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Notes on collection and germination of seeds

How to collect seeds of *Wrightia tinctoria*

Wrightia tinctoria locally known as 'Kodakapala' and in trade as 'Oudhi' is a small deciduous tree distributed through out the peninsular India. The wood is extensively used for carving, turnery, match boxes, match splints etc. The celebrated 'Chennapatna' toys and wooden idols are also made of Kodakapala wood. A dye is extracted from the leaves, roots and the seeds. The leaves are also used as wrapper for beedies. In South India the leaves are used as green manure in paddy fields. The bark, seed and leaves have medicinal properties. The fresh latex of the tree is used for curding milk. The seeds yield a deep red oil. This tree is reported to be suitable for poor soils and dry localities. It can be propagated from seeds, or by planting out entire plants or stumps.

The fruits consist of a pair of elongated and slender follicles cohering at the tips. When the fruits are fully ripe and dry (during January-February) they dehise and the seeds with coma escape. As soon as seeds are liberated wind carries it to far off places. Therefore it is necessary to collect the fully ripe fruits before dehiscence. A longitudinal fissure which develops on the inner side of the follicle indicates maturity. Collect the mature fruits in gunny or cloth bags and dry in sun. After a day or two, the dried fruits are transferred to a drum and churned lightly with a forked stick. The seeds escape from the follicles and get collected at the bottom of the bags.

Some details of the seeds of *Wrightia tinctoria* collected from Walayar (Kerala) in February 1989.

• Length of follicle	20 to 39 cm
• No. of seeds per pair of follicles	60 to 96
• Length of seed	1.3 to 2.0 cm
• No. of seeds per kg.	42200-45400
• Germination potential of seeds stored for 7 days:	59%
• Germination period	4 to 20 days

K. C. Chacko
Division of Silviculture

Cassia fistula seeds germinate better after one year in seed bed

Generally, when fresh seeds of *Cassia fistula* (Kanikkonna) are sown the percentage of germination is very low. Seed pretreatments with boiling water or chemicals are not very effective. Incidentally it was observed that, if the seeds are retained for one year after sowing in the nursery beds, more than 90% of the seeds germinate during the second year. Storing the seeds in containers for one year before sowing do not appear to have the same effect. The following method is suggested. Prepare permanent nursery beds and sow fresh seeds during February-March. Water the beds for about one month and allow the seeds to remain in the beds for one year. During next year resume watering the beds during February-March. The seeds will start germinating more or less uniformly within a few days. Keeping the seeds in the nursery beds (soil) for one year might have caused the disintegration of seed coats resulting in high percentage of germination.

Raising Agave seedlings from seeds

Usually Agave is propagated from bulbils. We often neglect the fruits and the enormous number of seeds in them. Agave can be raised from the seeds also. It will be less expensive if nurseries for germinating the seeds are near to the planting site. For raising the seedlings, the seeds are first spread in the nursery beds and covered with a thin layer of soil. The beds should be watered regularly. Germination was recorded to be around 40%.

N. Gopalakrishnan Nair
Division of Botany

Polyurethane foam technique for raising *Ficus* seedlings

While raising seedlings of Ficus sp. Prabhakaran and Balakrishnan of the Botany division found that the polyurethane foam technique developed for Eucalypts by Chacko of the Silviculture division could be suitably adapted. As per this method, collect ripe fruits (figs) and dry them. Cut them open and scrape out the seeds using a scalpel. Spread the seeds uniformly over a water soaked polyurethane foam sheet and keep the sheet in a tray of water. Germination of seeds starts within a week. After two weeks prick out the tender seedlings and plant them in trays filled with sand and cowdung mixture. Keep the trays in shade for about ten days and then expose to sunlight for about two weeks. Carefully prick out the seedlings and polypot them. A mixture of sand and soil can be used as planting medium. Maintain the seedlings in the nursery for about six months. By this time seedlings will be ready for outplanting.

Cowdung can enhance germination of sandal seeds

Gibberellic acid (GA) is frequently used to enhance germination of seeds of sandal *(Santalum album)*. Instead of GA it is very cheap and easy to use cowdung. Mix fresh sandal seeds in fresh cowdung and allowit to remain for 48-72 hours. Ensure that the moisture in the cowdung is maintained. Wash the seeds and sow them. A uniform germination is the result.

M. I. Mohammed Ali
Division of Plant Pathology

Cut-grass to suppress grass growth

In steep slopes it is not desirable to remove the grass, since it accelerates erosion. It is possible to use grass to check grass growth. Cut the grass at ground level before it flowers and cover the basal part with the cut grass. If fire protection is ensured there will only be comparatively less grass growth during the next monsoon.

N. Gopalakrishnan Nair
Division of Botany

Aerial photography in Forestry

The idea of using aerial cameras for forestry surveys was conceived during the eighteenth century. But practical application of aerial photography and photogrammetry had to wait until the development of the gelatin emulsion by Maddox in 1885 and air plane by Wright Brothers in 1903. The first aerial photograph from a plane was taken by Wilber Wright in 1909.

Germans were the pioneers in using aerial photography for forest mapping. Initially, hot air balloons were used to prepare forest stand maps. A method of direct sketching from air plane was attempted by Elwood Wilson of Canada in 1919. Later on with the perfection of cameras, this technique gave way for oblique and vertical photographs with more accurate results.

It was only in 1929 the techniques for forest type recognition and stand volume estimation from aerial photographs was perfected. Tree heights was estimated from shadows of aerial photographs and stand volumes were taken from crude aerial stand volume tables.

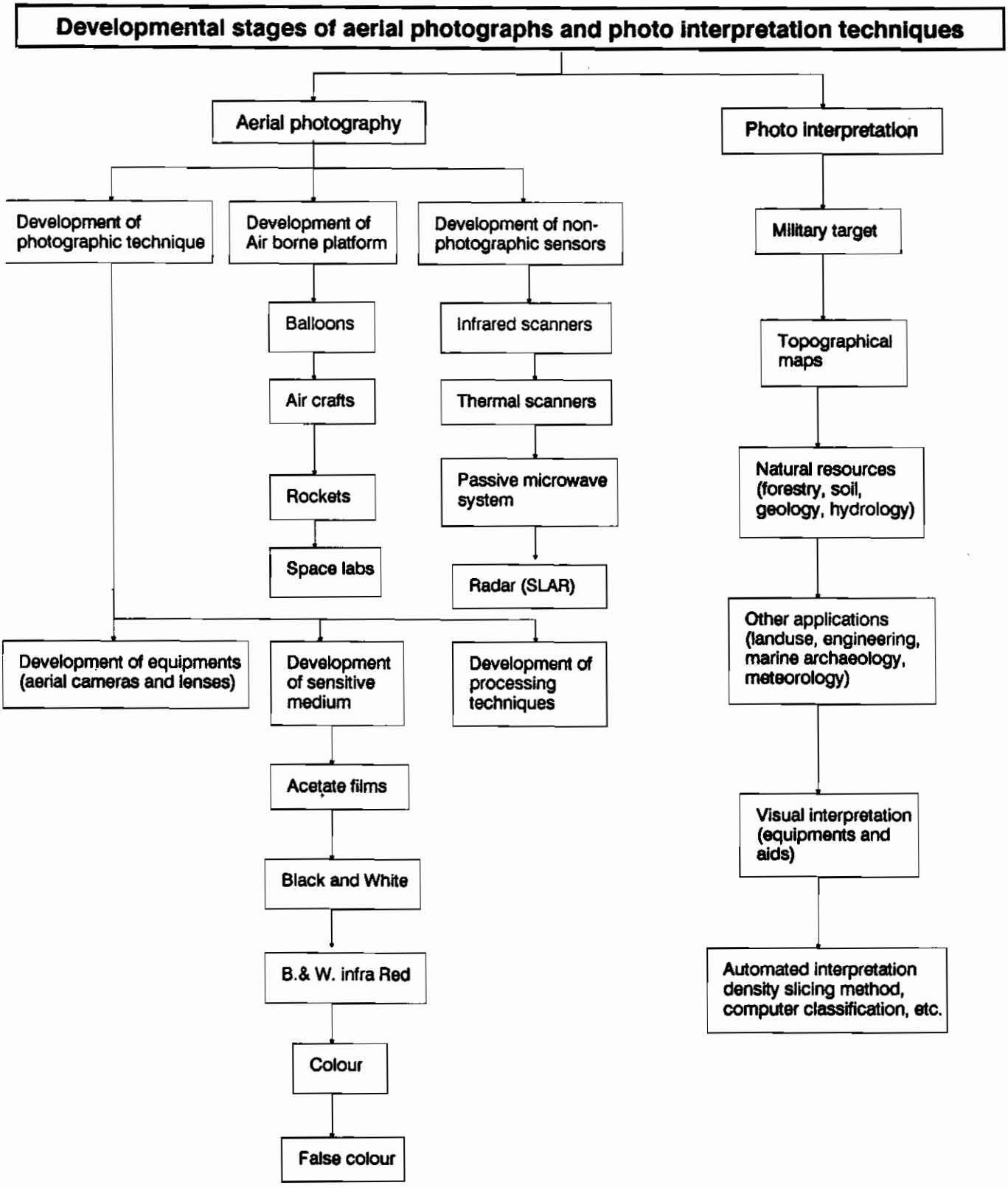
The Forestry Research Institute, Therandt, Germany developed the principles of aerial photographic measurements for timber volume estimation in 1923. This was a breakthrough and a series of research papers on this subject appeared afterwards. A report on the German developments on photogrammetry was published by Andrews in 1934.

In the United States photogrammetric techniques were started by Graff (1913). He used special panoramic cameras for this and pointed out its applicability in forestry. Between 1919 and 1933, a number of papers appeared on the potential use of aerial photographs in forestry. Ecologists like Cooper and Cain used aerial photographs in general vegetation mapping. In 1933, Ryker published trials of tree identification in the Sierra Neveda forests of California. In 1934, Foster explored the use of photographs in surveying the bottomland forests of Mississippi river banks. Subsequently, the U.S. Dept. of Agriculture used aerial photography in forest mapping.

