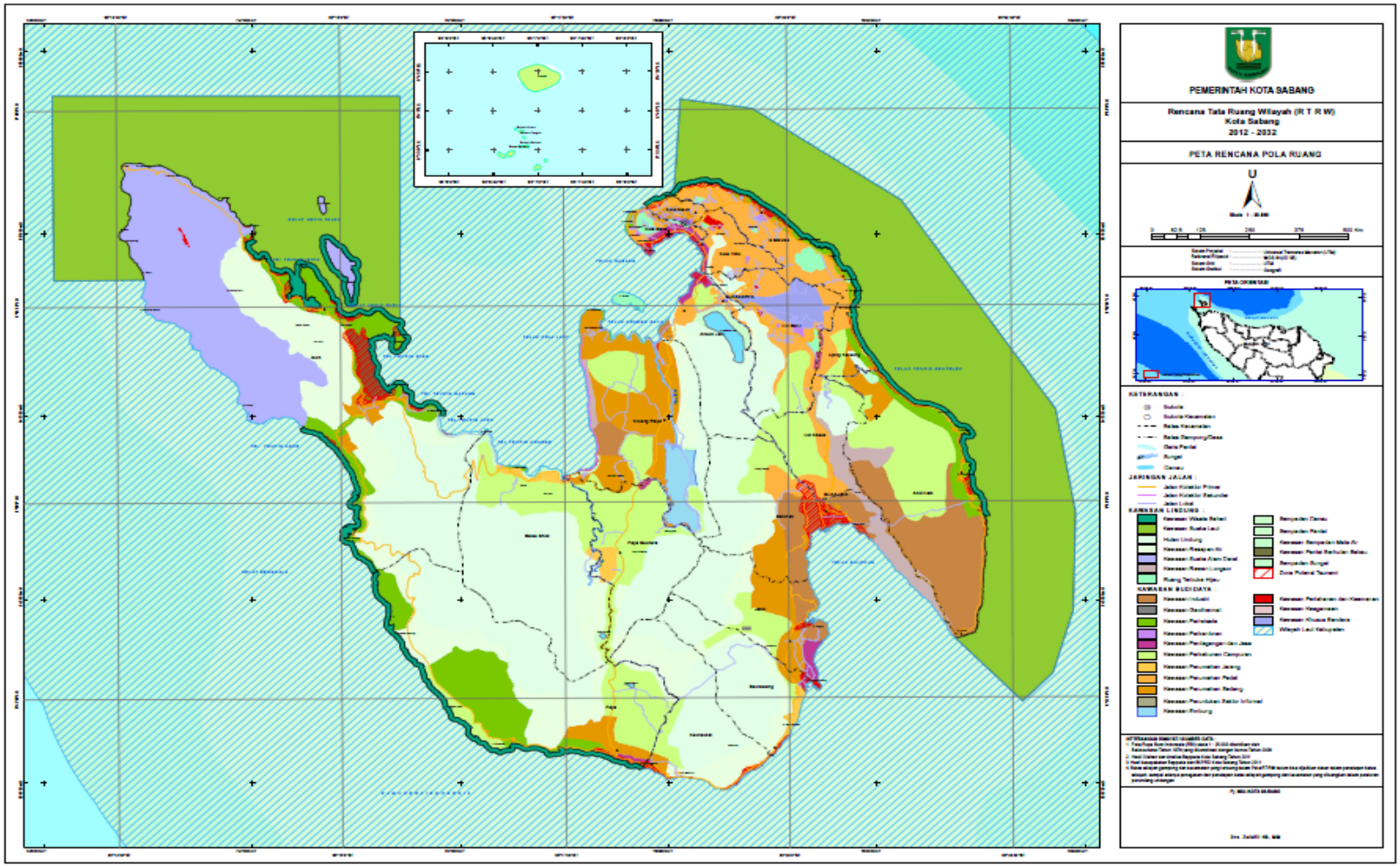
Source: Eck and Verheem (2013)

