The
CEYLON FORESTER

Vol. II, No. 2 (New Series)

Published by the Forest Department, Ceylon

PRINTED AT THE GOVERNMENT PRESS, CEYLON

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THE CEYLON FORESTER

The Ceylon Forester is published biannually by the Forest Department, Ceylon.

The Department does not hold itself responsible for opinions expressed in articles published. Criticism of Government policy or other Government departments will not be published without the prior approval of the Permanent Secretary, Ministry of Lands and Land Development.

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Contributors will be supplied with 12 extra copies of their contributions together with illustrations free of charge if 2 pages or more in length.

Subscriptions :—	Rs.	c.
Annual	1	50
(Concession rates to all forest guards, gameguards and forest overseers)	1	00
Single copies	1	00

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2——J. N. B 45566–755 (7/55)

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July-Dec., 1955

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"The forest is a peculiar organism of unlimited kindness and benevolence that makes no demands for its sustenance and extends generously the products of its life activity; it affords protection to all beings, offering shade even to the axeman who destroys it".—Gautama Buddha.

EDITORIAL NOTES

THE New Series of *The Ceylon Forester*, revived after a lapse of over half a century, has with this publication completed three years. Whilst the revival itself was the outcome of the enthusiasm of the previous Editor Mr. K. O. Koelmeyer, his indefatigable efforts have contributed in no small measure to the phenomenal success of this journal. The present Editor and all interested in the welfare of *The Ceylon Forester* thank Mr. Koelmeyer for his splendid work.

Fourth World Forestry Congress

THE Fourth World Forestry Congress was held in December, 1954, at the Forest Research Institute, Dehra Dun, the premier centre of forest Research and education in Asia.

All shades of colour and political creeds assembled at this conference and worked in unison to stamp the importance forestry played in the welfare of mankind. Today, when in most quarters the forest is considered merely a receptacle of timber to be done away with, with an "advancing civilization", it is indeed refreshing to note the most distinguished members of the forestry profession in the world rally together to pronounce in unmistakable terms to the world the imperative necessity of the retention of the forest and the dominant part it plays in proper land management.

The following countries participated in the deliberations:—Argentina, Afghanistan, Australia, Austria, Burma, Belgium Congo, Ceylon, The People's Republic of China, Czechoslovakia, Canada, France, Finland, Germany, India, Italy, Japan, New Zealand, Pakistan, Netherlands, Switzerland, U. S. A., U. K., and U. S. S. R.

Ceylon was represented by Dr. C. H. Holmes and Mr. R. A. de Rosayro. The former was elected Chairman of Section II of the Congress and the latter Rapporteur of Section III.

Fellowship

Mr. R. A. de Rosayro, Senior Assistant Conservator of Forests (Management), proceeded to the U. S. A. in early January on a F. A. O. Fellowship. He has visited Costa Rica, Switzerland, Morocco, Paris, and will be returning *via* Rome in mid-August.

Mr. S. Namasivayam, Assistant Conservator of Forests, has proceeded to Oxford last October on a one-year study tour sponsored by the Colombo Plan.

Forestry Conference—Tokyo

Mr. E. C. Tamby Raja, Senior Assistant Conservator of Forests (Utilization), represented Ceylon at the third sessions of the Asia Pacific Forestry Commission organized by the F. A. O. The conference was opened at Sangyo Kaikan Conference Hall at which 10 member-countries participated. At an inaugural meeting of the F. A. O. in Kandy Mr. Tamby Raja has indicated that Japan being a timber importing country, is making rapid strides at reforestation to become self-sufficient in timber. Government aid is given freely to national and private forests to increase the timber wealth of the country both for productive and protective uses. Schools have come to the forefront of the tree-planting campaign, having their own nurseries and organized planting being done by students.

Farewell

Mr. V. Chelvathurai, Accountant, was transferred to the Survey Department on March 10, 1955, bringing to an end his association with the Forest Department lasting close on 27 years. His outstanding efficiency earned for him early recognition and he was entrusted with many responsible duties the first of which was introduction of the Turner Office System to all the offices of the department in 1929. He specialized in accounting and after serving as Head Accounts Clerk and Chief Clerk at Head Office secured appointment as Temporary Assistant Accountant in October, 1943. He was appointed permanently to Class IV of the Accountants' Service in May, 1950, and was promoted to Class III in December, 1953.

Mr. Chelvathurai was closely associated with the formation and growth of the Forest Department Mutual Provident Association and the Forest Department Sports Club. He served as Honorary Secretary of both bodies in the early stages and was later on both Committees, giving freely his sound advice and guidance for several years.

While being strict in his duties Mr. Chelvathurai was a very considerate superior. He was a loyal friend. His absence from the department will be felt for a long time by all who came in touch with him.

Obituary

IT is with deep regret we record the death of Mr. S. Suppiramaniam, Accountant of the Forest Department, who passed away on June 2. He joined the Forest Department on March 10, after serving in the Home Ministry. His early death is indeed a loss to the Public Service. To his family we offer our condolence.

NOTES ON AN EXCURSION TO THE NILGIRIS AND WESTERN GHATS, SOUTH INDIA, DECEMBER 5TH TO 9TH, 1954

R. A. de Rosayro

GEOLOGY OF THE REGION

THE geology of the region of the Nilgiris and the Western Ghats, South India, was brought out well in the flight from Madras to Coimbatore *via* Bangalore, as well as in the excursions by bus from Coimbatore to Ootacamund, roughly 7,500 feet about sea level, to Nilambur, 900 feet above sea level. This region is closely allied geologically to Ceylon, having being derived from metamorphic gneiss and granite which show the same characteristic features of a series of ridgebacks or strike ridges thrust out from a peneplain extending from sea level to about 1,000 feet and containing isolated and rugged monadknocks or inselbergs. The semi-high plateau of the Nilgiris rises abruptly from the plains to over 8,000 feet, the Nilgiris proper consisting of undulating country with grasslands and shola, the latter being confined to the valleys and hollows. The Western Ghats in this region are characterized by steep escarpment slopes on both the eastern and western sides, which are rugged and partly bare of vegetation. The semi-high plateau of the Nilgiris is about 200 square miles in extent and is flanked by the continuous wall of the Western Ghats proper ; the semi-high plateau is surrounded by a series of sharp peaks, the highest of which is the Doddabetta peak (8,800 feet).

THE NATURAL VEGETATION OF THE REGION

Dry Mixed Evergreen Forest

THE forests of the escarpment slopes are of the mixed evergreen type as almost up to an elevation of 3,000-4,000 feet. In the forest between Mettupalayam and Ootacamund, many species characteristic of the same type of forest in Ceylon were observed. The rainfall here was stated to be less than 60 in., annually, but the North-East Monsoon is the rainy season. Terminalias, Pterocarpus marsupium, Careya arborea, Schlichera trijuga, Teak, Lannea grandis and Satin occur ; the last named being in much smaller sizes than in Ceylon and giving a darker and less valuable timber. The forest is of the same order of height growth as the Ceylon type.

The Wet Evergreen Forest

Only a small section of wet evergreen forest was seen on the southern flank of the western Ghats, a forest stated to be the property of the Nilambur Kovilagam, it lies between Gudalur and Nellikutha at an elevation of about 2,500 feet and above. The whole of the north-eastern flank of the Nilgiris, which rises steeply and terminates in a series of peaks, including Mukuthi mentioned earlier ; this region receives an annual rainfall of over 200 inches. The upper slopes at altitudes of over 3,000 to 4,000 feet contain the shola type of forest described below. The forest seen on both sides of

the main road is a somewhat degraded type due to heavy exploitation. It is stated to contain Mesua, Calophyllum and Hopea, but these were not observed. Alstonia scholaris, Artocarpus hirsuta, Campnosperma species, Dillenia sp., and characteristic understory species, shrubs and canes were identified.

Savannah Forest

This is an intermediate and isolated type seen between the wet evergreen forest and the grasslands of the Nilgiris. It has a few scattered trees including Careya arborea, Terminalia chebula, Anogeissus latifolia in grassland containing Chrysopogon and possibly Imperata species. Phoneix dactylifera is a characteristic and frequent species of this type. This type of savannah is attributed to shifting cultivation and recurrent fires.

Moist Deciduous Forest

This is actually included in the mixed dry evergreen type but the type is somewhat modified in the valleys and moist alluvial sites of the Nilambur valley and results in a very good type of high forest of good growth and stocking and in which economic species are well represented. This forest contains trees up to 150 feet and more in height. Natural teak grows fairly well here. The chief species are however Terminalia paniculata and tomentosa, which are both valuable timbers, Laegoetraemia lanceolata and flos-regina Strychnos nuxvomica, Pterocarpus, Tetrameles nudiflora and Grewia tiliaefolia. Dalbergia latifolia (rosewood) is also found in this zone. Bamboo (Bambusa arundinacea) is the characteristic understory of this type of forest.

THE GRASSLANDS AND SHOLAS OF THE NILGIRIS

THIS formation is unique in India and corresponds most closely to the patanas and evergreen montane forest of the Uva basin in Ceylon. The grasslands of the Nilgiris are confined to the rolling downs of the semi-high plateau, from 6,000 to 8,000 feet roughly. Shola or forest is confined to hollows and valleys which merge into the wet evergreen forest below. The grasslands are of the short close-cropped variety and include species characteristic of the dry patana zone of Ceylon. Themeda tremula, Cymbopogon spp. and Heteropogon spp. were observed. A characteristic shrub of these grasslands is Hypericum mysorense. Rhododendron arboreum var. nilagiricum is found in the moister regions particularly in the vicinity of the sholas. These grasslands are associated with rainfall of about 60 in. annually and therefore even at these high altitudes are not peaty and tufted like the wet patanas of Ceylon. They are associated with friable soils which respond well to cultivation, potato being the chief crop grown around Ootacamund. The soil is stated to be deficient in calcium and nitrogen.

The *sholas* are very similar to the montane forest type of Ceylon. They are a stunted formation and contain the same and similar species, such as Ternstroemia japonica and spp., Michelia nilagirica, Litsea and Neolitsea spp., Syzygium spp. and Strobilanthes and Ochlandra spp. in the undergrowth. The height growth and form of the trees improve as one descends to the moister zone of heavier rainfall on the north-eastern slopes of the Nilgiris. Here the grassland is more tufted and includes Chryspogon spp. similar to the dominant Chrysopogon zeylanicus in Ceylon.

THE ORIGIN OF THE GRASSLANDS

THE two theories which I am familiar are (1) the frost theory of Ranganathan who suggests that the grasslands are associated with severe frosts which prevent the establishment of trees, the sholas being confined to the protected sites. (2) The second theory is that of Bor who states that the grasslands are a biotic type brought about by clearing of the natural forest and firing, the sholas being the vestiges of the original forest. Champion also holds that there are no natural climax grasslands in the tropical regions of India. Here again as in Ceylon, there is no evidence of ancient shifting cultivation at these high altitudes. The original inhabitants of this region and who still exist as a small and diminishing race are the Todas, a tribe with strongly Semitic physiognomy, who are a purely pastoral people subsisting mainly on the milk of the buffalo. They are stated to show a *strong disinclination* on religious grounds to agricultural work involving manual labour. It is conceivable that the grasslands are an edaphically conditioned type.

AFFORESTATION IN THE NILGIRIS

THE earliest plantations raised by the Forest Department are the blue gum stands in Aramby shola, a few miles from Ootacamund. These are highly successful and the oldest plantation of the series is a tree increment plot preserved from 1863. This is a majestic stand, the tallest measured tree being 241 feet in height and the maximum girth being 19½ feet. The average height and girth of the stand is 200 ft. and 10 ft. 8 in. respectively. The plantation is being worked on a coppice rotation of 15 years for fuel. Here as in the private plantations of blue gum in the neighbourhood, distillation of eucalyptus oil is an important cottage industry, both the fresh as well as the fallen dead ones being used, the distillation being done in crude home-made stills. Heavy lopping of the side branches up to 2/3 the total height of the tree is permitted in the private plantations so that most trees have a curious palm-like appearance. This method, to my mind, is somewhat drastic. The return is considerable, about Rs. 150 per acre annually.

Large-scale wattle plantations of Acacia molissima have been started in the catchment of the Murkurti river in its upper reaches as both a method of land-utilization and tan-bark production. 500 acres have been planted annually from 1950 with wattle in belts of 60 lines 11 by 11 ft. with blue gum belts in between of 6 lines at the same spacing, the latter being to serve as wind belts. No fencing is done. The technique is simple, pits 1 foot cube being dug and weeding being restricted to patch-weeding only. The results are variable but the method may be considered to be suited to the locality, though the necessity for the blue gum is doubtful. "Mossed" transplants are now being used and fertilizer applied at the cost of Rs. 9 per acre. Ammonium sulphate in a patent mixture is stated to be used. The cost of planting is about Rs. 40 per acre. Two maintenance weedings in the first year are done ; bracken is used to protect the plants from frost damage at this time of the year. Similar plantations of blue gum are being raised departmentally around Ootacamund. The purpose of these plantations is to use the wattle for tanning extraction and the blue gum for rayon manufacture after test at Dehra Dun. I have ascertained from Prof. de Phillipis of Italy that rayon manufacture is done on a substantial scale in Italy from E. saligna.

