

Dimensions of ecology: from global change to molecular ecology*

In the last four–five decades, the scope of ecology has expanded from its main focus on organisms to study the planet Earth as an integrated ecosystem. For example, studies in 1960s were focusing on the number of individuals or species, their reproduction and adaptations to various environmental conditions. Now, aided by molecular and isotopic techniques, satellite technologies and computer models of the climate, the ecologists are emphasizing the broader views of the planet Earth that includes the effect of life on Earth, our role in affecting the species and ecosystem functioning, evolutionary changes in species and solutions to climate change effects on the Earth. To discuss scientific progress made in the mentioned areas, the 39th annual conference was jointly organized by the ecological society of Germany, Austria and Switzerland (GFÖ). The conference was attended by more than 400 scientists from various countries.

The focal theme of the conference was: ‘Dimensions of ecology: from global change to molecular ecology’. During the conference, six thematic symposia were organized: (1) Adaptation: from molecular mechanisms to ecosystems consequences. (2) Integrated ecosystem ecology: from energy and matter fluxes to social ecological systems. (3) Key methodology in ecological research. (4) Global change: from the importance of climate drivers to consequences of species and communities. (5) Ecology and society: conservation and education. (6) Reflecting on ecology. The conference covered a wide range of contents on molecular adaptation of species in the environment, environmental effects on plant growth and defence from organism to landscape, species coexistence, plant–animal interaction and ecophysiological mechanisms in changing environment, ecological heterogeneity of complex terrain and agricultural landscape, ecosystem services,

linkages of social–ecological systems, use of stable isotopes and remote sensing in solving ecological problems, long-term ecological research, winter ecology, community invasibility, vector-borne diseases, macroecology, molecular biogeography, nature conservation and environmental education.

The conference organized 6 plenary sessions and 29 sessions on six themes. Each day consisted of six concurrent sessions with several presentations on sub-themes on specific topics. Besides, full day concurrent poster sessions were held. There were more than 450 presentations, which include 6 keynote speakers, 250 oral presentations and 200 posters.

The conference started with the first keynote lecture by Donald L. DeAngelis (U.S. Geological Survey and University of Miami) on ‘Linking global change to landscape patterns and species populations’. He stated that many species vulnerable to extinction are at risk and some ecosystems are facing danger to be pushed to different steady state regimes need to be carefully monitored by down-scaling information of General Circulation Climate Change Models to fine resolution scale for more accurate projections of future climate change (i.e. temperature and precipitation) on wildlife and vegetation patterns across various eco-regions of the world. He presented a case study of southern Florida using integrated ecological models to simulate changes in populations including microbial over landscapes and regions.

The second keynote lecture was on ‘Metal hyperaccumulation and hypertolerance in *Arabidopsis halleri*’ by Ute Krämer (Heidelberg Institute of Plant Sciences and BioQuant Center, Germany). Krämer focused on metal hyperaccumulation and associated hypertolerance in *Arabidopsis halleri* and *A. thaliana* and concluded that the former has very high capacity to accumulate toxic metals like Zn and Cd than the latter because of the presence of three HMA genes. She emphasized on long-term goals to identify the molecular mechanisms underlying adaptive physiological traits and to effectively use plant metal homeostasis networks for phytoremediation, phytomining and biofortification.

The Third keynote lecture was on ‘Ecological understandings: teaching, learning and action’ by Bruce Johnson (University of Arizona College of Education). Johnson’s talk was on achieving the goal of sustainability by understanding the ecological systems in natural world and human societies, and focused on our place and role in these systems so that personal ecological perceptions can be developed that can turn into action oriented goals after receiving education to achieve the goal of sustainability.

The Fourth keynote lecture was on ‘Plio-Pleistocene climate change and its impacts on species distributions and diversity patterns’ by Jens-Christian Svenning (Department of Biological Sciences, Aarhus University, Denmark). He spoke on the effect of climate change on biodiversity by taking into account the past records of the late Pliocene and Pleistocene (3.6 million to 11,500 years ago). He presented that climate changes in the past drove dramatic species range dynamics, mild to severe regional extinction events, and are still affecting the species distribution and diversity patterns.

The Fifth keynote lecture was on ‘Trade-offs in plant allocation to antiherbivore defenses: a meager support for a major concept’ by Julia Koricheva (Royal Holloway University of London). She spoke on the trade-offs between plant allocation to different types of defences based on the meta-analysis of empirical studies and concluded that plants produce strong chemical and physical defences without compromising their growth and reproduction and often have more than one defence type.

The last keynote lecture by Kenneth B. Storey (Carleton University, Canada) was on ‘Life in the cold: a biochemist’s perspectives on animals in winter’. He spoke that many cold blooded animals like frogs and turtles often survive for weeks with as much as 65% of total body water frozen in extracellular ice masses due to wide range of molecular adaptations including strategies to manage ice growth, regulate cell volume, synthesize sugar, maintain energy in the absence of oxygen, and halt/restart vital functions such as heartbeat and breathing. He concluded that this research solved the mys-

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tery of biological phenomenon and holds promise against use of organ preservation in medical sciences.

