KFRI Evergreen
Newsletter of Kerala Forest Research Institute
An Institution of Kerala State Council for Science, Technology and Environment

Number 77-78
April 2016-March 2017

Contents

Editors' column

Tree planting and climate change mitigation

The news that the ozone hole above Antarctic is finally showing signs of healing is spreading bright rays of hope and reassurance on the effectiveness of collective international policy initiatives to tackle global environmental issues. As the changing local weather systems gradually gather a global pattern of climate change, the act of planting trees in agro-forestry and farms forestry has once again moved on to the centre stage of forestry discourses. Planting and maintaining trees outside forest lands have been an activity that has invited the keen attention of policy makers and practitioners of forestry worldwide. Now discussions on the factors determining the farmers' choice of tree species have once again come alive, this time with better incentive options that are linked to the climate change mitigation and the clean development mechanism for carbon offsetting. Bringing agro-forestry and farm forestry to the domain of climate change discourse involves adopting a trans-disciplinary approach where natural and social sciences have to communicate to each other to create a nuanced domain of knowledge and its practice. So trans-disciplinary in this sense is not merely an act of crossing the boundary, but creating a new object of practice and institutionalization with respect to the forestry. This issue of Evergreen presents an interesting case of maintaining trees in the home gardens of Kerala. The article by UM. Chandrasekhara who is an expert in the agro-forestry system in KFRI, invites our attention to the role of traditional knowledge and practices in tree management in Kerala home gardens. The article also presents a novel approach for co-realization of traditional practices and their scientific validation adopting a participatory approach. We hope a concerted international effort in forestry for promoting tree planting in productive spaces outside forest areas would help addressing the issue of climate change as in the case of healing the Antarctic ozone hole.

"The future depends on what you do today- Mahatma Gandhi

Evergreen

Newsletter of
Kerala Forest Research Institute
An Institution of Kerala State Council for Science, Technology and Environment

ISSN 0254-6426

Evergreen, the Newsletter of the Kerala Forest Research Institute, brought out in March and September, is intended for free distribution to individuals and institutions connected with forestry. The views expressed in the newsletter are those of authors and do not necessarily reflect the views of the Institute. The readers are welcome to communicate their comments and opinions. The Newsletter Committee reserves the right to choose among the contributions and make necessary editorial modifications.

Published by:

The Director
Kerala Forest Research Institute
Peechi-680-653, Thrissur, Kerala
Web: www.kfri.res.in
E-mail: director@kfri.org, director@kfri.res.in

Printed at:

Print Express Cochin - 682 017

Co-realization of traditional practices for tree management in Kerala home gardens

Chandrashekara UM and Reshma PK

Kerala Forest Research Institute Sub Centre, Nilambur

Sustainable management of ecosystems and resources on which we depend is a complex challenge. To succeed, we need to depend on insights and information originating from multiple knowledge systems. Among different knowledge bases, indigenous or local traditional knowledge systems, developed through experimentation, adaptation, and co-evolution over long periods of time can provide valid and useful information as well as methods, theory and practices for sustainable ecosystem management. It is a well-known fact that aged members of a society who practiced farming in general function as the 'information storage and processing unit'. They also play an important role for passing down the oral traditions through their teachings/ instructions to younger generations. However, transfer of traditional practices and technologies from generation to generation does not necessarily mean that traditional knowledge is applied in its original form (Balazs and Morello-Frosch, 2013). Very often, certain traditional practices are blindly followed without understanding their socio-cultural and/ or ecological dimensions. As a result, practitioners may face the risk of following a practice that is either not actually beneficial or by neglecting a useful practice by presuming that it is useless. As a consequence of this, some scholars may become increasingly suspicious about the usefulness of traditional knowledge and practices in dealing with environmental and biodiversity conservation related problems (Usher, 2000). Thus, there is a great need to realize the `science' behind each traditional practice and technology both by scientists and practitioners. To understand knowledge base of traditional practices and technologies, participatory approach is ideal as the user communities or practitioners and researchers are benefited in multiple ways. With this in view, this paper is prepared to share learning from co-realization and scientific validation exercises conducted on traditional practices related to management of trees in traditional home gardens of Kerala.

Tree branch pruning is a common management practice in Kerala home gardens to obtain green manure, forage, fodder and fuel wood. Documentation of traditional knowledge prevailing among home gardeners on intensity and frequency of branch pruning indicated that, depending on

the species, three broad levels of pruning intensity namely, minimum, moderate and heavy pruning are practiced. Traditional farmers are of the view that the growth of trees of *Erythrina indica* and *Macaranga peltata* would not be affected if pruned every year at minimum intensity or alternate years at moderate intensity. However, trees of *Grewia tiliifolia*, *Albizzia odoratissima* and *Ailanthus triphysa* may be subjected to minimum pruning once in two years. On the other hand, trees of *Xylia xylocarpa*,

Bridelia crenulata and *Terminalia paniculata* may be subjected to heavy pruning intensity once in two years. However, it was found that the traditional knowledge on tree pruning is not being applied in its original form (Chandrashekara and Sankar,

2004). It was also evident that scientific base of traditional knowledge related to tree management practices in homegardens of Kerala need to be understood jointly by farmers and researchers by conducting on-farm experiments. Thus, an on-farm participatory study was conducted to determine the impacts of different intensity and frequency of pruning on growth vigour and biomass production by a set of trees species (*Ailanthus triphysa, Albizia odoratissima, Bridelia crenulata, Erythrina indica, Grewia tiliifolia, Macaranga peltata, Terminalia paniculata* and *Xylia xylocarpa*) in homegardens of Kerala. The effects of four pruning intensities i.e., control (0% pruning) and pruning 50 per cent, 75 per cent and 90 per cent of the total crown length from crown base, on stem radial growth increment and leaf and twig biomass production were evaluated in these species (Chandrashekara, 2007). In *Ailanthus triphysa,* as the pruning intensity increased a significant decline in annual increment in stem diameter was recorded. On the other hand, in the remaining species the diameter increment began to reduce when the pruning intensity was above 75 per cent. Response to pruning in terms of biomass production also varied from species to species. The annual foliage and branch production in *Erythrina indica, Macaranga peltata* and *Terminalia paniculata* were significantly more in pruned trees than in un-pruned trees. However, in case of *Ailanthus triphysa, Albizia odoratissima, Bridelia crenulata, Grewia tiliifolia* and *Xylia xylocarpa,* when compared to un-pruned trees, the annual production of foliage and branches were more in trees that were pruned once in two years. The study also demonstrated the fact that traditional practices, such as, low intensity annual pruning of trees of *Erythrina indica* and *Macaranga peltata* and moderate intensity annual pruning of trees of *Ailanthus triphysa, Albizia odoratissima* and *Grewia tiliifolia* have scientific base. Similarly, the on-farm experiment also supported the traditional practice of bi-annual moderate intensity pruning of trees of *Erythrina indica and Macaranga peltata.* However, the experiment also showed that when trees of *Terminalia paniculata* and *Xylia xylocarpa* were subjected to high intensity pruning even once in two years, the tree growth and foliage and branch production would be affected. Thus, the traditional practice of pruning of trees *Terminalia paniculata* and *Xylia xylocarpa* does not have the scientific base.

Lessons learnt by researchers during knowledge co-realization process: Co-realization of scientific and socio-cultural dimensions of traditional knowledge is possible only by collaborative endeavour of practitioners and researchers. In the above mentioned case study, the researchers understood that among home gardeners broadly two different actor groups can be identified. For instance, when the supporters of a given traditional practice constituted one actor group, the opponents of that practice formed another actor group. During Participatory Rural Appraisal exercises and in the initial stages of knowledge validation exercises, researchers found a tendency of one or two actor groups to become dominant and trying to impose one-way transfer of knowledge from them to other groups. However, researchers made cautious efforts to make sure that knowledge co-realization process should continue based on a dialogue on equal terms between actor groups (thought collectives) and maximum relevant information are accumulated for understanding scientific and socio-cultural implications of traditional knowledge and practices.

After documenting the traditional practices of management of trees in homestead farming, the researchers felt that further collaborative understanding of 'truth' behind traditional knowledge is possible only when discussions between actors are held in conducive and conflict-free atmosphere. In such discussions, the researchers had to play two roles i.e., as a facilitator for smooth conduct of discussions and as an expert to highlight the potential value of traditional knowledge in resource management as well as to provide scientific input for formulating knowledge validation experiments.

The researchers also understood that by integrating farmer's knowledge and scientific knowledge and then providing analysed information to farmers would generate interest in farming community

to take more active role and responsibility in conducting on-farm experiments for scientific validation of traditional knowledge. During knowledge co-realization process, depending on the case, the researchers had to play different roles. For instance, in the case of tree pruning experiments, the researchers had to play important role in planning, coordinating, implementing and data gathering as these experiments were comparatively laborious and too technical.

Conclusions : The present study has illustrated how traditional practices of management of trees have scientific base and relevance in maintaining sustainability of an agroforestry system. Through collaborative exercises involving practitioners, natural and social scientists it is possible to pull back the veil that obscures our understanding on strengths and relevance of a rich traditional knowledge and practices prevailing in different farming systems for plant management. Experience gained from the present study indicated that the researchers who wish to undertake knowledge co-realization and validation exercises need to be equipped with intuition and skills in/to a) facilitating collective learning processes, b) diminish the dominant attitude of one or more actors which may inhibit fruitful communication between different actors, and c) blending wisdom of different thought collectives for unravelling scientific truth of traditional knowledge and practices.

