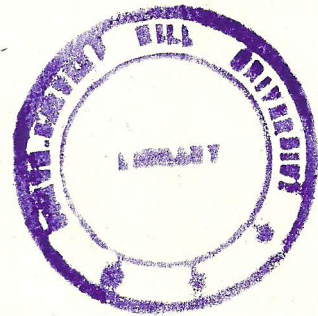


ECOLOGICAL STUDIES ON REGENERATION OF A FEW
TREE SPECIES IN SUB-TROPICAL WET HILL
FORESTS OF MEGHALAYA

By
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THESIS SUBMITTED IN FULFILMENT OF THE DEGREE OF
DOCTOR OF PHILOSOPHY IN BOTANY



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I certify that the thesis entitled "Ecological studies on regeneration of a few tree species in sub-tropical wet hill forests of Meghalaya", submitted by Mr. Mohd. Latif Khan, M. Sc. for the Degree of Doctor of Philosophy of the North-Eastern Hill University, Shillong, embodies the record of original investigation carried out by him under my supervision. He has been duly registered and the thesis presented is worthy of being considered for the award of the Ph. D. Degree. The work has not been submitted for any Degree of any other University.

Date : 30 September, 1986.

Place : Shillong.

Signature of the Supervisor

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GENERAL INTRODUCTION

Trees constitute one of mankind's most important assets and play a vital role in the maintenance of our environment. Forests are, indeed, God's gift to man, for as a young American poet, Joyee Kilburn, sang, 'Man can build a bridge, but God alone can make a tree'. Forests can contribute appreciably to world food supplies if proper exploitation, combined with satisfactory conservation, is carried out. In many places where arable crops and food grains would fail to grow, trees can flourish and yield abundantly. But unfortunately, instead of conserving forests for posterity, man looks on them as a source of wealth from too greedy harvesting.

Forests represent the largest, most complex and self-perpetuating system which cover approximately 40% of earth's biomass (Olson 1975). According to the estimates of the Department of Forest Survey, Royal College of Forestry, out of 2800 million ha world's forest area tropical forests cover 1456 million ha (52%). In the last 20-30 years, Man's exploitation of these forest ecosystems has increased dramatically, not only in extent but also in intensity of impacts. Tropical forests are being severely modified or destroyed in response to pressures from the rapidly expanding populations of tropical countries. Accelerated search for new timber resources by industrial temperate countries is another cause of exploitation. Improved technology, commerce patterns, and infrastructure development have widely increased the effective impact of wood harvesting and land clearing activities. Most investigators agree that if the present trends continue and effective

conservation measures are not implemented, most of the still-existing forests will be destroyed or replaced by degraded communities by the turn of the century. According to FAO (1981), by the year 2000 at least 500 million people will be unable to satisfy their minimum energy requirements. There is also disturbing scientific evidence to indicate that large scale loss of forest may bring about major, and perhaps irreversible changes in the global climate (Oza 1981a).

The natural vegetation of India is one or the other kind of forest. The various types of forests are (1) moist tropical forests, (2) dry tropical forests, (3) montane sub-tropical forests, (4) montane temperate forests, (5) sub-alpine forests, and (6) alpine scrub. According to official records the extent of forest cover in the country is 75 million hectares, i.e. about 23% of the total geographical area. But due to biotic disturbances (over-grazing, deforestation, rapid industrialization, shifting cultivation etc.) the natural vegetation has considerably deteriorated and presently, no more than 14% of country's land surface is forested (National Remote Sensing Agency Report, Govt. of India 1983). This has led to mass agitation of people in the form of 'Chipko movement' in Garhwal Himalayas (Joshi 1981) and Silent Valley movement in Kerala (Jha 1980). The Indian Society of Naturalists (INSON) is also engaged in promoting and supporting the World Campaign for the Biosphere, and has brought out strikers on 'Save Trees, Save India' and 'Save Trees, Save Our Biosphere' (Oza 1981b, 1982).

The North-Eastern region of India is endowed with vast forest resources which comprise a wide range of diverse plant species. However,

the forests of North-Eastern India are depleting at an alarming rate not only due to age-old practice of shifting cultivation that involves cutting and burning of the forest and other plant communities, but also on account of road construction, hydro-electric projects, extensive cultivation of clean tilled crops, urbanization and setting up of certain industries in recent years. With increase in population pressure, the Jhum cycle (the intervening fallow period after which the same forested land is again cultivated, Kushwaha et al. 1981) has been considerably shortened as a consequence of which the Jhum fallows do not get enough time to develop protective vegetational cover. As soon as some vegetation develops on abandoned Jhum fallows the area is once again brought under 'slash and burn agriculture'. Thus, the forests of this region have been shrinking at a very fast rate and this has resulted into a series of ecological problems, such as rapid soil erosion, desertification in certain areas and dwindling of orchid wealth, valuable wild-life and other germ plasm resources of the region. The forest cover in Meghalaya state has been reduced from 63.98% in 1975 to 55.39% in 1982 (NRSA 1983), which is quite alarming. Besides, natural regeneration of the forest trees is quite poor. Therefore, a scientific analysis of the factors which contribute to the decrease in forest cover and poor regeneration needs to be undertaken. This may help in suggesting appropriate measures to maintain the forest wealth of the region.

Although certain aspects of forest ecosystem such as seed germination and seedling establishment (Boojh & Ramakrishnan 1981a, b, 1982a, Shukla & Ramakrishnan 1981, 1982a); growth pattern (Das 1980, Singh

& Ramakrishnan 1981, 1982a, 1983, Boojh & Ramakrishnan 1982b, c, 1983, Ramakrishnan et al. 1982, Shukla & Ramakrishnan 1984, 1986); phenology (Boojh & Ramakrishnan 1981c, Shukla & Ramakrishnan 1982b); litter dynamics (Singh & Ramakrishnan 1982b, Boojh & Ramakrishnan 1982d); nutrient cycling (Das 1980, Singh & Ramakrishnan 1982a, b, c); mycorrhizal association (Sharma 1981, Sharma et al. 1986) and impact of shifting agriculture (Parkash 1980) in North- East region of India have been studied, there is conspicuous lack of studies on regeneration of trees. Thus a study on the regeneration of important forest tree species of Meghalaya viz., Alnus nepalensis Don, Quercus dealbata L., Q. griffithii Hk. and Schima khasiana Dyer., was undertaken.

The present study on the regeneration of above tree species covers the following aspects:

- (1) Analysis of age structure of the disturbed and undisturbed forest stands.
- (2) Survivorship of tree seedlings and sprouts in the disturbed and undisturbed forest stands.
- (3) The effect of diameter and height of tree stumps on sprouting and survival of the sprouts.
- (4) The effect of burning and sprout density on the growth of sprouts emerged from the stumps of different diameter and height.
- (5) Seed germination, and survival and growth of the seedlings in controlled and field conditions.

- (6) The effect of factors such as soil texture, soil moisture and light regimes on the emergence, survival and growth of seedlings.
- (7) Survival and growth of the transplants (nursery grown seedlings) in different ecological conditions.

The '**General Introduction**' which sets out the objectives of the thesis is followed by the '**Review of Literature**'. The experimental data on various aspects mentioned above have been presented in chapters **II-VI** which are preceded by a chapter on the climate, soil and vegetation of the study sites. Each chapter has been provided with a separate discussion. In addition to this, the results contained in various chapters have been discussed in an integrated manner under '**General Discussion**'.