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From the Director's Desk

Conservation of biodiversity

Conversion of tropical forests for agriculture and industrial purpose and degradation of existing forests, have resulted in loss of biodiversity. A large number of plants and animals have been categorized as rare, endangered and threatened due to shrinking of habitat and many have become extinct during the past century. Hence, the need to conserve the biodiversity has become a global issue. Recently, I came across an excellent publication on "The making of a Dusun Ethnoflora (Sabah, Malaysia)", People & Plants Working Papers, UNESCO, France February 2002 by GJ Martin, A. Lee Agama, JK Beaman & J. Nais. I am reproducing excerpts from the last Chapter on "Ethnobiological inventories, biodiversity loss and erosion of local knowledge" for the benefit of all concerned with the biodiversity conservation.

The call for a global biodiversity inventory

In 1992, the Convention on Biological Diversity (CBD) - echoing many other international declarations - called for a range of challenging approaches to conserve biodiversity, promote its sustainable use and ensure the equitable sharing of benefits from its commercial exploitation. One of the specific activities to have emerged from the Convention is the Global Taxonomy Initiative (GTI), which was established by the Conference of the Parties to address the lack of taxonomic information and expertise available in many parts of the world, thus improving decision-making in conservation, sustainable use and equitable sharing of the benefits derived from genetic resources. The GTI is specifically intended to support implementation of the work programmes of the Convention on thematic and cross-cutting issues.

A similar call has come from a non-profit foundation called *All Species* (www.all-species.org), whose goal is to record and sample every form of life during our generation. This initiative calls for funding and training of a network of local collectors and naturalists. The inventory would be matched with an effort to employ advances in information technology to manage the resulting biological data. In the words of the foundation, the justification for this multibillion dollar programme is that it will:

1. "give us, for the first time, a complete list of who is here," the roster of our fellow inhabitants;
2. provide a reliable baseline for counting populations and determining endangered species;
3. form the foundation for developing a complete genome of all life, and a new understanding of nature;
4. uncover multitudes of new species, many of which will have immediate cultural and economic impacts;
5. train many people as naturalists and scientists, who can leverage these skills further in their own lives and that of society; and
6. distribute wealth from the developed world to far corners of the Earth by employing indigenous and native observers and collectors".

Another major step for biodiversity inventory is the Global Biodiversity Information Facility (GBIF) established by the Organisation for Economic Cooperation and Development (OECD) Megascience Forum Working Group on Biological Informatics. In January 1996, the Working Group's Biodiversity Informatics Subgroup concluded that existing biodiversity and ecosystems information is neither readily accessible nor fully useful. They also realized that recent technological and political developments present leadership opportunities for OECD countries to provide access to this information, which they characterized as vast and complex and of critical importance to society. As of March 2001, 14 countries had joined the Facility and collectively pledged over 2.5 million US dollars to support GBIF's first year of operation. Its goal is to provide world-wide access, via the Internet, to information about the 1.8 million species of organisms that are known and classified. These data are mostly concentrated in developed countries and are not easily accessible especially to the developing countries from which much of the data originated.

Mohamed Kassas (2001), renowned desert ecologist and past president of the World Conservation Union (IUCN), has identified several gaps in our knowledge of biodiversity that these approaches could ameliorate. Foremost among these in his opinion is the lack of a complete inventory of global species diversity. This has been termed the 'global taxonomic impediment', and is limiting progress in biodiversity programmes encouraged under the CBD. Based on a best guess estimate of 10 million species, Kassas suggests that only 18% (1.8 million species) have been classified and named. Another gap relates to our lack of understanding of the role of each species in the ecosystem, which is key to setting priorities for conservation. Kassas also raises concerns about our limited ability to assess and forecast bio-ecological degradation. Drawing upon the writings of Pat Mooney (1999) "Erosion includes not only genetic erosion and erosion of species, soils and the atmosphere - but also the erosion of knowledge and the global erosion of equitable relations," he extends this concept of degradation to the erosion of local knowledge and cultural practices".

Preparation of Biodiversity Registers for Panchayat is the first step to fulfil requirement for CBD declaration and the Biodiversity Bill pending before the Parliament. Although a few Biodiversity Registers have been prepared in Kerala, their usefulness is neither realised nor put to practices. A unique example of preparation of Biodiversity Register involving school children is from Karnataka developed by Prof. Madhav Gadgil, a distinguished Scientist from Indian Institute of Science, Bangalore which can serve as a model for Kerala as well as the whole country, with appropriate changes to suit the local needs and involving subject experts as well in the whole process. We do not have to wait for the Biodiversity Bill to be passed to implement such excellent programme which will go a long way in conserving our biodiversity.

This Issue Features

Acacia mearnsii- a cultivated weed?

Acacia mearnsii De Wild. (black wattle), of the family Mimosaceae, is a fast growing leguminous tree native to Australia. It has been introduced and widely cultivated in many tropical and subtropical countries as a source of tannin, firewood, charcoal, poles, green manure, windbreak, etc. The tree is suited to high humid tropics where the annual rainfall is above 1000 mm and altitude >750 m asl. Extensive areas of black wattle plantations were established in South Africa, South America, southern Europe and southeast Asia in the early 19th century. It is grown in several States in India for firewood purposes and for extraction of tannin.

A. mearnsii is a moderately tall (5-7 m in height), profusely branched evergreen tree. Leaves are bipinnately compound and the small glabrous leaflets are oppositely arranged. Flowers are grouped into spherical balls, which together form racemes. The thick, brownish bark is the source of tannin. A mature plant produces thousands of small, black colored seeds, which are highly viable.

In Kerala state, A. *mearnsii* was introduced in the 1980's and mainly grown in the high altitude areas (>1000 m asl) especially in Devikolam Thaluk, Idukki district. Most of the *A. mearnsii* plantations were raised in degraded or fire burnt areas close to the natural forests. It was preferred over other candidate forestry species because of the higher seed viability, fast growth rate and minimum post- planting care required. However, attempts to grow *A .mearnsii* on a plantation scale was not successful in most places in Kerala state due to high seedling mortality, eco-climatic stress and other factors. Hence, it now occupies only a very small area in the high altitude areas in the State. Fresh planting is not undertaken due to recurrent failure in establishment of the trees.

Recently it was noticed by us that in certain isolated pockets in the high altitude areas, a few trees of *A.mearnsii* survived the odds and grow luxuriantly. At Vattavada (1800 m asl), Surianelli (1200 m asl) and Mannavan shola (1780-2500 m) in Idukki district the tree has penetrated into natural shola forests forming small scrub jungles suppressing the native vegetation. The fast growth rate, high competitive ability, the thick canopy, and allelopathic properties of the leaves aid in suppressing the indigenous flora. Tolerance to the extreme eco-climatic conditions and high rooting ability of even fragments of stem are favorable for its spread like a wildfire in to newer habitats. Moreover, the seed dispersal is helped by wild herbivores like bison and deer, which distribute them widely in the natural forest areas. This exotic weed also poses threat to tea plantations at Kolukkumalai (2480 m asl) and Chokkanad areas (1255- 1550 m asl) in Idukki district.

Needless to say, the biodiversity of the subtropical montane forests in Kerala is under great threat owing to the unchallenged invasion by *A.mearnsii*. It need be mentioned here that this species is reported as a common weed in South Africa where it was introduced much earlier than in India.

M.A. Sreenivasan and K.V. Sankaran
Division of Plant Pathology

Ecological dimensions and conservation issues of sacred groves

Sacred groves represent patches of forests protected by assigning them as the abode of Gods and Goddesses. In India, in spite of a general very high land to man ratio, sacred groves have survived under a variety of ecological situations. Sacred groves are present all along the Himalayas from north-east to north-west. 'Deorali' in the Darjeeling Hills, 'Lakyntang' in the Khasia and Jaintia Hills in Meghalaya, 'Jankor' in Dudh and Dhelki Kherias of Central India. 'Jaher' in Santal tribal region, 'Sarnas' in Bihar and Madhya Pradesh, 'Oran' in Rajastahn, 'Deorais' or 'Deoranis' in Maharashtra. 'Devarakadu' or 'Devara bana' in Karnataka. 'Koivlkadu' or 'Kavu' in Tamil Nadu and 'Sarpa kavu' or 'Kavu' in Kerala are different names for sacred groves. About 5691 sacred groves have been recorded so far. It is also expected that further inventory covering all regions of the Country may lead to encounter as many as 1,00,000 to 15,00,000 sacred groves. Sacred groves are considered as one of the land use systems with ecological and socio-cultural importance in the region. This paper deals with the ecological dimension of sacred groves of India with particular reference to those of Kerala. Threats and opportunities to conserve and manage the unique institution of sacred groves are also discussed.

Vegetation structure, floristic composition and biodiversity in sacred groves

Well conserved sacred groves may be compared with the regional natural forests for various ecological attributes. In the humid tropical forests of the Western Ghats of India, for example, the range of stem density of trees (gbh ≥ 10.1cm) is from 663 ha^{-1} to 3341 ha^{-1}, while the range of basal area is from 37.4 m^2 ha^{-1} to 83.8 m^2 ha^{-1}. The stem density recorded for sacred groves such as Iringole and Sree Narayana Puram (S.N. Puram) is 3339 ha^{-1} and 1873 ha^{-1}, respectively when the basal area in these sacred groves is 37.3 m^2 ha^{-1} and 53.2 m^2 ha^{-1}, respectively. Basal area recorded in a sacred grove at Karikan in Uttara Kannada District, Karnataka is reported as 63m^2 ha^{-1}. All these values are within the range of values recorded in the humid tropical forests of the Western Ghats. However, often both the tree density and basal area may be more in the sacred groves as in the case of Hariyali sacred groves in Garwal Himalaya (density: 1399 ha^{-1}; basal area 47.6 m^2 ha^{-1}) than the adjacent natural forests (tree density: 1144 ha^{-1}; basal area: 26.9 m^2 ha^{-1}). This has been attributed to the fact that such sacred groves are totally prohibited from biomass removal and disturbance. The regeneration potential of a given forest site can be determined by considering the size class distribution of trees. A negative exponential curve with a clear preponderance of stems of small girth classes is an indication of better regeneration potential. Such a negative exponential growth curve has been recorded from sacred groves in Iringole and S.N. Puram in Kerala as well as from sacred groves in Shekhala village in Rajasthan.

Sacred groves in the high lands of Kerala are reported to have typical Western Ghats forest type of vegetation. It may also be pointed out that species like *Dipterocarpus indicus, Kingiodendron pinnatum, Humboldtia brunnois* are characteristic of the low elevation evergreen forests of Western Ghats. However, it is reported that these species are absent or poorly represented in the sacred groves of Kerala. Thus it is clear that the above mentioned species have disappeared from the sacred groves and they are replaced by different species depending on the location specific micro-climate, availability of parent material, human interference etc. Some of the studies also recorded the maximum similarity between the flora of sacred groves in south-north direction rather than west-east lowland-highland direction in the State.

In general, sacred groves are richer in species. About 30 to 50 tree species in a hectare were recorded in sacred groves in Uttara Kannada District when about 60 tree species were documented from a 2 ha of sacred groves of

Siddapur Taluk in the same district in Karnataka. Fifty four tree species were recorded in the sacred grove at Iringole in Kerala. The 364 sacred groves (> 200 m^2) covering an area of 1.44 km^2 in Kerala contain about 720 species of angiosperms belonging to 472 genera and 126 families. Similarly, a baseline floristic survey in various sacred groves of Meghalaya revealed that as many as 514 species representing 340 genera and 131 families were present in these forests. At least 50 rare and endangered plant species in Meghalaya are now confined to sacred groves. In Shekhala village in Rajasthan, sacred groves, which occupy about 83 ha, possess about 31 species out of 59 recorded in the whole village. In this village, some of the species are sampled only in sacred groves and they include *Acacia nilotica, Azadirachta indica* and *Maytenus emarginata* among trees, *Acacia jacquemontii* and *Lycium barbarum* among shrubs, *Arnebia hispidissima, Eagonia cretica, Heliotropium ellipticum, Pulicaria wightiana* and *Trianthema portulacastrum* among herbs.

Sacred groves are regarded as the treasure of rare and endemic species. For example, analysis of the phytogeographical elements of sacred groves of Kerala indicated that out of 721 species (including *Gnetum ula*) recorded from sacred groves 154 are endemic to Western Ghats and 33% of them are trees. Similarly, a study in Uttara Kannada District inidcated that the sacred grove at Kallabbe. has 33 % of endemic trees, while in the adjacent secondary forests, endemism is only 15%. *Myristica malabarica, Northopegia beddomei, Artocarpus hirsuta* are rare and threatened species while *Aporosa bourdillonii* is a vulnerable species. These species were sampled from some of the sacred groves in Kerala. Other threatened species such as *Pterospermum reticulatum* and *Cleome barmannii* are found in a few sacred groves. It is also reported that the climber *Kunstleria keralensis* found only in sacred groves and not recorded from any other area.

Sacred groves, like any other natural forest ecosystems, harbour a large number of non-flowering plants. For example, a study in Kerala showed that average density of soil fungi in sacred groves is 3.28.666 individuals per gram of soil. It is also recorded that following 25 fungal species: Abisidia *corymbifera, Aspergillus ornatus, A.fumigatus, A.niger, A. japonicus, A..nidulans, A. restricus, A.flavus, Chaetomium datum, Circinella simplex, C. lunata, Curvularia lunata, Humicola fusco-atra, Poecilmyces varioti, Penicillium nigricans, P.luteum, P.lividum, P.achraceum, P.chrysogenum, P. citrinum, P. purpurogenum, P.lilacinum, P.urticae, Phoma medicaginis* and *Tarula herbarium*. However, sacred groves are yet to be studied for the species diversity and distribution pattern of other groups of non-flowering plants.

Sacred groves often serve as the last refuge for many wild animals. The presence in small numbers of the endangered lion-tailed macaque in and around Katlekan sacred grove in Siddapur Taluk, Karnataka is reported. Nilgiri langur, a threatened species can be seen in Thavadisserikavu, in Kerala. It is also reported the fact that in the sacred groves of North Kerala, hundreds of white tortoises are protected and nurtured by the local people and worshippers. About 9 species of frogs were also reported from the sacred groves. One study also available to indicate that more than half of the about 400 species of birds recorded from Kerala have been cited in the sacred groves of State. The white-bellied sea eagle (*Heliocetus leucogaster)* is a rare bird and is considered divine by the fisher folk. This bird has been spotted in some of the sacred groves of Kerala. *In* Uttara Kannada district, Karnataka, 107 species of birds were recorded in just two days sampling efforts in 54 sacred groves with total area of about 7.5 ha. Of these 107 species, 33 were typical forest species, one is endemic to the Western Ghats, eight were migratory and the rest were found in the general landscape.