References

1. Balazs CL and Morello-Frosch R. 2013. The three R's: how community based participatory research strengthens the rigor, relevance and reach of science. *Environmental Justice*, 6: 9-16.
2. Chandrashekara UM. 2007, Effects of pruning on radial growth and biomass increment of trees growing in homegardens of Kerala, India. *Agroforestry Systems*, 69:231-237.
3. Chandrashekara UM and Sankar S. 2004. Influence of tree canopy architecture and management regimes on growth and yield of undercrops in homegarden agroforestry systems of Kerala. KFRI Research Report No. 387. Kerala Forest Research Institute. 37 pp.
4. Usher PJ. 2000. Traditional ecological knowledge in environmental assessment and management. *Arctic*, 53:183-193.

Seed characteristics of *Memecylon randerianum*, an endemic species of Southern Western Ghats

Chandrasekhara Pillai PK and Nimisha Joy

Kerala Forest Seed Centre, Kerala Forest Research Institute

The genus *Memecylon* L. belonging to the family Melastomataceae is from palaeotropical region and it has about 250 species (Mabberley, 1990). In India,

the genus is represented by 39 species, of which 21 are endemic to the country, and the Western Ghats is reported to host 29 species (Rajendraprasad *et al.*, 2006; Murugan and Gopalan, 2006). They are distributed in wide variety of habitats; from dry deciduous to moist deciduous, semi-evergreen, evergreen and montane shoal forests. They occur in a wide range of altitudes from sea level to 2500 m above sea level. *Memecylon randerianum* SM & MR Almeida is a bushy shrub, endemic to Southern Western Ghats. The species is reported to have remarkable medicinal properties including the anti-microbial and anti-fungal properties (Hullati and Ravi, 2004; Jamuna *et al.*, 2011; John *et al.*, 2014).

M. randerianum blooms during the month of December and continues up to the month of July (Figures 1-2). Fruit is one-seeded globose berry, which becomes purple at maturity (Sasidharan, 2004) (Figure3-4). Mature fruits were collected during December, de-pulped and desiccated. The moisture content of 18.66 per cent was determined on fresh weight basis (ISTA, 1999). The size and weight of seeds vary from 220 to 228 mm diameter and 0.112 to 0.125 g respectively.

The de-pulped seeds were sown in vermiculite medium (n = 30 seeds in 3 replicates) and kept in germination room (30 ±2°C with 90-95 RH) in order to evaluate seed viability under laboratory conditions. Data was recorded from the commencement of seed germination till its culmination. Seed germination started two days after sowing and continued up to 29 days. The following germination related parameters were obtained i.e., germination percentage (88.88 ± 3.57 %), mean emergence time (9.74 ± 0.241 days), germination index (1.31 ± 0.03), energy (57.77 %) and energy period (9 days) as germination value (12.74 ± 2.66), germination per standard methods (Djavanshir and Pourbeik, 1976; AOSA, 1983; Butola and Badola, 2004). Polyembryony was also observed in the species.

Being an endemic species with remarkable medicinal values, conservation efforts need to be focused in the existing natural resources of *M. randerianum*is. Since it is an unpalatable species, it can be grown as an agroforestry crop on waste lands or marginal lands, and also as hedge around agricultural fields.

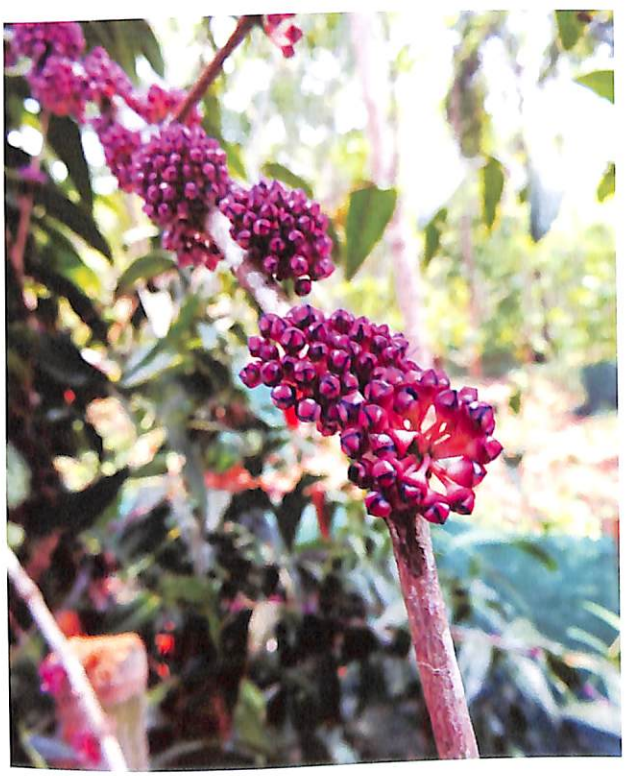


Figure - 1. *M. randerianurr* flower bud

Figure - 2. *M. randerianura* flower

Figure - 3. *M. randerianum* immature fruit

Figure - 4. *M. randerianum* pre-mature fruit

References

1. AOSA. 1983. *Seed Vigour Testing Handbook*. Association of Official Seed Analysis (AOSA), USA: Springfield.
2. Butola JS and Badola HK. 2004. Effect of pre-sowing treatment on seed germination and seedling vigour in *Angelica glauca*, a threatened medicinal herb. *Current Science* 87: 796-799.
3. Djavanshir K and Pourbeik H. 1976. Germination value - a new formula. *Silvae Genetica* 25: 79-83.
4. Hullati KK and Rai VR. 2004. Antimicrobial activity of *Memecelyon malabaricum*. *Fitoterapia* 75: 409-411.
5. ISTA. 1999. International rules for seed testing. *Seed science and Technology* 288p.
6. Jamuna BA, Ravisanker RV and Pradeepa VS. 2011. Evaluation of the antimicrobial activity of three medicinal plants of south India. *Malaysian Journal of Microbiology* 7 (1): 14-18.
7. John J, Ragi PR, Sujana KA and Kumar NA. 2014. Antifungal activity of selected plant extracts on *Peridiopsora mori* causing brown rust in mulberry. *Int. J. Pharmacognosy* 1 (9): 1000-1005.
8. Mabberley DJ. 1990. The Plant Book, 2nd Edn, Cambridge University Press, UK. 449p.
9. Murugan C and Gopalan R. 2006. Four new additions to India *Memecelyon* L. (Melastomataceae) from south India. *Indian Journal of Forestry* 29 (1): 105-108.
10. Rajendraprasad M, Prathapan SL, Pandurangan AG and Shaju T. 2006. *Memecelyon royenii* Blume (Melastomataceae): A new record for India. *Indian Forester* 132(2): 229-232.
11. Sasidharan N. 2004. Biodiversity documentation for Kerala- Flowering Plants, part 6: 182.

Research Reports

KFRI Research Report No. 515

Seed regeneration and ecological studies on keystone tree species of the evergreen and moist deciduous forest ecosystems

Chandrasekhara Pillai PK, Sreekumar VB, Sreejith KA and Mallikarjunaswami GE.

Population structure, seed ecology and regeneration of dominant keystone tree species were assessed in seven plots established by KFRI in evergreen, moist deciduous and Shola forest types of Kerala. The species in the present study are *Culleniae xarillata, Mesua ferrea, Palaquium ellipticum* (Muthikulam & Pothumala), *Cynometra travancorica, Diospyros paniculata, Reinwardtiodendron anamalaiense* (Vellanipacha), *Dysoxylum malabaricum, Knema*

attenuate (Vazhachal) from evergreen forests, *Cassia fistula, Catuna regamspinosa, Grewia tiliifolia* from moist deciduous forests in Parambikulam and *Gomphandra coriacea, Hydnocarpu salpina, Neolitsea scrobiculata, Syzygium densiflorum* from Shola forests (Mannavanshola & Vaguarrai). The dominant species observed were *P. ellipticum* in Muthikkuluam and Pothumala, *R. anamalaiense* in Vellanipacha, *K. attenuate* in Vazhachal, *C. fistula* in Parambikkulum, *G. coriacea* in Vaguarrai and *H. alpine* in Mannavan shola. Flowering and fruiting period varied with species i.e., *C. exarillata* (Jan-Nov), *P. ellipticum* and *K. attenuate* (Dec-July), *M. ferrea* (April- Dec), *C. travancorica* (Sept-April), *D. paniculata* (Feb-April), *R. anamalaiense* (Mar-Nov), *D. malabaricum* and *G. tilifolia* (Feb-June), *C. spinosa* (April-Oct), *S. densiflorum* (April-June), *G. coriacea* (Dec-March), *H. alpine* (Feb-July) and *N. scrobiculata* (May-Aug). Peak flowering of *C.*

fistula was observed in March-April and fruits ripening in December. Mode of seed dispersal of all the species' was identified as zoochory. Storage physiology of most species is recalcitrant except *C. fistula* (orthodox), *C. spinosa, G. coriacea* and *G. tilifolia* (intermediate). Good seed regeneration was obtained for *C. exarillata* and *P. ellipticum* from Muthikkulum, *C. exarillata* from Pothumala, *Reinwardtiodendron anamalaiense* from Vellanipacha. whereas regeneration was poor for *M. ferrea* at Muthikkulum, *M. ferrea* and *P. ellipticum* from Pothumala, *D. malabaricum* and *K. attenuate* from Vazhachal, *C. travancorica* and *D. paniculata* from Vellanipacha, *C. spinosa, C. fistula* and *G. tiliifolia* from Parambikkulam, *H. alpine* and *N. scrobiculata* from Mannavanshola as well as in *G. coriacea* and *S. densiflorum* from Vaguarrai. The species with poor regeneration may create possible gaps across different stages (seedlings-saplings-poles-adults) and the population may decline in due course. The

study suggests the need for augmenting the exiting natural resources of these dwindling keystone species' to sustain the respective ecosystems.

