

CHAPTER 8

FOREST RESEARCH

8.1 Introduction

Forest research is something that is frequently neglected in the rush for exploitation or national development. The history of forest research in Sri Lanka reflects a mixture of this short-sightedness with some notable examples of visionary work. The emphasis of research has changed from supporting exploitation of natural forests towards promoting the wider values of forests, and from internally-managed research programmes within the Forestry Department towards national and international co-operation in research. This trend looks set to continue.

8.2 The development of forest research up to Independence

Champion (1935) paved the way for organised forest research in Sri Lanka. In that paper he recommended the appointment of a Silvicultural Research Officer and the establishment of a separate Silvicultural Research Unit in the Forest Department. This was done in 1937. Like most new ventures this unit was adversely affected by very limited staff and resources to implement its ambitious research programmes that were considered priority areas at that time (Vivekanandan, 1981).

8.3 Research in the post-Independence period

Budgetary support for forestry research has been very low in many developing countries, and following Independence, Sri Lanka was no exception. Decision-makers, who were almost always non-scientists, considered forestry research to be a low priority, but in recent years, with a fast-declining forest cover and inadequate growing stock, both the Government and international agencies have provided the much-needed support. In the early 1960s the budget for research by the Forest Department was only a meagre Rs. 10,000, a mere

pittance compared to what other Research Units, like Agriculture, received at that time.

In its formative years, the Research Unit of the Forest Department handled mainly practical problems encountered in the regeneration, establishment, and management of forest (Nanayakkara and Vivekanandan (1986). In 1949, a Timber Utilisation Research section was established with the objective of studying the strength properties, durability, preservation and utilisation of Sri Lankan timbers, and for the study of lesser-known and less-utilised tree species. Unfortunately in 1985, the Timber Utilisation Branch, which was producing excellent results, was shifted to the State Timber Corporation in a misjudged decision by the bureaucracy, without heeding the advice of the Forest Department. This was a retrogressive step as the Corporation had no staff qualified to undertake the research work. The impasse created in this period was a setback to timber utilisation research. As anticipated, the activity has now been shifted back to the Forest Department, headquartered at Battaramulla (a suburb of Colombo), where, since 1987, it has been co-ordinated by the Research Branch and monitored by a Research Co-ordinating Committee, chaired by the Conservator of Forests.

Although forest research was earlier confined to the Forest Department, over the last decade other institutions – first the University of Peradeniya and then the University of Sri Jayewardenepura – and individual scientists have been conducting research programmes with firm linkages with the Forest Department which co-ordinates the research. Forestry research linkages have been established by the University of Peradeniya with Oxford University in the UK, and by the University of Sri Jayewardenepura with the University of Bangor, in the UK, and with other overseas institutions discussed below. So it would be correct to say that forestry research in Sri Lanka is now firmly established and is a growing concern with international support. International assistance to forestry research is seen as a recognition of the approaches Sri Lanka is taking for the conservation, expansion and wise management of its natural forests.

8.4 The development of forestry research institutions

Currently, the main forestry research institutions in Sri Lanka are:

- Mid-Country Forestry Research Station (MICOFORS), Agaratenna;
- Low-Country Forestry Research Station (LOCOFORS), Kurunegala;
- Forest Research Institute, Kurunegala (proposal for upgrading);
- Sri Lanka Forestry Institute (SLFI), Nuwaraeliya;
- University of Sri Jayewardenepura;
- University of Peradeniya.

Forestry research was decentralised to a certain extent with the establishment of MICOFORS in Agaratenna in the dry, mid-montane zone of Uva province in 1986, and LOCOFORS in the dry-to-intermediate zone at Kurunegala in the North-Western Province in 1988. Proposals have been made to upgrade LOCOFORS into a fully-fledged Forest Research Institute and planning has been set in motion to meet this goal, aided by international agencies. It is hoped that political will will prevail to get this expedited. Research is also being conducted at the new SLFI at Nuwaraeliya in the montane zone which started its teaching activities in 1990. The Institute now has its own experimental forest at Kandapola near Nuwaraeliya at an altitude of 1,986 metres.

MSc. course research work for the University of Sri Jayewardenepura is carried out at the Yagirala experimental forest in the wet zone. This forest was handed over to the University as its experimental forest in 1990. It is an ideal site for certain special subject research work by the postgraduate students. For example, pine underplanting with *Ochlandra stridula* has been done successfully at Yagirala (and at some other sites).