The technique of preparing photographic inventory was popularised throughout the country during 1945-1948. This lead to a situation in which a professionally trained forester had to compulsorily take up a course in photogrammetry and practically every major forestry school in USA and Europe provided opportunities for this. The aerial photographs and stereoscopes thus became the essential tools of every practicing forester in resource assessment.

In India, the use of aerial photographs was started in 1924 for delta mapping. But regular surveys using aerial photography were started only during the 1950s . First effective application of this technique was for the preparation of topographical maps. Preinvestment Survey of Forest Resources, India has been using aerial photographs for forest type mapping and inventories, since 1965. Establishment of the Indian Photointerpretation Institute (IPI)(now Indian Institute of Remote Sensing) in Dehra Dun was one of the major breakthrough in this field. With the opening of I.P.I, the photointerpretation technique was popularised and many organizations like Forest Survey of India, started photointerpretation works.

Nowadays, air borne recording techniques, that register reflected radiation in the visible and near infra red parts of the spectrum are used in aerial photography. Other techniques such as Side Looking Airborne Radar (SLAR), Thermal Infra-red Line scanner and Multispectral Scanner are also being developed. These methods in combination with orbital satellites have given new dimensions of sophistication and perfection.


Developmental stages of aerial photographs and photo interpretation techniques
Aerial photography
Photo interpretation
Development of photographic technique
Development of Air borne platform
Development of non-photographic sensors
Military target
Balloons
Infrared scanners
Topographical maps
Air crafts
Thermal scanners
Natural resources (forestry, soil, geology, hydrology)
Rockets
Passive microwave system
Space labs
Radar (SLAR)
Other applications (landuse, engineering, marine archaeology, meteorology)
Development of equipments (aerial cameras and lenses)
Development of sensitive medium
Development of processing techniques
Acetate films
Visual interpretation (equipments and aids)
Black and White
B.& W. infra Red
Automated interpretation density slicing method, computer classification, etc.
Colour
False colour

The application potentials of various satellite sensor systems for forestry studies are summarised in the table given below.

Sl. No.	Sensor	Approx. resolution	Possible application in forestry
1.	Landsat MSS	90 M (1.1 acre)	Broad forest types and occasionally specific types classification
2.	IRS1- (Liss 1)	73 M (1.0 acre)	Broad forest types and occasionally specific types classification
3.	IRS1- (Liss 2)	36.5 M (0.3 acre)	Association dominated by large crown species will be better classified. Forest types separation and area measurements improves
4.	Landsat TM	30 M (0.15 acre)	Disease attacks identification may be possible in addition to above
5.	Spot MSS mode	20 M (0.07 acre)	Forest type determination further improves
6.	Spot pan mode	10 M (0.02 acre)	Saw timber species distinguishable among the groups of smaller trees

A. R. R. Menon
Division of Ecology

'Alarm signals' from trees

Acacia trees can pass on an 'alarm signal' to others which quickly react by producing leaf tannin in quantities lethal to some animal species. Detailing the results of research in the South African Transvaal region at an international tree symposium, Mr. Wouter Van Hoven, said acacias, whose leaves were nibbled by antelopes, emitted ethylene into the air which could travel 50 meters.

Thus alerted in less than 15 minutes the neighboring tree increases the amount of tannin in its leaves which consequently become toxic, said Mr. Van Hoven, a zoologist from Pretoria University.

Autopsies ordered after some 3,600 antelopes died in 1985 in fenced in ranches indicated that the browsers did not die of disease, parasite infection or long term hunger or thirst.

A significant correlation emerged between density of kudu (antelope) percentage mortality and tannin concentration, Mr. Van Hoven said, noting that the antelope on the fenced in ranches could not avoid plants with high tannin.

His study involved a total 42 fenced in game ranches and game reserves from the north-west to north-east of the Transvaal. Giraffe grazing freely in game reserves avoided trees downwind from where they had been eating, apparently to avoid the chemical defenses in neighboring trees.

According to Mr. Van Hoven, the alarm system could be passed from one tree species to another. But Mr. Claude Edelin, a researcher at the Montpellier Botanical Institute which organised the symposium cautioned that although the discovery was 'terribly exciting one should be careful not to generalise too quickly about all tree species'.

Silent Valley National Park - A world heritage nominee

In November 1972, UNESCO at the seventh session of its General Conference held in Paris chalked out some guidelines concerning the protection of the cultural and natural heritages of the world. The important criteria adopted for inclusion of a monument or site in the world heritage list are as under;
natural features consisting of physical and biological formations or groups of such formations which are of outstanding universal value from aesthetic or scientific point of view;
geological and physiographical formations and precisely delineated areas which constitute the habitat of threatened species of animals and plants of outstanding universal value from the point of view of science on conservation;
natural sites or precisely delineated natural areas of outstanding universal value from the point of view of science, conservation or natural beauty.

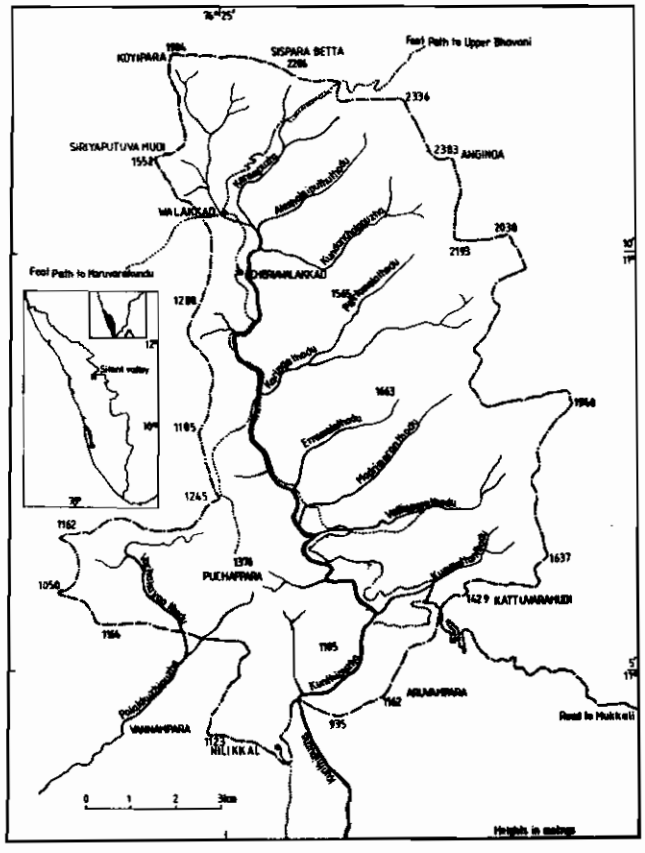


Fig. 1. Silent Valley National Park

In the 'MAB Regional Training Workshop on tropical forest ecosystem conservation and development in South and South-East Asia' at Trichur in Kerala during 1-15 May 1989, a resolution was passed for recommending to Government of India to nominate Silent Valley National Park as a World Heritage site of UNESCO on the basis of a suggestion made by Prof. P.S. Ramakrishnan. Inclusion of Silent Valley in world heritage list of UNESCO will strengthen international cooperation in protection, conservation and sharing of educational programmes in future.

The Silent Valley National Park (11° 3' to 11° 13' N latitude and 76° 22' to 76° 30' E longitude) situated at the south-western corner of the Nilgiri hills, comprising the Kundah hills of the Western Ghats is in Palghat District of Kerala State. The park is 8951.65 ha in extent and is bounded by Attappady reserve forest at the east, Mannarghat Forest Division at the south and Nilambur South Forest Division at the west. The northern boundary is contiguous with the Nilgiri forests. It is about 45 km away from Mannarghat by road and 23 km from Mukkali, a place on Mannarghat-Coimbatore road. The park is 75 km northwest of Palghat railway station and 200 km north east of Cochin airport.

History of the area

The Silent Valley was declared as a reserved forest in 1914. But human interference for removal of timber and collection of minor forest products like honey, wax, dammar, cane etc., started almost simultaneously. Timber extraction, which was confined to certain selected species was extended to more species with the introduction of the selection felling system.

The area has been managed by regular working plans since 1933. Though detailed prescriptions were given in the working plans for the harvest of timber as well as conservation of the area, the latter was almost neglected. However, due to the rugged nature of the terrain, accessibility was limited and the damage was concentrated only in certain portions of the valley leaving the rest of the area almost intact. Thus, in spite of continuous exploitation Silent Valley remained as one

of the least disturbed chunk of tropical evergreen forest in the Western Ghats. The area is totally devoid of human settlement probably due to harsh climate, inaccessible terrain and impenetrability of the forests.

Silent Valley became the focus of India's fiercest and most widely publicized environmental debate in the late 1970s, when the Kerala State Electricity Board decided to construct a hydroelectric project in the valley and as a preliminary step, trees from the submergible areas were removed.

A study[1] conducted by the Kerala Forest Research Institute, on the the wildlife wealth of Silent Valley sparked of the campaign to save the valley. Several governmental and nongovernmental organisations including IUCN and WWF joined the campaign. Ultimately, the Government decided to abandon the hydel project and declared it as a National Park on 15 November 1984. It is now one of the core areas of the Nilgiri Biosphere Reserve, the first biosphere reserve in India, declared on 1 st September 1986. Declaration of Silent Valley as a National Park and the inclusion of it in the Nilgiri Biosphere Reserve afford a special status calling for careful protection and conservation. The Kerala Forest Act, 1961 and the Wildlife (Protection) Act, 1972 and the rules made thereunder contain provisions for the overall protection of the area.

