Agroforestry

Jagdish Chander Dagar • Vindhya Prasad Tewari
Editors

Agroforestry

Anecdotal to Modern Science

Springer

Editors

Jagdish Chander Dagar
Natural Resource Management Division
Indian Council of Agricultural Research
New Delhi, India

Vindhya Prasad Tewari
Himalayan Forest Research Institute
Shimla, Himachal Pradesh, India

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Foreword

In the past, urban expansion has been at the expense of forests and woodlands. The accumulated effects of these changes are reflected in serious soil degradation, desertification and loss of biodiversity, leading to environmental insecurity and vagaries of climate change. Integrating trees on agricultural fields is one of the solutions for addressing these challenges. Agroforestry has the potential to restore degraded ecosystems and render environmental services along with socio-economic benefits.

In recent years agroforestry has been developed as an autonomous science that aims at helping farmers to increase the productivity, profitability and sustainability of their land, and, hence, scientific efforts have been made to classify, understand and improve models empirically established over the centuries by farmers' wisdom. Agroforestry imparts methods of ameliorating and mitigating the effects of harsh and erratic climatic conditions and poor soils, raising soil fertility buildup and enhancing symbiotic activities that help crop growth and sustainable production of food and feed, fuel, timber, fibre, medicines and several other products of day-to-day utilization on farms.

The need for sound scientific information in the development of agroforestry technologies at various levels has grown significantly in recent years. Against this background, this book *Agroforestry: Anecdotal to Modern Science*, edited by Dr. J.C. Dagar and Dr. V.P. Tewari, which encompasses 35 chapters contributed by leading agroforestry researchers from various countries throughout the world, is a very welcome move and will be extremely useful to everybody in understanding the evolution of agroforestry from a traditional system to modern art and science.

The editors of this book have embarked on a wide range of topics dealing with the evolution of agroforestry, traditional agroforestry systems, agroforestry as a modern science, the monitoring and assessment of trees outside forests, new approaches in cut-and-carry systems, urban and peri-urban agroforestry, the role of microbial biodiversity and soil micro-arthropods in enhancing agroforestry production, the regulation of ecosystem services delivered by agroforestry in different parts of the world and agroforestry for climate change mitigation.

I sincerely hope that this book will serve as a useful text of reference for researchers and students engaged in the pursuit of agroforestry research and development and will be a useful tool for those who are involved in policy issues. I congratulate the editors of this book for their sincere efforts.

A handwritten signature in black ink, appearing to read 'M. S. Swaminathan', written in a cursive style.

Chennai, India

M. S. Swaminathan

Preface

Most of the world's closed forests, covering approximately 2800 million hectares, are found in the Northern Hemisphere and in the equatorial region. The pressures exerted by the rising human populations on uninhabited forest areas are a cause of great concern. Natural forests are being destroyed permanently at a rate of 8–10 million hectares per year in the tropics. Appropriate and effective technologies have to be developed for the sustainable management of the forests and plantations. Trees outside forests play a very important role in catering to the day-to-day need of the rural population, and hence assessment of this valuable resource based on the reliable data is the need of the hour. Suitable strategies must be developed for the genetic improvement of the tree species for enhancing production to meet the needs of increasing populations. In recent times, agroforestry is playing a very important role in revegetating the degraded lands across the globe. Many of the anecdotal agroforestry practices, which are time-tested and evolved through traditional indigenous knowledge, are still being followed in different agro-ecological zones with some modifications. The traditional knowledge and the underlying ecological principles concerning indigenous agroforestry systems around the world have been successfully used in designing the improved systems. Many of them such as improved fallows, homegardens, alley cropping, and park systems have evolved as modern agroforestry systems.

During the past four decades, agroforestry has come of age and begun to attract the attention of the international scientific community, primarily as a means for sustaining agricultural productivity in marginal lands and solving the second-generation problems such as secondary salinization due to waterlogging and contamination of water resources due to use of excess nitrogen fertilizers and pesticides. Research efforts have shown that most of the degraded areas including saline, waterlogged, and perturbed ecologies like mine spoils and coastal degraded mangrove areas can be made productive by adopting suitable agroforestry techniques involving highly remunerative components such as plantation-based farming systems, high-value medicinal and aromatic plants, livestock, poultry, forest and fruit trees, and vegetables. New concepts such as integrated farming systems and urban and peri-urban agroforestry have emerged. Consequently, the knowledge base of

agroforestry is being expanded at a rapid pace as illustrated by the increasing number and quality of scientific publications of various forms on different aspects of agroforestry.

