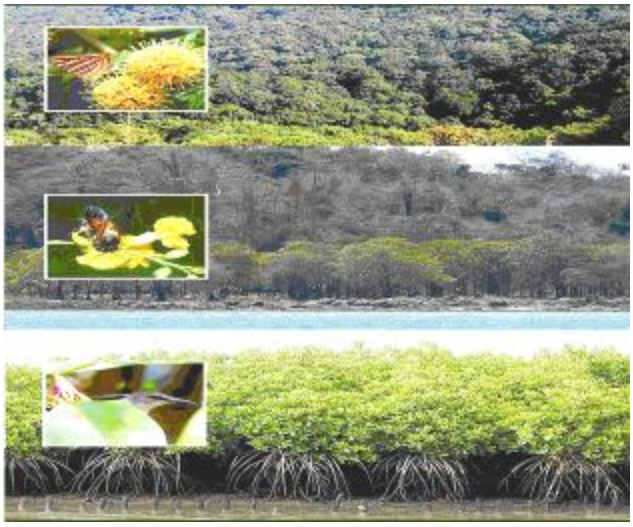
Proceedings of the National Seminar

on

Tropical Ecosystems: Structure, Function and Services

(TESFS -2010)

28th & 29th December 2010



Organized by

Institute of Forest Genetics and Tree Breeding

(Indian Council of Forestry Research & Education)

Coimbatore- 64 1002

Co-sponsored
by
Department of Biotechnology
&
Department of Science and Technology
Govt. of India

1. Background

Humankind is greatly benefited from various ecosystem resources of our Planet. Often it is not realized that very simple services such as availability of clean drinking water to getting a flower pollinated could be inadvertently disrupted. Though anthropogenic destruction is a major extinction vortex there are yet other forces. For instance, *Brugueira parviflora* an obligatory butterfly pollinated true mangrove taxon is reportedly extinct in the west coast of Kerala. It is presumed that the major extinction force in this case is pollinator limitation.

The Convention of Biological Diversity(CBD) declared that it is the responsibility of individual countries to document their natural resources. But a lot more has to be done from understanding the ecosystem diversity, documenting individual species and their genetic make up. The tangible and intangible benefits of natural ecosystems are very poorly understood and documented in general and particularly under Indian context.

TESFS-2010 was aimed to bring professionals involved in ecology and conservation biology together so as to make an insight in to the dynamics of tropical ecosystems. It was essentially an intellectual experience sharing on the structure, functions and services of different ecosystems. It is also needless to say that this initiative helped us to take stock of the current situation and apprise the policy makers and the beneficiaries on the recent developments in this field and chalk out future strategies to be adopted for the protection and preservation of the highly fragile tropical ecosystems of the country.

As a culmination of our activities at the Institute of Forest Genetics and Tree Breeding, Coimbatore during the International Year of Biodiversity (IYB-2010) and to welcome the forthcoming International Year of Forests (IYF-2011) the National Seminar on **Tropical Ecosystems, Structure, Functions and Services – (TESFS-2010)**, was organized on 28 th – 29th December, 2010 by inviting experts and professionals, young researchers in this field.

2. Objectives

To bring together Ecologists, Conservation Biologists and Professionals involved in Forestry Sciences from different parts of the country to reflect and share information on the Structure, Function and Services of diverse ecosystems in the country.

3. Thrust areas

Ecosystem Structure: Endemism, Extinction Vortices, Floristics, Forest Types, Fragile Ecosystems, Geomorphology, GIS studies, Landscape, Molecular Ecology, Population Biology and Species Recovery.

Ecosystem Functions: Apiology, Avian Biology, Carbon Sequestration, Ecotoxicology, Environmental Impact Assessment, Life History Traits, Phenology, Plant Pollinator Interactions, Reproductive Ecology, Vegetation Dynamics and Weed Invasion.

Ecosystems Services: Avian services Bio-economics, Cultural & Recreational services, Climate Regulation, Ecotourism, Eco-services disruption, Ethnobotany, Hydrology, Minor Forest Produce, Nutrient Cycling, Pollination, Pharmacognosy and Provisioning Services.

4. Organizers

The details of organizers, co-sponsors and the members of the National Advisory Committee of TESFS-2010 are as follows:-

Chairman and Chief Patron

Dr. G. S. Rawat,
Director General, ICFRE, Dehradun.

Convener

Dr. N. Krishnakumar,
Director , IFGTB, Coimbatore.

Organizing Secretary

Dr. B. Nagarajan, Scientist – E, IFGTB, Coimbatore.

Members

Shri. T. P. Raghunath
Dr. B. Gurudev Sigh
Dr. A. Balu
Dr. K. Palanisamy
Dr. S. Murugesan
Shri. R. S. C. Jayaraj
Shri. R. Vivekanandan
Dr. K. R. Sasidharan
Dr. C. Kunhikannan
Shri. K. Ravichandran

5. Co-sponsors

i) Department of Biotechnology
ii) Department of Science and Technology, Government of India.

6. National Advisory Committee

Shri. Srinivasamurthy, Directorate of Environment, TamilNadu.
Dr. Ajit Pattanaik, CDA, Orissa
Dr. K. V. Sankaran, Director, KFRI
Dr. K. Kathiresan, CAS in Marine Biology, Annamalai University
Dr. K. N. Ganeshiah, UAS & ATREE, Bangalore
Dr. G. V. S. Murthy, BSI, Coimbatore
Dr. G. Areendran, Envis Centre, WWF India.
Dr. A. J. Solomon Raju, Professor, DES, Andhra University
Dr. B. R. Ramesh, French Institute, Pondichery
Dr. Varatharajan, Manipur University
Dr. Rajesh Sharma, HFRI, Shimla, Himachal Pradesh
Dr. K. Ravichandran, MSU, Tirunelveli, Tamilnadu
Dr. K. Ravikumar, FRLHT, Bangalore
Dr. M. Siddhartha Muthu Vijayan, C-MMACS, Bangalore
Dr. R. Vasudeva, College of Forestry, Sirsi, Karnataka
Dr. D. Narasimhan, Madras Christian College, Chennai
Dr. Sabu. K. Thomas, St. Joseph's College, Calicut
Dr. C. Sivaperuman, ZSI, Port Blair, Andamans

7. Participants

A total number of 185 individuals, consisting of Scientists, Forest Officers, Forest Officer Trainees, Research Scholars, University and College teachers and students, Environmentalists and representatives from NGOs (Vide Annexture-1) actively participated in the seminar. Besides the seminar attracted many general public, the press and electronic media who were keen observers of the sessions.

8. Details of sessions

Date: 28.12.2010

(i) Inaugural Session

Rapporteur: Dr. K. R. Sasidharan

The Inaugural Session started at 9.30 am on 28.12.2010. Shri T.P. Raghunath, Group Co-ordinator (Research) welcomed the gathering and also read out the message from Shri Jai Ram Ramesh, Hon'ble Minister for Environment and Forests, Govt. of India.

Dr. N. Krishnakumar while addressing the participants expressed that the aim of the Seminar was to bring the Forest Managers, Professionals and Scientists to one platform for thinking about the current status of the tropical ecosystems and the need for conserving them. He observed that the tropical forests constitute nearly about 80 per cent of the forest area of India. With only 2.5 per cent of land area accounts for 7-8 per cent of recorded species of the world. Hence understanding the structure, function and services of ecosystem becomes important. He stated that IFGTB has been giving importance for research both on production forestry as well as conservation forestry. He added that the institute has released eight clones of *Eucalyptus* and *Casuarina*, but at the same time works on reproductive biology, plant-pollinator interactions and threatened plant recovery research are also given equal importance. He viewed that the information available on tropical ecosystem is scanty and the classical Botanists and Zoologists have become rare now-a-days. He reminded that, in the International Year of Forestry, 2011, we should be able to identify new areas of research on tropical ecosystems and hoped that the seminar would serve this purpose. He mentioned that, the recommendations emanated from the seminar shall be sent to the Govt. of India and all the organizations concerned for action and policy formulations.

Dr. B. Nagarajan, while narrating the objectives of the seminar informed that the United Nations declared 2011 as the International Year of Forestry. He also viewed that some of the constituent species of Mangroves like *Bruguiera gymnorrhiza* are facing serious threat and hoped that, the Seminar would help to take stock of the situation encountered by many such species.