KFRI Research Report No. 516

Conservation through restoration of wild nutmeg tree populations of Western Ghats of Kerala

Jose PA and Chandrasekhara Pillai PK.

A study on five wild nutmegs *viz. Myristica malabarica, M. beddomei, M. fatua* var. *magnifica, Gymnacranthera farquhariana, Knema attenuata* belonging to the family Myristicaceae was carried out as part of conservation and management of existing populations towards sustainable utilization of these endemic, threatened tree resources. The major populations of wild nutmegs in the Kerala part of Western Ghats were identified and mapped out. As part of the study, clonal propagation methods with the aid of auxins and ideal seed storage practices for recalcitrant seeds were developed. A fair quantity of planting stock was established in the nursery and 11,500 seedlings of five species were planted at 14 forest locations where the depleting natural stocks of these species' exist. The planting sites were demarcated by

signboards. The average seedling survival success @ 70- 90 per cent was recorded after six months of planting. A training programme was organised for capacity building on *Nursery practices, plant production and field planting* was imparted to 183 field staff of Thiruvananthapuram, Shendurney, Vazhachal and North Wayanad Forest Divisions where the restoration of species was carried out.

KFRI Research Report No. 517

Improving and maintaining productivity of eucalypt plantations in India and Australia

Sankaran KV.

The impact of site management practices *viz.* harvest residue retention, weeding, fertilizer application, legume intercropping, thinning and trenching on tree growth was evaluated in *Eucalyptus tereticornis* and *E. grandis* plantations in Kerala for a full rotation during 1998-2005. Biomass and nutrient content of the tree crop, forest floor and understory of the previous stands were determined before establishing the experiments. Quantities of carbon and nutrients in the soil were much higher than those found in the above ground biomass of plantations. The highland sites had higher organic C and double the amount of cumulative N than the lowland sites. Soil cations were significantly lower at the least fertile sites compared to the fertile sites. Removal of harvest residues (leaf, bark and branches) and understory from the sites was found to cause significant loss of N, P and cations from the site. Burning of residues, which is the normal practice in Kerala, will also result in volatilization and loss of major nutrients. Of the various treatments, retention of residues did not significantly improve eucalypt productivity at the sites probably due to the low amount of residues. Results indicate that the mean standing volume in harvest residue treatments was significantly higher than the previous rotation at all sites. The productivity increase at the end of the rotation was in the range 47-119 per cent at *E. tereticornis* sites and 77-224 per cent at the *E. grandis* sites which shows that use of good quality planting stock and periodic weeding alone can improve eucalypt productivity in Kerala. Intercropping of legumes in eucalypt plantations may be advantageous since *Pueraria* and *Stylosanthes* improved productivity at one of the *E. tereticontis* sites. However, choice of climbers like *Mucuna* and *Pueraria* may be avoided since they can smother trees if not managed periodically. The thinning experiments at the *E. grandis* sites showed that it would be ideal to keep 2300 stems ha-1 to

get higher productivity in intensively managed eucalypt plantations. Trenching will have an impact in sites where water becomes a limiting factor for growth. Also, conservation of top soil by trenching may have an impact on productivity at steep sites which are prone to erosion. Periodic weeding significantly improved the eucalypt productivity of *E. tereticornis*. Responses to fertilizers were quite variable across sites with one each of the *E. tereticornis* (Punnala) and *E. grandis* (Surianelli) sites showing good responses to N and P fertilizer which reflect the inherent difference in the nutrient supply characteristics of soils. The current annual increment (CAI) and mean annual increment (MAI) values of the standing crop show that 5-6 years may be an appropriate time to harvest intensively managed *E. tereticornis* and *E. grandis* plantations in Kerala. The influence of harvest residue retention on soil N, P and C was relatively minor in the short term period of this study with only a few detectable changes to the soil characteristics explored. Retention of harvest residues at the sites did increase the N mineralization and microbial biomass and it is evident that the residues contain large quantities of these critical nutrients. The incubation experiment with legume and eucalypt residues proved that the degree of N mineralization and immobilization was directly related to the N concentration of the residues. N mineralization rates quantified from plots applied with N fertilizer have shown that the best indicator of response to fertilizer across sites was the net N released during aerobic incubation.

KFRI Research Report No. 518

Impact of industrial activities on soil and water qualities in Koratty panchayat area

Sandeep S, Thomas P. Thomas and Jayson EA.

Human activities, in course of their development ventures may inflict irreparable damage to soil and water entities. Koratty panchayat in Thrissur District with a long history of industrial and agricultural activities is prone to soil and water

contamination. Hence, the present project was envisaged with the objective of assessing the land use pattern, generate baseline information and evaluate soil and water quality in Koratty panchayat area. Land capability classification shows that 98 per cent of the land in the region belongs to Class II and III, indicating moderate limitations for crop growth. Rice, coconut, banana, pepper, arecanut, nutmeg, rubber and vegetables are the main crops cultivated in the panchayat. Mixed cropping is the major cropping pattern in the region. Heavy metals in the surface soils and in water bodies of this area were analyzed to assess the impact of different land uses on soil and water quality. Total heavy metal contents in soil showed that cadmium in industrial sites and Cd and Ni in most of the agricultural lands in Koratty were beyond the permissible limits. To increase the information capacity (mobility/ bioavailability) of generated results a speciation analysis suggested by EU Standards, measurement and testing programme called BCR process of the heavy

metals in soil was conducted. Though Fe was the most mobile among the different heavy metals, more than 90 per cent of this metal was observed in the immobile residual fraction. Cd was the least mobile among the studied heavy metals in Koratty panchayat, but > 50 per cent of this metal existed in the easily available fractions (fractions 1 and 2) thus making it a contaminant of high bioaccumulation risk by way of plant absorption. Contamination factors for Cd, Ni and Pb were very high in the soils of Koratty. Enrichment factor values show that accumulation of these metals in soils occurred mainly due to anthropogenic - industrial as well as agricultural activities. Water quality of the region was assessed by collecting samples from ponds, wells and prominent water courses draining the area. The pH values were found to vary between 4.85 - 6.85, 4.95 - 6.35 and 5.25 - 5.76 in ponds, wells and water courses respectively. The values were lower than the prescribed BIS and ICMR standards. Among the anions, sulphide content was found to exceed the limits in all the water bodies of the region (ponds, wells and streams). Oil, grease and phenolic compounds were found to be other major pollutants of water in the region and present in levels above the prescribed standards in all water samples during the sampling period. All the analyzed water samples from wells indicated high pollution levels by coliforms and 32 per cent of them by *E. coli*. Water quality was thus found to be impaired to various levels in Koratty panchayat.

KFRI Research Report No. 519

Vetiver system technology for river bank stabilization

Sandeep S, Jayaraj R, Hrideek TK and Raghu AV.

Stream bank erosion is a major problem in Kerala. Physical and vegetative methods are effectively used for stream bank stabilization. In vegetative methods, *Vetiveria zizanioides* is a widely accepted plant. The present project was undertaken to identify and characterize different ecotypes of vetiver, evaluate their efficiency in river bank stabilization and to impart training for the benefit

of end users. A total of 15 vetiver accessions were collected from different research centres and private individuals. Correlation analysis and character associations of 12 morphometric characters of the collected vetiver accessions were done and their relationship derived. Plant height showed the highest factor loading followed by leaf breadth, root length, leaves per tiller and fresh root weight showing their higher contribution towards the variability of the population and their usability in breeding programmes as lead characters. In the collected accessions, phenotypic coefficient of variation (PCV) was higher than genotypic coefficient of variation (GCV) in all cases indicating polygenic background of characters and additive gene action. Field experiments conducted at the Field Research Centre of KFRI at Velupadam in Thrissur district showed that Periavura (vetiver accession) and ODV – 23 were the most promising in terms of growth parameters. Soil modifying parameters, such as, soil reaction, organic carbon

content and mean weight diameter (MWD) did not differ between accessions. However, organic carbon (%) and water stable aggregates expressed as mean weight diameter were higher vetiver cropping. Periavura accession had the lowest oil content in roots and ODV – 23 the highest. Thus, ODV – 23 though acceptable by growth standards its high oil content may tempt the planting community to harvest the crop thereby defeating the purpose of soil stabilization. Hence among the tested vetiver accessions, Periavura could be preferred for river bank stabilization.

