PROBLEMS RELATING TO STUDIES ON NATURAL REGENERATION AND AFFORESTATION IN RAIN FOREST OF SABAH

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Summary

Natural and artificial regenerations are extensively practised in Sabah. The paper highlights a few special problems relating to studies on regeneration and reafforestation in Sabah. Shortage of research personnel and facilities, and methodology available for studies are considered to be the most acute problems.

Among other things, the author considers that special training courses on research methods and techniques are necessary for the young researchers, and timber importer nations such as, Japan, Korea and others should provide technical aid to Sabah with the aim of solving the basic management problems so as to ensure continuous supply of timber. This will not only benefit Sabah but also the importer nations, in the long run.

Introduction

Tropical rain forest is "Evergreen, hydrophilous in character, at least 30 metres high, but usually much taller, rich in thick-stemmed lianes and in woody as well as herbaceous epiphytes" (Schimper, 1903). "Since the tropical rain forest is a climatic climax, it must, by definition, be in a state of equilibrium. When the trees die they are replaced by others of the same or different species ....." (Richards, 1957). The zone of tropical rain forest supports high forest and under a variety of conditions the climax is reasserted following man's intervention. Woody trees will grow without man planting them and, over a period of time, the forest will tend to resemble that which existed prior to exploitation (Fox, 1976). Removal of timber varies from "creaming" to a more or less clear felling, depending on relative frequencies and values of the larger species.

Basically there are only two approaches to silviculture i.e., even-aged or monocyclic and uneven-aged or polycyclic systems though many recognised silvicultural systems have been developed since the turn of the 20th century. In the case of monocyclic systems, more emphasis is placed on raising an even-aged stand from seedlings usually. The original concept and objective of Tropical Shelterwood System (T.S.S.), Malayan Uniform System (M.U.S.) and Regeneration Improvement Felling System (R.I.F.S.) aimed at producing even-aged stands of forest and hence these can be classified as "monocyclic systems". Selection Systems usually aim at raising uneven-aged and uneven-sized trees within forest stands. Under these systems, maintenance and retention of the forest structure, particularly for the commercial pole crop and seedlings are given high priority and are of paramount importance because the former are to be raised for subsequent cuts. Hence a shorter cutting is envisaged as opposed to monocyclic systems. Venniere (1975) concluded that there is no economic difference between monocyclic and polycyclic systems. Leslie (1977) points out that a firm verdict cannot be rendered in the case of monocyclic versus polycyclic systems because of the lack of knowledge concerning the silvics of the moist tropical forests. However, it must be pointed out that "Systems which seek to ignore the potential of the pole-crop will inevitably be expensive because of low increments of most commercial rain forest species".

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Though considerable efforts have been made by foresters in pursuing sound silvicultural systems for managing rain forests in different regions, Leslie (1977) pointed out that "Far too little is known about silvics and the silviculture of the different moist forest communities and thus appropriate silvicultural system can be confidently prescribed for only a few limited areas". All that needs to be done is to find the appropriate variation of monocyclic or polycyclic management for the conditions applying in a specific forest. But almost universally, it seems that the search for the appropriate methods is particularly difficult and represents an unrewarding task (Leslie, 1977). Thus, after a century or so of determined effort to mould the tropical moist forests into a managed natural state the solution to the problem is apparently to be found in abandoning the natural forest. It has been therefore commonly accepted that the replacement of natural forests by plantations is a rational move toward making the future wood supply in tropical areas much less uncertain. Hence tree plantations have become a fashion in the tropics and their popularity is already seen in Sabah (Tham and Liew, 1977; Liew, 1978). Experts show unbounded enthusiasm for plantations: "With high yielding crops grown on short rotations it becomes profitable to apply methods used in agriculture". Forests in Indonesia managed on the Selection System rarely produce more than 1 m^3/ha/annum. Pure stands of high yielding species on the same site can produce 10 - 30 m^3/ha/annum" (Lundquist, 1964; Lowe, 1975). Superior growth in plantations in Sabah has been reported by Tham and Liew (1977).

Despite apparent economic advantages of plantations, it has yet to be shown that the spectacular conifers or other species can be perpetuated indefinitely without detriment to the site (Dawkins, 1958). Similarly reliable prescriptions to avoid serious biological problems with plantations are not available (Wadsworth, 1974).

Natural regeneration and reafforestation in Dipterocarp forests or waste land in Sabah are no exception for many problems have been observed and recorded, and they have been dealt with by Fox (1972; 1976), Liew (1974; 1978), Chan and Liew (1977) and Tham and Liew (1977). The aim of this paper is to highlight a few significant problems relating to studies on natural regeneration and reafforestation in Sabah.

Major problems

The process of natural regeneration in tropical rain forest is exceedingly complex because of the enormous wealth of species, and the complexity of the structure and of the flora composition of the forest both in the vertical and in the horizontal plane (Schulz, 1960).

