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A case study of elephant deaths due to passenger trains in Kerala-Tamil Nadu border, South India

Asian elephants (*Elephas maximus*) are listed in Schedule (1) of Wildlife Protection Act (1972) and the latest census of elephants in the State of Kerala reported a population of about 3500 to 5000 elephants (Sivaram *et al.*, 2006). Many incidents of human-elephant conflicts were reported from Kerala in which elephants destroyed crops and property. Around 30 human casualties also occurred during the years 1983 to 1993 (Jayson, 1999). Wildlife casualities were reported due to train accidents from many locations in India. In Rajaji National Park, Uttaranchal, regular accidents involving elephants occur along the 18 km stretch of railway track that runs through the park (Kumar, 1995; Johnsingh and Williams, 1999). According to Singh *et al.* (2001), accidents were more during the summer period, when there was scarcity of water in the area and 18 elephants were killed due to train accidents during 1987-2001. Casualty of elephants due to similar reasons happened in Kerala also. In this paper, an attempt is made to analyse the reasons for elephant deaths due to accidents involving passenger trains in the railway track between Palghat and Coimbatore (Kerala-Tamil Nadu Border). Some portions of this track have become death traps for elephants and other herbivores. We visited the sites on 19th June 2009 when death of 2 elephants was reported. Later, two more elephants were killed on 16th and 17th July 2009 in the same track near Murukanpalam and Navakkara, respectively. In this incident, a cow elephant and a bull elephant were killed by speeding trains. The number of animal deaths reported from the area due to trains was collected from the records of Kerala Forest Department (Table 1).

A juvenile and an adult female elephant were killed by a speeding train (Trivandrum-Chennai mail) at 10:20 pm on 3rd June 2009 at Kanjikode, Palaghat. The juvenile fell down on the side of the railway track and died on the spot. The adult female was hit and was dragged for over 200 meters through the track. Remains of the body lay scattered on either side of the track. The incident occurred on the railway track which passed through the fringe of the forests. Coconut and plantain were being cultivated by local people on either side of the track. Wild elephants were attracted to the area due to the availability of fodder and water from a large pond near the track.

Table 1. Death of wild herbivores reported between Walayar-Kanjikode railway line.

Sl. no.	Year	Species	Date of accident	Location
1	1999	Spotted deer (*Axis axis*)	21-5-1999	Walayar
2	2002	Cow elephant	22-9-2002	Walayar
3	2002	Bull elephant	22-9-2002	Walayar
4	2006	Male elephant (makhana)	3-11-2006	Walayar
5	2007	Wild boar (*Sus scrofa*)	02-2-2007	Kottekkad
6	2007	Spotted deer	24-6-2007	Walayar
7	2007	Bull elephant	28-9-2007	Walayar
8	2008	Sambar (*Cervus unicolor*)	14-1-2008	Puthussery South
9	2008	Sambar	17-4-2008	Puthussery South
10	2009	Cow elephant	04-6-2009	Puthussery South
11	2009	Juvenile elephant	04-6-2009	Puthussery South
12	2009	Cow elephant	16-7-2009	Murukanpalam
13	2009	Bull elephant	17-7-2009	Navakkara

In the above accidents though the engine of the train got derailed, the coaches were unaffected and no passenger was injured. The railway track suffered major problems and some forty sleepers had to be replaced. The track where the accident

occurred passed through a cutting of a hillock and as such, it provided little space on both the sides for the animals to walk through or stay safe. Moreover, due to a curve in the track, the visibility was poor. Also, as the track climbs steep, the speed of the trains could not be reduced below 65 km/ hour. All these factors contributed to the occurrence of accidents. Between Kanjikode and Walayar (10 kilometers), 13 deaths of wild animals were reported due to accidents (Table 1). The unrecorded deaths of herbivores could be more, since the dead bodies of deer may have been removed by the local villagers for consumption. In the last six years, 12 elephant deaths were reported between Walayar and Coimbatore.

Figure 1. Railway track with narrow sideways

Figure 2. Warning signal to the loco pilots

The wild animals were apparently attracted to the track also due to the food waste thrown from the trains and in the attempt they get trapped in the cutting. Kerala Forest Department established an electric fence of 10 kilometers to prevent animals passing through the track, but it has not been efficient. Electric fence is not advisable in this part, as it prevents the entry of wild animals to their home ranges.

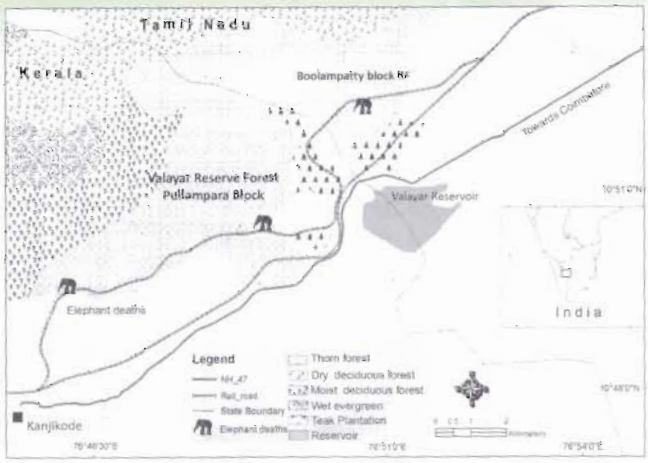

Figure 3. Locations of elephant deaths

The lack of maintenance of the fence leads to leakage of current reducing the efficiency of fences. Elephants are intelligent animals and they quickly learn to work their way around the barriers erected by people, whether it is electric fence or other blockages.

Suggestions to prevent accidents

A long-term solution to prevent accidents in these tracks is to remove the elevated banks on either side of the track and provide enough moving space for wild animals including elephants. Drivers should be directed to sound horns continuously when they approach the cuttings and pass through them. Arrangements are to be made to keep the track clean and devoid of food materials thrown by the passengers. Railways should remove growth of grass and other fodder on both sides of the track every fortnight.

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Establishment of bio-shield along coastal areas in Thrissur District

Under the Tsunami Rehabilitation Programme supported by the KSCSTE, KFRI planted *Casuarina* and other tree species in a strip of 32 km length along the coastal areas of Thrissur District to establish a bio-shield. Seedlings of *Casuarina equisetifolia* and other species found in coastal areas such as *Artocarpus hirsutus, Calophyllum inophyllum, Syzygium cumini, Terminalia catappa, Swietenia mahogany, Dendrocalamus strictus, Thespesia populnea, Gliricidia sepium, Terminalia bellirica, Saraca asoca, Samadera indica, Syzgium jambos* etc. and rooted cuttings of *Bambusa vulgaris* were produced in six nurseries adjacent to the planting sites. Planting was completed in two years time. Planting operations and watering were carried out by the respective Panchayaths through the Mahatma Gandhi National Rural Employment Guarantee Scheme (MGNREGS). The Panchayaths involved were Kadappuram (7 km) Vadanappally (4 km) Thalikulam (4 km) Nattika (3 km) Valappad (4 km) Edathuruthy (1 km) Mathilakam (2 km) Perinjanam (1 km) SN Puram (4 km) and Edavilangu (2 km). Sample plots with seedlings raised from selected seed production areas of *C. equisetifolia* and mixed bio-shield with other species and bamboo were also raised for experimental purpose.

Figure 1. View of nurseries

Figure 2. View of planted strip along the coast

Figure 3. Participation of women in planting

Change in the planting season from June to September contributed for better survival of saplings since inundation with salt water was less after the peak monsoon. Production of seedlings in nurseries in the same locations helped in acclimatization of the planting stock with the environment. MGNREGS was instrumental in arranging sufficient labor force and finance for planting, watering and maintenance. The awareness on the benefits of bio-shield and the employment opportunities, especially for women, enhanced the interest of the local people and officials and this is expected to contribute to the successful establishment of the bio-shield.

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Is avian migration an unresolved mystery?

The question where birds go during the winter, puzzled naturalists for centuries. It remains a puzzle even now when the pattern of animal journey to and from the breeding ground is finally accepted. As destinations and routes are being discovered, the impulses that trigger the journey and the energetics of the flight are better understood and the benefit of undertaking a potentially hazardous journey twice a year is becoming more and more clear. Migration in birds is considered to be an orderly departure and return to the same area with the changing seasons. In true migration, the movement is very regular and involves exploring the best areas for continuous food supply with the attendant hectic activity directed towards survival.

In India there are around 1,301 species of birds which belong to 22 orders, of which 16 orders comprise 376 species exhibiting migratory characteristics. Migrant avifauna of India has been conventionally classified as true migrants, partial or resident migrants and vagrants. As indicated above, in true migrants, the movement is very regular. In partial or resident migrants, some individuals of the population will remain at their birth place and others will migrate. Vagrants do not have a regular movement pattern, but may migrate if their food supply fails. Four possible factors have been suggested as causes for migration. However, none is totally acceptable in isolation. There is no doubt that a combination of these and other factors is involved. The factors include the effects of the Ice Ages, a return to some hypothetical ancestral home and cold weather and food shortage.

The ice-sheet theory points to the north and southward movements of the ice blocks during the Pleistocene period. It seems as an over-estimate since the Ice Ages occupied only a fraction of the time scale over which migratory movements have been evolving. That the presence of two original land masses which gradually drifted apart giving shape to the present continents and the birds which moved between one area and the next on the original land mass are now obliged to make the journey across a gradually widening width of water is the gist of Wegner's continental drift theory. 'Wheatear' is often cited as illustrative of the theory.

Weather is also said to affect migration patterns. However, extremes of climate have ameliorated recently and should we eventually return to the more extreme conditions, new migratory patterns could well emerge. Last is the food-shortage, as a proffered explanation of migrations. But this theory also does not appear tenable as most species are found to leave their summer grounds long before the food shortage occurs. How the birds navigate is explained by the faculty of built-in orientation that they posses. The path followed by the sun across the sky, called the sun-arc gives them a sense of direction. Further the earth's magnetic field detected by them by means of their built-in cerebral compass or by the spinning of the globe helps the birds to plot their course. The birds' ability to recognize the star pattern is yet another factor which determines their direction. To complement all, there is the biological clock which facilitates establishment of direction.

The endogenous factors enumerated above are established by the vector-navigation hypothesis as evidenced by the experiment in which long distance migrants are cross-bred with short distance migrants or with nonmigrants. The offspring showed intermediate amounts of migratory activity. Thus migrants appear to be equipped with inheritable population-specific time programmes. However, why a bird becomes a migrant or resident is not determined merely by genetic characters but by multiple reasons including environmental factors. Residents are seldom seen to turn migrant, but the other way round is sometimes true.

The proximate factors which trigger migration are photoperiod and build up of body fats. Ultimate factors such as optimum day length for bringing up the young and plentiful food supply during breeding period account for why migrations happen. The above theory is reinforced by the finding by Sandberg that the amount of stored fat reserves could predict whether an individual will select a seasonally appropriate direction in relation to the large fat reserves or engage in reverse migration due to scant fat reserves. Even though most of these studies have brought out many curious facts on what is happening in various facets of bird-life, a few of the findings seems to cast misgivings about the tenability of such theories, and some others that raise riddles which await answers.

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Owls of the Southern Western Ghats

Conservation of topical forests and its biodiversity is a matter of great priority now since the rate of destruction of these forests is exceptionally high and the resultant loss is often irrevocable. Owls are nocturnal avian predators, which possess large home range and occupy multifaceted habitats to conquer certain life history characteristics *viz.*, breeding, roosting and foraging. A total of 225 species of owls are recorded globally (Global owl project) of which 15 % are found in India. Of the 35 species of owls, majority are found in the North-eastern part of the Country. About 16 species were reported from the Kerala and 15 species from Tamil Nadu portions of the Western Ghats. Among these, Ceylon bay owl (*Phodilus assimilis*) is endemic to the Western Ghats and Sri Lanka. Earlier, it was considered as subspecies of the Oriental bay owl (*Phodilus badius*) but as per recent classification it has been recognized as a new species (*Phodilus assimilis*). Of the other owls, Mottled wood owl (*Strix ocellata)* is endemic to India and three owls namely Indian eagle-owl *Bubo bengalensis*, Indian scops-owl *Otus bakkamoena* and Jungle owlet *Glaucidium radiatum* are endemic to south Asia and Sri Lanka. According to IUCN (2008) Forest owlet is the only threatened owl in India.