Present Management

As a prerequisite for effective management, a separate forest division called Silent Valley Forest Division with required protective staff and headquarters at Mannarghat was constituted in 1985-86 exclusively for the management of this Park. Successful control of wild fire, which plagued this area earlier, has brought about positive changes in the succession pattern. Natural regeneration of tree species is observed in the degraded shola forests and adjoining grasslands. Human interference has been brought down to the minimum. No one is permitted to enter the National Park except protection staff and research workers. Visitors are permitted only in the peripheral regions. Outposts have been set up in the sensitive areas with wireless communication net work to check poaching and smuggling. The thrust of the management policy is in conserving the biological diversity of this unique forest ecosystem. Nature education is also considered as one of the focal themes in management since Silent Valley movement played a significant role for creating mass environmental awareness in the country.

Description and inventory of the area

The forests of Silent Valley National Park fall under the category of Malabar Rain forest Realm as per the world classification by Udvardy (1975)[2] This reserve is situated on a plateau of about 1000 m msl. The altitude varies from 685 m to 2383 m. There are several hillocks within the forest and water drains into Kunthipuzha, a tributary of Bharathapuzha.

The region is characterised by heavy summer rains. Mean annual rainfall is about 4400 mm spread over both south-west and north-east monsoon. The mean annual temperature is 20.2°C. Maximum mean temperature is recorded during April-May (23.5°C) and minimum during January -February (18°C). During June- December the relative humidity remains around 95 percent.

Fig. 2. Tropical evergreen forest

Climatic, edaphic and altitudinal variations reflect in the floristic composition, physiognomy and life forms. The types of forests recognized are; a) West coast Tropical Evergreen forest (Fig. 2); b)Subtropical broad-leaved hill forest; c) Montane Wet Temperate forest and d) Grassland-low and high level.

Most of the slopes and valley are covered with dense tropical wet evergreen forest.Grasslands are limited to

1. Vijayan, V.S. and Balakrishnan, M. 1977. Impact of hydroelectric project: A report of first phase of study, KFRI, Peechi, India
2. Udvardy, M.D.F. 1975. A classification of the biogeographical provinces of the world. IUCN, Gland, Switzerland.

the narrow sector west of the Kunthipuzha and on the higher slopes in the eastern sector. Forests form belts on either side of the tributaries of the Kunthipuzha in the eastern sector and occur in pockets in the west of Kunthipuzha. There are several pockets of grasslands formed as a result of clearance followed by repeated annual fires and very often fire from these gaps penetrated into the adjoining evergreen forests. This was the situation before the enforcement of more effective fire protection measures in 1985.

Angiosperm flora of Silent Valley (Manilal, 1988)[1] consists of 966 species belonging to 134 families and 559 genera. This include 701 dicotyledons distributed among 113 families and 420 genera and 265 monocotyledons distributed among 21 families and 139 genera. The five dominant families recorded from Silent Valley are Orchidaceae, Poaceae, Fabaceae, Rubiaceae and Asteraceae.

The forest of Silent Valley has seven distinct tree associations which is a unique feature. These are; *Palaquium ellipticum - Cullenia exarillata, Palaquium ellipticum -Mesua ferrea, Palaquium ellipticum - Poeciloneuron indicum, Mesua-Calophyllum elatum, Mesua - Cullenia, Ochlandra* (Reed) - *Calophyllum* and *Ochlandra (Reed) - Poeciloneuron*

According to a study by Subramanian (1986)[2] Silent Valley has a rich fungal flora. Of the 10 different locations in the Western Ghats from where fungal collections were made, Silent Valley appeared to have the richest fungal flora both in number and diversity.

Fauna of Silent Valley also exhibit great diversity. During an expedition (1980) by the Zoological Survey of India, 33 species of grasshoppers, 47 species of bugs, 119 species of beetles, 29 species of butterflies, 15 species of flies 5 genera of molluscs, 9 species of fish, 19 species of amphibians, 11 species of snakes and six species of bats were reported from Silent Valley. A study conducted by Kerala Forest Research Institute on the lepidoptera of Silent Valley, (Mathew 1990)[3] revealed the presence of 100 species of butterflies and 400 species of moths. Of the species collected, 13 were endemic to South India which included five species having protected status.

Silent Valley and adjoining forests are one of the viable habitats for endangered and endemic lion-tailed macaque, (*Macaca silenus*), (Fig. 3). Ramachandran, (1990)[4] reported 13 troops of lion-tailed macaque with a total of 171 individuals in an effective area of 2000 ha of evergreen forest. Most of the sightings of lion-tailed macaque were in the *Cullenia- Palaquium* tree association. The seeds and flowers of *Cullenia exarillata* available from May to December at various parts of the area are a favorite food item for the macaques. For maintaining ecological boundary for lion-tailed macaque it is desirable to include sufficient area of *Cullenia-Palaquium* tree association under the National Park administration.

Fig. 3. Lion tailed macaque

Bird population in Silent Valley area include, Great Indian hornbill, Malabar trogon, Great black woodpecker, Fairy blue bird, black and orange flycatcher etc.,. A recent study has recorded 122 bird species from this area (Jayson-1990)[5]

Faunal diversity is very high and includes a number of endemic and threatened species, notably caecilians (limbless amphibians), king cobra and some rare small mammals such as the Peshwa's bat (*Myotis peshwa*) and Hairy winged bat (*Harpiocephalus harpia lasyurus*).

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1. Manilal, K.S. 1988. Flora of Silent Valley Tropical Rainforests of India. The Mathrubhoomi Press, Kozhikode, 398p.
2. Subramanyan, C.V. 1986. The progress and status of mycology in India. Proc. Ind. Acad. Sci.(Plant Sci.) 96:379-392.
3. Ecological studies and long term monitoring of biological processes in Silent Valley National Park. 1990. KFRI Research Report. (Final report of the research project sponsored by the Ministry of Environment and Forests, India.
4. ibid.
5. ibid

Large and Medium-sized Mammals in Silent Valley area

Bonnet macaque *(Macaca radiata)*,
Lion-tailed macaque *(Macaca silenus)**,
Nilgiri langur *(Presbytis johnii)*+,
Tiger *(Panthera tigris)**,
Panther *(Panthera pardus)*+,
Jungle cat *(Felis chaus)*,
Small Indian civet *(Viverricula indica)*+·
Toddy cat *(Paradoxurus hermaphroditus)*,
Brown palm civet *(Paradoxurus jerdoni)**,
Jackal *(Canis aureus)*,
Wild dog *(Cuon alpinus)*,
Sloth bear *(Melursus ursinus)*+·
Malabar giant squirrel *(Ratufa indica)*,
Porcupine *(Hystrix indica)*,
Asiatic elephant *(Elephas maximus)*+·
Gaur *(Bos gaurus)*+·
Nilgiri Tahr *(Hemitragus hylocrius)**·
Sambar deer *(Cervus unicolor)*,
Barking deer *(Muntiacus muntjak)*,
Mouse deer *(Tragulus meminna)*,
Wild boar *(Sus scrofa)*,
Indian pangolin *(Manis crassicaudata)**·
Otter *(Lutra* sp.),
Nilgiri marten *(Martes* sp.),
Common mongoose *(Herpestes edwardsi)*,
Ruddy mongoose *(Herpestes smithi)*,

* **Endangered** + **Vulnerable.**

Why Silent Valley a World Heritage (Natural) Site?

In the biogeographical sense, the Silent Valley and the adjacent forests of Western Ghats represent "ecological islands" in which it is possible to observe the conditions that prevailed before modifications set in, in the humid tropical forests. Though the stability of these "ecological islands" is fast dwindling, they introduce an important factor in biogeographical evolution, viz., isolation mostly due to physical barriers as a result of Palghat gap. Isolation, therefore, has had the effect of preserving the relict characters of the fauna and flora of Silent Valley as indicated by the presence of several primitive groups of flora and fauna. The distribution range of these relict species has been considerably restricted, presenting an apparent picture of endemism.

The Silent Valley plateau represents a very well preserved example of undulating terrain at mid elevations under two zones, one along the water course (riparian), and the other away from the water course(non-riparian) in the high rainfall area. There is no other area really comparable to Silent Valley in terms of riparian and non-riparian ecosystem on undulating terrain at mid elevation and in the high rainfall zone over the entire stretch of Southern Western Ghats.

The tree species diversity in the Silent Valley is very high, (118 vascular plants of 84 species in 0.4 ha), and is comparable to other well known tropical rainforests like the Barro Colarado islands in Panama Canal. Considering the uniqueness of Silent Valley it is being nominated into the World Heritage List (Natural site) of UNESCO.

K. K. Ramachandran
Wildlife Biology Division

Energy-efficient methods for drying wood

Solar energy is the major source of energy available. It is calculated that the energy received over the total surface of the earth amounts to 1.73×10^{14} KW, an enormous amount of energy, and roughly 20,000 times larger than the current global energy consumption.

Generally speaking, the largest quantity of solar energy is found in two broad bands around the earth between 15° and 35° North and South parallels. The next favourable region for solar energy application is in the equatorial belt between the 15° N and 15°S parallels (Kerala lies between 8° and 15°N). In the latter, humidity is high, cloud cover is frequent and the proportion of scattered radiation is high. It is estimated that there are about 2500 hours of sunshine per year with very little seasonal variation. Conditions in most parts of India appears to be quite favourable for this purpose at least during nine months of a year.

An inexhaustible and pollution free energy source, solar energy, should be effectively harnessed in drying wood. Solar kilns and other methods are being developed for drying wood using different energy sources. This note deals with the recently developed methods for drying wood, with emphasis on low energy consumption and better energy utilization.

1. Solar kiln-drying

Solar kiln-drying is an alternative method of drying wood that is gaining interest. Here, wood is stacked in a closed chamber and heat from trapped solar energy

is supplied to air as it circulates in the chamber. The solar kiln can be of the greenhouse type, incorporating the collectors as an integral part of the kiln, or the external collector type where the collector is separate from the kiln and the kiln is heated by circulating air through the collectors to the kiln.