NILMBUR TEAK PLANTATIONS

THESE are situated in the Nilambur valley at an elevation of about 900 feet on fine alluvial soil and are well watered by two rivers which also afford facilities for transport by rafting from Nellikutha to Calicut, a distance of about 40 miles and taking 2 to 3 days. The site for teak is exceptional as can be easily gauged from the composition and height growth of the natural forest. The plantations comprising about 8,000 acres in scattered blocks have been raised by taungya, the peasants paying a premium of about Rs. 70 per acre for the right to cultivate. Taungya is restricted to one year only and hill paddy is the only crop raised.

At Nelikutha we were shown a stand of All-India tables first quality teak, 24 years old with an average height growth of 100 feet and G. B. H. of 4 feet. The trees are exceptionally straight and with fine boles. This is, however, a somewhat exceptional area, the average quality being third. The floor of the best stands is covered by woody shrub growth but, generally, the bamboo, Bambusa arundinacea, has invaded the area and tending operations have been carried out in some plantations to eradicate it. Teak in this section (series) as well as in Kanjira Kaduvu through which we pased is worked on a 70-year rotation. Some of the older stands have already been felled and replanted with teak. Natural regeneration of teak is scarce and is not sought after. The final yield is about 1,500 cu. ft. per acre, working out at 6 per cent. compound interest on the capital up to 1945.

We observed elephants at work (for demonstration). An interesting point is that dragging is done by the mouth and not by harness. We also saw a week old calf which had been born in captivity.

The most striking show-piece was Conolly's plot, a preservation plot from 1846 plantation. The largest trees are over 150 feet in height and 10 feet in girth. Each of these trees contain about 500 c. ft. of timber and at current prices is worth about Rs. 1,500 each. We were also shown the methods of rafting by bamboos and by boats. The teak nursery was seen *en route*. Ours in Anuradhapura compares very favourably with this. It appears from a comparison with our teak, that we have largely used seed of Indian origin in our plantations.

MISCELLANEOUS ITEMS OF INTEREST

THE Madras Forest College was inspected. This is a well equipped and impressive establishment, the museum, in particular, being most comprehensive and illustrative of the flora and timbers as well as other forest activities. Sandalwood is an important and valued product of the Madras Presidency but is now dying out due to spike disease which has not yet been brought under control.

The Government cinchona factory at Naduvattam on the foot-hills of the Nilgiris is interesting. Cinchona ledgeriana and the hybrid form is grown, the extraction of quinine and by products being done by modern methods. The fruit research station at Burliar at 2,500 feet elevation was interesting in its variety of tropical fruits. Between this station and Mettupalam were observed irrigated arecanut plantations, a very paying crop raised by the villagers and also a small irrigated plantation of 55 acres of teak on the plain below the Nilgiris.

ACKNOWLEDGMENT

I am grateful to Mr. E. A. Lasrado, Conservator of Forests, Ootacamund, for having read over these notes and suggested many corrections and additions.

RECOMMENDATIONS OF THE FOURTH WORLD FORESTRY CONGRESS

(Extract from a report on the Congress by Dr. C. H. Holmes)

A summary of the recommendations under each of the more important items is given below.

THE PROTECTIVE ROLE OF FORESTS

Forest Influences

(i) Intensified research should be conducted on forest influences on a co-operative basis between meteorologists, hydrologists, agriculturists and foresters.

(ii) International bodies like the F. A. O., U. N. E. S. C. O., I. U. F. R. O. should collect and write up all information available up to date.

River Valley Development Projects

(i) Where valley development projects are undertaken, prior attention be given to the treatment of the catchment from the Forestry angle with a view to reduction of costs, increased efficiency and longer life of engineering works involved.

(ii) In catchment basin-control there should be close collaboration and co-operation between engineers, agriculturists and foresters.

(iii) As finance is a limiting factor, costs of essential works and value of returns to be expected from them should be carefully examined.

(iv) Local land use practices should be given due weight.

(v) The F. A. O. should help set up working groups, similar to the European Working Group for torrent and avalanche control, for the purpose of study of stream control and catchment management.

Shelter Belts

(i) In all areas undertaken for new settlements adequate and suitably distributed belts of forest should be carefully retained, i.e., instead of clearing forest wholesale and then seeking to put it back where it is desired.

(ii) All available opportunities for the establishment of avenues or belts of trees along roads, rail roads and canals should be taken.

(iii) In view of the dangers to which such belts are exposed special care should be taken to see they are maintained.

(iv) Research be undertaken particularly in arid and tropical regions—

(*a*) to reduce any immediate adverse effects of shelter belts on crop yields directly or indirectly through shelter afforded to vermin.

(*b*) to help determine choice of species, methods of establishment, composition, widths and siting of belts.

(c) to find relative influences of single isolated or groups and belts of trees in and around cultivated fields, cities, around reservoirs and along roads and canals.

Soil and Water Conservation—Education

(i) School syllabuses should include principles of conservation of soil and water, and provide for teaching them as an integral part of their general curriculum.

(ii) All possible means and opportunities of spreading the gospel of conservation amongst the public should be taken and special training in propaganda work should be imparted in schools particularly in those of Forestry and Agriculture.

(iii) Such teaching should be supplemented by practical work in school wood lots.

(iv) Civil Servants working in rural areas should receive short courses of training with the Forest Services.

(v) Public education being itself the responsibility of specialists, foresters should combine with them at all levels, e.g., in close co-operation, at the international level, with F. A. O., U. N. E. S. C. O., in this work.

Principles of Water and Soil Conservation

(i) No unused land capable of supporting vegetation should be left bare.

(ii) Every drop of water falling on the land should be utilized to maximum benefit.

(iii) Land use determination should be on the basis of comprehensive survey and planning directed first to those regions most urgently needing attention.

(iv) All people particularly in rural areas should receive instruction in soil and water conservation.

PRODUCTIVE FUNCTIONS OF THE FOREST

Management Policy

(i) Changes in economic conditions should be met by adjusting growing stocks for new requirements within and without upsetting the biological equilibrium of the forest.

(ii) The area under forest required to meet production needs must be adequate.

(iii) Forests should be maintained on all lands best suited to Forestry.

Forest Management

(i) Emphasis be given to :

(a) the need for creation of public consciousness of the importance of Forestry.

(b) grant of public assistance be given to small private forest owners.

(ii) The F. A. O. call a world conference on *Eucalyptus* with a view to setting up of an international commission on the lines of similar commissions looking after chestnut, poplar and teak.

Forest Grazing

(i) the development of silvi-pastoral plans of management wherever possible.

(ii) the consideration of the need for and practicability of limiting grazing to definite areas.

(iii) investigations as to possibilities of adding to fodder trees and grasses.

Wildlife Management

(i) Wildlife is an integral part of the forest complex and its proper treatment and maintenance are important to man.

(ii) The idea of wildlife as a forest product should be adequately recognized and special research is needed to provide necessary basic knowledge for wildlife management practices.

(iii) Whereas in tropical lands wildlife must be segregated to distinct areas for protection of agricultural crops, this should be done by confining certain animals to specially managed areas.

(iv) For complete protection of certain species of fauna suitable legal enactments and special nature-reserves or sanctuaries are required.

The discussions also covered the recreational values of forests in its manifold aspects other than of hunting and concluded that :

(i) Recognition should be extended to value of forests for recreation as a basic human need.

(ii) The use of forests for such purpose should be encouraged by education of public and the formulation of forest management policies and methods to that end.

FOREST PRODUCTS UTILIZATION

Status of Forest Workers

(i) Study production rates of forest labour with a view to increasing efficiency.

(ii) Possibilities of improvement in tools and technique in forest operations.

(iii) Training of workers in use of tools and equipment should be organized.

Timber Uses and Treatment

(i) Collect and disseminate all technical data regarding physical properties and utility of all timbers and distribute the same on a national or regional basis.

(ii) Standardize suitability coefficients for different timbers for different purposes.

(iii) Prepare standard specifications for marketing timbers.

(iv) Carry out propaganda and demonstration of the possibilities of using secondary timbers after suitable treatment.

(v) Intensify research on increasing uses of non-durable timbers and prophylactic post-felling treatment to prevent damage.

Role of Forests in Economic Development

(i) Research and standardization of tests on new building materials and exchange of information on them.

(ii) Research on stress grading of structural timbers and intensification of research on glues and paints.

(iii) Propaganda and demonstration in wood uses amongst architects, engineers, and other industrialists and wood users.

(iv) A complete inventory of forest resources is the only sound basis for planning forest-based industries.

(v) Training in use of wood-working machinery.

PREVENT FLOODS WITH NATURAL DAMS

W. G. Weeraratna

THE recent floods particularly in the southern sector of the Island, causing untold hardship to man, beast, and plant, should awaken one to the urgent necessity of taking steps to prevent a recurrence of this in the future. Enthusiasm of the social workers is suddenly roused, flood relief societies crop up in every village, and the same enthusiasm subsides with the flood waters awaiting another periodical outburst. With the receding waters epidemics and pestilence are left behind taking further toll of life. It is opportune now to reflect on the cause of these periodic visitations and work out methods of combating the scourge. Floods are not a feature common to any one country. The recent floods in Assam, Bihar, and the Uttar Predesh have caused misery of an unprecedented nature throughout India, rendering hundreds of thousands homeless. To an ignorant public these are natural calamities which only God can avert.

Earlier Schemes

Innumerable schemes have been drawn up from time to time in Ceylon to mitigate the devastating effects of the floods particularly along the banks of the Kelani Ganga. Most of the schemes are of an "engineering nature" designed to tackle the problem down-stream and are more curative than preventive measures. Mr. R. L. Brohier has in a recent article reviewed some of these engineering schemes suggested by Layard, J. F. Churchhill, Sir John Coode, &c., from as far back as 1872. The dangers of erosion and siltation by deforestation were appreciated as early as the latter part of the 19th century by Sir J. D. Hooker, Trimen, F. D. A. Vincent of the Forest Service and by Eden in 1930. The writer suggests nature's method of preventing floods by growing more trees and tackling the problem at the source rather than at the end.

Nature's Channels

Throughout the geological ages nature has carved out channels along which water takes a natural course. Long before man appeared on the face of the earth "the land and the waters" existed side by side in perfect harmony, the one not encroaching on the other. Nature has built up the best dams in the form of trees to check the speed of water and restrict its passage along grooved channels called rivers. Where man asserted his superiority and destroyed these natural dams, nature has revolted in the most damning manner, unleashing its fury.

In a country like ours, rainfall is not distributed evenly throughout the year. The bulk of the annual rainfall is precipitated during the monsoonal period. Rain that falls could take two courses. It could percolate down into the soil in a more or less vertically downward direction or it could flow away horizontally along the surface. The entire question of floods is fundamentally pivoted on the initial directional flow of water that is precipitated in large quanta in the monsoonal period. If every single drop of water that falls at any time takes the downward course of seepage into the soil,

a rich and fertile soil would be built up, storing sufficient water for plant and animal life throughout the year. Along underground springs pure limpid waters would flow incessantly, only the excess water being discharged into rivers along which it would flow peacefully downwards. If, however, the initial flow of rain water is more or less along the surface, with a large precipitation of rain there would be a rapid run off into streams, the condition being aggravated in steep terrain. From the streams water would rush into rivers. The river bed has a limit of water-holding capacity—any excess over this is discharged over the bunds, fanwise, resulting in floods, its severity depending on the intensity of run off and the volume of the discharge over the bunds.

Hence, the crux of the problem is to determine why the greater portion of precipitated rain water does not percolate downwards into the soil and how it could be made to do so. To appreciate this problem at least a superficial knowledge of the biology of an individual tree, and the biology of the soil under a composite group of trees (or a forest) is a necessary beginning.

Biology of the Tree

A tree consists of a root system, a main stem, and branches with leaves. One of the functions of the root system is to hold the plant firmly in the soil, to prevent it being thrown off by the wind. To ensure this the plant puts out an intricate meshwork of roots running in all directions, closely adhering to the soil. One who is experienced in gardening sometimes finds how difficult it is to uproot a tuft of grass. This would indicate with what tenacity the roots of the grass grip the soil. With a tuft of grass behaving in this manner one could imagine how the roots of a giant forest tree would behave. In a forest, plants of all forms are found—ranging from the creeping grasses to the giant trees of the overwood, with innumerable shrubs in between. Each of these different types of plant forms have their root systems at different depths in the soil. Thus the entire " root organization " of the forest could play a tremendous role in gripping the soil and holding it firm. Besides holding up the soil the root system contains innumerable minute organs which absorb the soil moisture and conduct it along the stem to the leaves. The leaves utilize the water and the excess is thrown out by the process known as transpiration, whereby the moisture content of the air and its relative humidity is increased. This moisture is ultimately precipitated once again in the form of rain, to be reabsorbed by the soil and in turn by the roots. Thus a complete cycle is created, the different phases being : absorption by roots—conduction by the stem—transpiration by the leaves—precipitation in the form of rain—percolation into the soil—and reabsorption by the roots. The most important link in this cycle is the tree and the entire cycle will collapse if the tree is eliminated.