Notable presentations among oral papers were by A. Jousset (Soil Ecology, University of Gottingen) who spoke on altered soil food web structure within rhizosphere due to toxicity produced by bacteria (*Pseudomonas fluorescens*) as defence against bacterivorous protozoa. C. Laforsch (Ludwig-Maximilians University, Germany) presented the role of DNA barcoding in identifying the ecological and evolutionary characters, for example, crown of thorn evolved in *Daphnia* as a result of coexistence with predator species. T. Gram (Technische Universität, Germany) spoke on the higher competitiveness of spruce (*Picea abies*) compared to beech (*Fagus sylvatica*) for below ground resources because of greater C allocation to mycorrhizosphere by the former than the latter. S. Lively (The University of Melbourne, Australia) presented that quercitol serves as a stable compatible solute and stress metabolite and acts as an insurance policy in *Eucalyptus astringens* under stress conditions (drought, frost) in Australian arid ecosystems. D. H. Haarmeyer (University of Hamburg, Germany) presented that grazing slightly decreased species richness and abundance of endemic vegetation in South Africa, whereas the same increased reproduction of two dwarf shrubs.

A. Saveyn (University of California, USA) spoke on carbon assimilation in stem (i.e. re-fixing of CO₂ present inside

the stem originated from respiration) as a result of highly depleted ¹³C in CO₂ within the stem. G. Hoch (University of Basel, Switzerland) showed that two levels of CO₂ supply (14 and 540 ppm) did not vary the concentration of structurally bound hemicellulose and concluded that it might be re-mobilized as C sources in mature tissue thereby challenging the classical view of C storage in plants. Y. Kasyanov (University of Bayreuth, Germany) spoke on the significance of rhizosphere in carbon cycle and presented ¹⁴C studies that reflect the amount of organics released by roots corresponds to 15–25% of C assimilated mainly by root tips. S. Arndt (The University of Melbourne, Australia) presented that the mineral N is the main N source under intermediate N availability in Australian land-uses and the role of low molecular weight organic N is of less ecological relevance. J. Simon (University of Freiburg, Germany) spoke that girdling of adult beech trees reduced rhizodeposition, and affected N uptake, total microbial biomass and denitrification activity in soil without affecting the abundance of mycorrhizal fungi.

Besides, presentations were made by J. Tenhunen (University of Bayreuth) and others on ecological heterogeneity in complex terrain where the role of biotic, abiotic and social factors were correlated with forest and agricultural productions and services. Tenhunen spoke that mountainous complex terrain represents about 20% of the Earth's terrestrial surface that provide freshwater to about half of

humankind. He spoke on the intensive evaluation of quantity and quality of water obtained from these regions and on further understanding and developing a tool to manage these complex areas. O. Dennis (University of Bayreuth, Germany) spoke on formulating landscape level models of evapotranspiration by using the time series data of water use and heat exchange from eddy covariance studies. Further, he spoke on scaling forest water flux and key physiological parameter with climate variables. T. Koellner (University of Bayreuth, Germany) focused on evaluating multidimensions (i.e. ecological and socio-economic) of ecosystem services through simulation modelling.

Besides, there was a public talk by Erwin Beck (University of Bayreuth, Germany) in German to inform the development of the ecological sciences to the public.

The conference provided an opportunity for researchers to discuss the long standing principles of eco-science, armed with the analytical power of molecular, isotopic analysis and simulation modelling, to play major role in understanding and designing sustainable systems for the future that can provide good living standards, better diet and social stability to the growing population in the 21st century.

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MEETING REPORT

Nutrition security for India: issues and the way forward*

Malnutrition in India is a major health problem. It has a direct impact on the nation's inclusive and equitable growth

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and development and requires immediate attention. The resistant problem of malnutrition, its aetiology, consequences and measures for achieving nutrition security was the theme of a symposium entitled 'Nutrition security for India – issues and the way forward'.

M. S. Swaminathan (Chairman, M.S. Swaminathan Research Foundation, Chennai) inaugurated the symposium. M. Vijayan (President INSA) chaired the inaugural session. The theme of Swaminathan's talk was 'Achieving sustainable

nutrition security: a road map'. In the programme that followed, an overview of the problem and consequences of the double burden of disease that a country in transition like India faces, was given by Kamala Krishnaswamy (former director National Institute of Nutrition (NIN), Hyderabad). Four presentations that followed dealt with dietary and non-dietary aetiology of malnutrition. G. N. V. Brahmam (NIN) discussed the qualitative and quantitative aspects of Indian diets as revealed by the surveys done by the