Over the past 20 years most solar kilns constructed throughout the world have been the greenhouse type and of low efficiency. Recently, some solar kilns with external collectors and some with heat storage capabilities have been developed. In such kilns, relative humidity (RH) is controlled with a humidstat and vents with motorised shutter. When RH becomes too high, a blower is turned on automatically and the vents open allowing humid air to go out and outside air to enter. When RH goes below the prescribed level, the venting blower shuts off and the vents are closed. At night the venting system is shut down to reduce heat loss.

Drying wood in solar kilns has several advantages over air drying; drying rates are faster, especially below 30% moisture content (MC) wood can be dried to MC well below the outside equilibrium MC and degrade losses are lower than that in air- drying. But compared to conventional kiln drying solar kiln drying is slower and cannot easily dry wood to MC below 15%. Because of the large collector surface area required, solar- heated kilns of 10 to 15m^3 capacity are impracticable.

2. Dehumidification drying

Drying by dehumidification is a drying system with great energy- saving potential. This dryer differs from a conventional steam dryer in two ways. In the dehumidification dryer, moisture removed from wood is extracted from the air flowing over the cold heat exchanger (the evaporator) in the dehumidifier. So no energy is lost by venting hot, moist air as is done in a steam dryer. In the dehumidifier kiln, the air is heated by a hot heat exchanger (the condenser), or by an electric heating coil during the initial drying period, rather than by a steam boiler.

The air in the dehumidification dryer is moved through the wood stack by a fan as is done in a conventional kiln. However, part of the moist air leaving the stack is circulated through the dehumidifier to remove part of the water vapour and to heat the air.

The advantages of dehumidification drying compared to conventional kiln-drying are lower installation costs, lower energy requirements when drying wood to about 20% MC, less drying degradation, and ease of operation. The disadvantages are slower drying and higher energy consumption in drying wood to below 15% MC because of the low drying temperature (i.e. below 55°C). Equalising and conditioning are difficult because steam is not easily available.

3. Solar dehumidifier kiln

Combining solar and dehumidification drying offers advantages of both: the kiln and wet wood charge can be heated up faster and more economically, drying time is shorter due to added solar energy, and the total drying process depends less on the weather in contrast to when solar drying alone is used. Solar dehumidification drying is about three times faster than solar kiln drying and can be used throughout the year. Degradation will be less compared to solar drying alone.

4. Vacuum drying

A drying system which reduces considerably the drying time and at the same time minimises drying defects, has been introduced into the market recently. Unlike a conventional kiln, here the drying is carried out in a pressure cylinder. Initially, a vacuum is created in the pressure vessel and the pressure vessel is then filled with super heated steam at a temperature of 60-90°C. With a relative vapour pressure lower than 100% the super heated steam will absorb water from the timber when circulated in the pressure vessel. The drying is controlled by regulating the relative vapour pressure of the super heated steam.

5. High temperature drying

The drying rate depends on the temperature and relative humidity levels used, that is, the higher the temperature and the lower the relative humidity, the faster the drying. For example, to dry a stack of radiata pine boards of 50 mm thickness takes about 20 days in a low temperature dryer, 5-6 days in a conventional kiln, and about 24 hours in a high temperature kiln. However, only highly permeable timbers can be processed without excessive degrade under the service conditions imposed by high temperature drying. This method is widely used in New Zealand for drying radiata pine.

High temperature drying is usually carried out in an atmosphere of superheated steam and air at 115-120°C. A typical schedule for drying radiata pine would be dry bulb temperature (DBT) 120°C wet bulb temperature (WBT)70°C as compared to DBT 70°C WBT 60°c commonly used in conventional kiln drying.

A high temperature kiln requires a heating surface several times larger than a conventional kiln to allow rapid heating to the higher operating temperature. An increase in fan capacity is also necessary, while an air movement across the boards of 3 m/s is regarded as optimum for conventional kiln drying of radiata pine, at least 5 m/s is recommended for high temperature drying. Steaming after conventional kiln drying can be carried out in the kiln chamber and a separate chamber

should be used to recondition high temperature dried material. Steaming at 100°C and high humidity takes 4 hours for 50 mm stock, and weights should be kept on the stack (a weight of 1000 kg/m^2 of top surface is needed to restrain 50 mm stock adequately) until the load has cooled.

6. Microwave drying

Using microwave energy for cooking purposes has been commercialised in the western countries more than a decade ago. Now, experimental kilns using microwave energy for drying wood have been set up. Advantages of microwave drying include shortened drying time, increased product quality and a uniform moisture content profile in the dried wood. However, the cost is prohibitive now. If cost is reduced, this method has a high potential.

R. Gnanaharan
Division of Wood Science

Royal Chitwan National Park - the pride of Nepal

Nepal is the refuge of about three hundred species of mammals, eight hundred species of birds, one hundred and fifty species of reptiles and amphibians. The mammalian fauna include many endangered species like Bengal tiger, snow leopard, Greater one horned rhinoceros, red panda, musk deer and gangetic dolphin. Protection to the varied variety of flora and fauna is assured by declaring about six percent of Nepal's total area as National parks and Wildlife Reserves. There are seven national parks, four wildlife reserves and one hunting reserve. The seven National Parks are Royal Chitwan, Sagarmatha, Langtang, Rara, Shey Phoksundo, Khaptad and Royal Bardia. Royal Suklaphanta, Shivapuri, Parsa, Koshi Tappu are the Wildlife reserves. The only hunting reserve is Dhorpatan. The seven National Parks covers an area of about 8540 km^2. Of these, Shey Phoksundo, with an area of about 3555 km^2 is the largest and Rara extending over an area of 106 km^2 is the smallest. The Sagarmatha National Park with an area about 1148 km^2 include the Everest (8848 m) and other mountains over 7000 m in height. In addition to these, the Annapurna Conservation Area Project protects the Annapurna Hill region. The project is under the guidance of the King Mahendra Trust for Nature Conservation (KMTNC), a non governmental organisation, and is funded by WWF, U.S. The project emphasises natural resource management through local participation and conservation education of local inhabitants and visitors.

Royal Chitwan is Nepal's first National Park and was established in 1973. The park is located in the lowland Terai in Southern Nepal and is bordered by Mahabharat and Churia ranges along the Narayani river. The history of the park starts from the first Nepalese war with the British India in 1816. The Chitwan district was then extensively cultivated. The Nepalese lost the war and the settlements in Chitwan were removed. The area was dreaded by most people due to malaria. In fact, this helped to prevent further invasion from India. The Thars, the only inhabitants of the Terai, developed resistance to malaria and lived in close harmony with nature.

Great one horned rhinoceros

During this period, the Chitwan was reportedly abundant with rhinoceros and other animals. Chitwan teeming with wildlife, was a favourite hunting preserve of the then ruling Rana family. The largest recorded bag of the century during 1937-38 included 38 rhinos, 120 tigers and 14 bears. Such large scale hunting did not cause much permanent damage to the animal population.

The fall of the Rana regime in 1950 and the malaria eradication programme in 1954 attracted thousands of people to the valley. The human population increased to about half a million. By 1959, about 70% of the forests and grasslands were converted for agriculture. The influx of the people and the resultant habitat destruction wiped out the last of wild buffalo, swamp deer, Nilgai etc. from the area.

Conservationists throughout the world were primarily concerned with the rhino population and based on the recommendations of the Fauna Preservation Society, the area south of Rapti river and Narayani river was delcared as rhino reserve. A land settlement commission was constituted in 1963. About twenty four thousand people were resettled away from the area. The National Park authorities and the Royal Nepal Army keep a constant vigil to protect this area from further degradation.

Sal forest covers about 70% of the park. Sal dominates the forests in nearly homogenous stands 25-40 m tall, or sometimes in association with *Dillenia pentagyna, Syzigium cumini, Lagerstroemia parviflora* and hyllanthus emblica. Deciduous riverine forest constitutes about 7% of the park and grassland make up the rest 23% *Saccharum*, *Narenga* and *Themeda* species form tall (4-7 m) communities and occur on hydric sites. Of the eighty species of grass in Chitwan only six contributes to 90% of the biomass.

Royal Chitwan National Park harbours about forty species of animals. The park is famous as one of the strongholds of the endangered greater one horned rhinoceros, an animal of grassland riverine forest. Rampant poaching for horn and habitat destruction brought down the number of rhinos from 800 in 1951 to 100 in 1968. Fifteen poaching cases were detected in 70s. Rewards for informants of poaching proved effective and today, the park has an estimated population of 400 rhinos and a few were translocated to Royal Bardia National park for reintroduction to its former ranges. Chital, sambar deer, hog deer, barking deer and wild boar are the other herbivores in the park. Gaur and elephant are a rare sight in Chitwan.

Royal Chitwan is the site of serious scientific studies. The Smithsonian - Nepal Project Tiger, funded by WWF and Smithsonian Institution, could document the natural history of tiger in Chitwan. The use of advanced technique such as radio telemetry, as early as 1973, helped to study the prey-predator relationship in detail. The study, conducted by Sunquist, David Smith and Charles McDougal, was the pioneering one on this subject. Investigations of Andrew Laurie and Eric Dinerstein on different aspects of rhino population helped in the scientific management of this endangered species. Plant-animal interaction with respect to Chital was studied by Hemanta Mishra. The most important vegetation, the grassland community and the role played by the ever-changing course of the Narayani river in maintaining the grassland were investigated by John Lehmkuhl. Presently, the sloth bear, toddy cat, civets, and gharial are subjected to intensive scientific studies.

A gharial project has been implemented with the help of Frankfurt Zoological Society. The project is aimed to save the gharials through artificial hatching and rearing. The hatchery and the rearing center at Kasara, the headquarters of the park, is a tourist center. The young gharials are reintroduced to Kanali and Babai rivers in Royal Bardia National Park. Chitwan is also a bird watchers paradise. About 400 species of birds are recorded inside the park.

