Chapter 1
Introduction

1.1 Justification and Significance of the Study

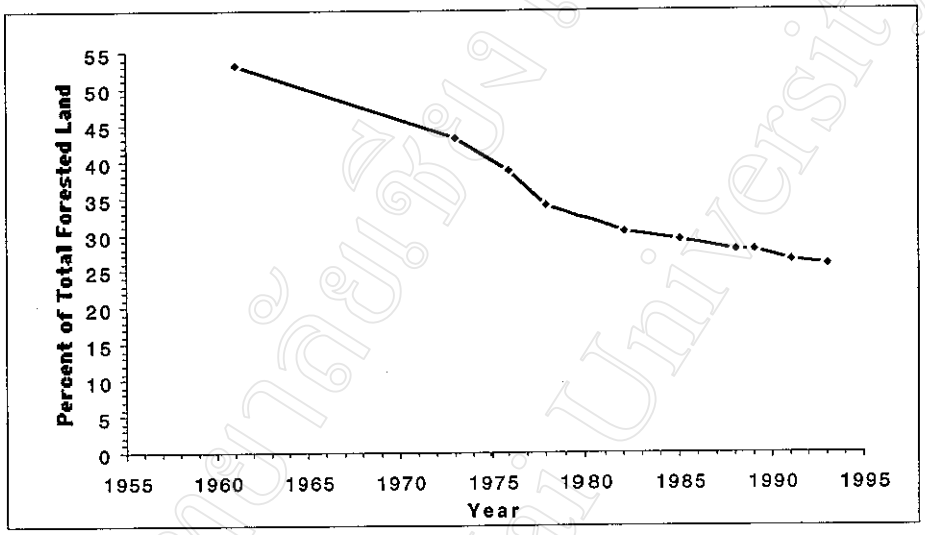
Over the last several years, Thailand has found itself facing two major environmental crises at once. The first major crises has been the rapid depletion of national forest cover which has been associated with high levels of soil erosion, floods, and water shortages due to the degradation of watershed regions (Leuangaramsri et al, 1992). Integrated with the rapid depletion of nation forest reserves, the over use of synthetic pesticides, the second major crises, has also caused a great deal of environment damage by poisoning fish and wildlife. The over use of synthetic pesticides has also lead to increased health problems for both farmers, who come into direct contact with these chemicals while spraying their fields, and for consumers who unknowingly digest large amounts of pesticides by eating fruit and vegetables which have high levels of chemical residue (Wong-Anan, 1996). Both of these environmental crises not only impact on the environment as a whole, but also effect the national economy.

1.1.1 The Costs of Forest Degradation

In the past, Thailand was a country with bountiful forests of teak and other types of woods that were sought after by Europeans and Asians alike. However, the economic developments of the last 50 years have taken their toll on these forests, and the large majority of forests in Thailand have been heavily depleted or completely cleared to make way for increased agricultural production. The first four Economic and Social Development Plans gave a great deal of importance to increasing agricultural production by relying on the expansion of land under cultivation and by focusing on the development of structural foundations such as the development of cultivated land and the expansion of roads. These early government policies rapidly expanded the area of land under agricultural cultivation and generated large-scale degradation of land and forest resources (Satiean Sriboonruang 2537). In 1961 the total land area under forest cover was 273,628 square kilometers or 53.33% of the

total land area under forest cover was 273,628 square kilometers or 53.33% of the country, but by 1978 these figures had dropped to 175,224 square kilometers or 34.15%. And, by 1993 these figures had fallen to an all time low of 133,521 square kilometers or 26.02% (Forestry Statistics of Thailand, 1986 and 1994). Thus, from