This research aspect of work at the University is new and close co-operation between this institution and the others is now needed to build up a forest research reputation at this University.

Forest research conducted by the University of Peradeniya concentrates on forest ecology, natural forest regeneration, biodiversity, the use of MPTS in agroforestry and some studies on socio-economics. All research, however, is co-ordinated by a central research committee chaired by the Head of the Forest Department, the Conservator of Forests. The progress of the research work is also monitored by the Committee which meets regularly. A significant contribution has been made by the Agriculture Faculty of the University of Peradeniya, jointly with F/FRED, to the scientific practice of the old art of

agroforestry in the country. Agroforestry is now influencing forest management practices and these influences are going to be widespread when agroforestry becomes the mainstay of forestry development in Sri Lanka. When no more suitable land is found for large blocks of industrial forest plantations, emphasis will be on agroforestry and agroforestry pastoral development. Regional workshops have been held by the university on multi-purpose tree species research and development and the proceedings have been disseminated through the Forest Department to all its field foresters (Gunasena, 1993). Agroforestry research findings are of importance in the management of the participatory agroforestry lots that are being established under the ongoing AsDB/Forest Department Participatory Forestry Project. A large number of tree species and crops are now permitted for use in agroforestry.

It is important that the research results coming out of the universities are also disseminated to field staff and given more publicity. There is much research being done on forestry subjects and related disciplines at most of the universities in Sri Lanka and some co-ordination is called for in dispersing important research findings connected with forestry for the better establishment, conservation and management of forests.

8.5 The current forestry research situation

Introduction

Currently, the main objectives of forest research as seen by the Forest Department are:

- provision of technical support to national forestry development programmes through research and development efforts;
- formulating research programmes in keeping with national priorities;
- dissemination of useful research findings among field staff and other end users;
- providing technical advisory services.

The important aspects, mainly those of dissemination and provision of advisory services, gained ground only after 1985 when research staffing was increased. Research is also being continued into species evaluation, tree improvement and propagation, bamboo and cane planting, under-planting and inter-planting, fire control, site/species matching, plantation conversion, and neo-agroforestry.

Natural forest silviculture

The main trend in forestry research in the early years concerned the need for regeneration of the main timber species in the heavily-exploited natural forests in the different climatic zones. These included research on seeds, establishment of seedlings, silviculture and planting techniques. Twelve research centres were established countrywide, despite the chronic shortage of staff, a hundred different species were studied and around five hundred field trials were set up on different sites. Records were maintained, although the analysis of results took time due to a lack of staff. The Research Branch became a virtual storehouse or archive for these records (Vivekanandan, 1987). Other studies undertaken were the phenology of natural forest trees; *ex situ* establishment of species under different soil and climatic conditions; silvicultural treatment of natural forests to improve species composition and distribution; and the yield improvement of forests.

Research into the girdling of unwanted trees, either by purely mechanical means or by poison frill girdling, was carried out in the early years to ensure the success of difficult thinning-type tree removal operations without causing damage to neighbouring trees and regeneration. This also had some influence on management operations in the implementation of the earlier Working Plans. It is also being continued in the implementation of management rules in some of the working circles of the present management plans, especially for natural forests. Only trees that were over-mature, obstructive, dead or dying, dwarf or whip trees were cleaned out by this method.

Plantation silviculture and watershed forestry

In view of the fact that plantation forestry has become the mainstay of the Forest Department, it is not surprising that the directions taken by forest research led to the establishment of better plantations, better yields on different sites in the different climatic zones, and research into vital nursery practices

to meet the needs of the newly-synergised plantation forest establishment. Spacing research trials have also influenced management planting operations in the case of teak in the dry zone and pine in the montane zone. Teak planted earlier at 10ft x 10ft and then at 3m x 3m is now planted at 5m x 2m, while montane planting of pine is now done mostly at 2m x 5m. Earlier planting was at 8ft x 8ft or 2.5m x 2.5 m. With wider spacing on matching sites, both eucalypt and pine plantations have profuse undergrowth.

The new system of management planning differs from the old Working Plans system and includes operations referred to in operation management terminology as pre-commercial thinnings, commercial thinnings, clean-up cutting, and regeneration cutting. Other felling activities are also added to these when and where needed, and working circles modified accordingly.