Influence of Forest

Although there is conflict of opinion as to the over-riding influence of forest in causation of rain, the significant role played by the forest in the retention of water brought by rain is not contested. The leaf in the living form on the branches acts as the strongest bulwark against the beating power and the erosive force of the rain-drops. In bare land without any tree growth the striking power of the rain-drops is itself sufficient to break up the crumb structure of the soil, and set the colloidal particles of soil in motion, to be deposited ultimately in the Indian Ocean. Besides the physical defence the leaf affords to the soil, it plays a significant role in improving the soil texture and increasing its permeability. Leaves of all plants drop

off after a period of active life and in due course is broken up into minute particles by microbiological activity of the soil microfauna and microflora. This broken down leaf litter, technically known as "humus", is in turn intimately mixed up with the soil by larger soil fauna such as the earth worms, termites, ground-inhabiting beetles, rats, mice, &c. Humus by its very nature is spongy, and its mixing with the soil renders the latter highly absorptive, increasing its water-retaining capacity. If a handful of humus is obtained from under a tree after a heavy shower and the humus squeezed, one would be surprised to find the quantity of water it could hold. A forest soil thus enriched by humus would permit absorption and percolation of a large quantity of water that falls during the monsoonal period. A soil bereft of any tree growth would have no humus in its composition, and its water-retaining capacity would be negligible. This is the fundamental difference between a forest soil and a non-forest soil. A forest soil permits percolation of the water downwards, whilst a non-forest soil would cause the flowing off of water along the surface.

Carrying Power of Water

Water that runs off takes the path of least resistance, the run off being faster on sloping lands. In the absence of tree growth, no mechanical obstruction is afforded by stems and roots to slow down the speed. Hence on barren land water takes a free course. In this process the water first carries the finer particles of soil in the upper layers. With prolonged free play of water, it eats its way into the soil further down carrying with it gravel, followed by boulders. Gullies are opened out and an advanced form of erosion sets in. In the absence of further resistance to the flow of water its speed increases. With the increase in speed the carrying power of the water increases. It has been ascertained that the carrying power is approximately proportional to the fourth power of its velocity. (To put this in more simple language, if water flows at the rate of 2 miles per hour and at this speed it can carry an object 25 pounds in weight, if the speed is increased to 8 miles per hour it can carry 25×4^4 or 6,400 lb.). With a torrential downpour on unprotected land the rushing waters develop a bewildering carrying power. Hence it is not surprising to hear of elephants being carried off along with the trees to which they were tethered in times of floods. With such a high carrying power that water can develop, one could imagine the fate of the small soil particle which nature has taken millions of years to build up. If by the same process of erosion the entire upper few inches of soil throughout the world is taken off, atom bombs would not be necessary to perish entire humanity.

The detritus which is carried off in the madly rushing waters is ultimately carried to the Indian Ocean or it gets deposited on the river beds. With each layer of detritus that settles down, the depth of the river decreases. With a decrease in depth the water-holding capacity of the river is naturally lowered. Hence it is logical to expect an overflow over the bunds in times of large water discharges.

From the foregoing it is abundantly clear that in an attempt to control floods one has to have a complete mastery of the flow of water at all stages. The soil must be in such a state to absorb the greater part of the water that falls and the excess should be made to flow gently into the rivers. If this could be achieved the river would carry only pure water which is colourless and not the clay and sand laden dirty-brown water our rivers are accustomed to carry. With pure water travelling down the river no siltation could occur. The depth of the river remains constant and possibilities of floods would be ruled out.

Food Production and Forest

If the above arguments are followed to their logical conclusion it is apparent that the most effective and the cheapest method of preventing floods would be to have under forest cover the entire hilly tract and all catchment areas. Ceylon however being a predominantly agricultural country there is a limit to which land could be reserved for forest. It is the considered opinion of qualified foresters throughout the world that a minimum of 33 per cent. of the land surface should be under forest cover, and that too properly distributed throughout the entire country—a larger percentage to be obviously maintained in the hills. In 1953, the total area of forests permanently dedicated to forestry has been only 17.04 per cent. of the total land area. With land development and colonization schemes that have been afoot, the forest would have receded further in the more recent years. Although food production is a vital problem today to feed the millions of increasing population, it is a fallacy of the highest magnitude that this could be done only by more extensive cultivation. It is time our food producers thought of more intensive production on already available cultivable land, instead of considering the forest an inexhaustible reserve to commandeer in the laudable attempt at food production. From data available, our forest resources are dangerously low and poorly distributed. Any attempt to play about further with such limited rescources would be courting disaster and inviting more catastrophic upheavals. Every attempt should be made to bring all lands not cultivable under forest cover, either by education or compulsion. Large tracts of barren patna land in the up-country have already been afforested by the Forest Department, improving these patna soils besides the millions of rupees of revenue earned by way of timber and firewood. Excellent virgin jungles rendered barren after food production during the so called " emergency period " and left abandoned, are also now being reforested to render to the soil its lost fertility. What is required is a stepping up of this process so that, instead of the few hundreds of acres taken up for afforestation annually, thousands should be taken up in every district. Rural development societies, volunteer organizations and politicians who have rendered admirable service during the recent floods should carry this crusade even after the flood waters have subsided, and educate the village folk on the value of growing trees. A right step has been taken in this direction by Government with the inauguration of the Tree Planting Campaign last year, although the accent was too much on " trees of agricultural value ". The Forest Department has made a significant contribution, silently, to this notable campaign by supplying free 296,411 plants which constituted the major portion of plant material distributed. In terms of a forest plantation with a spacing of 10 ft. by 10 ft. this is equivalent to the planting up of 686 acres. The Tree Planting Campaign should be made an annual feature as the " Vana-mahotsava " of India, whereby the public should be made to appreciate growing their own trees in village forests, home gardens, parks and private forests. Besides the speeches which accompany these ceremonies it is imperative to educate the public how to look after these trees until they are established and able to look after themselves. Of the forest species distributed at the last Tree Planting Campaign the following cabinet timbers were distributed :—*Teak, Mahogany, Satin, Nedun, Jak.* Other species included *Halmilla, Na, Eucalyptus, Katuimbul,* &c. In the next tree planting campaign it would be most appropriate to emphasize on the reforestation of catchment areas and consolidation of river banks with the aid of suitable bamboos, grasses and other moisture-loving tree species such as *Na, Bakmi, Nedun* and *Diyapara.*

As stated earlier it is not practicable to dedicate to forestry every inch of available land with the ever increasing demand for food. Hence a very careful examination will have to be made as to what extent of forest should be set aside in the light of present policy of land development, keeping in mind that forestry is the foster-mother of agriculture. The nebulous category of " other Crown forests " some of which are the best forests in Ceylon, particularly those in the Kukul Korale and Morawak Korale, close to the foot-hills of the Sinharaja, need careful reselection. Others in the Dry Zone ruined by continuous chena cultivation need rehabilitation with artificial aids to accelerate the progress. Unless these are immediately examined and allotted to specific land use categories there is likely to be too much emphasis on certain aspects of land use.

Erosion in Cultivated Lands

Where land is finally allowed to cultivation, all possible measures should be adopted to prevent erosion and run-off in such lands. Unlike in the forest, there is a natural tendency for the water that falls to take the passage along the surface due to the intrinsic properties of cultivated soil. Whether it be a tea estate or a cabbage plot every endeavour should be made to slow down the speed of water. Handicapped without the rich water-absorbing humus characteristic of forest soils, the estate owners and the village cultivator should scrupulously adhere to erosion control technique such as contour terracing, contour ridging, gully plugging, check damming, &c., with a view to detaining water as far as possible on the spot. It has been estimated that from the 16 million acres of the land mass of Ceylon 36 million acre feet of water flows into the Indian Ocean annually, carrying with it the fertile upper layers of soil. This is indeed a bewildering quantity of water that is lost whilst large tracts are left bare due to insufficient water for cultivation.

Historical Evidence

Historical evidence is overwhelmingly conclusive on the catastrophic results of deforestation. Mesopotamia, Palestine and Syria, once fertile and prosperous lands, are today virtually deserts. Erosion and recurrent floods have similarly impoverished China. Closer home in India, the relentless advance of the deserts of Rajasthan has become a serious threat to the economy of this state. In Ceylon too we have unmistakable signs of visitation of nature's wrath with the indiscriminate felling of trees, which are the stabilizers of Lanka's soil and the custodian of its waters.

Tree—The Natural Dam

Along with the expensive engineering schemes which are to be put into operation to divert or pond back the large volume of water flowing in our rivers, the simple and inexpensive nature's method of ponding back the water by natural dams should be given due consideration. Growing of trees and more trees is the need of the hour. In concluding, it would be appropriate to quote a few lines from the address of welcome by Shri K. M. Munshi, Governor of Utter Pradesh, India, at the opening of the Fourth World Forestry Congress : " We want trees in order to regulate our rains ; to prevent the water running away with the top soil in our channels and to prevent floods. They are the cheapest means of preserving water, for each tree is a dam. The challenge of billions of rain-drops can only be met by millions of tremulous leaves ".

OUR
RESEARCH LABORATORY

From afar I hear its roar
The good old Band-Mill C. D. Four ;
Ripping hard the matted grain
Piling floor-boards, more and more,
To the stock of Timber Store
And the State an income gain !

In loops and festoons on the wall
The verdant creepers twining fall,
By that bounded Nursery.
The " Bird-line " by the chimney tall
Are swallows who now welcome call
To this Laboratory !

Plantains all that mature there
You suddenly find them go somewhere,
Tho' grown on guarded land
And you'll see our Foreman stare
At our labour " Trio " fair
" Siri—Ruban—Kali " band !

On Casuarinas in the yard
Whistling " Minas " keep a guard,
On this working family
All the lake-bund trees they ward
Noontide heat that scorching stared
And the breeze blows happily !

Albert W. Wilson

PROPAGANDA–AN ESSENTIAL ADJUNCT TO FORESTRY AND FOREST DEPARTMENT ACTIVITIES

M. Sanmugampillai

THIS article is written in the hope that it will bring home to the reader the importance of propaganda in forestry if we as a nation are to reap the multifarious benefits that forests bestow on us.

To quote the words of the Lord Buddha, which rightly adorn the editorial page of *The Ceylon Forester* :—

> "The forest is a peculiar organism of unlimited kindness and benevolence that makes no demands for its sustenance and extends generously the products of its life activity ; it affords protection to all beings, offering shade even to the axeman who destroys it."

Mother Nature has therefore bestowed on man the most precious gift, and if we in this modern scientific age with all the available knowledge cannot preserve this for posterity then we ourselves stand self-condemned. Most of us including the enlightened folk are ignorant of the part forests play in the growing civilization of a country. Is it, therefore, strange that in the present times we hear of occurrences of floods and droughts and the accompanying miseries of life which had not been heard of in the distant past ? The answer is obvious. This has been due to the reckless short-sightedness and greediness of those responsible for clearing innumerable acres of well clothed mountain tops. This catastrophe could have been averted had the requirements of forestry been considered in its true perspective. It is therefore very essential that our people, rich and poor, high and low, the Socialist and the Communist, and especially those who lead the destinies of this fair isle, all alike should appreciate what forestry stands for. It is now too late for the common man to go back to school to study this as an important subject.

This vexed problem should however be tackled in various ways, one of which should be by showing propaganda films of the Forest Department and its manifold activities. How soil erosion is caused and with what ill-effects. How conservation of soil should be effected and with what relative advantages to the community. How forestry could help agriculture and the agriculturists, industry and the industrialists. How well maintained forests increase the national wealth of the land. It is a happy augury to note that a start has already been made with the showing of forest films by the department, but it would be better if these films are made available to the commercial cinemas so that a larger section of the population may see and appreciate them. Forestry knowledge could also be disseminated by participating in carnivals and exhibitions ; by writing to the press both in English and Swabasha on all important aspects of forestry ; by actively co-operating in tree-planting ; and lastly by direct contact between the masses and the members of the Forest Service.

The last is quite the most important of all the above, as the masses represent the bulk of the population and the forests are situated in places easily accessible to them. By educating the masses in these matters the forester will not have to rake his head with forest offences and spend many hours and days lingering in court houses. Instead he will be able to spend

much of his valuable time in the environs of the forests and could practise forestry as is meant to be done without any adverse interference from man.