Being the landscape unit in a rural landscape, the sacred grove performs several ecological functions, which directly or indirectly can help in the maintenance of ecosystem health of all interacting landscape units. Sacred groves with their complex array of interaction may influence the flora and fauna of the region as well as microclimate of that locality. It is also reported that the soils of sacred groves show high porosity and low bulk density compared to the soils of nearby areas. The thick litter cover and channels created by soil macro-fauna together enhance the water retention, root system development, gaseous exchange, and heat conductance. The role played by sacred groves as micro-watershed in local areas have been recognised by many workers. There is report dates back to as early as 1880s to highlight the fact that sacred groves of Uttara Kannada district in Karnataka favour the existence of springs and perennial streams and thus provide moisture for the nearby spice gardens. In Maharashtra, many major sacred groves are located in the catchment near the origins of rivers. For example, Bhimashankar in Pune district harbour a large grove of over 700 ha at the origin of Bhima, a major tributary of the river Krishna. The ecosystem services of sacred groves through watershed functions in Tamil Nadu is also reported. It may be pointed out here that most of the sacred groves in Kerala are associated with freshwater ecosystem and these water bodies to certain extent meet the water needs of the local communities. People residing in the settlements located near Nagoni sacred forest in Himachal Pradesh believe that the sacred forest being located on steep and rugged slope towards ridges regulates flow of water and sediment to the settlements and agricultural land down slope.

Linkages between the sacred groves and agro-ecosystems in the rural landscapes of Kerala are explained as follows: 'sacred grove is the abode of various organisms whose food chain is connected through a prey-predator interaction. The birds and bats find their natural nesting places in the sacred groves. They, in addition to their scavenger role check the insect and pest population. The bird droppings rich in phosphorus replenish the phosphorus deficient soil of the region. Snakes and mangoose find their home in sacred groves. The snake controls the rodent population, which if left unchecked will destroy the crops of the locality. The snake population is kept under check by the mangoose. Insect fauna, particularly the bees make their hives in sacred groves and facilitate the cross-pollination of many plant species of the locality'. In the rural landscape, sacred groves also act as refugia that help to reduce the chances of extermination of resource population. It is reported that reported that in the village Mangaon, Maharashtra, barking deer are not hunted in the Janni sacred grove of 10 ha; but hunted outside. It is also reported that local villagers have much better chances of hunting barking deer compared to neighbouring village where no such refugium exists.

Many workers have appreciated the role played by sacred groves as the gene-pool gardens for in-situ conservation of genetic resources. From sacred groves of Kerala as many as 63 species, which are wild relatives of cultivars have been identified. Sacred groves can also be considered as gene-banks of several economically important plants.

Threats to sacred grove

From the foregoing description and analysis of sacred groves in terms of their ecological dimensions it is evident that the preservation of these unique landscape units is of key importance for maintaining the biodiversity as well as comprehensive ecosystem health of the given landscape. However, due to changing socio-economic conditions and land-use systems, many sacred groves are now threatened and altered both in terms of size, vegetation structure and species composition. It may be mentioned that in 1920s about 15,000 sacred groves in Travancore and Cochin regions, Kerala have been reported. On the other hand, recent estimation indicated the presence of only 2000 well preserved sacred groves in the entire State. Similarly, another study showed that out of 361 sacred groves studied in Kerala a vast majority of them remain fragmented (< 0.5 ha). In addition, the dominance of light demanding species in population by replacing the species characteristic to the lowland evergreen forest as a consequence disturbance in several sacred groves is also reported. Some of the specific causes for the depletion of sacred groves in India in general and in Kerala in particular are listed below:

Weakening of faiths, beliefs and taboos relating to the sacred groves

Collection and removal of biomass from sacred groves

Exclusion of local people from the forests and thus their pressure on sacred groves for natural resources

Cattle grazing, trespassing, collection of green manure and fuel-wood due to the absence of physical and social barriers between sacred groves and other landscape units

Mining of china clay and laterite bricks from sacred groves

The break-up of old joint families into nuclear families and consequent lack of man-power to manage family sacred groves

Increasing demand for land resulting in the reduction in size and partial clearing of the sacred groves. This is done after observing necessary rituals propitiating the God and by installing the idols in tiny enclosures in the places where the entangled groves once present. There are instances of complete clearing of the sacred groves by transferring the deity to a new place of a temple after conducting special rituals

Repeated and frequent disturbances even by natural means which can adversely affect the regeneration of species characteristic to mature forests and thus promote the colonisation of light demanding species. This is possible when the sacred groves are fragmented and smaller in size

Invasion of exotic weeds such as *Chromolaena odorata*, *Mikania micrantha*, *Lantana camara* etc., and consequent arrested succession and further degradation of sacred grove forests

Government programmes such as construction of roads through the sacred groves, which lead to fragmentation of forests and adversely affect the traditional cultures and practices responsible for the conservation of sacred groves on local peoples' perceptions

Regardless of whether the responsibility of managing the sacred grove is under one or few families or is fully assigned to a statutory agency for temple and sacred grove management, it has been a fact that many stakeholders have interest and role to play for ensuring the effective management of such systems. Discussion with the stakeholder groups in some well managed sacred groves indicated that better management of the groves can offer them direct monetary or material benefits even without the extraction of biomass from the groves. Several stakeholder groups such as sacred grove managers, priests, local shop owners mentioned that they are getting benefits because of their involvement with the sacred groves in one way or the other. The economic and material benefits are coming through the tourists, devotees and visitors. Discussion with the stakeholders also highlighted the fact that self-imposed complete ban on the removal of biomass and full protection to the grove by social or physical fence would certainly help in revitalisation of ecosystem and its importance in the locality. It was also observed that the contributions of many stakeholders for the management of a given sacred grove are poor. For example either negative or neutral attitude of local youth clubs, schools, Forest Department. Municipality and Panchayaths towards the conservation and management of several sacred groves was noticed. Organisation of awareness campaign on the functional role and importance of sacred groves would help to trigger the interest among stakeholders to participate and jointly chalk out plans to manage and conserve the existing system in the light of any possible threats in future. As already mentioned many of the sacred groves are under the verge of degradation. Rehabilitation of such sacred groves using ecologically and socio-culturally accepted plant species and their protection and management by ensuring the support of the local people through economic incentives need to be considered. There is also a suggestion to promote eco-pilgrimage to the sacred groves having high cultural values. This can improve the income of the grove through the offering of devotees and the grove maintained properly. Thus eco-pilgrimage should get priority over eco-tourism. It may be pointed out that each sacred grove in general is different from the other in terms of ecological, socio-cultural, economic and political dimensions. Thus while certain strategies may be common for the conservation and management of sacred groves, there may be some critical and location-specific strategies which need to be considered when a given sacred grove is to be effectively managed. This necessitates the preparation of database on individual sacred grove covering various aspects such as area under the grove, climate and soil, associated plants and animals, ecological structure, function and dynamics, cultural and religious importance, past and present management aspects etc. Such data base will be of great use for developing and implementing site-specific conservation/restoration strategies by the co-operation of local village-level traditional institutions and state, national and international organisations.

U.M. Chandrashekara
KFRI Sub Centre, Nilambur

CD - Server in KFRI Library

CD - Server, Axis Storpoint, has been installed in the Library with hard disk capacity of 80 GB. About 100 CDs can be mirrored. Presently, about 20 CDs have been loaded which include databases and other publications brought out in CD. The server is connected to the LAN in the Institute for the scientists to make use of any CD stored in the CD-server. Multiple access to the same CD is also possible.

Repeated natural disturbance and tree regeneration in a tropical forest

Gap, an opening in the forest canopy, formed by natural cause, plays a vital role in forest dynamics. When a gap forms, it drives a forest growth cycle consisting of three arbitrary but convenient phases: the gap phase, the building phase and the mature phase (Watt 1947). The gap phase represents the regeneration stage, comprising suppressed or newly colonising seedlings and saplings; the growth of these juvenile trees leads to the building phase constituted by their pole stage. The continual growth of these poles leads to the mature phase in which the canopy openings repeat the cycle. Thus, at any given stage in the forest dynamics, mosaics of vegetation patches of different sizes and ages can be seen (Oldeman 1978). The importance of gap dynamics in the regeneration of many canopy species (Aiyar, 1932; Chandrashekara and Ramakrishnan, 1991), maintenance of the community structure in a forest (Richards 1952) and high species diversity in tropical forests (Denslow 1980) have been repeatedly emphasised.

It may be noted here that in all the above studies, it was considered that the forests follow the pattern of cyclic development and steady state. However, one might also expect that new gap formation adjacent to old gaps or natural disturbance within the old gaps slow down the process of gap closure. The repeated natural disturbances, depending on their severity and size of the disturbed area can affect the regeneration and establishment of trees. In this context, following hypotheses can be made

A. the repeated natural disturbance adversely affects the regeneration and establishment of shade-tolerant species in a forest,
B. due to repeated natural disturbance the vegetation structure changes drastically favouring the regeneration of light demanding species, and
C. there is relation between the gap size and the stand density of light- demanding tree species.

In this article, results of a study conducted to test the above mentioned hypotheses are given. The study was conducted in a sacred grove located at Iringole (hereafter, Iringole Kavu) ($10^{0}10'$North latitude and $76^{0}30'$ East longitude) in Ernakulam District of Kerala State. The total area of the sacred grove is about 11 ha of which the forest surrounding the temple covers an area of about 10.2 ha and it represents the Southern Tropical West-coast Evergreen type. *Hopea ponga* (Dennst.) Mabber, and *Artocarpus hirsutus* Lamk. are the dominant species in all the three stages namely mature trees, saplings and seedlings. Here natural canopy gaps formed during the year 1992-93 were due to branch fall.

Table 1. Contribution (in percentages; Mean ± S.E.) of seedlings and saplings of primary, late secondary and early secondary tree categories in different types of gaps in Iringole Kavu, Kerala. Values in parentheses are for saplings. N=20 gaps for each gap type.

Gap types		Tree categories*		
		Primary	Late secondary	Early secondary
		Percentage contribution to the stem density		
Branch fall	Non-reopened	79.6± 1.5 (81.8± 3.5)	17.2 ± 1.1 (15.8 ± 3.0)	3.3± 1.0 (2.5± 1.4)
	Reopened	67.5 ± 2.6 (67.0± 3.8)	15.5 ± 1.5 (20.0± 2.3)	17.0± 1.8 (13.0± 2.3)
Standing dead trees	Non-reopened	50.0 ± 2.8 (52.0± 3.0)	32.0± 2.0 (35.0±2.5)	18.0± 2.1 (13.0± 2.5)
	Reopened	20.8 ± 0.9 (35.5± 1.6)	38.0 ± 1.9 (53.0 ± 1.6)	41.3± 1.9 (11.2± 1.6)
Crown fall	Non-reopened	35.0 ± 3.3 (34.3±2.7)	47.0 ± 1.5 (49.0± 2.8)	18.0 ± 3.1 (16.8± 3.2)
	Reopened	25.5 ± 1.5 (31.0± 2.3)	37.5 ± 1.5 (39.0± 1.4)	37.0± 1.8 (30.0± 1.4)
Tree fall	Non-reopened	47.4 ± 0.9 (60.7± 1.9)	28.7 ± 1.4 (30.3 ± 1.5)	24.0± 1.3 (9.1± 0.7)
	Reopened	28.0 ± 1.1(34.5± 1.6)	53.0± 1.4 (38.3± 1.7)	19.0 ± 1.6 (27.3± 1.5)

*, Primary species: species whose seedlings establish in closed canopy area but need small gaps to grow up. Late Secondary species: species whose seedlings establish in small canopy area but need small to medium gaps to grow up. Early secondary species; species whose seedlings need larger canopy gaps for both establishment and growth.

crown fall, standing dead trees and tree fall; gaps due to standing dead trees were more in number followed by the tree fall gaps. Out of the 707 gaps formed in 10.2 ha forest during the year 1992-1993, 167 were disturbed for the second time during the year 1995-1996. This second time disturbance in the gaps was either due to the death or severe injury to one or more canopy trees surrounding the gap or due to the fall of a large branch from the tree adjacent to the gap. The survey conducted in September-October 1997 showed that a very large fraction of the land area (22.25% of the 10.2 ha forest) was affected by natural perturbation.

In the second time disturbed areas, no significant correlation between seedling/sapling density and gap size was recorded. Primary tree species did not show the correlation between its population size and the gap size difference because these species largely depend upon the seed source from the surrounding relatively undisturbed forest. However, the absence of any correlation between gap size and seedling/sapling density of late and early secondary tree category may be an indication of the existence of a gradient of regeneration behaviour among these species in terms of their population dynamics and gap-size requirement. Thus further studies are needed to find out at what scale of regeneration behaviour each species in the Western Ghats stands.

Comparison of different types of canopy gaps for the contribution of a given tree category to the total density of seedling and sapling population in the gap area has provided some interesting results. For instance, in the branch fall gaps, the contribution of primary species to the seedling/sapling density was significantly higher than that by late and early secondary species (Table 1). Reopening of the branch fall gaps did not alter much the proportion of seedlings and saplings of three tree categories. Thus it is clear that branch fall gaps, either one time or repeated, favour the regeneration of primary tree species due to the minor difference in the environmental conditions between the gap and the forest

Table 2. Density (individuals 100 m^{-2}; Mean ± S.E.) of seedlings and saplings of primary, late secondary and early secondary tree categories in different types of gaps in Iringole Kavu, Kerala. Values in parentheses are for saplings. Mean ± S.E., and range of sizes of different types of gaps are also given. N=20 gaps for each gap type.