Most investigations pertaining to natural regeneration and reafforestation in Sabah consist of superficial considerations on observations and measurements of certain parameters. Understanding of the function of the ecosystem relating to the succession of disturbed forests has never been investigated to a certain depth. For example what are the 'normal' mortality rates occurring within the different serial species? What is the role of the serial species in the recovery of the ecosystem following intervention? What are the chances of bared soil being restocked with economic species under the natural process? What are the effects of the loss of nutrients from the system in our destructive logging system, particularly as regards the great proportion of the top soil which is being removed or eroded from the system? Similarly, little is known about the function of the man-made system (tree plantation) in the tropics. Tree breeding research has almost been neglected. All of this information is a prerequisite to management of rain forest regeneration either under natural or artificial processes. Unfortunately, numerous problems exist in the studies of this wanting information. Some of these special problems are briefly examined.

1 Shortage of research personnel

Sabahans specialising in forestry research are few. Research is generally unattractive as it carries no executive authority and requires high educational qualifications and long periods of training. Suitable scientists have many job options, and are therefore difficult to attract and retain. The present staff situation in the Research Centre at Sepilok is as follows:

(i)	3 professional staff:	Permanent
(ii)	2 professional staff:	Contract
(iii)	2 foreign professional researchers:	A Colombo Plan Expert from Japan, and a C.U.S.O. Volunteer from Canada.
(iv)	3 sub-professional staff:	Permanent
(v)	90 field and clerical staff:	Permanent
(vi)	150 labourers:	Temporary

This indicates that there is a serious shortage of staff at professional and sub-professional levels. Research output and effectiveness can be adversely affected by shortage of qualified researchers. In the extreme case a branch of research may be closed down when the Department fails to obtain a suitable researcher. For example, the forest entomology section ceased to function in 1971 when the Colombo Plan Entomologist from India left the country. This section was reactivated in 1977 when Professor R. Yoshii joined the Centre under the scheme of J.I.C.A.

A strong team of researchers is the basic requirement for solving many elementary management problems. However, according to the present trend of development, it is unlikely that there will be any major change in the near future. Seeing the difficulty in obtaining capable personnel to undertake forestry research, the Department has now explored various overseas technical aid agencies such as J.I.C.A., U.N.D.P., C.U.S.O., J.O.V.C. etc. as for the possibility of providing such scientific researchers. To date the response has been encouraging.

2 Inadequate research facilities

Though a new Research Centre was built in 1974, there has been little improvement in research facilities. However, steps have been taken to equip a soil laboratory with basic equipment and apparatus in the light of the increasing importance of artificial regeneration which requires some basic knowledge on the relationship of edaphic factor and tree growth. It is envisaged that the laboratory will only be used to analyse chemical properties of soil as well as nutrition status of foliage with respect to macro-nutrients and certain micro-nutrients. Physical aspects of soil will not be investigated in the Centre in view of the expensive apparatus/equipment involved.

Usually plants and equipment used for research are manufactured in developed countries, far away from the conditions in which they will be used. As a result, the available equipment is not necessarily the most suitable. Furthermore, manufacturer's maintenance facilities in these countries are generally poor, consequently expensive equipment could remain idle for long periods because of simple faults or unavailability of spare parts. For example, when our desk computer, Programma 101, is out of order it has to be sent to Singapore for repair.

In certain areas, research is also adversely affected by relatively poor utility services such as telephone, transport and electricity.

3 Methodology

Methodology available for studying the dynamics of regenerating forests is often difficult because of the complexity of the rain forest. For example, studies on growth of seedlings and pole-sized trees are often facing difficulties. This is because growth of seedlings and saplings not only varies with the species but also with the crown size, crown freedom, etc. For this reason, it is extremely difficult to assess and project the growth of the forest as a whole. Though it has been found that seedlings or saplings of a specific species with vigorous crown which receive sufficient light intensity grow at a faster rate, it is difficult to analyse the data statistically. Although many scientists have commented on the growth of the rain forest in term of commercial volume this problem has not been accurately assessed but the author would be happy to learn the proper methodology for studying it.

As mentioned earlier, planting of pine trees has become a popular fashion in the tropics, particularly in Sabah. The entrepreneurs reveal that cost of establishment, particularly weed cost is

high. Both mechanical and chemical methods have been tried out, but it has been found that the former is more effective. The author would be pleased to know the best method and suitable chemicals for weed control in the tropics.

It is difficult to study the problems of the rain forests because of the size and the height of the trees. For example, Professor R. Yoshii is interested in studying the attack of weevils on Dipterocarp fruits, but he is not certain about the best way of tackling this problem.

4 Absence of long-term development plans

In the past long-term development Plans for forestry problems did not exist and a great deal of research effort has been wasted. For example, many of the research projects pertaining to studies on natural regeneration have been focused on the Lowland Dipterocarp forests in the past two decades. Before any concrete result could be obtained most of these Forest types including research plots have already been allocated for agricultural development or other lines of development. This may be not the fault of the government. As Dr. F.S. King asked "It has been said that there is much poverty, much misery, much malnutrition, much want, much ignorance, and much death in tropical countries that are blessed with forests. Should we not develop these forests? Should we preserve them while men starve and die?".