Forestry is quite an extensive subject and cannot be disseminated overnight—I dare say, it will take quite a long time—a number of years. A start has therefore to be made at some stage or another and the best course would be to begin it in our schools. Natural history should be made an important subject in the curricula of the schools so that the older children may be taught the natural resources of their own land ; about the vegetation ; about the soil that gives them plenty to eat ; about the birds and animals which do quite a lot in the propagation of some of the important forest species. They should also be told by special lectures, preferably by Forest Officers, that forests should be regarded as a legacy from preceding generations to the present one, which must be passed on to future generations intact, if not increased. They should also be told that contrary to this, man continues to be in the main the chief unauthorized destroyer of the forest due to a lack of " social sense ". If the coming generations could be made to realize and appreciate the fact that the forests are the property of the community and that no one has a right to appropriate to himself the dues which belong to the State, a great contribution would have been made to the well-being of the country as a whole. This is only possible by well organized propaganda.

Just as in the Agricultural, Co-operative and a few other departments, propaganda officers are appointed to carry out propaganda in their own spheres, it is extremely essential that a propaganda section be created in the Forest Department to wipe out effectively the ignorance that pervades about the department and its officers, and induce the people to realize that the capital of Sri Lanka lies only in her natural resources and that the Forest Officer is an agent to help in the judicious administration of the extensive estate—The Forest.

At the moment, the man in the street knows next to nothing of what the Forest Department and its officers are doing for him. In his ignorance he thinks that either they are responsible for hacking the forests indiscriminately wherever large-scale exploitation operations take place, or unlawfully debarring him from the full enjoyment of the forest produce which nature had given him.

Had propaganda been carried out in the proper lines in the past, the part that the Forest Officers so silently yet so efficiently play for the common good of the land will have been better appreciated and tangible expression given to their efforts by those responsible for the management of the State. Theirs is a thankless job which takes them to the remotest parts of the jungles where, amongst other hazards, that from the denizens of the jungle cannot be taken lightly. Their tales of woe go unheard of, as may be realized from the paltry salary increases they had been granted in contrast to some of their more fortunate brotheren serving in other departments of the Public Services. Their conditions of service offer them hardly any scope for future prospects ; and added to these disabilities, they are generally branded as dishonest and untrustworthy. The hardships that these officers are undergoing are to a great extent due to lack of proper propaganda.

Ours is now a highly commercialized department, and well organized propaganda work on a wide scale through Rural Development Societies, Community Centres and other local bodies will be useful in several ways. The villagers should be encouraged to grow forest trees in their gardens

and along boundaries of such gardens. For this purpose, central nurseries should be maintained by the department in the principal zones with adequate stocks of plants of forest utility species and these should be distributed free or at nominal prices to those who may require them for planting purposes.

This will improve the knowledge of our countrymen. They will learn to appreciate the utility of our forests ; the direct and indirect benefits that accrue to them ; the necessity for its effective maintenance and improvement. This will also indirectly improve the lot of the poorly paid servants of the department who will be able to give of their best in the development of this little fair isle " Sri Lanka ".

In conclusion the truism " Prevention is better than cure " is aptly applicable to forestry, for any damage done to the forest cannot be remedied for a very long time. It is therefore very essential that the willing co-operation of all members of the public, especially those of the rural areas, is given freely to the Forest Officers. This can only be achieved by the right type of propaganda.

HOW TRUE IT IS !

" I have been told that it is customary to say a few words of advice to the outgoing students. Giving advice is a very common and a very cheap pastime and many people indulge in it. Nowadays the outstanding topic where a few officers gather together is corruption. There are rumours of corruption and whispers of worse wherever these men gather. If you open the newspapers you see the proceedings of anti-corruption committees or the creation of anti-corruption bodies, investigations into the conduct of officers and so on and so forth, and one wonders at what has gone wrong with the people of this country. Have we suddenly changed ? It seems as if corruption has broken out like an epidemic. Whatever the answer may be, there is far too much talk of corruption. Every public servant walks in fear and dread not knowing when his own turn might come next. Whose fault is this ? To a large extent, the fault is with the public servants themselves. Old standards of loyalty, service and *esprit de corps* seem to have disappeared. Brother is fighting against brother. Colleague is carrying tales against collegue. This is a most deplorable state of affairs. No doubt, there can be no question that our standard of public conduct must be above reproach. But it is also probably true that in these matters standards have today become stricter. We should observe those standards, try to rise to those standards, and if possible to better those standards. But if the public servant goes about in fear and trembling, then obviously there will be not time for him to do the work for which he is primarily engaged and paid for out of the public revenues. "

(*An extract from a speech by Mr. C. R. Ranganathan, Inspector-General of Forests, India.*)

SWIETENIA MACROPHYLLA (BROAD-LEAVED OR HONDURAS MAHOGANY) AND ITS PROPAGATION BY STRIPLINGS

S. P. Perera

THE broad-leaved Mahogany is a large, upright, fast-growing ornamental tree of commercial value. It has a good demand for cabinet work and many other purposes for which large quantities are exported from British Honduras and Central America.

The success with which it can be grown under shade along fences, in gardens, and in poor inhospitable soils within a shorter period than most other timber species should commend itself to the public as a tree worth planting. Very little attention is required to have it established under shade. In growing trees, one rarely expects to make use of the timber oneself. It is therefore most encouraging that in planting mahogany it is not only possible for the planter to utilize the tree but thereafter he could pass on the benefit to his future generations as the tree regenerates profusely, providing trees for the future.

There are several Mahoganies of Central America, but for a large number of requirements this species is regarded as superior to all. Unlike the Cuban mahogany (Swietenia mahagoni) which is another exotic grown in the drier northern parts of the Island, the wood of this does not become darker with age, but on the other hand the pinkish colour of the freshly sawn timber bleaches on exposure and turns into a beautiful golden brown or even a greyish shade. The wood is also lighter in weight and of a finer texture. The weight per cubic foot, according to Gamble, is 35 lb.

This tree is indigenous to Honduras and the Central America where it grows from sea-level to a height of 1,500 ft., with a rainfall of 60 to 200 inches and a temperature ranging from 52° to 98°F. There it is said to occur in a variety of soils including shallow and swampy sites.

India

Its introduction to the East in 1872 had been quite accidental ; seeds received at the Royal Botanical Gardens, Calcutta, labelled as *Swietenia mahagoni,* were on germination found to be a different species. The identity had been established by Sir S. G. King 12 years later when the plants flowered and bore fruits. It has now spread and thrives in many parts of India.

Trinidad

The oldest plantations date back to 1906. It has come up in soils varying from sand to clays and also in abandoned sugar-cane fields. The oldest trees felled are claimed to have given excellent timber.

Malaya and Mauritius

The former grows it as a shade and ornamental tree ; and in the latter, at lower elevations, successful reforestation has been carried out with this species

Fiji

Large-scale planting is now in progress and Ceylon has contributed its quota of seed requirements.

Ceylon

It was in 1890, for the first time, that this species has been introduced at an elevation of 1,700 ft. Since then it has been raised in other parts of the Island to such an extent as to have today extensive plantations in mixture with other species. As has happened in India, here too there appears to be two varieties of the broad-leaved Mahogany growing side by side. One has a smoother bark and a softer wood, while the bark of the other is conspicuously fissured, often flaking off in vertical strips which have a tendency to roll upwards. The latter is also slower in growth with a wood of deeper pink. The writer in the course of thinnings observed these differences but further investigations are necessary to establish the existence of two varieties. Mahogany in mixture with Jak, Nedun, and Teak, cover over 10,000 acres in the Kegalla, Kurunegala, Colombo, Galle, Dambulla and Puttalam Districts.

Being a pronounced shade bearer it has been under-planted mainly in Jak of 3-10 years with the expectation that it would form an under-storey to the moderately fast-growing Jak. However, nearly in all plantations by quick and vigorous growth it has shot up either suppressing the Jak or offering it serious competition. Jak has gradually lost increment and the crowns have been reduced to a few weak branches. In this unhealthy condition *Eutermes greenii* has appeared attacking the trees at a point just below or above the lowest branch. At the point of damage the crowns get blown off or die back, leaving stems struggling with epicormic branches.

This tree is not exacting in soil requirements ; nor does elevation, rainfall and temperature affect the growth, as the statement below which refers to stations where it is grown will indicate.

Station	*Elevation feet*	*Average Annual Rainfall inches*	*Average Temperature*
Kandy (Ampitiya)	1,700 ..	82·10 ..	77·0°
Puttalam	10 ..	44·23 ..	81·0°
Kurunegala	400 ..	85·03 ..	80·6°
Ratnapura	130 ..	153·53 ..	80·8°
Badulla	2,200 ..	71·95 ..	73·6°

Natural Regeneration

Plants grown artificially under Jak, Nedun and Teak have come into fruit in about 15 years, fruiting abundantly either at the middle or end of the year. The pods, tightly packed with seeds, dehisce, dispersing the light, winged seeds over a wide area. Generally over 75 per cent. of the seeds are sound and over 50 per cent. germinate under normal nursery conditions. When sown direct, seeds were found after 2½ months to be in process of germination. The long period of retaining viability assists the wind-blown seeds to lie dormant until the outbreak of the rains and germinate forming carpets of recruits. In Dikkele (Pannala), Kankaniyamulla (Kuliyapitiya), Sundapola and Badagomuwa (Kurunegala), and Polhunnawa (Batapola)

the regeneration from recruits to saplings of 20 ft. is so profuse that one could hardly see or walk through. The canopy formed by the species and others is sometimes almost closed, but this has in no way affected the vigour of the plants of all stages. There is a possibility of Mahogany affording a sustained yield at the rate it has progressed.

Artificial Regeneration

As described under natural regeneration, this exotic was underplanted in Jak, Nedun and Teak in quincunx to each of the species at an espacement of 10 feet apart, using one or more of the following types of planting material :—(1) Direct sowing, (2) Basket plants of 8-10 inches, (3) Transplants of under 12 inches, (4) Stump plants, and (5) Stem and branch cuttings. Of these the only two types which have consistently given good results were the basket plants and fresh seeds dibbled at stakes. Plain plants and stumps were mostly failures.

A pestilent weed very common in young plantations is Lokapalu (Micania scandens). It grows extremely fast enshrouding the crowns and ultimately killing the young plants unless by circle weeding and climber cutting it is checked. Thus Mahogany plants hardly a foot in height, with a rather slow growth at the start, suffer heavy mortality by suppression. Control of the weed has been found to be both difficult and expensive. It was therefore considered that if larger plants could be successfully planted this vexed problem of weeding could be eliminated.

In May/June 1935, the writer had to underplant 250 acres of scattered Jak plantations in the Kegalla District, using Mahogany plants collected from plantations and private sources in Kandy. The bulk of the plants was 8 to 12 inches in height while a few hundreds of larger sizes were also tried. A census of survivals taken 3 months later indicated the superiority of the larger plants. This exploratory trial was followed up in 1941 by carrying out an experiment under shelter at Kurunegala, using plants of 2½ to 3 feet in height along with other types of planting material. The results after 1 year and 10 months were as follows :—

No. of Plants used	*Type of Planting material*	*Survival Per cent.*	*Mean Ht.*	*Range of height*
200 pegs, with 5 seeds at each	Direct sowing	24·0	6′ 6″	3′ 0″ to 8′ 0″
200	Plain plants 2½′ to 3′	65·5	7′ 8″	2′ 0″ to 10′ 0″
200	Stumps 5·7″ Diam.	11·0	6′ 0″	3′ 0″ to 10′ 0″

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Further investigations were made with still larger plants and it was found that plants of 4½ to 5 feet invariably gave over 85 per cent. of survivals. Selection of plants was confined to those in which the apical shoots were more or less inactive as otherwise the tender shoots are liable to be killed with the onset of the drought.

In 1952, it became necessary to investigate the most suitable species to rehabilitate the highly degraded lands abandoned after intensive food production in the wet zone. For this purpose an area of 9.6 acres in Potgulkanda (Ratnapura) was selected. The land is hilly, partially eroded and the vegetation consisted of low scrub infested with *Lantana*, *Eupatorium*, *Kekilla* (*Gleichenia linearis*), *Illuk* (*Imperata-cylindrica*), *Bata* (*Ochlandra stridula*) with an occasional *Kenda* (*Macaranga peltata*), *Gedumba*

(*Trema orientalis*) and *Cadju* (*Anacardium-occidentale*). Through the scrub, belts 15 feet in width were cut contourwise at intervals of 33 feet. The cut material was piled up in the centre of lines beaten down and burnt in late September. Trenches 6 feet in length, 1 foot wide and 1 foot deep, spaced out 6 feet apart, and pits 1′ × 1′ × 1′ in between every two trenches were cut, and filled up with ash and top-soil. Each species occupied 4 lines, planting being done both in pits and trenches. The five species used were Basket plants of *Dawata, Del, Lunumidella, Albizzia moluccana* and striplings (large plants) of 4½ to 5 feet of Mahogany. The Mahogany striplings obtained from Badagamuwa plantation had to undergo a rigorous test before planting. The plants had been collected with the first rains after a prolonged drought; packed and transported in a cart to Kurunegala Station, a distance of 3 miles, conveyed by train to Colombo over 59 miles, and then transferred to the narrow gauge line for a further rail transport of 65 miles to Ratnapura. From Ratnapura Station they were taken in a car to the Range Officer and then carted 3 miles. The final mode of conveyance was by head loads for 1½ miles to the planting site. Further misfortune awaited them there, for after a trying journey of 2 days planting was not possible as the monsoonal rains were late. The plants had therefore to be kept in trenches under shade for 16 days until the rains set in.

