# Why are exotic species used for forestation

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Following the discussion in the *Economic Review* of February 1978 on issues connected with forestry resources in Sri Lanka a former Senior Assistant Conservator of Forests in charge of the National Forestation programme and now the Acting Secretary General of the National Science Council, comments here on some of the biological and economic factors involved in choosing species for forestation in Sri Lanka.

Forestry is a much discussed subject today. It has almost become fashionable to extol the values of forests. Yet, up to a decade or two ago, if forests were mentioned at all, it was generally as an obstacle to progress or as an inexhaustible source of raw material to be pillaged for industry. This trend has changed dramatically, and no one now disputes the evils of deforestation and the benefits of carrying out a reforestation programme to put back into forest those areas that have been denuded of their natural vegetation. In discussions on this subject many conceptions and misconceptions arise; one of these areas of misunderstanding is the use of *exotics* vs. *indigenous* species for forestation. It would therefore be useful to explain the rationale of the choice of species for forestation.

I have used two terms which should be explained before proceeding further. An indigenous species is one which is found naturally in the country i.e. it is a part of the native flora of the country. An exotic or non-indigenous species is one that has been introduced by man. Some exotics that were introduced several years ago have now spread widely by natural dispersal and may be mistaken for indigenous species. Adding one more term, an endemic species (of Sri Lanka, for example) is an indigenous species that is found only in Sri Lanka. Non endemic, indigenous species of Sri Lanka may also be found in parts of the Indian subcontinent and elsewhere.

The total extent of man-made forests in the island is approximately 200,000 acres. Man-made forests or forest plantations are raised either by "afforestation" where land containing no forest cover (e.g. grassland) is planted up or by 'reforestation' where land containing forest is cleared and the area replanted.

The main species used for forestation in recent years were Teak, Pine, Eucalyptus, Albizzia and some 'male' bamboo. All these plant types are exotics. Teak, which alone exceeds, by far, the acreage of all the other species put together, was, it is believed, introduced into Sri Lanka in the latter half of the 17th century. It is indigenous to the Indo-Malaysian region but is not native to Sri Lanka.

Eucalyptus, the home of which is Australia, is a genus with over 300 species. One could say that there are species of Eucalyptus to suit almost any site or climate in the tropics and sub-tropics. In Sri Lanka, one species of Eucalyptus *(E. camaldulensis)*, is planted in the dry zone, while there are quite a few suitable for the montane zone and the wet lowlands.

Teak, bamboo and the species of Eucalyptus referred to above have been planted in the dry zone. Pinus is planted in the patana grasslands of the upper and lower montane zone (e.g. Uva patanas, Belihuloya etc.) as well as in the low country wet zone. Of the many species of Pinus, *Pinus caribaea* is a remarkable species. It thrives on the most impoverished of soils. In the mid-country patanas (e.g. on either side of the road between Belihuloya and Haldumulla), in derelict and abandoned tea lands where the top soil has eroded away, and in abandoned chenas of the wet zone where nothing but the Kekilla fern and grasses

abound, *Pinus caribaea* when planted, not only readily establishes itself, but also shows rapid and vigorous growth. Its adaptability to our degraded sites in the wet lowlands was discovered about 10 years ago, and since then, it has been used to convert many hundreds of acres of barren wastelands to highly productive forest plantations.

### The Wet Zone

Let us go back to our original question now, why *Pinus caribaea?* Why not *Hora (Dipterocarpus)*, Dun or other indigenous species? The reply generally given by foresters to this question is that indigenous species are too slow growing. However, this is neither an adequate nor a complete answer.

Let us examine this question in relation to the region we call the wet zone. The natural climax vegetation of this region is the Tropical Rain Forest (TRF). The TRF is in fact the climax vegetation of the wet tropics in all equatorial regions of the world. The forests of the Congo, Amazon and Malaysia are similar in general structure (though not in the species composition) to our Tropical Rain Forest. The Tropical Rain Forest could be described as the most complex and the richest ecosystem found anywhere in the world. With an abundance of life-giving sunlight and water, and with an equable temperature throughout the year there are more ecological niches in the TRF than in any other ecosystem on earth. Recently, a research team of the Botany Department of the Peradeniya Campus enumerated 145 species of trees in 10 one-acre plots in the Sinharaja Rain Forest. Such richness of species is unheard of outside the humid tropics.

In sharp contrast to the richness of the flora, the soils of the Tropical Rain Forest regions are generally very poor in nutrients. Most of the free nutrients released by rock weathering, unless utilized by the plants, get rapidly leached out because of the very heavy rainfall. The rich and complex TRF has evolved over the millenia and sustained itself by the rapid utilization of any available nutrients. In the forest, all leaf debris and other decaying organic matter in the soil are rapidly decomposed under the prevailing conditions of high temperature and humidity, and the nutrients that are released are literally snapped up by the plant roots. There is therefore a continuous cycling of nutrients, and the ecosystem though so elaborate and complex is nevertheless a very delicately balanced one.