Forest owls pose special challenges to forest managers because they are top predators, with large home ranges and complex habitat requirements. A landscape approach is necessary for modeling distributions of forest owls and conserving habitat for them. Some owl species need extensive areas of natural forest within their home range, as reported for Sooty owls (*Tyto tenebricosa*) in Australia and Northern spotted owls (*Strix occidentalis caurina*) in North America. All forest owls need tree hollows for nesting and some species need them for roosting. Arboreal mammals form a high percentage of their prey and most of those mammals depend on tree hollows for daytime shelter. Large hollows suitable for these species do not form until trees are very old and large trees tend to contain more hollows than small trees.

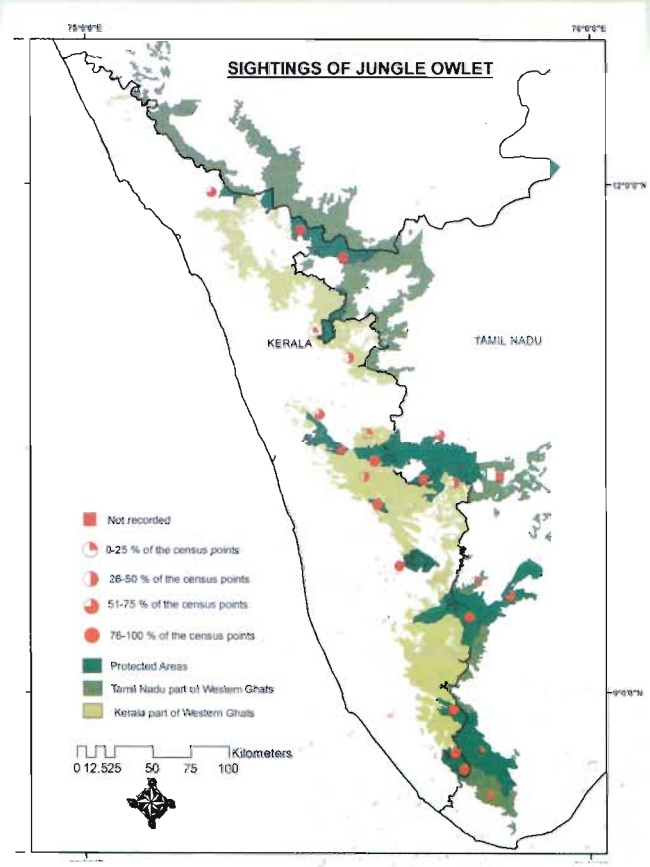
Owls are a worldwide order of birds known as Strigiformes and the 225 species range in size from tiny, sparrow size Elf Owl, to the Eurasian Eagle Owl, which has a wing span of nearly 2 meters and can weigh almost 5 kg. They are a group of predatory birds, characterised by large forward facing eyes surrounded by disk of short stiff feathers and an upright posture. A large proportion of owls are nocturnal. They occupy the equivalent niche as the diurnal birds of prey such as hawks, falcons, eagles and buzzards, but they are not actually related. The resemblance to the daytime birds of prey is just an example of convergent evolution, where both groups have evolved several features such as the hooked beak and talons, independently to perform the same function. Owls are all very closely related to each other, much more so than for instance the diurnal raptors, which include birds as dissimilar as vultures, secretary birds, falcons etc. Even so, they are separated into two fairly distinct families. The first family is the Tytonidae which is made up of 15 species of barn and grass owl, and three species of bay owl. This family is quite distinct from other owls and possess several differences. The most obvious external differences are the heart; rather than round facial disk, the longer skull and beak, longer legs, longer more pointed wings and a forked tail. Grass owls come from Africa, South East Asia and Australia and are very similar to Barn owls but have longer legs. All of the other owls are in the family Strigidae. The collective noun for owls is a "Parliament". Scientific and common names basically follow the information by Claus König, Friedhelm Weick, and Jan-Hendrik Becking in their Book "Owls, A Guide to the Owls of the World" and Rasmussen and Anderton (2005).

Owls of the Western Ghats

All owls are predators and the size of the prey generally reflects the size of the owl. Owls prey on a variety of insects, spiders and other invertebrates, although, some are quite voracious and can take birds as large as themselves. Eagle owls at the other extreme have been recorded to take such formidable prey as Golden eagles and a Roe deer of 13 kg as well as foxes, herons and domestic dogs. Hunting normally is carried out in two different ways, the first is perch hunting, (sit and wait predator) where the bird sits and waits from a suitable perch until a prey item is located.

Mottled wood owl

Common barn owl



The other technique is flight hunting where the owl slowly quarters the ground from a low altitude looking and listening for prey and diving down when food is detected. The length of the wings is normally a good indication to the preferred method of hunting- short wings for perch hunting and long wings for flight hunting. Most owls are opportunists and virtually anything that moves is caught. Some species are more specialised feeders in particular the Fishing owls. These are two genera of owls one from Asia and the other from Africa whose members feed mainly on fish, amphibians and aquatic invertebrates snatched from beneath the water surface.

Protected area managers should focus on owls for special consideration in forests because of their large home ranges and known needs for elements of old forest to provide nest sites in large hollow-bearing trees and support high densities of arboreal mammal prey. The implication is that they are the species with the most demanding requirements and if they are conserved many other species will also be well conserved. This fits the concept of owls as umbrella species. In the forest habitats commercial rotations for timber production are usually shorter than the time needed to develop hollows and hollows in the trees are the favourite places for nesting and breeding of the forest owls. Three primary strategies are available to conserve hollow-dependent fauna in forests used for wood production. Of these, selected stand retention (and replacement over time) is the most popular and generally the most effective strategy. The other primary strategies are extended rotations or tree retention on coupes. None of the owl species recorded in Kerala and Tamil Nadu is endangered. Species of owls found in the southern Western Ghats are listed below.

1. Common Barn Owl (*Tyto alba)*
2. Eastern Grass Owl (*Tyto longimembris)*
3. Ceylon bay Owl (*Phodilus assimilis*)
4. Oriental Scops Owl (*Otus sunia*)
5. Indian Scops Owl *(Otus bakkamoena)*
6. Indian Eagle Owl *(Bubo bengalensis)*
7. Forest Eagle Owl (*Bubo nipalensis)*
8. Brown Fish Owl *(Ketupa zeylonensis)*
9. Jungle Owlet (*Glaucidium radiatum)*
10. Brown Hawk Owl (*Ninox scutulata)*
11. Spotted Owlet *(Athene brama)*
12. Mottled Wood Owl (*Strix ocellata)*
13. Brown Wood Owl *(Strix leptogrammica)*
14. Northern Long-eared Owl (*Asio otus*)
15. Short eared Owl *(Asio flammeus)*
16. Dusky Eagle Owl (*Bubo coromandus)*

Of the sixteen species of owls distributed in the Kerala part of the Western Ghats, nine species are found in the forests and others in the cultivated areas. Two species are migratory and 14 species are resident in nature. Owls are easily identified based on their calls. They utilise their calls and songs for attracting mate and also to defend their territories. Pitch and volume of the call reflect the size of the territory of the owl. Diurnal species are far less vocal than the nocturnal ones, because they use visual displays to advertise for partners and defend their territories.

Tree hollows and cavities are the preferred site for many species but nest sites vary. Larger species scratch a scrape or use old stick nests of crows, pigeons or diurnal birds of prey. Many owls are territorial, during the breeding season and even other owl species are not tolerated. Some species are known to defend the nest sites but will share the hunting habitat. Breeding seasons coincides with the peak availability of food for rearing chicks. Owls lay white eggs, which suggest that they are all evolved from a hole-nesting ancestor. The number of eggs laid varies from species to species, year to year and between individual birds. Owl eggs are relatively spherical. In most species, the female starts incubating as soon as the first egg is laid. During incubation and until the smallest chick is large enough to maintain its own body temperature, all the food is provided by the male; the female rarely leaves the nest site. The female despatches the food and feeds the chicks small slivers until they can swallow the whole prey; she then helps the male with the hunting. The age of fledging

Maintenance and growth observations in multilocational provenance trial plots of eucalypts and acacia (Phase I & II)

KFRI Research Report No. 323 (Balasundaran, M. 2009).

About 22 ha of eucalypt provenance trial plots raised at Kodanad (Malayattor), Muthanga (Wayanad) and Vallakkadavu (Peermade) during 1990, 1992 and 1993 using seeds obtained from CSIRO, Australia, were maintained during 1998-2003 under this project. There were 78 provenances comprising *E. tereticornis* (20 provenances), *E. camaldulensis* (22 provenances), *E. urophylla* (8 provenances), *E. pellita* (10 provenances) and *E. grandis* (20 provenances). Two provenance trials comprising *A. auriculiformis* (11 provenances), *A. mangium* (12 provenances), *A. aulacocarpa (A. peregrina)* (8 provenances) and *A. crassicarpa* (7 provenances) raised during 1997 at Kodanad (4 ha) and Kulathupuzha (2 ha) were also maintained during the second phase (2001-2003). Plots for maintenance also included eucalypt clonal multiplication area (1 ha), clonal germplasm bank (0.5 ha), both at Kodanad, and mist chamber and hardening units at Kodanad and Devikulam, established for mass multiplying eucalypt and acacia clones for lowlands and high ranges, respectively. In addition to the maintenance work such as weeding and making fire line, activities such as recording data on growth and disease resistance, development of new clones, mass multiplication of clones and supply of clones to the Forest Department and Hindustan Newsprint Ltd, Kottayam were also carried out.

Based on adaptability, growth performance and disease tolerance, eucalypt and acacia provenances suitable for raising plantations in Kerala had been identified at the age of 4 years and reported to the Silviculture wing of Kerala Forest Department. These provenances had shown consistently better performance during subsequent years also. The same provenances have shown similar performance when they were planted in separate trial plots during different periods. A few of the *E. urophylla* and *E. pellita* provenances have shown better performance than *E.tereticornis*. Considering the yield and the unique quality of water conservation possessed by *E. urophylla* and to a lesser extent by *E. pellita*, and their desirable tree architecture, the currently raised plantations of *E. tereticornis* can be replaced with these two species. *E. camaldulensis* is unsuitable for planting in Kerala because of severe leaf blight disease caused by *Cylindrocladium* spp. and pink disease caused by *Corticium salmonicolor*. A few of the *E. grandis* provenances have shown tremendous growth in high ranges reaching up to 62 m^3/ha/yr at sixth year. Among the four acacia species, *A. mangium*, followed by a few provenances of *A. crassicarpa* and *A. auriculiformis* have performed well. Based on their performance, 2-5 provenances of each species have been recommended for planting in Kerala. The best performers are listed below.

Sl. No.	Species	Provenances	Yield (m^3/ha/yr)
1	*E. grandis*	Baroon pocket maleny, qld	62
2	*E. urophylla*	N of telemar sw netar, ind	39
3	*E. pellita*	71-72 km ne wenlock, qld	43
4	*E. tereticornis*	Palmer river, qld	34
5	*A. mangium*	Morehead, png	116
6	*A. auriculiformis*	S of coen cape york, qld	27
7	*A. crassicarpa*	Limal-malam , png	40

varies greatly and some species even remain in the area until the following year. Gradually the young ones learn to hunt, often starting on insects or food brought in by the parents, which may still be alive. Because of their predominantly nocturnal tendencies, owls have evolved several physical adaptations, which facilitate catching prey in the dark. All owls have large forward facing eyes giving good stereoscopic vision vital for judging distances. In smaller species, the head often appears flattened so that the eyes can be as widely spaced as possible to increase the stereoscopic effect.

Conservation

As the owl species are in various size categories and utilise varied habitats, a common conservation strategy cannot be evolved. Hence, conservation measures need to be oriented based on the size of owls and type of habitat inhabited by them. As lesser owls require old and dead stumps in natural forest, firewood collection should be controlled in the periphery of the protected areas and reserve forests. Majority of the nest sites of lesser owls were recorded on dead tree stumps. Collection of vertical dead branches of live trees also should be controlled, as they are the important perching sites for this group of owls. Three of the larger owls are reported mainly from the hillocks and low altitude dry thorn forest and these areas are attracting least attention from the managers. As most of these patches are near the agricultural landscapes or near human habitations, these habitats are highly disturbed. Nest sites of two larger owls are found in the hillocks, where frequent fire causes the damage to the nestlings as well as to the eggs.

