CHAPTER I

INTRODUCTION

1.1 Overview of the study

During the last few decades, massive destruction on forest ecosystem has extensively occurred in the tropics (IUCN, 1999). In Thailand, over-exploitation of forest resources has been found all over the country (Wongpakdee, 1990). Throughout the 1970s, parallel to the decline in forest coverage, alteration of forestland for agriculture had rapidly expanded. The problem has long been concerned by the Thai's government as one of the most serious causes of uncertainty in the existence of Thailand's biodiversity. Trade-offs between continued expansion of extensive cultivation and environmental loss become more apparent. As regards, '*Protected Area (PA)*' establishment has been emerged to enlarge the scales of natural resource protection in reserves. Although the successes apparently exist and the strategy is approved as an appropriate direction to forest protection, agricultural expansion and habitat encroachment still occur in many reserve sites. Apart of the failure can prove evidently to be a result of ineffective management planning and control mechanism in resource monitoring (IUCN, 1978; and Wongpakdee, 1990). Some particular problems have been found in the largest protected area of Thailand, Kaeng Krachan National Park (KKCNP). Even though Kaeng Krachan has been under the authorization of the Royal Thai Government and the Royal Thai Forest Department, this site has long been faced with massive activities from both nature and human-induced interactions. The inherent problems such as ecosystem destruction and overuses of forest resources, and other troubles from external factors such as growth of tourism, agricultural intensification by rural people, or pesticide contamination in water system steadily increase. Difficulties will shortly turn into uncontrolled and unmanageable problems if Kaeng Krachan is still being driven by ineffective management plan and with inappropriate methods (Kasetsart University, 1987; and RFD, 1994). Changes of land-use

characteristics accompanied with those uncertainties encourage the government to solve these problems urgently. Regarding those combining figures, new management procedures with former conventional system had been proposed. *Zoning and buffer zone construction* have been induced towards the natural resource management plan throughout the country (IUCN, 1978; Sayer, 1981; Wongpakdee, 1990), and extended to Kaeng Krachan in the year 1987 (RFD, 1994). However, it is not mentioned that monitoring such a complex ecosystem by this strategy will be proficiently protected forest ecosystems from all degradation. To manage an ecosystem without integration of other knowledge bases such as the incorporation of socioeconomic status of local community may prolong success and possibly halt the advances of ecosystem management (Sayer, 1981; Constanza, 2002; and King and Mazzotta, 2002). This is the reason why pressures on forest ecosystems in all protected areas, also in Kaeng Krachan are likely to be persisted (RFD, 1994).

So far The Thai's government dominated forest management in the reserve sites as the same ways they managed forests in nature. Although some modern strategies had been induced, the main purpose was to maximize yields of forest products (Kasetsart University, 1987). Unless other aspects of the ecosystems were integrated and unified, management actions and procedures would not be revised and transformed. With regard to an integrative ecosystem management, the patterns can be changed by three main reasons. Firstly, conceptual clarification of the underlying problems must be explicitly clarified. Secondly, defining levels and scales of the problems, which often crossed and led to different descriptions, require understanding of the ecosystem's processes and levels of organizations. Thirdly, appropriate methods that combine together of existing data, perspectives, approaches, models or theories that are apparently disparate, are simply identified as an integrative method of ecosystem management (Pickett *et al.*, 1994).

An empirical research on ecosystem management is uncommon, or even where it exists, it is impractical to perceive the relationships of essential elements and their responses to influencing factors as a whole. To date, there has been no a comprehensive management that comes by an integration of forest management and ecosystem approach, despite new management procedure has long been enhanced. The findings of previous analyses and its conclusions are fragmented so the country has not extremely benefited from these experiences. To bridge the gap, idea of integrative method accompanied with ecosystem management approach is proposed. Some existing entities of the systems of interest and other relevant constituents are combined. An idea of ecological modelling is applied for developing new perspectives to forest resource management in protected areas. An alternative of making decision and developing management plan for natural forest sources at local level is given.

An idea of system approach has been found increasing application in fields of ecology and natural resources management since late 1960. The practical method of system thinking and structural analysis is quite direct to conceptualizing, organizing and communicating such complexity of ecosystem circumstances. Grant, Pedersen, and Marin (1997) directed that problems related to systems with relatively many interrelated components could not be interpreted effectively alone by either qualitative or quantitative methods. Problems involving ecological, economic and social aspects must call for analysis and simulation specifically focused on the intermediate states characterized by organized complexity which system's structure can be changed by that system dynamics. They confirmed that, with relatively few data provided, but at least some understanding of ecosystem structures and dynamics, system analysis and simulation can be a useful tool to investigate system behaviours because apparently clarify that how the system works.

