Tropical Ecology **53**(3): 241-244, 2012 ISSN 0564-3295

www.tropecol.com

Himalayan ecology and environment: redefining paradigms

UPPEANDRA DHAR*
Guest Editor

NASI-Senior Scientist, Department of Botany, Jamia Hamdard (Hamdard University), New Delhi 110 062

The knowledge base on Himalayan ecology and environment has evolved over the years. The enrichment has been, and hopefully will continue to be, interdisciplinary and multidimensional. And the studies that are being undertaken in recent years have, to a large extent been driven by contemporary areas of concern, be it, nutrient dynamics, carbon sequestration, climate change, ecosystem services, etc. Besides, the scientific community is keenly monitoring the global happenings on the subject matter especially with regard to our International commitments. The quest for identifying ecological processes that help in developing linkages with sustainable development are gaining momentum and these paradigms will determine and direct our future course of action.

Tropical Ecology has been an effective forum in disseminating valuable information on ecological issues of the mountain ecosystems. The research work on the Himalayan ecosystem has featured adequately in the journal. And the themes that are being investigated and published are as diverse as the subject matter. However, research on community structure and biodiversity assessments in relation to disturbances are more prominent (e.g., Deb & Sundriyal 2007; Hussain *et al.* 2008; Khera *et al.* 2001). Besides, the papers also represent functional dynamics at species level (Khan & Shankar 2001), indigenous ecological knowledge (Rao *et al.* 2003), participatory conservation planning at landscape level (Chettri *et al.* 2007), land use change and its impact on hydro ecological linkages (Sharma *et al.* 2007), traditional agroforestry in eastern Himalaya (Sharma, Xu & Sharma 2007), *in situ* conservation through concept of maintaining sacred forests (Rawat *et al.* 2011), etc.. This is an indication of the nature and type of research work that is being pursued over the last decade or so and published in *Tropical Ecology*. Tropical Ecology Congress, jointly sponsored by the International Society for Tropical Ecology and H.N.B. Garhwal University and held in Dehradun in December 2007, recommended the publication of four Special Issues of the journal (Singh *et al.* 2009). The first three special issues on Current trends in tropical biodiversity research and conservation, Remote sensing of tropical ecosystems and Plant invasion and environmental pollution have already been published (Hiremath & Agrawal 2010; Kushwaha *et al.* 2010; Rawat 2009). This Special Issue is the fourth in the series.

In order to further enrich the understanding on the subject matter and put across diverse viewpoints on the contemporary priority areas of interest especially at a time when we have entered into the "Decade of Biodiversity", this Special Issue on "Himalayan ecology and environment: redefining paradigms" may identify newer areas of research and help us to better understand linkages of ecology with human well being and sustainable development.

Diversity is inherent in our pursuit in science. And this is so well reflected in this issue. I have attempted to sequence the papers in such a way so as to establish connect between the authors and the readership. And to facilitate this process, I am providing a brief outline, emphasizing on major inferences of each of the papers included in this issue. At the outset, I am including two invited review papers; one provides a regional perspective on the progress made to significantly reduce the current rate of biodiversity loss and the other features tools for identification, assessment and monitoring of biodiversity.

Towards a better understanding of the

* *Corresponding Author*; e-mail: uppdhar@gmail.com

regional perspective on biodiversity conservation keeping in view the 2010 targets, Chettri *et al*. (2012) analyse the extent of progress made by member nations of the Hindu Kush Himalaya (HKH) in significantly reducing the current rate of biodiversity loss and measures taken to meet the set targets through the assessment of identified indicators. Three important headlines emerge through this analysis: (i) significant progress made by member countries by bringing 39 % of the terrestrial area under some form of protection, (ii) initiatives evident in 'people-centred community-based' and 'ecosystem/landscape' approaches to biodiversity conservation and (iii) need for improvement and enrichment of knowledge base on environmental parameters for appropriate action on possible impacts of climate change. Roy *et al*. (2012) review the progress made thus far in developing contemporary tools for identification, assessment and monitoring of biodiversity. Without doubt the transition from documentation of biodiversity to the use of sophisticated technology-driven organized exercise with potential uses in developing indicators of ecosystem sustainability and climate change has been remarkable. Absence of uniformity in documentation of the biodiversity and insufficient tools to disseminate the observations has resulted in the exercise being relegated to various reports. The recent advancement in the field of Remote Sensing & Geographic Information System, mobile computing, GPS technology, wireless connectivity, and internet has enabled accurate and uniform documentation of the biological diversity with revisit capability helping in identification of the hotspots of biodiversity and the gaps in biodiversity exploration. The unlimited connectivity through the World Wide Web has also ensured the proper dissemination of the biodiversity data and reduced the redundancy in data generation.