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Besides maintenance work and growth studies of provenances, about 95 candidate plus trees (CPTs) belonging to *Eucalyptus tereticornis*, *E. camaldulensis, E.urophylla* and *E. pellita* and 79 CPTs of *Acacia auriculiformis* and *A. mangium* and 45 CPTs of *E. grandis* were utilized for raising fast growing, disease tolerant clones. Of these, 34 eucalypt clones belonging to *E. tereticornis, E. camaldulensis, E. grandis* and *E. pellita* and 6 clones *A.auriculiformis* and *A. mangium* and 10 clones of mangium hybrid were supplied to the Forest Department and HNL for raising Clonal Multiplication Area in their Central Nurseries and for raising clonal plantations. More than 1.33 lakhs ramets of eucalypt and acacia clones have been supplied to the Kerala Forest Department till 2003. Seeds of *A. mangium* and *A. uriculiformis, E. tereticornis, E. grandis and E. pellita* have been supplied to Kerala Forest Dept., Kerala Forest Development Corporation, HNL and several private agencies.

Development of microbial inoculants for aerobic composting.

KFRI Research Report No. 324 (Balasundaran, M. 2009).

The present study was carried out to characterize thermophilic microorganisms present in five different organic waste materials and to identify a consortium of microorganisms suitable for degrading different types of waste materials. The five organic materials selected were forest weed, ayurvedic factory herbal waste, tea factory waste, coir pith and sawdust. Statistically significant differences were observed between the bacterial, actinomycete and fungal populations of the compost samples. The density of each of the microbial population depended upon the nature and chemical characteristics of the raw material used. One hundred and twenty eight thermophilic microorganisms comprising 49 bacteria, 62 actinomycetes and 17 fungi were selected for detailed study. Taxonomic identification of the microorganisms was performed through morphological, biochemical and molecular characterization (G+C content, and 16S rDNA sequencing and sequence analysis).

More than 69 per cent of the bacterial isolates belonged to the genus *Bacillus*. The rest of the isolates belonged to *Thiobacillus, Azotobacter, Caryophanon, Lactobacillus, Cellulomonas* and *Sporosarcinia*. Most of the actinomycete isolates were *Streptomyces* sp., *Streptoverticillium* sp., *Thermomonospora* sp., *Saccharomonospora* sp., *Kibdellosporangium* sp., *Kitasatoporia* sp. *Actinomadura* sp., *Rhodococcus* sp., *Faenia* sp. and *Thermoactinomyces* sp. were also isolated. *Aspergillus* sp., *Humicola* sp. and *Torula* sp. were the major fungal species, followed by species belonging to the genera *Penicillium, Thermomyces, Chaetomium* and *Mucor*. Thirteen different genera and 29 species were identified from weed waste, whereas 11 genera and 17 species were identified from ayurvedic factory herbal waste. Eight genera and 13 species were found in tea waste, 11 genera and 25 species in coir pith and 10 genera and 16 species in sawdust. The total bacterial isolates from the five sources comprised 7 genera and 22 species; actinomycetes, 11 genera and 33 species; and fungi 7 genera and 16 species.

All the 128 isolates were analyzed for their ability to produce five enzymes, namely, amylase, catalase, cellulase, phenol oxidase and xylanase. Actinomycetes showed maximum enzyme producing ability compared to that of bacterial and fungal isolates. Fourteen isolates were selected for testing their suitability as microbial consortium for quicker composting, based on their biochemical characteristics and ability to produce enzymes. These included 2 bacteria, 3 fungi and 9 actinomycetes. The isolates did not show mutual antagonism.

Application of the microbial inoculum to forest weeds, herbal waste and coir pith enhanced the speed of composting considerably to 19 days, 22 days and 26 days, respectively. The C/N ratio of the final compost samples showed that compost from forest weed (C/N ratio = 9.8), herbal waste (C/N ratio = 10.3), and coir pith (C/N ratio = 18.6) were of better quality. The sawdust underwent only partial degradation till 50th day and the C/N ratio was reduced up to 275.5 only. It is concluded that the consortium of microorganisms is suitable for quick composting of forest weeds, herbal waste and coir pith. For composting of saw dust, initial application of nitrogen along with isolates having lignin degradation ability may have to be used.

Livelihood improvement of marginal bamboo dependants artisans and farmers of Thenkurussi Panchayath, Palakkad.

KFRI Research Report No.325 (Seethalakshmi, K.K., Sankar, S. and Pandalai, R.C. 2009).

Production and value added utilization of bamboos were given high priority by Government of Kerala during the last five years for environment protection and employment generation for the rural poor, especially women. Bamboo cultivation and craft are two areas where there is tremendous potential for employment generation. A project was implemented by the Kerala Forest Research Institute (KFRI) as part of a one-year programme supported by Government of Kerala to set up model bamboo village by coordinating the production and utilization of bamboo in Thenkurussi Panchayath in Palakkad District during

January to December 2005. The farmers, artisans, officials from Panchayath, District Industries Centre along with resource persons from KFRI, National Institute of Design and URAVU, worked together for implementation of the programme. The artisans received training in the use of modern tools and in the manufacture of value added products such as bamboo furniture, and decorative and household items. They were also exposed to the development in this sector by participation in exhibitions and fairs and visits to other units. For promoting artisans, a Bamboo Consortium was organized in one of the traditional artisans' colonies at Vakkathara.

The farmers in the area with bamboo in homesteads were trained in scientific management of bamboo culms such as removal of congestion, maturity marking and annual harvesting. Farmers interested in bamboo cultivation were also provided with suitable species for planting that are not currently grown in homesteads.

Mapping biodiversity of the *Myristica* swamps in Southern Kerala.

KFRI Research Report No.326 (Nair, P.V., Ramachandran, K.K., Swarupanandan, K. and Thomas P. Thomas 2009).

Myristica swamps were first described from Kulathupuzha in Kerala State in 1960. *Myristica* swamps need special non-biotic conditions to develop; hence these ecosystems have become highly restricted and fragmented. In Kerala, these swamps are present in Anchal and Kulathupuzha Forest Ranges and Shendurney Wildlife Sanctuary (between 77. 27° and 77.58° E and 8.74°N and 9.03°, below 200 m MSL (so far wrongly reported as 300 m). This study is the first of its kind to map 60 individual swamps which constitute 1.5 km^2 which hardly make up 0.004% of the total land area of Kerala and 0.014% of the total forest area of the State.

Mapping was done using a combination of GPS in relatively open areas and conventional survey under dense canopy. The swamps have been accurately plotted over 1:50,000 SOI toposheets enabling accurate relocation, spatial analysis and 3D visualization. Average annual rainfall of the area during the period of study was 1284.9 mm and was distributed well.

Each swamp has a central stream, which causes inundation of the swamps. Each swamp has different inundation characteristics such as time period of inundation, depth of inundation and area under inundation. Many of the swamps dry up during the months of December to March. Water table beneath the ground recedes below 50 cm during summer. The soils of these swamps vary in texture from sandy soils to sandy loams to silt loams and rarely clay loams depending on location factors including geology and physiography of the land; gradational variations within the swamps being common. In general, most of the swamp soils are acidic (pH 4.5-6.0 exchange acidity <2 cmol kg^{-1} exchangeable bases <5 cmol kg^{-1}) non-saline (electrical conductivity <70 µs cm-^{1}) and with low organic carbon content (0.3 to 1.3%). But, highly acidic peaty soil with pH values of 3 - 4 and organic carbon content of < 20% is also encountered. Gleying is common down the profile in most swamps except those that are very coarse textured.

The vegetation inside and outside the swamps has been analyzed using a total of 33 sample plots of 0.33 ha area each. Shrubs have been enumerated in subplots of 4 x 4 m and herbs in subplots of 1x1m. Eighty-two trees and ninety-four species of herbs/shrubs constitute the vegetation. Forty-nine lianas have also been recorded. Twelve of these plant species have been red-listed and about 28 species of them are endemic to Western Ghats. Of the 19 sample plots, *Gymnacranthera farquhariana* was dominant in 10 plots. *Myristica fatua* var. *magnifica* was the dominant tree in 6 swamps. In the remaining plots, *Vateria indica* was the dominant tree. *Holigarna arnottiana and Lophopetalum wightianum* dominated in another two plots.

The *Myristica* swamps are famed for its charismatic and archaic vegetation; however, studies documenting the animal wealth of these swamps are almost nonexistent. Faunal diversity of the *Myristica* swamps consisted of

Bufo melanostictus

Hoplobatrachus tigerinus

Rana aurantiaca

Calotes elliotti

Trimeresurs malabaricus

Platihelminthus (Bipalium-2, tapeworm-1) - 3 species, Nemathelminthes - 1 species, Annelida (Oligochaeta-2 and Hirudinea-2) - 4 species, Mollusca- 10 species, unidentified Crustacean-1species, Insecta - 281 species belonging to 83 identified families, Myriapoda- 6 species and Arachnidae-54 species, Pisces-14 species, Amphibia-56 species, Reptilia-155 species, Aves-129 species and Mammalia-27 species. Quantitative analysis of herpetofauna revealed that the differences in the environmental characteristics inside and outside the swamp play an important role in regulating the species diversity and abundance of both amphibians and reptiles. Patterns of diversity and abundance during day and night, across swamps and among months varied. There was no significant difference in patterns of diversity and abundance recorded during the two years.

The present study highlights the high biodiversity of the *Myristica* swamp forests. The study also indicates that there are gaps in information which can be filled up only with further studies in this region. The challenge is how further studies can be carried out without disturbing the delicate ecosystem of these swamps. A pertinent question is whether all human entry should be banned into the best and least disturbed patches of swamps, leaving only the disturbed patches for human visits (tourism and research). Conservation of these small and scattered swamp patches must also address the contiguous areas. Strategies for management and conservation of the *Myristica* swamps forms part of the report.

Preliminary study for conservation and sustainable utilisation of Erankol and Koorankolli, rare and endemic bamboo species of Western Ghats.

KFRI Research Report No. 329 (Muktesh Kumar, M.S., Krishnankutty, C.N., Vijayakumaran Nair, P., and Pandalai, R.C. 2009).

Erankol (*Pseudoxytenanthera ritchiei*), a rare and endemic bamboo of Western Ghats, is distributed in northern Kerala and Karnataka. In Kerala, it is distributed in Palakkad, Malappuram, Kozhikode and Kannur districts. Koorankolli (*Dendrocalamus strictus*) is also limited in distribution in the forests of Kerala. It is distributed mainly in semi-dry and dry zones along the plains of Attappady, Nelliampathy, Chinnar and Nilambur.

In the Nilambur Forest Division, Pothukkallu and part of the Erankol Kunnu adjoining the cultivated areas had a good population of Erankol; but, due to large scale extraction, the natural population is considerably reduced and therefore, there is no scope for further large scale extraction. However, though the present regeneration status is satisfactory, it is better to avoid any commercial extraction within the next five years. The survival percentage recorded for the rhizome cuttings collected from Erankol Kunnu was 82% while that for Pothukkallu was 64% in the nursery. Field establishment was better for the propagules from Erankol Kunnu (85%).

Market survey indicated that most of the Erankol was moved out to different places in Tamil Nadu whereas Koorankolli was used in both Kerala and Tamil Nadu. As the markets are mostly in Tamil Nadu, the native community is not benefited from the product and hence it is not imperative to continue harvesting of Erankol and Koorankolli. The harvesting of Erankol from the forests has hardly any economic benefit to the tribals or the State, although traders make a good profit. Therefore, it is advisable that the remaining patches of Erankol in the forests are reserved for conservation.

Revisionary studies on four genera of Indian bamboos.

KFRI Research Report No.330 (Muktesh Kumar, M.S. 2009)

India is endowed with a large number of bamboo species. The country is considered as one of the largest resources of bamboos in the world. Due to non-availability of flowers and irregular flowering phenomenon, the species identified by earlier workers has posed several problems with regard to the correct identity. Since most workers neglected the geo-climatic variations, several generic and specific delimitations among the Indian bamboos are confusing. It also needs to be pointed out that most of the genera described by earlier workers have been treated congeneric with one taxon or the other. Therefore, reports on the number of taxa occurring in different localities vary considerably.

There are over 1575 species under 111 genera of bamboos distributed in the tropical, subtropical and temperate regions of the world. In India, so far, 128 species belonging to 18 genera are known to occur. They are distributed mainly in the geographic zones such as, Western Himalayas, Eastern Himalayas including Northeast India, Peninsular India and Andaman and Nicobar Islands. Peninsular India is one of the richest domiciles of native bamboos, second to the Eastern regions. So far, 32 species and two varieties spread over eight genera are known to occur in the region. Of these, 22 species and two varieties belonging to six genera, namely *Bambusa, Dendrocalamus, Ochlandra, Oxytenanthera, Schizostachyum* and *Sinarundinaria* are native to Kerala.