The writer travelled from Colombo to initiate this trial under his personal supervision but the prevailing drought did not permit planting to be done as desired. There was no alternative but to entrust the work to a Forest Overseer and a nurseryman, both of whom had no previous experience. In spite of the cumulative disadvantages the results after 2½ years as outlined below were very encouraging.

Species	*No. of Plants used*	*Number surviving*	*Average Height*	*Range of Height*
Dawata ..	242 ..	220 ..	6′ 10″ ..	11·7″ to 14′ 6″
Mahogany ..	226 ..	213 ..	11′ 10″ ..	2′ 8″ to 21′ 10″
Del	212 ..	84 ..	3′ 5″ ..	·9″ to 9′ 0″

Lunumidella—a complete failure.

Albizzia moluccana—a complete failure.

Of the 213 Mahogany survivals there are 42 stems of 15′ 0″ and over. Both *Dawata* and Mahogany are extremely healthy and vigorous. The failure of *Lunumidella* and *Albizzia* was due to repeated attacks by porcupines which have found a safe home in uncleared belts in between planted lines.

Pests and Diseases on Mahogany

Mahogany does not thrive well in the open, being subject to attack by the shoot borers *Hypsipyla robusta* and *Zeuzera coffeae*. Under such open conditions the larvae of a Pyralid moth also cause severe defoliation periodically. Every tender shoot put on is bored, with the result that growth is retarded and the plant becomes bushy and misshapen. However, plants struggle on and after reaching a height of about 20 feet the stems clean up with hardly a trace of the original form. Under shelter it is entirely free from these pests.

Rate of Growth

The growth is rapid ; an average height of 53″ 8″ has been attained in 15 to 16 years in Kendehena Jak/Mahogany mixture plots. In Sundapola Plantation a girth of 6″ 0″ has been reached in about, 50 years. In Honduras, according to Hummel's estimate, an average girth of 7 feet can be obtained in 30 years.

Striplings of Mahogany are now very successfully used by this department in rehabilitating degraded forests in the Southern and Western Divisions. There are several thousands of acres of abandoned food production areas in the hands of the Revenue Department, and it is hoped that use will be made of this valuable and hardy tree to establish a tree growth in these waste lands. Millions of striplings of the optimum sizes are available in the plantations at any time for reforestation work.

Thanks are due to Mr. M. Sammugampillai, Forester, for the personal attention given to the collection of the correct size, packing and despatch of the plants used in the last experiment.

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GOVERNMENT TO TAKE OVER PRIVATE FORESTS

New Delhi, Sunday.

Private-owned forests, which are rich in timber content, will soon be taken over by the Government.

This decision has been taken by the Union Government to facilitate the evolution of a uniform national forest policy and utilize the forest resources to the best advantages of the country as a whole.

The Nilambur Kovilagom Forest in Madras and similar forests of former rulers in several other States are among those proposed to be taken over.

A sum of Rs. 20,000,000 has been provided in the second Five-Year Plan for long-term loans to State Governments to enable them take over such forests and initiate planned development schemes there.—(NAFEN.)

(*An extract from the "Morning Times" of 6th June, 1955*)

NOTE ON A WOOD-ROTTING FUNGUS ON SAPU

Favolus ciliaris Mont.

(With One Plate)

T. R. A. Ruberu

Introduction

Rots and decays of timber are caused by a group of plants called Fungi, living parasitically or saprophytically on living or dead tissues of other plants respectively. The majority of Wood-rotting Fungi are Saprophytes, bringing about a decay of the host timber on which they are living. Saprophytes strictly limited to one mode of existence are called Obligate Saprophytes ; but sometimes a fungus starting life as a parasite of a living tree, after causing the death of the tree, continues to live further on the dead tissues of the same tree as a saprophyte until the tree is partly or completely destroyed. Such forms are called Facultative Saprophytes.

Whatever the mode of existence, whether parasitic or saprophytic, all the wood-destroying fungi, with a few exceptions, belong to a class of fungi called Basidiomycetes. Within this class are two families : Agaricaceae and Polyporaceae, both including a large number af Wood-rotting Fungi. A few of the well known wood-rotting fungi of Agaricaceae are *Armillaria asprata* (Berk) ; *Lentinus giganteus* Berk ; *Lentinus-sajor-caju* Fr. and *Schizophyllum commune* Fr. Of these *Lentinus* has a wide distribution in Ceylon, and is one of very common occurrence. Petch in *Fungi of Ceylon* states " The commonest Ceylon Lentinus is L. *subnudus Berk.* ; known in low-country as the tank mushroom, because it grows in profusion on dead tree trunks left standing in the tanks ".

Favolus ciliaris, subject of the present study, belongs to the larger family Polyporaceae. In this family *Ganoderma lucidum* (Leyss. ex Fr) Karst. enjoys a wide distribution in Ceylon. Polypori such as *Polystictus elongatus* Berk. ; *Polyporus versicolor* Fr. are found particularly in the up-country, while *Fomes dochmius* (B. & Br.) *F. rhinocerolis* Cooke. and *Trametes dubia* Berk. are a few of the low country forms. *Polystictus sanguineus* (L) Mey ; (The Red Bracket Fungus) *Trametes persoonii* (Fr) Lloyd. and *Lenzites striata* (Wulf) Fr. are yet a few more species of common occurrence.

Two well known types of decays in timber are, the White Rot and Brown Rot. In the former type of decay, all the components of wood, including Lignin, are decomposed by the fungus and the decayed parts appear in the form of White Pockets, separated by regions of strong unattacked wood. In Brown Rot, the lignified elements remain unattacked, while the decomposed parts turn brown and can be powdered between the fingers. Sometimes, rots are described according to the place of decay on the tree, as Root Rot ; Stump Rot ; Trunk Rot ; Top Rot ; or according to the kind of wood attacked, Sap Rot or Heart Rot when sap wood or heart wood is attacked respectively.

An attempt was made in the course of this work to grow such a Wood-rotting fungus, *Favolus ciliaris,* in artificial media under laboratory conditions, after making a careful study of the fungus as it grows in nature. This fungus was isolated from decaying timber of *Sapu* (*Michelia Champaka L.*).

Description of the Fungus

SPOROPHORE OR FRUIT BODY (Fig. 1)

The sporophores of *Favolus ciliaris* appear in groups of 3 or 4, on the decaying timber. As in other wood-rotting fungi, the timber at the time of the appearance of fruit bodies is in a state of complete decay. The sporophores are fleshy, delicate structures, each consisting of a cylindrical stalk terminating in a symmetrically placed pileus or disc. The basal region of the stalk is slightly bulbous at the point of fixation to the substratum. The largest specimen collected had a height of 1.6 inches. The terminal portion of the stalk widens gradually, and passes on to the pileus unnoticed. The pileus is a symmetrical disc, having a convex upper surface and a slightly toothed edge. At the central region of the disc, on the dorsal side, is a shallow depression which becomes deeper as the fruit body matures. The size of the disc is proportional to the stalk. A fully formed sporophore having a stalk of 1.5 inches carries a disc measuring 1 inch in diameter. The sporophore is grey in colour but turns brown with age.

The fertile surface of the sporophore, which is the ventral side of the disc, extends from the margin of the disc to the central region and, in some fruit bodies, the uppermost part of the stalk too, is fertile. The pores in which basidiospores are formed, present on the ventral surface, are polygonal in shape with the number of sides in each pore varying from 4 to 6. Pores at the peripheral region are small, and the pores become larger and larger towards the centre, reaching the largest size at the lowermost region of the disc, where the stalk joins the pileus. In these larger pores, the longer sides are in a plane parallel to the radius of the disc. (Fig. 2.) The lining layer of the pore is the hymenium, on which the basidia, producing the basidiospores are found. The basidia are associated with sterile paraphyses. Thin hand sections of the hymenium, cleared in Potash and stained in Cotton Blue, show the basidia and paraphyses very clearly separated from each other, by the latter taking a deeper stain than the former. (Fig. 3.) The basidia project slightly beyond the level of the paraphyses. In *Favolus ciliaris* each basidium carries two sterigmata, a feature contrasting with most other members of Polyporaceae where the characteristic number of sterigmata per basidium is 4. It is possible that only one basidiospore is formed from each sterigma to make a total of 2 basidiospores per basidium. Formation of 2 basidiospores from each sterigma, one after the other, is a possibility ; but no definite statement could be made at present.

The above description is applicable only to a fresh sporophore, immediately before the dissemination of the spores. Unlike some other polypori where perennial fruit bodies are formed, e.g., *Fomes* sp. in *Favolus ciliaris* the sporophore withers up in a short time of 4 to 5 days after the appearance of the sporophore.

BASIDIOSPORES

(Fig. 4.) The basidiospores are biconvex in shape, with an oval or spindle shape outline. When examined under the microscope in a drop of water, the presence of a shining wall is evident. On staining with Cotton Blue, the content of the spore gets stained, leaving the wall unstained. On this wall is a ridge of thickening extending along the edge of the spore. (Fig. 5.)

MYCELIUM

The fungus, at the time of formation of sporophores, appears in cotton wool like felts on the exposed sides of the infected timber. Sporophores develop from such mats of hyphae, and the appearance of these mats indicate that the fungus is about to produce fruit bodies. Hyphae taken from these regions show very thin, frequently branched, filamentous threads, with poor septation.

DISTRIBUTION OF HYPHAE IN THE HOST TISSUE

A detailed examination of the fungus in the host tissue was carried out by making thin longitudinal sections of the infected timber. The sections were stained in saffranin for 10 minutes, and counter-stained with Cotton Blue. The former will stain all lignified elements, while the fungal hyphae get stained by the latter. (Fig. 6.) Broad hyphae run in the xylem parenchyma, in between the xylem elements. Some of these hyphae are seen even in the lumina of the tracheids and vessels. Arising from these longitudinally distributed hyphae are lateral banches, penetrating radially into the wood. They are more numerous and better developed in the medullary rays, most probably due to the fact that the fungus gets a better supply of easily consumable food materials in the ray-cells. Direct entry of hyphae into the xylem elements is of frequent occurrence. In badly decayed timber the xylem gets disorganized completely, leaving only broken pieces of xylem elements.

CLAMP CONNECTIONS

No clamp connections have been observed. Diploidization occurs, most probably, immediately before the formation of fruit bodies, so that a great part of the vegetative mycelium is only primary, without clamp connections.

Cultivation of the Fungus in Artificial Media

Fungus isolated from infected timber, when grown in artificial media, revealed more interesting points which could not have been obtained from an examination of the timber alone. A brief summary of techniques employed is given below.

CULTURE MEDIA TRIED

(i) Malt extract medium containing 5 per cent. powdered Malt ; 5 per cent. wood flour, and 5 per cent. sucrose in Normal Knopps' solution, with the addition of Vitamin B Complex added in the form of *Binerva.*

(ii) Potato extract medium made from potato extract, obtained by boiling potato chips in water for a few hours. The medium was acidified by adding 0.5 per cent. solution of Citric Acid to prevent contamination by bacteria.

ISOLATION

Two methods were employed for the isolation of the fungus from the infected timber.

(i) Direct inoculation of the sterilized medium with spores taken from an active sporophore under aseptic conditions.

(ii) Tissue culture method. A small piece of tissue taken from the sporophore was used as the inoculum. This piece thus taken was passed through a solution of Mercuric chloride, 1 part in 1,000 parts of distilled water, before introducing into the medium.

Isolation by both these methods was satisfactory. The first method has an advantage over the second by the appearance of the fungus in a shorter period of 2 days. In the second method it takes 4 days or more for the fungus to appear.

GROWTH CHARACTERS OF THE FUNGUS

The growth of the fungus varied to an appreciable extent in the two media tried. Of the two media tried, Malt extract medium showed the best growth of the fungus. Hyphae appeared in the first few days were narrow ; but, after getting established in the medium, a rich growth of the hyphae was seen. These hyphae are very broad, with very clear transverse septa. At the place of each septum is a constriction on the side wall. Individual cells show a granular content with many nuclei in the peripheral cytoplasm. (Fig. 7.) The fungus when grown in this medium behaves as a surface feeder. Special kind of spores (which appear to be of the nature of chlamydospores) appeared when the fungus is grown in artificial medium. These were more frequent in potato medium and a full description will be given at the end of the paper.

