DEFINING FOREST RESTORATION FOR WILDLIFE CONSERVATION

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Deforestation in the tropics is now widely accepted as one of the greatest threats to wildlife on Earth. The last decade of the 20th century saw rapid changes in attitudes towards this problem and some innovative attempts to devise solutions. In many parts of Southeast Asia, producing timber by logging natural forests is rapidly becoming a thing of the past, not only because forest areas where logging remains economically viable are diminishing, but also due to growing public opposition. Some countries, such as Thailand, have completely banned commercial logging in natural forest, whilst others have imposed stricter controls, in an attempt to achieve sustainable timber production. With the traditional logging industry under pressure, more timber plantations are being established. The hope is that vast plantations of eucalypts, pines, teak etc. will meet the increasing demand for timber, paper, fuel-wood etc. Although these plantations will become essential to provide wood products, they do not provide suitable habitat for the millions of plant and animal species that formerly inhabited the forest ecosystems they are replacing. Within conservation areas, such as national parks and wildlife sanctuaries, reforestation should meet the needs of wildlife, rather than those of the timber industry. Southeast Asia has an extensive system of protected areas (KASHIO, 2000). Many of these areas, however, encompass large deforested or degraded sites that require forest restoration, primarily for wildlife conservation and environmental protection.

Forest restoration is one particular form of reforestation. Whereas the term **reforestation** covers the re-establishment of any kind of tree cover, including plantations and agro-forestry, the term **forest restoration** is confined to the re-establishment of entire forest ecosystems, as similar as possible to the original forest ecosystems that were present before deforestation occurred. If strictly applied, this definition makes forest restoration almost impossible to achieve. Quite often it is not known exactly which tree species were present in any particular area before deforestation occurred. Consequently, it is difficult to know which species to plant. Furthermore tropical forests contain so many different tree species, it would be impractical to grow them all in nurseries and plant them. It would also be unrealistic to expect that seeds of all the original tree species would be dispersed into deforested sites and re-establish themselves naturally. Rather than quibble over the exact species composition aimed for by any particular forest restoration project, forest restoration should aim to match original levels of species diversity, ecosystem structure and ecosystem function, whilst planting or encouraging tree species that are known to have been originally present. The success of forest restoration programmes could therefore be assessed in terms of gradually increasing levels of the following attributes: species richness and diversity indices of plants and

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animals; diversity of life forms; presence of keystone species; biomass and primary productivity; soil organic matter content and moisture holding capacity.

The term **wildlife** also requires some clarification. Common usage of this term is sometimes restricted to mean only large vertebrates. For the purposes of the workshop, however, "wildlife" was used to mean *all* animal *and plant* species indigenous to areas undergoing forest restoration. The term included plant or animal species still present, or those that had become extirpated, due to deforestation, requiring re-introduction. In recent years, the term **biodiversity** has almost superseded the term wildlife. However, biodiversity includes genetic diversity of domestic or exotic plants or animals. In order to focus attention on indigenous forest plants and animals, the term wildlife was preferred.

Forestry research in Southeast Asia is quite advanced. For example, in Thailand, the ASEAN Seed Centre, the FORGENMAP project (PEDERSEN, 2000) and the Silviculture Division of the Royal Forest Department have all undertaken excellent research on genetics, propagation and planting, mostly of commercial tree species. On campus at Chiang Mai University, the Multiple Cropping Centre and the International Centre for Research on Agro-forestry (ICRAF) both carry out research to support agro-forestry. However, most of the current forestry research concentrates on establishing plantations for economic or commercial objectives, rather than reconstructing complex forest ecosystems. When it comes to restoring forests to provide habitat for wildlife, wide gaps in knowledge remain. Many thousands of tree species grow in the Southeast Asian region – species that may have no immediate economic value but which are vital in maintaining ecological stability. It is not known how to grow, plant or take care of most of these species. Thus, the main focus of the workshop was on forests for wildlife, rather than for economic or commercial purposes.

