

Ecology, Ecosystems and Stress: Impacts, Adaptation and Mitigation

Edited by

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Preface

This chapters consists of disciplines with voluminous and diverse issues in ecosystem. Ecosystems offer many goods and services that are of imperative significance for the execution of the biosphere, and provide the basis for the delivery of tangible benefits to human society.

The chapter selected in different disciplines is based on the following priorities:

- Supporting services, such as primary and secondary production and biodiversity
- Provisioning services, such as food, fibre and medicinal products
- Regulating services, which are of principal significance for human society such as carbon sequestration, climate and water regulation, protection from natural hazards ,water and air purification, and disease and pest directive
- Climatic variability and ecosystem change drivers
- Synergies and trade-offs between adaptation and mitigation

Further these collections will provide a much needed platform to discuss the emerging issues and problems in ecosystem and will come out with a well defined strategy to overcome the challenges in times to come. This book is therefore an extremely valuable contribution towards natural sciences with its roots in science disciplines, most notably biology and chemistry.

The sixteen papers of this book published by ATINER is a mirror image of a representative part of the huge initiatives in the field of ecosystem. I hope that the readers will find this collection of papers interesting as well as stimulating. I am very grateful to **Gregory T. Papanikos**, President, ATINER, Greece for inspiration and administrative support and to Olga Gkounta for editing the manuscripts. Last, but by no means least, I acknowledge the exceptional commitment of the members of the Technical Support Unit of ATINER throughout the preparation of the book .Many of the experiments are analyzed and explained in this volume are ongoing, and the interpretation and suggestions offered will contribute to future course of the deliberations.



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About the Author



Amitava Rakshit, an IIT, Kharagpur alumnus is presently the faculty member in the Department of Soil Science and Agricultural Chemistry at Institute of Agricultural Sciences, Banaras Hindu University (IAS, BHU). Dr. Rakshit worked in the Department of Agriculture, Government of West Bengal in administration and extension roles. He has visited Scandinavia, Europe and Africa pertaining to his research work and presentation. He was awarded with TWAS Nxt Fellow (Italy), Biovision Nxt Fellow (France), Darwin Now Bursary (British Council), Young achiever award and Best Teacher's Award at UG and PG level. He is serving as review college member of British Ecological Society, London since 2011. He is the fellow of Society of Earth Scientists. He has published 100 research papers, 15 book chapters, 28 popular articles, one manual and co-authored ten books.

Ecology, Ecosystems and Stress: Impacts, Adaptation and Mitigation: An Introduction

Amitava Rakshit

Ecology is the study of certain processes that tie the living, or biotic, components to the non-living, or abiotic, components which seek to comprehend the vital networks between plants and animals and the world around them. Ecology also provides information about the reimbursement of ecosystems and how we can use Earth's resources in ways that leave the environment healthy for future generations. Ecologists study these associations among organisms and habitats of many different sizes, ranging from the study of microscopic bacteria growing in a fish tank, to the complex interactions between the thousands of plant, animal, and other communities found in a desert. Ecologists also study diverse kinds of environments. **Ecosystems study** mainly concentrates on the study of certain processes that link the living, or biotic, components to the non-living, or abiotic, components. More or less all ecosystems involve living organisms, a physical environment and a source of energy to make the whole thing work efficiently. And with in this framework energy transformations and biogeochemical cycling are the main processes that comprise the field of **ecosystem ecology**. **Ecosystem ecology** is basically the integrated study of biotic and abiotic components of **ecosystems** covering **biology**, geography and **earth** science with a special reference to the varieties of species, genes, and **ecosystems** and their interactions within an **ecosystem** framework. This science examines how **ecosystems** work and relates this to their components such as chemicals, bedrock, soil, plants, and animals.

Recent evidences demonstrated that nearly all ecosystems are subject to intermittent disturbances by natural events, such as flood, fire, drought, and biotic persuasion. Recent estimate predicted that earth has lost 80% of her old-growth forests, 50% of her soil, 90% of the big fish – and many water, land, and ocean ecosystems, as well as atmospheric stability, as a resultant collective impairment by both biotic and abiotic component with a human population which has soared more than sevenfold in a time frame of 135 years. The human population continues to grow and this, combined with the strain for economic growth and development, will tend to increase our demands on other living things and the physical environment. The global ecological system is in trouble and dying under the convergence of inexplicably devouring their ecosystem habitats. Apart from this, Climate is an important environmental influence on ecosystems. Climate changes and the impacts of climate change affect ecosystems in a variety of ways. For instance, warming could force species to migrate to higher latitudes or higher elevations where temperatures are more conducive to their survival. Similarly, as sea level rises, saltwater intrusion into a freshwater system may force some key species to relocate or die, thus removing predators or prey that were critical in the existing food chain.

When such turmoil are intense, ecosystems of immense complication undergo rapid renovation to systems of incredible simplicity that are characterized by a dearth of life forms and few or no symbiotic connections. However, this transformation sets the stage for recovery, which allows the ecosystem to acclimatize to altering environments. In vigorous systems, therefore, these perturbations are infrequently more than a temporary arrest, and healing is generally rapid. To administer – or defend – an ecosystem one need to know how the living things it contains depend on each other, and how they depend on the air, soil and water in which they live. In large part, this means understanding the interrelationships concerned, and so recognizing the penalty of our actions for the ecosystem as a whole.

There is an urgency to study in depth the health of ecosystems to find out how to protect them. There are some pertinent questions which need to be addressed .How much alteration has already taken place? What will be the long-term consequences of our actions? How can we increase an ecosystem's ability both to resist change and to recuperate from the changes that have happened by now .We are the most authoritative actors in most ecosystems, yet until in recent times we have been largely unaware of the ecological consequences of the way we live our lives. Adaptation to climate change for any kind of ecosystems encompasses a broad range of sustainable management techniques or crops, soil and organism under *soil-plant-animal-atmosphere continuum* .Ecosystem-based approaches provided extensive interlinked benefits across different agro ecological set up which basically involves the creation of green and blue space, which aids biotic and abiotic stresses. To make this approach more vibrant there are few issues which warrants immediate attention: stakeholder engagement and communication, and monitoring and adaptive management.

In nut shell the following agendas are very pertinent with reference to UNDP-GEF agenda:

- *Promoting ecosystem elasticity*
- *Nurturing ecosystem-based adaptation to and mitigation of climate change*
- *Reinforce the capability of secluded areas to enable climate change adaptation and mitigation*

Furthermore, from a climate change standpoint where doubt of changes is high, adaptive management is the only way to guarantee success.