When grown in potato medium an entirely different type of growth was seen. Growth in this medium can be described as " poor ". Instead of being a surface feeder, the few hyphae appeared were seen to be buried in the medium and the aerial hyphae were more or less encrusted to the surface. The fungus, instead of being white, showed a dirty grey colour. Reproductively, the fungus was very active when growing in this medium. " Chlamydospores ", which appeared also in Malt extract medium, were of more frequent occurrence here. In addition to the " Chlamydospores ", certain structures, apparently abnormal sporophores, were seen in large numbers in this medium. (Fig. 12.) They had no definite shape or size, but were irregular structures of a pseudo-parenchymatous nature. They are thought to be abortive fruit bodies. These structures dry up after 10 to 12 days.

" CHLAMYDOSPORES "

As stated earlier, these chlamydospores appear in both media. " Chlamydospores " are formed from ordinary vegetative hyphae of the mycelium. Appearance of broad hyphae is the first noticeable feature at the time of " Chlamydospore " formation. (Fig. 8.) The end of each of these hyphae enlarge by the accumulation of protoplasm and this protoplast gets surrounded by a thick wall of its own. In many instances only one " Chlamydospore " is formed from each terminal cell. Sometimes, however, 2 to 3 spores are to be seen in the form of a chain within each cell. These spores are smaller than the normal ones. (Fig. 11.) Singly formed " chlamydospore " occupies the full space of the mother cell, but possesses a wall quite distinct from the mother cell wall. Majority of the spores formed are, spindle-shaped, and are variable in size. (Fig. 9.) Unequal thickenings at different regions of the spore sometimes, produce spores of a varied shape. (Fig. 10.) Though there is a tendency for spore formation to be restricted to the ends of the hyphae, intercalated chlamydospores also occur though rare. " Chlamydospores " are shed after, with the decay of the mother cell wall.

Acknowledgement

My thanks are due to the Plant Pathologist, Department of Agriculture, Peradeniya, for identifying the fungus.

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EXPLANATION OF THE PLATE

Fig. (1) Group of Sporophores.

Fig. (2) Pores on fertile surface. Note small pores at the perepheral region and larger ones at the central region of the disc.

Fig. (3) Hymenium with Basidia and Paraphyses.

Fig. (4) Basidiospores.

Fig. (5) Side-view of Basidiospore showing ridge of thickening.

Fig. (6) Semidiagrammatic drawing of longitudinal section of the infected timber showing fungal hyphae in host tissues.

Fig. (7) Part of hypha.

Fig. (8) Enlargement of hyphal end, prior to chlamydospore formation.

Fig. (9) Two chlamydospores.

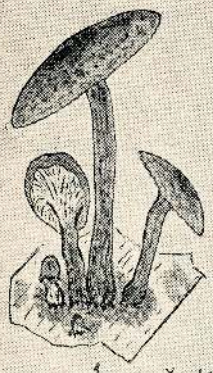
Fig. (10) Abnormal chlamydospores.

Fig. (11) Chain of chlamydospores in an enlarged cell.

Fig. (12) "Fruit Body" on the Potato medium.

Fig. (13) Enlarged hyphae from abortive "Fruit Body".

PLATE



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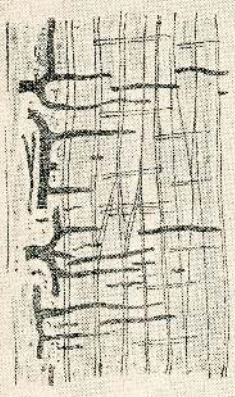

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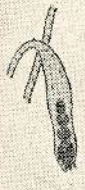
7. × 1200

8. × 1500

9. × 1200



11. × 1500

10. × 1200

12. × 2

13. × 900

T. R. A. R.
10-5-55.

*NOTES ON CEYLON TIMBERS

X. M. Fernando

Botanical Name : Artocarpus nobilis, Thw.

Local Names : Bedi-del or Del (S.) ; *Asini-pila* (T.)
The Wild Bread-fruit Tree (E.).

Family : Moraceae.

The Tree. A very large, handsome, fast-growing, evergreen tree with a straight, clean, cylindrical bole, of about 60 to 70 feet having a dense crown. Shade-tolerant in early life requires full overhead light for optimum development from sapling stage. Bark thick, dull greenish-brown, irregularly furrowed, exfoliating in unequal scales ; blaze, creamy white, exuding a white sticky latex.

Flowers, March to June. Fruits, May to August. Both fruit and seeds are edible. Valuable fast-growing tree, propagation of which should be encouraged.

Distribution. Peculiar to the moist low-country up to about 2,500 feet altitude. Endemic.

General Description. Weight and hardness varies according to locality and age, but at 12 per cent. moisture the average weight is approximately 38 pounds per cubic foot. Sapwood greyish-white ; heartwood yellow to light golden-brown, darkens rapidly to a dark yellowish brown on exposure. Coarse-textured with interlocked grain, rather rough to the touch, moderately hard, stands contact with water. Has no characteristic odour or taste.

Anatomical Structure. Diffuse porous, pores moderate to large, visible to the naked eye, often subdivided, scanty, rather irregularly arranged. Tyloses and chalky deposits present. Medullary rays fine to moderately broad, moderately frequent. Parenchyma predominantly paratracheal, visible as " eyelets " around the pore, sometimes aliform or winged.

Mechanical Properties. Del, through lighter than teak, has all the important qualities for its weight. It retains its shape well.

The experiments made by Professor W. C. Unwin, F.R.S., for the Imperial Institute on Ceylon woods give the following results (9) :—

Weight	.. 48.09 lb. per cu. ft.
Resistance to shearing along the fibres	.. 1236 lb. per sq. inch.
Crushing stress	.. 2.932 tons per sq. inch.
Co-efficient of transverse strength ..	.. 4.155 tons per sq. inch.
Co-efficient of elasticity ..	.. 632.8 tons per sq. inch.

Air-seasoning Features. Del can be air-seasoned easily without degrade provided the converted material is stacked in open sheds so that there is a good circulation of air through the stack.

Durability and Treatment. Heartwood is very durable and could be used untreated. It is resistant to white ants' attack (4). Sapwood is perishable and subject to borers but could be used if suitably treated.

Wood-working Qualities. The timber works easily with machine or hand tools, but quickly blunts them. Despite coarse texture and interlocked grain, can be satisfactorily polished and takes a high lustre particularly if fillers and sealers are used.

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* To be continued.

Uses. Like Jak, this is a general utility wood of medium weight. Used for furniture-making, house-building, carving, turning, panelling, ceiling-boards, making large dug-out sea going canoes, smaller river and tank canoes, *Adandas* (foot-bridges) in which use, this timber subject to periodic wetting and drying, is still said to last long periods.

Botanical Name : Albizzia odoratissma, Benth.

Local Name : Suriyamara, Hurimara, Huri (S.).
Ponnai-murunkai, Karu-vagai (T.).

Trade Name : Black siris.

Family : Leguminosae-Mimoseae.

The Tree. A large tree with a cylindrical bole carrying a well-balanced crown with drooping green foliage. Bark grey to yellowish grey with irregular cracks ; blaze crimson.

It is a moderate light demander. It coppices well. The stem is very whippy when young, and as a result of this the stems are easily bent and browsed by deer and sambhur which cause much damage. Therefore fencing is necessary in plantations.

Flowers—April-June ; Fruits—October to December.

Distribution. Common in the dry zone but also found scattered in the intermediate zone. Profuse regeneration is seen in abundant new clearings.

General Description. Weight approximately 55 pounds per cubic foot (air-dry) ; sapwood fairly wide, white ; heartwood handsome, brown to dark brown with lighter and darker streaks, lustrous when fresh. Moderately heavy to heavy, broadly interlocked grain, coarse-textured. It is slightly more reddish, somewhat finer-textured and more ornamental in figure than Albizzia lebbek (Mara). It has no characteristic odour or taste.

Anatomical Structure. Diffuse porous, pores medium-sized to large, visible to the naked eye, open or occluded with deposits of reddish brown gum, mostly solitary or in radial rows of 2-4 (mostly 2-3) perforations simple, tyloses wanting, Medullary rays medium-sized, lighter and more lustrous than the background. Parenchyma paratracheal, at times paratracheal zonate but not in bands. Deposits of reddish gum abundant.

Mechanical Properties. The timber is harder, heavier and stronger than teak. Keeps its shape relatively well. The comparative suitability of Suriyamara expressed as percentages of teak is tentatively as follows (8) :—

Teak = 100

Suriyamara (46 lb. at 12% moisture	Weight	105
	Strength as a beam	115
	Stiffness as beam	120
	Suitability as a post	125
	Shock-resisting ability	140
	Retention of shape	90
	Shear	180
	Hardness	175

The experiments made by Professor W. C. Unwin, F.R.S., for the Imperial Institute on Ceylon woods gave the following results (9) :—

Weight	57·01 lb. per cubic foot
Resistance to shearing along the fibres ..	1,283 lb. per sq. in.
Crushing stress	4·184 tons per sq. inch
Transverse strength	6·518 tons per sq. inch
Co-efficient of elasticity	775 tons per sq. inch

According to Limaye (6) the safe working stresses for Suriyamara are as follows :—

1.	Weight per cu. ft. at 12% moisture	46 lb.
2.	Modulus of elasticity, 1,000 per sq. inch	1,930 (all grades)
3.	Working stress in pounds per sq. inch for Standard Grade—	
	(*a*) Bending and tension along grain—Extreme fibre stress :	
	1. Inside locations	2,650
	2. Outside locations	2,200
	3. Wet locations	1,800
	(*b*) Shear :	
	1. Horizontal	220
	2. Along grain	310
	(*c*) Compression—Parallel to grain :	
	1. Inside locations	1,900
	2. Outside locations	1,700
	3. Wet locations	1,350
	Compression—Perpendicular to grain :	
	1. Inside locations	1,030
	2. Outside locations	800
	3. Wet locations	660

Air-seasoning Features. The timber seasons with little degrade if ends are coated and stacked for air-seasoning immediately on conversion and protected against rapid drying, otherwise it tends to split and wrap. Once seasoned the timber is very steady.

Durability and Treatment. The heartwood is fairly durable and could be used untreated and is moderately resistant to white ants. The sapwood is perishable and subject to borers but could be used suitably treated.

Wood-working Qualities. The wood is somewhat difficult to saw and work as it is apt to tear due to interlocked fibres. It is hard on working tools especially when in a dry state. It works to a fine smooth shining surface by hand and takes a good polish with filling. It is very attractive under polish, with a pleasing golden lustre and could be easily mistaken for Nedun (Pericopsis mooniana) the valuable furniture wood of Ceylon.

Uses. Cabinet-making, high-class heavy furniture, decorative works and panelling, agricultural implements, carts and their parts, building, &c.

Sample wood obtained from Ceylon was tested by the Royal Aircraft Establishment for propeller blades. It is reported to hold promise of being a first-class timber for the purpose (7).

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PRIZE-WINNERS AT THE FORESTRY SCHOOL

NINTH SESSIONS—

Silviculture (Forest Ranger)	..	**B. L. Abeyawarna**
Silviculture (Forest Guard)	..	**M. K. Sellathurai**
Best all-round Trainee (Forest Ranger)		**S. B. Herath**
Best all-round Trainee (Forest Guard)		**K. D. Darmasena**
Best Herbarium collection	..	**K. A. S. Samaratunga (R. A.)**

TWELFTH SESSIONS—

Silviculture (Forest Ranger)	..	**P. F. R. Wille**
Silviculture (Forest Guard)	..	**W. V. Fernando**
Best all-round Trainee (1st)	..	**S. Dharmarajah (F. G.)**
Best all-round Trainee (2nd)	..	**M. B. Dissanayake (F. G.)**
Best Herbarium collection	..	**M. T. Sirisena (F. G.)**

INDIAN COUNCIL OF ECOLOGICAL RESEARCH

The Indian Council of Ecological Research at the Forest Research Institute, P. O. New Forest, Dehra Dun (India), is attempting to build an Ecological library. An appeal is made to all Ecologists and Ecological Societies of the world for help. The Council trains teachers and post-graduate students in ecological research from Indian universities and offers facilities to research workers for carrying on original work and in consulting ecological works. Publishers of Ecological books, Ecological Societies and Ecologists are requested to help generously by sending as many of their publications as they can kindly spare. Contributions will be gratefully received by Secretary of the Council, Dr. G. S. Puri, Ecologist, Forest Research Institute, Dehra Dun (India).

ROVER SCOUTS

After a lapse of nearly 14 years the Rover Scout Crew has been revived in the department with headquarters in the Research premises.

The present strength of the crew is 12. It is intended to extend this brotherhood to other divisions of the department. Those who have been scouts and other well-wishers interested in scouting in the divisions could please write to the Rover Scout Leader, " Sri Lanka Forest Rovers ", Mr. A. W. Wilson, Range Assistant, Forest Department, 9, Kew Road, Colombo 2, for further information.

The motto of the crew is " Service ".

"SOME FACTS CONCERNING ELEPHANT CONTROL IN EAST AFRICA"

A. M. M. Davies

FOR some years now there has been criticism aimed at the existing system and ultimate results of present day methods of Elephant Control by the Game Departments of British East Africa.