Generally, ecosystem and resource management primarily deal with a system characterized by hierarchy or its organized complexity. Systems at higher and lower

levels (nested hierarchy) usually impose constraints on the systems of interest (IUCN, 1994; and Ford, 1999). Regarding this, managing natural resources requires an assessment of the extent at spatio-temporal scale ranging, including comprehension of causes in variation to complex structures and its performances. One rapid way to understand and achieve success is being to model the responses to current and future scenarios, either because of human interventions or of natural processes (Rizzoli & Young, 1997). A group of interrelated objects can best be shown and understood by viewing them as a whole. Simulation increases understanding, assessing and optimizing estimates of the system's interactions and behaviors (Hall and Day 1977; and Starfield and Bleloch, 1986). Modeling allows prediction of an expected future state, and thus is an important part of the decision making informed in resource management. Due to budget tightening and growing of management actions, the government must take difficult decisions on how to allocate budgets to protect or restore natural ecosystems effectively. That must provide benefits mainly to both publics and ecosystem itself, in appropriate scales. Resource managers may consider various objectives including environmental quality, threats to ecosystem integrity, and effects on people's quality of life (King and Mazzotta, 2002). Making clarification of ecosystem structures and behavioural responses, a holistic model combining natural processes and human interactions is required to develop.

While protecting and conserving forest resources are the main purposes at Kaeng Krachan, tourism and infrastructure development indicate cumulative priorities in management justification. Growing tourism and increasing pressure of recreational activities affect characteristics of Kaeng Krachan in some ways (RFD, 1994). According to this, valuation of ecosystem benefits plays important roles when manager needs to provide a way to justify and set priorities for the policies or actions that conserve ecosystems and their services. In this Kaeng Krachan case, aesthetic values and recreation performances in KKCNP are evaluated and discussed. Contingent Valuation

Method (CVM) is employed to estimate the Willingness To Pay (WTP) of visitors for new recreation activities introduced by researcher. Travel Cost Method (TCM) is also applied to estimate the economic uses values of this recreational site.

Ecosystem analysis and simulation of system structures and its functions, as well as valuation of ecosystem benefits are applied to particular problems in Kaeng Krachan National Park. An ecological model allows quantitative and comparative analysis of which specific outcomes of the current management actions through some relevant ecological and socio-economic factors, at different circumstances, are simulated. Evaluation of ecosystem benefits gives alternatives to managers about tourism development and local people enrollment at this specific site, in appropriate ways. Existing resource management plan may need to be revised and reorganized in order to protect and conserve the last remaining natural forest ecosystems for future and sustainable uses.

1.2 Objectives of the study

An integrative method combining knowledges of ecosystem study and management is used to construct a system-dynamics model of forest ecosystems and management regimes in Kaeng Krachan National Park. The model components include important ecosystem's entities and forest components, together with important ecosystem's processes. Interactions between nature and human-induced processes are also included. Issues of forest ecosystem and management including policies and actions, uses of forest resources, and problems such as illegal logging and wild animal hunting, reforestation, community settlement, tourism development are stated. The relationships, consequences and the inconsistencies amongst those issues are also indicated. All of the above, a multi-objective management model of forest protected area is developed to give an alternative of making decision and organization of a more effective management plan in future. Besides, this may be a prototype management model which managers can reconstruct all model components by themselves to suit their specific problems.

The research objectives are subjected to the model's issues mentioned above:

1) To develop a general conceptual framework of forest protected area management in Kaeng Krachan National Park.

2) To identify the influencing factors on forest ecosystems and management in Kaeng Krachan.

3) To construct a prototype management model of forest protected areas and management.

1.3 Hypothesis of the study

Based on the assumption that management actions and strategies currently dominated in forest protected area can generate greater values of ecosystem benefits to both park and people. The actual ecosystem's behaviors can be estimated and observed by selection of appropriate ecosystem indicators. Thorough all existing facts and scattered empirical results, modelling system-related elements and simulating it within a specific extent of time-and-space can give insights into the problems and enhance understandings across the boundaries of integrative study and ecosystem management. Regarding model's efficiency, existing and expected conditions of forest ecosystem to management actions can be estimated by modelling the responses to current and future scenarios. Changes of quantitative values of selected ecosystem's indicators can indicate efficiency of management actions, also status of the ecosystem.

