

Prithipalsingh

Perspectives in Plant Ecology and Environmental Biology



**PERSPECTIVES IN PLANT
ECOLOGY AND
ENVIRONMENTAL BIOLOGY**

PERSPECTIVES IN PLANT ECOLOGY AND ENVIRONMENTAL BIOLOGY

**KIRORIMAL COLLEGE
GOLDEN JUBILEE COMMEMORATIVE VOLUME**

Editor
PRITHIPALSINGH



SCIENTIFIC PUBLISHERS (INDIA)
P. O. BOX 91 JODHPUR

Published by:

Pawan Kumar

Scientific Publishers (India)

5-A, New Pali Road, P.O. Box 91

Jodhpur - 342 001

E-mail : info@scientificpub.com

www.scientificpub.com

© Prithipalsingh, 2006

ISBN: 81-7233-415-X

ISBN: 97-881-72334-15-3 (13)

eISBN: 978-93-87741-35-5

Lasertype set: Rajesh Ojha

Printed in India

Foreword

“Peace on Earth depends on our ability to secure our living environment”

— Nobel Peace Prize Citation – 2004

“The environment is very important in the aspects of peace because when we destroy our resources, they become very scarce and we fight over that”

— Wangari Maatthai, Nobel Peace Prize Winner – 2004

Books such as “Silent Spring” by Rachael Carson, “Deserts on the March” by Paul Sears, and “The Quiet Crisis” by S.L. Udal attracted the attention of mankind on several important ecological issues. Similarly, compilations such as “The Global Environmental Outlook Series”, and “The Millennium Report on the Environment” have enlightened us on the need to understand the complex interrelationships in nature. The present volume commemorating the Golden Jubilee of Kirorimal College presents current knowledge in different areas of the environment. Dr. Prithipalsingh has done a commendable job in collecting the different contributions from eminent scholars. The volume shall serve as a very valuable source of information to teachers and students.

I.M. Kapahi

Convenor, Golden Jubilee Celebration Committee

Bhim Sen Singh

Principal

Kirorimal College

Preface

*“Knowledge is not gained through one means alone.
Whether that is talked of as Science or Religion
Or the Intuition that integrates all
Or Imagination, Emotion or Greater Reason”*

**“Years of Pilgrimage”
- a long poem by Tim Cloudsley**

Ecology is the oldest science and the most primitive humans must have been ecologists of some kind. They were required to understand where and when to look for their food and other needs as well as to protect the same. In this context, primitive humans learnt about the distribution and abundance of the plants and animals beneficial/harmful for their survival. This led to the management of their natural resources by allowing them to:

- maximize the rate at which food is collected from natural environments, and how this can be done repeatedly over time;
- how domesticated plants and animals can best be planted or stocked so as to maximize rates of return;
- how food organisms can be protected from their own natural enemies;
- how to control the populations of pathogens and parasites that live on us.

In the early days of this science, the term commonly used for referring to these activities of humans was ‘Natural History’. The term ‘Ecology (originally in German: *Oekologie*) was first defined in 1866 by Ernst Haeckel as “the comprehensive science of the relationship of the organism to the environment”. More recently, Ricklefs (1973) in his textbook (*Ecology*, Nelson, London) defined ecology as “the study of the natural environment, particularly the interrelationships between

organisms and their surroundings". This has led to the recognition of "Environmental Biology" as a sub-discipline encompassing ecology in all its facets.

In compiling this volume to commemorate the Golden Jubilee Year of the establishment of Kirorimal College, it has been my endeavour to focus on the growing awareness about plant ecology and environment biology. The different contributions present an up-to-date, detailed and balanced overview of the current knowledge within specific topics. The volume is meant to serve as a useful reference book for graduate and post-graduate students.

Planning and publishing a book is a challenging task. It becomes easy when one receives co-operation from different individuals. This must be acknowledged. It is therefore a pleasure to record my gratitude to the people who helped me in compiling this Golden Jubilee Commemorative Volume. First and foremost, I must acknowledge the fact that I learnt many aspects of Plant Ecology from my teacher, Professor K.M.M. Dakshini, an ecologist, plant taxonomist, field biologist, and a true naturalist. He has been a constant source of guidance and inspiration. The Principal of Kirorimal College, Dr. Bhim Sen Singh, and the Convenor of the Golden Jubilee Celebration Committee, Shri I.M. Kapahi encouraged me in this task and I am grateful to them. They provided me with all necessary support required for the successful completion of this endeavour.

I am grateful to all the contributors who readily responded to my request and shared my enthusiasm by sending me their articles for editing and inclusion in the volume. They very generously accepted the suggestions made by me and incorporated the same in their contributions. Without their support and co-operation, this task would have been impossible. I also thank the publisher (Shri Pawan Kumar Sharma and his team) for the concerted effort of taking this volume from manuscript into print and doing a commendable job.