The collaboration with Smithsonian Institutions, WWF-US and a number of American universities helped Nepal to build a team of young well trained scientists,. Most of scientific studies in the country are presently carried out by them. The King Mahendra Trust for Nature Conservation (KMTNC) and Nepal Conservation Research Training Center (NCRTC) coordinate all scientific studies in the country. Protected areas throughout the world are always under threat and Chitwan is no exception. The people around the park depend on the grass for thatching and binding materials. By January each year, about six thousand people enter the park and the grass cutting continues for two weeks. The permit issued for the two week period cost only Rs. 5/-. Crop raiding by rhinos is a threat to the agriculture crop of the people in the surrounding areas. The man-wildlife interaction is presently a topic of research in the area. The NCRTC recently initiated agroforestry programmes in the surrounding areas. This is expected to meet the requirements of the public thereby reducing the pressure on the park.

Tourism accounts for about 95% of the revenue of the park. The number of visitors increased from 836 in 1974 to 35,000 in 1989 contributing about five million rupees. About 35 hotels and lodges provide accommodation in and around the park. Tourists are taken inside for wildlife viewing on elephant back and the well informed guides provide them information on wildlife. The canoeing, the gharial breeding center and the elephant camp are the other attractions.

Chitwan which literally means 'heart of the jungle' is well preserved for its natural wealth. The park is declared as a world heritage natural site in December, 1984.

P. S. Easa
Division of Wildlife Biology

Diseases of forest trees in Kerala

6. Leaf Diseases of Eucalypts in plantations

Eucalypts in Kerala are found to be vulnerable to many foliage diseases, as revealed by a disease survey conducted during 1979-85. Some of the foliar diseases attain epiphytotic status resulting in premature defoliation and shoot die back. This article deals with some of the major foliar diseases recorded during the survey.

1. Cylindrocladium shoot infection

Causal organisms: *Calonectria quinqueseptata* and its conidial stage, *Cylindrocladium quinqueseptatum, Calonectria ilicicola* and *Cylindrocladium ilicicola Calonectria theae* and *Cylindrocladium theae, Cylindrocladium clavatum, Cylindrocladium scoparium.*

Fig. 1a. Leaf spots of *E. grandis* caused by *Cylindrocladium* sp.

Fig. 1b. Leaf spots of *E. torelliana* caused by *C. quinqueseptatum*

Species affected: *E. grandis, E. tereticornis, E. urophylla, E. torelliana, E. deglupta, E. globulus, E. citriodora*

Symptoms: Leaf infection: Leaves of all maturities from young and old plants, epicormic and coppice shoots were found to be equally susceptible to *Cylindrocladium* infection. The colour, size and spread of the lesions varied depending upon the leaf maturity and micro and macro climatic conditions and species. Symptoms of leaf infection in respect of various species of eucalypts are described below.

E. grandis- On young leaves the infection appeared as minute grayish black spots which coalesced to form large necrotic areas. Under high humid conditions the initial spots were usually large grayish black patches, which spread further at times to cover the entire leaf lamina. In mature leaves occasionally the infection initiated either from the leaf tip and spread downwards or from the margins and gradually spread towards the mid-rib. During the dry period the lesions became dull brown. Extensive leaf infection caused blight which resulted in premature defoliation.

E. tereticornis - Initially the symptoms were similar to those found in *E. grandis* but later the colour of the lesions became different. Since foliage of this species exhibited some degree of polymorphism the symptom of leaf infection also varied greatly. The infection took place at any place on the leaf lamina, but usually at the tip or margins and produced irregular grayish black spots, which coalesced to form large necrotic areas. These later turned light to dark brown during the dry period. Severe infection of leaves caused premature defoliation.

E. urophylla - Infection usually occurred either at the margins or the tip in the form of large grayish black lesions with regular margins. In young leaves the lesions spread rapidly and covered a large part of lamina. During the dry period these spots turned light pale brown in colour giving a blotchy appearance to leaf.

E. torelliana - Usually infection was common at the leaf margins and tip. Initially the infection appeared as minute dark grayish black circular spots, which became as reddish brown spots lined with dark brown margin. These spots along the margins and at the tip coalesced to give rise large irregular necrotic areas.

E. citriodora - The symptoms on this species produced as small grayish black flecks which later turned as yellowish brown to reddish brown necrotic areas. Usually the individual lesions remained as small spots without further spread except at the tip along the

margins, where they coalesced to form large irregular reddish brown necrotic area.

Fig. 2a. Leaf infection of *E. grandis* caused by *Coniella fragariae*

Fig. 2b. Leaf spots of *E. grandis* caused by *Coniella castaneicola*

E. deglupta -The infection appeared as minute purplish flecks which turned into yellowish brown spots. Generally, these spots did not spread and coalesce, and remained as individual spots.

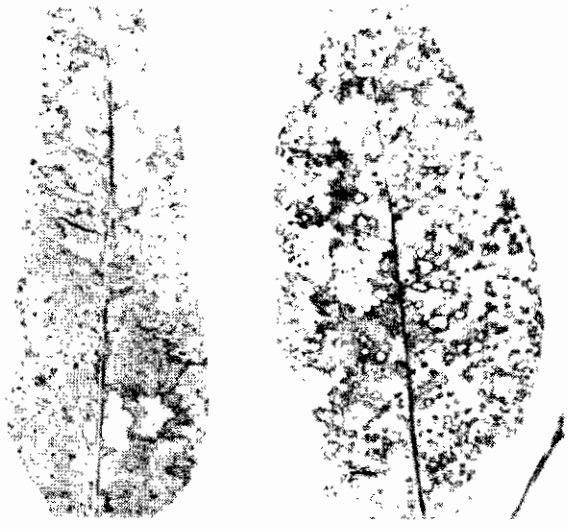

Fig. 3a. Leaf spots of *e. tereticornis*

caused by *Pestalotropsis disseminata*

Fig. 3b. Leaf infection of *E. grandis* caused by *P. neglecta*

E. globulus - The infection was confined either at the tip or along the margins of leaves as dull yellowish brown areas.

Stem infection: The stem infection, observed in coppice shoots and branches of young trees, appeared somewhere on the branch and caused a canker characterised by a dull brown depression on the stem. During high humid periods *Cylindrocladium* was seen to produce profuse mycelium and conidial mass. The portion of the branch above the canker was killed outright when completely girdled. During the rainy season; numerous fructifications (teleomorphs) developed on the dead stem. Stem infection coupled with severe leaf blight resulted in die-back of shoots.

Influence of tapioca cultivation on infection: Tapioca as a taungya crop in young eucalypt plantations had a considerable impact on *Cylindrocladium* infection. The tall variety of tapioca almost covered the eucalypt and formed a closed canopy, thus providing conducive microclimatic conditions for infection. Extensive leaf blight resulting in premature defoliation and die back of shoots occurred in such plantations. In 2 to 3 year old plantations, the plant parts under the tapioca only suffered and the top above the canopy remained healthy. However, in severe cases the infection gradually moved upwards thus infecting the entire foliage of trees. Defoliated branches produced new flush within two to three weeks.

Control measures

Control of *Cylindrocladium* infection in plantations is not economically feasible. However, the incidence and severity of infection can be brought down to low level either by replacing tapioca with some other crop like ginger, paddy, sesame or growing only a dwarf variety of tapioca. Mortality in one-year-old plantations due to *Cylindrocladium* infection can be avoided by planting only healthy seedlings of appropriate age after the onset of premonsoon showers or during the first week of the monsoon. Any delay in the planting will facilitate *Cylindrocladium* infection. During the period of heavy showers seedlings will not be able to establish properly after the transplanting shock and succumb easily to infection.

2. Phaeoseptoria leaf spot

Causal organism: *Phaeoseptoria eucalypti*

Species affectd: *E. grandis, E. tereticornis and E. globulus*

Symptoms: The infection first appeared on mature leaves as purple to brownish purple amphigenous spots which were characteristically angular and marked by veins especially on *E. tereticornis and E. grandis*. The leaf spots gradually progressed upwards and late in the

season, they were frequently noticed on younger leaves. By this time generally, all the mature leaves had defoliated prematurely due to heavy infection. When the spots turned necrotic, minute black fruiting bodies (pycnidia) generally more on the abaxial surface, developed embedded in the leaf tissue. Pycnidia produced long grayish black tendrils which appear as brownish black woolly mass on both the leaf surfaces. Due to rain or dew to conidia got dispersed from the tendrils and formed a black layer over leaf surface.

Control measures:

Chemical control trials indicate that the disease can be controlled effectively by Bavistin. It is recommended to treat the seedling in nurseries as soon as the disease is noticed. If the remedial measures are delayed, two applications of Bavistin may not be sufficient because of build up of high inoculum. Once the disease appears in plantation it is not economically feasible to attempt control measures.

3. Coniella leaf spot

Causal organisms: *Coniella fragariae, C. castaneicola*

Fig. 4. Leaf spots of *E. tereticornis* caused by *Alternaria alternata*

Species affected: *E. grandis*

Symptoms: *Coniella fragariae*: The spots usually along the leaf margins, appeared during the rainy season as more or less circular areas with regular margins. Initially the spots were grayish black in the centre gradually becoming lighter towards the periphery. During the dry period the spots turned light to pale brown. Leaves which had large area covered by the spots blighted and defoliated. Numerous light to dark brown coloured pycnidia arranged more or less in concentric rings developed even in a very small necrotic spot. As the spots enlarged new rings of pycnidia were added. During the wet period pycnidia produced off white to light pale coloured conidial ooze which was easily dispersed by rain drops, thus spreading the infection to other healthy leaves.

Coniella castaneicola: The infection usually restricted to margins and the spots extended towards the midrib. Initially spots were grayish irregular, later became dark reddish brown during the dry period, the necrotic area being brittle. The pycnidia developed over the necrotic spot, were irregularly distributed minute and dark brown in colour.

4. Pestalotiopsis leaf spot

Causal organisms: *Pestalotiopsis disseminate, P. guipenii, P. neglecta, P. mangiferae, P. versicolor.*

Species affected: *E. grandis, E. tereticornis, E. globulus*

Symptoms: Varied kind of symptoms were produced depending upon the species of *Pestalotiopsis, Eucalyptus* species and maturity of leaf. Usually the amphigenous spots were irregular, pale to dark brown coloured with clearly defined border along the leaf margins. On the lamina the spots were slight gray to pale scrochy. Occasionally black dot like fructifications developed either on both the surfaces of the necrotic spot or only on the (abaxial) lower surface.