Amongst some of the accusations of the ignorant are that the various departments are guilty of shooting all the large tuskers thereby leaving only the small ones for licence holders ; that since the inauguration of government paid hunters, far more elephants are being killed annually than ever before, even to the extent that the African Elephant is in danger of extermination. Without any doubt it can safely be said that neither of these accusations are based on fact, and the present system of control is the only secure means of trying to preserve the elephant in association with man. To those who may doubt the truth of this statement and to those in Ceylon who are interested in trying to preserve our few remaining elephants, some facts concerning elephant control in the three territories of British East Africa, may be of some interest.

Ever since the opening up of East Africa some hundred years ago, the country has become the world's greatest source of ivory, and, with the handsome price this commodity has always secured (approximately fifteen shillings per lb. at the ivory auctions held at Mombasa in 1951) it is not surprising to learn that anything up to seventy-five to a hundred thousand elephants were killed annually during these early years. Unlike present day conditions the elephant of the Nineteenth Century was a far easier adversary than he is today, and when one considers the slaughter that used to take place, both by natives and ivory hunters, with the aid of pitfalls, poisoned arrows, traps, organised massacres and the final introduction of the high powered rifle, it is not hard to believe that so many animals were killed annually. John Taylor, a professional hunter of over thirty years' experience, maintains that the quantity of ivory passing through Khartoum yearly fifty years ago must have required some 20,000 elephants from Uganda and the Sudan to supply it.

This was the position before the advent of the various Game Departments, but now practically all elephant control work in East Africa is carried out by the staff of the Game Departments and not, as in Ceylon, entrusted to people outside the department. This method ensures that the *right* animal destroyed at the right time and *in as humane a manner* as possible. The elephant control staff are neither interested in killing a large number of animals nor in choosing those with the heaviest ivory as they have no pecuniary or any other interest either in the amount of ivory or in the number of animals destroyed in the course of their work.

It would be most gratifying, and I am sure more successful in the long run, to see such an "Elephant Control Section" inaugurated in the Wild Life Department of Ceylon where the destruction of "rogues" would be in the hands of a body of specially picked men from the department who should be in a far better position of fulfilling the job than entrusting the

work to, sometimes, supposedly "competent sportsmen". The present system of control in force in Ceylon is too open to abuse and the resulting anguish that is often inflicted on the proclaimed, and sometimes even an unproclaimed, animal is undeniable.

It is the policy of the three departments, Kenya, Uganda and Tanganyika, to select in any troublesome herd, only tuskless animals. If, however, there are none or if it should be necessary to destroy more than one animal, single tuskers or those with small tusks are chosen. The average weight of ivory obtained on control in Tanganyika in 1953 was 11 lb. per tusk as against 53 lb. per tusk for ivory obtained on licence. In Uganda 77 per cent. of the tusks obtained on control were under 20 lb. each, or an average of 13¾ lb. per tusk. From these figures the reader will realize how incorrect the allegation is that the various departments only shoot the large tuskers.

To prove the incorrectness of the second of the two allegations; that the Game Departments are responsible for the annual destruction of nearly as many elephants as were destroyed in the early days before the introduction of elephant control, I quote the returns of the number of elephants killed annually on control work for the three departments during 1951 and 1952.

These figures speak for themselves:—

Year	*Kenya*	*Uganda*	*Tanganyika*	*Total*
1951 ..	102 ..	639 ..	1,837 ..	2,578
1952 ..	82 ..	477 ..	2,420 ..	2,979

The comparatively large figure shown against Tanganyika is due to the heavy elephant population and the ever-increasing African population with its consequent need for more and more cultivation.

Apart from the erroneous statement that the African Elephant is in danger of extermination, it is often asked if the elephant population is actually increasing or decreasing. It would be quite impossible to give an accurate estimate as to anything like the exact total elephant population of British East Africa, and any figures must be regarded as mere "guesstimates". One thing, however, is quite certain that *Loxodonta Africana* is in no danger of extermination. Authorities on African Wild Life have put the population figure between fifty and seventy-five thousand which, at first glance, may seem a high figure, but it must not be forgotten that since the introduction of the various Game Departments and National Parks the elephant has been allowed a far greater chance of reproducing itself. It is now not uncommon to see nearly every cow with at least one calf at heel, a fact that was practically unheard of during the late Nineteenth Century.

The credit for the survival of the African Elephant is due to the vast sanctuaries provided by the National Parks and Reserves, and the hard and unceasing work of the Game Departments. The specialised work of elephant control has been designed purely in the interests of the cultivator, sportsmen and the principals of game preservation. Any dispute as to the reasons or consequences of elephant control might well be left to the prudent judgment of those who have studied this subject over a period of many years.

Ury Group,
Passara, July 6, 1955.

NOTES ON A TOUR IN KASHMIR–(4TH WORLD FORESTRY CONGRESS)

C. H. Holmes

THE assembly of the Congress was, in the tradition of earlier World Forestry Congresses, preceded by tours in the host country. This gave visiting delegates opportunity of seeing for themselves something of the forests and Forestry activities over such a wide range of conditions as is unlikely to be found in any other single country in the world. Conditions ranged from near equatorial moist tropical regions, arid desert lands to the snow bound temperate zone of the Himalayas. It also served to enable the delegates to get to know one another informally before the formal meetings of the Congress.

The writer has from previous visits been fairly closely acquainted with many of the forest regions over the greater part of India, except the Rajasthan deserts and the State of Kashmir. Consequently, he took the opportunity provided of following the tour in Kashmir whilst his colleague took that in the Nilgris.

Tour in Kashmir

The Kashmir tour was, as might well be expected, the best attended of the 10 different tours the host country and Pakistan had arranged for the Forestry Congress delegates. A party of 44 delegates assembled at the Willingdon Aerodrome, Delhi, at 8 a.m. on Saturday the 4th December, 1954. They came from 15 different countries. The tour arrangements were in the hands of Messrs. Mercury Travels (India) Ltd. who had chartered 2 special Dakotas of the Indian Air Lines to take the party to Srinagar.

The East Punjab Plains

The flight from Delhi to Srinagar lay over the East Punjab part of the reputedly fertile valley fed and drained by the two great river systems of the Indus and Ganges. This plain relatively low, flat and, unrelieved by prominences, rarely exceeds a thousand feet in elevation. The depth of silt carried down from the Himalayas is said to vary from 6,000 to 20,000 feet!

From the air the land below takes the appearance of an enormous patch worked quilt of mainly different shades of brown and some greens. The scattered villages appear as grey scrofulous growths. Forests are notably absent. A glimpse was obtained of some spectacular irrigation works, the Barahara Dam, said to be nearing completion and the magnificent irrigation channel, taking off from the left bank at Hoshiapur, a long glistening silvery ribbon of many miles.

Nearing the Kashmir-Jammu state the outermost foot hills of the Himalayan Range, the Siwaliks come into view. These are mostly bare and eroded. Forest Department efforts at conservation of the heavily browsed low scrub forests of these hills are said to have been set to nought by the opposition encountered from the indigent and ill informed local peasantry.

Efforts are now being renewed to get some control established through carefully planned soil conservation schemes.

The Siwaliks

The outer Siwaliks are soon followed by the inner Siwaliks of entirely different appearance. The hills here are in sharply defined ridges and deeply fissured by narrow valleys. The slopes are mercifully and refreshingly clothed in a green mantle of trees mostly of Chir pine, *Pinus longifolia*, broken here and there by open brown patches of grass or scrub land. Range upon range of the snow covered Himalayas of which it was possible to count no less than seven, formed a magnificent and awesome background.

First glimpses of Kashmir

The 'plane about this point gained rapidly in height making for the Banihal Pass to Kashmir and as we went over the snow covered pass a wonderful view of the west Himalayas was obtained. The single majestic conical mountain to the right, or east, and the twin peaked mountain a little further away are said to be Brahma (21,800 ft.) and Kun Kun (23,000 ft.). The western range surrounding the valley of Kashmir seen to the right of the 'plane is said to be Pir Panjal. Snow storms were seen to be raging and obscuring the mountains due north. The Kashmir plain below is a large flat of drab brown colour. The mountain slopes further out are also barren and bare on the southern and eastern aspects and with Deodar—*Cedrus deodara*—and *Khail* or Blue Pine, *Pinus excelsa*—on the northern and western aspects with a mantle of snow on the floor below them. The absence of forest on the slopes of the southern and eastern aspects is due to the failure of regeneration following clear felling owing to frost and the sudden exposure to the morning sun on such aspects. The terraced cultivation even at 10,000 ft. so much resembling paddy fields in the hills at home were subsequently found, much to my surprise, to be actually of paddy !

The 'planes touched down at the Karewa Aerodrome about 12.30 p.m. and the party were met by a friend of earlier visits to India, Mr. Harnam Singh, Chief Conservator of Forests, Kashmir and Jammu, and other officers of his staff. Soon we were on our way to the capital, Srinagar, 8 miles away.

Valley of Kashmir

At this time of the year the Kashmir Valley is perhaps seen at its worst and most disappointing to any one who from travel accounts has been expecting something of a paradise on earth. The valley is dead flat, as is to be expected from the fact that it formed the bottom of an enormous lake in geologic times and was drained probably with the upheavel of the present Himalayan ranges. The point at which the lake was drained is said to be the single gap in the surrounding mountains at Baramulla. The Wular Lake of some 50 to 60 square miles to the north of the valley is said to be a part of this prehistoric lake that is now the valley of Kashmir. The river Jhelun and its tributaries drain the valley.

The land within the valley was of a dusty grey brown unrelieved by green vegetation of any kind. There was hardly any grass in the meadows

and what there was, was brown and parched. The terraced paddy fields were bare, caked mud blowing off in a fine dust. The trees lining the road sides and scattered over the country side were all leafless. The most common were the Kashmiran Plane, Poplars, mostly of the Lombardy type, *Populus nigra* and also *P. alba,* willows, (*Salix alba* and *S. fragilis*), Mulberry and apples. It is not understood why there are no evergreens like the Deodar and Pines even if only to provide some colour to the valley in the winter. Somewhat reminiscent of the practice in the Scandinavian countries winter fodder is heaped high up on trees out of reach of cattle.

The delegates were put up at the Nedous Hotel, the best hotel yet in Kashmir but by Ceylon standards not very comfortable. The electric lighting both in the streets of the city as well as in the rooms of the hotel were only able to glow due to the inadequacy of the power supply. There was no central heating and the main reception rooms as well as the bedrooms were heated by primitive wood burning stoves of a design apparently peculiar to the country.

Sericultural Institute, Srinagar

The afternoon of the first day on tour in Kashmir was spent visiting the Government Sericultural Institute and Silk Factory, the Silk Weaving Factory and the Arts and Crafts Emporium. The Sericultural Institute carries out research into the culture and breeding of the silk worm, control of its pests and diseases and the storage of cocoons. Both the Institute and the Factory are well run and a great deal of scientific attention is being paid to keep up the high standard of quality Kashmiran silk has justly earned for itself in the world market. The manager of the factory was able to show his visitors round with justifiable pride and point out a locally manufactured spinning machine which he claimed was a considerable advance on a similar machine imported from Europe.

Silk Factory, Srinagar

The Government issues some 40,000 ounces of silkworm eggs per annum free to villagers, about an ounce to each family growing silk worms, and obtains from them some 27,000 mounds of silk per annum. The silk Factory employs approximately 2,000 workers at an average stipend of Rs. 2.25 per day. The quantity of silk yarn produced is approximately 130,000 lb. valued at Rs. 8,000,000 per annum. The best part of this yarn is used by the Weaving Factory which employs some 75 permanent and 500 part-time workers. This Factory produces the world famous Kashmiran sarees with an average annual turn over of more than Rs. 1,250,000.

Arts and Crafts Emporium, Srinagar

The Arts and Crafts Emporium is one of a chain of such display and retail sale centres the present Government of India has distributed all over India. Housed in the old Residency of the Governor of Kashmir the Srinagar Emporium has an interesting and valuable display of locally made articles of a very wide range, e.g., Furs, gaily coloured *papier mache* articles, finely carved silver ware, silk shawls, sarees, &c., exquisitely carved wooden articles of many kinds, woollens, Kashmiran embroidery, &c. The yearly business of the emporium is said to be about 2½ millions.

Journey to Lolab

The valley of Kashmir contains no forest whatever. One has to make a journey of at least 40 miles from Srinagar before any forest can be seen. The second day's journey brought us 70 miles from Srinagar by jeeps to the Lolab forests of Deodar the pride of the Kashmir forests, even indeed of India. The drive through the plains was none too pleasant. At this time of the year the lack of cover leaves the valley a veritable dust bowl.

Points of interest on the way to Lolab were the flood spill channel just 4 miles out of the city where the " raiders " were said to have been " held and routed " by Indian troops, the local school for training of subordinate forest officers at Bandipur, a picturesque avenue of Lombardy Poplars which must be very beautiful in spring and summer and the ancient temple (A.D. 900) ruins at Pathan. All along the most astonishing feature for one coming from the equatorial belt is the unexpected juxtaposition of terraced paddy fields with apple orchards ! Paddy even at this relatively high latitudes is said to be grown successfully at 10,000 feet in summer when in Ceylon near the equator it gets not much higher than 4,500 ft.