In the present study detailed taxonomic account of the genera, *Dendrocalamus, Oxytenanthera, Schizostachyum* and *Sinarundinaria* is provided. Some of the salient findings of the study are the following; one species is added to the genus *Dendrocalamus* as a new combination *Dendrocalamus stocksii*, formerly known under *Oxytenanthera- Pseudoxytenanthera* complex. The lectotypification of *Dendrocalamus stocksii, D. colletianus, D. callostachyus* and *D. longispathus*, and neotypication of *D. stictus*, the type species of the genus, have been carried out. Some of the species under *Dendrocalamus* such as, *D. sahinii, and D. somdevai* are treated as conspecific with *D. hamiltonii* and therefore synonymised under it. *Dendrocalamus sericeus* is also conspecific with *D. strictus*. The genus *Pseudoxytenanthera* is synonimised under *Oxytenanthera* with two species, *O. bourdillonii* and *O. monodelpha*. The ectotypification of *O. bourdilonii* has been carried out. The generic status of *Schizostachyum* has been critically examined and three species from Andaman Islands alone are retained under this genus along with the two new taxa described. *Schizostachyum rogersii* is relocated after a gap of 98 years from the type locality and the lectotypification of the species was carried out.

The position of Indian Arundinoid bamboos is still not clear owing to the complexity of the group and unless further studies using molecular techniques and re-evaluation are done, the exact position of Indian genera under this group will remain ambiguous with regard to the generic status of different taxa included under the sub tribe Arundinarinae.

Extension Projects

DNA finger printing of selected medicinal plants.

KFRI Extension Research Report No. 31. Kerala Forest Research Institute, Peechi (Sasidharan N. and Balasundaran, M. 2009)

Genetic diversity with reference to mean gene diversity and percentage of polymorphic loci and genetic similarity between respective accessions of four species of medicinal plants namely, *Adathoda zeylanica, Coleus aromaticus, Baliospermum montanum* and *Nothapodytes nimmoniana (Mappia foetida)* were studied using ISSR markers. Samples were supplied from the Medicinal Plants garden of Aryavaidyasala, Kottakkal. Accessions of *A. zeylanica* showed the highest genetic diversity (0.2862) and percentage of polymorphic loci (78.85%). Lowest genetic diversity (0.2012) was shown by *B. montanum*. The genetic similarity coefficient among the accessions ranged between 0.4615-0.9423 for *A. zeylanica* indicating a wider representation of the available genotypes. The study gave opportunity to prioritise the accessions for conservation and reject some of the genetically identical genotypes within a species.

NEW RESEARCH PROJECTS

KFRI 563/2009: National carbon project: Spatial assessment of vegetation and soil carbon pool of Northern Kerala (A.R.R. Menon, Thomas, P. Thomas, April 2009)

KFRI 564/2009: Role of bamboo in sustainable rural livelihood in South India (V. Anitha, April 2009)

KFRI 565/2009: Structure and functioning of bamboo handicraft industry in South India (P.K. Muraleedharan, April 2009)

KFRI 566/2009: Revision of the book and the CD 'An annotated bibliography on Bamboos of the World (N. Sarojam, April 2009)

KFRI 567/2009: Species recovery of selected endangered rattan species of the Western Ghats (C. Renuka, April 2009)

KFRI 568/2009: Floristic studies in Aralam Wildlife Sanctuary (N. Sasidharan, April 2009)

KFRI 569/2009: Effect of crop rotation with short duration tree crops on the nutrient status of soil in clear felled teak plantation sites (Thomas, P. Thomas, May 2009)

KFRI 570/2009: Preparation of a detailed approach paper for adaptation and mitigation measures to deal with climate change in the forestry sector of Kerala State (U.M. Chandrashekara, May 2009)

KFRI 571/2009: Kerala forestry statistical database data mining and information dissemination (M. Sivaram, June 2009)

KFRI 572/2009: Technology for low-cost micro-propagation for *Bambusa balcooa* and *Thyrsostachys oliveri* (E.M. Muralidharan, June 2009)

KFRI 573/2009: Evaluation of *Ochlandra* germplasm mass propagation and field trials of elites (P. K. Thulasidas, June 2009)

KFRI 574/2009: Computerisation of KFRI Herbarium - Phase II (C. Renuka, June 2009)

KFRI 575/2009: Standardisation of bamboo cultivation practices for homesteads of Kerala Phase II (U.N. Nandakumar, June 2009)

KFRI 576/2009: A Compendium of project profiles and a digital archive of project records in KFRI (K. Swarupanandan, June 2009)

KFRI 577/2009: Empowerment of community reserve stakeholders for livelihood enhancement and conservation of natural resources at Kadalundi and Vallikkunnu Panchayaths through popularization of appropriate technologies (K.V.M. Kunhi, July 2009)

KFRI 578/2009: Establishment of bioresources nature trail at Nilambur in the Kerala part of the Western Ghats Phase II (U.M. Chandrashekara, July 2009)

KFRI 579/2009: Pink disease in teak plantations in Kerala and its management (C. Mohanan, July 2009)

KFRI 580/2009: Development of a prophylactic control strategy for managing the mahogany shoot borer *Hypsypyla robusta* in trial plantations (K. Mohanadas, July 2009)

KFRI 581/2009: Indexing contents of the back volume collections of KFRI Library (N. Sarojam, July 2009)

KFRI 582/2009: Digitization of Indian Forest Records, Forest Bulletins and Forest Leaflets (N. Sarojam, July 2009)

KFRI 583/2009: Digitization of KFRI Research Reports 251-300 (K. F. George, July 2009)

KFRI 584/2009: Establishment of Tree Health Helpline for the State of Kerala (V.V. Sudheendrakumar, July 2009-June 2012)

KFRI 585/2009: Preparation of a Tiger Conservation Plan (TCP) for Periyar Tiger Reserve (K.K. Ramachandran, September 2009)

NEW EXTENSION PROJECTS

KFRI Ext.159/2009: Preparation of manual for seed collection and further handling of forestry seeds in Kerala (R.C. Pandalai, April 2009)

KFRI Ext.160/2009: Collection, processing and storage of seeds of medicinal plants and management of seed center under FRLHT programme (K.C. Chacko, June 2009)

KFRI Ext. 161/2009: State level orientation programme on identification of small hydroelectric sites in Kerala (K.V.M. Kunhi, April 2009)

KFRI Ext. 162/2009: Pre-project workshop on decision support system for forest sector of Kerala (K. Jayaraman, July 2009)

KFRI Ext. 163/2009: One-week compulsory training course on conservation and development of medicinal plants and benefit sharing with local communities for IFS Officers (N. Sasidharan, August 2009)

KFRI Ext. 164/2009: One-day training workshop on Kerala Forestry statistical database mining (M. Sivaram, August 2009)

KFRI Ext. 165/2009: Workshop on production and marketing of teak wood: future scenario (K. Jayaraman, August 2009)

KFRI Ext. 166/2009: Preparation of a proposal for voluntary relocation of human settlements in Wayanad Wildlife Sanctuary (S. Sankar, September 2009)

KFRI Ext. 167/2009: Biodiversity documentation of seven selected districts of Kerala (G. Mathew, September 2009)

KFRI Ext. 168/2009: Establishment of a butterfly garden in Pathiramanal biopark for promoting ecotourism and public awareness on biodiversity conservation (G. Mathew, September 2009)

KFRI Ext. 169/2009: Training course on 'Watershed Management for Teekoy Grama Panchayath, Kottayam (S. Sankar, August 2009)

KFRI Ext. 170/2009: Preparation of a handbook of forestry technologies (K.V. Sankaran, September 2009)

PUBLICATIONS

Papers in journals

Abdul Kader, S. and Seethalakshmi, K.K. 2007. Germination and storage behaviour of Mahogany (*Swietenia macrophylla* King) seed. *Indian Journal of Tree Sciences* 26 (1): 1-14.

Abdul Kader, S. and Seethalakshmi, K.K. 2008. Structure of Mahogany (*Swietenia macrophylla* King) fruit, seed and their characteristics. *Indian Journal of Forestry* 31 (3): 413-416.

Babu, S. and Jayson, E.A. 2009. Abnormal mating behaviour of Tufted grey langur, *Semnopithecus priam* at Kalakad-Mundanthurai Tiger Reserve, Tamil Nadu. *Journal Bombay Natural History Society* 106(1): 90.

Babu, S. and Jayson, E.A. 2009. Anti-predator behaviour of Large brown flying squirrel (*Petaurista philippensis*): Is this an effective census method to survey the species? *Current Science* 96 (6): 772-773.

Jayson, E.A. and Jayahari, K.M. 2009. Distribution of Spiny tree mouse (*Platacanthomys lasiurus* Blyth 1859) in the Western Ghats of Kerala, India. *Mammalia* 73: 331-337.

Jijeesh, C. M., Seethalakshmi, K. K., Beena, V. B. and Ravindran, V. P. 2009. Recent flowering of an endemic bamboo – *Pseudoxytenanthera monodelpha* (Thw.) Soderstron and Ellis in Munnar, India. *Phytomorphology* 59 (1&2) 35-39.

Juliya, R. F., Sudheendrakumar, V. V. and Varma, R. V. 2009. Laboratory evaluation of four fungal pathogens against the teak defoliator, *Hyblaea puera* (Cramer) (Lepidoptera: Hyblaeidae) *Journal of Biological Control* 23(3): 285–293.

Juliya, R. F., Sudheendrakumar, V.V. and Varma, R.V. 2009. Susceptibility of teak skeletonizer, *Eutectona machaeralis* Walker (Lepidoptera: Pyralidae) to *Beauveria brongniartii* (Saccardo) Petch. *Hexapoda* 16(1): 83-85.

Mathew, G. 2009. Ecology, infestation status and possible management of the teak Carpenter Worm *Alcterogystia cadambae* (Moore) (Lepidoptera: Cossidae) in forest plantations of teak in Kerala. *Envis Forestry Bulletin* 9(1): 112-122.

Mathew, G. 2009. Insect diversity of New Amarambalam Reserve Forest in the Nilgiri Biosphere Reserve, India. *Biosystematica* 3(2): 37-63.

Mathew, G. and Unnikrishnan, P. 2009. Biology of the Palm King *Amathusia phidippus,* an extremely rare and endangered butterfly of peninsular India. *Journal Bombay Natural History Society* 106 (1): 118-120.

Mendham, D.S., Kumara Swamy, S., Sankaran, K.V., Smitha John, K., Grove, T.S., Connell, A.M., Rance, S.J., and Sujatha, M.P. 2009. An assessment of responses of soil-based indicators to nitrogen fertilizes across four tropical eucalypts plantations. *Journal of Forestry* 20: 237-242

Rugmini, P. and Jayaraman, K. 2009. Intrinsic units of growth for teak trees. *Trees*, 23: 51-58.

Seethalakshmi, K. K., Jijeesh, C. M. and Ravindran, V. P. 2008. Seed and seedling attributes of *Melocanna baccifera* and *Ochlandra travancorica*. *Journal of Bamboo and Rattan* 7(1&2):101-108.

Seethalakshmi, K. K., Jijeesh, C. M, Beena, V. B. and Ravindran, V. P. 2009. Flowering and regeneration of three endemic reed bamboos of Western Ghats - *Ochlandra travancorica*, *O. soderstromiana* and *O. spirostylis*. Bamboo Science and Culture. *Journal of American Bamboo Society* 22 (1&2): 32-39.

Sivaperuman, C. and Jayson, E.A. 2009. Population dynamics of wetland birds in the Kole wetlands of Kerala, India. *Journal of Scientific Transactions and Technovation*, 2(3): 152-162.

Sujanapal, P. and Sasidharan, N. 2009. Diversity and ethno botanical uses of pteridophytes in Parambikulam Wildlife Sanctuary, Kerala, South India. *J. Econ. Tax. Bot.* 33(1):135-142.

Papers in Books/Proceedings/Newsletters

Babu, S. and Jayson, E.A. 2009. Habitat use and response of Brown hawk owl *Ninox scutulata* to the broadcast of conspecific calls. *In*: Shakunthala Sridhara(ed.). Recent Trends in Animal Behaviour, New India Publishing Agency, New Delhi, pp 47-58.

Babu, S. and Jayson, E.A. 2009. Potential changes to the bird fauna of southern Western Ghats due to global warming. National workshop on global warming and its implications for Kerala 19- 21st January 2009, Thiruvanathapuram, pp 53.