Gap type	Gap size (m^2) Mean ± S.E. and gap size range	Density (individuals 100 m^{-2})			
		Tree categories			All species
		Primary	Late secondary	Early secondary	
Branch fall					
Non-reopened	9.6 ± 0.6	448.5 ± 108.6	102.3± 46.5	21.0± 2.7x	571.3± 150.0
	5.3- 12.5	(90.1± 25.4)	(20.9± 19.6)	(4.1± 11.0)	(115.0± 40.9)
Reopened	13.7 ± 0.9	438.5 ± 90.4	105.4 ± 57.6	122.7±74.3	666.3 ±157.6
	8.0-24.3	104.2± 30.4	(35.4+_21.5)	(24.5± 21.2)	(162.5± 52.3)
Standing dead trees					
Non- reopened	40.2+ 4.6	497.6 ± 28.5	341.1± 32.5	206.5±34.1	1044.8± 66.2
	12.0- 96.3	(132.0± 7.5)	(93.1± 9.0)	(36.9± 7.9)	(261.9± 14.6)
Reopened	68.9±4.7	297.3 ±11.6	550.0 ± 30.7	600.6±34.1	1447.5 ±37.4
	26.8-100.3	(53.0±_4.0)	(79.0 ± 5.6)	(17.6± 2.7)	(149.5± 9.5)
Crown fall					
Non- reopened	36.4± 7.3	156.6 ± 13.4.	235.6 ± 27.8	107.0±26.8	498.8 ± 57.3
	(6.4 - 92.8)	(49.8± 8.6)	(72.9± 10.4)	(35.9±10.0)	(65.9± 26.5)
Reopened	55.9± 8.4	207.5 ± 25.2	305.3 ± 42.4	296.5±39.6	808.8 ± 96.0
	(16 - 170.1)	(46.0± 2.8)	(63.1±5.7)	(49.5± 5.7)	(158.4± 11.4)
Tree fall					
Non- reopened	60.5± 7.7	644.4 ± 30.3	388.7 ± 24.5	329.9±25.9	1362.5 ±61.4
	(27 - 140.6)	(64.1± 4.5)	(33.3 ± 3.0)	(10.4± 1.3)	(107.6± 7.9)
Reopened	125.2± 8.8	286.6± 17.3	536.1± 24.5	211.6±29.0	1036.3 ±63.9
	36.8- 206.8	(46.6± 10.8)	(51.3± 10.2)	(51.9±15.5)	(146.4± 34.3)

*, Primary species: species whose seedlings establish in closed canopy area but need small gaps to grow up. Late Secondary species: species whose seedlings establish in small canopy area but need small to medium gaps to grow up. Early secondary species; species whose seedlings need larger canopy gaps for both establishment and growth.

understorey. Similar observation was also made in gaps created by standing dead trees. However, the study also indicated that when the standing dead tree gaps were reopened the late secondary species contributed more to the seedling and sapling density as compared to the primary species. Thus, the reopening of standing dead tree gaps leads to the dominance of secondary tree species. Canopy gaps created by crown fall, irrespective of whether they are reopened or not, appear to provide the resource base suitable for late secondary species than for primary species.

Reopening of the crown fall gaps also created unfavourable conditions to primary species as recorded by the lowest contribution by this category of trees to the stem density of seedlings and saplings (Table 1).

In the Iringole Kavu, average size of the tree fall gaps was much greater than that of the crown fall gaps (Table 2). However, it is interesting to note the contribution of primary tree species to the stand density was relatively more in tree fall gaps than in crown fall gaps. This could be attributed to the fact that, more than the gap size, its shape determines the microenvironmental conditions. The ratio between the length and width of the gaps created by crown fall is generally greater than that of the tree fall gaps, because the former is generally circular in shape while the latter is dumb-bell shaped. The insolation is expected to be more uniform and intense in crown fall gaps and thus provide favourable niche to secondary species than to primary species. However, unlike in areas experienced one time tree fall gap, the microenvironment in the area experienced another gap formation after a tree fall seemed to be altered in such a way that such reopened tree fall gaps favoured the recruitment of late secondary species than the primary species.

The present study indicates that canopies, which were opened ones by natural causes, reopened by crown fall and tree fall and they covered large area. Further repeated disturbance in these gaps in future can be expected because the environment next to disturbed area is severe than elsewhere, and so new tree deaths are expected to occur primarily among the border trees. It may also be concluded that due to such repeated natural disturbance, the canopy gap regeneration is likely to be affected. Thus there is clear possibility of change in vegetation structure and composition of the forest, favouring recruitment and establishment of the late and early secondary species.

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U. M. Chandrashekara
KFRI Sub Centre
Nilambur

Malabar Spiny Dormouse (*Platacanthomys lasiurus*)

Class : *Mammalia* Order : *Rodentia* Sub-Order : *Sciurognahthi* Family : *Muridae* SubFamily : *Platacanthomynae* Genus : *Platacanthomys* Species : *lasiurus*

In the process of transformation of natural habitat into man made landscapes by anthropogenic influences, endemic organisms become depleted causing severe ecological imbalance. Malabar Spiny Dormouse (*Platacanthomys lasiurus* Blyth 1859) is one of the endemic mammals found in the Western Ghats of Kerala. The animal is distributed from south of Shimoga in Karnataka State to the southern tip of Western Ghats. It is one of the 12 endemic mammals found in the Western Ghats. Comparatively long pointed ears, dark coloured dorsal spines and tuft of hair present at the tip of the tail gives Malabar Spiny Dormouse a characteristic appearance, by which it can be easily recognised. The name 'Dormouse' is a misnomer from French word *Dormir*, to sleep. The animal is nocturnal like almost all the rodent species and arboreal in habit. This is about the size of a common rat and lives in tree holes in colonies and locally called as "Muttely, Mullanely or Mullely".

Dormice are distributed in Africa, Europe and Asia except in Malay region and Islands. Unlike the European and African species, *Muscrdinus avellanarius* (Hazel Dormouse), *Glis glis* (Fat Dormouse), *Grafiurus marinus* (African Dormouse), and *Eliomys ouercinus* (African Pigmy Dormouse), which come under the squirrel Family *Gliridae* the Malabar Spiny Dormouse comes under the rat Family *Muridae*. Malabar Spiny Dormouse shows many similarities to the European and African Dormouse species in nocturnal activity and arboreal habit. No detailed study has been conducted on the Malabar Spiny Dormouse except for some occurrence reports, which are given below.

Ellerman (1961) have reported the occurrence of this species from Bonacord area in Trivandrum District and Rajagopalan (1968) reported the species from Shimoga. After a laps of around 45 years Jayson and Christopher (1995) reported the species from Peppata Wild Life Sanctuary, Shankar (1996) located the species at Upper Bhavani Hills of Nilgiri District, Tamil Nadu and Meena (2001) had sited the species at Mudumalai Wild Life Sanctuary, Tamil Nadu.

Similarly Mudappa (2001) reported the trapping of 20 individuals of Malabar Spiny Dormouse during her studies in Kalakkadu Mundanthurai Tiger Reserve. She found this as the second abundant out of the six species of small mammals trapped at an elevation of 690-1310 m above MSL. She had pointed out the decreasing trend in the population of Malabar Spiny Dormouse when the elevation increased and Shankar (1999) had trapped 12 individuals of Malabar Spiny Dormouse from Upper Bhavani, at an elevation of 1800-2500 m from MSL, where the Malabar Spiny Dormouse was the sixth abundant.

All the previous studies described the Malabar Spiny Dormouse as a species seen in moist deciduous, semi evergreen and evergreen forests and confirm its arboreal habit. Rajagopoalan (1968) identified the species as a pest on pepper in Shimoga District of Karnataka and reported the frequent entry of Malabar Spiny Dormouse in the toddy pots. There were no detailed studies on any other aspects of Malabar Spiny Dormouse, other than a report from Rajagopalan (1968) that a female Malabar Spiny Dormouse survived more than 20 months in captivity.

A detailed study on the ecology and behaviour of Malabar Spiny Dormouse is being carried out in Kerala Forest Research Institute, supported by the Dept. of Science and Technology, Govt. of

India. The objectives of the study are:
a) To determine the population status and distribution of the species in Western Ghats, and
b) To assess the food and feeding behaviour of the evergreen and moist deciduous forests

Limited field surveys on the distribution of Malabar Spiny Dormouse was carried out in 16 forest Ranges, coming under 5 forest Divisions (Nenmara, Parambikulam, Peechi, Chalakudi, Eravikulam and Vazhachal) in which the presence of Malabar Spiny Dormouse was asserted by enquiring to the tribes and forest officers.

Except in the Olakara area of the Peechi Wild Life Sanctuary, in all other areas the presence of Malabar Spiny Dormouse has been recorded. From the statements of the tribals of Sholayar it was clear that the animal is occurring in the lower regions of the Sholayar forest and it is rare or absent in the upper regions. In the estates on the way to Nelliyampathi, nobody has noticed the presence of Malabar Spiny Dormouse. Even though pepper is cultivated in the estates, the workers have not experienced such a pest as reported from Shimoga. From the Thamprankad estate. which lies in the midst of a semi evergreen forest and evergreen forest where coffee and pepper are planted, the estate workers have seen them in the forest as well as in the plantations. In the forest, it was sighted on the tree hollows. Workers of Alexandria estate near Pothumalai have the same opinion. From the Chimmony Wild Life Sanctuary also the species was reported in the semi and evergreen forests. On a visit to Maruthottivellm area, in Chimmony Wildlife Sanctuary a semi evergreen forest, some of the hollows on large trees. which by its characteristic shape seems to be of Spiny Dormouse. In Parambikulam tribes of the Sungam colony reported that Malabar Spiny Dormouse was not seen in the surrounding forest, but a few have claimed that they have seen this in the dry deciduous forest near the Top Slip in Indira Gandhi Wildlife Sanctuary. The tribes of the four settlements of Hill Pulayas and Muthuva communities at Chinnar Wild Life Sanctuary reported that. Malabar Spiny Dormouse were sighted in the semi and evergreen forests, in the early mornings and late evenings.

It is quite revealing that these small creatures with rat legacy and squirrel characters have differential distribution through out the Western Ghats. The distribution and behaviour of the species goes beyond the scope of present analysis. It acts as a pest on pepper in Shimoga. where as it does not reaches into an estate with pepper in the midst of an evergreen forest at an elevation between 600-800m above MSL in central Kerala. It has been believed to be extremely rare or even absent above an elevation of 1100 m. but becomes the sixth abundant among nine species of rodents trapped at an elevation between1800-2400 m. Many veteran tribes in Olakara region of the Peechi Wildlife Sanctuary even do not know such an organism. where as many of the same tribal community at Sholayar trap it and use as a tribal medicine. Detailed studies with live trapping and radio telemetry is necessary to bring out the real status of Malabar Spiny Dormouse in the Western Ghats of Kerala.

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E. A. Jayson and K.M. Jayahari
Division of Wildlife Biology

Human-related constraints in Protected Area management

The most critical area of conflict in the natural resource management are the forest lands in and around which there is a dependent populace. One dimension to be emphasised above others, is the complex resource and social systems and the range and diversity of these linkages. Of particular impact are the links between forestry and the basic needs of forest-dependent communities. Tensions and constraints in conservation are created on access and use of natural resources by forest dependent communities and others wanting the same scarce resources. Those who depend on a particular resource and are unable to partake in the planning or monitoring of its uses get marginalised. A conflict also surfaces when local traditional practices are no longer viewed legitimate or consistent with the National policies, or when entities external to a community are able to pursue their interest, while ignoring the needs and imperatives of local people (Anderson et.al., 1996).

Conflicts occur both at the micro or macro levels, that is, among and/or between local communities and others like government, private organization etc. These types of conflicts have both long-term and short-term adverse impacts in management. These can vary from a provisional reduction in the competence of resource management regimes, to a complete collapse of initiatives of the government and others, and in extreme cases conflicts over natural resource management can escalate into physical violence.

Types of [illegible]

Human-related constraints in conservation often lead to conflictual situations. In the study area, conflicts identified are basically i. *for land* (change in boundaries, wanting social security); ii. *for produce / resource*, either for self-consumption or for sale (either authrorised - eg. cheenikka, or unautho-rised -eg. rose wood, deer meat); and iii. *for political dominance*, exhibiting extremist behaviour / attitude. These are often found on outer boundaries of the PA, along inner boun-daries, between social groups, and also between Forest Department and local communities. There are such wide range of conflicts and disputes adversely influencing the PA management.

The genesis of the human-related [illegible]

All forestry interventions deal with a historical interface between people and the landscape, which is often considered less significant in any management plan. Most of the development programmes, project appraisals and documents focus on the current scenario or situation. An understanding of the historical background can help compile a picture of people in their landscape, and mutual influences between them. The Forest Laws ensured that the forests were kept inaccessible to the people, and people considered the forest to belong to the Forest Department. People saw these as restrictions on their livelihood. It was none of the peoples concern if the forests got degraded or even destroyed. Whatever be the amount of policing done by the Forest Department the people always found a way to enter the forests to meet their livelihood needs. They also left their cattle to graze due to lack of common grazing land or caused fires for several reasons, which further accelerated the process of degradation. To counter this loss of forests the forest officials' book or charge cases for violation of forest laws against the people and very often the poor get punished. This led to a feeling of fear, discontent and hostility on the part of the people towards the PA managers and a general feeling of mistrust developed between the two. Now, in many PAs there exists a strained relationship between the two. Their hostility has been and is being manifested in several ways that poses a constraint in the management of the PA. The resultant scenario was that neither are the peoples needs satisfied nor is the forest protected and conserved. This only aggravates the already strained relationship between the PA managers and the local community.

There are a number of factors that have contributed to the natural resources based conflicts. The causative factors of human-related constraints identified in the PA are discussed below.

Property right are often not well defined or enforced, indeed many frontier areas are *de facto*

open access areas. Conflicts arise over land ownership, allocation of land to people, lack of access roads, and sometimes the land use practiced by them. Undefined tenure issues, leads to exploitation of natural capital (*open access resources*) under no rules. In the case of forests, previously defined under communal ownership, later on reserve and allocated to individuals (as is clear from history) had accelerated encroachments.

Lack of community awareness

Most of the people living next to or inside the forests do not know the provision of the laws as to their rights and responsibilities to forest conservation. When forest are being denotified or put to different use, the community is never consulted yet they are the first ones to immediately feel the impact. Sometimes they even participate in destruction. They also know very little about their rights of access to forests and forest products. They are in most cases denied access to by the Departmental staff even when it is permissible to collect firewood and grass. They, therefore strive to use the forest unauthorisedly without taking sustainability into account.

Population pressures Vs dwindling resources

Estimates show that large number of people live in the areas adjacent to PA and directly depend on the natural capital for their livelihood and survival. Population increase implies that the number of users and uses have grown competing over the available scarce resources. Available research reports show that deforestation is a big threat to the PAs and economic development at large.

Unclear institutional arrangements

Unclear institutional arrangements end up confusing the resource dependent communities. There is a lack of coordination between the various institutions working in a particular area. Absence of a clear delineation of the responsibilities and accountability is severely lacking, i.e., lack of an integrated approach to the management of the same resource.

Policy and legal framework

The policy and legal structure are not in line with the changing demands of various stakeholders for example, experience / research has shown that peoples participation / involvement is vital in sustainable resource management. Yet, most of policy and legal frameworks for many decades have been anti-peoples involvement i.e., in the form of policing attitude of the department staff, resulting in uncontrolled exploitation of the resource by forest adjacent communities whose livelihood depends on the forests.

Forest land allocation

Forest land is being allocated to people who end up putting it to different uses that may have a negative impact on environment. In most cases, the land is developed for agriculture or commercial use that beats the purpose of reserve. Reduced Wildlife and forest habitats fragmentation has exacerbated the human-Wildlife situation. Mechanisms that ensure that local people benefit from forest and Wild life conservation are yet to be developed.