Figure 1.1 Percent of Total Forested Land in Thailand 1961-1993

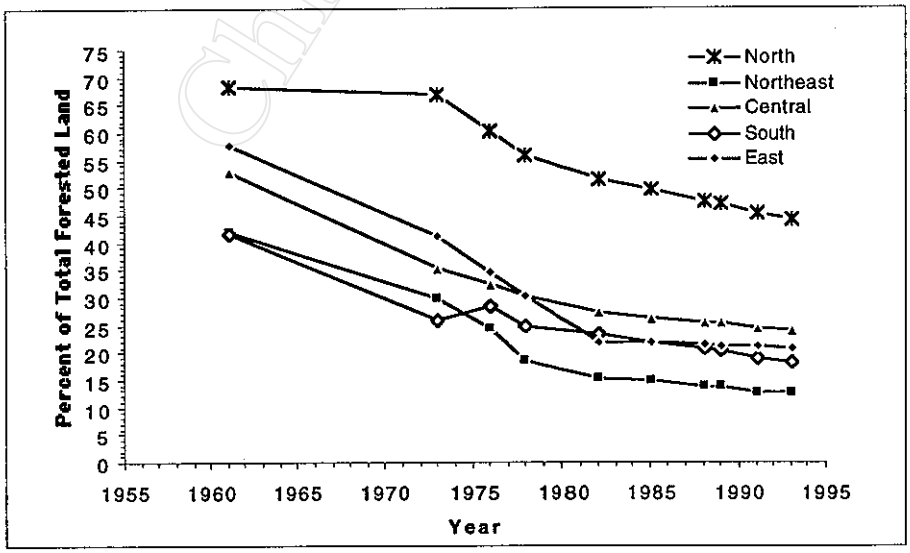


Source: Forestry Statistics of Thailand, 1986 and 1994

1961 to 1993 the total forest covered area decreased by 140,106 square kilometers or 51.20%. The deforestation trends described above can be seen in Figure 1.1.

It should also be noted that the deforestation trend has not been an isolated

Figure 1.2 Percent of Total Forested Land by Region 1961-1993



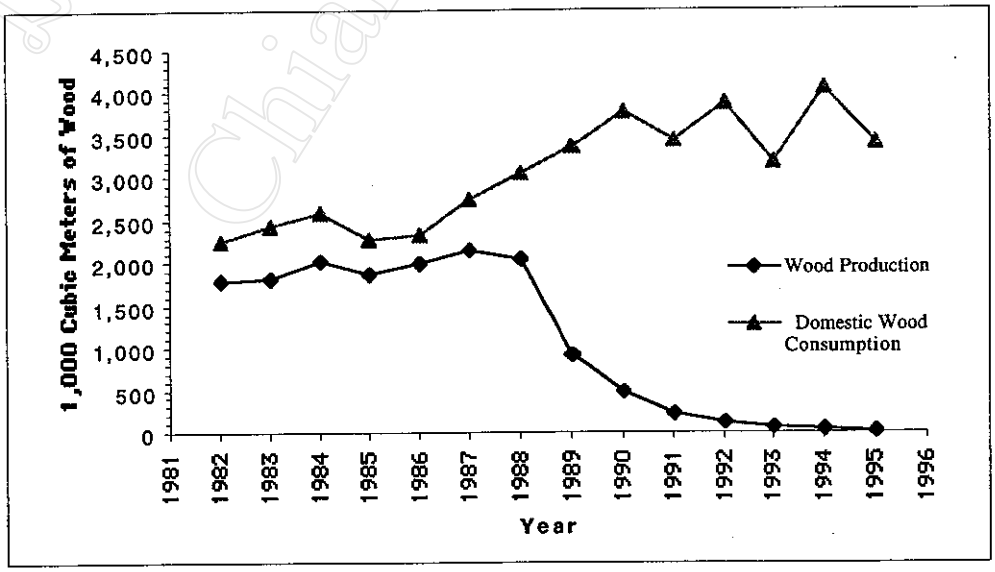
Source: Forestry Statistics of Thailand, 1986 and 1994

occurrence in only one or two regions. To the contrary, major deforestation has been experienced in all regions of Thailand as is shown in Figure 1.2.