Dr. G.S. Rawat, Director General, ICFRE informed that TESFS-2010 is the last activity of ICFRE in the International Year of Biodiversity, 2010. He said that the Council had conducted a series of programmes related to Biodiversity conservation during this year. He added that the National Bureau of Forest Genetic Resources is being established in ICFRE. He stated that India is a megadiversity country and the people are depending on the tropical ecosystems, particularly the forests for meeting various requirements. The per capita forest cover of the country is very less, he observed. He stressed for developing strategies for conservation of ecosystems and their sustainable management, by pooling the inputs from biologists, managers, conservationists and people from socio-political fields. He emphasized for long term monitoring of the ecosystems and proper networking with all stakeholders, especially the public, whose support is essential for the success of all efforts towards conservation.

Dr. P. J. Dilip Kumar, Director General (Forests), MoEF inaugurated the Seminar, by lighting the lamp. He stated that, we are moving from the International Year of Biodiversity in 2010 to International Year of Forestry in 2011. He observed that mankind gets a number of products and services from the tropical ecosystems. He quoted the Vedic concept of unity of all living beings, including human beings, natural forces and the environment. He opined that the civic society is very much interested to understand more about the nature and its conservation and hence communication on biodiversity is very important. He noted that, this is an era of communication and particularly, the younger generation is habituated with the use of internet and it could be an effective tool for communication on nature, biodiversity or conservation. He called up on the forestry sector not to remain in isolation and advised to show case the developments, findings etc. through the internet. He also stressed to have networking between the Departments, NGOs, Civic Societies etc. for effective communication on matters related to environment.

He noted that, during colonial rule, forests were looked up on as a commercial resource and there was no sensitivity to the ecological services provided by them. He mentioned that even during 1960s and 1970s the economic returns from the forests were considered as important and stress was given to raising of monoculture plantations of industrial wood species. Subsequently in 1980s there was a shift in the thought and more awareness was there on the ecological values of forests, he said. Currently, the forests are looked upon as a solution to climate change situation, at global level.

He stated that forests are the source of 30 to 40 percent of the income of the rural people and hence it has a greater role to play in the rural economy. He observed that forests provide livelihood for 200 to 300 million poor people of India, as they depend on the biodiversity, water etc. from the forest areas. He cited an example of a village near Chennai, wherein through watershed management there was improvement in the water table and well water. He hoped that, when the economical situation improves, the dependency on forests is also likely to be reduced. He noted that now-a-days there are lots of opportunities for the youth of our country; they are to be productively engaged skills to be developed and literacy improved, so as to enable them to compete in the global market for human resources. He opined that the developments have to reach rural areas and the rural masses have to become part of the larger economy. He also mentioned that, ICFRE would be organizing the National Forestry Congress in November 2011 and requested everybody's active participation in the event.

Shri K. Ravichandran, Extension Officer, proposed the vote of thanks.

Theme: Topical Ecosystems: Structure

Lead talk by: Dr. D. Narasimhan, Madras Christian College, Chennai

(ii) Technical Session-1: Forest Biodiversity

Chairman : Dr. R.Annamalai
Co-chairman : Dr. C. Sivaperuman

Rapporteur 1 :Dr. J. P. Jacob
Rapporteur 2 : Dr. Anjan Kumar Prushty

The following papers were presented during the session:-

1. Bird communities of Great Nicobar Biosphere Reserve (GNBR): Patterns of diversity and abundance- C. Sivaperuman

He informed that in Andamans, the major birds preying on bees was Drongo in Andamans. Occurrence of migratory birds was not observed in the Great Nicobar Biosphere Reserve.

2. Bryophyte diversity of the Malabar Wildlife Sanctuary in the Westen Ghats of India- K. P. Rajesh

No specific comments

3. Mulberry (*Morus* sp.) biodiversity conservation management and sustainable utilization in India- C. K. Kamble

He stated that the maximum leaf biomass obtained is 70 MT/ha/yr. Shade tolerant varieties are available for intercropping. Salt tolerant varieties have less productivity.

4. Diversity indices: Is it the time to move on - A case study on butterflies- K. S. Anoopdas.

Discussion / comments: Very scanty information is available on butterfly migration. The reasons for butterfly migration to be elucidated besides how the epicenters are formed and dispersed and how the population gets supplemented in the local areas.

5. Diversity of non-pathogenic root fungal association in South Indian Grasses- K. Sathiyadash

Grasses in dry areas also harbour the VAM fungus, *Glomus mossae*.

Discussion / comments: Seasonal variation needs to be studied.

6. Life forms of bryophytes in Kerala part of Western Ghats, India- Manju C N

No specific comments

7. Assessment of status and diversity of Sea grasses in South Andaman- R. Ambika

Discussion / comments: Species composition in inter tidal and tidal zones to be studied.

8. Patterns in the composition and distribution of fauna, Thar Desert, India- C. Sivaperuman

Changing perception of people after digging of Indira Gandhi Canal was discussed. The economic level was enhanced by involvement in many agricultural practices including cash crops.

Discussion / comments: Correlation between high bird population and insect population to be looked in to.

9. Biodiversity of trees and ornamental plants in Karunya University- D. Subhashini

Discussion / comments: Comparison of nearby forest area with the campus tree diversity may be done.

10. First record of Avifaunal communities in sathyamangalam Wildlife sanctury, India - A. Kumaraguru.

No specific comments.

11. Species diversity of wood destroying termites- A comparative assessment between natural and man- made ecosystem in South India- R. R. Shanbhag

Discussion / comments: Preference for wood hosts of termites may be studied.

12. Assessment of floral biodiversity of Tropical Dry Evergreen Forest at Point Calimer- R. Revathi

Discussion / comments: Plants which can help in prevention of soil erosion in the area may be identified. Invasion by *Prosopis* in to the forest areas needs monitoring.

13. Population dynamics of soil fauna - R. Rajarishi

Discussion / comments: Rate of decomposition may be compared between the sites for understanding correlation with faunal abundance.

(iii)Technical Session-2: Population Biology, Endemism and Species Recovery

Chairman : Shri T. S. Srinivasamurthy
Co-chairman : Dr. R. Vasudeva

Rapporteur 1 : Dr. N. V. Mathish
Rapporteur 2 : Dr. S. P. Subramani

1. *Semecarpus kathalekanensis*: The first critically endangered freshwater swamp tree species to be conserved through species recovery plan – R. Vasudeva

The author presented the recovery of one of the critically endangered species of Anacardiaceae, *Semecarpus kathalekanensis,* and its habitat of freshwater swamp in the Western Ghats. The species occurs in low altitude, in relic forests and is associated with *Myristica malabarica, Dipterocarpus indicus, Syzygium travancoricum* and *Saraca asoca*. The population has been threatened due to land conversion and consequent habitat loss, low seed germination and reproductive constraints. The loss of associated flora and fauna were also discussed. Scanty natural regeneration of this species and problems of re-introduction were highlighted discussed. Tissue culture in this species was reported to be difficult.

Discussion / comments: To a query on the sex ratio in natural and introduced populations, the author replied that in one of the populations there were 60 males, 40 females and 3 monoecious individuals. No SSR markers were available for determination of the sex of the introduced populations. The recovery was successful as about 2000 plants were established in six populations.

2. A study of the effect of fencing around sholas in Nilgiris with special focus on endemic and threatened species – P.S. Udayan

The Shola forests of Nilgiris, their characteristics, effect of chain link fencing during HADP programme in 1992-94 on the present day species diversity especially on rare, endemic and threatened plants were described.

Discussion / comments: Dr. Rajiv Srivasthava, mentioned that the species composition depended on the aspect of the Sholas. He informed that Wattle was a major threat to Sholas. During discussion, it was agreed that the population studies of rare species, species diversity along shola edges, inner forest areas, effect of invasive species like wattle need to be studied. Comparative studies with controlled plot are also required for long term monitoring of sholas. Dr.Krishnakumar informed that such studies need to be taken up in a programme mode. Dr. Balaji mentioned that these studies need to be carried out over a period of time. Fencing may prevent grazing and the studies will yield data for year wise management practices.

3. Morphological description and cluster analysis of some species of Bamboo - A. Suganya

The author presented the different types of bamboos, and their morphological characters for easy differentiation of bamboos. Habit, number of culms, nature of sheath, culm and internode, thickness, zig-zag pattern, colour, bud formation, branching pattern, and other characters were used for cluster analysis to determine the genetic relatedness.