Political interference

Political interventions with the forest also led to irregular forest land allocation with sustainability of the resulting settlements not guaranteed. This is not backed by any impact assessment or legislation resulting in conflict and irregularities in the implementation of laws governing the use of forests.

Market forces

Local communities who cannot afford to compete in a liberalized market, have no alternative but to over-exploit resources. As a result of the 'globalisation' process the local resources are exposed to the international market, which implies competition over limited resources ending up on market.

Human-related constraints in management mainly relate to insufficient attention to

the approach of involving local communities and others who care about the PA in the planning, management and decision making for the area;

the social and economic dependencies of the local communities, (eg. for grazing land, firewood, building material, fodder, medicinal plants, etc.) that conflicts with the objectives with the PAs;

and

the actual commercial threats facing the PAs.

A deeper analysis shows that the conflicts are fuelled by scramble for land in the newly and politically created settlement schemes, political pressure, and unequal distribution of resources. This has affected the land use and investment on land as insecurity ranges, resulting in deliberate destruction of the natural capital. Most of the causes of conflicts are a result of constraints within and between local communities and the State over the resource ownership and access Vs protection.

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V. Anitha, P.K. Muraleedharan and A.S. Binilkumar
Division of Forest Economics

Leaf morphological variations in teak (*Tectona grandis* L.f) clones

Different clones of teak exhibit morphological variations, which can be considered as a manifestation of the variation in their genetic constitution. Interesting leaf morphological variations were observed in different clones of teak established at the Central nursery, Chettikkulam (Chalakkudy Division). The plants were raised by the newly standardized cloning technique for teak at KFRI and were field planted during November, 2001 at the Nursery campus.

It is known that most of the morphological characters such as phyllotaxy, venation, size of the petiole, leaf shape, pigmentation *etc.* are controlled by the genetic constitution of the plant. A close observation was made on the leaf morphological characters of nine-month-old clonal plants (ramets) belonging to fifteen different clones of teak established at the Central nursery. It revealed that there are distinct variations in their leaf morphological characters as shown in the Table.

It is notable that each clone is different at least in one or two characters observed such as leaf shape, tip, petiole length, venation or pigmentation. For example, clone 6 and 10 of Nilambur origin are similar in many characters of leaf except in petiole length (partial obtuse and winged obtuse.

Leaf morphological differences in various clones of Teak (*Tectona grandis* L.f)

Table: Leaf morphological features of different clones of Teak(*Tectona grandis* Lf)

Clone No.	Location	Average leaf size (cm)		Leaf shape	Texture		Leaf tip	Leaf margin	Main lateral veins	Petiole length (cm)	Leaf pigmentation	
		Length	Width		Upper	Lower					Above	Below
1	Nilambur	57	38	Ovate	Smooth	Medium smooth	Acuminate	Wavy + Crenate	Touching leaf margin	Winged obtuse	Light green	Light green
4	Nilambur	56	44	Obovate	Smooth	Medium smooth	Acute	Wavy + Crenate	Not touching to leaf margin	Winged obtuse	Light green	Light green
5	Nilambur	57	34	Oblanceolate	Smooth	Medium smooth	Acute	Wavy	Touching leaf margin	Winged obtuse	Light green	Light green
6	Nilambur	56	40	Elliptical	Smooth	Medium smooth	Acute	Wavy	Not touching to leaf margin	Obtuse + 1.8	Light green	Light green
10	Nilambur	51	33	Elliptical	Smooth	Medium smooth	Acute	Wavy	Not touching to leaf margin	Winged obtuse	Light green	Light green
11	Nilambur	57	38	Rhombate	Smooth	Medium smooth	Acuminate	Wavy	Touching leaf margin	Truncate + 5.2	Light green	Silvery green
13	Nilambur	55	37	Elliptical	Smooth	Very smooth	Acuminate	Wavy	Not touching to leaf margin	Winged obtuse	Light green	Silvery green
24	Nilambur	59	36	Elliptical	Smooth	Very smooth	Acuminate	Wavy	Not touching to leaf margin	Truncate + 4.5	Parrot green	Silvery green
26	Thenmala	55	33	Elliptical	Smooth	Very smooth	Acuminate	Wavy	Not touching to leaf margin	Truncate + 5.0	Light green	Silvery green
27	Thenmala	50	31	Obovate	Smooth	Very smooth	Acuminate	Wavy	Not touching to leaf margin	Truncate + 4.9	Light green	Silvery green
34	Thenmala	49	33	Ovate	Smooth	Very smooth	Acuminate	Wavy + Crenate	Touching leaf margin	Truncate + 2.7	Parrot green	Silvery green
36	Thenmala	49	35	Deltoid or Heart	Smooth	Very smooth	Acute	Wavy	Touching leaf margin	Truncate + 4.0	Light green	Silvery green
44	Thenmala	53	34	Elliptical	Smooth	Very smooth	Acute	Wavy	Not touching to leaf margin	Truncate + 3.1	Parrot green	Silvery green
46	Thenmala	47	31	Obovate	Smooth	Very smooth	Acuminate	Wavy + Crenate	Touching leaf margin	Truncate + 1.9	Light green	Silvery green
47	Thenmala	57	41	Rhombate	Smooth	Very smooth	Acuminate	Wavy	Touching leaf margin	Truncate + 6.3	Light green	Silvery green

respectively) whereas clone 27 and 46 of Thenmala origin having leaf shape similar in most of the features but differ in their leaf margin (wavy and wavy + crenate, respectively) and venation (lateral vein not touching leaf margin and lateral vein touching the leaf margin, respectively).

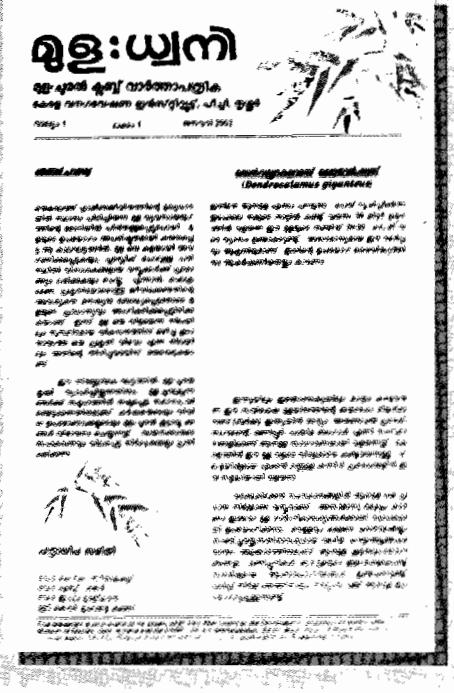
The observations clearly indicate that there exists considerable phenotypic variation between Plus trees of teak which calls for a detailed study. The practices to establish variations within and between clones by advanced techniques such as isozyme and RAPD analyses are relatively expensive. But if we can recognize the definite variations in morphological/phenotypic features between clones it would be a cheaper tool for quick identification of the clones

Rajesh P Gunaga and T. Surendran
Division of Plant Physiology

BAMBOO-CANE CLUB NEWSLETTER

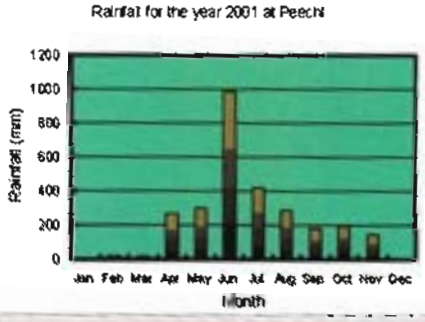
The first Newsletter of the Bamboo-Cane Club "Muladhwani", an outcome of a research project on bamboo and cane supported through the UNDP and the Ministry of Textiles, Government of India was brought out on 31 December 2001.

The Director released the first copy by giving it to Smt. Pushpakumari, Vilangannur, Peechi an organizer of self-help groups in bamboo and cane handicraft. The objective of the Newsletter is to network information, materials and technology among different stakeholders in the bamboo-cane scenario.


മുള:ധ്വനി

Weather data at Peechi during the year 2001

Using an automated weather station (Skye Instruments, UK) hourly data on atmospheric temperature, humidity, wind velocity, rainfall, solar radiation and soil temperature at two depths were monitored for all months of the year 2001. For temperature, humidity, wind speed and solar radiation measurements were made at every 30 seconds and averaged over an hour. Rainfall was measured at he time of raining using a tipping bucket mechanism and hourly total was recorded in the data logger.



During the year 2001, a total of 2562 mm rainfall was recorded at Peechi. Except January and December, all months received rain, maximum being in June amounting to 987.1 mm. 71 days of the year received more than 10 mm rain and 10th April contributed a maximum of 144 mm. Atmospheric temperature showed a minimum of 18.6°C in December and a maximum of 34.6°C in March. Mean monthly averages of temperature varied between 25.1 °C to 28.1 °C. Relative humidity was comparatively low in February and March. The total solar energy received per square meter during the year in this station amounted to 6569 MJ m^{-2}. The month of March received highest solar radiation amounting to 1264 MJ m^{-2}. Wind speed varied between 0 to 5.6 m s^{-1}, maximum being in the months of January and December. Soil temperature in the upper 15 cm of soil varied between 24.3 °C to 31.2 °C while in the lower layer of 30 cm deep soil it was 23.2 °C to 35.4 °C.

Jose Kallarackal and **C.K. Somen**
Plant Physiology Division

Monthly Meteorological Data: Peechi-Vazhani WLS Year= 2001

Day	Wind_speed m/s			Temperature oC			Humidity %		Rain mm		Solar MJ/m2	Sol(15cm) oC			Soil(30cm) oC		
	Min	Avg	Ma	Min	Avg	Max	Min	Av	Max	Total	Total	Min	Avg	Max	Min	Av	Max
Jan	0.0	2.0	5.6	20.6	26.4	33.4	58.2	90.2	100.	0.0	613	26.1	28. 3	1.2	24.9	29.0	35.4
Feb	0.0	0.9	4.6	21.3	27.4	35.6	44.4	93.6	100.0	26.1	566	27.3	29.0	30.7	26.0	29.4	34.8
Mar	0.0	0.8	4.6	21.3	28.0	36.4	44.4	94.3	100.0	26.3	1264	27.3	29.4	30.7	26.0	29.7	34.8
Apr	0.0	0.5	2.7	22.6	28.1	37.2	61.0	97.5	100.0	271.4	559	25.2	28.5	30.7	25.0	28.2	32.2
May	0.0	0.6	2.2	22.1	27.9	34.7	83.5	98.8	100.0	298.8	564	26.4	28.5	30.0	25.5	28.1	30.7
Jun	0.0	0.6	2.3	21.0	25.4	32.9	89.3	99.9	100.0	987.1	359	24.2	26.1	29.0	23.8	25.7	29.2
Jul	0.0	0.6	2.2	21.6	25.1	30.6	97.0	100.0	100.0	423.0	347	23.9	25.5	26.	23.7	25.5	26.8
Sep	0.0	0.5	2.5	20.6	26.2	33.0	92.7	99.7	100.0	180.3	483	24.9	26.3	27.2	23.9	26.1	28.1
Oct	0.0	0.5	2.3	22.1	26.3	33.0	92.9	99.8	100.0	199.2	420	24.4	26.2	27.0	24.3	26.1	27.9
Nov	0.0	0.9	3.8	21.7	26.4	33.9	83.6	99.5	100.0	149.8	459	24.3	26.1	27.1	23.8	25.8	27.8
Dec	0.0	2.2	5.6	18.6	26.0	31.5	76.9	98.4	100.0	0.0	533	24.4	25.6	26.8	23.2	25.5	27.9

Campus News

Distinguished visitors

KFRI, Peechi

Ms. Abigail E. Ley, Fulbright scholar has been attached to the Institute from September 2001 on a nine-month research programme on bamboo.

Mr.M. Satyanarayana, Deputy Inspector General of Forests (Forest Policy), Ministry of Environment & Foresis, Government of India on 14 September 2001.

Mr. Shinji Yoshiura (Dy. Director), Ms. Tomoko Taira and Mr. Shirou Arai (Consultant), Forestry & Natural Environment Depart-ment, Japan International Cooperation Agency (JICA) team on 6-8 November 2001.

Dr. N.J. Kurian, Advisor, Planning Commission, Govt. of India on 19 & 20 November 2001.

Ms. Vickie Poole, ACIAR Country Manager, South East Asia and Dr. Kuhu Chatterjee, Assistant Country Manager on 12 December 2001.

Prof. T.N. Ananthakrishnan, Loyola College, Chennai on 14 December 2001.

Prof. Takashi Okuyama, Department of Biomaterial Physics, School of Agriculture Science, Nagoya University, Japan visited KFRI as INSA Visiting Scientist from 21 December 2001 to 2 January 2002.

Dr. Masuda Misa, Associate Professor, Institute of Agriculture and Forestry,University of Tsukuba, Tsukuba, Ibaraki 305-8572. Japan in February 2002.

Sub centre & Teak museum, Nilambur

A team of 14 Indonesian forest officials visited Nilambur Subcentre and Teak Museum to acquaint with the activities undertaken by KFRI on teak on 22 November 2001.

Mr. Peter Brannoy, World Bank Supervision Mission, Kerala Forestry Project on 14 December 2001.

Mr. P. V. Jayakrishnan, Secretary, Ministry of Environment and Forests, Government of India on 15 December 2001.

Mr. Jukka Hoikkoro, Finland on 25 December 2001.

Mr. John Bates, Convey Island, England on 29 December 2001.

Installation of new facilities

Two ISDN connections have been provided in the Institute for providing Internet browsing facility for the LAN users. With this facility all the LAN users have direct access to the Internet. A high quality colour printer was also installed in the LAN System.

Coming soon

Handbooks

Commercial bamboos of Kerala
Commercial canes of Kerala
Nursery and Silvicultural techniques of bamboo
Nursery and Silvicultural techniques of rattan
Oil curing technology for value-added rattan (cane) products
Manual on Preservation of Bamboo
Protection of rattan against fungal staining and bio-deterioration.
Micro-propagation of bamboo and cane

Directory

Directory of Bamboo and Cane in Kerala

Workshop Proceedings

Proceedings of the National Workshop on Policy And Legal Issues In Cultivation And Utilization Of Bamboo, Rattan And Forest Trees In Private And Community Lands. 7-9 August, 2001. Kerala Forest Research Institute, Peechi.