After catastrophic floods and landslides in the South were linked with the depleted state of the national forests, on January 17, 1989 the Thai Government canceled all remaining commercial logging concessions on reserved forestland, which has had two effects. First, it led to increases in domestic wood prices that in turn increased the incentives for illegally logging of the remaining forests. And second, it accelerated the rate at which the timber supply shifted from internal sources to external ones in neighboring countries where rampant logging is still permitted.

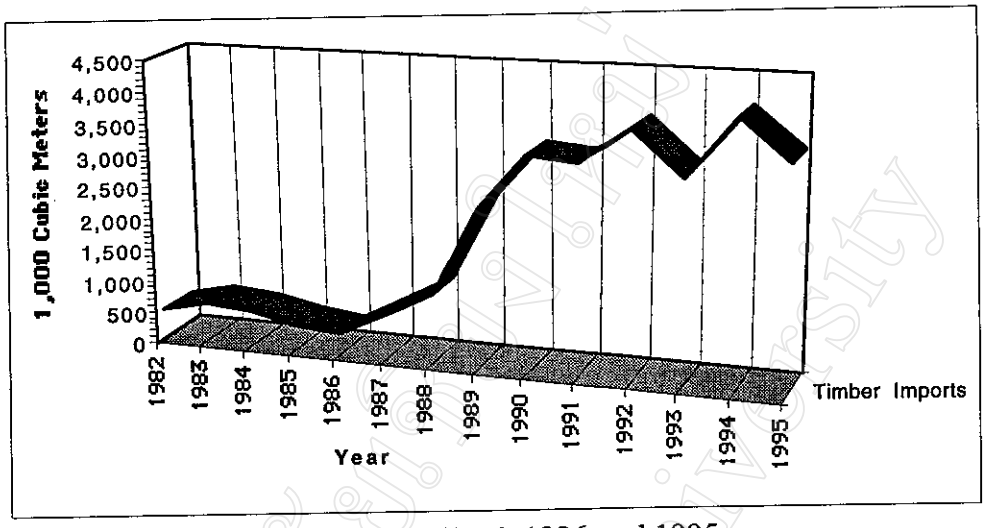
Even before the logging ban was enacted, domestic wood consumption exceeded domestic wood production. In 1982 the gap between domestic consumption and production was only 487 thousand cubic meters of wood. By 1988 the gap had expanded to 1,005.2 thousand cubic meters, but after the 1989 logging ban the figure jumped to 2,454.7 thousand cubic meters. Over the next six years this statistic climbed to a staggering figure of 3,383.1 thousand cubic meters, see Figure 1.3. The short fall in domestic wood production has been compensated for by increased timber imports. Figure 1.4 presents the timber importation trend over the 13-year period of time between 1982 and 1995.

Figure 1.3 Thai Domestic Wood Production and Consumption, 1982-1995



Source: Forestry Statistics of Thailand, 1986 and 1995.