Although the art of restoring tropical forests for wildlife conservation is very new, various approaches, requiring different levels of input are being tested. Perhaps the simplest approach is **assisted or accelerated natural regeneration** (ANR) (HARDWICK, 2000). This method usually involves no or minimal tree-planting, but instead encourages the natural processes of forest succession (HARDWICK ET AL., 2000). Existing naturally-established trees are protected and nurtured, by weeding, mulching or application of fertiliser. Seed dispersal into restored areas is encouraged and fire prevention measures are implemented. The method requires very low inputs and is simple to implement at low cost (DUGAN, 2000). However, ANR can only work with the trees that are already established in deforested areas. Most tree species capable of colonising such areas tend to be fast growing pioneer trees with small easily dispersed seeds: a small subset of the tree species that comprised the original forest ecosystem. Rapid restoration of a more complete forest tree community usually requires some tree planting, at least to ensure early representation of large-seeded, climax forest tree species.

This has led to the development of more intensive (and more expensive) systems of forest restoration, involving tree planting, such as the **Miyawaki method** (MIYAWAKI, 1993; ALIAS *ET AL.*, 2000). In Malaysia ALIAS *ET AL.* (2000) experimented with direct planting of up to 42 climax forest tree species, to return the forest to its primary condition as quickly as possible. In other systems both climax and pioneer tree species are planted. In Queensland, Australia, the **framework species method** (TUCKER, 2000) uses a mixture of 20-30 pioneer and climax species planted in a single step. The

framework species are selected for their ability to shade out competing weeds and attract wildlife into planted areas. The planted trees re-establish basic forest structure and function, whilst birds and bats add diversity to the forest by dispersing seeds of non-planted trees into the planted areas. This method is now being adapted for use in northern Thailand, with promising results (FOREST RESTORATION RESEARCH UNIT, 1998 & 2000). In Vietnam forest succession is mimicked by the "**accelerated pioneer-climax series**" or APCS method (SÔÛ, 2000). With this method, pioneers are planted first and are later interplanted with climax tree species.

An alternative technique is to make plantations of commercial tree species more attractive to wildlife. This is the so-called "**plantations as catalysts**" approach discussed by PARROTTA (2000). Establishment of almost any kind of tree cover tends to accelerate natural forest regeneration, by ameliorating the harsh environment of open degraded areas and creating cover for seed-dispersing wildlife, thus providing suitable conditions for the natural establishment of native trees. The degree of this effect depends on the tree species planted, the silvicultural management applied, site conditions, the position of the site relative to remaining forest and many other factors. Further research is needed to determine how the catalytic effects of plantations could be enhanced. Another important question is how can such plantations be harvested without destroying the native trees and wildlife that may have colonised them?

Most experiments to test the methods outline above are less than 10 years old and are generating more questions than answers. There is, therefore, considerable scope for further research. The workshop provided an opportunity for proponents of the various forest restoration techniques currently being developed to showcase their latest findings, whilst discussion groups developed new ideas for further research.

Once the different techniques of forest restoration have been tested in experimental plots, the next problem will be how to scale up planting to cover larger areas. Enlisting the support of government agencies and local communities will be vital for this (MUNEZ, 2000). In recent years, training programmes and seminars, such as those organized by the Regional Community Forestry Training Centre (or RECOFT), based in Bangkok (SUKWONG, 2000), have propelled the concept of community or social forestry from obscurity to wide acceptance throughout the region. Some of the strongest incentives for local people to become involved in forest restoration projects are the links between healthy forest ecosytems and the provision of resources, especially water (LAL, 2000; SVASTI, 2000; DUGAN, 2000). The need for better understanding of the factors that motivate local people to become involved in forest restoration activities was a recurrent theme throughout the workshop.

The workshop also focused on the seasonally dry tropical forests characteristic of this region, rather than the tropical rain forests. Tropical rain forests are famous for their high biodiversity and consequently they have attracted most attention. However, recent evidence suggests that seasonally dry tropical forests might be just as diverse as tropical rain forests (ELLIOTT *ET AL.*, 1989) and they may be more endangered than tropical rain forests (JANZEN, 1988). Furthermore, seasonally dry tropical forests present unique challenges for restoration, of which annual drought and frequent fires are the most serious.

By concentrating on the technical and scientific aspects of forest restoration for wildlife conservation in Southeast Asia's seasonally dry tropical forests, the workshop

avoided repeating what other workshops and symposia had already covered and promoted a new area of scientific discovery for many of the countries in the region.

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