International conference

Quality Timber Products of Teak from Sustainable Forest Management

Peechi, India, 2-5 December 2003

Plantation investment
Productivity
Economic returns
Genetics
Silviculture
Clonal teak
Wood farming
Wood quality
Further processing
Life cycle analysis (LCA)
Residue utilisation
Value added products
Recycling
Certification
"Green" products
Trade
Policy
Technology transfer
Joint venture
Networking

Criteria & Indicators
Tree health
Carbon balancing
Soil degradation
Site management
Biodiversity
Poverty alleviation
Employment
Community participation

organised by
Kerala Forest Research Institute (KFRI)
in collaboration with the
International Union of Forest Research Organizations
(IUFRO 5.06.02: Timber Quality of Teak from Plantations)
under the auspices of
International Tropical Timber Organization (ITTO)
and
Ministry of Environment and Forests, Government of India

http://kfri.org/html/k0500fm.htm
http://iufro.boku.ac.at/iufro/iufronet/d5/hp50602.htm

KFRI ITTO IUFRO

CONTEXT AND RATIONALE

Teak (*Tectona grandis* L.f.) is an undisputed leader of high quality tropical timbers. It is taken as a standard for comparative evaluation of the utilisation potential of other tropical hardwoods. Of late, teak has attracted the investor's attention on sustainable production of quality timber from both public and private sectors in the massive tropical plantation programmes. While the global teak plantations are estimated to exceed 3 million ha, 94% is located in tropical Asia with a major share in India (44%) and Indonesia (31%). Involvement of farmers and small land holders in the model of industrial wood supply from shorter rotation teak of 20-30 years is being tested in many countries, viz. Brazil, Costa Rica, Ghana, India, Myanmar, Thailand and Malaysia. Majority of hill farmers in Northern Laos prefer teak to fruit trees and other crops because of better market potential, cash income and wood for construction. Teak wood production is stated as an attractive proposition for the Venezuelan flood-plains. With an annual national target of 50,000 ha, teak is planted extensively in India and about half of the forest plantation area in Kerala State is under teak. Although three regional workshops were held on teak in the Asia Pacific Region during 1995-2000, the most crucial pending issues of global and local concern include:

- Does teak maintain superiority in timber quality in high input short rotation plantations with silviculturally and genetically modified trees?
- What is the potential of teak for sustainable forest management (SFM) to meet the environmental and economic criteria in the tropics?
- What is the role of teak plantations in the livelihood of rural communities and poverty alleviation in promoting the tropical timber trade with value-added products?
- Is teak amenable, under socially acceptable conditions, to advanced technology of production and further processing for better marketability and to certification / "green" labelling?

It is in this context that the international conference is planned with a theme - **Quality Timber Products of Teak from Sustainable Forest Management (SFM)** - to address the various issues involved in the Tree-to-Product wood chain. The Conference is targeted to both public and private sectors concerned with timber production including the small land holders/farmers, processing enterprises, traders, State Forest Departments, Forest Development Corporations, Policy Makers and scientists.

OBJECTIVES

To provide an international forum for critical appraisal of the role of teak plantations in tropical timber development programmes and market situation, including the recent research findings, in environmentally acceptable and socially desirable conditions.

To identify the constraints and strategic solutions for sustainable utilisation of plantation grown teak

ORGANISERS

Under the auspices of International Tropical Timber Organization (ITTO) and the Ministry of Environment and Forests, Government of India, the Kerala Forest Research Institute (KFRI) will hold the Conference, in collaboration with International Union of Forest Research Organizations (IUFRO 5.06.02 Working Group - Timber Quality from Teak Plantations).

VENUE AND DATE

The Conference venue is Peechi - located in central Kerala in the midst of tropical forests with a scenic beauty, which attracts a large number of tourists throughout the year. The nearest city is Thrissur (18 km), the cultural capital of Kerala which is well connected by road and train. The new Cochin (Kochi) International Airport at Nedumbassery is only 60 km away while another accessible domestic airport is at Coimbatore, Tamil Nadu (100 km). More information about Kerala can be accessed through the websites:

www.keralatourism.com
www.keralagreenery.org
www.kerelam.com

Kerala is a major tourist destination in India. The Post-Conference tour and accompanying persons' visits to places of tourist interest will be arranged if sufficiently large number of participants indicate their interest.

The Conference will be held during 2-5 December 2003. Weather in Kerala during December is very pleasant with an average temperature of 25-27 °C.

SCIENTIFIC PROGRAMME

Language of the Conference deliberations will be English. In addition to Key Note Address, the scientific programme includes several plenary and sub-plenary sessions to address the following core issues:

- Review of current situation of key producer countries (country reports)
- Teak timber quality from high input plantations including trees outside forests (ToF)
- Production and processing technology vs environmental and social acceptability
- Economics and policy issues of teak plantation ventures
- Teak wood industry, tropical timber trade and policy

Researchers are encouraged to submit voluntary papers which will be presented in the form of posters in order to provide opportunity for effective scientific interactions without time limitation. If the voluntary paper is of high standard addressing the theme of the Conference, it will be permitted as an oral presentation. However, both oral papers and posters will have equal status in the proceedings to be published.

During the Conference, many satellite meetings are expected to take place to cater to the needs of different stakeholders and teak networking organizations.

In-conference field excursion to Nilambur is planned to get acquainted with the prevailing plantation management practices, industrial processing and trade, including the world's oldest teak plantation raised in 1842. The other major attraction is a visit to teak museum - first of its kind established by KFRI depicting history of teak cultivation, management and utilisation.

IMPORTANT DEADLINES:

Receipt of pre-registration form
31 December 2002
Receipt of Abstract of voluntary paper/poster:
31 January 2003
Receipt of full paper :
30 April 2003
Second Announcement/registration pack:
10 June 2003

CONTACT ADDRESS:

Send all your communications to:
Dr. K. M. Bhat
Convener, International Teak Conference 2003
Kerala Forest Research Institute
Peechi 680 653, Thrissur Dist. Kerala State, India
Tel: +91-487-699037, 699061-64, 699365
Fax: +91-487-699249
Email: kmbhat@kfri.org URL: www.kfri.org

Conference Websites:
http://kfri.org/html/k0500frm.htm
http://iufro.boku.ac.at/iufro/iufronet/d5/hp50602.htm

Conference Advisory Committee (CAC)

Manoel Sobral Filho
Executive Director, International Tropical Timber Organization, Yokohama, Japan
M. K. Sharma, IFS
Director General, Ministry of Environment and Forests (Govt. of India), New Delhi, India
P. K. Surendranathan Asari, IFS
Principal Chief Conservator of Forests, Kerala Forest Department, Trivandrum, India
K. K. Srivasthava, IFS
Managing Director, Kerala Wood Industries Ltd. Nilambur, Kerala, India
J. K. Sharma
Director, Kerala Forest Research Institute, Peechi, Kerala, India

Conference Organising Committee (COC)

Ma Hwan Ok
Projects Manager, Forestry Industry, ITTO, Japan
Takashi Okuyama
Coordinator IUFRO 5.06.02, Nagoya, Japan
K. M. Bhat
Convener, KFRI, India, Deputy Coordinator IUFRO Division 5

Pre-Registration Form

International Conference

QUALITY TIMBER PRODUCTS OF TEAK FROM SUSTAINABLE FOREST MANAGEMENT

Peechi, India, 2-5 December 2003

Title.....Surname .....

First Name.....

Organization.....

Postal Address.....

.....

City.....

Country.....

Tel.....

Fax.....

Email.....

Tick the appropriate boxes:

- ☐ I am interested to attend the Conference: Single / With spouse/ companion.
- ☐ I wish to receive the Second Announcement/Registration pack in June 2003 (for detailed information on Scientific Programme, Accommodation, Accompanying persons and Post Conference Tour, etc.).
- ☐ I wish to submit a Poster/Paper Abstract.
- ☐ I wish to receive a copy of Guidelines for preparing papers/ posters by email.
- ☐ I wish to participate in Post-Conference Tour : Number of person(s).....
- ☐ I am interested in accompanying persons programme.
- ☐ I wish to seek financial support for my participation (Limited funds will be available for the participants from developing countries who will make significant contribution towards the success of the Conference).

☐ Special / dietary requirements: .....

Submit duly completed Pre-Registration Form by **31 December 2002** either online or by email/snail mail/fax

5th Meeting of IUFRO Working Party S7.03.04

DISEASES AND INSECTS IN FOREST NURSERIES

at

Kerala Forest Research Institute, Peechi, Kerala, India

May 6-8, 2003

The Fifth Meeting of the Working Party S7.03.04 " Diseases and Insects in Forest Nurseies" will be held during May 6-8, 2003 at the Kerala Forest Research Institute. The main objective of the Working Party Meeting is to review the progress made in combating diseases and pests in forest nurseries since the last WP meeting held at Suonenjoki Research Station, Finland during July 25-28, 1999.

The Registration Fee for the WP Meeting is USD 200 (Rs. 2000 for delegates from India) which will cover the cost of Registration materials, tea/coffee, lunches, banquet, transportation during the meeting, Air port transfers, and the Proceedings of the Meeting.

Post- meeting field visits are being planned to various forest nurseries, plantations and natural forests. The field trips will emphasize on production practices as well as insect and disease problems and their control.

IMPORTANT DATES :
Last date for Registration: March 31, 2003
Last date for submission of Abstract : April 15, 2003

For further details contact:

Dr. C. Mohanan
Convener, IUFRO WP Meeting
Kerala Forest Research Institute
Peechi 680 653 Thrissur,
Kerala, INDIA
E-mail: mohanan@kfri.org
Fax: +91 487 2699249

World Computer Literacy Day

was observed in KFRI with a talk entitled, Linux-Potentials and Possibilities, by Professor C.K. Raju, KILA, Thrissur on 3 December 2001. The Botany Division has been shifted to new location during December 2001. Since the Silviculture Division building needs major repairs, the Division moved to an area earlier occupied by the Genetics Division. The Teak Museum, after renovation and modification, was reopened to the public on 5 October 2001.

Research activities

Varma, R.V. 2001. Termite control in clonally propagated root trainer raised planting stock. KFRI Research Report No. 215. p.41.

Information gathered from selected clonal plantations of eucalypts showed that the intensity of termite attack varied from 0-29%. Root trainer raised Acacias and teak was also found attacked by termits. Damage to transplanted teak seedlings by termites is reported for the first time. A comparison of the various potting media indicated that clones/seedlings raised in vermiculite is the least susceptible to termite attack.

Among the various treatment methods evaluated under field conditions, dipping the root trainer contained clonal planting stock in a 0.5% a.e. solution of chlorpyriphos before planting out gave adequate protection against termites during the establishment phase. This treatment methodology was filed tested at Kottappara in Malayattur Forest Division and also in 10 ha eucalypts clonal plantation raised by Kerala Forest Development Corporation at Mannamangalam in Trichur Forest Division and proved effective. Though the treatment was standardised for eucalypts, other species of planting stock can also be treated in the same manner to contain damage by subterranean termites. Remedial treatment in the field like application of insecticide solution around the base of the plant once termite infestation is noticed will be costly, labour intensive and can only be partially effective when carried out in a large scale.

Bhat, K.V. 2001. Anatomical changes associated with culm maturation in *Bambusa bambos* and *Dendrocalamus strictus*. KFRI Research Report No. 216. p.18.

The culm wall consisted of ground parenchyma tissue enclosing a large number of fibro-vascular strands (bundles) that varied in their size, structure and relative proportion in different parts of the culm both in axial and radial directions. The outer, denser part of the culm wall had smaller but more numerous bundles and denser fibrous tissue as compared to the inner part, which contained more of soft tissues. The main change that occurred during culm maturation was the thickening of cell wall and lignification. The increase in density was dramatic during the first two years in both *B.bambos* and *D. strictus* which subsequently became more gradual or stable suggesting a culm maturation period of about two years in both the species. The moisture content percentage, which showed an inverse relationship with density, declined rapidly during the first two years and reached a stable value in later years. Storage metabolites in culm tissues consisted mainly of starch; lipids were not found, and proteins which were conspicuous in young material, decreased with culm age.

Chand Basha, S., Chacko, K.C., Sankar, S. and Pandalai, R.C. 2001. Establishment of green belt around Cochin Refineries Ltd. KFRI Research Report No. 217. p.

One hundred and six species were planted over an area of 8.11 ha in the campus of Kochi (Cochin) Refineries Ltd (KRL) at Ambalamugal. Growth, overall health, diseases and disorders, pest incidences as well as flowering and fruiting were recorded periodically. Health scoring was also done for 23 tree species, which were present prior to the project period. Based on the study, a number of tree, bamboo and rattan species were identified as suitable for planting in similar industrial areas subjected to severe air pollution. The parameters that were followed for selection of species were tolerance to air pollution and growth rate.

Based on height growth at third/fourth year, the 87 species were grouped into four growth rate categories as very fast growing (a mean annual height increment of >1.80 m at third/fourth year), fast growing (1.21-1.80 m), moderately fast growing (0.61-1.20 m), and slow growing (<0.60 m). Species, which normally grow slow, recorded remarkably higher mean annual height increment at KRL. These include *Azadiracta indica, Hopea parviflora, Mimosops elengi, Pterocarpus marsupium, Xylia xylocarpa* and *Calamus hookerianus*. Of the older category of trees, *Cocos nucifera* (coconut) showed unhealthy symptoms similar to that of root wilt disease. A number of species flowered and produced fruits during the study period.

Vijayakumaran Nair, P. 2001. Biodiversity mapping of shola forests through remote sensing and GIS techniques. KFRI Research Report No. 218. 48p.

Multispectral images of 22 m resolution taken by IRS 1C satellite in February 1997 were used. The sholas are grouped into five regions namely Wayanad, Nilgiris, Anamalais, Periyar and Ashambu hills. The sholas in these regions are spatially mapped and characteristics examined.

Among the four locations studied in detail, girth distribution shows that smaller trees are most predominant, frequency of larger tree decreasing. This pattern is not as clear in the case of tree height. An examination of genus-wise distribution of trees shows that three genera have five or more species, one genera four species, three genera three species, nine genera two species and 36 genera one species alone. *Cinnamom wightii* is common to all the locations. A total of 82 birds were sighted during the field trips to the four areas. Of all seen, six species of birds are common to all the sites. These are common birds such as jungle myna, crow pheasant, jungle crow, large pied wagtail, red whiskered bulbul and white eye. Another 14 birds were common to three sites. Twenty one species were present in two locations. Forty one birds were restricted to one site. The structural data from the study indicate that there is much variation in the shola composition even within the same locality.

Sudheendrakumar, V.V., Sajeev, T.V. and Varma, R.C. 2001. Teak defoliator management by controlling epicentre populations - A case study. KFRI Research Report No. 219. p.31.