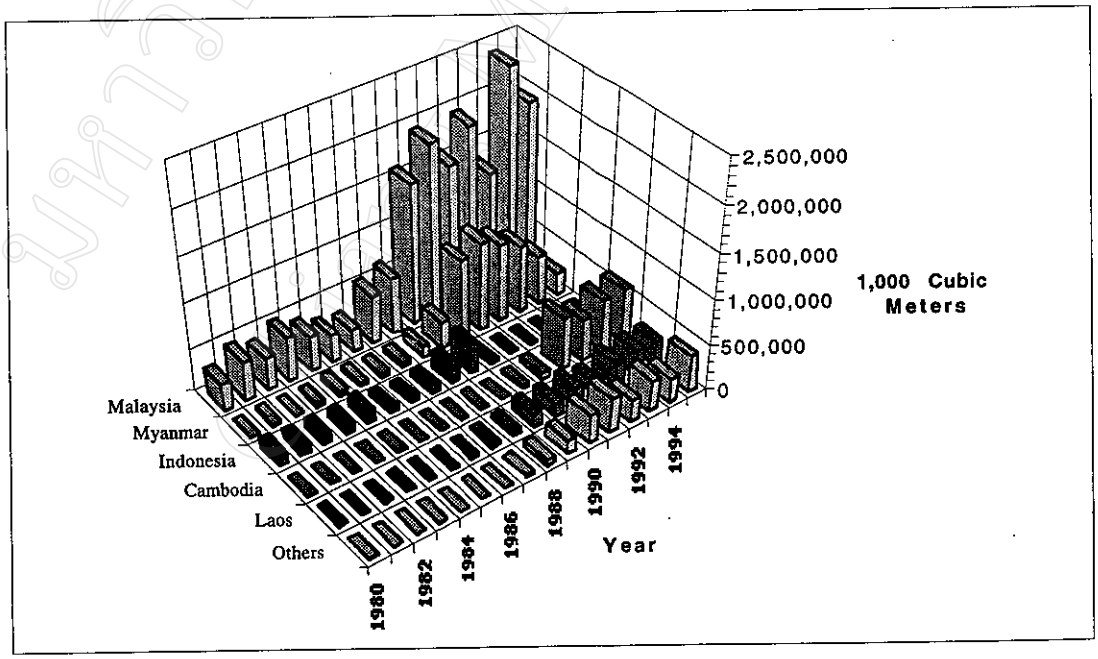
Figure 1.4 Thai Timber Imports, 1982-1995



Source: Forestry Statistics of Thailand, 1986 and 1995.

The primary supply of imported timber has come from the neighboring countries of Malaysia, Myanmar, Cambodia, and Laos, see Figure 1.5 below.

Figure 1.5 Thai Timber Imports by Country, 1980-1995

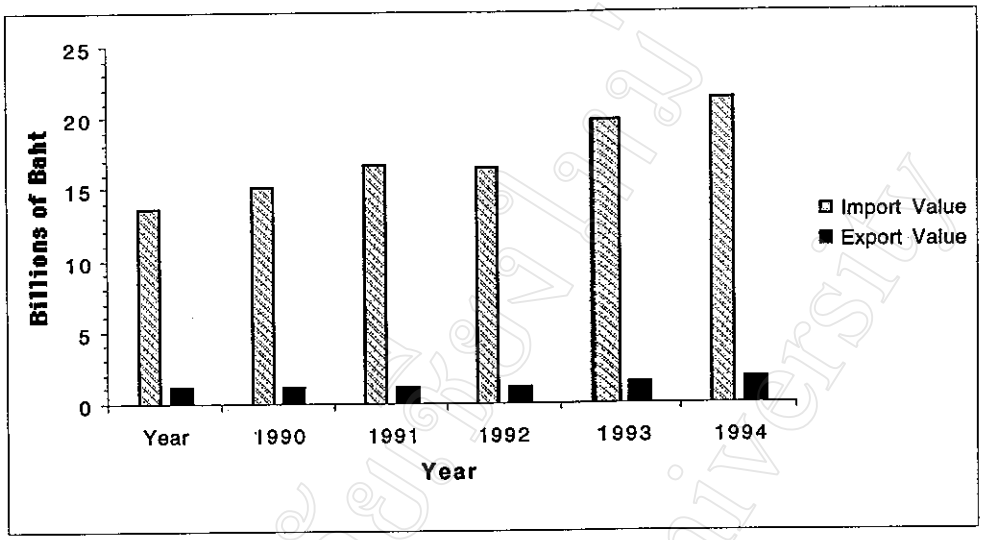


Source: Forestry Statistics of Thailand, 1986, 1990,1994, and 1995.