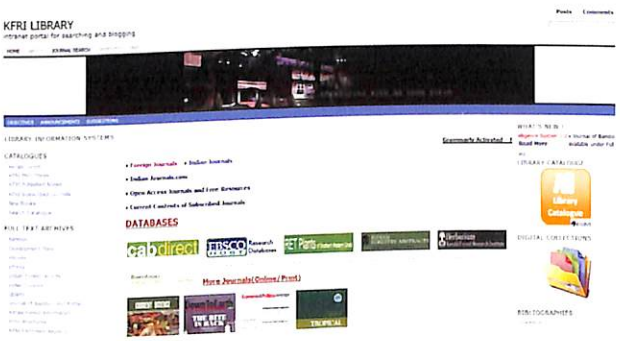
KFRI Research Report No. 520

Digital Library in Forestry

Sarojam N.

The vast amount of information being generated in an exponential manner makes it difficult to collect and organize. Adding to the complexity are images and multimedia content which present even more challenges for retrieval. Recent developments in information and communication technologies help in organizing the vast amount of information.

Digitization of documents offers many advantages to manage a large collection of documents of any format. It is possible to preserve the documents for long term and store systematically.



It is easy to locate information stored in the library. Space of the library can also be saved. It facilitates easy access to the materials at any time from remote places. KFRI Library had initiated the work of building up a digital archive of the publications of KFRI and later other collections of the library were added. An overview of the collections brought into digital archives and how it is implemented and the benefits to the users are discussed in this report.

KFRI Research Report No. 521

Development of a prophylactic control strategy for managing the mahogany shoot borer Hypsipyla robusta in trial plantations

Mohanadas K

Mahogany is one of the valuable timbers of the tropics. In spite of excellent growth potential and adaptability to a wide range of conditions including degraded sites, the tree is susceptible to shoot borer attack by *Hypsipyla* species. A package of practice is suggested in this study to manage new mahogany plantations from the shoot borer, *Hypsipyla robusta*. This study was done at a six year old mahogany trial plots (*S. macrophylla* and *S. mahagoni*) established at the Field Research Centre (FRC), at Veluppadam in 2003. A three-way approach including the physical, biological and chemical tree-injection control methods was attempted. In the physical control, the leading tender shoot of mahogany plants was covered with a hood made of bamboo frame and covered with fine nylon mosquito net. This covering protected the tender shoot from *H. robusta* infestation and further damage. In the biocontrol method, weaver ants (*Oecophylla smaragdina*) along with their nest were collected from the neighbourhood forest trees, released on the mahogany plants and allowed to establish their new nests. These weaver ant nested plants were connected to other mahogany plants in the study plots using some thick threads to ensure the surveillance of these ants. Significant differences with respect to the infestation percentage were observed between the plants in the control plots and weaver ants established (treated) plots. In the chemical tree-injection control method using systemic insecticide (Dimethoate 30% EC), 100 per cent protection could be observed in all the three concentrations applied (0.1, 0.2 and 0.5 %), and no infestations were occurred upto 100 days. Further experiments are needed to recommend the

frequency of treatments with regard to the long term protection of the plants. All these control methods can be applied as a package of practice during the establishment of new mahogany plantations.

KFRI Research Report No. 522

Wild animal kills and its causative factors in selected forest roads in Kerala

Easa PS.

A study was conducted on wild animal kills along the road connecting Vazhachal - Malakkapara and Chinnar - Marayur in Udumalpet – Munnar road. The 16 kms long stretch of the road passes through the dry deciduous forests and scrub jungle in Chinnar Wildlife Sanctuary. The 50 kms distance in Vazhachal Malakkapara road is through the tropical

wet evergreen and moist per standard methods (Djavanshir and deciduous forests and reed patches. The observations during 2013-14 were made by covering the distance on a bike at a slow pace. During the trip, the kills were recorded along with the details including the species name, GPS reading and the surrounding habitat. A total of seventy five wild animal kills were recorded from the road passing through Chinnar Wildlife Sanctuary. These included a number of animals included in Schedule IV of Wildlife Protection Act, mostly reptiles and birds. Indian garden lizard and the three striped palm squirrel were the highest in term of number of kills. Gray slender loris, black naped hare and lesser bandicoot rat were the mammals recorded as vehicle hitin Chinnar. The birds included the rare yellow throated bulbul. The observations in Vazhachal-Malakkapara road recorded about 315 road kills, which included almost uniformly the reptiles, amphibians and mammals. A number of

Western Ghats endemics included under Schedule I and Schedule IV were seen hit by vehicles. These included Nilgiri langur, Indian crested porcupine and small Indian civet. The highest number of kills was that of bi-coloured frog with about 197 numbers followed by 52 numbers of Indian bullfrog. Indian rock python (under schedule I), checkered keelback and spectacled cobra (both Schedule II) were also observed to be killed. The observations indicate the vulnerability of wildlife to vehicular traffic in both the areas. It is suggested to establish speed breakers in most of the areas in Chinnar to regulate the speed of the vehicles thereby helping the drivers stop the vehicles in case of sighting animals on the road. The canopy connectivity could be maintained by planting suitable tree species in identified areas and go for artificial canopy bridges as a temporary relief. Highway patrolling as suggested by National Tiger Conservation Authority could be arranged in Vazhachal road. Awareness among the drivers is considered crucial in both the areas.

CAMPUS NEWS

Dr. B.S. Corrie IFS, Principal Chief Conservator of Forests and Head of Forest Force takes charge as Director KFRI on 09 November, 2016

New Research Council (RC) in place The following members have been appointed to the new RC of KFRI.	
Chairman Dr. Ramesh B.R, Researcher InstitutFrancais de Pondicherry French Institute of Pondicherry.	
Members Director, Institute of Forest Genetics and Tree Breeding Indian Council of Forestry Research and Education, Coimbatore.	Dr.C.T.S.Nair, Former Director, KFRI & Former Executive Vice President, KSCSTE.
Prof.Dr.N.Parthasarathy, Professor & Dean, Sciences & School of Life Sciences, Pondicherry University, Puducherry.	Dr.R.V.Varma, Former Chairman Kerala State Biodiversity Board.
Dr. Raman Sukumar, Professor, Centre for Ecological Sciences Indian Institute of Science, Bangalore.	Member & Ex-Officio Convener Director Kerala Forest Research Institute.

New Research Projects initiated

1. Genetic Improvement of Selected Tree Species-Phase I: Plus Tree Selection, Standardization of the Propagation Techniques, Establishment of Seed Orchard and Clonal Hedge Garden
2. Management of the invasive Alien Giant African Snail (Achatina fulica bowdich) in Kerala
3. Economic valuation of ecosystem services from the moist deciduous forests of Kerala
4. Authentication of major commercially traded raw drugs in the Ayurvedic systems of medicine in India
5. The medicinal plants market in South India: Economic value and tribal rights
6. Development of management protocols for already established invasive alien species in the protected and other forests of Kerala
7. Establishment of a Herbal Garden as a peri-urban green space of Nilambur, Malappuram District, Kerala
8. Bird hazard to aircrafts in the Cochin Naval Air Station(INS Garuda)
9. Facilitating the establishment of Bamboo and Cane Enterprises through training and technology transfer
10. Exploration of medicinal plant resources of Panju islands of Maharashtra
11. Collection, Identification, documentation, exploration and conservation of biodiversity of parasitic foliicolous hyphomycetous fungi from Tarai forests flora of Uttar Pradesh
13. DNA Barcoding a promising molecular tool for timber forensics
14. An information system for forests of Kerala

Recent Publications

1. Chandrashekara UM. 2016. Growth and physiological responses to an elevation gradient by co-occurring tree species in a Shola forest of Kerala, India. Current Science 110(10): 1900-1901.
2. Chandrashekara UM and Thasini VM. 2016. Non-Crop edible plants and medicinal plants in homegarden agroforestry system of Palakkad District, Kerala. Int J. and Environmental Sci. 42(2): 183-191.
3. Hrideek TK, Ginu J, Raghu AV and Jijeesh CM. 2016. Phytochemical profiling of bark and leaf volatile oil of two wild *Cinnamomum* species from evergreen forests of Western Ghats. Plant Archives 16(1): 266-274.
4. Jayaraj R, Sasidharan N, Beenu Tom and Muhammad Anaz K. 2016. Comparative phytochemical profiling and quantification of mangiferin content in species of *Salacia* from Southern Western Ghats of India. Journal of Biologically Active Products from Nature 6(3): 209-222.
5. Jose Mathew, Hrideek TK, Sreekumar VB and Madhusudhanan K. 2016. *Seidenfadeniella*

salimii (Orchidaceae): a new plant species from South Western Ghats, India. Webbia: Journal of Plant Taxonomy and Geography 70(1): 69-71.