The data were gathered from about 85000 ha of teak plantations at Nilambur, Kerala, during the pest outbreak period in 1999 and 2000. The plantation area was divided into 189 observation units of about 50 ha each and each year the pest population was monitored from January onwards. On detection, each epicentre population was controlled with either a chemical (Quinalphos) or biological (Br) insecticide, using ground operated sparying equipments, rocker sprayer, mist blower and an ultra low volume sprayer. In 1999, twenty epcentre populations ranging from 1.125 ha in area, covering a total of 375 ha were detected between late February and mid April and control measures were adopted. Subsequent to control operations an area of 7532 ha was infested. The control operation was not successful as none of the sprayers used were efficient to target the insecticide to the canopy of tall trees as high as 30 m and above. In 2000, sixteen epicentre patches ranging from 0.12-5 ha in area, covering a total area of 18.2 ha occurred between late February and late March and were successfully controlled using high volume motorised sprayer. About 26-40 ha of teak plantations were infested subsequent to the control operations. The study also revealed a high correlation between epicentre populations and subsequent large-scale outbreaks suggesting the prospects of epicentre control. As the possibility of lean years with reduced infestation cannot be ruled out, a further long-term study is warranted for validating of the findings of this study.

George Mathew. 2001. Conservation of invertebrates through captive breeding. KFRI Research Report No. 220.74p.

Attempts were made to standardise methodologies for augmenting local butterfly fauna in order to maintain them in recreated habitats - both indoors and outdoors- which has application in, *in situ* and *ex situ* conservation programmes.

In situ propagation of butterflies was achieved by establishing a butterfly garden in a 0.5 ha of moist deciduous forest patch in the KFRI Campus at Peechi, Kerala, India. During the first half of the project, 4509 sightings of butterflies belonging to 43 species were recorded. In the second half, 5993

sightings of butterflies belonging to 50 species have been recorded. Altogether, 10502 sightings of butterflies belonging to 56 species were recorded during the thirty months study period. These included nine species that are endemic to the Western Ghats and 10 species having protected status under the Indian Wildlife Act.

For many butterflies, an average temperature ranging between 25-26°C was the most favourable followed by 23-25°C and 27-29°C. Similarly, atmospheric humidity ranging between 80-100 percent was the most preferred range followed by 60-80 percent. With regard to daily rainfall, 50 mm was the most favourable level followed by 50-100 mm rainfall. Heavy rainfall was found to be unfavourable since very few butterflies were observed above 100 mm of daily rainfall.

Investigations showed that there was a continuous population trend for butterflies belonging to the families Danaidae, Lycaenidae Papilionidae and Pieridae which also developed resident populations in the study area. Attempts to manipulate local populations of certain aggregating danaine butterflies to roost on some alkaloid containing host plants (such as *Crotalaria retusa* and *Heliotropium keralense*) were successful.

In order to examine the suitability of various butterflies for captive breeding in *ex situ* conservation and for butterfly exhibitory programmes, biology of 20 species of butterflies was studied and methods for captive breeding standardised. Based on the data generated in this study, 13 species of butterflies, *viz*., *Chilasa clytia, Pachliopta aristolochiae, Papilio demoleus, P. hector, P. polytes, Troides minos* (Papilionidae); *Catopsilia pyranthe, Eurema blanda* (Pieridae); *Talicada nyseus* (Lycaenidae); *Danaus chrysippus, Parantica aglea, Tirumala limniace* and *T. septentrionis* (Danaidae) were proposed as good candidates for butterfly gardening / captive breeding programmes in Kerala.

Vijayakumaran Nair, P., Menon, A.R.R. and Krishnankutty, C. N. 2001. Survey and estimation of bamboo resources of Kerala. KFRI Research Report No. 221. 60 p.

The Olavakode region has the maximum quantity of bamboo (34.0 %) among the five regions in the state. Most of the bamboo in this region is in Nilambur North and Nilambur South Forest Divisions and Parambikulam Wildlife Sanctuary. This is followed by the Northern region (30.7 %). The Northern region in this consideration includes the Northern Circle and Wayanad Wildlife Sanctuary. The Southern region comes third (21.7%) in terms of bamboo availability. The Trivandrum Wildlife Division and Achenkovil Forest Divisions contribute the maximum. The Central region and the High Range region contain 8.9 per cent and 4.66 per cent respectively. In these cases also the Wildlife Sanctuaries/National Parks of the region are included.

Division wise, maximum quantity of bamboo is in the Wayanad Wildlife Sanctuary (16.2% of total) and Nilambur North Division (15.0%). This is followed by Achenkovil (7.9%), Parambikulam (6.0%), Nilambur South (5.7%), Wayanad North (5.3%), Trivandrum (2.8%) and Trivandrum Wildlife (2.68%) Divisions. Other divisions have relatively less bamboo.

The total bamboo stock in the state is to the tune of 2.63 million tonnes. This is much higher than that was reported to be available in 1973 (1.4 million tonnes). Based on present age distribution, it is evident that Parambikulam area will have fully grown bamboo clumps by about 2010. The availability of bamboo can fluctuate because of reasons like gregarious flowering, and utilization plans should take this into account.

Renuka, C. 2001 Maintenance of seed stands and species trial plots of rattans. KFRI Research Report No. 222.20p.

Eight rattan species, were evaluated for their performance at two altitudes 1000 m and 300 m at Vazhachal and Nellaimpathy. Of these, *Calamus gamblei* is found to be the best suited species for higher elevation. At lower elevations, *Daemonorops kurzianus* and C. *rotang* are the suitable species. The Malaysian species, Ca. caesius, is not suitable for cultivation in Kerala.

Seed stands for nine commercially important rattan species were established - during of which four species - have started flowering and fruiting. In the germplasam collection, 28 species of rattans have been established, some of which also have started flowering and fruiting. *C. perigrinus*, a species introduced from Thailand, has also started to produce fruits regularly.

Factors leading to premature fruit fall was also investigated and a fungus *Phomopsis* sp. Was also found to be the major cause. Fortnightly application of Mancozeb 75 WP (0.25%) on the inflorescence from the early flowering stage to fruit formation was found to give effective control of the infection.

Swarupanandan, K., Sankaran, K.V., Thomas P. Thomas, Surendran, T. and Menon, A.R.R. 2001. Fire related ecosystem dynamics in the moist-deciduous forests of the Western Ghats. KFRI Research Report No. 223. 69p.

Observations on the behaviour and spread of fire during burning indicated that once the quantity of fuel and its moisture content were optimum to trigger an outbreak, further change in fire behaviour was controlled by factors like fuel porosity, continuity, its size and thickness, soil moisture content, wind speed and presence of grass in the forest.

Fire during early summer (early burn) caused only minimum damage to plants compared to that during mid and late summer. Impact of fire was more pronounced in plants under 5 cm dbh. Regeneration of plants with higher dbh was not seriously affected. Tree saplings in the lower diameter classes got dried up due to fire while there was an increase in the number of shrubs, herbs and grasses.

In general, burning treatments caused a temporary increase in pH and level of K, Ca and Mg in soils. Bulk density, porosity and organic carbon contents in the soils were, however, adversely affected. Though some of these changes are beneficial to the acidic soil in the short-term, recurrent fires may render the soil bare, promoting run off and washing away of ash, which will lead to impoverishment and degradation of the soil in the long run.

Fire caused a decrease in the number of soil macro and meso fauna. The population recouped to its original status in an year's time after fire. A significant reduction in the density of fungal and bacterial propagules in the upper most layer of soil (0-2 cm) was observed as a result of the mid burn treatment. The population of actinomycetes was unaltered. The population of fungi and bacteria reverted to the preburn status after a week of burning. The rate of decay of leaf litter of *Xylia xylocarpa* was not affected by fire. Burning (mid burn) resulted in a temporary rise in litter fall compared to unburnt plots.

Search for tree species resistant to fire showed that thick barked species like *Gmelina arborea* and *Pterocarpus marsupium* have high fire survival capacity. Thicker stumps of these tree species (Collar diameter >1.5 cm and shoot height >1 m) were found promising for revegetating areas prone to recurrent fire in the moist deciduous forest.

Chacko, K.C., Seethalakshmi, K. K., Mohanan, C. and George Mathew. 2001. Seed handling and nursery practices for selected forest trees of Kerala. KFRI Research Report No. 224.

Mohanadas, K., George Mathew and Indira, E.P. 2001. Pollination ecology of teak in Kerala. KFRI Research Report No. 225. 36p.

The number of flowers in an inflorescence in teak varies from 5.000 to 7,000 and it takes 30-40 days for the flowering to complete in a single inflorescence. Usually, only less than one per cent of the initial number of flowers results in fruiting. Studies using fluorescent microscopy have shown that teak prefers cross pollination although a certain amount of selfing could also be observed. Observations have also shown that the same tree that rejected selfing till 3 pm allowed it afterwards. Insects were found to play a major role in pollination. Pollination by insects was observed to commence in the morning and continued till noon after which the insect activity decreased. Maximum insect visit coincided with the anthesis. The insects observed on the teak inflorescence, belonged to the orders Hymenoptera, Coleoptera, Lapaidoptera, Diptera, Thysanoptera, and Hemiptera. Maximum number of species recorded belonged to Lepidoptera, mosot of which were butterflies. Based on the quantity of pollen carried and potential to effect pollen transfer, the soliatary

bees, Halictus tectonae Narendran & Joberaj, *Nomia elliptii* Smith, Anthophora niveo-cincta Smith and A. zonata Lin, as well as the wasps. Eurmenses flavopicta Blanch and Rhynchium brunneum (Fabr.) were to be the main pollinators. Thus, the most of the insects contributed to selfpollination rather than crosspollination. Isolation of flowers from pollinators showed marked reduction in fruit setting.

Sujatha, M. P., Thomas P. Thomas and Sankar, S. 2002. Prospects of reed bamboo (*Ochlandra travancorica*) for soil conservation in degraded sites. KFRI Research Report No. 226. 27p.

It was found that surface soils of reed growing soils were coarse textured, loose and acidic with higher content of organic matter whereas adjacent non-reed soils in general were with higher content of lateritic gravel and clay but with lower water holding capacity and organic carbon.

Reed plants raised from rhizomes could establish better in the degrading lateritic soils than the seedlings and if seedlings are preferred for planting on degrading lateritic soils, then they should be at least 18 months old with well developed rhizomes. After the establishment phase, the plants grow vigorously irrespective of the nature of the planting material. Reed bamboo (*Ochlandra travancorica)* can thus be recommended as a very suitable species to arrest soil degradation and improve the soils in the Western Ghats of Kerala.

Consultancy reports

Mukthesh Kumar. 2002. Preliminary survey report on the lower plants of Peppara Wildlife Sanctuary, Kerala State. KFRI Consult. Report 2 (Part I). 35p.

Mukthesh Kumar. 2002. Preliminary survey report on the lower plants of Neyyar Wildlife Sanctuary, Kerala State. KFRI Consult. Report 2 (Part II). 26p.

Mukthesh Kumar. 2002. Preliminary survey report on the lower plants of Shendurney Wildlife Sanctuary, Kerala State. KFRI Consult. Report 2 (Part III). 26p.

Renuka, C. and George K.F. 2001. Genetic conservation of rattans - A state of the art review (with an annotated bibliography) KFRI consultancy report No.1 (Part 2) 92p.

Seethalakshmi K.K, Muktesh Kumar M.S , Renuka C., Gnanaharan R. and Rajan A.R.. 2002. Species utilization database for Bamboo and Rattan. KFRI consultancy report No.3

New Research Projects

KFRI 374/01 : Evaluation of seed production areas of teak in Kerala for their seed quality and the nursery performance of different seed sources in root-trainers (T.Surendran - Kerala Forest Development Fund).

KFRI 375/01 : Biodiversity of plant pathogenic Fungi in the Kerala part of the Western Ghats (C. Mohanan, K.V. Sankaran and K. Yesodharan - Ministry of Environment and Forests,GOI).

KFRI 377/02 : Developing know - how for the improvement and sustainable management of teak genetic resources (E.P. Indira, M. Balasundaran, K. Mohanadas- European Economic Commission).

Collaborating institutes:

Asian countries- Agricultural Genetic Engineering & Biotechnology Centre, Kasetsart University, Thailand; Bogor Agricultural University, Indonesia

and

European countries- Centre for Ecology and Hydrology, UK; Institute for Plant Biotechnology for Developing Countries, Belgium Royal Veterinary University, Denmark.

KFRI 378/02 : Status, distribution, food and feeding of Malabar Spiny Dormouse (*Platacanthomys lasiurus* Blyth) in the Western Ghats of Kerala (E. A. Jayson - Dept. of Science & Technology, GOI).

KFRI 379/02 : Evaluation of plant diversity and restocking of selection felled gaps in the tropical wet evergreen forests of Nelliampathy R.F. in the Western Ghats of Kerala (K. Swarupanandan- Ministry of Environment and Forests, GOI).

Consultancy projects

KFRI Cons.87/01(I) and (II) : Training on Herbarium Techniques

KFRI Cons.88/01 : Workshop on self help and community mobilization to community based enterprise

KFRI Cons.89/01 : Data collection and documentation of insects of Peppara and Neyyar Wildlife Sanctuaries

KFRI Cons.89/01(I) : Data collection and documentation of insects of Shendhurni Wildlife Sanctuary

KFRI Cons.90/01 : Data collection and documentation of the lower groups of plants of Peppara and Neyyar Wildlife Sanctuaries

KFRI Cons.90/01 (I) : Data collection and documentation of the lower groups of Sendhurni Wildlife Sanctuary

KFRI Cons.91/01 : Field identification of 15 primary timbers of Kerala

KFRI Cons.92/01 : Preparation of a technical report on gregarious flowering and management of bamboo resources

KFRI Cons.93/01 : Organising the meeting of the expert group on research programme in Eastern and Western Ghats

KFRI Cons.94/01 : Organising the fifth meeting of the task force on biopesticides and crop management

KFRI Cons. 98/2002 : Production and supply of Kadam seedlings to Apsara Plastics Pvt. Ltd., Mumbai

KFRI Cons. 99/2002 : Environmental impact assessment of the links of the proposed hill highway through reserved forests

Extension works

As per the order of Hon'ble High Court of Kerala vide CMP No.61511/2000 in O.P. No.36087/2000, KFRI has prepared a guideline for reporting weeding operations undertaken by KFD and HNL in plantations and natural forests under ANR, RDF 1, RDF 2, RRB and Compensatory afforestation schemes.

The Die-back of seedlings at the beach in Chavakad was a serious problem and a recommendation was given for controlling the problem (Physiology, Pathology, Entomology and Soil Science Divisions)

Diseases and disorder problems in nurseries (Central nuresries at Kulathupuzha, Chettikulam, Valluvassery, Cheruvancherry), plantations (*Eucalyptus grandis* plantation at Kattappana and teak plantation at Nilambur) and homesteads (Trichur and Malappuram districts) were severe and appropriate control/correction measures were suggested (Pathology Division).

Fertilizer recommendations were made for teak, eucalypt *(Eucalyptus tereticornis, E. camaldulensis and E. grandis)* and acacia *(Acacia auriculiformis* and *A. mangium)* plantations on the basis of soil analyses as per the request of Kerala Forest Department and Kerala Forest Development Corporation.