Discussion / comments: Dr. P. Ravichandran, MS University, appreciated the work. He agreed with the author that ligules and culm sheaths were two of the key characters for differentiation of Bamboo species. Dr. Varatharajan, informed that Karyotypic work is also necessary for this kind of work and is being carried out in Manipur University. Shri. Shanmugasundaram felt that some of the species like *Bambusa wamin*, is now grouped under *Bambusa vulgaris* and felt that more detailed studies using molecular markers need to be carried out to resolve these issues.

4. Distribution, stand structure and habitat of a critically endangered plant *Coscinium fenestratum* Colebr. (Menispermaceae): implications to conservation - H.N. Thriveni

The author presented on *Coscinium*, its uses, distribution, mapping of their wild populations and GIS studies. The results suggested that there is a need for a species recovery programme.

Discussion/ comments: To a query by Dr. Balaji, Ms. Thriveni replied that it is not cultivated as it is a woody climber. Dr. Vasudeva informed that vegetative propagation, and nursery techniques have been studied by their group. It was informed that *Berberis aristata* was commonly used as an adulterant to meet the industrial demand of this species.

5. *Terminalia gella* Dalz.: A lesser known endemic tree species of India - N. Venkata subramanian

Terminalia gella, a lesser known species of *Terminalia* and is also data deficient according to the IUCN classification. The distribution, morphological characters, allied species, fruit size, colour, leaf characteristics, glands and leaf galls were described. The author explained that the fruit size and shape were a critical parameters for differentiating this species from *T. chebula*. The high fruit set in *T. gella* compared to *T. chebula*, and the limited knowledge on their distinction, resulted in admixture of these fruits.

Discussion/ comments: To a query, the author informed that there were no studies on the Tannin content, and that 18 of the 200 *Terminalia* species were hermaphrodite. To a query by the Co Chairman, Dr. Venkatasubramanian replied that *T. gella* was not an uncommon species. Dr. Maheshwar Hegde felt that there is considerable intra-specific varation in *T. chebula* itself, to which Dr. Venkatasubramanian replied that there were a number of other traits also which need to be considered before determining the species identity . In response to a query from Dr.D. Narasimhan, the author mentioned that the species was not endangered.

6. Conservation of wild jack (*Atrocarpus hirsutus* Lam.) - A threatened medicinal and multipurpose endemic tree of Western Ghats - Maheshwar Hegde

The author presented various aspects of wild jack, endemism, natural distribution, lack of regeneration in wild, isozyme studies using different markers and establishment of Seed production Areas at Palode. The Isozyme studies revealed 95 % intra-population variation.

Discussion/ comments: To a query, the author informed that the species is getting threatened due to expanding rubber plantations and oil palm cultivation. He informed that in Topslip, no regeneration was observed sue to wildlife. Shri. Shanmugasundaram enquired as to why thinning was carried out in a vulnerable species. The author replied that it was needed to increase the quality of the SPA. Dr. D. Narasimhan felt that it could be possible to raise plantations in lower areas also.

7. Role of plantation forestry in the tropical ecosystem – perspective of *Ailanthes excelsa* Roxb - D.R.S. Sekar

The author presented the distribution of Ailanthus, its seed variations, nursery establishment, clonal trials in different places; their growth performance and their use in Match box industries.

Discussion/ comments: To a query by Shri. Shanmugasundaram, the pest control measures for *Eligma* and *Atteva* were discussed. The author replied that Endosultan 5% or Jatropha oil mixed with Kerosene are recommended for the pests. He also informed that *Atteva* was the more serious pest among the two.

13. Genetic variation in *Terminalia chebula* – an important minor forest produce from Eastern Ghats of Tamil Nadu - Maheshwar Hegde

The author presented the distribution of *T. chebula* in the Eastern Ghats, the variations in fruit size, and the variations as determined using RAPD markers.

(iv) Technical Session-3: Ecorestoration, Fragile Ecosystems and Landscapes

Chairman : Dr. S. Balaji
Co-chairman : Dr. K. Kathiresan

Rapporteur 1 : Dr. V. Mohan
Rapporteur 2 : Ms. K. Shanthi

1. Mangrove forest ecosystem of India: Unique features of biodiversity and ecosystem services- Dr. K. Kathiresan

He gave a detailed account of the mangrove forests in India in general and that of Tamil Nadu in particular. He highlighted environmental services of mangroves during Tsunami. He emphasized that in the last 2 decades, mangrove coverage in India has been well maintained without any drastic change in spite of growing threats by man and natural calamities. He also highlighted the new mangrove species *Rhizophora annamalaiana* Kathir. reported by him and explained about various propagation techniques. The efforts made by his research station could save lives of 1000 people in Tamil Nadu, he said. He suggested that conserving or restoring mangroves will save the coastal communities from future events of natural disasters.

2. Endemic and non-endemic dung beetles in tropical montane cloud forests [Shola forests] in the Western Ghats and the conservational implication - Sabu K. Thomas

He gave community structure and species composition of dung beetle assemblage in the Shola forest in Eravikulam National Park. The study revealed that the dung beetle is dominated by flightless species *Ochicanthion devagiriensis* and presence as well as dominance by this dung beetle species is indicative of the ready availability of food resources and lack of competition from other dung beetle species.

3.Occurrence and diversity of Arbuscular Mycorrhizal Fungi in Sholas of Nilgiri Biosphere Reserve, Western Ghats – T. Muthukumar

He highlighted the importance of Sholas and assessment of microbial diversity. The study revealed that, of the examined 100 plant species belonging to 42 families, 72 species had AM fungal colonization. He could record spore morphotypes belonging to 26 AM fungal species in the study.

4. Urban verdures and the disregarded diversity within: A case study of butterflies from Mumbai- P. R. Arun

The paper described the Butterfly diversity of green urban township in Mumbai. He recorded 82 species of butterflies from the study area, which included several uncommon and non-generalist species.

5. Fragile ecosystems requiring utmost attention – The Sacred Groves - Kannan C. S. Warrier

He gave an account of the role of Sacred Groves in conserving Biodiversity and stated that many of the Sacred Groves in our country are fragile and face threat from human population due to changes in land use patterns, socio-economic status and cultural beliefs. He highlighted exhaustive floristic inventory carried out in Alappuzha district, Kerala and reported that many valuable medicinal plants and wild relatives of cultivated species were found in those groves.

6. Wetland ecosystem of Kachchh: Unique structure varied function- Dr. H. Hegde

He gave a profile of diverse kinds of wetlands in the study area including Mangroves, coral reefs beaches, mudflats, tidal flats, flood plain system and fresh water lakes and reservoirs and these wetlands are major wintering areas for cranes, pelicans, flamingos, ducks and shore birds. He also highlighted dominant mangrove vegetation and diverse group of organisms reported from Little Rann of Kachchh wet land.

7. Seed biology of selected shola species of Nilgiris - elements of a fragile ecosystem- R. Anandalakshmi

She highlighted the seed biology of eight different Shola species of the Nilgiri hills. The study indicated variation in the adaptability of the species for germination under different environment conditions.

8. Distribution of mangrove Meiofaunal composition with relationship to organic carbon and carbonate in Port Blair, South Andaman, India – V. Sachithanandam

He highlighted the importance of mangroves in Andaman group of Islands and need to understand the relationship between distribution of meiofaunal composition with particular reference to organic carbon and carbonate in Port Blair, South Andaman. The study revealed that the nematodes are dominant in all the study locations. He concluded that the average amount of organic carbon and carbonate is essential for meiofaunal diversity in mangroves.

9.Forest restoration through Tamil Nadu Afforestation Programme - S. Balaji

He highlighted the achievements made under Tamil Nadu Afforestation Programme (TAP) in Tamil Nadu, in phase I and Phase II. He suggested the following activities as follow up of TAP: Periodic monitoring and biodiversity assessment, improvement in carrying capacity for wild life and cattle, sustainable use of bamboos and other NTFPs for better livelihood.

