CHAPTER 1

INTRODUCTION

Rationale

Degradation of natural resources and the environment is presently one of the most important problems in Thailand. One of the main forms of environmental degradation is deforestation. Thailand's forest cover has been reduced from 53.3% (273,508 km^2) in 1961 to 19% in 2000, averaging about 4,056 km^2 loss per year (RFD, 1995). In reality, remaining natural forest cover might be even lower, *e.g.* 15% (Maxwell, 2001). Forest destruction has been slowed by a commercial logging ban since 1989. The National Forest Policy of Thailand (1985) stated the goal of having 40% of the country under forest with 15% as production forest and 25% as conservation forest, using two approaches: i) protection of remaining forest resources and ii) efficient reforestation. Therefore, forest planting projects were established to support the policy. Although, a lot of deforested areas were recovered, deforestation continues due to illegal logging, agricultural expansion, and forest encroachment (Chatwiroon, 1997).

Tree planting can solve the problem of deforestation (Chatwiroon, 1997). A symposium in Washington, D.C. in June 1996 concluded that all tree plantations facilitate restoration of degraded forests and lands in the tropics (Parrotta *et al.*, 1997). Initially, the Royal Forest Department (RFD) planted fast-growing monoculture

plantations, such as pines, teak, and eucalyptus, which are easier to manage than mixed-species plantations. Although, such plantations can facilitate forest restoration, their ecological functions are generally weak (Lamb, 1997; Zhuang, 1997). For example, Karimuna (1995) reported that the species diversity of the ground floras in pine and eucalyptus plantations is less diverse than in evergreen forest. Subsequently, tree planting events, organized by government agencies, companies, villagers, and students have become very popular. One tree planting project was to celebrate the Golden Jubilee of His Majesty King Bhumibol Adulyadey in 1994. The target of this project was to plant 8,000 km^2 of deforested land. This target has not been met (Chatwiroon, 1997) because lack of knowledge about appropriate methods of planting native forest tree seedlings (FORRU, 1998).

Biological diversity has been widely promoted. Planting native trees is recommended for reforestation projects because they promote biodiversity (Lamb, 1997; Robison and Handel, 1993). Although, secondary forest can accrete biodiversity rapidly in the tropics, it may not be of direct value in conservation. It can have other indirect roles, such as providing resources for native animals and buffering and protecting primary forest fragments (Turner *et al.*, 1997). Forest restoration goals are divided in three alternative goals, reclamation, rehabilitation, and restoration. Rehabilitation involves planting mostly native species and some exotic species planted in deforested areas. Reclamation is done only with exotic species, for economic or ecological reasons. Finally, restoration attempts to restore a forest ecosystem to its original condition, with the main objective to preserve biological diversity (Lamb *et al.*, 1997).

The framework species method of forest restoration (Goosem and Tucker, 1995) was first developed in the late 1980's in Queensland, Australia. The method is based on the selection of fast-growing native tree species with dense spreading crowns that shade out weeds. Selected trees must also attract seed-dispersing wildlife and they must be easy to propagate in nurseries. Planting by this method can accelerate forest regeneration and restore biodiversity (FORRU, 1998). The cost of planting is high because an input of labor is required restoration at every stage of the process, from collecting seeds or seedlings, to raising them in nurseries, preparing sites, planting seedlings, and maintaining them afterwards (Lamb *et al.*, 1997). Tree planting is not always an appropriate technology in cash-poor communities. An alternative is to accelerate the natural processes of succession.

Accelerated natural regeneration (ANR) has been practiced in the Philippines (Dugan, 2000). It entails cutting or pressing the weeds around existing, naturally established seedling, protecting the area from fire, and interplanting with desired tree species where necessary. It is important to know what specific factors limit the rate of regeneration in deforested areas in order to devise minimum input strategies to overcome them.

In Thailand, ANR has not been successful, due to lack of knowledge about natural processes of forest regeneration. Although some aspects have been studied, such as limiting factors of natural regeneration (Hardwick *et al.*, 1997), there are many more in need for further research, such as the seed rain and seedling establishment (Hardwick *et al.*, 2000a).

Seed dispersal and seedling establishment are the most critical and sensitive stages in forest regeneration. The roles of different dispersal agents in seedling recruitment are very poorly understood. Consequently, both seed dispersal by birds and the role of isolated trees as perches require attention, as identified in The Chiang Mai Research Agenda for the Restoration of Degraded Forestlands for Wildlife Conservation in Southeast Asia (Elliott *et al.*, 2000a). It is rarely possible to plant all species of trees for ecological restoration, especially in large areas, but natural regeneration may be accelerated by planting a smaller number of trees which act as suitable perches to attractive seed dispersers for enhancing seed rain. More needs to be known about whether or not isolated trees really enhance seedling recruitment. Which remnant tree species are most attractive and what birds disperse seeds? My research investigated the effects of different remnant mature tree species on the establishment of natural seedlings in deforested sites. Furthermore, observations of birds visiting remnant trees in deforested sites and birds visiting fruiting trees in intact forest determined which bird species are important seed dispersers. Such knowledge will help to improve tree species selection for planting to accelerate forest regeneration.

Hypotheses

1. Remnant mature trees attract seed-dispersing birds into deforested areas.

2. There will be a higher density of animal-dispersed seedlings beneath remnant trees than in control areas with no mature trees.

3. The density and species richness of the seedling community beneath mature remnant trees will depend on the species of the mature trees.

Objectives

The main objectives of this study were:

1. To determine the effects of mature remnant trees on tree seedling establishment in deforested areas, and

2. To determine which tree species should be planted to attract frugivorous seed-dispersing birds into deforested sites.

Future implications of this study

The results of this study will provide some basic ecological knowledge on natural forest regeneration. Specifically, the results show the differential role of remnant forest trees on reforestation. The importance of frugivorous seed dispersing birds which use these trees as perches in deforested areas and increase seed deposition beneath them. This knowledge can help to improve tree planting / reforestation design by accelerating natural regeneration (ANR).

6

Limitations of the study

I studied seven relicts tree species on deforested sites. My information might not be applicable to other tree species. This study focused only on natural tree seedlings that are most important in natural regeneration. Therefore, this study did not analyze other factors involved, such as differences in herbaceous vegetation and soil conditions.