**Appendix 5 Plan for spatial structure of Sabang Municipality**



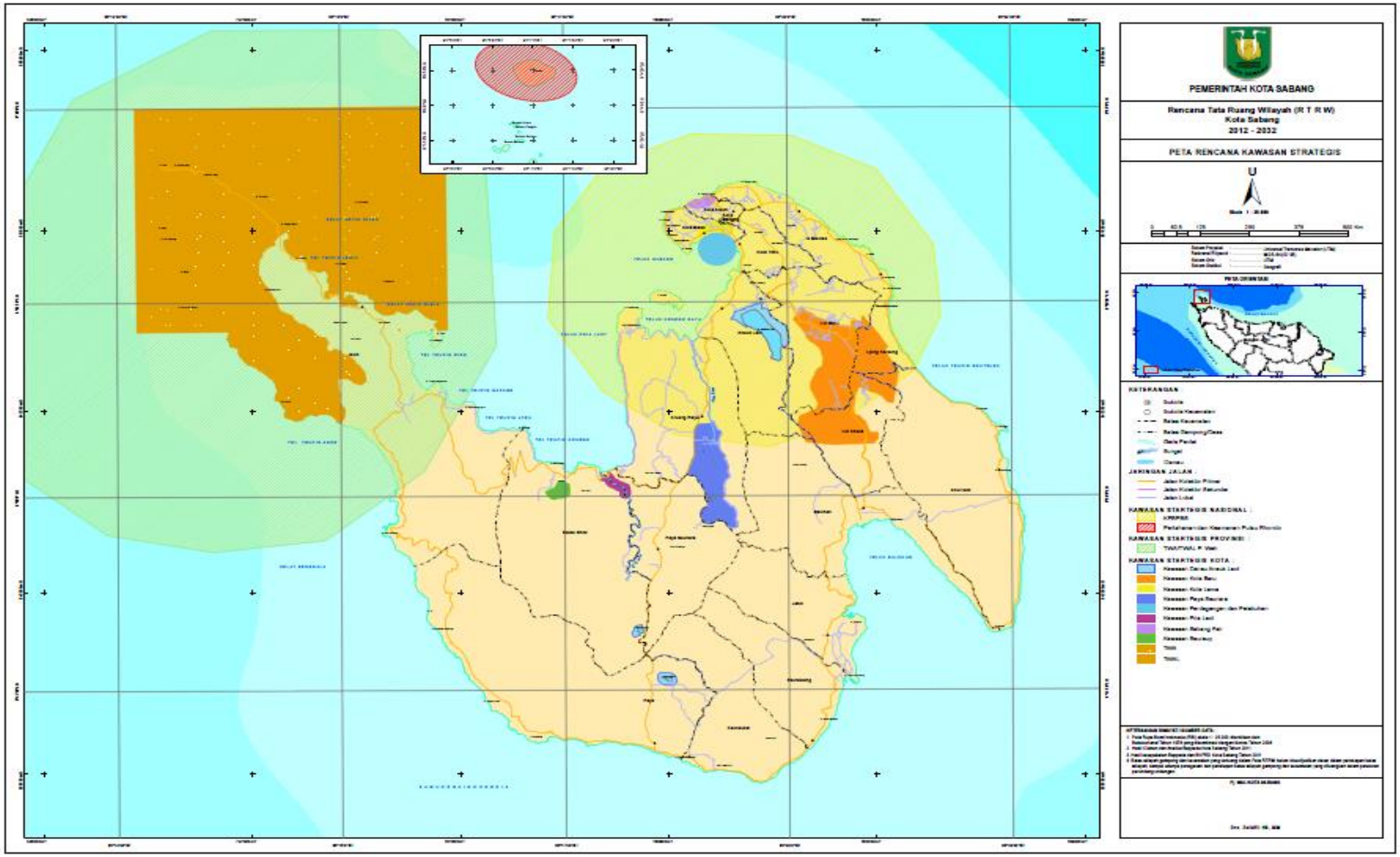

Source: Sabang Local Development Planning Agency (2012)

**Appendix 6 Plan for spatial pattern of Sabang Municipality**




Source: Sabang Local Development Planning Agency (2012)

**Appendix 7 Plan for strategic area of Sabang Municipality**




Source: Sabang Local Development Planning Agency (2012)