(v) Poster Session

A total number of 31 posters were presented during the seminar (Annexure-2). The posters were evaluated by a committee consisting of Dr. S. Maniyan and Dr. V. Narmadha Bai, from the Department of Botany, Bharathiar University, Coimbatore and Dr. K. Sasikala from the Department of Zoology, Bharathiar University, Coimbatore. The best poster awards were won by Dr. C. Sivaperuman (I-Prize), Mrs. A. Shanmugapriya (II –Prize) and Mr. P. Ramana (III –Prize).

(vi) Cultural evening

A cultural evening consisting of music and classical dance performance by local troupes of children was arranged for the participants on 28.12.2010.

Date: 29.12.2010

Theme: Tropical Ecosystems: Functions

Lead talk by: Dr. A. J. Solomon Raju, Professor & Head, Department of Environmental Sciences, Andhra University, Visakhapatnam

(vii) Technical Session-4: Molecular Ecology, Geomorphology and GIS studies

Chairman : Shri P. Durairasu
Co-chairman : Dr. G.Umapathy

Rapporteur 1 : Shri R. Vivekanandan
Rapporteur 2 : Dr. K. S. Anoopdas

1. Application of GIS & Remote Sensing in Forestry- G. Areendran

He discussed about the recent trends in GIS, Remote sensing and GPS tools in forest decision making with case studies *viz.* Satellite remote sensing based forest cover mapping of Kaziranga Karbi-Anglong Landscape, Mapping of Forest Degradation in Singrauli region of Madhya Pradesh, Mapping of *Rhododendron* distribution in Western Arunachal Landscape (WAL), Mapping of Land use/ Land cover changes in and around Mundra port, Kutch, Gujarat, Addressing REDD using Remote sensing and GIS tools – A study of Sonitpur district, Assam etc.

2.Ecology driving genetic variation: A comparative phylogeography of Indian populations of jungle cat (*Felis chaus*) and leopard cat (*Prionailurus bengalensis*)- Shomita Mukherjee.

She explained how geographic distribution and ecology shape genetic variation and population structure in jungle cat (*Felis chaus*) and leopard cat (*Prionailurus bengalensis*) and explained the sampling, Phylogenetic trees, Haplotypic networks, distribution and genetic variation, Niche model analysis using climatic variables etc.

3. Impact of habitat fragmentation on arboreal mammals in wet evergreen forest of Western Ghats with special emphasis on lion-tailed macaque – G. Umapathy

The following points were presented:-

- The Lion-tailed macaque (*Macaca silenus*) was present only in 10 of the 25 quality habitat fragments surveyed.
- The canopy height was the best predictor of the occurrence of the lion-tailed macaque.
- Low reproductive fecundity noticed.
- Feeding ecology, habitat parameters, co-existence with other animals (Langur and Squirrels).
- Decrease in birth and growth rates-compared previous reports.
- Genetic studies using faecal samples carried out.
- Total number of individuals increased from 154 to 242 with high increase in Puthuthotam area (Availability of coffee and berry type fruit) from 43 to 122.

4.Assessment of fruit variations in *Kingiodendron pinnatum* – A red listed species from Southern Western Ghats by Random Amplified Polymorphic DNA (RAPD) -
P. Ravichandran

He discussed the outcome of a survey of *Kingiodendron pinnatum* throughout the Southern Western Ghats, the morphological variations existing among populations and the genetic diversity studies using molecular markers.

(viii)Technical Session-5: Vegetation Dynamics, Plant-Animal Interactions, Phenology, Life History Traits and Carbon sequestration

Chairman : Shri N. Gopinathan
Co-chairman : Dr. A. J. Solomon Raju

Rapporteur 1 : Dr. Maheswar Hegde
Rapporteur 2 : Ms. Desa Meena

1. Role of Anthophilous Thrips in Pollination- R. Vartharajan

Discussion / comments: Dr. C. K. Kamble said that thrips are pests in Mulberry and enquired about the damages caused by thrips in other crops. The speaker replied that there are about 700 species of thrips occurring in India, out of which only 12 species are pests which carry dangerous viruses. Flower thrips are not pests. They do not affect the flower because they lay only eggs inside. Dr. Vasudeva enquired about the thrips functionality and their synchrony of emergence with flowers. The speaker replied that they adjust with the environmental factors and flower opening time quickly. Dr. Solomon Raju enquired whether thrips help in cross pollination or not and what distance they carry pollen. The speaker replied affirmatively and told that they can carry pollen up to 3-5kms distance. Dr. Gurudev Singh enquired what makes thrips to move with female flowers. The speaker replied that once the male cones open, they produce heat and severe stinking smell which repel thrips to female cones which also produce mild sexy odour to attract thrips carrying pollen.

2. Conifers of N.W. Himalayas: Problems, prospects and their reproductive system- Rajesh Sharma.

He highlighted the problems encountered in the production of quality seeds in conifers and stated that, he could get some solutions to this issue, particularly after listening to the talks given by Dr. Solomon Raju on reproductive biology in Cycas and Dr. Varatharajan on thrips pollination.

3 Regeneration status of *Terminalias* in the Central Forest Circle of Kerala – P.K. Chandrasekhara Pillai

Discussion / comments: Dr. C. K. Kamble and Dr. G. Kumarvelu enquired about differences found in the regeneration of *Terminalia* species including *T. arjuna*. The speaker replied that the regeneration is mostly through root suckers or re-sprouts from earlier seedlings. He also added that, higher regeneration was observed in the *T. paniculata*. He stated that, poor seed germination, i.e less than 1% was observed in *T. crenulata*.

4. Butterflies as bio-indicators in tropical forest ecosystems- Dr. J. Prasanth Jacob

Discussion/ comments: Dr.Vartharajan enquired whether any endangered species of butterflies were included in the study. The speaker replied that only ten common Papilionid species were studied. Dr. Solomon Raju enquired about the overlapping occurrence of species. The speaker replied that many species are specific to particular forest types. Solomon Raju asked whether host species of butterflies at larval stages were studied to which speaker answered no.

5. Mangrove ecosystems in Mumbai, present status and need for conservation - Maya Mahajan

Discussion / comments: Dr. C. K. Kamble enquired about the use of mangroves to the society. The speaker replied that mangroves act as a buffer between sea and land. There are some medicinally important mangroves available. They absorb CO_2 and heavy metals. They help many fishes and crabs to breed which is useful for fishermen.

6. Plants associated with the bee funa of the Nilgiris- K. R. Sasidharan

Discussion / comments: Dr. Solomon Raju suggested to prepare a seasonal phenological variations calendar. He also enquired whether any species of bee studied was endangered. The speaker replied that only some bee species are classified as rare species, but not endangered. Shri. Gopinathan enquired about the logic behind the sample plot selection. The speaker replied that it has been done proportionately to the area under different forest types.

7. Comparative study on physical and physiological features of pollination-with special emphasis to Bats- Deepan Chakravarthy

Discussion / comments: Shri N. Gopinathan appreciated the study and opined that as it is taken up by Forest Department the works need to be continued.

8. Population and Breeding Ecology of select species of birds in Thiruppudaimaruthur Heronry, Tamil Nadu- S. Jayakumar

Discussion / comments: Dr. Solomon Raju enquired about any exotic species other than *Prosopis chilensis* (*Prosopis julifora)* occurring in the area. He asked why birds preferred *Prosopis*. The speaker replied that 90% of bird's nesting was found on *Prosopis* as they gave protection from predators, due to the presence of thorns.

9. A study of floral biology and pollination in *Excoecaria agallocha L.* (Euphorbiaceae) – P. Suvarnaraju

There was no discussion on this topic.

10. Phytosociological studies of forests in Sankosh river basin, Bhutan – C. Kunhikannan

There was no discussion on this topic.

Shri. N. Gopanithan, Chairman concluded the session and suggested that awareness on biodiversity should be promoted. Panchayats should be linked with the information sources so as to create awareness among the local people. He also suggested to involve the people in *ex-situ* conservation. Dr. Solomon Raju suggested to promote active participation of youngsters in field biology as there is dearth of qualified field biologists in the country.

(ix)Technical Session-6: Weed Invasion, Ecotoxicology, EIA and Ecosystem Management

Chairman : Dr. Rajiv K. Srivastava
Co-chairman : Dr. P. Ravichandran

Rapporteur 1 : Dr. A. Karthikeyan
Rapporteur 2 : Dr. N. Venkatasubramanian

1. Impact of tourism visitation to cultural heritage sites in the Western Ghat forests of Tamil Nadu – T. Sekar

The paper dealt with ecological uniqueness of the Western Ghats and its diverse forest types, indigenous communities and cultural heritage. It insisted on creating awareness about the importance of forests among the people. It also highlighted necessity for evaluation of impacts of tourism.