Compost samples from central nurseries of Kerala Forest Department as well as from private organizations were analysed for physical properties and nutrient status (Soil Science Division).

Statistical analysis for the Kerala Forest Department in connection with following experiments

Seasonality tests of root trainer seedlings

Experiments with various types of planting materials of teak at Emanangad (Statistics Division)

Wood samples from Kerala Forest Department,

Food corporation of India and private sectors were tested for timber identity, density, moisture content and preservative treatment (Wood Science Division).

Identification/Certification/ Expert advice

Dr. M. Balagopalan (Soil Science) and **Shri K.C. Chacko** (Silviculture) visited Alathur Range in November 2001 and gave technical advise on management of degraded natural forests and plantations.

Dr. M. Balagopalan (Soil Science Division) and **Sri. K.C. Chacko** (Silviculture Division) visited the solid waste management sites at Guruvayur and recommendations were given to improve the quality of compost to M/s Safe Motors Ltd., Kodungalloor.

Dr. P. S. Easa (Wildlife Division) visited

Attappady as per the request of the Chief Conservator of Forests(WL) to look into the Elephant problem on 21 October 2001.

Thirupathi and Kaundinya Wildlife Sanctuary as a member of the team for Project Elephant Review during 25-29 November 2001.

Dr. A.R.R. Menon (Ecology Division) gave expert advice to Kerala Forest Department in connection with the development plan for upper Moozhiyar microwatershed inGoodrickal Range for species selection and weed management aspects during 18-22 February 2002.

Dr. A.R.R. Menon (Ecology Division) and **C. Mohanan** (Pathology Division) assisted the Advocate Commission for evaluating extractable timber quantity from Karuna Plantation, Munnar as per the order of Hon'ble High Court of Kerala during 8-9 & 16-17 March 2002.

Dr. N. Sasidharan (NWFP Division) identified herbarium specimens received from various agencies and provided technical information on the status of mangrove forests to the Divisional Forest Officer, Social Forestry, Kozhikkode in connection with the visit of Hon. Minister for Forests, Kerala to Kadalundy.

As per the request from Cochin Devaswom Board, Thrissur, **Drs. N. Sasidharan** (NWFP Division) and **R.C.Pandalai** (Silviculture Division) gave all technical advice for transplanting an Elengi tree of 10 year old from KFRI campus, Peechi in the Vadakkunnadhan temple premises.

Seminars/Workshops attended

Dr. K. M. Bhat (Wood Science Division) attended the ITTO Consultative Meeting/ Workshop on Lesser Used Species and Tropical Timber Data Base held at Kuala Lumpur, Malaysia during 3-5 February 2002 and presented a country report for India on Tropical Timbers.

Drs. J.K.Sharma (Director) and **M. Balasundaran** (Pathology Division) attended the 10th International Workshop on BIO-REFOR held in Tokyo, Japan during 7-11 October 2001 and the following papers were presented

Clonal propagation of eucalypts in Kerala, India - Dr. J.K.Sharma

Genetic diversity of *Santalum album* in South India- Dr. M. Balasundaran .

Dr. M. Balagopalan (Soil Science Division) attended

Seminar on Coir in connection with India - International Coir Fair s+-organized by Coir Board at Kochi during 12 - 13 October 2001.

Meeting on Coir Geotextile Development Programme at Alleppy on 14 February 2002.

Drs. M. Balagopalan and **Thomas P.Thomas** (Soil Science Division) attended DAE-BRNS Regional Workshop on Impact of Application of Radiation on Food and Agriculture organised by BARC and KAU during 27 - 28 December 2001 at KAU, Vellanikkara.

Drs. M. Balasundaran, E.J. Maria Florence (Plant Pathology Division), **K.K. Seethalakshmi** (Plant Physiology Division) and **K.M. Bhat** (Wood Science Division) participated in the Workshop on Problems and prospects in clonal forestry at ITC Bhadrachalam during 19-21 December 2001, and presented the following papers

Increasing eucalypts productivity through high yielding disease resistant clones: Method of mass multiplication - Dr. M. Balasundaran

Importance of disease in selection of clones of acacias and its multiplication - Dr. E.J. Maria Florence

Clonal propagation of Sympodial Bamboo species - Dr. K.K. Seethalakshmi

Heritability and genetic gains in timber quality attributes of clonal teak plantations - Drs. K. M. Bhat and E.P.Indira

Dr. T. K. Dhamodaran (Wood Science) attended an International Training Workshop on Affordable Bamboo Housing in Earthquake - Prone Areas at Aizawl, Mizoram during 30 October - 11 November 2001.

Dr. P.S.Easa (Wildlife Biology Division) attended

Meeting of Elephant Researchers and Wildlife Managers to discuss the possibilities in elephant management, Aranya Bhavan, Bangalore on 7 September, 2001.

Seminar on Management of Protected Areas with People's Participation at Rajiv Gandhi Centre, Thekkady on 6 October 2001.

Discussion Meeting with AIG of Forests & Director, Project Elephant at New Delhi during 09-10 October 2001.

Meeting of Working Group on Forestry at Forest Head Quarters, Thiruvananthapuram on 17 November 2001.

National Symposium on Elephant Conservation, Management and Research at Rajaji National Park, Uttaranchal during 16-21 December 2001 and presented a paper on Elephants in Kerala - Status and Constraints for Conservation.

Discussion on Wildlife and Tourism at Munnar on 05 December 2001.

Meeting for planting indigenous varieties of plants at Thrissur on 31 December 2001.

South Regional Workshop of National Biodiversity Strategy and Action Plan, Krishi Vigyan Kendra, Pastapur, Zaheerabad, Andhra Pradesh during 5-7 January 2002.

Discussion on Inventories of Captive Elephants at Forest Head Quarters, Thiruvananthapuram on 16 January 2002.

Review Meeting on Fragmentation in Western Ghats by Wildlife Ministers of India at Forest Head Quarters, Thiruvananthapuram on 28 January 2002.

Regional Workshop of Field Directos of Project Tiger at Kanha National Park during 14-15 February 2002.

Meeting of the Sub-committee for Wildlife Population Estimation at Aranya Bhavan, Forest Head Quarters, Banglore on 20 February 2002.

Drs. T. Surendran and **K.K. Seethalakshmi** (Plant physiology Division) and **E. P. Indira** (Genetics Division) attended the National Workshop and Peer Review Meeting on Teak held at IFGTB, Coimbatore on 27 November 2001 and presented a paper

Tree improvement and propagation of teak in Kerala.

Dr. E. P. Indira (Genetics Division) attended the NationalWorkshop on Fast-growing and High Yielding Selected Cultivars in Non-timber Forest Products including Medicinal Plants at Indian Wood Science Institute, Bangalore during 16- 18 January 2002 and presented a paper

Selection of better provenances/ progenies in *Calamus andamanicus* Kurz. for faster growth.

Dr. E. A. Jayson (Wildlife Biology Division) attended

Methodology Finalisation Workshop on Wetlands held at Kerala Forest Head quarters, Thiruvanathapuram on 21 January 2002

Workshop on Small Mammals held at Forest Head quarters, Thiruvanathapuram on 28 January 2002.

Kerala Science Congress held at Cochin University of Science and Technology on 29 January 2002.

Dr. Jose Kallarackal (Plant Physiology Division) attended

The Regional Workshop on Planting Technology in Hard Laterite land incorporating Watershed Engineering during 30 January to 1February 2002 and presented a paper on Physiology of Tree Root Penetration and Water Uptake from Deeper Soil Layers

Indo-UK Seminar on Distance Learning: New Technologies and Opportunities at Chennai during 7-8 February 2002.

Dr. A.R.R. Menon (Ecology Division) attended a meeting on Management Plan Review at Thiruvananthapuram during 11-12 December 2001.

Dr. Muktesh Kumar (Botany Division) participated in the 6th National Seminar on Orchid Diversity in India held at Palampur, Himachal Pradesh during 11-13 October, 2001 and presented a lead paper

Comparative Floral Anatomy of *Orchidaceae*: A Phylogenetic Analysis.

Dr. K.K.N.Nair (Botany Division) attended the NBSAP State level workshop on 13 October 2001.

Dr. K.K. Ramachandran (Wildlife Biology Division) participated in the Workshop on Impact of Rainforest Fragmentation on Small Mammals and Herpetofauna in the Western Ghats, South India on 28 January 2002.

Dr. C. Renuka (Botany Division) attended

Executive Committee Meeting of IRTC at Trichur on 19 September 2001

Seminar on Traditional Industries of Sambavan Community - Problems and Solutions held at Guruvayoor during 13-14 October 2001 and gave a talk on Rattan Industry - Problems and Solutions.

Dr. N. Sasidharan (NWFP Division) participated in the

Swadeshi Science Congress held at KFRI, Peechi and presented a paper Diversity and distribution of flowering plants of Kerala during 7-9 November 2001.

Workshop on Farmers Right from Legislation to Action and Kerala's Bio-future: Bioresources Conservation and Sustainable Utilisation at M.S. Swaminathan Research Foundation, Community Agro-biodiversity Centre, Kalpetta during 24-26 November 2001.

Dr. K.K. Seethalakshmi (Plant Physiology Division) attended a Regional Workshop on Policy for Bamboo and Cane in the North East at Guwahati, Assam during 22-24 January 2002.

Dr. M.P. Sujatha (Soil Science Division) attended the International Training Workshop on Recent Trends in Ecohydrology at Jawaharlal Nehru University, New Delhi during 25-30 November 2001 and presented a paper

Ecohydrological Investigations in the Western Ghats of India.

Dr. Thomas P.Thomas (Soil Science Division) attended

Watershed Development Exposure Workshop at Ahmednagar during 17 - 20 January 2002

Dr. T. Surendran (Plant Physiology Division) attended

One day Workshop on PATENT AWARENESS held at the Regional Engineering College, Calicut on 01 October 2001.

One day Workshop-cum-Peer review Meeting on Teak Projects at IFGTB, Coimbatore on 27 November 2002 and presented the details of the ongoing projects on Teak in KFRI.

Sri. P.K. Thulasidas (Wood Science Division) attended a Training-cum-Workshop on Extension Support Fund (ESF) Projects of ICFRE, at FRI, Dehra Dun during 19-21 September 2001 and presented a paper on

Transferring some selected wood technologies to wood industry in Kerala by R. Gnanaharan, T. K. Dhamodaran and P.K. Thulasidas

Dr. R.V. Varma (Entomology Division) attended

Seminar on Future Dimensions in Entomological Research at COSTED, Chennai on 19 January 2002 and gave an invited talk.

Drs. R.V. Varma and **George Mathew** (Entomology Division) attended the NBSAP Working Group Meeting on Wild Animal Diversity held at Kottayam on 17 September 2001.

Training/Workshop/Meeting organised

Dr. K. Jayaraman (Statistics Division) conducted a training workshop in Laos for forestry researchers, Vientine, Laos from 19 November to 14 December 2001.

Drs. K. M. Bhat and **K. V. Bhat** and **Sri. P.K. Thulasidas** (Wood Science Division) conducted a Training Programme on Field Identification of Timbers for staff members of the Kerala Forest Department at Peechi during 17-20 October 2001.

Dr. T. K. Dhamodaran (Wood Science Division) organised a training programme on Oil curing of canes (Rattan) at Tipi, Arunachal Pradesh on 29 September 2001.

Dr. P.S.Easa (Wildlife Biology Division) organised

Workshop on conservation strategy for mangroves in Kerala at Kannur.

Workshop on Rubber Plantation and Biodiversity Conservation in Kerala at Palai.

Meeting of the Biosphere Reserve at KFRI during 8-11 September 2001.

Dr. Jose Kallarackal (Plant Physiology Division) organised Awareness Meeting for the PFM at Vellimuttom, Nilambur on 8 October 2001.

Workshop in connection with the World Computer Literacy Day at KFRI on 3 December 2001.

Dr Jose Kallarackal (Plant Physiology Division) and **Sri. A.R. Rajan** (LAN) organised the following training/workshop programmes for the LAN users in KFRI -

Internet Connectivity by Mr. Manoj Nair, IT Consultant, Nexus Computers, Kochi on 19 September 2001.

Programing by FoxPro by Mr. Rajiv Somen, Dy Registrar (Accounts), KFRI on 8 October 2001.

Care and Maintenance of your Computer by Mr. Jeyakumar, Consulting Engineer, Redington India Ltd., Cochin on 15 October 2001.

Introduction to Spreadsheet programs - 2 Sessions by Mr. O. S. Mirash, KILA, Thrissur on 24 October and 19 November 2001.

Intranet Portal and Office Automation for KFRI by Mr. S.R. Nair, MD, Team Frontline, Kochi on 11 December 2001.

Dr. M.S. Muktesh Kumar (Botany Division) conducted training on Field Identification of Orchids to the field staff of Kerala Forest Department, Mankulam Division during 6-8 February 2002.

Dr. E. J. Maria Florence (Plant Pathology Division) conducted three-day workshop/training to forest officials on Identification of provenances of new and fast growing species and development of new clones of eucalypts and acacia during 14-16 March 2002.

Dr. K.K.N. Nair (Botany Division) organised a meeting of NBSAP-Wild Plant Diversity Working Group members on 27 September 2001 and prepared details of the future course of action of the Working Group.

Public hearing workshop on Wild Plant Diversity for NBSAP programme at Ernakulam on 13 October 2001.

Dr. R.C.Pandalai (Silviculture Division) conducted a training programme on

Cultivation and Preservation Technique of Bamboos for Farmers during 24-29 October 2001

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Nursery techniques and management of bamboos and canes for farmers of Golden Dreams.

Dr. C. Renuka (Botany Division) held public hearing workshop on Domesticated biodiversity at Palakkad on 11 November 2001 under NBSAP programme.

Dr. S.Sankar (Agro forestry Division) organised the 11th Swadeshi Science Congress during 7-9 November 2001.

Dr. N. Sasidharan (Non wood Forest Products Division) conducted training programmes on Herbarium Techniques to the Foresters and Forest Guards of Southern and Olavakkode Circles, Kerala Forest Department during 12-15 September 2001 and 09-12 October 2001.

Dr. T. Surendran (Plant Physiology Division) conducted training on Identification and propagation of Bamboos and Rattans to KFD officers on 23 January 2002 at KFRI.

Training received

Overseas

Dr. T. Surendran (Plant Physiology Division) attended a training course in vegetative propagation of tropical tree species at QFRI, Gympie, Queensland, Australia from 08 - 26 October 2001.

Dr. P.K.Muraleedharan (Economics Division) attended a training on Environmental Economics for practicing Scientists at G.B.Pant Institute of Himalayan Environment and Development, Almora during 16-20 October 2001.