6. Jose PA, Siju Tom Kuruvila and Binoy NM. 2016. New record of seed pest, *Alcidodes* sp. Indet. (Coleoptera: Curculionidae) in *Cynometra beddomei* Prain. Indian Journal of Forestry 39(2): 97-100.
7. Joshi Y, Sreekumar VB and Sequeira S. 2016. First report of teleomorphic stage of *Normandina pulchella* from India. Kavaka 47: 155 - 157.
8. Kumar P, Prabhukumar KM, Nirmesh TK, Sreekumar VB, Hareesh VS and Balachandran I. 2016. *Habenaria sahyadrica* (Orchidaceae, Orchideae) a new species from the Western Ghats (India) with critical notes on allied taxa. Phytotaxa 244 (2): 196–200.
9. Manjunatha M, Santhoshkumar AV, Kunhamu TK, Sandeep S, Sunil KM and Suresh Kumar P. 2016. Organic carbon and Total Nitrogen status of Soils under the Teak plantation of various ages in Kerala. Environment and Ecology 34(3): 882:886.
10. Pillai PKC, Deepa K and Jiji AH. 2016. Pre-treatment for improved seed germination. Geography and You 16 (95): 66-69.
11. Raghu AV, Deepa K, Daisy MJ and Chandrasekhara Pillai PK. 2016. Effect of pre-germination treatments and storage conditions on germination of *Embelia ribes* Burm f. (bidanga) with special reference to Vrikshayurveda. J. Traditional and Folk Practices 2/3/4(1): 160-163.
12. Sandeep S and Manjaiah KM. 2016. Impact of tillage and nutrient management practices on soil aggregate carbon pools of rice-wheat cropping systems in semiarid India. Indian Journal of Geomarine Sciences 45(2): 207 -214.
13. Sajitha KL and Suma Arun Dev. 2016. Quantification of antifungal lipopeptide gene expression levels in *Bacillus subtilis* B1 during antagonism against sapstain fungus on rubberwood. Biological Control 96: 78-85.
14. Sajitha KL, Suma Arun Dev and Maria Florence EJ. 2016. Identification and characterization of lipopeptides from *Bacillus subtilis* B1 against sapstain fungus of rubberwood through MALDI-TOF-MS and RT-PCR. 2016. Current Microbiology 73: 46-53.
15. Sarojam N and Raman Nair R. 2017. Design and development of Bamboo information system. Informatics Studies (Jan-Mar): 19-28.
16. Sasidharan N, Sujanapal P, Dantas KJ and Robi AJ. 2016. Enigmatic new species, *Strobilanthes Agasthyamalana* (Acanthaceae), from Agasthyamala Biosphere Reserve of Southern Western Ghats, India. 2016. Kew Bulletin 71(4): 1-6.
17. Sivaram M, Ramachandran KK, Jayson EA and Vijayakumaran Nair P. 2016. Evaluation of line transects sampling technique in estimating elephant abundance in Kerala forests using dung survey. Indian Forester 142(10): 959-964.
18. Sreejith KA, Chandrashekara UM, Nirmesh TK and Sreekumar VB. 2016. Tree species composition and distribution pattern in a *Myristica* Swamp of Northern Kerala, India. Current World Environment 11(3): 743-750.
19. Sreejith KA, Sreekumar VB, Nirmesh TK and Sugantha Sakthivel R. 2016. New population of *Santalum album* L. (sandalwood) from Agali Forest Range, Kerala, India. Current Science 110(2): 148-150.
20. Sreejith KA, Prashob P, Sreekumar VB, Manjunatha HP and Prejith MP. 2016. Microhabitat Diversity in a Lateritic Hillock of Northern Kerala, India. Vegetos 29:3. doi:10.4172/2229-4473.1000145.
21. Sreekumar VB, Sugantha Sakthivel R and Sreejith KA. 2016. Distribution mapping and conservation of *Rhopaloblaste augusta* (Kurz) H. E. Moore in Nicobar Islands, India. Tropical Ecology 57(2): 271-277.
22. Sreekumar VB, Sugantha Sakthivel R,

Sreejith KA and Sanil MS. 2016. Predictive distribution modelling of *Calamus andamanicus* Kurz: An endemic Rattan from Andaman and Nicobar Islands, India. Journal of Forest and Environmental Science 32(1): 94-98.

23. Sreekumar VB, Hussain KH and Renuka C. 2017. Virtual herbarium of Kerala Forest Research Institute, Peechi, Kerala, India. Current Science 112(3): 466-470.

Papers in Proceedings/ Newsletters

1. Chandrashekara UM and Reshma PK. 2016. Hidden Harvests. LEISA-INDIA, 18(2): 28-30.

2. Chandrashekara UM. 2016. Benefits of using newspaper to cover teak nursery beds. Teaknet Bulletin 9(2): 4-6.

3. Corrie BS and Sreekumar VB. 2016. A Strategic Vision for Natural Capital Management in the Kerala part of Western Ghats. Proceedings of National Conference on 'Western Ghats Revisited' November, at Maharashtra Forest Department.

4. George KF. 2016. Application of data mining in library and information services. In: Balachandran S and Ramesh Babu V. (Eds.) Proceedings of two day national conference on Quality of library and information services for teaching, learning and research in the present era: challenges and opportunities. Thiruvalluvar College, Papanasam, Vickramasingapuram, Tamil Nadu, on 5-6, August 2016: A7-A13.

5. Jithin KV, Jose PA, Subin K and Suma Arun Dev. 2017. Population ecological studies of *Hydnocarpus longipedunculatus* Robi, Sasidh. & Jose- A newly described endemic taxon of the Western Ghats, Kerala. Proceedings of Extended Abstracts, 29th Kerala Science Congress, Marthoma College, Thiruvalla 28-30 January 2017. p.656.

6. Jose PA, Ranjith CV and Chandrasekhara Pillai PK. 2017. Clonal propagation and germplasm storage of wild nutmegs - a tool for conservation and resource enhancement. National Conference on Tree Improvement Research in India: Current Trends and Future Prospects, IWST, Bangaluru, 2-3 February,2017. p.42.

7. Jose PA, Ranjith CV and Chandrasekhara Pillai PK. 2017. Developing seed propagation protocols for conservation of endemic and threatened trees of Western Ghats: A case study on Wild nutmegs. Technical Notes of National Workshop on Seed Collection and Conservation. Botany Dept., University of Kerala, Kariavattom, Thruvananthapuram, pp. 40-43.

8. Jose PA, Ranjith CV and Pillai PKC. 2017. Clonal propagation and germplasm storage of wild nutmegs - a tool for conservation and resource enhancement. Proceedings of the National Conference on Tree Improvement Research in India: Current Trends and Future Prospects (Abstracts), 2-3rd February, Institute of Wood Science and Technology, Bengaluru. 42pp.

9. Jose PA, Ranjith CV and Pillai PKC. 2017. Developing seed propagation protocols for conservation of endemic and threatened trees of Western Ghats: A case study on wild nutmegs. *In: Proceedings of the national Workshop on Seed Collection and Conservation*, 8-10 March, Organized by Department of Botany, University of Kerala, supported by Kerala state Biodiversity Board, Govt. of Kerala: 40-43.

10. Pillai PKC. 2017. Seed handling of recalcitrant group: A case study on selected tropical tree species. Proceedings of the national Workshop on Seed Collection and Conservation, 8-10 March, Organized by Department of Botany, University of Kerala, supported by Kerala state Biodiversity Board, Govt. of Kerala: 15-28

11. Pillai PKC, Mahendran R and Sarath MS. 2016. *Hopea erosa* (Bedd.) Van Sloot. a critically endangered endemic species in Southern Western Ghats: Need to conserve. *In*: 121 pp. (abstract) *Souvenir-cum-Abstracts of National Conference on "Forestry in India: Current Challenges and Future Prospects"* at Shimla,

Himachal Pradesh organized by Himalayan Forest Research Institute (HFRI) during 15-18 November, 2016.

12. Pillai PKC, Sanal C Viswanath and Jiji AH. 2017. Influence of pre-sowing treatments on seed germination of mahogani (*Swietenia macrophylla* King. Proceedings of the 29th Kerala Science Congress, 28-30 January, Mar Thoma College, Thiruvalla, pp. 649-645.
13. Sani Lookose and Anju Antony. 2017. Teak Museum at KFRI Sub centre, Nilambur as a destination for promoting Science Education and Conservation awareness among the students and Society'. Proceedings of the 29th Kerala Science Congress, Marthoma College, Thiruvalla, Pathanamthitta, 28-31 January, 2017
14. Sreejith KA, Prejith MP, Sreekumar VB and Alex CJ. 2016. First Report of forested ecosystem from paddy fields of Lateritic biotope, Northern Kerala, India. National Conference on Forestry in India: Current Challenges and Future Prospects, Himalayan Forest Research Institute, 15-18 November, Shimla, India
15. Sreekumar VB, Sreejith KA, Sanil MS and Sasi R. 2016. Geographical Modelling for the conservation and management of two endemic and threatened dipterocarps in the Western Ghats. National Conference on Forestry in India: Current Challenges and Future Prospects, Himalayan Forest Research Institute, 15-18 November, Shimla, India.

Chapters in Books

1. Hrideek TK, Nampoothiri KUK. 2016. Millets as an integral part of nutritional diet in India. In: Benjamin S (ed.) Examining the Development, Regulation, and Consumption of Functional Foods, IGI Global, United States. pp. 83-108.
2. Rao KS, Saxena KG and Chandrashekara UM. 2015. Inventory, functions and management of soil biodiversity; An overview. In: K.G. Saxena and K.S. Rao (eds.). Soil Biodiversity. Bishen Singh Mahendra Pal Singh, Dehardun, India. pp. 403-442.
3. Sivaram M and Sandeep S. 2016. Error Propagation in the Estimation of Greenhouse Gas Emissions due to Forestry Sector. In: Statistics and Informatics in Agricultural Research, IASRI, New Delhi.pp. 24 -33.
4. Sujanapal P and Kunhikannan C. 2017. The Genus *Syzygium* in Western Ghats (pages 15-56) in The Genus *Syzygium: Syzygium cumini* and Other Underutilized Species Edited by K. N. Nair. CRC Press, Taylor & Francis group. ISBN: 978-1-4822-4972-9.
5. Sureshkumar P and Sandeep S. 2016. Secondary Nutrients in Soils and their Management. In: Soil Science: An Introduction, Indian Society of Soil Science, New Delhi. pp 601 - 622.