The route from Srinagar followed the main road to Rawulpindi for about 27 miles then branched off and went on through Sopore, very much like its name seems to sound, to Kupwara and Lolab. The roads in some parts were lined with poplars, *Populus alba* and *P. ciliata*, white barked like Birch. Willows lined stream banks. Mulberry plantations and apple orchards marked zamindar lands and peasant allotments.

Lolab Forests

The Lolab forests are in a picturesque side valley a few thousand feet above the main Kashmir valley. The Working Circle covers approximately 35,000 acres about 3/5 of which is of prime Deodar Forest and the balance mainly of Blue Pine. The mature trees are of majestic proportions around 125 feet in height and 6/7 feet in girth. These forests are being worked on what is described as the Indian Irregular Shelterwood Compartment System, on a rotation of 150 years, a Regeneration Period of 30 to 40 years and a Conversion Period of 110 to 120 years. The system takes advantage of any and all advance growth up to pole size.

The lower slopes of the Lolab range of mountains are subject to heavy grazing. The ground is so hard that natural regeneration is precluded. Trials are being made to improve the situation by soil wounding and, in the last resort, it is intended to carry out artificial planting of the Blue Pine (Pinus excelsa). This pine is said to be the primary colonist of the clayey soils of the lower slopes. The Deodar occurs on the higher slopes with an intermixture of both species on mid-slopes.

Kashmir-Foresters eschew mechanized logging and extraction

In regeneration fellings great care is taken against damage to seedling regeneration on the ground. Daring and hardy woodsmen are employed to lop side branches working from top downwards on these mighty trees before they are felled. Nearly all work in the forest, as was later found to be the rule generally all over Kashmir, was done entirely by manual labour which is said to be cheap enough at Rs. 2 per diem. Though

these concentrated stands of high yield values would lend themselves to economic mechanized extraction and greatly help haulage particularly in these mountain tracts, the local forest authorities are not enamoured of mechanization and would rather depend on manual labour and provide employment for men rather than machines. Even big logs are hauled down the slopes by teams of men without even the aid of animal traction.

On the way back a visit was paid to the Ningli Willow plantations of *Salix alba* and *S. gracilis* raised on reclaimed marshes near the Wular Lake and dating from 1915. A rotation of 16 years is followed and the timber is supplied to the Government Sports Goods Manufactory. The plantations are artificially regenerated after clear felling by planting branch cuttings 12-15 ft. in length.

The Wular Lake, the remnant of the prehistoric lake of the geologic ages past that is now the great valley of Kashmir, was seen at dusk. It formed an eerie unnatural looking picture of a still glassy lake shrouded in a misty haze with a background of awesome mountains covered in snow. There was not a sign of life about and from the sense of desolation the scene created one might have been on the Moon.

On the third day's tour the party took the main road to Jammu up to the 29th mile. En route a stop was made at the ruins of the Pandrettan Temple. From the 29th mile of the main road, a fair weather forest road, very much the worse for wear, took us to the Zowra Pine Forest about 12 miles on.

The ruins of the temple is said to mark the site of the old capital of Kashmir founded by the King Asoka in the Third Century B.C. Hence the name "Panderathen" which means the old capital. The temple itself built entirely of granite is said to date from about the 10th Century A.D.

Zowra Saw Mill

On the entrance to the forest is a small Saw Mill worked by the contractor carrying out current fellings in the Zowra Forest. This mill is provided with a horizontal break down band saw and 2 vertical band resaws, which are belt driven by a 26 H. P. Diesel Engine. The timber being sawn, mostly of Blue Pine, has to be man handled. For want of any ramps or roller feed benches the timber has to be half carried and half pushed through the saws by hand. This is only possible on account of the relative lightness of the wood and the general huskiness of the local labourers. It is said to produce a 1,000 cubic feet, described as meagre, of sawn timber per day.

The Zowra Forest

The forest is not so striking as that seen on the second day of the tour. The stand at the entrance to the forest said to be approximately 50 years of age was generally of much lower height and smaller girth. Compartments 21 to 24, were in various stages of regeneration fellings conducted under what is called the Shelterwood Compartment System.

These Blue Pine Forests of the sedimentary rocks of Karewa are said to be amongst the finest of their kind in India. Compartment No. 24 the last to

be seen, said to have been underplanted with Deodar some 25 years ago, is now well stocked with the Deodar up to 15 feet in height. The overwood of pines is being removed. All the larger standing trees have had their branches lopped so as to reduce damage to the undercrop in the course of final fellings. Many of these are found to be suffering from heart rot due to *Trametes pini*. A curious little phanerogamic parasite, no bigger than the end of a match stick is said to set back growth of the pines very seriously. Another problem ever present in the forests bordering the populous valley is grazing.

Sawing of the logs is done in situ by manual labour using frame saws. Side wanes on sleepers are hacked off by sharp large bladed adzes. Logs are moved to the sawing sites by gangs of labourers, pulling the logs by ropes in front and pushing them by hand from behind.

Mogul Gardens

On the way back, visits were made to the remains of the 17th Century gardens of *Nishat Bagh* said to have belonged to Asaf Khan, the then Prime Minister and father-in-law of the Emperor Shah Jahan and of *Shalimar*, once the residence of the Emperor Nurjehan and Jahugir. These gardens are picturesquely situated beside the beautiful Dal Lake.

Trout Hatchery, Harwan

A stop was made at the Trout Hatchery maintained at Harwan by the Kashmir Forest Department. The Hatchery breeds both the Brown and Rain-bow Trout and also carp. An interesting demonstration was given how trout eggs and sperm are extracted from selected females and males in breeding condition for artificial semination and breeding. The hatchery is run by a small band of trained Forest Guards under the control of the territorial Forest Ranger.

On the fourth day of the tour (8-12-54) the route again took a southerly direction from Srinagar, but instead of turning right at the Channel Spill Bridge at Karewa, went straight on to Charari Sharief and thence to the Ramsha Forest. On the way out a visit was made to the Government Joinery Mill at Pampore.

Joinery Mill, Pampore

This mill has recently been built and equipped for the Government of Kashmir by a Swedish firm of wood working engineers at a cost of 3 million rupees. The mill has been carefully designed to meet needs of mass production on a continuous and progressive assembly line from the raw material at one end to the finished products at the other. It is employed in the manufacture of doors and windows of Deodar in a few standard patterns. Its production capacity is said to be 35,000 doors and windows per annum.

The mill is served by a dust collecting plant similar to the one recently installed at the Research Laboratory of the Department in Kew Road. The main pipe line and ducts, however, are laid below a wooden floor and tap each of the wood working machines from underneath instead from overhead as in our plant. Another point of contrast is that the suction fan is placed a good distance away from the cyclones, which have been set up over the boiler house serving the timber seasoning kilns.

All timber used in the Joinery Mill is seasoned in a battery of steam heated kilns of the most modern design. Thereafter it is treated under pressure under the empty cell process with aqueous solutions of Boliden salt. The pressure treatment plant is also of Swedish manufacture specially designed for use with this preservative.

Just below the Joinery Mill and contrasting with it, as is typical with nearly all things in India, is a rather primitive make shift mill for manufacture of shooks. This mill is powered by 2 old steam roller engines and provided with a number of circular saw benches driven by belts.

Soil erosion around Charai Sharief

The route out to the Ramsha Forest carried through the dust laden flat of the valley and wound steadily up through denuded hills carrying terraced paddy fields and apple orchards in the more sheltered folds. At and around the holy village of Charari Sharief one sees the most ghastly evidence of erosion of all kinds. The village itself is precariously perched on the edge of a sharp escarpment, in mortal danger of being carried away by a landslide at any moment. Some of the population perhaps conscious of the danger are building themselves houses on the easier slope on the opposite side of the ravine.

The Forest Department is said to be meeting with stiff opposition and no assistance from the local population in the valiant effort being made to affect afforestation of the barren slopes. This is being done using intercepted contour trenching and planting with large striplings of *Ailanthus glandulosus* and *Robinia pseudoaceaecia* on the higher slopes and Poplars on the lowest reaches and valleys. Prof. Phillipis of Italy who was in the party suggested *Ulmus pumila* should also be tried.

Ramsha Forest

The Ramsha Forest is a fine stand of Silver Fir, *Abies pindrow* in mixture with some Spruce, Picea morinda and Pine, *Pinus excelsa*. At the time of our visit the streams were frozen but there was no snow about. The floor of the forest is grassy and grassy downs break into the forest here and there. Both the forest and these are heavily grazed by flocks of sheep and it is said also by buffaloes. Recent fellings have apparently continued experimentally on the Uniform Compartment System but the revised working plan is said to provide for a change over to Selection Fellings.

The afternoon was spent participating in a tree planting ceremony, to commemorate the visit of the IVth World Congress Delegates to Kashmir, on the Shankracharya Hill in Srinagar. Each delegate planted a deodar arranged to form the outline of the Congress crest.

The morning of the last day in Kashmir was left free to enable delegates to do as they pleased. The writer formed a small party with three other delegates and the Chief Conservator of Forests, Kashmir, kindly took us in his jeep to Gulmarg, a distance of some 30 miles the last 5 miles of which was a rather perilous and slippery climb on a steep gradient over a snow covered bridle track which only a 4-wheeled drive military type jeep would take.

Gulmarg

The elevation was around 8,000 to 10,000 feet and to all appearances we might have been in the Swiss Alps in mid winter! The Gulmarg meadows of even rounded hills were covered 2 feet deep in glistening snow, that hurt the eyes unprotected by sun glasses. An eerie atmosphere was created by the closely shuttered and abandoned cottages and hotels used only in summer.

No view of Nanga Parbat (26,660 ft.) was possible owing to heavy mists and clouds covering the Himalayan Range. Though a most attractive centre for winter sports apparently only the army makes use of it in winter for training purposes.

The forests around consisted mostly of *Abies pindrow, Picea morinda,* Pinus excelsa, and *Taxus bacata*. Here again it was said that in spring, summer and autumn the forests and meadows were subject to heavy grazing.

FOREST CROSS-WORD

Across

1. Forests improve this of a country.
6. These are a great danger to Teak plantations in the Dry Zone.
7. Hard, indehiscent, one-seeded fruit.
8. A nocturnal insect, the larvae of which damage plant organs.
9. Barks and fruits of several forest plants give this minor forest produce.
10. The chief agent in the destruction of forest.
11. This often causes damage to seedlings in Up-country.
13. Michelia champaca.
16. A good wood preservative.
18. An exotic timber tree of the Up-country.
19. May be a map or a tabulated statement.

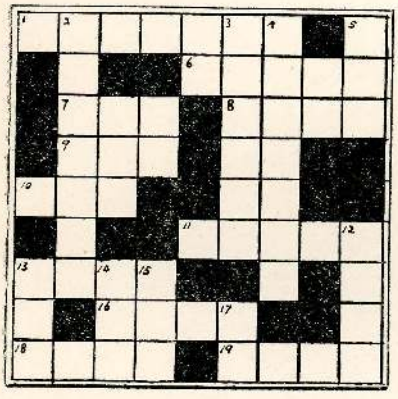
Down

2. A noxious weed in abandoned land.
3. Man can do without gold, but not this.
4. Causes soil degradation and leads to floods.
5. A good burn which produces this, aids rapid growth in young plants.
12. This should be done in congested crops.
13. Presence of this in timber invites borers.
14. Formation of this in the soil retards tree-growth.
15. A knowledge of Forestry is essential for proper land—.
17. Seeds and fruits should preferably be collected from—the tree than down on the ground.

(*Open only to Forest Guards*)

cut here

Retain



Retain this for comparison and study with the correct solution which will be published in the next issue.

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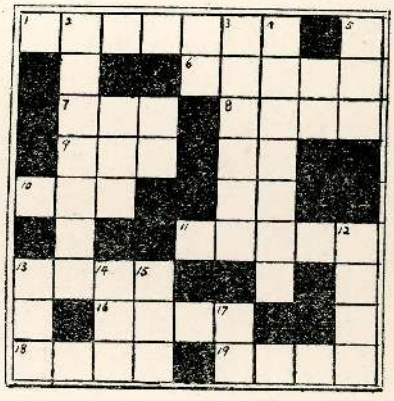
—Free Entry—



Name : .....

Beat : .....

Range : .....

Division : .....

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1. Entries are free and should reach the Editor, *The Ceylon Forester*, Forest Department, Kew Road, Slave Island, on or before 12 noon on *Saturday, December 17th*
2. " Cross-word " should be marked on the envelope enclosing the entry.
3. The first correct solution opened will receive a cash prize of Rs. 10 and one year's free issue of *The Ceylon Forester*.
4. The decision of the Editor will be final.
5. Name of the prize-winner will be published in the next issue.

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