All these operations need to be carefully monitored as there is the distinct possibility that they may result in overcutting of stands. Thinning research is therefore indicated to determine how judiciously these operations have to be performed. Conservative foresters and forest scientists are generally also very suspicious, when words like commercial, cutting and pre-commercial are used in management prescriptions.

Experiments in stand conversion have had management implications. The conversion was resorted to after some criticism (generally not justified) of the successful planting of *Pinus caribaea* monocultures to serve as catchment forests in the montane Mahaweli river catchment. Conversion of such stands has been successfully achieved by the introduction of broad-leaved species in mainly hilly terrain, but their effectiveness in preventing top soil erosion has yet to be studied. Best results are achieved where the pine trees are planted at a wider spacing and where rainfall is high.

Watershed catchment studies carried out by the University of Georgia, USA, proved the phenomenal success of the *Pinus caribaea* catchment forestation project in reducing siltation and run-off to minimum levels. Hitherto, this has proven to be the best tree cover for catchment purposes. The best example is in the Ginigathhena area in the wet, mid-montane region. The management implications of this research for watershed forestry are therefore clear. Under the catchment-watershed afforestation component of the USAID/Forest

Department of Sri Lanka project, 10,118 ha of steep land had been planted by mid-1988. It was a show-piece planting effort by the Forest Department.

Indigenous tree silviculture and nursery practice

Research into the *ex situ* establishment of indigenous species was also given priority as the Forest Department envisaged the establishment of ten per cent of its annual planting target with indigenous species, but fell far short of expectations in view of the natural difficulty of establishing indigenous species in open barren lands and for the want of adequate aftercare, which is dependent on the cost factor. Research into the growth and establishment of new species and provenances, and into modern nursery techniques and plantation establishment techniques also continued. Forest Department nurseries raise planting stock for the Department's planting programmes, and for raising high quality seedlings and "instant" trees for social tree-planting programmes by the Government and NGOs.

Research into the transport of plants to planting sites is needed however, as at times there is much damage to planting stock during transport. It is often difficult to locate nursery sites close to the planting area. Much thought should be given to the selection of nursery sites, especially in hilly terrain, and the correct transport of seedlings to planting sites adopted. Research into nursery practices is providing interesting results which are sure to pay rich dividends.

Traditional nursery and planting-out practices, especially in the dry zone, have had to change because the land to be planted now is highly-degraded scrub-cum-grass *chena* lands and the traditional planting material (such as bare-root stumps of teak or containerised, polythene-tubed plants of other species) do not give good results. As a result, in the case of teak, the use of bare root stumps is being abandoned in favour of containerised plants or stumps, and "root trainers" for other species. Teak is quite hardy and the root system is fairly well developed at planting, while in other species it is not quite so. In management planting operations these new techniques have been found to be highly successful with good survival. They could therefore revolutionise the planting of both dry zone natural forest species and exotics on the compacted soils of the dry agro-ecological-climatic zone. As for teak, a change from

bare-root stumps to even-tubed plants in this terrain have given superior results.

Forest protection

Research also looked into the nature of diseases of timber and forest trees caused by insects and fungi, and into the damage to forest plantations by deer and elephant. Practical applications were found for controlling defoliation and leaf skeletonisation attacks on teak, borer attacks on satin logs, pinhole borer attacks on rubber wood and fungal attacks on sawn timber. Research has also helped to tackle diseases of seedlings in central and site nurseries.

Utilisation

Timber utilisation research increased the number of species available to the market through promotion of less-known species into the timber classification, while less-used species became more popular. Rubber wood, a disregarded species earlier except for fuelwood, came into the market as a furniture timber as a result of pioneering research in the Forest Department through the use of boron salts to preserve the wood. Now rubber wood is used for furniture not only in Sri Lanka, but also in other countries of the region. The end-splitting of eucalypt logs cut for transmission poles or industrial use has been reduced or controlled by the use of “gang-nail-plates”, a development of utilisation research. A reduction in the number of end-split poles has also been achieved by the timing of felling operations, a principle that has management implications in the management of montane eucalypt plantations for transmission poles, railway sleepers and industrial timber.

Research now under way into oleoresin tapping from pine plantations will have a significant impact in the country in view of the value of resin as an export. Value-added resin is of still greater importance. Almost all *Pinus caribaea* plantations are in great demand for resin-tapping. However, care needs to be taken to ensure that tapping levels do not exceed sustainable levels, and it must also be remembered that tapping can easily ruin the prospects of a worthwhile timber harvest.