Balagopalan, M. and Rugmini, P. 2009. Management of soils of teak plantations for sustainable productivity, Paper presented in the *International Workshop on Production and Marketing of Teakwood: Future Scenarios*, November 23-25, 2009, Kerala Forest Research Institute, Peechi, Thrissur.

Balagopalan, M. and Rugmini, P. 2009. Effect of coir geo-textiles on the growth of teak: An experience in a highly degraded area for improving the soil and the productivity, Paper presented in the *International Workshop on Production and Marketing of Teakwood: Future Scenarios*, November 23-25 2009, Kerala Forest Research Institute Peechi, Thrissur.

Balagopalan, M., Jijeesh, C. M. and Seethalakshmi, K. K. 2009. Foliage nutrient variation in flowering and non-flowering clones of teak (*Tectona grandis* Linn.f). Poster presented in the *International Workshop on Production and Marketing of Teakwood: Future Scenarios*, November 23-25 2009, Kerala Forest Research Institute Peechi, Thrissur.

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Mathew, G. 2009. Butterfly Gardens (Malayalam). *Karshakan*, Annual issue p. pp 72-74.

Sajeev, T.V. and Sankaran, K.V. 2009. Species on the move - are business highways watching? Business 2010: pp 10-11

Sasidharan, N. and Pramod Pathrose 2009. Mass multiplication of *Saraca asoca* (Roxb.) de Wilde, through stem cuttings and air layering. In: Sasidharan, N., Muktesh Kumar, M.S. Ramachandran, K.K. and Jayson, E.A. (eds.), 2008. *Proceedings of the National Seminar Conservation, Cultivation and Sustainable Utilization of Saraca asoca*. Kerala Forest Research Institute, Peechi: pp 69-77.

Sasidharan, N., Muktesh Kumar, M.S., Ramachandran, K.K. and Jayson, E.A. (eds.), 2008. *Proceedings of the National Seminar Conservation, Cultivation and Sustainable Utilization of Saraca asoca*. Kerala Forest Research Institute, Peechi, 100.

Seethalakshmi, K.K. 2008. Technology for production of planting stock and plantation establishment for bamboos. *Proceedings on National Seminar on Modern Tools in Plantation Forestry*, 25th March 2008. Forestry College and Research Institute, Tamil Nadu, Agricultural University, Mettupalayam pp 5-12.

Sivaperuman, C. and Jayson, E.A. 2009. Population fluctuations of shore birds in the Vembanad- Kole Ramsar site, southern India. (Abstract) *National symposium in recent advances in biodiversity of Indian subcontinent*, March 11-13, 2009, Port Blair, Andaman and Nicobar Islands.

SEMINAR/WORKSHOPS ATTENDED

Dr. E. P. Indira attended the Technical Discussion Meeting on Descriptors of Eucalyptus and Casuarina at IFGTB, Coimbatore on 23rd September, 2009.

Dr. E. A. Jayson attended National Workshop on Global Warming and its Implications for Kerala, 19th to 21st January, 2009, Thiruvanathapuram and also attended one day seminar at A.V.C. College, Mayiladuthurai, Tamil Nadu and delivered a lecture on the Avian diversity in Kerala on 7th March, 2009. He also attended one day seminar entitled Integrated Management of Drainage Basins in Relation to Wise Use of Wetlands at Alappuzha organized by Karunya University, Coimbatore on 22nd March, 2009.

Dr. G. Mathew and Dr. P. Rugmini presented a paper entitled Biodiversity in relation to land use pattern: a case study with reference to insects in the Kerala part of Western Ghats at the National Seminar on - Land use Planning for Biodiversity Conservation, August 6-7,Thrissur, pp 96-102.

Dr. U.N. Nandakumar participated in a one day training programme on Solid Waste Management organized by the District level faculties of Total Sanitation, Thrissur, 21st April 2009.

Dr. P. Rugmini participated in the National seminar on land use planning for biodiversity conservation during 6-7 August, 2009, held at Thrissur.

Dr. P. Rugmini participated in the International Workshop on Production and Marketing of Teakwood: Future Scenarios during 23-25 November 2009 at Kerala Forest Research Institute, Peechi, Thrissur, Kerala, India.

Mrs. Sani Lookose participated and acted as a Rapporteur in the National Conference on Museum accessibility during 24 to 25th July, 2009 at Thiruvanathapuram, organised by the Regional Museum of Natural History, Mysore and the Directorate of Museums & Zoos, Govt. of Kerala.

Dr. M. Sivaram participated in the One day seminar on Forestry Statistics of India on 26 June 2009 at ICFRE, Dehra Dun.

Dr. V. V. Sudheendrakumar participated in the 5th International Conference on Biopesticides: Stakeholders Perspectives during 26-30 April, 2009 at New Delhi (Organised by Society for promotion and innovation of biopesticides) and presented an invited paper "Preventing large scale pest outbreak in forestry: the case of sublethal dosing. (Authored by Dr V.V. Sudheendrakumar and Dr.T.V.Sajeev)

Dr. P. K. Thulasidas participated and presented a paper entitled Wood quality of teak (*Tectona grandis L.f.*) from short rotation plantations and home-garden forestry practices in India in the Regional Workshop on Development of Plantation Teak Utilisation in ASEAN Region, 7-10 July 2009, Hmawbi, Myanmar, organised by Forest Research Institute, Yezin in association with the Forest Department.

EXTENSION ACTIVITIES

Dr. George Mathew investigated borer attack to seedlings of 2009 Acacia plantation at Naduvathumoozhi, Konni Division.

Dr. E. A. Jayson visited Kalady area to examine the suspected Leopard attack as per the request of Kerala Forest Department.

Dr. N. Sasidharan identified the plant specimens referred by CWRDM, Calicut on 29.06.09 and St. Thomas College, Thrissur on 27.05.09. He also prepared an Inspection Report on five properties notified as EFL area in the South Wayanad Forest Division, as a Member of the Inspection Committee, constituted by the Chief Conservator of Forests, (Wildlife) Kerala Forest Dept., during 22-24 May, 09.

Dr. U. N. Nandakumar, Dr. K.V. Bhat and Dr. P.K. Thulasidas prepared a technical report based on site inspection about the need for felling of trees in Teacher's Training Institute, Nadakkavu, Calicut as per the direction of Hon. Ombudsman for Local Self Government, Trivandrum, 15th June, 2009.

Dr. U.N. Nandakumar monitored tree planting programme under NREGA in Panancherry Panchayath as expert member social audit team, June 2009. Dr. U. N. Nandakumar provided technical input to the Ad. Commissioner for EFL court case OA 1st of 2008 Ponmudi estate along with Director.

Dr. U. N. Nandakumar provided input for preparing a feature on activities of Mahima Cluster undertaken with technical support from KFRI for the Haritha Bharatham Programmes of Amrita TV, May 2009.

Dr. U. N. Nandakumar attended the Technical Advisory Committee Meeting of District Committee, Total sanitation programme at District Panchayath Conference Hall, 30th June, 2009.

GUEST LECTURES/CLASSES

Mr. P.K. Chandrasekhara Pillai gave lectures on Conservation and development of medicinal plants and benefit sharing with local communities for Indian Forest Service Officers during 3-7 August, 2009.

Dr. E.A. Jayson offered classes to the students, who attended nature camps at Peechi Wildlife Sanctuary on 4th February, 2009 and on Environmental Conservation in the Extension Centre of KFRI, Peechi in September 2009 and also on 8th October, 2009. He also offered a class at Academic Staff College at John Mathai Centre of Calicut University, Aranattukara, Thrissur on 25th September, 2009 to college lecturers.

Dr. K. K. Seethalakshmi delivered a talk on bamboo varieties suited for small homesteads on 1st April, 2009 in All India Radio.

TRAINING IMPARTED

Training Courses Coordinated

Dr. M. Sivaram conducted a training course on Kerala Forestry Statistical Database and Data Mining for the Officers of the Kerala Forest Department on, 21, 24, 26 and 28 August of 2009 at Thrissur, Kottayam, Thiruvanathapuram and Kozhikode.

MEETING ORGANISED

Dr. V. V. Sudheendrakumar organised DBT Task Force Meeting 3-4, May 2010.

A summer course was organised for students in Teak Museum, Nilambur during 21 to 30 April 2009. Thirty students participated in this one-week long course.

In connection with the Teak museum Day on May 21, a documentary festival on nature, forests and wildlife conservation and environmental aspects was organised in the Teak Museum, Nilambur during May 21 to 31.

A one day workshop on Teak Cultivation and Management' was organized on 20th August 2009, for the +2 Agriculture students of Vocational Higher Secondary School, Arimbra, Malappuram District.

MEMBERSHIP IN COMMITTIES

Dr. E.A. Jayson was nominated as Board of Studies Member of the Kuvempu University, Shimoga, Karnataka and was appointed as member of Mangalavanam Bird Sanctuary Advisory Committee by Govt. of Kerala 2009. He was also nominated as a Member of the Southern Regional Committee for the Management Effectiveness Evaluation of Tiger Reserves in India by the Ministry of Environment, Govt. of India.

Congratulation to the winners of KFRI circle in the 22nd Kerala State Forest Meet 2009-2010

Forest Meet 2010-ThrissurWinners List

Sl.No.	Item	Name	Prize
1	400M (Women Open)	1. Prabitha Prakash 2. Prathiba	Silver Bronze
2	Table tennis (Double)	1. Dr. Mammen Chundamannil 2. Dr. K. Mohandas	Silver
3	Table tennis (Single)	1. Dr. Mammen Chundamannil	Bronze
4	Power lifting	1. Shanthakumar	Bronze
5	Weight lifting	1. Shanthakumar	Silver
6	Badminton (Doubles)	1. Prathiba 2. Priyanka	Silver

Ph.D. Awarded

Mr. P.M. Sreekanth was awarded doctorate degree by the Forest Research Institute (FRI) University, Dehra Dun, in March 2009 for his work on **Population genetic structuring and gene flow estimates in *Tectona grandis* L.f. using AFLP markers**, under the guidance of Dr. M. Balasundaran, Programme Co-ordinator, Forest Genetics and Biotechnology Division, KFRI, Peechi.

Teak (*Tectona grandis* L.f.) is one of the most durable timbers in the world that is used for all conceivable purposes. The genetic structure within and between nine natural teak growing forests of the Western Ghats belonging to the states of Kerala, Karnataka and Tamil Nadu (9 populations X 20 trees), four seed production areas (SPAs) of Kerala (20 teak trees from each SPA) and 31 clones from clonal seed orchard established in 1985 at Kalluvettankuzhi (8.58ha) in Thenmala Forest Division in Kollam District of southern Kerala was investigated to provide reasoned scientific management practices and conservation measures, using ten selective Amplified Fragment Length Polymorphism (AFLP) primer combinations. Attempts were made to identify putative AFLP markers associated with phenotypic characters of teak trees in the natural forests.

The natural teak populations of Kerala and Tamil Nadu part of the Western Ghats in the Indira Gandhi Wildlife Sanctuary showed more genetic diversity than the Karnataka populations. Nilambur teak forests from Kerala showed its separate genetic identity. Considering the genetic divergence of Nilambur teak and their reported unique quality, genetic purity of Nilambur teak should be maintained avoiding mixing of genotypes from other provenances, especially in breeding populations and SPAs. Mixing up of genotypes in SPAs could be due to mixing of seeds from different geographic origin (provenances) for raising the original plantation which might have been converted as an SPA later. It may be also due to planting of stumps from different geographic origin into same SPA. Understanding the genetic diversity status of each SPA will be useful in ascertaining the quality of seeds required for raising future plantations. The results of the present study also indicate chances of mislabeling of clones that were used for raising CSOs. The lower genetic distance between the clones (higher genetic similarity) might be the reason for inbreeding in CSO resulting in poor seed set, poor seed germination and unhealthy seedlings.

Future CSOs should be established using genetically diverse clones showing profuse synchronized flowering and seed set, selected within a provenance. These attributes have to be ensured while selecting candidate plus trees or plus trees from which the clones will be developed. The lack of congruence between morphological and molecular data suggested that morphological systems may be useful for morphotypes management. Geographical and genetic distances were significantly correlated showing genetic divergence between distant populations. The unique AFLP loci identified can be further exploited for developing Sequence Characterized Amplified Region (SCAR) markers.

