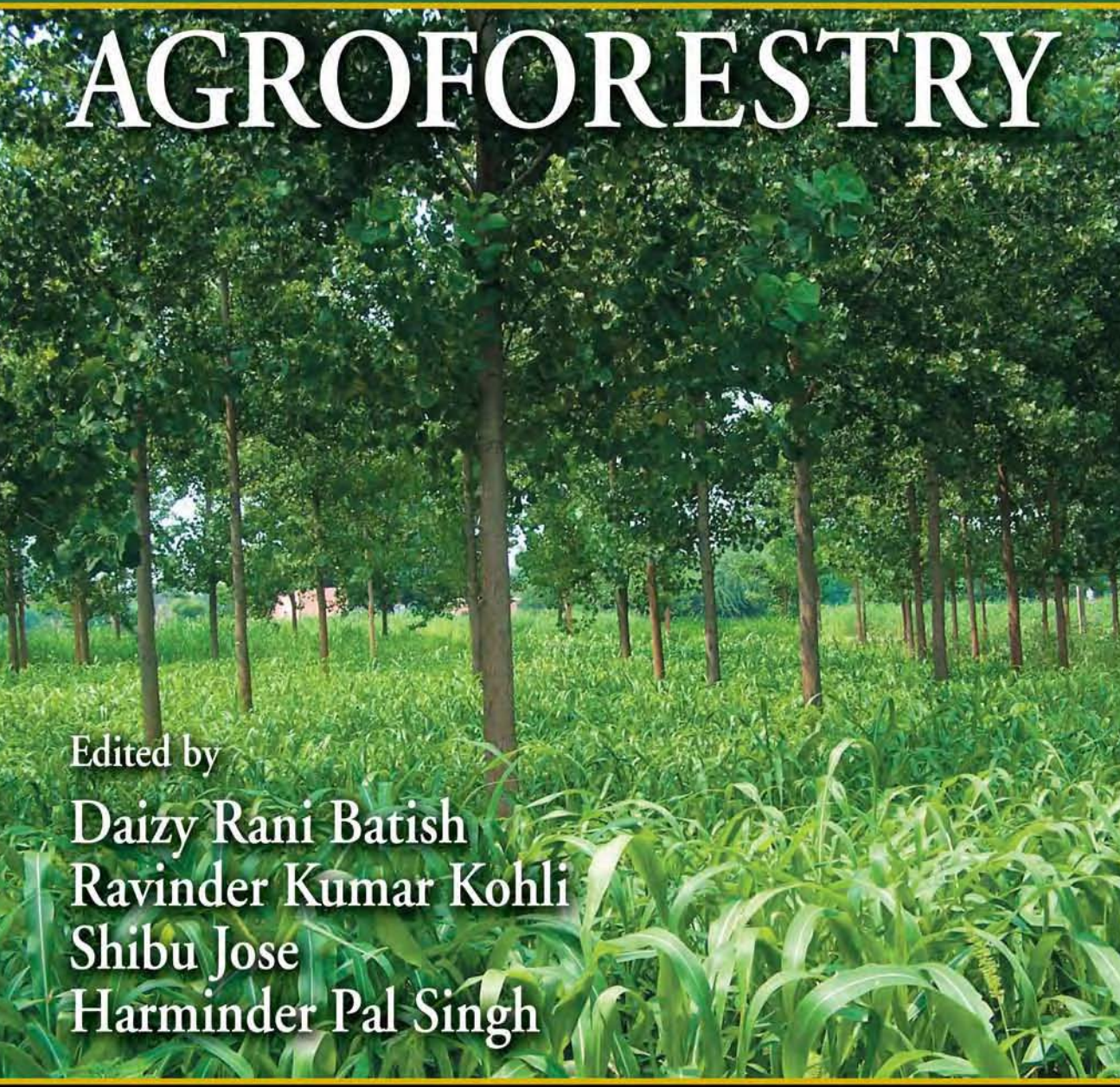
ECOLOGICAL BASIS OF AGROFORESTRY



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Contents

Preface

The world at present is facing innumerable problems such as burgeoning population, ecosystem degradation, particularly in the tropics, declining agricultural productivity, and changing environment. In order to sustain in the future, it is essential to find solutions to these problems, particularly with regard to ensuring food security and coping with the changing environment. Existing approaches to enhance productivity and mitigate environmental degradation are inadequate. Proper land-use patterns, sustainable agroecosystems, and resource management are possible alternatives to these problems. Agroforestry—a traditional practice of combining trees with agricultural crops or pasture—can contribute substantially in this direction through its multiple benefits and ecosystem services. If properly designed, agroforestry may help in alleviating poverty, providing food security and livelihood, maintaining ecosystem health, managing pest and weeds, conserving biodiversity, and mitigating greenhouse effects by carbon sequestration. Conversely, a poorly designed agroforestry system may lead to problems such as loss of productivity due to resource competition and allelopathy or negative effects of shading, aggravated problems of pest and weed infestation, loss of diversity, and ecosystem degradation due to the introduction of invasive species.

For an agroforestry system to be profitable, better understanding of various ecological processes that govern these complex systems is required. This volume aims at providing knowledge as to how ecologically sustainable agroecosystems can meet the challenges of enhancing crop productivity, soil fertility, and environment sustainability. The topics of the 19 chapters were carefully selected to accomplish the above objectives. These are divided into four sections—Ecological Interactions: An Overview (seven chapters), Belowground Ecology (six chapters), Models in Agroforestry (two chapters), and Ecological Economics (four chapters).

Part I focuses on various tree–crop interactions in different ecoregions of the world. Various above- and belowground interactions, especially in alley-cropping systems in temperate zones, have been critically analyzed and will be of immense help to readers. Among various interactions that affect crop productivity, allelopathy—a chemical-mediated interplant interaction—has often been rejected because of lack of sufficient field demonstration. A chapter is devoted to this important aspect of chemical ecology, which also highlights how allelopathy and the chemicals involved therein can be put to some practical use. The proof of attempt has also been made to include other important issues such as tri-trophic interactions and ecologically based pest management in agroforestry and how crop production can be enhanced. Part II is devoted to root-mediated belowground interactions in agroforestry systems and their role in enhancing crop productivity, soil fertility, and sustainability. An exhaustive study on litter dynamics in plantation and agroforestry systems and various factors affecting nutrient release may be beneficial to readers. Part III provides insight into the role of ecological modeling of complex agroforestry systems such as shelterbelts and how they help in choosing suitable computer-based designs to gain profitability. Part IV deals with various socioeconomic aspects of agroforestry and technological tools that benefit society in different eco-regions of the world. It also intends to supply in-depth knowledge on various farming systems and technologies that help enhance the socioeconomic status of farmers and provide environmental benefits to land users.

In sum, efforts have been made to integrate the relevant information on various ecological processes in the agroforestry system into a single comprehensive volume that will be useful to