LITERATURE REVIEW

Tropical forests are the home of countless kinds of life. The genetic pool and biological diversity there are unsurpassed by any other type of terrestrial community on earth (Hubbell and Foster, 1983).

Ironically, forests have been destroyed by humans at an alarming rate. Lanley (1982) reported that the rate of tropical deforestation was 4.33% per year.

Thailand has a high rate of population and economic growth resulting in severe degradation of natural resources. These trends are reflected in the decline of nearly one half the country's forest, from 54% to less than 28% cover today (Poffenberger and McGean, 1993). Furthermore, Leungaramsi and Rajesh (1992) reported that between 1976 and 1980, Thailand's annual deforestation is 333,000 ha., almost twice the rate in 1980. In northern Thailand, specifically, forests have decreased from 7.4 million hectares in 1961 to 3.2 million hectares in 1978 and to 2.88 million hectares by 1988 (Leungaramsi and Rajesh, 1990). Doi Suthep-Pui National Park alone has lost about a third of its forest cover and Doi Inthanon has nearly half of what it originally had (Elliott *et al.*, 1993).

The consequences of forest destruction range from local stream siltation to changes in the global climate which will lead to the extinction of many species, perhaps including human beings. In addition, the removal of forest cover causes a gross disruption of nutrient cycles and water balances.

With the alarming rate of natural forest disappearance which brings about a huge losses of biological diversity, the government and private sectors are slowly becoming aware of the urgent need to conserve the country's remaining forests.

Several forest restoration and conservation activities are being fully supported by groups of people in the private sector and non government organizations. Likewise, the support of the local people is often quite active. In fact, villagers and hilltribe people are now actively participating in tree planting activities encouraged by the Thai Government on the occasion of His Majesty the King's golden jubilee in 1996.

Many forest restoration and management activities are now continuing, but choosing the best way for the ensurance of their success is still unlikely due to our lack of knowledge of the forest and the forest ecosystem as a whole. In fact, Elliott *et al.* (1994) stated that restoration of forests to their natural conditions requires detailed knowledge of the ecosystem functioning. However, this requires too much time, effort, and expertise of various taxonomists and budget. Using alternative methods to understand the ecosystem is the answer to this problem. Studying a certain group of indicator species that reflects the overall situation of the forests provides a cost effective and rapid alternative for forest assessment.

A bioindicator is a group or community of organisms whose presence or absence can be closely correlated with certain environmental conditions that it can be utilized as a pointer or quantitative test (Ellenberg, 1991).

Sharma (1994) mentioned that plant species and communities serve as indicators of the environment. Every plant is a product of the conditions under which it grows and is, therefore, a measurement of the environment. Thus, a dominant species in a particular area is the most important indicator as it receives the full impact of the habitat for over longer periods. Consequently, plant communities are more reliable indicators than individual plants. Furthermore, the presence, relative abundance, and relative size of various plants in the forest reflect the nature of the forest ecosystem of

which they are part of and may serve as an indication of site quality (Spurr and Branes, 1980).

Schlenker (1964), Seblad (1964), and Spurr and Branes (1980), reported that each site unit is characterized by a local overstory type and is floristically delineated through the use of ecological species groups in which each group is composed of several plant species which, because of similar environmental requirements or tolerances, indicate certain site-factor complexes, i.e. soil moisture or soil acidity gradients. Therefore, Spurr and Branes (1980) concluded that site quality study and site classification using vegetation and physical site factors are suitable methods of assessing forest conditions. This has attracted the attention of many ecologists.

Pteridophytes are group of vascular plants in the Division Pteridophyta which includes ferns and their allies. It has often been observed that Pteridophyte communities vary with different niches. Pichi-Sermolli (1973) stated that although fern taxonomists in the past tried to generate as much morphological information about them, a wide gap of knowledge about their ecology, uses, and even their systematics and classification still exists.

Few decades ago scientists tried to investigate this group of plants. There were some reports stating that some species of Pteridophytes were noxious weeds. *Pteridium aquilinum* (L.) Kuhn is one of the feared weeds in which biological study has been conducted for the purpose of its control (Gleissman, 1978). He confirmed that *P. aquilinum* is vigorous and dominant in many types of vegetation throughout the world. Likewise, Haufler (1997) noted that *P. aquilinum* is considered a noxious weed in northern England and Scotland and lots of money has been spent for its unsuccessful control.

Zamora and Co (1986) reported that some Pteridophyte species are known for their economic importance. Some examples are *Diplazium esculentum* (Retz.) Sw. (Athyriaceae) for its food value, *Lygodium flexuosum* (L). Sw. (Schizaeaceae) for its commercial value as handicraft material, *Cibotium barometz* (L.) J. Sm. (Cyatheaceae) for its medicinal value, and *Nephrolepis cordifolia* (L.) Presl (Davalliaceae) for their ornamental purposes. Also, *Marselia crenata* Presl (Marseliaceae) is now considered as noxious weed in many ricefields in the Philippines.

There are some reports considering the ecological roles of Pteridophytes. Maheswaran and Gunatilleke (1988) reported that fallow agricultural fields in Sri Lanka become almost permanent fernlands. Also, Zamora and Co (1986) reported that a non-Philippine species of *Equisetum* (fern ally) has been used as an indicator of the mineral content of the soil in which it grows.

Koop (1992) reported that the genera *Anthrophium* (Polypodiaceae), *Trichomanes* (Hymenophyllaceae), and *Selaginella* (Selaginellaceae) are good indicators of high air humidity. In addition, he reported that *Nephrolepis biserrata* (Sw.) Schott (Oleandraceae), *Dicranopteris curranii* Copel. (Gleicheniaceae), and *Cyathea borneensis* Copel. (Cyatheaceae) are good indicators of high light intensity.

A study on the comparison of litter decomposition conducted in Sri Lanka revealed that the rate of litter decomposition and organic matter accumulation in fernlands is significantly lower than in natural forests (Maheswaran and Gunatilleke, 1988).

In addition, the initial results of a study conducted in New Zealand to assess the niche requirements of Pteridophyta and to determine the predictability of species

occurrence in relation to natural and artificial disturbance revealed that most Pteridophyte species are extremely habitat specific (Given, 1994).

Moreover, Van Valkenberg *et al.* (1994) reported that the differences in fern composition in different forest regrowth on Mt. Kaindi, Papua New Guinea gives a clear idea that ferns are good indicators of successional stages of vegetation. They found that *Histiopteris incisa* (Thunb.) J. Smith, *Microlepia* sp., *Pteridium aquilinum* (L.) Kuhn (all Dennstaedtiaceae), *Nephrolepis* sp. (Oleandraceae) and *Pteris* sp. (Pteridaceae) were present in 3-5 year old regrowth plots and are light-demanding species of open, disturbed areas, while *Coryphopteris* sp. (Thelypteridaceae), *Dryopteris* sp. (Dryopteridaceae), and *Hymenophyllum* sp. (Hymenophyllaceae) were present in shadier conditions of 10 year old regrowth forest. They concluded that some ferns are good indicators of the successional stage of vegetation.

As of now, very few ecological studies about Pteridophytes have been done. My study will hopefully add to the meager information about the ecological role of this important group of plants as well as in the zonation of forest reserves leading to proper forest restoration and management in Thailand as well as South East Asia.