Discussion / comments: There were queries on the mode of developing tourism in the forest areas, without disturbing it. It was answered that tourism could be encouraged in forest areas by creating better amenities and managed by creating awareness on environmental protection among people.

2. Heavy metal contamination in fishes from select Bird Sanctuaries in Tamil Nadu-S. Jayakumar

The study conducted on four bird sanctuaries, which were highly contaminated by the heavy metals such as Copper (Cu), Chromium (Cr) and Cadmium (Cd) was presented. The heavy metals were found to affect some fish communities like *Catla catla, O. mossambicus* etc.

Discussion / comments: To a query on the logic in selection of these three heavy metals, it was replied that, they are the most common heavy metals contaminants found in the waters of bird sanctuaries. Regarding the question on the adverse effect of the three heavy metals to the fishes, it was answered that, Chromium was the most dangerous one.

3. Effect of forest disturbance on rain forest butterflies: A case study from Silent Valley Park, Kerala, India- C. F. Binoy

The paper gave a detailed account on the role of butterflies in ecosystem services and the endemic butterflies present in Silent Valley. The study carried out in disturbed and undisturbed forest areas and the diversity of butterflies in these habitats was highlighted.

Discussion/ comments: To a query on the abundance of butterflies in disturbed forest areas, it was replied that in disturbed forests there would be more flowering plants as undergrowth and the butterflies prefer this kind of habitats. When it was asked whether any specific group of butterflies is specific to grasslands, it was answered that, there is no specific group confined to grasslands.

4. Pesticide contamination in select species of frogs in an Agro-ecosystem in Kerala –K. Ganesh

The studies conducted on pesticide contamination in the agro-ecosystems in Kerala, during two seasons of rice cultivation (Rabbi and Khariff) were presented. It gave a detailed account on frogs which were mostly affected by the pesticides like DDT, heptachlor, HCH, endosulfan etc.

Discussion / comments: To a query on whether DDT and endosulfan are still used, it was replied that in some places, these insecticides are being used.

5. Ecological and social dimensions of *Prosopis juliflora* in drylands of western India: Management challenges- Anjan Kumar Prushty

A critical review of *Prosopis chilensis* (*Prosopis juliflora)* in dry lands, both positive and negative aspects and its role in the common man's economy were explained in the presentation.

Discussion /comments: The impact of eradication or removal of *P.chilensis* (*P. juliflora)* on the society was discussed and it was pointed out that, if this species is eradicated, the fuel wood consumption and the pressure on the existing forests are likely to increase.

6. An overview of carbon sequestration techniques- Kailasha Chandra Ahir

The carbon sequestration techniques in oceanic regions were highlighted in the presentation.

7. Marine ecosystem management: Mahatma Gandhi Marine National Park, Wandoor, Andaman Islands - K. Ravichandran

A holistic view of the Andaman Islands and management of the unique marine ecosystem were discussed.

Discussion / comments: To a query on human intervention in the mangrove ecosystem in the Andamans, it was replied that, now-a-days, the intervention is not much, as there is awareness among the people on the conservation of mangroves. To another enquiry on the magnitude of bleaching of coral reefs, it was clarified that, the bleaching is about 60 per cent.

8. Ecological services of two traditional agroforestry systems in two contrasting agro-climatic zones of Karnataka – B. Dhanya

The paper highlighted on the native tree species which gave good yield in coffee plantations and ensured its quality. The importance of planting trees like *Ficus* in the agricultural fields at Mandya district was discussed and recommended such species for planting as an intercrop along with agricultural crops.

Discussion / comments: It was enquired that, if shade could give better yield in coffee plantations, whether such species could be recommended to planters and it was replied that the maintenance of native species is more labour intensive.

9. Carbon sinks services of soils of different tropical forest ecosystems in Tamil Nadu, Kerala and Andaman Islands - C. Buvaneswaran

The role of forests as carbon sink and its importance in the present day context was discussed. It was pointed out that the soil carbon content reduced from evergreen to dry deciduous forests.

Discussion / comments: To a query on the relationship between the vegetation and soil carbon content, it was answered that soils of different forest types have their own carbon sinking properties.

10. Geospatial technology in locating the landslide zones in parts of Kodaikanal Taluk, South India- B. Gurugnanam

The application of geospatial technology to identify the land sliding zones in Kodaikanal area and the findings made during the study were discussed.

Discussion/ comments: To a query on the utility of geospatial technology to predict landslides on roads, it was replied that it has yet to be used in such situations.

Theme: Tropical Ecosystems: Services

Lead talk by: Dr. G. Kumaravelu, Additional PCCF (Retd.) & Full Time Member, Planning Commission, Govt. of Tamil Nadu

(x)Technical Session-7: Ecosystem Services, Bioprospecting and Bioeconomics

Chairman : Dr. P. A. Azeez
Co-chairman : Dr. M. Muthuraman

Rapporteur1 : Shri M. Maria Dominic Savio

In his opening remark, Dr. Azeez, Chairman of the session made an appeal that the knowledge on conservation should reach the intended groups / stakeholders, so that the full potential of the ecosystem services can be utilized.

1. Role of forestry extension in biodiversity conservation- V. Irulandi

The various activities being carried out by the Extension Wing of Tamil Nadu Forest Department were presented.
There was no discussion on this topic.

2. Life saving gadgets for wild honey gatherers - M. Muthuraman

He detailed the progress made under a unique attempt to use high end technology to empower tribals to sustain their traditional livelihoods. He listed the use of screw carabiner, tape sling seat harness etc. being attempted during the traditional method of harvesting honey in Sathyamangalam forests.

Discussion / comments: As part of the presentation, Dr. Seshadri of National Adventure and Leadership School spoke of his experience in being associated with this unique attempt.

3. Xenogenomics: Genomic bioprospecting for unique alleles- Modhumita Dasgupta.

She described Xenogenomics as the genomic bioprospecting of novel genes / alleles from indigenous and exotic species for promoting bioprospecting of biodiversity. She stated that sequencing of databases has been completed in *P. trichocarpa* while in *Eucalyptus* it is ongoing. She informed that *Casuarina* is a genomic data deficient species. She emphasized the creation of true gene banks with functional inventories by characterizing unique genomes that would accelerate the utilization of candidate genes in transformation programs.

There was no discussion on this topic.

4. Plants with promising anti-infective activity: Role of bioprospecting - S. Murugesan

He stated that 150 distinct chemical substances from plants are being used as important drugs. Taxol is extracted at the rate of 0.35 g per tree while an patient needs around 2 g of taxol for treatment. He emphasised the need for focussing research by institutes and industries jointly for discovery of novel natural products from renewable forest resources.

Discussion / comments: To a query on whether biopropecting will encourage biopiracy, it was replied that by giving due consideration for the indigenous knowledge of forest dwellers the problem of biopiracy can be addressed.

5. Ethnic usage of rattans by indigenous tribes and settlers of Andaman and Nicobar Islands, India- U. Senthil Kumar

He detailed the ethnic uses of rattans by the Nicobarese and Shompens and also the migrants. He presented an extensive overview on the diversity of rattans and its extensive use by the locals.

(xi)Technical Session-8: Ethnobotany and Pharmacognosy

Chairman : Dr. T. Sekar
Co-chairman : Dr. S. Muralidharan

Rapporteur 1 : Dr. C. Buvaneswaran
Rapporteur 2 : Ms. R. Sumathi

1. Medicinal Plant Conservation Areas - *In-situ* conservation component for medicinal plants- T.S. Srinivasamurthy.

He shared the experiences gained in the FRLHT programme wherein MPCAs were created in Kerala, Tamil Nadu and Karnataka. The MPCAs are so well distributed that about 50% of medicinal plants areas were covered under this programme. This programme also assisted in collection of huge database. During floristic survey, 2743 herbaria of medicinal plants were collected. In threat assessment study, out 330 species assessed, 110 species were RET listed. He concluded that policy and budgetary support are needed for such efforts and it has to be continued and sustained.