1.4 Organization of the thesis

This research composes of six main chapters.

Chapter I: This chapter states about rationales, backgrounds, objectives of the study, and thesis assumption. Problems relating to forest ecosystems, forest management, land-use management and tourism development in Kaeng Krachan are generally explained. Causes to the problems and the incompetence of resource management system are

explained. Incentives and importance of ecosystems study, and system approach in solving those problems to integrative method are stated. Integrative method for making decision and management of forested protected area is proposed. Integration of existing facts and results of empirical studies previously conducted in this area are unified as an important source of information for a dynamic model development.

Chapter II: Chapter 2 consists of four main parts. Firstly, general framework of this research is described in a conceptual flowchart. The main part is to give an information on and explain how to construct an ecosystem-management model for some specific problems in Kaeng Krachan. Secondly, information on forest protected areas in Thailand, legal and institutional frameworks and current situation of forest resources management in Kaeng Krachan are described. This section provides background and gives rationales to the researcher when developing a policy-related issue in model construction. Thirdly, general description and introduction to system thinking and modelling-building process are described. System theory and concept of modelling and simulation needed to be stated. Although several researchers have stated and constructed different types of models, all fall into the main concepts of system approach and system hierarchy. Defining of those and of model-building process in general is very important. Fourthly, essentials of ecosystem valuation and valuation techniques are described. Background on types of economic values, ecosystem benefits and techniques of valuation such as Contingent Valuation Method (CVM) and Travel Cost Analysis (TC) are explained. Economic use and nonuse values and its relations to the values of environmental entities and understanding of Total Economic Value (TEV) of the environment are discussed. Finally, previous studies relating to the extents of modelling and valuation of natural resources are reviewed.

Chapter III: This chapter mainly describes research methodology and the way to develop a prototype model for resource management and valuation of ecosystem benefits in Kaeng Krachan. Information of Kaeng Krachan national park is briefly explained (full

details are in Appendix A). In general, the study is divided into two main parts: construction of a prototype management model and evaluation of ecosystem benefits and recreational site.

Three sub-models are described in details to tell about general characteristics, importance and relationships of all components. The conceptual frameworks of each sub-model are designed. Components and relationships are indicated. However, model component and other model entities such as linkage agents can be either increased or decreased thereafter. The relationships amongst model components are specified and translated into model variables. SIMILE software is preferred for running and simulation. Specified components are translated into SIMILE diagrams. Some of those variables and parameters are indicated in all three sub-models but some are not, however, the names given may differ. Information needed for each sub-model is gathered from various organizations and all are verified. Information needed include land-use characteristics, forest and vegetation patterns, agricultural pattern and cropping system. Demographic data and climatic data are also required.

The second main part involves valuation of recreational benefits and valuation of KKCNP. Alternatives to tourist are given by proposing new recreational activities including bus service, home stay service and forest ranger service to the park. One thousand sets of questionnaires are posed to visitors and tourists in specific time periods to ask about their opinions on introduced activities. Tourists are required to share their opinions on the existing condition of tourism management and tourist preferences in KKCNP. CVM employing WTP is used to analyzed those tourists' features. We mainly estimated the costs of recreational fees and the charge systems of new services. Finally, the value of Kaeng Krachan National Park is estimated using TCM analysis.

Chapter IV: In this chapter, the results of initial values, constants and parameters are calculated and indicated. Parameterization and testing of model properties (model

validation and verification) are included in this section. Existing conditions of Kaeng Krachan and different scenarios proposed are explored. The results of all scenarios are indicated.

For recreational benefits, questionnaires are analyzed to show tourists' opinions on bus service, home stay service, and forest ranger service. The appropriate fees and charging systems of each are analyzed. TCM analyses are analyzed and the value of Kaeng Krachan is estimated.

Chapter V: The final chapter ends this research with the conclusion of what have been conducted thoroughly. Some suggestions are given as more possible and suitable strategies and directions to Kaeng Krachan management in future. The recommendations are also hinted for future application and the extent of ecosystem study in other kinds of protected areas or reserves in Thailand.