Nevertheless, the rapid pace of deforestation in these countries will most likely lead to a Thai style depletion of their forest reserves in the future. The distinct implication of this is that the supply of cheap lumber needed for several different industries such as construction, furniture, wood carving, paper processing, etc. will be greatly diminished or depleted. Instead, these industries will have to import more expensive lumber from countries like Indonesia, New Zealand, Canada, America, and Russia or close down their operations. This in itself could possibly have the effect of seriously hurting these industries. Sanit (1993) reports that the lack of available timber before the logging ban had adversely affected the number of wood products factories. In 1985 Thailand was home to 4,783 different wood working factories. However, by 1986 and 1987 these numbers dropped to 3,839 and 3,466 factories respectively. Nonetheless, these numbers increased back up to 6,007 in 1993 and then dropped slightly in 1995 to 5,762 factories (Forestry Statistics of Thailand, 1994 and 1995). Due to the fact that the number of wood products factories has increased while at the same time the amount of wood produced domestically has decreased, it can be assumed that these factories are relying on imported timber, and thus making them vulnerable to external timber shortages.

Another implication of the high level of timber importation is its affect on the current account deficit and the national economy. In the past, Thailand experienced an inflow of foreign exchange from the export of domestically produced timber. Yet, today the opposite is true. For the last several years, Thailand has been losing Billions of Baht on the import of timber, which increases the current accounts deficit and puts pressure on the Thai Baht. For this reason alone, Thailand needs to find ways of decreasing the amount of timber imported annually. Obviously, the alternative or maybe the best way of doing this without changing consumption patterns is to plant more trees thereby creating a domestic supply of timber. The disparity between the value of timber imported and exported can be clearly seen in the Figure 1.6.

Figure 1.6 Value of Timber Imports and Exports, 1990-1995



Source: Forestry Statistics of Thailand, 1994 and 1995
Note: All figures given in 1990 prices.

