stration with lectures on processing of hyperspectral data and S. K. De (GSI, Bangalore) on signature database management. B. K. Mohan (IITB) delivered a talk on image classification and G. Mathew (IITB) shared his experiences in thermal emission and planetary explorations. A fieldwork for spectral signature collection using spectroradiometers (ASD and GER) followed by data processing session in the laboratory exposed all the participants to real-time data-acquisition and processing. The lectures on the application aspects of hyperspectral remote sensing had a wide coverage of agriculture and forestry (R. N. Sahoo, IARI), geology and marine biology (D. Ramakrishnan, IITB), and snow and ice (H. S. Negi, SASE). The afternoon sessions included processing the datasets using ENVI software. Representatives from Sierra Atlantic helped make the software learning easier. Research scholars from IITB enthusiastically joined the practical sessions.

The very academic environment of IITB contributed to the satisfaction of all the participants. However, inclusion of focused case studies can strengthen these types of training programmes. The gap areas will help the participants to come up with newer project proposals and case studies in this specialized subfield of remote sensing. Hopefully, the funding agencies will be able to recognize the importance of this and applications in the subfields of environmental studies and natural resource management. Only with their support to develop newer algorithms can help such training courses become to operation-level applications.

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MEETING REPORT

Functional biodiversity and ecophysiology of animals*

'The worst thing that can happen... is not energy depletion, economic collapse, limited nuclear war, or conquest by a totalitarian government. As terrible as these catastrophes will be for us, they can be repaired within a few generations. The one process ongoing... that will take millions of years to correct, is the loss of genetic and species diversity by the destruction of natural habitats. This is the folly our descendants are least likely to forgive us.'

'As genomics and biomedicine are to human health, so ecology and conservation biology are to the planet's health. Unfortunately, compared with their sister disciplines, ecology and conservation biology are still disadvantaged.'

E. O. Wilson[1,2]

Almost three decades later, Wilson's prophecy is borne out by accumulating evidence of serious anthropogenic threat to biodiversity, which constitutes the very basis of human survival on earth. It is apt that this report begins with quotes by Wilson, who has not only extensively championed the cause of biodiversity conservation, advocated the need for studies on bioprospecting, ecosystem functioning and evolutionary biology, but also introduced the term 'biodiversity' for the first time[3]. The area of conservation biology currently needs more research emphasis than ever before. Therefore, a symposium on 'Functional biodiversity and ecophysiology of animals' was recently organized. Drastic changes in land use, enrichment in the nitrogen cycles and emission of greenhouse gases are just a few of the major anthropogenic activities, which have contributed to the accelerating decline in the biological diversity. Basically of course, all these are the outcome of overwhelming human dominance on the earth due to the phenomenal population growth in the last century.

Functional biodiversity focuses on the diversity of ecosystem functions, provided by the biological community, while ecosystem functioning is a measure of the changes occurring in ecosystem processes[4]. However, the changes occurring at the level of ecosystems and adaptations in organisms under the influence of human-driven activities are not adequately understood. Consequently, functional biodiversity is rapidly emerging as an interdisciplinary area of research, involving the study of ecosystem processes as well as behavioural, physiological and ecological adaptations and interactions amongst the organisms. The goal of the present symposium was to provide a forum for an interactive discussion, to understand the emerging trends in ecosystem functioning and to assist in the germination of new ideas and approaches in this area. The meeting was attended by about 98 participants (including 12 invited speakers) from 14 different states of India.

In his keynote lecture, S. Ayyappan (Indian Council of Agricultural Research, New Delhi) provided an overview of freshwater and marine species with high potential in aquaculture. He suggested various measures to meet the predicted increase in the per capita demand of the protein-rich fish food in future. Ayyappan referred to the fish breeding techniques and discussed aquaculture potential with respect to the available resources in different states of India. He also emphasized economic and environmental benefits of multi-farming systems, for instance, greater profitability of fish and rice farming compared to rice farming alone.