Books

- Sujanapal P and Sankaran KV. 2016. Common Plants of Maldives. Food and Agriculture Organization of the United Nations, Bangkok. ISBN 978-92-5-109295-8

Participation in Seminars/ Workshops/ Training

Jose PA

- Participation and paper presentation at National Conference on *'Tree Improvement Research in India: Current Trends and Future Prospects'* organized by the Institute of Wood Science and Technology, Bengaluru (2-3 February, 2017).
- Resource person in the National Workshop on *'Seed Collection and Conservation'* held at Botany Dept., University of Kerala, Kariavattom, Thruvananthapuram (08-10 March, 2017).

Pillai PKC

- National Workshop on *'Seed Collection and Conservation'*, Organized by Department of Botany, University of Kerala, supported by Kerala state Biodiversity Board, Govt. of Kerala (08-10 March, 2017).
- National Conference on *'Forestry in India: Current Challenges and Future Prospects'* at Shimla, Himachal Pradesh organized by Himalayan Forest Research Institute (HFRI)

(15-18 November, 2016).

- Seed Conservation Training Workshop organized by the Botanic Gardens Conservation International, U.K. in collaboration with and hosted at JNTBGRI (09-13 May, 2016).

Sreekumar VB

- Participation and Paper presentation in a Conference on *'Western Ghats revisited at Pune'* conducted by Maharashtra Forest Department (08-10 March, 2017).
- Attended One-day workshop on *'Grassland Restoration'* at Munnar organized by Kerala Forest Department (18 February, 2016).
- Participation and Paper presentation on *'Dipterocarps'* in connection with National Workshop at HFRI Shimla (November, 2016).

Sujanapal P

- Attended International Symposium and Training Course on *'Forest Invasive Pests'*; Haikou, Hainan, China, Organised by the International Society of Zoological Sciences P.R. China (18 - 22 October, 2016).

Sani Lookose

- Participation and Paper presentation on *'Teak Museum at KFRI Sub centre, Nilambur as a destination for promoting Science Education and Conservation awareness among the students and Society'* in the 29th Kerala Science Congress held at Marthoma College, Thiruvalla, Pathanamthitta District (28-31 January, 2017).

Seminars/ Training Organized

Chandrasekhara UM

- 2-day Interaction meeting of practitioners of traditional systems of medicine at KFRI Sub Centre, Nilambur (25-26 October, 2016).
- Three Workshops on medicinal plants to the farmers and staff of Karnataka Forest Department, KFRI Sub Centre, Nilambur (06-09 December, 2016; 20-23 December, 2016 & 10-14 January, 2017)
- One week compulsory training on managing green spaces for urban biodiversity and ecosystem services for IFS Officers (06-10 February, 2017).

Sani Lookose

- Summer training programme for students through prior registration, in Teak museum at KFRI Sub centre, Nilambur (April 12- 22, 2016).
- Teak Study training programme for teacher trainees from various training Institutes in Teak museum (10-21 January, 2017).

Meetings attended

Jose PA

- Technology Vision 2035, organized by KSCSTE, Kanakakunnu Palace, Thiruvananthapuram (15 -16 July, 2016).
- Board of Studies in Botany at Christ College, Irinjalakuda.

Pillai PKC

- Marayoor Sandal Division in connection with preparation and implementation of Microplan project under Green India Mission (15 December, 2016).

Sreekumar VB

- Institute of Management in Government, Thiruvanathapuram proposal development on the theme 'Biodiversity Conservation' in connection with UNDP IHRML Project (December, 2016).
- **Sani Lookose**
- Inaugurated the Training Workshop on 'Women empowerment through capacity building' organised by Fatimagiri Social Service Centre for their Self Help Group members at Nilambur (22 October, 2016).

Extension activities

Jose PA

- Implemented organic vegetable and fruit cultivation programme under the Harithakeralm programme in the campus,

Peechi.

- Training manual published in Malayalam. Jose PA and Ranjith CV (2016).
- വനസസ്യ സംരക്ഷണം : നഴ്സറി അടിസ്ഥാന സൗ കര്യങ്ങൾ, സസ്യ ഉത്പാദനം, ആവാസ മേഖല യിലെ സസ്യ പരിപോഷണം : ഒരു പരിശീലന പരിപാടി, KFRI, Peechi. pp 8.

Pillai PKC

- Site visit (Vadasserikkara - Kummannur, Nellidappara, Tekkumala, Mundonmuzhy, Padayanippara, Mundonmuzhy) along with UN Nandakumar & TK Hrideek, KFRI and DCF & ACF Research South, KFD in connection with identification of Teak Seed Production Areas vide request from PCCF (WP & R), KFD and submitted report (06-10 June, 2016).

Sani Lookose

Conducted/Organised :

- Awareness Programme on World Environment Day for Students of Amal Public School, Myladi, Nilambur. Tree Saplings were distributed among the students in coordination with Social Forestry Department, Malappuram (06 June, 2016).
- Two-day Orientation Programme on *'Teak-scientific and historical aspects'* for Students of NICT English Medium School, Kuttikkad (30-31 July, 2016).
- Orientation Programme on *'Teak cultivation and management'* for Fazfari Orphanage, Padinjattumuri, Malappuram (20 August, 2016).
- Wildlife Week Activities for Nature club members and students from various Educational Institutions (01-07 October, 2016).
- One day Orientation Programme on theme *'Biodiversity Conservation'* for NSS members of MMET Higher Secondary School, Melmuri, Malappuram (26 November, 2016).
- Orientation Programme on *'Biodiversity Conservation'* for members of Mathrudeepam, Kudumbasree unit, Chokkad, Malappuram (03 December, 2016).
- One day Orientation Programme on theme *'Natural forests and plantations in Kerala with special reference to Teak'* teacher trainees of Sree Vivekananda College of Teacher Education, Palemad, Malappuram (13 February, 2017).
- Two-day Orientation programme on *'Natural forests and plantations in Kerala with special reference to Teak'* for Bachelor of Travel and Tourism Management Degree students of M.E.S College, Perinthalmanna, Malappuram (09-10 March, 2017).
- One day Awareness Programme on *'Natural forests of Kerala'* for the Saksharatha Mission Members of Nilambur Block Panchayath, Malappuram (21 March, 2017).
- Nature Study Programme for the N.S.S. members of Government Higher Secondary School, Thrikkavu, Malappuram (29 March, 2017).
- Documentary Fest on topics related to Forest, Wildlife & Nature conservation and various environmental issues was organized in Teak Museum at KFRI Sub centre for the public and other organized groups in connection with the Teak Museum Day (21-31 May, 2016).

Guest lectures

Jose PA

- Field demonstrations on clonal propagation methods to the students from Sree Ramakrishna Gurukulam Vidyamandiram HSS, Puranattukara at KFRI, Peechi (29 September, 2016).

Pillai PKC

- Lecture on "Seed handling of recalcitrant group: A case study on selected tropical tree species" in the National Workshop on *Seed Collection and Conservation*, Organized by Department of Botany, University of Kerala (08-10 March, 2017).
- Lecture on 'Establishment of KFRI Bambusetum and Arboretum at FRC Velupadam' and

activities of KFSC to the Forest Officers in connection with 'Exposure visit of front line staff of Assam Forest Department' (09-18 June, 2017).

- Lecture on 'Seed handling and certification of forestry species' in the Comprehensive Training on Tropical Forestry and Exposure Visit to Kerala for Assam Forest Officers' (14-20 May, 2017).

Sani Lookose

- Talk on 'Nilambur Teak and Geo-graphical indications tag' to 'Akashavani' for their programme 'Dheshathanima, Dheshaperuma' (10 August, 2016).

Nominations

EA Jayson

Member of State Expert Appraisal Committee, State Environment Impact Assessment Authority of Kerala.

Sreekumar V.B.

Member of climate change focal theme of Directorate of Environment and Climate Change

Academic activities

Doctorate awarded

Ms. PK Kripa, was awarded doctorate degree by the Forest Research Institute (FRI) University, Dehra Dun, in month 2016 for her work on *'Bio indicators for monitoring soil and water quality in Koratty region, Kerala'*, under the guidance of Dr. Thomas P Thomas, Scientist-F and Head of Soil Science Department, KFRI, Peechi.

Soil and water qualities in Koratty region were assessed and bioindicators were identified. Multivariate analyses such as canonical correspondence and similarity percentage, were utilized to segregate the species with properties of soil and water. Earthworms are very good indicators of soil quality as they are exposed to pollutants through the skin and the gut. In the present study, sensitive species of earthworms decreased while the tolerant ones survived with deterioration of soil quality. Earthworms were totally absent in extreme situations of high input chemical cultivation. *Travoscolides chengannures* was the most sensitive species which was present only in organically managed fields. *Pontoscolex corethrurus*, an exotic taxa, was the most tolerant one. *Argilophilus* sp., *Drawida ghatensis*, *Drawida* sp., *Drawida impertusa*, *Metaphire houletti* and *Megascolex konkanensis* were the other genera observed in the decreasing order of tolerance respectively. Organically managed plots were species rich while chemically cultivated plots were having poor representations. Barcoding of selected earthworm species was also carried out to support identification. Similarly, aquatic macro-invertebrates that respond to water quality variations were studied and suitable indicator species' were identified. Barcoding of selected species of Ephemeroptera was also carried out to support morphological identification. Sensitive groups included Ephemeroptera, Plecoptera and Trichoptera, while odonata showed tolerance and Diptera showed high tolerance to pollution. The most sensitive taxa identified were *Torleya nepalica, Choroterpes* sp. and *Indobaetis* sp. while the tolerant taxa were *Chironomus* sp., and *Ablabesmyia* sp. Shannon and Margaleff indices revealed higher diversity of species in upstream locations while tolerant taxa were dominated in the downstream sites.