I also thank all my colleagues in the Department of Botany, Kirorimal College, for their encouragement and valuable co-operation. Last but not the least, the support from my family helped me in this task. Very special thanks to my wife, Avinash and daughter, Ishleen for accepting my work schedule during the editing of this volume.

List of Contributors

- **Dr. Anuradha Agrawal**, National Bureau of Plant Genetic Resources, Pusa Campus, New Delhi 110012.
- **Ms. Chetna Anand**, Senior Research Fellow, Biology Laboratory, Central Pollution Control Board, Parivesh Bhawan, East Arjun Nagar, Delhi 1100032 (chetna_anand@rediffmail.com)
- **Dr. B. Balaguru**, The Rapinat Herbarium, St. Joseph's College (Autonomous), Tiruchirapally – 620002.
- **Dr. D.R. Batish**, Associate Professor, Department of Botany, Panjab University, Chandigarh 160014 (Corresponding author, daizybatish@yahoo.com)
- **Dr. Sumana Bhattacharya**, Expert Consultant, NATCOM Project Management Cell, 1, Navjeevan Vihar, New Delhi 110017.
- **Dr. Pratibha Bрами**, Senior Scientist, National Bureau for Plant Genetic Resources, Pusa Campus, New Delhi 110012 (Corresponding author, pratibha@nbpgr.ernet.in, Kirorimal College alumnus)
- **Dr. S. John Britto, S.J.**, Director, The Rapinat Herbarium, and Principal, St. Joseph's College (Autonomous), Tiruchirapally – 620002 (Corresponding author, sjcbritto@rediffmail.com)
- **Dr. Amit Garg**, Expert Consultant, NATCOM Project Management Cell, 1, Navjeevan Vihar, New Delhi 110 017.
- **Shri Deepak Jolly George**, Research Fellow, Sustainable Natural and Plantation Forest Management Division, Kerala Forest Research Institute, Peechi
- **Shri P. Shajeesh Jan**, Research Fellow, Sustainable Natural and Plantation Forest Management Division, Kerala Forest Research Institute, Peechi
- **Dr. V. Jeeva**, Scientist, Environment Impact, Directorate of Research, Indian Council for Forestry Research and Education, P.O. New Forest, Dehradun-248076 (Corresponding author, sudhir@icfre.org; sudhirjeeva@yahoo.co.in)
- **Dr. Jose Kallarackal**, Programme coordinator, Sustainable Natural and Plantation Forest Management Division, Kerala Forest Research Institute, Peechi (Corresponding author, jose@kfri.org)
- **Dr. M. A. Khalid**, Senior Fellow, Forestry and Biodiversity Division, The Energy Research Institute (TERI), India Habitat Centre, Lodhi Road, New Delhi 110003 (Corresponding author, makhalid@teri.res.in, makhalid2005@rediffmail.com)
- **Shri Khushwant Singh**, IFS, Forestry and Biodiversity Division, The Energy Research Institute (TERI), India Habitat Centre, Lodhi Road, New Delhi 110003 (kssethi@teri.res.in, Kirorimal College alumnus)
- **Dr. R. K. Kohli**, Department of Botany, Panjab University, Chandigarh 160014.
- **Dr. Sudhir Kumar**, Scientist, Environment Impact, Directorate of Research, Indian Council for Forestry Research and Education, P.O. New Forest, Dehra Dun-248 076.