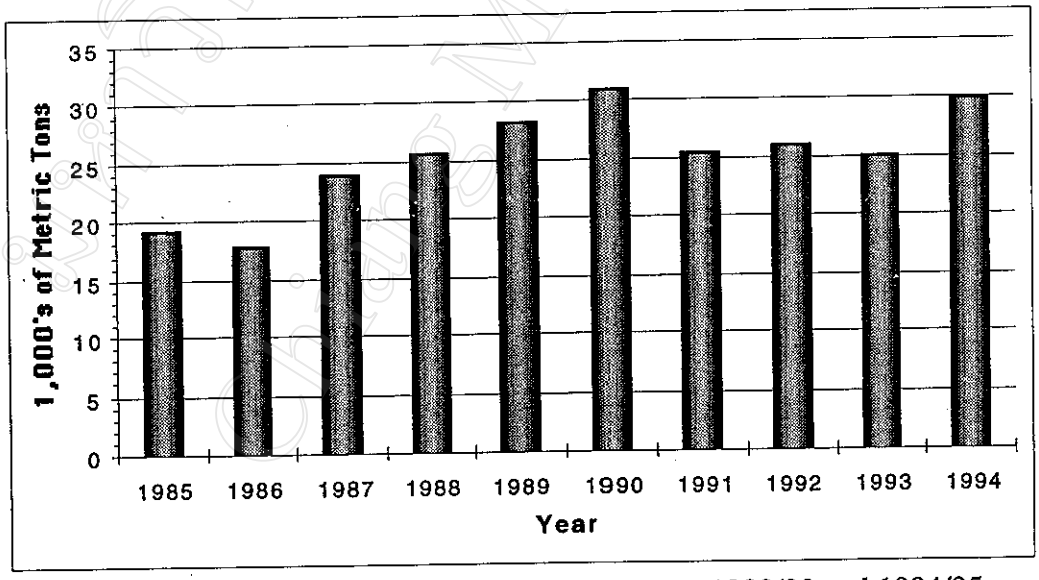
1.1.2 The Costs of Pesticides

At the same time as the Thai environment has been suffering the effects of over logging, it has also been suffering from the over use of synthetic pesticides. Many uneducated farmers have been poisoning themselves and consumers of agricultural products by misusing and over-spraying fields with extremely poisonous pesticides. Two examples of the pesticides used are azinphos-ethyl, a chemical that can send people into a coma or cause seizures, and sodium hydrosulfate, a chemical that can build up in the blood stream to lethal levels from eating contaminated food. More educated farmers who heavily use these and other similar pesticides avoid eating their own fruit and vegetables, because they know the health risk (Wong-Anan 1996). However, the end consumer cannot avoid the health risks associated with pesticide contaminated food unless he or she can identify which fruits and vegetables are contaminated and which are insecticide free. Thus, if the consumer does not avoid fruits and vegetables all together, every meal becomes a game of Russian Roulette with long term consequences. Other than death, Scientists and doctors can only guess at what the health impacts in the long run will be from heavy exposure to these insecticides. To what extent these health impacts will effect the overall economy is even less clear, but they will surely cause people to spend more money on

health care and less on consumer goods. Insecticide related health problems could also affect the labor market if a large number of people become to sick to work.

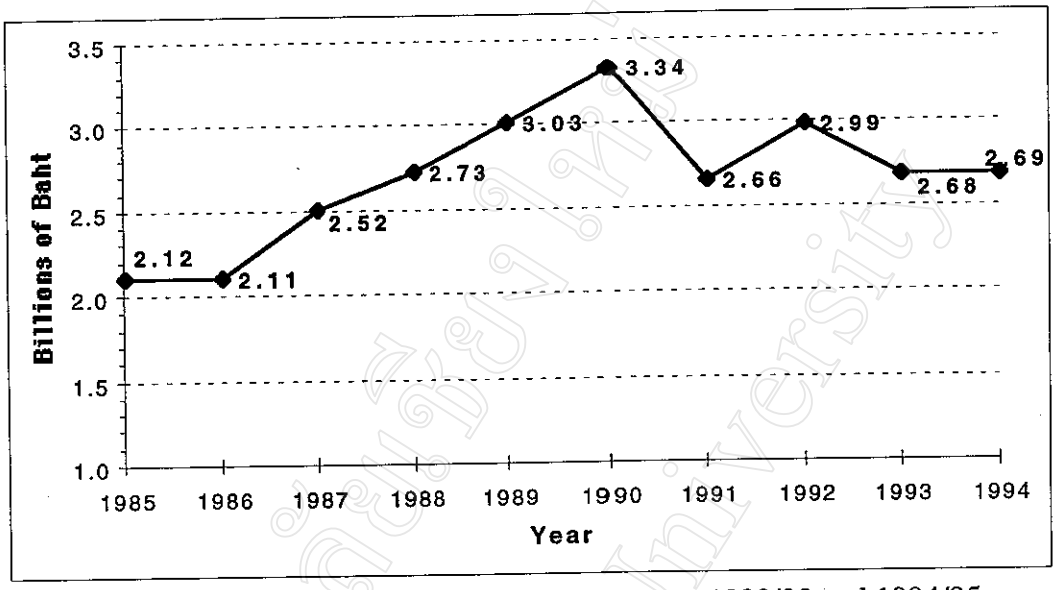
Even though this is occurring, Thailand continues to import thousands of metric tons of pesticides each year (Figure 1.7). And, just like the massive annual importation of timber, the importation of chemical pesticides drains billions of Baht out of the government's foreign exchange reserves each year. The value of imported pesticides for the period 1985 - 1994 is shown in Figure 1.8. It should be noted that these are the apparent costs to the Thai economy. The less apparent costs of lost wages and health care problems related to pesticide poisoning are also sucking the life out of the Thai economy.