Ms. A. Haseena was awarded doctorate degree by the Forest Research Institute (FRI) University, Dehra Dun, in March 2009 for her work on **Morphological, biochemical and molecular characterization of thermophilic micro organisms involved in aerobic composting,** under the guidance of Dr. M. Balasundaran, Programme Coordinator, Forest Genetics and Biotechnology Division, KFRI, Peechi

For her study, Haseena isolated thermophilic bacteria, fungi and actinomycetes from five different compost samples produced from forest weed, herbal factory waste, coir pith, saw dust and tea factory waste. All the isolated organisms were identified through, morphological, biochemical and molecular characterisation. The isolates were screened for their ability to produce Catalase, Amylase, Cellulose, Xylanase and Phenoloxidase. Based on their enzymes production efficiency, a consortium of microorganisms was developed for quicker and efficient composting. The consortium was capable of fast composting of forest weeds, herbal factory waste and coir pith when tested.

List of students who were awarded Ph. D. Degree based on the work carried out at KFRI (1992-2009)

Sl. No.	Name of the student	Supervising Guide/ Co-Guide(Discipline)	Title of Thesis	Year	University
1.	Rahamathulla, V.K.	Dr. George Mathew (Entomology)	The studies on the Geometrid fauna (Insecta: Lepidoptera) of Kerala	1992	University of Calicut
2.	Mohammed Ali, M.I.	Dr. J. K. Sharma (Pathology)	Studies on seed pathology and seedling diseases of some important indigenous tree species of Kerala	1993	CUSAT
3.	Mohanan, C.	Dr. J.K. Sharma (Pathology)	Studies on diseases of bamboos and nursery management of Rhizoctonia web blight in Kerala	1994	CUSAT
4.	Anitha, V.	Dr. P.K. Muraleedharan (Forest Economics)	Land use changes and its impact on the socio-economic conditions of the tribals	1997	FRI-U
5.	Manoharan, T.R.	Dr. P.K. Muraleedharan (Forest Economics)	Economics of protected areas: A case study of Periyar Tiger Reserve	1997	FRI-U
6.	Maria Florence, E. J.	Dr. J. K. Sharma (Pathology)	Sapstain microorganisms associated with selected commercially important timbers of Kerala and their possible control	1997	CUSAT
7.	Mohanadas, K.	Dr.K.S.S.Nair (Entomology)	Population trend of *Hyblaea puera* cramer (Lepidoptera : Hyblaeidae) in teak plantations and the factors influencing it	1997	CUSAT
8.	Jayakumar, P.	Dr. Jose Kallarakkal (Tree Physiology)	Physiological investigations on the performance of oil palm (*Elaeis guineensis* Jaca) introduced into India from different sources	1998	FRI-U
9.	Jayasankar, B.	Dr. P.K. Muraleedharan (Forest Economics)	Economic analysis of forest resource management: A study of bamboos in Kerala	1998	FRI-U
10.	Soman, C.K.	Dr. Jose Kallarackal (Tree Physiology)	Ecophysiological studies on *Acacia auriculiformis* under experimental and natural conditions	1998	CUSAT
11.	Suraj, M.A.	Dr. A. R. R. Menon (Ecology)	Phytosociological mapping of Chimmony Wildlife Sanctuary using remote sensing techniques	1998	FRI-U
12.	Varghese, A.O.	Dr. A. R. R.Menon (Ecology)	Ecological studies of the forests of Peppara Wildlife Sanctuary using remote sensing techniques	1998	FRI-U
13.	Ancy Mathew	Dr. K.M. Bhat (Wood Science)	Structure and behaviour of Indian rattans	1999	University of Calicut
14.	Christopher, G.	Dr. P. V. K. Nair (Wildlife Biology)	Studies on man- wildlife interaction in Peppara WLS and adjacent areas, Trivandrum District, Kerala	1999	FRI-U
15.	Dhamodaran, T.K.	Dr. R. Gnanaharan (Wood Science)	Preservative treatment and chemical modification of rubber wood	1999	CUSAT

Sl. No.	Name of the student	Supervising Guide/ Co-Guide(Discipline)	Title of Thesis	Year	University
16.	Gigi, K. Joseph	Dr.K.K. Ramachandran (Wildlife Biology)	Ecology of lion-tailed macaque (*Macaca silenus*) in tropical forests of Southern Western Ghats, India	1999	FRI-U
17.	Indira Devi	Dr. S. Sankar (Agro forestry)	Socio-economic analysis of landuse and agro forestry systems in Thrissur District, Kerala	1999	FRI-U
18.	M. Balasubramanian	Dr. P. S. Easa (Wildlife Biology)	An ecological study on Asian elephants in Wayanad Wildlife Sanctuary with emphasis on crop damage	1999	FRI-U
19.	Mercey, K.A.	Dr. K. Jayaraman (Statistics)	Methods for estimating the abundance of herbivores in forest	1999	FRI-U
20.	Priya, P.B.	Dr. K. M. Bhat (Wood Science)	Growth periodicity and juvenile wood formation in teak	1999	FRI-U
21.	Surendra Gopal, K.	Dr. J. K. Sharma (Pathology)	Studies on enhancing the biomass of *Acacia auriculiformis* in highly acidic soils using most efficient strains of Rhizobium	1999	FRI-U
22.	Surendran, T.	Dr. J. K. Sharma (Pathology)	Studies on clonal propagation of eucalypts in Kerala	1999	FRI-U
23.	Suresh Babu, P.K.	Dr. A. R. R.Menon (Ecology)	Vegetation mapping and analysis of Eravikulam National Park using remote sensing techniques	1999	CUSAT
24.	Vairavel, S.M.	Dr. P. S. Easa (Wildlife Biology)	Ecology of gaur (*Bos gaurus* H. Smith) with special reference to habitat utilization in Parambikulam Wildlife Sanctuary, Kerala, India	1999	FRI-U
25.	Anjana Shankar	Dr. P.K. Muraleedharan (Forest Economics)	A study on the economics of collection, marketing and utilization of non-timber forest products in Kerala	2000	FRI-U
26.	Indira, E.P.	Dr.C. Renuka (Botany)	Studies on the variability of the species *Gmelina arborea* Linn.	2000	University of Calicut
27.	Jayanarayanan, T.	Dr. A. R. R. Menon (Ecology)	Floristics and phytosociology of moist deciduous forests of Central Kerala with special reference to Vazhani-Vellani hill tracts	2000	FRI-U
28.	Nandakumar, U.N.	Dr. S. Chand Basha	Ecosystem optimization through multi-tier forestry - A systems approach	2000	FRI-U
29.	Narayanan, C.	Dr. J. K. Sharma	Studies on wilt disease of *Casuarina equisetifolia* caused by *Trichoshorium vesiculosum*	2000	FRI-U
30.	Sanal Kumar, M.G.	Dr. S. Sankar (Agro forestry)	Problems and prospects of biodiversity conservation and management in some forest areas of the Kerala Western Ghats	2000	FRI-U
31.	Sanathanan Vellua	Dr. P.K. Muraleedharan (Forest Economics)	Dynamics of land use in recently settled forest areas: A case study of Attappady	2000	FRI-U
32.	Sunil Thomas	Dr. M Balasundaran (Pathology)	Detection of sandal spike phytoplasma using immunological and molecular techniques	2000	CUSAT

Sl. No.	Name of the student	Supervising Guide/ Co-Guide(Discipline)	Title of Thesis	Year	University
33.	Thomas, P. Thomas	Dr. S. Sankar (Agro Forestry)	Soils of bamboo (*Bambusa bambos*) brakes in Kerala forests	2000	FRI-U
34.	Veeramani, A.	Dr. P. S. Easa (Wildlife Biology)	An assessment of crop-damage by wild animals and the effectiveness of control measures	2000	FRI-U
35.	Francy, C.F.	Dr. George Mathew (Entomology)	Studies on the Noctuidae (Insecta: Lepidoptera) of Kerala	2001	FRI-U
36.	Santhosh Kumar, V.	Dr. S. Sankar (Agro Forestry)	Impact of land use on the hydrological behaviour of micro-watersheds in the humid tropics: A case study of Kunthipuzha, Palakkad, Kerala	2001	FRI-U
37.	Shaji, C. P.	Dr. P. S. Easa (Wildlife Biology)	Distribution and habitat ecology of fishes in Kerala part of Nilgiri Biosphere Reserve	2001	FRI-U
38.	Ajith Kumar, P. K.	Dr. S. Sankar (Agro forestry)	Socio-economic impact at upland management on downstream villages : A case study of Bharathapuzha River Basin	2002	FRI-U
39.	Binoy, C. F.	Dr. George Mathew (Entomology)	Effect of fire on forest insect species diversity - A study in the Silent Valley National Park, India	2003	University of Calicut
40.	Mary Anto	Dr. George Mathew (Entomology)	Ecology and conservation of southern birdwing butterfly	2003	FRI-U
41.	Sajeev, T. V.	Dr. K.S.S Nair (Entomology)	Spatial dynamics of teak defoliator (*Hyblaea puera*) outbreaks : Patterns and causes	2003	CUSAT
42.	Suma, T. B.	Dr. M. Balasundaran (Pathology)	Studies on genetic polymorphism in *Santalum album*	2003	CUSAT
43.	Abdulkader, S.	Dr. KK Seethalakshmi (Tree Physiology)	Seed longevity and storage of mahogany and hopea	2004	FRI-U
44.	Jayakumar, R.	Dr. K.K.N. Nair (Botany Division)	Studies on the plant diversity of New Amarambalam Reserved Forest of the Western Ghats of Kerala	2004	FRI-U
45.	Jayasree, V. K.	Dr. C. Renuka (Botany)	Root morphology and development in selected species of *Calamus* Linn.	2004	University of Calicut
46.	Sulekha, K.	Dr. C. Renuka (Botany)	Reproductive biology and micropropagation of selected species of *Calamus* L.(Arecaceae)	2004	University of Calicut
47.	Kishore Kumar, K.	Dr. A.R.R. Menon (Ecology)	Taxonomic and ecological studies on the shola forest of Kerala	2004	University of Calicut
48.	Mahesh Kumar, M.	Dr. George Mathew (Entomology)	Studies on the lepidoptera of Nelliampathy forests	2004	University of Calicut
49.	Padmakumar, P. K.	Dr. C. Renuka (Botany)	Developmental morphology in relation to conservation in the family *Palmae* (Arecaceae)	2004	University of Calicut
50.	Sibichan Varghese	Dr. U.M. Chandrashekara (Agro forestry)	Impact of natural and man-made disturbances on vegetation structure and diversity in shola forests of Kerala, India.	2004	FRI-U

Sl. No.	Name of the student	Supervising Guide/ Co-Guide(Discipline)	Title of Thesis	Year	University
51.	Sreenivasan, M. A.	Dr.K.V.Sankaran (Pathology)	Natural distribution and control of the alien invasive weed *Mikania macrantha* HBK in the Western Ghats.	2004	FRI-U
52.	Stephen Sequiera	Dr. Muktesh Kumar (Botany)	Taxonomy and ecology of lichens of Silent Valley National Park, Southern Western Ghats, India	2004	FRI-U
53.	Sasidharan, K.R.	Dr. R.V. Varma (Entomology)	Studies on the insect pests of *Casuarina equisetifolia* L. in Tamil Nadu and their management	2005	FRI-U
54	Sreekumar, V.B.	Dr.C. Renuka (Botany)	Systematics and phylogeny of the genus *Calamus* Linn. (Arecaceae) in the Western Ghats	2005	University of Calicut
55.	Biji, C. P.	Dr.V.V.Sudheendrakumar (Entomology)	Investigations on the nucleo polyhedron virus of the teak defoliator with special reference to quality improvement	2006	FRI-U
56.	Brijesh, C.M.	Dr. George Mathew (Entomology)	A study on the diversity of Lepidoptera (Insecta) in shola forests of Munnar (Kerala)	2006	FRI-U
57.	Chacko, K. C.	Dr. Jose Kallarackal Tree Physiology	Seedling development of teak (*Tectona grandis L.F.*) in response to environmental and nutritional factors	2006	FRI-U
58.	Sivaperuman, C.	Dr. E.A.Jayson (Wildlife Biology)	Ecology of wetland birds in the Kole lands of Thrissur, Kerala	2006	FRI-U
59.	Sreelakshmi, K.	Dr. P.K. Muraleedharan (Forest Economics)	Economic benefits of non-wood forest products in a changing rural economy: A case study of Wayanad, Kerala	2006	FRI-U
60.	Sunanda, C	Dr. K. Jayaraman (Statistics)	Simulations calibration of allomertic relations in even –aged teak stands using multilevel models	2006	FRI-U
61.	Swaran, P.R.	Dr. R.V. Varma (Entomology)	Management of termites in forest plantations	2006	FRI-U
62.	Durai, V.	Dr. S. Sankar (Agro forestry)	An assessment of ecological stability and sustainable productivity in home garden agro forestry system in Kerala	2007	FRI-U
63.	Sreejith, K.A.	Dr. U.M. Chandrashekara	Ecological and ecophysiological studies on the successional status of tree seedlings in tropical wet evergreen and semi evergreen forests of Kerala	2008	FRI-U
64.	Sheik Mohammed Shamsudeen, R.	Dr. George Mathew (Entomology)	Studies on Microheterocera (Insecta: Lepidoptera) in Kerala part of Western Ghats	2008	FRI-U
65.	Thulasidas, P.K.	Dr. K.M.Bhat (Wood Science)	Timber properties of Teak (*Tectona grandis L.F.*)grown in the homesteads of Kerala	2008	FRI-U

Sl. No.	Name of the student	Supervising Guide/ Co-Guide(Discipline)	Title of Thesis	Year	University
66.	Sabna Prabha, S.	Dr. E.P.Indira (Forest Genetics)	Analysis of mating system and contemporary gene flow in natural teak forests and plantation through DNA marker studies	2008	FRI-U
67.	Haseena, A.	Dr. M. Balasundaran	Morphological biochemical and molecular characterisation of thermophilic microorganisms in aerobic composting	2009	FRIU
68.	Sreekanth, P. M.	Dr. M. Balasundaran	Population genetic structuring and gene flow estimates in *Tectona grandis* L. using AFLP markers	2009	FRIU

Academic Attachment and Ph. D. Programme

(APRIL 2009 – MARCH 2010)

Ph.D. Programme

Ph.D. thesis of the following student was processed and forwarded to FRI University.