- **Dr. Payal Mago**, Department of Botany, Sri Aurbindo College, University of Delhi, New Delhi 110 017 (payal500@hotmail.com)
- **Dr. Neelam Malkani**, Department of Botany, Daulat Ram College, University of Delhi, Delhi 110 007 (s.malkani@eil.co.in)
- **Dr. V. M. Mehr-Homji**, 20-D Sagar Sangeet, 58 Colaba Road, Mumbai 400 005.
- **Dr. K.K. Mohapatra**, Senior Fellow, Forestry and Biodiversity Division, The Energy Research Institute (TERI), India Habitat Centre, Lodhi Road, New Delhi 110 003.
- **Dr. N. Nagamurugan**, The Rapinat Herbarium, St. Joseph's College (Autonomous), Tiruchirapally – 620 002.
- **Dr. D. Natarajan**, The Rapinat Herbarium, St. Joseph's College (Autonomous), Tiruchirapally – 620 002.
- **Dr. Roshini E. Nayar**, Principal Scientist, National Bureau for Plant Genetic Resources, Pusa Campus, New Delhi 110 012 (roshinienayar@yahoo.com)
- **Shri R. C. Pal**, IFS, Head Environment Impact, Directorate of Research, Indian Council for Forestry Research and Education, P.O. New Forest, Dehra Dun-248076.
- **Dr. P. K. Pande**, Wood Anatomy Discipline, Botany Division, Forest Research Institute, Dehradun 248 006 (pandep123@rediffmail.com)
- **Dr. P. K. Parihar**, Department of Geography, Dyal Singh College, University of Delhi, New Delhi 110 003.
- **Dr. Seema Parihar**, Department of Geography, Kirorimal College, University of Delhi, Delhi 110 007 (Corresponding author, parihars@vsnl.com, Kirorimal College alumnus)
- **Shri Piyush Kumar Sharma**, Lecturer, Campus, Law Centre, Faculty of Law, University of Delhi, Delhi-110 007. (piyushsharma2005@rediffmail.com)
- **Dr. Prithipalsingh**, Department of Botany, Kirorimal College, University of Delhi, Delhi 110 007 (prithipalsingh_1946@yahoo.co.in)
- **Professor P. S Ramakrishnan**, Emeritus Professor, School of Environmental Sciences, Jawaharlal Nehru University, New Delhi 110 067 (psr@mail.jnu.ac.in).
- **Dr. A.S. Raturi**, Scientists, Environment Impact, Directorate of Research, Indian Council for Forestry Research & Education, P.O. New Forest, Dehra Dun 248076.
- **Professor G. S. Roonwal**, Department of Geology, University of Delhi, Delhi 110 007 (gsroonwal@hotmail.com)
- **Dr. Subodh K. Sharma**, Advisor, Ministry of Environment & Forests, Government of India and National Project Director, India's Initial National Communication to the UNFCCC (NATCOM), CGO Complex, Lodhi Road, New Delhi 110 003 (Corresponding author, subodh14@yahoo.com)
- **Dr. H. P. Singh**, Department of Botany, Panjab University, Chandigarh 160014.
- **Dr. S. Soosairaj**, The Rapinat Herbarium, St. Joseph's College (Autonomous), Tiruchirapally – 620 002.

Contents

<i>Forword</i>	<i>v</i>
<i>Preface</i>	<i>vii</i>
<i>List of Contributors</i>	<i>ix</i>
1. Introduction	
	— <i>Prithipalsingh</i> 1
2. Climate Change: A Global Environmental Challenge	
	— <i>Subodh Sharma, Amit Garg and Sumana Bhattacharya</i> 11
3. Climate Change and its Impacts on Tropical Forest Ecosystem	
	— <i>P. Shajeesh Jan and Jose Kallarackal</i> 53
4. Status, Impacts and measures to combat desertification- Indian Scenario	
	— <i>R.C. Pal, V. Jeeva, Sudhir Kumar and A.S. Raturi</i> 59
5. Environmental Laws in India: An Appraisal	
	— <i>Piyush Kumar Sharma</i> 79
6. The Biodiversity Act of India: An Appraisal	
	— <i>Pratibha Brahmi and Anuradha Aggarwal</i> 121
7. Biodiversity and Intellectual Property Rights	
	— <i>Payal Mago</i> 135
8. Mineral Industry, Environment and Development	
	— <i>G. S. Roonwal</i> 169
9. Environmental Applications of Remote Sensing and GIS	
	— <i>Chetna Anand</i> 183

- 10 Characterization of Forest Resource Units of the Bhagirathi River Basin in Garhwal Himalaya using Remote Sensing and GIS
— *Seema M. Parihar and P. K. Parihar* 199
- 11 Analysis of Vegetation Pattern and Influences of some Abiotic Factors using Remote Sensing and GIS
— *S. John Britto, B. Balaguru, N. Nagamurgan, S. Soosairaj and D. Natarajan* 225
- 12 The Changing Face of Delhi
— *Neelam Malkani* 239
- 13 Impacts of Converting Tropical Forests into Plantations
— *Deepak Jolly George and Jose Kallarackal* 255
- 14 Allelopathy and its Role in Sustainable Agriculture
— *D.R. Batish, H.P. Singh and R.K. Kohli* 261
- 15 Wild Relatives of Crop Plants in the Indian Region: Diversity, Distribution and Phytogeography
— *E. Roshini Nayar* 271
- 16 Management of Muli bamboo (*Melocanna baccifera*) flowering in Tripura
— *Khushwant Singh* 291
- 17 Managing Protected Areas: Towards Sustainability
— *P.S. Ramakrishnan* 299
- 18 An overview of Wetland ecosystems in India with special emphasis on Conservation and Management of Wetlands of Gangetic plains of U.P.
— *M.K. Khalid and K. K. Mohapatra* 337
- 19 Coastal Erosion
— *V. M. Meher-Homji* 357
- 20 Biomass stocks and productivity potential in the disturbed open canopy forests of Satpura plateau
— *P. K. Pande* 363