It is both a challenge and an opportunity to the scientific community working in this interdisciplinary field. To prepare themselves better for facing future challenges and seizing the opportunities, scientists need access to synthesized information and develop technologies to assess the environmental benefits we get from different agroforestry services. The global community is still only in the beginning phase to recognize the potential benefits of many underexploited systems to address the most intractable land management problems of the twenty-first century, such as food and nutrient security, climate change mitigation and adaptation, biodiversity conservation, and rehabilitation of degraded ecosystems. As we move forward to vigorously exploit these potential benefits, we will witness the involvement of agroforestry and its progress for solving these problems and be able to ensure food and environmental security at a global level.

To develop the strategies for moving forward, it is essential to evaluate the past and present status of research and concepts and think of developing strategies for further progress in the field seeing the modern challenges ahead. Therefore, it has been tried to obtain contributions from eminent persons working in their fields of specialization at a global level. Many of the articles are related to the most modern fields of agroforestry such as rehabilitation of problem soils; urban and peri-urban agroforestry; mitigation of climate change through carbon sequestration; role of pollinators, arthropods, and microbiology in enhancing agroforestry production; and environmental services availed from different agroforestry systems. The editors are thankful to the contributors as well as to all those who helped in the preparation of this volume. We hope that this compilation will be of value to the researchers and students pursuing the goals of harnessing management and genetic options to enhance farm productivity and value of trees and medicinal plants to provide our populace with forest produce of day-to-day need on a sustained basis and improved environmental quality for better health, thought, and mind. The book will also be useful for teachers, researchers, students, and policy makers and all those who are interested in this unique field of agroforestry.

New Delhi, India
Shimla, Himachal Pradesh, India

Jagdish Chander Dagar
Vindhya Prasad Tewari

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About the Authors

Dr. Jagdish Chander Dagar has published more than 280 research papers in peer-reviewed journals and papers in proceedings of conferences/symposia, has authored and edited 12 books, and has written more than 50 articles. He was the Assistant Director General at the headquarters of ICAR and Emeritus Scientist. His research interests are in the areas of biosaline agriculture, agroforestry, management of natural resources, rehabilitation of degraded lands, biodrainage, ethnobotany, plant ecology, climate change, and sustainable agriculture and policy. In recognition of his research contributions, Dr Dagar has been conferred with several awards and honors: the Sajjad Memorial Gold Medal, the ICAR's Hari Om Ashram Trust Award, UGC's Swami Pranavananda Saraswati National Award, CSSRI Excellence Award on Soil Salinity and Water Management, Bharat Excellence Award and Gold Medal, and Dr KG Tejwani Award for Excellence in Agroforestry Research and Development. Further, he is a Fellow of the National Academy of Agricultural Sciences and Fellow and Life Member of several other professional societies. He is Chief Editor of the journal *Soil Salinity and Water Quality*.

Dr. V.P. Tewari is a Scientist at the Indian Council of Forestry Research and Education (ICFRE), Dehradun (an autonomous council under the Ministry of Environment & Forests, Government of India) and is presently working as Director of the Himalayan Forest Research Institute, Shimla. He also worked as an FAO fellow for 1 year (1995 to 1996) at the Institute of Forest Management and Yield Science, University of Goettingen (Germany). He was awarded the Brandis Prize in 1998 by the Indian Forester for publishing the most outstanding paper in the field of silviculture and forest management. He has authored over 70 research papers in various peer-reviewed international journals and has 3 edited books to his credit. He has also presented 38 papers at various international and national conferences and workshops. Lastly, he has served as a National Subject Matter Coordinator on "Forest Biometrics" at the ICFRE and is listed in the UNCCD Roster of Experts from India.