At species level Shankar & Synrem (2012) recorded, measured and analyzed variability for nine morphological traits of fruits and seeds of seven individuals each of the three provenances of *Prunus nepaulensis* in Meghalaya (northeast India). The studies showed that differences among the three provenances with respect to the mean quantities of pulp content were not significant. Tree-to-tree variation was, however, more significant than provenance variation. The study also showed that the weight appeared to be a more variable and environmentally-controlled trait, whereas the dimensions appeared less variable and under genetic control.

Bamboo is an important resource and a component in the rural landscape of northeast India. Nath & Das (2012) gives an account of the Carbon (C) pool and sequestration potential of this resource in the farmers managed land in Cachar district, Assam. They infer that C pool in the above ground biomass substantially increased in three years and found that about 82 - 89 % of annual C sequestration was contributed by new culms. The authors advocate harnessing the immense potential of bamboo agroforestry in C storage and C sequestration and as a possible CDM project under Kyoto protocol.

In their study on population dynamics in traditional agro-ecosystem of central Himalaya, Ghosh & Dhyani (2012) show that intercropping (wheat and lentil) enhances biological activity of soils in comparison to sole cropping and, based on dry matter yield, the intercropped plots were 52 to 69 % more efficient than sole cropped plots. The authors emphasize on the need to promote traditional practice of growing wheat and lentil as intercrops as they are reported to be beneficial in terms of soil nitrifier population and N dynamics.

A wealth of information on structure and species diversity of forest ecosystems at various levels of disturbance across the Himalaya has been generated over the years. And in this context Pokhriyal *et al*. (2012) have assessed and analyzed the Phakhot watershed of central Himalaya that harbours *Anogeissus latifolia* subtropical dry deciduous forest (600 - 1200 m asl) and *Quercus leucotrichophora* moist temperate forest (1500 - 1900 m asl). The results showed that tree density was higher in the *Anogeissus latifolia* mixed forest, while shrub and herb density was high in *Quercus leucotrichophora* forest as compared to the *Anogeissus latifolia* mixed forest. And that Asteraceae was the dominant family at all disturbance levels in both forest types. A sharp decline in tree density and basal area was recorded with increasing disturbance level in both the forests. Species richness (number of species per unit area) of trees, shrubs and herbs declined with disturbance, except for the highly disturbed *Anogeissus* forest which was more species rich than the undisturbed or moderately disturbed forest. Another related study by Pant & Samant (2012) on diversity and regeneration status of tree species in Khokhan Wildlife Sanctuary, North-Western Himalaya reveals that *Cedrus deodara* community represented maximum sites and maximum density of trees, seedlings and saplings among the 17 forest tree communities identified in 65 sample

sites. And the *Picea smithiana* community showed maximum total basal area (186.20 m^2 ha^{-1}). The results were found comparable with the recorded values reported for sub-tropical, temperate and sub-alpine regions of the west Himalaya. A trend of possible change of species composition particularly in sapling layer calls for long term monitoring of tree communities for developing best practices in conservation management.

Kaur *et al.* (2012) while assessing the extent of natural resource degradation in three micro-watersheds of river Tons (Uttarakhand) using RS and GIS data on forest fragmentation, biodiversity inventories and socio-economic data identified linkages between the biodiversity loss and its impact on ecosystem services. The authors infer that during the last 10 years, the vegetal cover has undergone significant changes with increasing population pressure (both human and animal), increase in agricultural land and over- exploitation of forest resources that has altered the natural landscape to a great extent. This in turn has led to increased incidents of hazards such as mass movement and soil erosion in this valley.