5. Alternaria leaf spot

Causal organism: *Alternaria alternata*

Species affected: *E. grandis,E. tereticornis*

Symptoms: Initially minute grayish brown spots developed near the tip and along the margin of leaf. These coalesced to form large dull brown to pale brown irregular areas with diffused margins. The necrotic area along the leaf margins often showed splitting due to wind.

6. Little leaf disease

Causal organism: Mycoplasma like organisms

Species affected: *E. tereticornis, E. grandis E. globulus*

Symptoms: The affected plants showed prominent stunting and produced much smaller leaves when compared to healthy ones. the new leaves showed considerable reduction in size and became thin, pale, scaly

Fig. 5. Little leaf disease of *E. tereticornis*

with narrow lamina. The apices of such leaves often showed browning. The internodes became stunted and all axillary buds got sprouted resulting in bushy shoots with abnormal minute leaves. The root system of the diseased plants remained apparently unaffected as no abnormality was observed. Affected *E. tereticornis* trees became weak due to reduction in stem diameter and height growth; however, in *E. grandis* apparently no such symptoms were observed, except for the compact bushy appearance of shoots, which snapped easily on bending.

J. K. Sharma
C. Mohanan
E. J. Maria Florence
Division of Plant Pathology

Bark eating caterpillars in Albizia

Albizia falcataria, an exotic tree, has been raised in recent years as plantations by the forest department. Most of these plantations are in central and southern forest circles of Kerala. In addition, *Albizia* has also been planted in private holdings mostly in southern parts of Kerala.

Though over 25 spp. of insects have been reported to be associated with this tree crop, only a bagworm, viz *Pteroma plagiophleps* (Lepidoptera, Psychidae) has been recognised as the major pest of *Albizia* in Kerala. Recently the attack by the bark eating caterpillar - *Indarbela quadrinotata* (Lepidoptera, Indarbelidae) has been brought to our notice by the Forest Dept. A brief account of this insect problem in *Albizia* is given.

Biology

Eggs are laid usually in clusters of 15-20 on the bark of the tree. Newly hatched larvae bore small tunnels in the stem and the initial infestation is centered around the axial regions or dead branches (Figs 1 and 2) The full grown larva is 3-5 cm long and is black in colour. Pupation takes place in the tunnel within the wood. The pupal period lasts for about 3 weeks. The life cycle is annual with a peak period of moth emergence during May-July. The adults live only for a few days, but the female lays over 2,000 eggs during this period.

Nature of attack

The larvae make tunnels by gnawing the bark and bore into the sapwood. The larvae feed actively during night and during the day hiding inside the shelter tunnels made out of the excrement and fragments of tree bark. During heavy infestation, ribbon like shelter tunnels can be noticed on the stem. In young trees or branches, the stem may break at the point of larval hole.

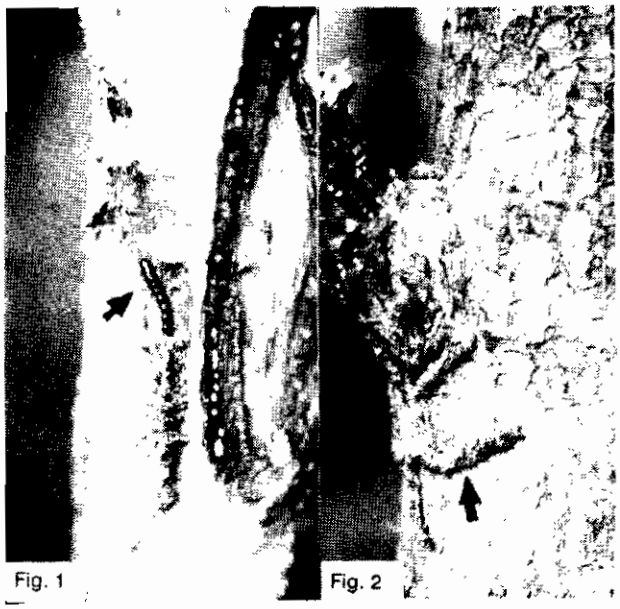

Fig. 1 Fig. 2

In a six year old *A. falcataria* plantation at Karavalloor in Anchal Range, a number of trees were found attacked by this borer during June-July, 1990. The larval infesta-

tion was observed in all girth classes ranging from 24-68 cm. Many trees showed multiple infestation but death of the trees was not noticed. On a few trees dead branches showed secondary attack by some fungal pathogens and subsequent die-back.

Host Range

The following trees are reported to be attacked by the larvae of this borer *Cassia fistula, Acacia,* spp. *Bombax ceiba, Gmelina arborea, Tectona grandis, Shorea* spp. *Psidium, Ziziphus, Xylia xylocarpa, Mangifera indica,* Poplars, etc.

Control strategy

It is stated that outbreaks of this bark eating caterpillars occur due to the unhygenic conditions that prevail in a plantation (eg. excessive quantities of dead branches on standing trees). One of the suggested control measures against this borer is to remove the matted frass and paint the bark with insecticides like dichlorvos (Nuvan) and quinalphos (Ekalux). It is also possible to use a sprayer to apply the insecticide. However, we need more quantitative data on the economic loss before attempting any control measure.

Division of Entomolgy

Know your information sources

National Information Centre Net Work (NICNET) and District Information System of National Information Centre (DISNIC)

In any organisational set up information plays a vital role in formulating development plans, welfare programmes and policies. This is more so in a developing country like India where planned development has become a tradition and various socio-economic factors have to be considered for planning. Information systems are thus assuming an ever increasing importance in the development process. There should be free flow of information from the lowest level of administration to the highest level and vice versa. In other words, basic data on all aspects of the country should be effectively organised and made accessible to any user at any level. Information dissemination will serve the desired purpose only when the user is provided with relevant information without any time lag eliminating unwanted items.

To facilitate this, the Government of India organised a National Informatics Centre (NIC). Informatics is the combination of Information Technology, Telecommunication and Computer Technology for the free flow of information bridging the gaps of space and time. NIC has been developed into a net work (NICNET) connecting district head quarters, state capitals and regional centers. The NICNET comprises of:

1. Super Computers ((NEC-S1000) at the NIC Regional Centers (Delhi, Pune, Bhubaneshwar and Hyderabad).

2. ND-550 or equivalent super mini computers at state capitals for providing informatics services to the states.

3. Super PC-AT computer systems at each district to provide services to the District Administration.

NICNET uses satellite communication for information exchanges among districts, states and regional centers in the country. The **Mother Earth Station** installed at Delhi and Micro Earth Stations would facilitate information flow among districts, states and centre. INTELSAT/INSAT 1-C provides the communication links. All the states and Union Territories have become connected to the NICNET.

In the NIC head quarters there are 27 information systems divisions for developing data bases on various areas like Agriculture, Energy, Environment, Health, Industry, Science and Technology etc. NIC also has 10 support groups which are responsible for maintenance and operation of computers, coordination of various centers, software development, training programmes, computer aided design, systems analysis etc.

District Information System of National Informatics Centre (DISNIC)

A good amount of information exists at the district level on all aspects of development, environment and resources. In our country, District is the basic administrative unit and Collectors are responsible for planning and implementing various development functions. Considering this aspect NIC has launched the District Information System (DISNIC) as an integral part of NICNET.

DISNIC is responsible for;

1. developing the necessary data bases in various sectors of economy for planning and decision making at the district level;

2. promoting informatics culture at the district level;
3. improving the capabilities of data analysis and presentation in a readily usable form;
4. developing modeling and forecasting techniques.

Using the NICNET facilities the information generated and organised at the district level can be made available at the state and national levels in a standardised form, eliminating the earlier practice of preparing periodic reports which took considerable time and delayed development processes. The network facilitates flow of information both upwards and downwards. DISNIC will thus, pave the way of easy collection, organisation and on line retrieval of information on several sectors of the economy at all levels such as District, Taluk, Block, Panchayat and Village. DISNIC also facilitates building up of databases of national importance through the active cooperation of state Governments.

DISNIC has the following functional components;

1. Management Information Systems (MIS) for the Revenue Administration
2. MIS for the Development Administration
3. District Planning Information System
4. Geographic Information System of NIC (GISNIC)
5. National Natural Resources Management Systems (NNRMS)

MIS for the Revenue Administration will include information on, Revenue recovery, Land administration, Housing schemes, Literacy programmes, Relief works following natural calamities, law and order, Pension and Welfare schemes and Public grievances monitoring systems.

MIS for the Development Administration takes care of information on sectors like, Agriculture, Construction Works, Civil Supplies, College Education, District Treasury, Employment and Training, Fisheries, Health, Industry, Water Supply and Irrigation, District Planning, Environment, Forest and Wildlife, Transport, etc.

District Planning Information System (DISPLAN) will help district authorities in the planning processes. The data base will store information at all administrative level of the district, i.e. District level, Block Level, Taluk level, Panchayat level and village level.

Computer cartography is a component of Geographic Information System. Cartography, a graphical method of description and visual communication is used for generating maps of landscapes, atmosphere, weather, climate, population, resources, industries etc.

The National Natural Resources Management System make use of data obtained from satellites and aircraft surveys to study and monitor natural resources, natural phenomena and human interactions with them.

As per the memorandum of understanding made between the Government of India and states governments NIC will purchase, install operate and maintain the computer communication facility and it will bear all expenses for setting up centers at all levels.

K. Ravindran
Librarian

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Studies on stump as planting material for *Eucalyptus tereticornis* plantations. KFRI Research Report No. 63. Final Report of project Silvi 04/81.