Afforestation of denuded lands

From the late 1950s, the Forest Research Branch has had to determine quickly, species that could be grown fast and satisfactorily in many denuded forest lands, including *chena* and grasslands that had to be planted up in the dry, wet, and montane zones. This continued with great success for almost two decades. The ground available for planting was infertile, eroding in some places, open, windswept, and in places, subject to foraging mammals like free-grazing cattle, deer and elephant – a tall order for the researchers. The most successful species were *Eucalyptus camaldulensis*, *E terreticornis*, *Pinus caribaea*, *Acacia auriculiformis*, *A. mangium* and *Leucaena leucocephala*.

The low, wet zone, denuded forest areas were fast turning into indigenous fernlands which were of no economic use. One species that was used for planting up in the 1960s was *Fragraea fragrans*, but it had no timber or utility value. The Research Branch, with only one Research Officer supported by Divisional Forest staff (who were also engaged in other duties), set up a series of trials both in the low, wet zone where invasive grass was a problem and in the montane, wet zone where both edaphic and biotic *patana* grasslands presented a challenge to afforestation.

Many species were tried out, including exotics and indigenous tree species, but *Pinus caribaea*, with its phenomenal growth rate and easier establishment and management, was the obvious choice. Indigenous species failed miserably as they were far too demanding and needed much tending and care at great cost to succeed on harsh open sites. Large blocks of *P. caribaea* were established successfully and became one of the principal species to be planted. The use of this species has had a multiplier effect and it is today a valuable national asset. Apart from use for wood pulp, the tree can be used for rosin, resin and turpentine production. It is the best tree for mid-montane catchments and watersheds. When grown at the correct spacing, indigenous flora creep in and form a dense undergrowth.

With the suspension of the conversion of natural forests into teak under the Co-operative Reafforestation Scheme in 1981, teak was tried out in scrubland reafforestation in a “Modified Co-operative Reafforestation Scheme”, but the teak fared poorly because of the unsatisfactory pre-planting burn provided by the cut scrub and a consequent paucity of nutrients for the initial take-off of

the teak. Indigenous dry zone species tried out on these scrublands (which were really lands subjected to intensive shifting cultivation) fared very badly. Species trials demonstrated finally the success of two eucalypts, namely *E. camaldulensis* and *E. terreticornis* for these lands. Success at planting, however, had mixed results because on some sites, the provenances used did not respond well, for example at Puttalam. However, in some areas of the North Central Province dry zone, eucalypts have proved promising. In an analysis of the results, it was concluded that the provenances used for planting out should be chosen with the utmost care.

Multi-purpose tree and cane species

The Forest Department, in its planting efforts, did try to pacify the lobby that was against the planting of exotic species by once again starting up research into *ex situ* planting, this time of species like *Acacias* and other multi-purpose tree species. The irrational antagonism against exotic trees was partly on environmental grounds, but was perhaps more of a reaction against forestry development on lands which interested parties wanted for future industrial crops, rather than a genuine concern for species choice. This reaction was successfully countered by the Forest Department's awareness programmes, publicity in the press, and practical demonstrations in the field of the success and value of exotic species. The end result was that criticisms of the planting of exotics gradually died down and are today at a low level.

Of the multi-purpose tree species tried out, *Acacia auriculiformis* and *A. mangium* are now used on a management scale in the dry and wet zones respectively. *A. mangium* has also been successfully established in wet, mid-montane regions. Because they are fast-growing and dense-canopied, both species are also popular for amenity planting, hedgerows and home gardens. They are also used for roadside and avenue planting.

Research, sponsored by the IDRC/Forest Department project, continues to be conducted into the planting of bamboo and rattan, the establishment of which is becoming popular. The potential for bamboo and rattan in the country is enormous as they are in great demand for the manufacture of furniture, matting, curtains, curios for export and miscellaneous artefacts. Promising results with management implications have been obtained in the seed propagation of the following species of exotic bamboo: *Thyrostachys*

siamensis, *Dendrocalamus membranaceous*, *Dendrocalamus broundisii*, and *Bambusa arundinacea*. Species site trials are being carried out in Anuradhapura and Kurunegala Forest Divisions. Under-planting plantation forests with rattan cane has been successful, especially in the case of pines. A mixed-management system is being evolved for this new kind of intervention. Cane has also been introduced into wet zone natural forests and into mixed jak/mahogany plantations in the wet and intermediate zones.