Figure 1.7 Thai Pesticide Imports, 1985-1994



Source: Agricultural Statistics of Thailand Crop Year 1989/90 and 1994/95
Note: Figures based on 1990 prices

Figure 1.8 Value of Thai Pesticide Imports, 1985-1994



Source: Agricultural Statistics of Thailand Crop Year 1989/90 and 1994/95

1.1.3 The Agro-Forestry of the Thai Neem Tree -- One Possible Solution

When the average Thai is asked about his familiarity with the Neem tree (Sadao Thai), the response is generally recognition of the Neem tree as a source of food. This is a reference to the use of boiled neem tree flowers as a vegetable side dish eaten with certain favorite Thai dishes such as grilled shrimp and Nam Prik. However, the Thai neem tree (Azadirachta siamensis) produces a great deal more benefits than just flowers, and could be a partial solution to Thailand's timber and insecticide importation problems.

The real problem of solving lumber supply shortages and environmental degradation problems is one of how to encourage more people to plant trees on private lands, thereby reducing the pressure on protected forest areas. Forestry projects are generally not very attractive to potential investors due to their large initial capital expenditures and substantial periods of time needed before the investor sees a return on his investment. As most people generally can't afford to wait twenty to forty years to see a return on their investment, it is extremely important to find and promote tree species which have multiple purposes that create intermediate income flows. Trees of this nature have the ability to provide both short and long term income flows, thus, making them more attractive to farmers and local villagers.

The Neem tree is an example of such a kind of tree, because it produces both lumber and seed products. Neem seeds contain a high concentration of the chemical Azadirachtin that can be used as a environmentally friendly pesticide. Azadirachtin is just now starting to gain world attention as an alternative to other types of pesticides which have environmental side effects (see Schmutterer 1995 and Singh 1996). Although the present domestic and global market demands for neem-based pesticides is still relatively small, the world demand for the chemical Azadirachtin will most likely markedly increase in the coming years thereby creating a heavy demand for Neem seeds and Neem seed oil. Already in Thailand, neem-based pesticides have gained the support of the government and His Majesty the King, and are being promoted by the provincial agricultural extension offices through out the country. As a result of the growing demand for neem-based insecticides, companies producing these insecticides have been scrambling to buy neem seeds from farmers who have trees growing wild on their land. Therefore, farmers who plant neem trees are almost assured a short-run profit return from sale of the Neem seeds produced on their lands.

Lumber from the Neem tree is deemed a semi-hardwood and can be used for wood carving, housing construction, paper pulp, and furniture manufacturing. The long-term lumber returns are also much shorter than those from Teak, due to the fact that the Neem tree is a semi-fast to fast growing tree (depending on the species) while Teak is a slow growing tree.

The market conditions mentioned in the first two parts of this discussion point to the fact that a tree which can produce both timber and a form of pesticide is ideally suited for production in Thailand. Yet, few people know of the neem tree's economic potential and no economic research on the neem tree has been published. Unfortunately, the neem tree has become another example of a tree variety with promising properties / characteristics, but on which systematic research is inadequate for production investment decisions. This study seeks to set up both an economic and financial model that can serve as an example of how to approach this problem.

1.1.4 Two Types of Thai Neem (Sadao Thai and Sadao Tawai)

The primary focus of this study is on the economic benefits from Thai neem seed and timber production, as the author is making the assumption that this form of production will offer the highest rate of economic return to the country as a whole. However, seed and timber production is not the only type of neem production available to investors interested in neem tree farming. To the contrary, at present the seed and timber production investments have to compete for investment capital with a growing and more established interest in neem flower production cultivation.

The flower production system was first established approximately seven years ago when a Chiang Mai resident discovered a hybrid variety of the Thai neem which produces flowers in large quantities almost year round. The flowers of this hybrid neem, which was given the name Sadao Tawai, which translates from Thai into English as "Off-season neem," are less bitter than the ordinary Thai neem (Sadao Thai) and are preferred over the Sadao Thai's flowers. It is has been reported that the Sadao Tawai flowers demand a price of 80 - 120 Baht per kilogram in the Bangkok markets. Up front, this is a much more attractive price than the 5 - 30 Baht per kilogram price given for Sadao Thai seed. The question begging to be answered is which production system shows greater profitability.