Guest Lectures

Dr. M. Balagopalan (Soil Science Division) gave two lectures on forest fires in connection with the public awareness one day campaign at Ponganamkadu on 30 December 2001 and Poovanchira on 19 January 2002.

Dr. P.S.Easa (Wildlife Biology Division) gave a radio talk on importance of planting trees in homesteads on 20 October 2001 and lectures

on wildlife conservation at Chinmaya Mission College,Ernakulam on 03 October 2001.

in connection with the Wildlife Week Celebration, Thekkady, 07 October 2001.

on biodiversity at Nirmala College, Muvattupuzha on 15 November 2001.

on biodiversity for the benefit of participants organised by Santha Higher Secondary School, Avanoor, Thrissur on 18 January 2002.

Dr. E. P. Indira (Genetics Division) gave a lecture on teak improvement at KFRI Teak Museum in connection with the visit of 14 member Indonesian and DANIDA team on 22 November 2001.

Dr. Jose Kallarackal (Plant Physiology Division) delivered lectures on

use of modern ecophysiological equipments in forestry research on 9 October 2001to the visiting students of B.Sc. Zoology, Assumption College, Changanassery.

problem solving research in Botany and application of instrumentation at Botany Association, Sri Krishna College, Guruvayoor on 15 November 2001.

Dr. A.R.R. Menon (Ecology Division) delivered a lecture on remote sensing on 23 October 2001 at Academic Staff college, Calicut and two lectures on forest fire at Varavoor and Vattayi on 30 December 2001.

Dr. E.M.Muralidharan (Genetics Division) gave a lecture on tissue culture of bamboo and rattans given during the training programme on identification and propagation of bamboo and rattan for f ield officers of Central Circle on 23 January 2001.

Dr. K.K.N. Nair (Botany Division) gave a talk on shola forests for the visiting M.Sc. (Forestry) students of Raipur Krishi Vidhyalaya, Madhya Pradesh.

Dr. R.C. Pandalai (Silviculture Division) acted as a resource person in a workshop on preservation and management of sandal regeneration forests of Marayoor at St. Marys' UP School, Marayoor and also attended the discussion on natural and artificial regeneration of sandal conducted by Kerala Forest Department.

Dr. C. Renuka (Botany Division) gave lectures on

plant diversity during the inaugural function of the Botany association of N.S.S. College, Nenmara on 23 November 2001.

the rattans of South India and
economic evaluation of rattans in India

in the UGC sponsored Refresher Course in Botany at the Manomanian Sundaranar University, Tamil Nadu on 29 November 2001.

Dr. S. Sankar (Agroforestry Division) delivered a lecture on biodiversity in agriculture at KILA Mulankkunnathukkavu on 2 November 2001.

Dr. N. Sasidharan (NWFP Division)

delivered Dr. V.V. Sivarajan Memorial Endowment Lecture on *Floristic Diversity of Kerala* at Department of Botany, Calicut University, organised by Prof. V.V. Sivarajan Endowment Committee on 18 December 2001 and gave lectures on

plant nomenclature to the M.Sc. Botany students of Sree Narayana College, Nattika, Thrissur during their visit to KFRI on 15 November 2001.

use of medicinal plants in primary health requirements in the workshop organised by Wildlife Division, Peechi to the Women's Self Group at Peechi on 19 November 2001.

herbarium methodology to the B.Sc. Botany Students, NSS College, Nenmara during their visit to KFRI on 16 November 2001.

floristic diversity of Thrissur District and
field identification of forest trees

to the participants of UGC Refresher Course for college lecturers at Manomanian Sundaranar University, Alwarkurichi, Tirunelveli on 29 November 2001.

Dr. K. K. Seethalakshmi (Plant Physiology Division) was a resource person at regional workshop on policy for bamboo and cane in the North East at Guwahati, Assam on 22-24 January 2002.

Dr. J.K. Sharma (Director) delivered lectures on

plant biodiversity of Kerala: conservation and sustainable use in a public meeting organized by Kerala State Land Use Board, Trivandrum on 18 January 2002.

bio-resources in Kerala - past, present and future in the Kerala Science Congress held at Cochin during 29-31 January 2002.

Dr.T. Surendran (Plant Physiology Division) gave a talk on
clonal propagation of tree species
to the visiting batch of M.Sc. and B.Sc. students of S.N. College. Nattika and demonstrated the working of Mist Chamber on 13 November 2001.

Dr. Thomas P.Thomas (Soil Science Division) gave a talk on

soil and water management in degraded forests in the Training programme on management of degraded forests and fire control held at KFRI. Peechi on 28 January 2002.

Dr. R.V. Varma (Entomology Division) attended the Entomology camp held at MES Mampad College during 11-13 November 2001 as Chief Guest and gave a talk on

the need to integrate teaching and research in academic institutions.

Prof. Takashi Okuyama , Department of Biomaterial Physics, School of Agriculture Science, Nagoya University, Japan was attached to the Division of Wood Science during 22 December 2001-2 January 2002 on a collaborative teak wood research programme under the Indian National Science Academy (INSA)/Japan Society for Promotion of Science (JSPS) fellowship.

Recent Publications

Anto, P.V., Renuka, C. and Sreekumar, V.B. 2001. *Calamus shendurunii*, a new species of Arecaceae from Kerala, India . *Rheedea* 11(1): 37-39.

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Chandrashekara, U.M., Sivaprasad, A., Nair, K.K.N. and Pandalai, R.C. 2001. Establishment and growth of some medicinal tree species in two degraded lands and in an agro-forestry system, Kerala, India. *J. Trop. For. Sci.* 13: 13-18.

Dhamodaran, T.K. and Gnanaharan, R. 2001. Optimizing the schedule for CCA impregnation treatment of rubber wood. *Holz als Roh- und Werkstoff* 59: 294-298.

Easa, P.S. and Sabu Jahas, S. A. 2002. A demographic study of elephant population in Periyar Tiger Reserve and adjacent areas in Kerala. *Ind. For.*, 128: 217-227.

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Indira, E. P. and Renuka, C. 2002. The occurrence of albinos in *Calamus hookerianus*. *J. Trop. For. Sci.*, 14 (1): 156-157.

Jayaraman, K. and Zakrzewski, W.T. 2001. Practical approaches to calibrating height-diameter relationships for natural sugar maple stands in Ontario. *For. Ecol. Manage.*, 148: 169-177

Krishnankutty, C. N. 2001. Rural bamboo trade in Kerala and retail markets. *Ind. For.*, 127: 671- 677

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Menon, A.R.R. 2001. Structural reflectance characteristics of vegetation of Sourthern Western Ghats (India) and their use in forest classification. *Malay. For.*, 64: 77-87.

Menon A.R.R.and Varghese, A.O. 2001. Evaluation of the feasibility of remote sensing techniques in forest degradation analysis - A case study of Peppara Wildlife Sanctuary. *Econ. Env. Cons.* 7(3): 70-76.

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Muktesh Kumar. 2002. Field identification key to native bamboos of Kerala. KFRI Handbook No.9.

Matters of general interest

Dr. M. Balagopalan (Soil Science Division) set question papers of Kerala Agricultural University.

Dr. K.M. Bhat (Wood Science Division) reviewed scientific papers as referee for Journals, Silva Fennica; Journal of Tropical Forest Products.

Dr. E.P. Indira (Genetics Division) set question paper and carried out valuation for Kerala Agricultural University.

Dr. E. A. Jayson (Wildlife Division) gave an interview on conservation of kole wetlands of Trichur for the Asianet

Dr. Jose Kallarackal (Physiology Division)

set question paper for M. Sc. Environmental Science of Cochin University of Science and Technology.

peer reviewed the paper entitled Agroecological zoning for productivity of rubber in India.

reviewed the proposal entitled Reproductive biology and genetic diversity of three economically useful forest tree species of Western Ghats entrusted by Ministry of Environment and Forests, GOI.

Dr. A.R.R. Menon (Ecology Division) set question paper for Tamil Nadu Public Service Commission.

E. M. Muralidharan (Genetics Division) visited Regional Plant Resource Centre, Bhubaneshwar and National Botanical Gardens, Kolkatta for collection of bamboo germplasm and discussion about micropropagation of bamboo during 3 to 13 September 2001.

Dr.K.K.N. Nair (Botany Division) served as external expert and conducted the Ph.D. viva-voce examination of Bharathiar University, Coimbatore on 25 September 2001.

Dr. J.K. Sharma (Director) evaluated several research proposals as expert member in Biosphere Reserves, Eastern Ghats and Western Ghats and Ecosystem Research Committees and refereed several papers for Indian Phytopathology.

The delay in periodicity is deeply regretted

-EDITOR

EVERGREEN

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Editor
Dr. M. Balagopalan

Associates
Dr. E.P. Indira
Dr. C.K. Soman
Mr. B. Sajeev
Mr. Subhash Kuriakose

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Address all communications to :
The Editor, Evergreen
Kerala Forest Research Institute,
Peechi - 680 653, Thrissur, Kerala, India.
Ph. : 0487-2699037, 2699061
E.mail : balagopal@kfri.org
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Forthcoming Events

1. 6-12 April 2003. World Perspective on Short Rotation Forestry for Industrial and Rural Development. 1.09.02 Integrated Research in Tropical Bioenergy Systems. Nauni. Solan, India. Kartar S. Verma, Dr. Y.S. Parmar University of Horticulutre and Forestry, College of Forestry, Department of Silviculture & Agroforestry. PO Nauni, Solan H.P. 173 230, India. Tel (direct): +91-1792-52270, Fax : +91-1792-52242, E-mail (pers): verma-ks@yspuhf.hp.nic.in <mailto:verma-ks@yspuhf.hp.nic.in>

2. 7-12 June 2003. Tree Biotechnology. 2.04.06. Molecular Biology of Forest Trees; Umea Plant Science Centre. Umea, Sweden. Ulrika Hjelm, Dept. of Forest Gentic and Plant Physiology, SLU, 901 83 Umea, Sweden. Tel +46-(0)90-7869086; fax. +6-(0)90-7865901. E-mail treebiotech.2003@genfys.slu.se <mailto:treebiotech.2003@genfys.slu.se>. Web site; www.treebiotech2003.normod.se <http://www.treebiotech2003.normod.se>.

3. 11-15 March 2003. 4th World Symposium on Logistics in Forest Sector. 3.12.00 Forest Logistics, 5.13.00 Industrial Logistics, and Wood Logistics Network. Rotorua, New Zealand. Timber Logistics - Econpap, postal: Anjas 3 A 33, 02230 Espoo, Finland. E-mail: econpap@yahoo.com <mailto:econpap@yahoo.com>. Web site: http:/members.surfeu.fi/otaniemi/sympnz.htm.

4. 12-15 May 2003. 2nd Forest Engineering Conference. SkogForsk, 3.00.00 Forest Operations and Techniques. Vaxjo,Sweden.. Maria Jwarsson, Manager Training, SkogForsk, Uppsala Science Park, SE:751 83 Uppsala, Sweden. Tel :+46-18-188500; Fax +46-18-188600.
E-mail:maria.iwarsson@skogforsk.se
Web site : www.skogforsk.se/fec <http://www.skogforsk.se/fec>.

5. 11-15 March 2003. All Divisions 5 IUFRO Meeting Forest Products Research - Providing for Sustainable Choices. 5.00.00 Forest Products. Rotorua, New Zealand. Lesley Caudwell, Forest Research, Sala Street. Private Bag 3020. Rotorua, New Zealand Tel: +64-7-343-5846; Fax +64-7-343-5507. E-mail:alldiv5iufronz@forestresearch.co.nz
Web site: http://www.forestresearch.co.nz/site.cfm/alldiv5iufronz.

6. 11-15 March 2003. Joint 5.03.00 and 5.06.00 meeting during the all Division 5 meeting. 5.03.00. Wood protection, and 5.06.00 Properties and utilization of tropical woods. Rotorua, New Zealand. Gan Kee SENG, Forest Research Institute Malaysia (FRIM), 52190 Kuala Lumpur, Kepiong, Malaysia. Fax : + 60-3-6367753. E-mail (pers):ganks@frim.gov.my. Andrew WONG, Forest Research Institute Malaysia (FRIM). Fax : +60-3-6367753, E-mail (pers):andrew@frim.gov.my.

7. 13-15 January 2003. History & Forest Biodiversity. Challenges for Conservation. 6.07.04. Ecological History: 8.07.00 Biodiversity. Leuven, Belgium. Mrs. Sofie Bruneel, Laboratory for Forest, Nature and Landscape Research, Catholic University of Leuven, Vital Decosterstrat 102. B-30001 Leuven, Belgium.Tel : +32(0)16.32.97.21. Fax : +32(0)16.32.97.60. e- mail: foresbiodiv@agr.kuleuven <mailto:foresbiodiv@agr.kuleuven> ac.be Web site:http://www/agr/kuleuven.ac.be/lbh/ Ibnl/forestbiodiv/.

8. 10-15 March 2003. Forestry and Rural Development in Industrialised Countries: Policy, Programs and Impacts. 6.11.02. Forestry and Rural Development in Industrialised Countries: Bawden Associates Limited. Rotorua, New Zealand. E-mail:bal@wave.co.nz. Tel: +647 3627 865, Fax: +647 3627 875, Bawden Associated Limited, R.D. 4 Rotorua, New Zealand.

9. May 2003, planned. 5th International Symposium on Experience with New Forest and Environmental Laws in European Countries with Economies in Transition. 6.13.00. Forest Law and Environmental Legislation. Czech Republic. Peter Herbst. Wulfenstrafie 15. A-9500 Villach, Austria. Tel: +43-4242-52471 Fax: +43-4242-264048. E-mail: (pers.):hp@net4you.co.at.

10. 24-28 March 2003. II Congress Latinoamericano IUFRO. IUFRO; EMBRAPA, etc. Fos. Do Iguazu, Brazil. Vitor Afonso Hoeflich, Empresa Brasileira de Pesquisas Agropecuaria. Centre Nacional de Pesquisa de Florestas, PO Box 319, 83-411-000 Colombo Parana, Brazil. Tel : +55-41-6661313; Fax: +55-41-6661386 E-mail (pers):hoeflich@cnpf.embrapa.br. E-mail (org): postmaster@cnpf.embrapa.br <mailto:poastmaster@cnpf.embrapa.br>.

11. 11. 28-30 April 2003. 4th Ministerial Conference on the protection of Forests in Europe - MCPFE. MCPFE. Vienna, Austria. MCPFE Liaison Unit Vienna, Marxergasse 2. A-1030 Vienna,Austria. Tel: +43-1-710-7702/ Fax:+43-1-710-770213
E-mail: liaison.unit@lu- vienna.at <mailto:liaison.unit@lu- vienna.at>.
Web site: www. mepfe.org