Discussion / comments: Dr. T. Sekar, Chairman enquired about the post-project evaluation. Shri.T.S. Srinivasamurthy replied that so far it has not been done. Dr. N. Krishnakumar, Director, IFGTB suggested that the MPCAs can become 'Permanent Plots' for assessment on impacting factors as well as for long term monitoring.

2. Endemism: Influencing factors in tropical ecosystem management-S. K. Shanmugasundaram.

The presentation was on the floristic status of Kalakkad-Mundathurai Tiger Reserve, a plaeo-endemic site. He reported that KMTR inhabits 150 strict endemic species. Among many factors, alien invasive species threaten native species including endemic once. Several surveys and studies are available but, Information networking is lacking. He also suggested that 'National endemic list' to be maintained.

Discussion / comments: Dr. B. Gurudev Singh, Scientist-F, IFGTB wanted clarification on usage of term 'strict endemism'.

3.House hold remedies of human health through herbal medicines - M.U. Kukadia

The presentation was centered on both 'Immunity inducing plants, as well as on 'sure to cure plants'. He presented several case studies on usage of herbal medicines for human health.

4.Biochemical differentiation among *Terminalia chebula* Retz. and *T. bellirica* (Gaertner) Roxb. population in Eastern and Western Ghats of Tamilnadu-M. Smitha

She reported that alkaloid content varied amog different populations and Talavadi population had highest concentration of gallic acid and ellagic acid. Among two species studied *Terminalia chebula* had higher concentration of alkaloids than *T. bellirica.* However, there was no difference among population in the Eastern and Western Ghats.

5. Morphological and biochemical characterization of *Gloriosa superba* – an endangered medicinal climber- R. Chitra.

She estimated variation in 'colchicine' and 'colchicoside' using HPLC. Among different populations studied, 'colchicine' and 'colchicoside' contents were highest in Andhra wild collections having 1.33% and 0.42% respectively. The least amount was registered in cultivated types from Kallimadayam having colchicin of 0.02% and colchicoside of 0.01% .

Discussion/ comments: Chairman added his observation on less concentration of active principles in cultivated medicinal plants.

6. Germplasm conservation of red tamarind - a potential bio-colorant for food processing industries- A. Mayavel

He informed that before start of this study, there was only seven trees of red tamarind on record. By completion of this study, a total of 47 trees have now been recorded. All the germplasms of these red tamarind trees have been assembled in Kurumbapatti, Salem. Variation in 'Anthocyanin' content for the assembled germplasm was estimated and there existed variation among the trees.

7. Ethno-botanical information from the indigenous people of Ariyalur District in Tamil Nadu - K. Panneer Selvam

His study revealed that only old people were able to share their traditional knowledge on herbal medicines and younger age groups are losing interest on gaining traditional knowledge.

9. Overview of Forest Genetic Resource Management Network (FGRMN)

A talk on Forest Genetic Resource Management Network (FGRMN) was delivered by Dr. N. Krishnakumar, Director, IFGTB and views for effective networking were sought. It was suggested that as the issue is of importance it may be circulated and views of all obtained to establish an FGRMN. Dr. N. Krishnakumar assured circulation of FGRMN concept and also hold consultative meeting for a path ahead.

10. Plenary Session

The Plenary Session of the seminar started around 5.30 pm on 29.12.2010. The following officials acted as Chairman, Co-chairman and panel members during the Plenary Session:-

Chairman : Dr. G. Kumaravelu
Co-chairman : Dr. N. Krishnakumar

Panel members:

1. Dr. P.A. Azeez
2. Shri T.S. Srinivasamurthy
3. Dr. R. Vasudeva
4. Dr. R. Annamalai
5. Dr. T. Sekar
6. Shri N. Gopinathan
7. Shri Siddappa
8. Dr. A.J. Solomon Raju
9. Dr. M. Muthuraman
10. Dr. K. Kukadia
11. Dr. B. Nagarajan

Rapporteurs 1 : Dr. C. Kuhikannan
Rapporteur 2 : Dr. K. R. Sasidharan

Dr. B. Nagarajan, the organizing Secretary, TESFS-2010 presented the draft recommendations of all the eight technical sessions. Subsequently, there was discussion.

Discussion/ comments: Dr. T. Sekar opined that there has to be sufficient time for discussing the recommendations thoroughly and hence he requested to send it to the members to come out with suggestions. Dr. G. Kumaravelu, Chairman also endorsed this view.

Shri T.S. Srinivasamurthy requested to identify the agencies against each recommendation, so that it can be monitored in future. He also stated that funding is a must to translate the recommendations in to actions. He suggested to have collaborative works between different organizations. He also requested to put the recommendations in the website, so as to get inputs on them.

Dr. G. Kumaravelu suggested to incorporate the points emanated during the presentation of lead talks also in to the recommendations. Dr. Vasudeva remarked that the ecosystem services are to be given adequate importance.

Shri K. Ravichandran, Extension Officer of IFGTB opined that, instead of sending the recommendations to the members, it would be better, additional points if any are suggested for incorporation in the recommendations.

Dr. N. Krishnakumar remarked that, there are many areas for collaborating through programme approach. He also said that, "Green India Mission" has given opportunity for much collaboration among the research partners.

Shri Siddappa viewed that the Ph.D. programme offered by FRI University is very rigid. He asked for liberalizing the policies of the university, so that the candidates could easily register for their Ph.D.

Dr. A. J. Solomon Raju mentioned that phenological studies in the forests are to be taken up for studying the impact of climate change on flushing, flowering and fruiting pattern. He also suggested interested forest staff to work on these lines. Dr. G. Kumaravelu also supported this view.

Dr. P.A. Azeez expressed that the recommendations chalked out are primary areas, based on which final recommendations could be made. He underscored the necessity for monetary evaluation of the ecosystem services and emphasized the need for apprising the policy makers. Dr. G. Kumaravelu also supported this view.

Dr. M. Muthuraman explained about the importance of Api- agro-forestry, wherein the agro - forestry plantations could be used for bee keeping. He also mentioned that bee keeping is a sustainable livelihood for the tribal communities.

Shri T.S. Srinivasamurthy observed that now-a-days the field biologists are becoming rare. He suggested to encourage those who have intention to work on such fields, by creating permanent positions. He expressed that students have to be motivated to study pure Science subjects, so as to meet the requirements of field biologists. He also called up on the scientific community to communicate their findings published in scientific journals to the policy makers in a way they understand the things.

Dr. N. Venkatasubramanian said that, there is not much information available on the gall flora of India and hence suggested to take up studies on this aspect.

Dr. Somitha Mukherji expressed that the waste lands have high biodiversity value, especially those available in Rajasthan and Gujarat.

Dr. G. Kumaravelu, remarked that, in the seminar there was good participation of delegates during the deliberations.

The Plenary Session was followed by the vote of thanks proposed by Shri T.P. Raghunath, Group Co-ordinator (Research), IFGTB and the proceedings were concluded.

11. Session – wise recommendations

Session-1: Forest Biodiversity

Chairman : Dr. R.Annamalai
Co-chairman : Dr. C. Sivaperuman

Rapporteur1 : Dr.J.P.Jacob
Rapporteur2 : Dr. Anjan Kumar Prushty

1. Conservation of coastal wetlands may be taken up on a priority basis considering the climate change scenario.
2. Site specific/ PA specific avian studies may be carried out for better conservation planning.
3. Below ground entomofaunal diversity in forest ecosystem and their role in nutrient cycling need be studied.
4. Tropical forest ecosystems are facing various threats and threat specific strategies and actions may be evolved and adopted by various States.
5. *In-situ* conservation of wild relatives of cultivated Mulberry species may be taken up.

Session -2: Population Biology, Endemism and Species Recovery

Chairman : Shri TS.Srinivasamurthy
Co-chairman : Dr. R. Vasudeva

Rapporteur1 : Dr. N. V. Mathish
Rapporteur2 : Dr. S. P. Subramani

1. RET taxa that need to be recovered to be prioritized. Species recovery programmes on RET taxa facing high degree of threats need to be supported by the State Forest Departments.
2. Studies on Mangrove restoration and capacity building for Forest Department staff to be undertaken in Andamans.
3. Revision of the *Terminalia* genus to be initiated and tannin content estimation in *T. gella* to be taken up.
4. Detailed studies to be carried out on the effect of chain-link fencing of sholas.
5. Planting of indigenous timber tree species like *Artocarpus hirsutus* to be promoted in suitable farm lands.
6. Microhabitats in tropical forests need to be studied in detail to understand their dynamics.