Name	Topic for research approved by FRI	Date & Month	Supervisor
Roby, T. J.	Floristic structure and diversity of *Myristica* swamps at Kulathupuzha in a GIS perspective	22/07/2009	Dr. P. Vijayakumaran Nair

Pre-submission Ph.D. Thesis seminars were given by the following students

Name	Topic for research approved by FRI	Date & Month	Supervisor
Chandrasekhara Pillai	Effect of site management practices on growth and wood properties of eucalypts in Kerala	11/12/2009	Dr. R. C. Pandalai
Mujeeb Rahman, P.	Characterization of soil fauna in different land use systems in the Kerala part of Nilgiri biosphere reserve	16/12/2009	Dr. R. V. Varma
Ramya, R.	Physiological and genetic diversity studies on regeneration of *Santalum album* L.	25/02/2010	Dr. M. Balasundaran

Seminars presented by Ph. D. students

Name	Supervisor	Date	Topic
Magesh, G.	Dr. A. R. R. Menon	13-05-2009	Basics of Remote Sensing
Bindhu, K. Jose	Dr. Sudheendra Kumar	3-06-2009	The flying belladonas : Sequestration, transformation and uses of toxins for defence
Ramya, R.	Dr. M. Balasundaran	16-07-2009	*Santalum album* L: from 'Vulnerable' to 'Endangered'
Sojan Jose	Dr. E. P. Indira	21-10-2009	Teak: The well known timber tree
Linto, E. L.	Dr. C. Renuka	29-09-2009	Taxonomy : A molecular approach
Smitha John, K.	Dr. M. P. Sujatha	18-11-2009	Soil carbon sequestration –An approach to save our environment

Academic Attachments during 2008-2009

Sl.. No	Name of the student	Year	Supervising Guide	Name of College	Subject
1.	Sreeraj, V. S.	October 2009	Dr. A. R. R. Menon	PSNA College of Engineering &Technology	M.Tech. Remote sensing
2.	Shobitha Chandrashekhar	December 2009	Dr. E. M. Muraleedharan	PSG College of Arts and Science, Coimbatore	Biotechnology
3.	Sruthi, M. R.	December 2009	Dr. E. M. Muralidharan	PSG College of Arts and Science, Coimbatore	Biotechnology
4.	Rini John	December 2009	Dr. V. V. Sudheendrakumar	Karpagam Arts and Science College, Coimbatore	Biotechnology
5.	Rani Varghese	March 2010	Dr. T. V. Sajeev	St. Mary's College, Thrissur	Microbiology
6.	P. Reshma Vijay	March 2010	Dr T.V. Sajeev	St. Mary's College, Thrissur	Microbiology
7.	Priya Varghese	March 2010	Dr. E. P. Indira	St. Mary's College, Thrissur	Biotechnology
8.	Devi, P.	March 2010	Dr. E. P. Indira	St. Mary's College, Thrissur	Biotechnology
9.	Ramsheena Abdul Vahab	March 2010	Dr T.V. Sajeev	Indira Gandhi College of Arts & Science, Kothamangalam	Microbiology
10.	Reesna Hussain	March 2010	Dr T.V. Sajeev	Indira Gandhi College of Arts & Science, Kothamangalam	Microbiology

Extension activities during April 2009 – September 2009

Sl. No.	Year & Month	Service provided	Client
1.	2009 April	Wood identification	The Judicial Ist Class Magistrate Court - 1Manathavady, Wayanad Dist.
2.	2009 May	Wood identification	M/s. Romko Umas Enterprises, 158, Valayamadevi Road, Neyveli - 607802
3.	2009 May	Wood identification	M/s. Nemat Traders, No. 15, Vannier StreetP.B. No. 1207Cheennai - 600001
4.	2009 May	Wood identification	Assistant Engineer,Cochin Central Sub - DivisionC.P.W.D, Kakkanad, Cochin - 682037
5.	2009 June	Wood identification	Dr. P. A. Muhamed Sayeed, President, Cheraman Juma Masjid Committee, Cheraman Malik Nagar, P.O. Kodungallur, PIN - 680664
6.	2009 June	Wood identification	Managing Director, Forest Industries (Travancore) Ltd., Thaikkattukara, P.O. Aluva - 683106, Ernakulam Dist.
7.	2009 June	Wood identification	M/S Sree Balaji Timbers, 119, Meenkarai Road, Zamin Uthukuli, Pollachi - 642004, Tamil Nadu
8.	2009 June	Wood identification	M/s. Wood Crafts, A-18, Industrial Estate, Thattanchavadi., Pondicherry - 605009
9.	2009 June	Wood identification	The Chief Manager/CivilCivil/Maintenance/North zoneTownship Administrative office, Block – 10, Neyveli – 607801, Tamil Nadu
10.	2009 June	Suitability of Pettimudi (Block – X) for Captive Pulpwood Plantations	M/S Hindustan Newsprint Ltd, Forestry Department, Newsprint Nagar, Kottayam
11.	2009 June	Failure of wattle plantation raised by KFDC In Silent Valley, Munnar	Managing Director, KFDC, Munnar
12.	2009 June	Note on: The Burned Pine Plantation of the KFDC Near Silent valley, Munnar	KFDC Officials, Munnar

FAREWELL

Dr. R. Gnanaharan

Dr. R. Gnanaharan served as the Director of the Institute during January 2007-May 2008. He super-annuated from the service of the Institute on 30th August 2009. Before taking charge as Director, Dr.R. Gnanaharan was Research Coordinator and Member of the Institute Management Committee. He obtained his M. E. in Chemical Engineering from the Indian Institute of Science, Bangalore (1973) and Ph. D. in Wood Technology from the University of Minnesota, USA (1979). As the Head of the Wood Science and Technology Division, he strengthened the Division through academic inputs and skills especially in developing technologies for efficient utilization of non-conventional timber such as rubber wood, coconut wood and bamboo. He is a world authority on wood preservation techniques and has published several research papers, technical reports, handbooks and information bulletins in the areas. He was a Member of the Bureau of Indian Standards in the Timber Sectional Committee on Wood Preservation and the International Research Group (IRG) on Wood protection. Dr.R. Gnanaharan was responsible for initiating the first international project on bamboo in the Institute sponsored by IDRC Canada and was organiser of the First International Conference on Bamboo in Kochi in 1998. His skills as a scientist and an administrator and uncompromising ethical qualities put him in good stead in performing his duties as the Research Co-ordinator and later as Director in the most commendable way.

Dr. Jose Kallarackal

Dr. Jose Kallarackal Scientist F and Programme Coordinator, Sustainable Forest Management Division superannuated from the Institute on 30 April 2009 after serving for 21 years and four months. His area of specialisation was Ecophysiology and Tree Physiology. While in KFRI, he initiated several research projects dealing with the water use of exotic and indigenous tree species, especially, eucalypts and acacia. He also completed a study on the water use of 12 tree species in the tropical deciduous forest using modern techniques. His other interests in research included climate change with special reference to response of plants to elevated carbon dioxide. He initiated the collection and documentation of daily weather data in KFRI starting from 1989. Dr. Jose was also the coordinator of a World Bank funded project which helped KFRI set up a well-accomplished Local Area Network and a Website as early as 1999. He equipped the Tree Physiology Division with very modern equipments for field studies. He attracted sponsorship for several KFRI projects both from India and overseas. Dr. Jose took a keen interest in many institution-building activities. During his tenure in KFRI, Dr. Jose participated in several national and international conferences and organized training programmes and workshops. He has published over 60 scientific papers and several popular science articles. He is a Fellow of the Alexander von Humboldt Foundation (Germany) and member of several other learned societies. KFRI is fortunate to associate with Dr. Jose even after his retirement since he accepted a CSIR Emeritus Scientist position and rejoined the Institute on 31st August, 2009.

Shri. K.K. Ahamad

Shri. K.K. Ahamad joined the KFRI on 2nd August 1979 as attender and retired from the service on 31st May 2009.

Shri. V. Mohammed Ali

Shri.V. Mohammed Ali joined the sub centre of KFRI at Nilambur on 1st August 1986 as attender and retired from the service of KFRI on 30th June 2009.

Shri. K.S. Karunakaran

Shri. K.S. Karunakaran joined KFRI as attender on1st December 1978 and retired from the service as Clerical Assistant on 31st July 2009.

Shri. P. Achuthankutty

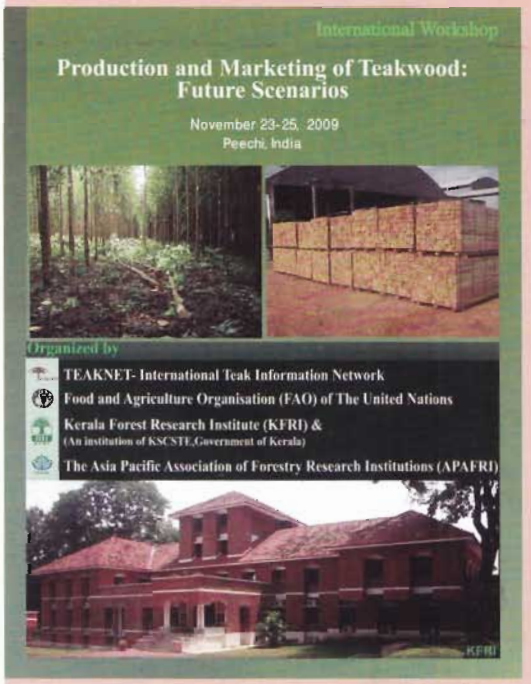
Shri. P. Achuthankutty joined KFRI on 3rd January 1983 as PA to Director and retired from the service on 30th September 2009 as PS to Director.

WEATHER DATA

Monthly weather data for 2009 at Peechi Latitude-10° 31'47" N **Longitude-** 76° 22'7.5" E **Altitude-** 45 msl

Month	Max. Temp. °C	Avg.Temp. °C	Min.Temp. °C	Max.rh %	Avg. rh %	Min. rh %	Rainfall mm	Wind Velocity km/h	Solar Radiation kw m^{-2}
Jan	33.17	25.39	18.31	100.00	71.63	26.07	0.00	8.87	167.01
Feb	36.51	27.05	18.42	100.00	73.62	20.56	0.00	4.90	159.74
Mar	36.55	28.45	21.58	100.00	82.27	22.76	23.40	3.01	166.03
Apr	37.26	28.88	22.14	100.00	87.50	24.97	46.60	1.86	141.40
May	35.48	28.00	22.51	100.00	91.71	49.41	152.80	1.98	131.89
Jun	32.78	25.93	21.95	100.00	98.31	67.74	538.40	1.66	111.52
Jul	31.40	24.96	21.57	100.00	98.62	68.30	1188.00	1.63	89.35
Aug	31.72	25.83	22.21	100.00	94.69	63.64	465.20	1.16	119.24
Sep	31.45	25.85	22.74	100.00	91.73	60.88	311.00	1.31	105.95
Oct	33.35	26.45	21.87	100.00	84.30	31.90	193.60	2.54	128.86
Nov	31.91	26.17	21.46	100.00	85.91	43.62	194.40	4.44	110.95
Dec	32.19	26.23	21.15	100.00	74.77	35.17	6.40	7.36	133.53
Total/Avr.	**33.65**	**26.60**	**21.33**	**100.00**	**86.25**	**20.56**	**3119.80**	**3.39**	**130.45**

Proceedings of the International Workshop on *Production and Marketing of Teakwood: Future Scenarios*



The CD contains the Proceedings of the International Workshop on *Production and Marketing of Teakwood: Future Scenarios* held at KFRI, Peechi during 23-25 November 2009. The workshop was conducted with the main objective of making the stakeholders aware of the current situation with respect to teak production and marketing at a global level, and to build on the opportunities available from these developments. This workshop was also important to strategize the future activities of TEAKNET taking into consideration the emerging opportunities and challenges and how the teak network may facilitate coordinated efforts by network members.