Agroforestry and participatory management

Research activities directed at improving production from participatory agroforestry woodlots is under way at the Forest Department's two regional research stations and in the Forest Divisions of Kandy, Matale, Nuwaraeliya and Badulla, where farmers' agroforestry woodlots were successfully established under the AsDB's Community Forestry Project I. They are now being continued under the AsDB's second project. Agroforestry practices in an abandoned tea plantation at Welimada (in which the tea is left as one of the crops) have also been a success. Many popular vegetables have been grown in these agroforestry plots along with trees.

Collaborative research

Foreign institutions play an increasing role in determining the direction of forestry research in Sri Lanka, or at least in helping to implement it. Those currently or recently involved in collaborative research include:

- University of Oxford, UK;
- University of Bangor, UK;
- University of Hawaii, USA;
- Overseas Development Administration (ODA), UK;
- Danish International Development Agency (DANIDA);
- Tropenbos, Netherlands;
- Commonwealth Scientific and Industrial Organisation (CSIRO), Australia;
- International Union of Forest Research Organisations (IUFRO), Austria;
- Food and Agriculture Organisation of the United Nations (FAO).

Apart from the current collaboration in forest research between the Forest Department, Peradeniya University, Sri Jayewardenepura University, Oxford

University and the University of Bangor, it should be recorded that the Forest Department has established research and exchange linkages with many other organisations. These international linkages have enabled the country to benefit from an exchange of research results, participation in seminars, workshops and consultations, thereby gaining more research knowledge, as well as from an exchange of germplasm.

The Forest Department co-operates with the University of Hawaii on *Leucaena leucocephala* (ipil ipil), and with the Commonwealth Scientific and Industrial Organisation (CSIRO) Australia on the supply of genetic materials (Vivekanandan, 1981). Another important link was with the USAID-sponsored F/FRED (Forestry Fuelwood Research and Development) project with support from Winrock International USA (located in Bangkok), with which the Forest Department signed a memorandum of understanding in 1986. The University of Peradeniya followed suit later with its own memorandum of understanding with F/FRED. Much data on multi-purpose tree species planting in the region was obtained as a result of this technology transfer linkage and Sri Lanka's agroforestry programmes benefited. The Forest Department is a Council member of the International Union of Forest Research Organisations (IUFRO). The F/FRED project was conceived and developed at the IUFRO Research Planning workshop for developing countries hosted by Sri Lanka in Kandy in 1984. Other research linkages are with the Danish International Development Agency (DANIDA) and the Food and Agriculture Organisation of the United Nations (FAO). In 1986, a linkage was also established with TROPENBOS of Netherlands whose objective is for "*a united approach for research in the Humid Tropical Forests*", and stresses a co-operative approach (Nanayakkara, 1986c). TROPENBOS is the Dutch word for tropical forest. In an important development in 1994 a Forest Nursery Manual was prepared for the country by the Forest Department with support from the ODA and FAO. It is a useful manual which is now used at all nurseries.

Foreign-aided forestry projects in the country have their own forestry research components with links with the Forest Department. These have included USAID, AsDB, World Bank and IDRC projects. The Forest Tree Improvement Programme, mentioned on page 89 para 8.5, is supported by UNDP/FAO and Australia.

8.6 Future direction of research: development of a Forest Research Master Plan

A National Forest Research Master Plan (Neil, 1991) for Sri Lanka has been mooted and preliminary action has been taken to consider the views of all concerned agencies. However, a Master Plan for Research, like the Forestry Master Plan, could end in controversy if a rational approach is not taken in its preparation and if national needs and national views are not given due consideration. There is, therefore, a need for some participatory influences to guide the preparation of this Research Master Plan. It should be prepared by national foresters and forest scientists in a process driven by them and not by the bureaucracy and donor interests as was the Forestry Master Plan.

Most constraints to the future development of forest research have been overcome with the provision of new staff over the last decade. However, studies have revealed that yet more research staff are required, especially in the eighteen Forest Divisions. As forest research is a long-term business, it is important that research staff are able to conduct their assignments over long periods, without being subject to frequent transfers. The output to date of the research conducted by a small branch with limited funds, such as the Research Branch of the Forest Department, is therefore most creditable, to say the least.