Ms. KL Sajitha, was awarded doctorate degree by the Forest Research Institute (FRI) University, Dehra Dun, in month 2016 for her work on 'Identification and mass production of bacterial biocontrol against sapstain on rubber wood', under the guidance of Dr. Suma Arundev, Senior Scientist, Forest Biotechnology Department, KFRI, Peechi.

Rubber wood, the most preferred alternative of hardwood timbers, suffers huge economic

loss owing to the sapstain fungal (Lasiodiplodia theobromae) infection. The health hazards and environmental pollution caused by chemical wood preservatives necessitate an alternative environment friendly biocontrol approach. The first phase of the study focussed on the isolation of effective bacterial biocontrols from three different aerobic composts such as Kerala Forest Research Institute weed compost, Kerala Agriculture University vermi-compost and market available composts. Seven out of seventeen visually different bacterial isolates screened for antagonism, showed inhibition towards the test fungus. Morphological, biochemical and molecular techniques could identify six efficient strains of Bacillus subtilis and one strain of Bacillus polymyxa. PCR amplification of B. subtilis B1 genomic DNA revealed the presence of antifungal lipopeptide biosynthetic genes and cell wall degrading enzyme genes, such as, iturin, surfactin, fengycin, mycosubtilin, bacillomycin, bacilysin and β-1,3-glucanase, respectively. The Matrix Assisted Laser Desorption Ionization-Time of Flight-Mass Spectrometry (MALDI-TOF-MS) analysis of whole cell surface extract of B. subtilis B1 during the inhibition of L. theobromae also revealed the presence of these antifungal lipopeptides. The antifungal antibiotic gene expression study using quantitative Real Time PCR revealed the constant expression of fengycin gene throughout the antagonism. The mass production of B. subtilis B1 was also achieved in a bioreactor using coconut water medium at pH 7, 30°C, 250 rpm and 1lpm aeration. The sixth day culture with better viable cell count (1.03 × 1010 CFU ml-1), spore count (5.57 × 1010 spores ml-1) and lipopeptide (with 50.08 % inhibition) was used for the field efficacy study. The mass produced culture with proven biocontrol efficiency in the laboratory gave significant inhibition of sapstain fungus during the field experiments in pre-monsoon, southwest monsoon and northeast monsoon seasons. Mass produced B. subtilis B1 could be used as a holistic approach in controlling the dominant sapstain fungus L. theobromae along with various wood infecting fungi on rubber wood.

Mr. KM Prasanth, was awarded doctorate degree by the Cochin University of Science and Technology, Kerala, in month 2016 for his work on 'Soil and water quality as influenced by land use in Koratty region', under the guidance of Dr. Thomas P Thomas, Scientist-F and Head of Soil Science Department, KFRI, Peechi.

The study analysed the soil and water quality parameters in the Koratty region and its variation according to land use changes. Soil was acidic and contaminated with heavy metals, lead (240-380 ppm), cadmium (8-29 ppm), nickel (117-396 ppm) and chromium (75-130 ppm). The maximum permissible levels of these heavy metals are 70, 10, 70 and 60 ppm, respectively. Other heavy metals, such as, iron, manganese, zinc and copper also exceeded permissible levels in certain pockets. Lead, cadmium and nickel were identified as the serious contaminants in the studied area. Enrichment factor, contamination factor and mobility of these elements were also assessed. The threats are aggravated by acidity of the soil, since the mobility of these metallic ions increase with acidity leading to greater bioaccumulation even along the food chain. Fractionation of the different heavy metals revealed variations in pattern. Water bodies viz. wells, ponds and streams in the region when analysed for their physico-chemical and biological properties highlighted that water in most of these water bodies was acidic and the vicinity of industries resulted in extremely low pH (<4). Dissolved oxygen was less than the optimum and biological oxygen demand, chemical oxygen demand, oil, grease and phenolic compounds were beyond the permissible levels. Nitrate, phosphate, sulphate and fluoride were within the permissible levels. Pesticide residues and heavy metals were either absent or negligible. Coliforms were present beyond the permissible levels in most of the water bodies. The north eastern part of the region had better quality of water than the south western region. GIS based maps could depict the

pattern of variation in both soil and water qualities. Industrial and highly managed agricultural areas were comparatively more contaminated and degraded.

Mr. KK Sreejesh, was awarded doctorate degree by the Cochin University of Science and Technology, Kerala, in month 2016 for his work on 'Carbon sequestration potential of teak plantations in Kerala', under the guidance of Dr. Thomas P Thomas, Scientist-F and Head of Soil Science Department, KFRI, Peechi.

Carbon sequestration potential of teak plantations in Kerala was assessed in the selected plantations at Nilambur. Biomass samples collected from different compartments of teak at prescribed felling stages of 5, 10, 15, 20, 30, 40 and 50 years were subjected to carbon analysis using CHNS analyser. An increase in carbon sequestration potential with age was observed. 50 year old teak tree was found to sequester 332.88 kg carbon in its bole, 60.63 kg in branch, 26.57 kg in bark and 80.06 kg in its root, giving a total carbon of 508.14 kg per tree. Allometric models were also tested to predict the carbon sequestration, with height and diameter at breast height as independent variables and carbon as dependant variable. The best model was $\sqrt{Y}$ = 2.289 + 0.415 D, for predicting the sequestered carbon. Soil had the highest pool of carbon. A 50 year old teak plantation was found to sequester 197.8 tons of carbon per hectare in its 0-100 cm layer. Carbon sequestration potential of teak plantations in Kerala prescribed for felling in 2014 was found to be 0.21 million tons of carbon based on area.

M.Sc. Attachment Programmes

Sl. No.	Name of students	Subject
1	Ms. Jitha K.C	Environmental Sciences
2	Ms. Ruheena T.V.	Environmental Sciences
3	Ms. Ashina M.A.	Zoology
4	Ms. VandanaBharathi C.V.	Zoology
5	Ms. Athulya P	Environmental Technology
6	Ms. Keerthana V.P.	Chemistry
7	Ms. Geethu T.S.	Biotechnology
8	Ms. Athira M.P.	Biotechnology
9	Ms. Anitha V.A.	Biotechnology
10	Ms. Sruthi C. Madhavankutty	Biotechnology
11	Ms. Henna P. Jojo	Biotechnology
12	Ms. Amrutha K.S.	Biotechnology
13	Ms. Sajana Florence Peter	Environmental Sciences
14	Ms. Silpa A.R.	Environmental Sciences
15	Mr. Nikhil V.G.	Environmental Sciences
16	Mr. Akhlesh.K.B.	Environmental Sciences
17	Ms. Sruthi Sebastian	Environmental Sciences
16	Ms. Silpa P.	Botany
17	Ms. Prajisha	Botany
18	Ms. Jishamol KC	Botany
19	Ms. Meera K.	Microbiology
20	Ms. Hafsa M.K.	Biochemistry
21	Ms. Reshma K.V	Biochemistry
22	Ms. Anjaly George	B.Sc.-M.Sc., (Integrated) Climate Change Adaptation)
23	Mr. Nidish P. Madhu	B.Sc.-M.Sc., (Integrated) Climate Change Adaptation)
24	Mr. Nirajlal K.	B.Sc.-M.Sc., (Integrated) Climate Change Adaptation)

Sl. No.	Name of students	Subject
25	Mr. Sarath B	B.Sc.-M.Sc., (Integrated) Climate Change Adaptation)
26	Ms. Haneefa M.K.	Microbiology
27	Ms. Sikha K.S.	Microbiology
28	Ms. Nima T.G.	Microbiology
29	Ms. Jamsheer K.	Microbiology
30	Ms. Blaze Maria P.V.	Botany
31	Ms. Snema V.R.	Botany
32	Ms. Bevina T. George	Botany
33	Ms. Sreeya Francis	Botany
34	Ms. Silpa C.P.	Botany
35	Ms. AmruthaVinod	Botany
36	Ms. Delna Davis	Botany
37	Ms. Nivya .K.P	Botany
38	Ms. Donna George	Microbiology
39	Ms. Lija Gopinath	Microbiology
40	Ms. Sreedevi P.K.	Microbiology
41	Ms. Midhuna M.G.	Chemistry
42	Ms. Kavya Ramanujan	Chemistry
43	Ms. Sreelakshmi N.	Chemistry
44	Ms. Faniya Toby	Chemistry
45	Ms. Amrutha V.S.	Chemistry
46	Ms. Reshma Varghese	Chemistry
47	Ms. Ann Mariya Thomas	Chemistry
48	Ms. Ajay Johnson	Botany
49	Ms. Sreelakshmi Prakash	Envntl.Sc. &Management
50	Ms. AnjanaUnni	Envntl.Sc. &Management
51	Ms. Ayisha Abdul Khalam	Envntl.Sc. &Management
52	Ms. Aswathi .O.S.	Envntl.Sc. &Management

Dr. C. Chandrasekharan Memorial Endowment 2016

Vivek Philip Cyriac, School of Biology, Indian Institute of Science Education and Research, Thiruvananthapuram and Ms. Jis Sebastian, Research Scholar, Saraswathi Narayanan College, Perungudi, Madurai Kamraj University, Madurai are the joint recipients' of the Dr. C. Chandrasekharan Memorial Endowment Award 2016.