Session -3: Ecorestoration, Fragile Ecosystems and Landscapes

Chairman : Dr. S. Balaji
Co-chairman : Dr. K. Kathiresan

Rapporteur 1 : Dr. V. Mohan
Rapporteur 2 : Ms. K. Shanthi

1. Biodiversity monitoring should be given top priority.
2. Conservation and restoration of mangroves need to be enhanced with the help of local people and student community.

3. Research on bioprospecting of mangrove ecosystem in search of valuable products and genes should be taken up for patent development.
4. Effect of climate change on flora and fauna of mangrove ecosystem needs to be studied in detail.
5. Study on carbon sequestration potential of mangrove ecosystems need to be taken up.
6. Genetically Diverse Hot Spots (GDHS) in Sacred Groves should be identified for conservation.
7. Exploration and utilization of AM fungi and other beneficial microbes for quality seedling production of different shola species for their better survival and field establishment to be undertaken.
8. Urban biodiversity conservation to be given priority.
9. Wetland Conservation should be intensified.
10. Environmental Impact Assessment (EIA) should be taken up in Wetlands and adjoining areas where developmental activities are proposed, for conservation of flora and fauna.
11. In depth study on seed biology of different shola should be taken up for their eco-restoration.
12. Studies on carrying capacity may be conducted in wildlife areas and other areas, where the forests are open for cattle grazing.

Session - 4: Molecular Ecology, Geomorphology and GIS studies

Chairman : Shri P. Durairasu
Co-chairman : Dr. G.Umapathy

Rapporteur 1 : Shri R. Vivekanandan
Rapporteur 2 : Dr. K. S. Anoopdas

1. Endangered animals like Lion Tailed Macaque are undergoing demographic stocahsticity due to complete isolation of fragmented population. The population of these animals in the forest fragments needs long-term monitoring.
2. Genetic variability studies to be undertaken in isolated populations of endangered animals to understand what is happening at molecular level, so as to take steps for their conservation. Such studies will also throw light on the distribution and migration pattern of animals, which are essential for their conservation
3. Modern tools like GIS and Remote Sensing have to be fully utilized for habitat management, especially wildlife corridor management.
4. Intra-specific variations existing in tropical tree species to be studied in detail.

Session - 5: Vegetation Dynamics, Plant-Animal Interactions, Phenology, Life History Traits and Carbon sequestration

Chairman : Shri N. Gopinathan
Co-chairman : Dr. A. S. Solomon Raju

Rapporteur 1 : Dr. Maheswar Hegde
Rapporteur2 : Ms. Desa Meena

1. The lower levels of staff involved in the management and conservation of ecosystems should be made aware of all aspects of conservation.
2. Awareness has to be created on the importance of ecosystem conservation among the public through popular articles in local languages and also through electronic media.
3. The outcome of scientific deliberations should be brought in local languages in the form of brochures and pamphlets for public distribution.
4. Lesser known components of ecosystems like butterflies, bees, birds, bats, thrips and their functions in the ecosystem to be investigated in detail and conservation strategies to be evolved.
5. Regular field biology training course and workshops should be conducted to train younger generations.
6. Interest to be inculcated among younger generations to take biology courses as there is dearth of qualified field biologists at present. Though there is overwhelming interest among younger generations to pursue studies in molecular biology and biotechnology, basic subjects like biology should be given adequate importance in educational institutions.
7. Field guides on biodiversity should be published and made available to the public.

8. Session - 6: Weed Invasion, Ecotoxicology , EIA and Ecosystem Management

Chairman : Dr. Rajiv K. Srivastava
Co-chairman : Dr. P. Ravichandran

Rapporteur1 : Dr. A. Karthikeyan
Rapporteur 2 : Dr. N. Venkatasubramanian

1. Heavy metal contamination in natural resources is to be quantified for the biodiversity welfare and such studies need to be extended to agricultural and cultivable lands.
2. Studies on butterfly diversity and its plant associates to be carried out in different ecosystems.
3. Eco-toxicological effects of pesticides on aquatic organisms need monitoring. Organic farming to be promoted to avoid ill effects of chemicals used in agriculture.
4. Preservation of marine ecosystem with the people's participation and its long term monitoring has to be undertaken.

Session - 7: Ecosystem Services, Bioprospecting and Bioeconomics

Chairman : Dr. P. A. Azeez
Co-chairman : Dr. M. Muthuraman

Rapporteur : Mr. Maria Dominic Savio

1. Research findings should reach the intended stakeholders through appropriate tools.
2. Tribal communities are to be empowered through utilization of hi-tech tools for sustainable exploitation of forest resources.
3. Bioprospecting to be carried out in such a manner that biodiversity is not affected. The traditional knowledge should be acknowledged and the benefits shared, during bioprospecting.
4. The monetary/ economic value of ecosystem services to be evaluated/ quantified and disseminated to public and policy makers.

Session -8: Ethnobotany and Pharmacognosy

Chairman : Dr.T.Sekar,IFS.,
Co-chairman : Dr. S. Muralidharan

Rapporteur 1 : Dr.C. Buvaneswaran
Rapporteur 2 : Ms. R. Sumathi

1. Efforts made in MPCA programme need to be continuned as it was an effective method.
2. MPCA can be redesignated as " Permanent Plots" and are to be monitored.
3. "Information networking" relating to biodiversity assessment to be carried out and status of species to be disseminated.
4. Knowledge sharing on "Immunity inducing plants" and "Sure to cure" plants needs to be encouraged.
5. Medicinally important trees need to be studied at population level for biochemical variations in active principles.
6. Germplasm assemblage of commercially important plants like Red Tamarind and *Gloriosa superba* need to be supported.

12. Final Recommendations

1. Tropical forest ecosystems are facing various kinds of threats mainly due to anthropogenic activities and therefore threat specific strategies and action plans to be evolved and adopted to preserve these ecosystems.

Action: MoEF/SFDs

2. Biodiversity monitoring should be given top priority. Conservation of coastal wetlands, different tropical forest types and constituent species to be given priority, considering the climate change scenario. Environmental Impact Assessment (EIA) to be made mandatory before initiating developmental projects, in and around wetlands.

Action: MoEF/SFDs/Research Institutes/NGOs

3. Marine ecosystem and its constituent species are facing high threat due to pollution. Therefore, various dynamics of this ecosystem to be monitored on a long term basis and action for preservation taken up with active participation of local communities.

Action: MoEF/SFDs/Research Institutes/NGOs

4. Species recovery programmes on RET taxa facing high degree of threats need to be taken up. Genetic variability studies to be conducted to understand the relationship among populations of RET species distributed in fragmented areas, so as to evolve conservation strategies.

Action: MoEF/SFDs/Research Institutes

5. Non-charismatic groups like lower plants, microbes inhabiting above and below ground habitats of tropical ecosystems to be given attention and their role in ecosystem functioning and services investigated.

Action: MoEF /SFDs/Research Institutes/Universities

6. Impact of physical protection given to fragile ecosystems like Shola forests and their contribution to eco-restoration of degraded ones to be elucidated.

Action: SFDs

7. Information on phenology, reproductive biology, pollination ecology, breeding behaviour, seed biology, population structure and animal-plant associations to be generated so as to support species specific conservation programmes.

Action: Research Institutes/Universities

8. Modern tools like GIS and Remote Sensing have to be fully utilized for habitat management, especially in wildlife corridor management.

Action:SFDs

9. Impact of fire, grazing, weeds, tourism and other developmental activities in and around wildlife areas needs thorough investigation and long term monitoring.

Action: SFDs

10. *'In-situ'* and *'ex-situ*' conservation of germplasms of commercially important species/ varieties (like Mulberry, Red Tamarind and wild relatives of crop plants and medicinal plants) to be given priority. The Medicinal Plant Conservation Areas (MPCAs) already established '*in-situ'* are to be designated as "Permanent Plots" and status of constituent species monitored. Establishment of more MPCAs to be undertaken, covering important medicinal plant species, for long term conservation. **Action: SFDs/Research Institutes**

11. Biodiversity of urban landscapes and wastelands also to be given adequate attention, as several valuable species occur in these habitats too.