If such a forest is cleared, the utilizable timber removed, the balance material burnt and the land chena cultivated, the nutrient cycle is drastically disrupted. Most of the nutrients that were in circulation in the TRF ecosystem are lost for good by the removal of timber and by the leaching out of what is returned to the soil with the burn as well as by the burn itself. For all practical purposes we could assume that the disruption of a TRF in this manner is an irreversible process. No human effort can reconstruct a Tropical Rain Forest ecosystem in such an area. Attempts to raise a mixture of species, anything like that found in the natural forest in an abandoned chena area, even if we were to add fertilizers to the soil, could never be successful.

There are thousands of acres of such land in the wet zone now in scrub jungle or covered with the Kekilla fern. If these areas are unsuitable for permanent agriculture they could be used for forestry only by reforesting them with a species that will tolerate the very infertile site conditions, and we cannot expect a TRF tree species to meet this requirement. Of the species tried out, one in particular, *Pinus caribaea*, was predominantly successful in establishing itself in such sites, and it was therefore the automatic choice for reforestation. Fortunately *Pinus caribaea* is a valuable species, particularly as a source of long fibre pulp for the paper industry.

### Determining Factors

This brings us to another aspect of forestation. While the choice of species will have to be confined to the ones that will tolerate the site conditions and would show reasonably rapid growth, the field will be narrowed down further by confining our selection to one or more species that would provide us with a particular type of timber to meet future needs. In any country, the projected demands will be a determinant factor in deciding on the magnitude and composition of the forestation programme.

The total extent of natural forests in the wet zone (including the montane region) is a little over 300,000 acres. Of this, perhaps only 200,000 acres could be described as Tropical Rain Forest, the balance being montane and submontane forests.

A Tropical Rain Forest need not remain unproductive since what is termed selective logging can be carried out without causing any serious imbalance to the ecosystem. In selective logging, upto 500 cu. ft. of timber per acre is removed at 20 yearly intervals — if the forest in question is divided into 20 blocks, one block can be worked each year. Such a felling if done in accordance with silvicultural rules, is well within the resilence limits of the system. The amount of nutrient so removed is below the annual turn-over of nutrients in the TRF (Brunig, 1977) and there is no serious damage to the structure of the soil or any adverse effects on the population of micro-organisms. In the scattered gaps created by the selective felling numerous seedlings of the forest dominants like hora etc. appear, and under these conditions they show reasonably rapid growth. Eventually the composition of the TRF may show some change from its primeval state, but it will still remain a Tropical Rain Forest with its great diversity and complexity. If a TRF is assuredly to remain in its primeval form, retaining all, the original species intact, then no logging should be done at all. It is in order to ensure that samples of the main forest ecosystems are retained in their primeval or near primeval state that certain representative forest areas have been demarcated and preserved as Man and Biosphere Reserves.

I have discussed the TRF at length as this illustrates the general principle that natural ecosystems once destroyed cannot be artificially reconstructed, least of all the Tropical Rain Forest.

### The Dry Zone

In the dry zone, the Dry Mixed Evergreen Forest is the natural climax vegetation. However, this forest ecosystem is not primeval since most of the dry zone was at one time or another cultivated, and the natural forest now found in the area is what has got

naturally re-established after the cultivations were abondoned several centuries back.

The dry zone forest ecosystem is not at all so complex as the Tropical Rain Forest. The soil is generally richer in mineral nutrients, and the destructive effects of forest felling are less serious than in the wet zone. The ecosystem is also more resilent than the TRF, and it is not uncommon to find seedlings of natural high forest species like palu, satin and milla in areas where forests have been cleared. But one serious problem in regard to the artificial propagation of indigenous tree species in the dry zone is what was stated originally i.e. their exceedingly slow growth. So, although we cannot artificially reconstruct the original mixed forest once destroyed, we could raise plantations of one or a few indigenous species. But the rate of growth of most of these species is very slow (Wijesinghe, 1959: Fernando, 1962) — about 3 to 4 times slower than teak. This means the rate of production of wood is that much slower and the cost of maintenance of plantations that much higher. The strategy for the dry zone is therefore, clearly, to raise large extents of relatively fast growing species e.g. teak, so as to ensure supplies to meet future needs, and to progressively reduce fellings from the remaining natural forests as the supplies from plantations increase. The natural forests that are left can be partly preserved for purely conservation purposes and partly selectively expolited without causing permanent damage to the ecosystem.

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