The Award instituted in the memory of KFRI's first Director, Dr. C. Chandrasekharan an expert in tropical forestry, carries a purse of Rs.40,000/-, a gold medal and certificate. The Award was handed over by the Hon'ble Justice K. Sukumaran (Retd.) who also delivered the Dr. Chandrasekhara memorial lecture on 17th November 2016 at KFRI.

TEAKNET

Expert Group Meeting on *"Global Evaluation of Teak Management"* (Vienna, Austria, 5-7 December 2016).

As part of a study sponsored by the International Tropical Timber Organization (ITTO), a group of experts from the International Union of Forest Research Organizations (IUFRO), the United

Nations Food and Agriculture Organization (FAO) and TEAKNET met in Vienna, Austria during 5-7 December, 2016 to finalize a Technical Report on "Global Evaluation of Teak Management" and to draft policy recommendations and guidance for future work of governments and international organizations' to promote the sustainable management of natural and planted teak forests. Besides, an evaluation mission on an ITTO-supported project "Ex-situ and In-situ Conservation of Teak (Tectona grandis) to support Sustainable Forest.

The Technical Report on global evaluation of teak management is expected to address the best practices and lessons learnt on the conservation of teak genetic resources and the sustainable management of teak forests in different country contexts in Africa, Asia and Latin America. The same aims at presenting topics of far-reaching importance to the international forest and forest-related professional community. A Global Teak Support Program was proposed by the study team

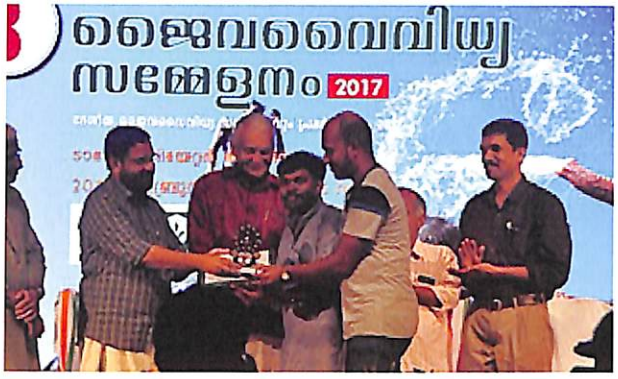
that would contribute to the preservation of the still existing native teak resources before they decline further. It would strengthen the understanding and knowledge of teak genetic resources, promote their sustainable use and management, and contribute to the development and promotion of in-situ and ex-situ conservation programs through international assistance and research collaboration. The group meeting organized by IUFRO Headquarters based on financial support provided by FAO was attended by 12 experts from 11 countries.

Asia-Pacific Forest Invasive Species Network

Species and habitat-specific protocols for the management of FIS, dissemination of these protocols among researchers and forest managers, promote data exchange and collaboration between member countries and discuss new strategies for APFISN were the key focal points of the Workshop on *'Habitat and species specific protocols for management of Forest Invasive Species (FIS) in the Asia-Pacific region' held* at Bandaranaike Memorial International Conference Hall, Colombo, Sri Lanka (23 - 27 October 2017). The successful conduct of the same by APFISN was highlighted by the presence of Mr. Kenichi Shono (FAO RAP, Thailand), Dr. Shiroma Sathyapala (FAO RAP, Italy), Dr. Weerawardana NDR (Forest Dept., Sri Lanka),

Dr.Sajeev TV (Coordinator, APFISN), and national representatives. Prominent delegates from Asia-Pacific region has shared their experiences, views and suggestions on the topic. The entire Workshop had five scientific sessions where the final session exclusively addressed the FIS related issues of Sri Lanka.

'INVASIVES' a bimonthly newsletter of the APFISN is intended to share information among countries in the Asia – Pacific region on Forest Invasive Species (FIS). The Newsletter comprises of a short description of APFISN, a short description of new invasive threat, recent news on invasive species, new publications, new books and future events. **Fact sheets** on *Mikania micrantha, Parthenium hysterophorus, Lantana camara,* Coconut leaf beetle, *Mimosa diplotricha,* Papaya mealy bug, Eucalyptus rust, *Achatina fulica* and Blue gum chalcid have



been produced and disseminated. A fact sheet gives information about the taxonomic position of a species, its distribution, biology, description, infesting habitats, threats and damage, spread, uses and management. APFISN has secured a third prize for the best stall in the National Biodiversity Congress 2017 held at Thiruvananthapuram (22–26 February 2017), organized by Kerala State Biodiversity Board, Government of Kerala.

Distinguished visitors

Hon'ble Justice K. Sukumaran (Rtd). gave away the Dr. C Chandrasekharan Endowment award and delivered the memorial lecture on 17.11.2016.

Dr. V.S. Vijayan renowned ornithologist, delivered the Forestry day lecture on 21-03-17 as part of the World Forestry Day Celebration 2017 and Open day Programme of the Institute.

Farewell

Dr. K. Mohanadas, Scientist F and Programme Coordinator, Extension and Training Division, superannuated on 31st August 2016 after 34 years of service. He was associated with Extension and Training Division since 1998 in various scientific capacities and was instrumental in facilitating various State and National level training programmes for the government officials, Forest Department officials, NGOs, farmers, horticultural officers, among others and for creating awareness on environmental conservation to students and publics by taking classes at KFRI during their regular visits. A Doctorate in Environmental Sciences from Cochin University of Science and Technology, Cochin, Dr. Mohanadas specialized in '*Population trend of Hyblaea puera Cramer* vand had successfully completed a training course on 'The safe use of pesticides - hand held applications & motorized mist blowers' from International Pesticide Application Research Centre at Imperial college of Science, Technology and Medicine, UK. His specific interests are in the field insect diversity in different forest types, insect pest management, insect population dynamics and pollination ecology studies of teak, *Tectona grandis* as part of European Union project on 'Developing know-how for the improvement and sustainable management of teak genetic resources'. He has brought out eighteen research reports, authored and co-authored many scientific papers and a number of popular articles. Dr. Mohanadas a sportsman himself was instrumental in encouraging sports in KFRI and bringing commendable achievements in various sports events during the period from 1994 to 2016. As KFRI sports team captain, he participated in KFRI annual sports, Forest Department Circle meets, Kerala State Forest Sports and in four All India Forest Sports meets. To his credit are seventy four medals, from Circle and State level sports and games events.

Dr. Mammen Chundamannil, Scientist F, and Programme Coordinator, Forestry and Human Dimension Programme Division, superannuated on 28th February 2017 after 35 years of service at KFRI. His publications have contributed immensely to knowledge on economics of forest management, especially on plantations and production forestry. Dr. Mammen Chundamannil acquired M.Phil degree (1986) from Centre for Development Studies, Thiruvananthapuram on '*Pattern of investment in forestry and its Implications on sustained yield management in Kerala*' . Subsequently, he completed doctoral research (1997) in Economics from Cochin University of Science and Technology on '*Teak plantations in Kerala an analysis of productivity and profitability*'. Dr. Mammen joined KFRI on 29th May, 1982 at the Economics Division and carried out research on natural forest, Institutional analysis, plantation economics, industry studies, wood-balance study and market studies in Kerala, site technology and productivity of teak plantations in India, history of forest management in Kerala, socioeconomics of farm forestry, and policy studies during his tenure. He has also associated in research exploring 'Intensive Multiple Use Forest Management in the Tropics: A case study of the Evergreen Forests and Teak Plantations in Kerala' as part of a project funded by the Food and Agricultural Organization of United Nations which is widely cited and had influenced the policy changes in forestry sector at the national level. His reviews (author and co-author) titled 'History of Forest Management in Kerala', 'Teak plantations in Nilambur: an economic review', 'Forest management systems in the tropical mixed forests of India' and 'Characteristics of private sector forestry research in India' has received wide acclaim and contributed significantly towards popular and expert understanding on the forestry situation in the state. Dr.Mammen's presentation on 'Sustainable use of forests: Citizens' Rights for Effective Control' during the seminar on the 'Economics of the Sustainable Use of Forest Resources' held in New Delhi in 1992 calling for popular participation in forest management was way ahead of implementation of Participatory Forest Management programme in Kerala. He had also prepared report on the progress of participatory conservation and forest management in Kerala. Dr. Mammen's significant contributions as a team member in the Environmental Impact Assessment of the Silent Valley hydroelectric project and the proposed Pooyamkutty hydroelectric project that was eventually shelved considering the social and ecological implications brought out by the study. He has published several research reports, articles in academic journals and had made presentations in national and international seminars and conferences. Dr. Mammen maintained close relations with all cadres of staff in KFRI and on many occasions represented the interests of staff to the authorities. He was active in the annual sports events representing KFRI and has won medals for KFRI on several occasions at the National Forest Sports Meet.

Mr. T.P. Padmanabhan joined the Institute on 17th October 1991 as Cook cum Attender and retired from service on 30th June 2016 as Attender after 25 years of service.


KFRI