Divisions of Silviculture, Entomology, Plant Pathology and Plant Physiology

Abstract: A field study was conducted at Nilambur, Kerala, during 1981-84 to standardise the practices for raising *Eucalyptus tereticornis* plantation with stump as planting material. The effect of planting season and method, length and diameter of stump, different methods of stump storage and sealing growth of the stumplings were investigated. Effect of some growth regulators as well as insecticidal and fungicidal treatments was also evaluated. The study led to the following conclusions.

The survival of stump planted during the period between the pre- monsoon and the intense monsoon (latter half of May) was found better than those planted during the first premonsoon showers in early May and intense monsoon in June. Variations in stump dimensions, tap root length, 10 to 15 cm, root diameter at 15 cm below collar, 0.5 to 1.1 cm; shoot length 2.5 to 5 cm and shoot diameter at 2.5 cm above collar,0.8 to 1.6 cm had little influence on sprouting and survival of stumps. Treatment of stumps with boric acid 90 ppm prior to planting enhanced rooting percentage and abundance. Storage of stumps either in pits or under shade enhanced callusing at root end. Stumps wrapped in moist gunny bags and stored under shade for 4 days or stored in pits in bundles for 11 days before field planting registered better survival. Drenching the planting hole (2 cm dia and 15 cm deep) with 100 ml of 0.1% Aldrin 30 EC solution before planting ensured protection of stumps from termite attack. Drenching the planting hole with carbendazim (Bavistin) 0.1 a.i. (2 g of Bavistin 50 WP per litre or water) and application of fertilizer (NPK 8:8:16. 100 g per stump) in two holes dug close to the planting hole ensured protection against fungal infection better survival and height increment. Sealing of shoot-end of the stump prior to planting either with wax or coaltar did not increase survival or growth. The study showed lower percentage of survival in stump planting as compared to planting of polypotted seedlings in pits. However, this method is suitable for raising plantations making use of older seedlings from previous year's nursery beds.

Sasidharan, N., Muktesh Kumar, Nambiar, V. P.K. and Renuka, C. 1990. Establishment of an orchidarium in the Institute Campus. KFRI Research Report No. 64. Final Report of Research Project Bot 02/79. Division of Botany.

Abstract: Nearly 200 species of orchids have been recorded from Kerala, but several of them have a restricted distribution. Urgent steps have become

necessary for the protection of orchids, especially the rare and endemic species. Although the best way to conserve a species is to conserve its habitat, this is not always practicable in the case of orchids as each species has its own habitat preferences. In addition to *in situ* conservation, *ex situ* conservation is possible through establishment of orchidaria.

An orchidarium was constructed in the institute as per the design obtained from the orchidologist National Orchidarium, Yercaud, for *ex situ* conservation and multiplication of indigenous orchids. About one hundred species were collected during the study period and 84 species are maintained in the orchidarium, including some rare and endemic species., Herbarium specimens were also prepared and incorporated into the institute herbarium (KFRI). The specimens were identified with pertinent literature and by comparing with authentic specimens. Suitable planting methods were adopted for growing the orchids in the orchidarium depending on their habit and habitat. In general, epiphytic orchids come well under cultivation. Among the orchids collected, five species are new records of occurrence for Kerala.

Jayaraman, K. and Rugmini, P. 1990. Statistical Techniques in Forestry Research and Forestry. KFRI Research Report 65. Final Report of Project Stat 06/84.

Division of Statistics

Abstract: A comprehensive review and evaluation of the current status of research methods in forestry are made and some specific refinements suggested. The methods in general belong to three categories viz. experiments, surveys and simulations. While these components are the essential elements of any scientific research programme, they can be brought under a broader framework of systems analysis designed to arrive at optimal solutions through model building.

In the case of field experiments use of optimum plot size and shape, proper blocking, analysis of covariance and repeated measurements over time have been found helpful in reducing the error variance. Incomplete block designs could be useful in certain specific cases but the possibility of missing values reduce their utility. Response surface or other optimal fractional factorial designs have limited use in forest field trials unless they are of higher order. Proposition of a multivariate selection index devised to identify superior treatments with balanced expression is an outcome of this study. The magnitude of error variance is usually lesser in the case of nursery trials, when compared to field trials. But this cannot be generalized, since high levels of variability could be observed in the case of a study on growth of bamboo seedlings in bags of different sizes. This indicates the need for choosing appropriate error reducing techniques.

Sample surveys are taken up for a multitude of purposes in forestry like surveys on resources, pests, diseases, industries and wildlife. A review of the current state of affairs indicated the need to work out specific sampling strategies in each of these individual cases. Considering the time and effort involved in ground surveys, remote sensing would be a valid alternative in contexts where it is practicable. A certain extent of redundancy can always be expected within a multivariate system observed through a survey, and this feature can be exploited by developing prediction equations to estimate properties which are hard to measure from easily measurable characteristics.

Simulation techniques are recommended where experiments with real life systems are unfeasible. Experimenting on the state of a system with a model over time is termed simulation. Problems like forecasting demand for forest products, projecting future condition of forests under different management regimes etc. are handled by this system of investigation.

The present report also provides a bird's eye-view of the diverse applications of statistical techniques in some specific areas in forestry. Apart from these, statistical expert system was developed for some common situations in forestry research. The system is available as a userfriendly software package and is helpful in choosing an experimental design, a sampling method or any analytical technique suited to the user's specific requirements.

Book Review

A History of English Forestry. By N.D.G. James Basil Blackwell, Oxford 1990. 339 pp. ISBN–0521–3340–0 Paperback edition of the original published in 1981. Price £. 9.95.

The book covers a period of approximately 900 years spacing from the medieval period to the present. Although much technical information such as the evolution of laws, the development of policy, the influence of wars and even the art of ship building is presented, the book is lightly readable. Apart from detailed references and an index, valuable information is provided in six appendices - ranging from a vocabulary of old forestry terms to lists of reports and committees of the forestry commission.

The medieval forests were administered for providing the sovereign with preserves over which he had the right to hunt. The almost janatical keenness of the medieval sovereigns were no longer displayed by their successors. By the middle of the fifteenth century many of the

laws and restrictions in the royal forests tended to be applied less vigorously and to fall gradually to disuse and those in authority began to loose control. The disintegration of forests was hastened by the civil war from 1642-1646. Although the monarchy was restored in 1660, the pattern of the old forests was rapidly falling apart expedited without doubt by the laxity and dishonesty of some forest officials. The author stresses that the basic reasons for the crumbling of the structure of medieval forests were financial and economic. With increasing financial pressures, the revenue from forests which were quite incidental in the medieval period began to be examined as a source of fresh revenue. The author traces the development of ideas that preceded the making of policies that led to the beginnings of modern forestry in England. Among several others, mention is made of a book by John Evelyn published in 1664 which proposed a plan of felling for obtaining a sustained yield of timber. Royal Acts such as the one in 1482 which provided for fencing regeneration areas and another in 1543 on the preservation of woods which required that 12 stantils (standards or mother trees) should be retained per acre after coppicing. It may be noted that the system of coppice with standards was an important silvicultural practice in the deciduous forests in India even now. The first reference to forest nurseries (which was also called seminaries) is found in Rocke Church (1612) describing the raising of young oak, the preferred species for ship building timber.

The growing wealth of the landowners who could afford lavish expenditure on their woodlots or estates and the encouragement of the society of arts by offering awards for establishment of plantations of exceptional merit in the eighteenth century is referred to. While many woodlots in private ownership was showing signs of improvement and prosperity in the early nineteenth century, the Crown forests were rapidly deteriorating. The reasons given by the author are lack of ability among those responsible for the management of the forests, the unsatisfactory system of remuneration of those employed in these which encouraged dishonesty, the damage caused by deer and the effect of commoners exercising their right in respect of underwood, timber, grazing and so on.

An important landmark in the change over from the old forestry was the sinking of two wooden ships of the Royal Navy by the iron clad Merrimac during the American Civil War in 1862. The replacement of timber by iron and subsequently by steel for ships of the Royal Navy had a profound effect on forestry in England during the latter half of the nineteenth century.

The founding of the Royal Scottish Forestry Society in 1854 the English Arboricultural Society (now the Royal Forestry Society) in 1882 and the International Forestry Exhibition held in Edinburgh in 1884 generated a new interest in forestry. One result of the exhibition was to focus attention on forestry education and training and a select committee was appointed in 1855. In the same year forestry courses were introduced at the Royal Indian Engineering College at Coopers Hill in Surrey. These were for those who wished to enter Indian Forest Service and were only available to students who intended to take up forestry in India.

The contribution of foresters and forestry teachers who worked in India, to English forestry is laudably mentioned. German forestry Science and practices had been implemented in Indian forestry before they were incorporated with British practices.

The ravages of two world wars on the country's timber wealth and the enlightened and concerted action taken to minimise the long term effects are highlighted. Army and civilian forestry units and the work of the Women's Timber Corps are elaborated.

What relevance a book on English forestry, has on Indian forestry? Is a relevant question. This reviewer feels that the most important lessons we can learn from English experience is that 1. Competence and efficiency in management can and has improved English forestry from a position much worse than Indias, and 2. Informed debates based on painstaking surveys and analysis of the actual forestry situation has enabled English forestry to forge ahead with achievement, education, research and environmental stability. Forest Research Institute and Universities have a key role to play in raising the level of debates in Indian forestry. Above all, without a mention of Indian forestry the history of English forestry will not be complete.

The book is recommended to all those who have an interest in forest history. The text is well produced with illustrations and this paper edition is available at an affordable price.

Mammen Chundamannil
Division of Economics

Seminars, Symposia, Workshops, Trainings and visits

National

Dr. K. S. S. Nair and **Dr. R. V. Varma** (Entomology) participated in the one day seminar on "Entomological Research in India: thrust areas for the future" at Entomology Research Institute, Layola College, Madras on 5. March 1990.

Dr. K. M. Bhat and **Mr. T. K. Dhamodaran** (Wood Science) attended the Third Forest Products Conference at Dehra Dun during 26-28 June 1990 and presented the following papers.