There were altogether eight sessions during the three days of the symposium. The first two sessions dealt with the basic issues of biodiversity richness, conservation and management in terrestrial and aquatic ecosystems respectively. The first speaker, J. S. Singh (Banaras Hindu University (BHU), Varanasi) drew attention to the current high rate of species extinctions and stressed the need to understand the processes of speciation, endemism,

*A report on the symposium on 'Functional biodiversity and ecophysiology of animals', organized at the Department of Zoology, Centre of Advanced Study, Banaras Hindu University, Varanasi during 21–23 February 2009.

co-existence, extinction and differential vulnerability of taxa with the view to protect biodiversity. He highlighted the complexity of biodiversity control mechanisms by taking some recently documented case studies. A. J. Solomon Raju (Andhra University) gave an account of flower–animal interactions in forest ecosystems and discussed the relationship between animal pollinators (insect, bird and bat) and different floral species. How one can utilize an indigenous technology for biodiversity conservation was amply illustrated by M. S. Devy (Ashoka Trust for Research in Ecology and the Environment (ATREE), Bangalore), who demonstrated the use of traditional tribal knowledge for the study of canopy pollination ecology, in the Western Ghats. A. K. Pandey (National Bureau of Fish Genetic Resources (NBFGR), Lucknow) dealt with current fish diversity of India and discussed strategies for the conservation of endangered species.

The two sessions on the 'Ecophysiology of animals' and on 'Diversity, ecophysiology and management of pests and beneficial animals' discussed basic and applied ecophysiological research respectively. A. Dutta-Gupta (University of Hyderabad) pointed out the serious health hazards imposed by the present use of about 100,000 metric tonnes of chemical pesticides in India every year, and stressed the need to shift to safer pesticides. She drew attention to the ecofriendly nature of *Bacillus thuringiensis* (*Bt*). *Bt* insecticidal crystal protein-based bio-pesticides and transgenic crops, while being less harmful to the natural enemies are more insect pest species-specific. Dutta-Gupta focused on the current research efforts to identify, isolate, characterize and evaluate potent local strains of *Bt*, which could be used for the management of lepidopteran pests. The importance of 'village forests' and floral diversity in determining productivity of agroecosystems was addressed by P. Dharama Rajan (ATREE, Bangalore). He showed that paddy fields located near biodiversity-rich village forests exhibited high abundance of major predators and chalcid parasitoids compared to fields in close proximity to monocultural plantations. In the session on 'Ecology, behaviour and biological rhythms', B. N. Singh (BHU) discussed the lack of evidence for character displacement for behavioural isolation between two closely related sympatric species of *Drosophila*. He concluded that behavioural isolation might have originated as a consequence of genetic divergence in allopatric populations rather than as a direct product of natural selection in sympatry. A. Parganiha (Pt Ravishankar Shukla University) discussed multifactorial control of phototactic behaviour in the fish, *Clarius batracus*.

The current concern on climate change, the major global impact of human interference in ecosystem functioning was highlighted by P. B. Rastogi (Ministry of Environment and Forests, New Delhi) in the session on 'Environmental pollution, climate change and their impacts on biodiversity'. Impact of environmental stresses on ecosystems and biodiversity, a consequence of escalating emission of greenhouse gases in the atmosphere, was a topic of extensive discussion. If unchecked this may pose a major threat to human survival itself, since it is predicted to have serious indirect effect on agriculture, along with an impact on the melting of glaciers, rising sea levels and threat to coastal regions. Rastogi emphasized the need for interactions amongst scientists, corporate sectors, policy makers and the general public, to understand the biological and economic implications on the one hand and to implement the mitigation, adaptation and policy decisions on the other. T. K. Ghosh (National Environmental Engineering Research Institute, Nagpur) discussed the impact of thermal pollution on aquatic ecology by taking the Kadra reservoir as a case study.

In the session on 'Environmental toxicology', A. Dhawan (Indian Institute of Toxicology Research, Lucknow) raised concerns regarding the potential adverse human health effects on exposure to some commonly used nanomaterials. He demonstrated the genotoxic effect of zinc-oxide nanoparticles in mammalian cells and cautioned the use of various cosmetics containing zinc-oxide nanoparticles. While S. Bhattacharya (Visva Bharati University) discussed biomarkers for detection of the effect of toxic xenobiotics, A. Kumar (University of Rajasthan) focused on cancer chemoprevention strategy and advocated bioprospecting for phytochemicals with antioxidant/anti-inflammatory properties. He deliberated on the antioxidant properties and cancer chemopreventive potential of plant extracts of *Ocimum sanctum*, *Acacia nilotica*, etc.

In the session on 'Aquaculture', W. S. Lakra (NBFGR) deliberated on the integration of scientific information on biological traits, genetic stocks, captive breeding, brood banks, gene bank, etc. on the formulation of management strategies. A. K. Mittal (BHU) compared the adaptive modifications in the buccopharynx of a carnivorous catfish with those of herbivorous catfish species, in relation to their food and feeding habits.

The symposium was attended by a large number of research students. High-quality research work coupled with lucid presentations by student participants led to the award of two first prizes each, in poster and oral presentations.

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