Climate change issues have attracted serious attention across the globe for the past decade or so and India is no exception. In this issue, we have three such papers that include a short communication. Negi *et al.* (2012) dwell on the impact of climate change on agriculture, water and forest ecosystems in the western Himalaya and provide a review on extent of utilizable information, need for categorizing such information and scope for strengthening climate data collection network. The authors emphasize on the need to (i) augment coordinated efforts for preparedness and mitigation approaches as mountain ecosystems and the communities are vulnerable and at a much greater risk of climate change impacts, (ii) network with other potential players to utilize the synergy in the best interest of survival, and ensuring livelihood security of the inhabitants of the region and that of the adjacent low-lands and (iii) balance between economic interests and ecological imperatives is also essential. Another paper on the subject by Murthy *et al.* (2012) on potential for increasing carbon sinks in Himachal Pradesh by increasing the tree cover and thereby the biomass and carbon as a mitigation option is analyzed. The study includes degraded forestland, degraded community land and degraded and abandoned private land and estimates the mitigation potential at the state level considering land available under more than one category. It also provides a roadmap for future work in support of mitigation analysis and implementation. A short communication on climate change, alpine treeline dynamics by Negi (2012) reviews the variability in application of terminology and methodology adopted in a case study and emphasizes the need to develop a uniform framework of sampling methodology that is compatible with international standards so that the inferences drawn on climate change related issues are based on robust datasets.

The results and recommendations that emanate through the above papers in this Issue indicate the importance of application of ecological knowledge in (i) developing people centred community based conservation approaches, (ii) augmenting biodiversity assessments, (iii) measuring variability at various levels, (iv) measuring sequestration potential, (v) promoting traditional practices in agro-ecosystems, (vi) assessing status of dominants/co-dominants over time and space, (vii) linking biodiversity loss with impact on ecosystem services, (vii) striking a balance between economic interests and ecological imperatives in the event of changing patterns and (viii) developing a uniform framework of methodologies to monitor changing patterns that are compatible with international standards.

It is my earnest hope that readers will find this Issue interesting and informative.

Acknowledgements

At the outset I thank Professor J. S. Singh, Chief Editor, *Tropical Ecology* for giving me an opportunity to be a Guest Editor for this Special Issue. I consider this an honour and privilege. I thank all those associated with the preparation and publication of this issue. I wish to thank all contributors and, of course, reviewers who did a magnificent job and helped me a great deal in putting the selected papers together. The support from The National Academy of Sciences, Allahabad, India, in the form of NASI-Senior Scientist Platinum Jubilee Fellowship is gratefully acknowledged.

References

Chettri, Nakul, Rajesh Thapa & Bandana Shakya. 2007. Participatory conservation planning in Kangchenjunga transboundary biodiversity conservation landscape. *Tropical Ecology* **48**: 163-176.

Chettri, Nakul, Eklabya Sharma & Robert Zomer. 2012. Changing paradigm and post 2010 targets: Challen-

ges and opportunities for biodiversity conservation in the Hindu Kush Himalayas. *Tropical Ecology* **53**: 245-259.

Deb, Panna & R. C. Sundriyal. 2007. Tree species gap phase performance in the buffer zone area of Namdapha National Park, Eastern Himalaya, India. *Tropical Ecology* **48**: 209-225.

Ghosh, P. & P. P. Dhyani. 2012. N-transformation rates and nitrifier population dynamics in traditional agro-ecosystem of central Himalaya. *Tropical Ecology* **53**: 295-305.

Hiremath, A. & M. Agrawal. 2010. Plant invasion and environmental pollution: causes of concern. *Tropical Ecology* **51**: 303-304.

Hussain, M. Shah, Aisha Sultan, Jamal A. Khan & Afifullah Khan. 2008. Species composition and community structure of forest stands in Kumaon Himalaya, Uttarakhand, India. *Tropical Ecology* **49**: 167-181.