1. Modification of wood quality under short rotation plantation management. K.M. Bhat
2. Preservative treatment of green rubber wood (T.K. Dhamodharan)

International

Mr. C. Mohanan (Plant Pathology) participated in the Third International Conference on Plant protection in the tropics at Genting Highland, Malaysia during 20-23 March 1990. He presented a paper on Field Diseases and Storage degradation of Rattans in India. He also visited Asian Plant Quarantine Centre and Training Institute and Forest Research Institute of Malaysia during 24-29 March 1990.

Dr. K. S. S. Nair, Dr. George Mathew. (Entomology), **Dr. K. M. Bhat** (Wood Science) and **Dr. P. K. Muraleedharan** (Economics) participated in the 19th IUFRO World Congress at Montreal, Canada from 5-11 August 1990. The following papers were presented.

Priorities in forest entomological research in India (K.S.S. Nair and George Mathew)

Dr. K. S. S. Nair also chaired a congress session entitled "Priorities in entomological research in the tropics" organized by him for the IUFRO Working Party S2.07.07 (Protection of forest in the tropics).

Rattan trade and industrial development in India (K.M. Bhat and P. K. Muraleedharan)

Wood quality improvement of eucalypts in India (K.M. Bhat).

The participation of Dr. K. S. S. Nair and Dr. George Mathew were supported by the Scientist Assistance Programme of the IUFRO World Congress; of Dr. K. M. Bhat by IDRC and of Dr. P. K. Muraleedharan by Ford Foundation.

Dr. George Mathew also visisted the Commonwealth Institute of Entomology, London from 22 August – 22 September 1990 on his return trip to prepare a checklist of Indian pyralids. His visit to U.K. was supported by the British Council.

Dr. R. V. Varma (Entomology) attended the 11th International Congress IUSSI during August 5-11 1990 at Bangalore and presented a paper entitled "Effect of juvenile hormone analogues on *Odentoformes gupatai* under laboratory conditions (R.V. Varma).

Dr. J. K. Sharma (Plant Pathology) participated in the first meeting of IUFRO Working Party S2. 07-09 (Diseases and Insects in Forest nurseries) held in Victoria B.C. Canada from August 22-30 1990. He presented an invited paper "Disease and pest problems in forest nurseries in India and their management" (J.K. Sharma and George Mathew) and a voluntary paper – Effect of nursery practices on incidence and severity of diseases of *Eucalyptus* seedlings. (J.K. Sharma and C. Mohanan). Dr. Sharma received the travel grants from the Commonwealth foundation, U.K.

Trainings, visits and meetings

Dr. K. Swarupanandan (Ecology) was deputed for specialist Forestry Course at Oxford Forestry Institute, U.K. for three months from July 1990 under Colombo plan.

Dr. K. V. Sankaran (Plant Pathology) visited CAB International Mycological Institute, Kew, England during 21 May-22 June 1990 to take up a collaborative research work with Dr.B.C. Sutton, Head, Taxonomic and Identification services.

Mr. K. Ravindran (Librarian) participated in the Bamboo Bibliography Board Meeting on 9-10 September 1990 in Singapore on invitation by University of Technology, Eindhoven, The Netherlands.

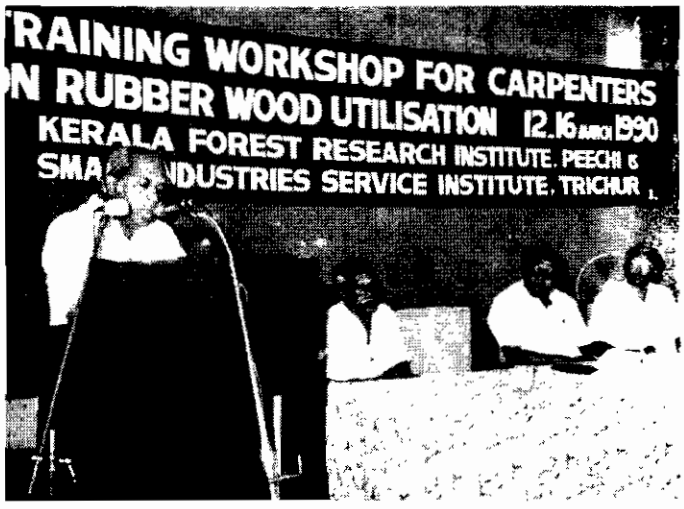
Guest lectures

Dr. R. Gnanaharan gave invited lectures on 1. Problems of procurement of packing case timber and substitution 2. Quality requirements for packing use timber and 3. Principles of wood drying and preservation to the shipping, purchase and stores personnel of M/s Bharat Heavy Electrical Limited, Tiruchirapalli on 9 and 10 April 1990.

Training Workshop for Carpenters on Rubber Wood Utilization

A work shop was organised by the institute in collaboration with the Small Industries Service Institute, Trichur during 12 - 16 March 1990 to update the skills of carpenters and to motivate them to make use of treated rubber wood for the manufacture of furniture. The workshop was sponsored by the State Committee on Science, Technology & Environment. Eight carpenters from different parts of Trichur district, out of nearly 100 applicants were selected and given the training.

The trainees were shown the demonstration of treating rubber wood by a simple technique, standardised by KFRI, with boric acid borax by diffusion process. Also, lecture classes on wood (defects in wood; relationship between wood properties and end use); chemical treatment against attack by borers and fungi; different chemicals and methods of treatment; modern concepts in furniture design; wood working tools; costing; project preparation and managing a small industry were given to the trainees.



Prof. N. M. Joseph, Minister for Forests inaugurates the workshop

The trainees made different furniture items including desk, bench, table, sofa and dish-rack with the treated rubber wood. Many of them testified that they never realised the utilization potential of treated rubber wood till they themselves made furniture out of treated rubber wood. The workshop as a step towards the popularisation of treated rubber wood, was a grand success.

The workshop was inaugurated by Prof. N. M. Joseph, Minister for forests. Shri. E. K. Menon and Shri. A. M. Paraman MLAs graced the occasion.

KFRI Seminars

Propagation and utilisation of Bamboos

Prof. O.P. Sharma — 24 April 1990
Department of Basic Sciences
Himachal Pradesh Agricultural University
Palampur, H.P.

Seed technological aspects of Silvicultural species

Prof T.V. Karivaratharaju — 26 April 1990
Department of Seed Technology
Tamil Nadu Agricultural University
Coimbatore

Technology of Afforestation - site preparation techniques and after care methods

Mr. J.C. Clarke — 12 June 1990
Management Training Centre
Forestry Commission
Gloucester, U.K.

Donations Acknowledged

Reprint collection

The personal reprint collection of the noted entomologist, the late Prof. M.G. Ramadas Menon was donated to KFRI Library by his wife Mrs. M. Leelavathy Amma. We appreciate this gesture and acknowledge the donation with gratitude. Professor Menon's contributions in the field of Entomology will be long remembered by all the contemporary and future entomologists.

Equipments

The Alexander von Humboldt Foundation of Germany donated to the institute scientific equipments worth Rs.5,00,000 as part of the scholarship held by Dr. Jose Kallarackal of the Physiology Division. Dr. Gudrung Vogel, Consul General of Germany formally handed over these equipments in a simple function held in the Institute on 1 June 1990 in which Shri K. K. Nair, Member, Governing Body also participated.

Campus news

Deputed for higher studies

Mr. K. Sankara Pillai, Assistant Librarian has been deputed to undergo M.L.I.Sc. (Master of Library and information Science) degree course in the Madurai Kamaraj University, Madurai during 1990-91 under the Bamboo Information Centre Project sponsored by the International Development Research Centre (IDRC). Canada.

Prakrithi Samrakshana Award

Dr. P.S. Easa of the Wildlife Biology Division was awarded the Prakrithi Samrakshana Award by the Rotary Club of Cochin Harbour cosidering his contributions on wildlife conservation. Dr. Easa received the award on 10 September, 1990 at a function organised in the Malabar Hotel, Cochin.

KFRI Library installs Microfilm Reader Printer

As part of the Bamboo Information Centre Project supported by the International Development Research Centre (IDRC), Canada, a very sophisticated microfilm reader-printer (MINOLTA RP 605Z) has been installed in the library. The machine is very versatile and convenient to use. Microforms of any size and shape, positive on negative, can be read and copies of desired pages can be made instantaneously on plain papers. A microfilm reader printer of this magnitude is installed for the first time in Kerala.

Joined KFRI

Mr. M.A. Padmanabhan Nair joined the institute as Internal Auditor on 16 July 1990. He is on deputation from the Government of Kerala service.

Left KFRI

Mr E. P. Somasekharan Nair, Word Processing Assistant resigned from the service of the institute on 12 May 1990

Transfers

Mr. K. Mohanadas, Scientist –E of the Entomology Division was transferred from the sub centre, Nilambur to the headquarters at Peechi on 31 March 1990.

Distinguished visitors

Dr. V. Agnihothrudu
Director, Tea Reseaech Institute
Valparai, Tamil Nadu — 5 March 1990

Mr. J.B. Lal, IFS
Director General
Indian Council of Forestry Research and Education (ICFRE)
Dehra Dun — 16 May 1990

Dr. R. Gudrung Vogel
Consul General
Federal Republic of Germany — 1 June 1990

Mr. J.C. Clarke
Management Training Centre
Forestry Commission
Gloucester, U.K. — 11-12 June 1990

TROPICAL FOREST ECOSYSTEM CONSERVATION AND DEVELOPMENT IN SOUTH AND SOUTH-EAST ASIA

Proceedings of the MAB Regional Training Workshop, Kerala Forest Research Institute, Peechi, India, 1-13 May, 1989, in press.

A comprehensive publication comprising 55 papers including lectures by experts and case study presentations by trainee participants, on the following aspects of conservation and development of tropical forest ecosystem in South and South-East Asia:

- Objectives and basic principles
- Biological conservation
- Biosphere reserves
- Ecosystem redevelopment
- Man-forest interaction
- Modern tools in conservation

For further information:

Librarian
Kerala Forest Research Institute
Peechi - 680 653, Kerala, India