Action: MoEF

12. Several inland water bodies are polluted due to discharge of effluents containing pesticides, heavy metals and so on and hence their toxicological effects on aquatic organisms and associated fauna need continuous monitoring

Action: MoEF/SFDs/Research Institutes/Universities

13. Bioprospecting research based on traditional knowledge to be strengthened and benefits derived to be shared with ethnic communities, which own the knowledge. Utmost care has to be taken while commercialization of bioprospecting, so that it is not detrimental to the bioresources.

Action: Research Institute/SFDs/Universities/NGOs

14. The monetary/ economic value of ecosystem services to be evaluated/ quantified and disseminated to public and policy makers.

Action: Research Institutes/ Universities

15. Mangrove forests are highly fragile in nature and are fast dwindling due to various environmental and anthropogenic factors. Eco-restoration of mangrove forests especially that of Andaman Islands needs urgent attention. In this connection, programmes for capacity building of Forest Department officials and awareness creation among local people are to be launched.

Action: SFDs/Research Institutes/Universities

16. Studies on carbon sequestration potential of mangrove ecosystem and impact of climate change on flora and fauna of mangrove forests need to be taken up.

Action: SFDs/Research Institutes/Universities

17. The lower staff involved in the management and conservation of ecosystems to be imparted training to deal with various conservation issues. Awareness on biodiversity and its importance to be disseminated through popular articles, brochures, pamphlets etc. preferably in local languages to public. The services of print and electronic media and Information Technology tools are to be fully utilized for awareness creation and establishment of networks.

Action: SFDs/Research Institutes/Universities/NGOs

18. Unique ecosystems like Sacred Groves, fresh water swamps (eg: - *Myristica* swamp) which are encountering enormous threats due to various anthropogenic activities. Action has to be taken for their documentation, monitoring and conservation.

Action: SFDs/NGOs/Local Self Govts.

19. Since there is dearth of field biologists at present, interest has to be inculcated among younger generations to take up biology courses for their higher education. Further, regular field biology trainings and workshops are also to be organized to train younger generations and student community.

Action: Universities / Research Institutes

20. Field gene banks of genetic resources of important forestry species to be established with active participation of State Forest Departments and other stakeholders, for long term conservation and sustainable utilization.

Action: ICFRE/ SFDs

13. Acknowledgements

We are thankful to the Department of Biotechnology and the Department of Science and Technology, Govt. of India for providing financial support for organizing this seminar.

View of dignitaries on the dais during Inaugural session

View of audience

View of audience

Inauguration of the seminar by Dr. P. J. Dilip Kumar, Director General (Forests), MoEF, Government of India

Ceremonial planting of sapling by Dr. P. J. Dilip Kumar

Lead Talk by Dr. D. Narasimhan on "Ecosystem Structure"

Lead Talk by Dr. A. J. Solomon Raju on "Ecosystem Function"

Lead Talk by Dr. G. Kumaravelu on "Ecosystem Services"

View of poster presentations & evaluation

Dr. C. Sivaperuman receiving I prize for best poster

Mrs. A. Shanmugapriya receiving II prize for best poster

Mr. P. Ramana receiving III prize for best poster

View of delegates during lunch

Snaps from cultural evening

Dr. N. Krishnakumar, Director, IFGTB talking on Forest Genetic Resource Management Network (FGRMN)

View of Plenary Session

Annexure- 1

LIST OF PARTICIPANTS OF THE SEMINAR

S. No	Name	Designation	Organization/Address
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Annexure – 2

Details of Poster Presented during the National Seminar on Tropical Ecosystems: Structure, Function and Services (TESFS 2010)

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1.	Lakshmanan G	Aditanar College,Tiruchendur	Insect biodiversity of Palayakayal mangrove forest, Thoothukudi Coast.
2.	Balakumbahan R	TNAU, Coimbatore	Effect of preharvest treatments on growth and yield of *Gloriosa superba.*
3.	Shanthi A	IFGTB,Coimbatore	DNA polymorphism in two different genetic resources of *Casuarina equisetifolia*.
4.	Sivakumar V	TNAU, Coimbatore	Influence of spacing and organics on plant nutrient uptake of black nightshade (*Solanum nigrum*).
5.	Sangeetha Menon V	IFGTB, Coimbatore	Status of beneficial microflora in saline soils of Tamilnadu and Puducherry.
6.	Sureka	IFGTB,Coimbatore	Diversity of Arbuscular mycorrhizal fungi associated with indigenous multipurpose tree species.
7.	Mohan V	IFGTB, Coimbatore	Diversity status of Ectomycorrhizal fungal flora in association with important tree species.
8.	Ananthalakshmi M	IFGTB,Coimbatore	Tropical Dry Evergreen forest, Structure, Function and Services.
9.	Shanmugapriya A	IFGTB,Coimbatore	Analysis of population structure in *Eucalyptus* using SSR markers.
10.	Ramana P	College of Forestry,Sirsi, UAS, Dharwad	Study on the ecology of a pond at Padambail, Uttara Kannada District of Karnataka.
11.	Sivaperuman C	ZSI, Andaman&Nicobar	Seasonal dynamics of birds assemblages in Kole Wetlands, Kerala.
12.	Singh H	IFGTB, Coimbatore	Evaluation of plant species diversity and nutrient status from the soil of Pantnagar and its adjoining area.

13.	Ben C P	IFGTB,Coimbatore	Rapid multiplication of *Artocarpus hirsutus Lam.*- An endemic and threatened keystone tree species of Western Ghats.
14.	Subashini V	IFGTB,Coimbatore	Efficient DNA markers for Population Genetics.
15.	Karmaly K A	St. Xavier's college for Women' Aluva	Studies on Fomicid fauna (Hymenoptera: Formicidae) of Forest Campus, Coimbatore.
16.	Tomar A	FRI, Dehradun	A rhizomatus study of *Cyrtomium caryotideum* Presl. - An endangered fish tail holly fern.
17.	Deenathayalan P	IFGTB, Coimbatore	Callus induction and plant regeneration in Red Sanders (*Pterocarpus santalinus L.*)
18.	Raja Mamannan M A	SACON, Coimbatore	Structure of bird communities in Andaman Islands
19.	Balaji S	Ayya Nadar Janaki Ammal College, Sivakasi	Study of heavy metal analysis in fish in the Senkulam pond, Thiruthangal, Virudhunagar District.
20.	Paramanandham J	SACON, Coimbatore	Effect of Mercuric chloride and the influence of Glutathione on haematological studies in fingerlings of Rohu, *Labeo rohita* (Hamilton).
21.	Sisubalan N	IFGTB, Coimbatore	Variation in seed filling and germination response in ecotypes of *Gmelina* and *Tectona* populations: Adaptive and characteristic variations.
22.	Venkatachalam R	IFGTB, Coimbatore	Enhancing Carbon Sink potential in ecosystems-An approach through Lectin Nucleotide Phosphohydrolase (LNP).
23.	Jesubalan D	IFGTB, Coimbatore	Quantifying PERS in *Mimosa diplotricha* C. Wright : A potential threat to ecosystem in the AHA, Kerala.
24.	Meena D	IFGTB, Coimbatore	Reproductive ecology of the red listed tree species: *Canarium strictum.*
25.	Sujana K A	M.S. Swaminathan Research Foundation, Wayanad	Lianas as a food source for arboreal mammals of Western Ghats.
26.	Kunhikannan C	IFGTB, Coimbatore	Role of elephants in regeneration and distribution of wild mango, *Mangifera indica* – An

			experience from Silent Valley National Park, Kerala.
27.	Ramana P	UAS, Dharwad	Studies on effect of different finishes in controlling moisture entry into strips of *Holigarna arnottiana.*
28.	Krishnamoorthy M	IFGTB, Coimbatore	Mangrove biofence! An inadvertent conservation.
29.	Sasikumar J M	Karpagam University,Coimbatore.	Exploration of ethno-medico-botanical knowledge of 'Irulars' of the Nilgiris, Western Ghats.
30.	Ramachandran V S	Bharathiar University, Coimbatore	Documentation of the wild edible and medicinal plants of the Karunya University campus, Coimbatore.
31.	Ramachandran V S	Bharathiar University, Coimbatore	*Phyllanthus indofischeri* Bennet (*Euphorbiaceae*)- An underexploited edible plant from Tamil Nadu