5 Lack of flow of information and co-ordination

Usually there is an inadequate flow of information from the researchers to the Government or to the public and vice versa. Normally the latter is much more pronounced. Often there is a lack of knowledge on how the researcher can contribute to the solving of developmental problems, particularly in the field of tree plantations whether in the public or in the private sector. It is also not uncommon for the public and private sectors to forge ahead with plantation projects without seeking appropriate scientific information or assistance though the project may require sizeable scientific inputs and investigations. In bridging the communication gap a much better perspective of research programme could be formulated.

More management problems could have been solved in Sabah if there had been more coordination in research policies and activities between institutions within Malaysia and South-east Asian Countries. Admittedly, there has been some liaison in the past, either through personal meetings or correspondence. A positive approach should be adopted in order to avoid duplication and excessive study of less important areas while neglecting the more pressing and critical problem areas, such as phenology of Dipterocarps, particularly stimulation of fruiting, tree breeding etc.

However, recently a healthy sign has developed in Malaysia as a National Forestry Research Committee has been formed. Though the first meeting has yet to be arranged, Dr. D.G. Nikles of the Forest Department, Queensland is now also organizing tree breeding programmes (tropical pines) at the international level in which interested nations are invited to participate.

Researchers working in isolation in Sabah could by no means solve most of the management problems to any appreciable extent.

Recommendations

(1) Special training course on research methods and techniques, handling of equipment and report writing, are necessary for young scientists who have to deal with national problems. Research project leaders require research training in project formulation and analysis. It is hoped that advanced countries could offer scholarship for such training programmes.

(2) Provisions for funds, staff, equipment, laboratory space and vehicles for the execution of research programmes are never adequate. To be effective, research institutions must get much greater support for these facilities.

(3) It is essential for the head of research institution to be involved in the forestry development project right from the planning stage.

(4) Co-ordination between research institutes remains insufficient. Such situation should be rectified.

(5) Silvicultural and tree breeding research programmes make up the bulk of research work in many developing countries. The tendency has been to work on many species which could be used for afforestation. It is desirable to concentrate on a carefully selected few species which could be beneficial to Sabah.

(6) Timber importer nations such as Japan, Korea and others should provide technical aid to Sabah with the aim of solving the basic management problems so as to ensure continuous supply of timber. This will not only benefit Sabah but also the importer nations, in the long run.

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Discussion

Choob K. (Thailand): At what age do you fertilize your *pinus caribaea.* At what rate and what kind of fertilizers do you use? How about the leaching of fertilizers applied?

Answer: NPK Blue (4 oz) is applied to each tree one month after planting. Subsequent applications are carried out at two-month intervals during the first year so as to promote higher growth rate in order to shorten the time spent in the plantation as the cost of weeding and fertilizer is high. In the second year the number of applications is reduced to three. At this stage the height of the trees exceeds that of weeds and further applications may not be necessary. Fertilizers are applied by way of surface broadcast around the trees.

Sasaki, S. (Japan): From Sandakan to Kota Kinabaru there are extensive areas where shifting cultivation is practised. Are there any difficulties involved with respect to silvicultural practices?

Answer: According to the customary rights, the land under shifting cultivation belongs to the local inhabitants. Reafforestation in these areas could not be carried out without their consent. The Sabah Forestry Development Authority has introduced an agro-forestry project which involves subsidising the local inhabitants to plant up the areas with useful tree species as well as with agricultural cash crops. Under this arrangement 50% of the profit derived from the tree plantations would be distributed to the local inhabitants who participate in the project. It is most likely that the shifting cultivation areas may be reafforested in the near future.

Wawan K. (Indonesia): I would like to know more about *Acacia mangium.*

Answer: *Acacia mangium* was introduced to Sabah from Northern Queensland about 13 years ago. It can be grown easily on various soil types ranging from podzolic to clay or even water-logged soil. MAI is about 20 m^3/ha/annum at year 10. Seeds are easily available. The timber is suitable for general construction and it can be easily sawn and peeled. Good plywood can be obtained according to the tests. We plan to plant approximately 2,000 acres per month.

Glori, A. (The Philippines): I noticed in one of the slides you have shown that cacao is interplanted under the understocked Dipterocarp forest in line with the agro-forestry concept. Do you suppose that such practice would not create any danger of cutting the remaining forest trees in the area?

Answer: Planting of cocoa under the regenerating forest (logged-over Dipterocarp forest) in Sabah is in its early stage. Although it seems to be possible to plant cocoa under the regenerating forest, the canopy of the forest requires continuous manipulation in order to allow enough light to reach the forest floor to stimulate the growth of cocoa plants. This is done by poison-girdling. As cocoa commands a very high price, there is a tendency to eliminate the valuable Dipterocarp species. Therefore, planting of cocoa under the regenerating forest is not encouraged by the Forest Department. However, the Department encourages the agricultural entrepreneurs to plant their shade trees using species of economic importance such as *Albizzia falcata*. In this case both cocoa and timber can be harvested.

Glori, A. (The Philippines): You mentioned that *Pinus caribaea* was not growing well in Sabah. Perhaps you should look for better provenances more suited to the climatic conditions of Sabah.

Answer: The majority of the trees growing in the lowlands are defective while those growing at higher elevations give good performances and seed orchards have even been established.