It should be noted that these two production systems do not produce any of the same products. The Sadao Tawai hybrid produces a large quantity of flowers, but does not produce a salable quantity of seed. In addition to this, Sadao Tawai trees must be continually pruned short so as to provide convenient flower collection. As result, Sadao Tawai does not produce lumber quality wood. On the other hand, the Sadao Thai variety produces lumber quality timber and seed, but no flowers. Flowers could be collected, but this precludes seed production. Moreover, Sadao Thai trees produce flowers only one or two months out of the year, and their flower's bitter taste demands a lower market price. Therefore, each variety represents a distinct investment alternative.

Figure 1.9 Sadao Tawai Flowers

Figure 1.10 Sadao Tawai Tree Trunk

Figure 1.11 Sadao Thai Plantation

Figure 1.12 Sadao Thai Fruit and Kernels

1.2 The objectives of the Study

1.2.1 To study and describe the neem tree, the types of neem based products, and the potential markets for neem based products.

1.2.2 To study the potential financial benefits from investing in small scale Thai neem (Sadao Thai and Sadao Tawai) tree farming in Thailand.

1.2.3 To compare the economic benefits between small scale Sadao Thai and Sadao Tawai tree farming in Thailand.

1.2.4 To conduct sensitivity analyses on both Sadao Thai and Sadao Tawai investment frameworks in order to identify the impacts of changes in stumpage, seed, and flower prices; production quantities; and tree growth rates and the inclusion of land values.

1.2.5 To identify and prioritize the types of further information and data needed to better determine the economic feasibility of neem tree production.

1.3 Expected Benefits

1.3.1 To gain an understanding of the neem tree, the types of neem based products, and the potential markets for neem based products.

1.3.2 To gain an understanding of the potential financial benefits from investing in small scale Sadao Thai and Sadao Tawai tree farming in Thailand.

1.3.3 To learn of the differences in economic benefits between small scale Sadao Thai and Sadao Tawai farming in Thailand.

1.3.4 To gain an understanding of each sensitivity framework by changing stumpage, seed, and flower prices; and tree growth rates and the price of land.

1.3.5 To be able to identify key knowledge and data gaps that can be used by other researchers for better understanding and determining the economic feasibility of small scale-neem tree production.

1.4 Scope of the Study

The scope of this study will be limited to an economic analysis of the costs and benefits of planting two varieties of the Thai Neem tree (Azadirachta indica Var. siamensis, Valeton or Azadirachta siamensis Valeton). The first variety, known as Sadao Thai or Sadao Baan, represents the majority of Thai neem trees growing wildly throughout the country. The second variety, given the name "Sadao Tawai" which translates into English as "Off-season Neem", is a hybrid variety of the Thai neem tree which produces a large quantity of flowers, but an abnormally small quantity of seed. The two varieties of Thai neem tree analyzed in this study have different end uses. The Sadao Thai variety is used primarily for seed and timber production, while the Sadao Tawai hybrid variety produces flowers for domestic consumption and a non-timber grade quality wood.

Considering the fact that most of the land in Thailand is owned by a large number of small land holders, this study plans to examine the economic returns of an investment size of one rai. Although there are a substantial number of large and medium land holders who own more than one rai, the goal of the present economic analysis is to establish whether or not an investment in either type of neem plantation is a viable forestry option for use by a typical small scale holder of marginal land in Thailand.

1.5 Source and Collection of Data

1.5.1 Secondary Data

The primary source of data used in this study was secondary data and came from the following: Documents and articles directly related to the biology of the neem tree, neem tree planting methods, and products made from the neem tree and neem seeds; and Data and Statistics from other organizations dealing with the neem tree, i.e. the Royal Forestry Department, the Department of Agricultural Research, the Department of Business Statistics, etc.

1.5.2 Primary Data

Primary data was also obtained from interviews and direct correspondence with neem tree experts and companies producing and selling neem based products.