The workshop was organized by TEAKNET in collaboration with the Kerala Forest Research Institute. Financial support for the workshop was provided by FAO of the United Nation and Asia Pacific Association of Forestry Research Institutions (APAFRI). The workshop was attended by a total of 67 participants from different countries including India and several eminent scientists and experts in various fields of tropical timber development programmes presented their papers. The participants represented a cross section of the major sets of stakeholders like growers, traders, researchers and policy makers.

The technical sessions centered on the topics such as supply of and demand for teakwood, market intelligence on teak price, grading of teakwood, timber certification, production technology and future perspectives for TEAKNET. The workshop concluded with certain recommendations to develop the global teak sector so that the sector can increase the production of teakwood for meeting the rising demand by expanding teak cultivation to new areas, promoting growing of teak in community homesteads and private plantations and enhancing market for teakwood through improved strategies like the development of market intelligence on teakwood availability and price.

Training programmes conducted

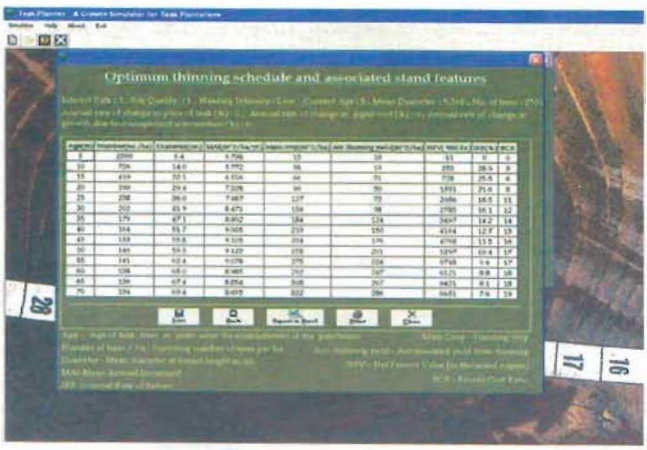
April 2009 – September 2009

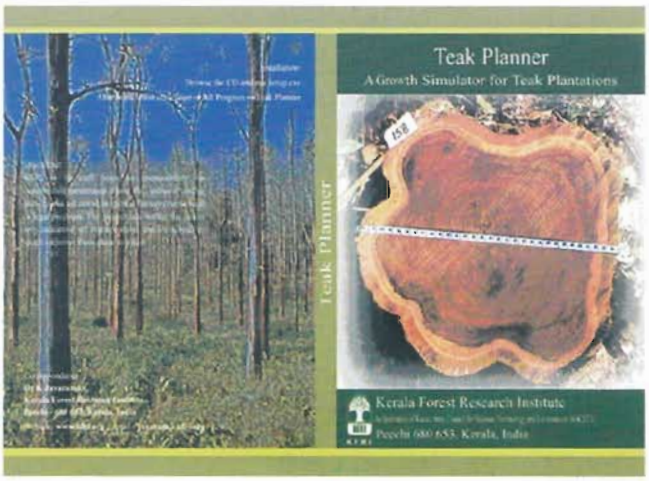
No.	Date and Year	Title	Sponsor
1.	20 April 2009	Kerala State Biodiversity Board, Thiruvanathapuram	Kerala State Biodiversity Board, Thiruvananthapuram
2.	21 April 2009	Kerala State Biodiversity Board, Thiruvanathapuram	Kerala State Biodiversity Board, Thiruvananthapuram
3.	23-24 April 2009	CARE Training	CARE
4.	8-11 June 2009	Collection, processing and storage of medicinal plants and management of Seed Centre under UNDP/MoEF programme (FRLHT)	UNDP/MoEF Programme
5.	12-13 June 2009	Kerala State Backward Classes Development Corporation Ltd., Thrissur	Kerala State Backward Classes Development Corpn. Ltd., Thrissur
6.	17-22 August 2009	Priority species, resource estimation, plantation development, post-harvest technology and socio-economic livelihood potential of bamboos	NBM
7.	20-22August 2009	Watershed Management	Teekoy Grama Panchayath, Kottayam
8.	20 October 2009	Vegetative propagation and seedling Development of *Saraca asoka*	
9.	26-31 October 2009	Priority species, resource estimation, plantation development, post harvest technology and socio-economic livelihood potential of bamboos	NBM
10.	14-15 November 2009	Training for teachers Ideal English Higher Secondary School	IEHSS
11.	16-20 November 2009	Training course on collection, compilation, validation and dissemination of forestry statistics	MoEF
12.	7-9 December 2009	Bamboo training for farmers from Thiruchirappilly	NBM
13	8-9 December 2009	Bamboo training for farmers from Krishnagiri	NBM
14	26 Nov.- 1 Dec. 2009	Modern trends in teak cultivation and management	Future Forests, Fiji Island
15	2-3 December 2009	Training of 8th All India School Education Survey	NCERT
16	14-15 January 2010	Two-day training workshop on effect of weeds on productivity of forest plantations and natural forests and different cost effective methods for their control	MoEF
17	18-23 January 2010	Training course on priority species, resource estimation, plantation development, post harvest technology and socio-economic livelihood potential of bamboos	NBM
18	6-9 February 2010	Training on vegetation carbon pool field data collection demonstration	

Teak Planner

Teak planner functionally is a growth simulator for teak plantations. Its scope of application is the range of growing conditions that is available in Kerala. This programme can be used to identify the optimum thinning schedule and rotation age for even-aged teak stands under a range of site quality and management levels. The optimum thinning schedule is that which maximizes the net present value of cash flows, out of a variety of possible thinning schedules in a plantation. It also enables the user to make an investment plan by providing information on net present value (NPV), internal rate of return (IRR), benefit cost ratio (BCR) and payback period (PBP) for a range of management options. The software is also an effective tool for financial valuation of the growing stock for commercial purposes.

The input data at the first level consists of interest rate that is to be used for discounting purposes, site quality class and weeding intensity. The system can then generate mean diameter at 5th year which is the starting point of simulation assuming an initial planting intensity of 2500 trees per ha. In case, the user wants to optimize purchase cost of a plantation or maximize the returns from a purchased plantation, the corresponding input values can be entered and can proceed further. With the input data that is supplied, the programme identifies the optimum thinning schedule for the stand under consideration and displays the number of trees to be retained at 5 yearly intervals with information on several associated stand features like mean diameter of trees, volume of standing crop, accumulated yield from thinning and mean annual increment in total volume (MAI).





It also displays the NPV, IRR and BCR. The optimum rotation age can then be taken as the age at which NPV reaches its maximum. This programme thus fills in the need for a self-contained user-friendly software for finding out optimum thinning schedule and associated stand features for any given stand.

One additional feature is that the user is supplied with the option of making the financial projections either under 'constant' levels of teak timber price, input cost and management interventions or under 'varying' rates. This option provides the user a whole scenario of possible projections and every time the simulator identifies the best thinning schedule to be followed to maximize the returns.

The simulator has been built using visual Basic software. The equations used for projecting the different stand features were developed using long-term data gathered for permanent sample plots laid out in teak plantations in Kerala. Whole stand models based on Richards function with biologically meaningful parameters formed the basis of diameter and volume growth functions.

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Priced Publications

		Price	
	Bamboo	Rs.	US$
1	An Annotated Bamboo Bibliography. KFRI CD 4	200.00	20.00
2	Bamboo: A Crop (CD-ROM)	250.00	25.00
3	Bamboos of India	2250.00	100.00
4	Edible Bamboo Shoot Recipes	30.00	10.00
5	Edible Bamboo Shoots: Collection and Processing (Malayalam)	10.00	10.00
6	Information Resources for Bamboo and Cane Development in Kerala	75.00	10.00
7	Policy and Legal Issues in Cultivation and Utilization of Bamboo, Rattan and Forest Trees in Private and Community Lands	400.00	40.00
	Rattan (Cane), Palms		
8	A Manual on the Rattans of Andaman and Nicobar Islands	175.00	20.00
9	Annotated Bibliography on Rattans of the World	350.00	35.00
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11	Field Identification Key for Rattans of Kerala	125.00	15.00
12	Field Identification Key for Indian Palms. KFRI CD 8	150.00	15.00
13	Nursery and Silvicultural Techniques for Rattans	50.00	10.00
14	Oil Curing Technology for Value-added Rattan (Cane) Products	50.00	10.00
15	Palms of Kerala	200.00	20.00
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20	Bibliography on Teak. KFRI CD 2	500.00	50.00
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23	Teak (Seminar Proceedings)	200.00	20.00
24	Teak Planner. KFRI CD 7	1000.00	80.00
25	Teak Bibliography (Print)	700.00	70.00
26	The Teak Defoliator (CD-ROM)	250.00	25.00
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35	Plantation Technology: *Melia dubia* (Malaveppu)	50.00	10.00
36	Plantation Technology: *Vateria indica* (Vellaoavin)	50.00	10.00
	Natural Forests		
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38	Biodiversity Documentation for Kerala. Part 2: Fungi	300.00	30.00
39	Biodiversity Documentation for Kerala. Part 3: Lichens	150.00	15.00
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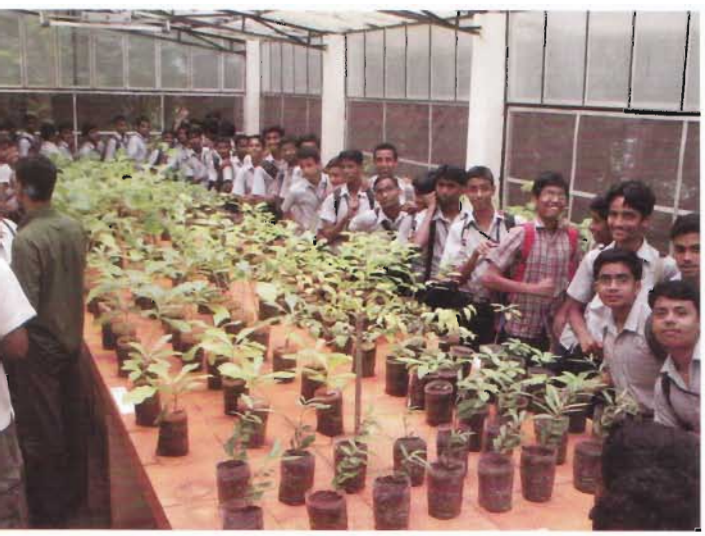

Training Programmes

KFRI Main Campus, Peechi

KFRI offers specialized training courses in tropical forestry. It will also be possible to provide tailor-made training depending upon specific needs of the stakeholders. The medium of instruction is English. KFRI is an approved training centre of the Ministry of Environment, Government of India for training the officers of Indian Forest Service. Also, various state forest departments have sponsored candidates for several training courses in the past. Overseas participants from Myanmar, Sri Lanka, China, Nepal, Ethiopia and Uganda have attended different training courses.

Faculty

The Institute has 56 well – qualified and trained scientists with national and international exposure. Apart from the scientists of the Institute, renowned experts from other reputed institutions/universities are also engaged as resource persons/guest faculty.

Facilities

Training courses are conducted in the Training Extension Centre with modern lecture hall, seminar hall, meeting room and computer hall with internet facility. The Institute has well-equipped laboratories, library, herbarium, insect museum, wildlife museum, nursery and live collection of bamboos, rattans, palms, medicinal plants and tropical tree species. Kerala Forest Seed center, Teak Museum and Bioresourse Nature Park are other attractions for the visitors. Accommodation is provided in the Trainees Hostel having modern facilities.

Bioresourse Nature Park, Nilambur

Teak Museum, Nilambur

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Evergreen

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