Kaur, Ranjeet, S. P. Joshi & M.M. Srivastava. 2012. Natural resource degradation in three micro-watersheds of river Tons, Uttarakhand, India. *Tropical Ecology* **53**: 333-343.

Khan, M. L. & Uma Shankar. 2001. Effect of seed weight, light regime and substratum microsite on germination and seedling growth of *Quercus semiserrata* Roxb.. *Tropical Ecology* **42**: 117-125.

Khera, Neeraj, Arvind Kumar, Jeet Ram & Ashish Tewari. 2001. Plant biodiversity assessment in relation to disturbances in mid elevational forest of Central Himalaya, India. *Tropical Ecology* **42**: 83-95.

Kushwaha, S. P. S., V. K. Dadhwal & Skip J. Van Bloem. 2010. Remote sensing of tropical ecosystems. *Tropical Ecology* **51**: 1-2.

Murthy, I. K., Arvind Kumar Alipuria & N. H. Ravindranath. 2012. Potential for increasing carbon sinks in Himachal Pradesh. *Tropical Ecology* **53**: 357-369.

Nath, Arun Jyoti & Ashesh Kumar Das. 2012. Carbon pool and sequestration potential of village bamboos in the agroforestry system of northeast India. *Tropical Ecology* **53**: 287-293.

Negi, G. C. S., P. K. Samal, J. C. Kuniyal, B. P. Kothyari, R. K. Sharma & P. P. Dhyani. 2012. Impact of climate change on the western Himalayan mountain ecosystems: An overview. *Tropical Ecology* **53**: 345-356.

Negi, P. S. 2012. Climate change, alpine treeline dynamics and associated terminology: focus on north-western Indian Himalaya. *Tropical Ecology* **52**: 371-374.

Pant, Shreekar & S. S. Samant. 2012. Diversity and regeneration status of tree species in Khokhan Wildlife Sanctuary, north-western Himalaya. *Tropical Ecology* **53**: 317-331.

Pokhriyal, Prerna, D. S. Chauhan & N. P. Todaria. 2012. Effect of altitude and disturbance on structure and species diversity of forest vegetation in a watershed of central Himalaya. *Tropical Ecology* **53**: 307-315.

Rao, K. S., R. L. Semwal, R. K. Maikhuri, S. Nautiyal, K. K. Sen, K. Singh, K. Chandrashekhar & K. G. Saxena. 2003. Indigenous ecological knowledge, biodiversity and sustainable development in the central Himalayas. *Tropical Ecology* **44**: 93-111.

Rawat, G. S. 2009. Current trends in tropical biodiversity research and conservation. *Tropical Ecology* **50**: 5-6.

Rawat, Mehga, H. B. Vasistha, R. K. Manhas & Mridula Negi. 2011. Sacred forest of Kunjapuri Siddhapeeth, Uttarakhand, India. *Tropical Ecology* **52**: 219-221.

Roy, P. S., Arijit Roy & Harish Karnataka. 2012. Contemporary tools for identification, assessment and monitoring biodiversity. *Tropical Ecology* **53**: 261-272.

Shankar, Uma & Idaiarilin L. Synrem. 2012. Variation in morphometric traits of fruits and seeds of *Prumus nepaulenis* Steud. in Meghalaya, India. *Tropical Ecology* **53**: 273-286.

Sharma, E., S. Bhuchari, M. A. Xing & B. P. Kothyari. 2007. Land use change and its impact on hydro-ecological linkages in Himalayan watersheds. *Tropical Ecology* **48**: 151-161.

Sharma, Rita, Janchu Xu & G. Sharma. 2007. Traditional agroforestry in the eastern Himalayan region: Land management system supporting ecosystem services. *Tropical Ecology* **48**: 189-200.

Singh, S. P., S. J. Van Bloem & A. R. Nautiyal (Series Editors). 2009. Papers from Tropical Ecology Congress. *Tropical Ecology* **50**: 1-3.

(Received on 13.05.2011 and accepted after revisions, on 04.06.2011)