

Preface

The environment is constantly changing due to our unsustainable activities. The challenge we are facing currently is to predict how future agriculture will respond to the changing environment. A rise in global mean temperature will mean increase in the melting of mountain glaciers, the permafrost soil zone, and the polar ice caps, posing a common global threat. The climate change impacts on soil structure constitute a more complex process. The direct impact will be on the degradation of aggregates in the soil due to raindrops, surface runoff, and leaching, especially during heavy rains, thunderstorms, the increasing in flood frequencies which are the typical characteristics of climate change. The indirect influences will originate from the changes in the vegetation patterns and land-use practices.

The ecosystems are a part of the climate and living beings have adapted to their regional climate over time. However, our adhoc activities and degradative attitudes have lead us to a situation that more than 60 % of the species have shifted from their habitats and grow now as “refugee species.” Infact, human created climate change will be one of the major threats of extinction to the biodiversity. Nearly 30 % of the species are face to face with a risk of extinction today. The habitat change is expected to result in the extinction of approximately 26 % of the species upto 2050. Atmospheric concentrations of carbon dioxide have been steadily rising, and projections are that in 2100 these may reach the levels ranging between 500–1000 ppm. These increases together with the changes in temperature; expected to reach to approximately 3 °C above the current values by 2100; will pose a serious threat to global crop production, change the geographical distribution and growing season of crops, and may reduce crop yields up to 17%. Plants will face several types of injuries from temperature stress, eventually leading food insecurity.

Already these changes are affecting the high-altitude and high-latitude ecosystems. Their resilience will be affected greatly during the course of this century. The effects of regional climates on the plant diversity at high altitudes is revealing that there is shift in the distributional ranges of species, directly depicted by phenological changes, an early onset of flowering, migration, and lengthening of the growing seasons.

The temperature increase due to global climate change will bring significant alterations in the altitudinal patterns of high-altitude forests in particular alpine zones.

These will face a change in the important ecosystem processes including impacts on snow accumulation, melting of glaciers, and a decrease in the water resources. Any degradation of forest cover will mean facing avalanches, decrease in the reflectance of solar radiation, increase in soil erosion, flooding, and landslides. The timberline species will serve as a key for understanding altitudinal variations.

Objectives of this book are to present a comprehensive insight on the problems related to ecosystem fragmentation, health and well being of high altitude ecosystems, ecosystem services for food and medicine, and the situation of invasive alien species.

A total of 23 chapters have been included contributed by the eminent scientists of the subject from Turkey, Pakistan, South America, Malaysia, Nepal, Kirgizistan, Kazakhstan, Georgia, Russia, Macedonia, Indonesia, and from North America.

We have more hotter and drier times ahead, many valuable ecosystems will be lost, there will be changes in the timing of seasonal life-cycle events, range shifts in many species, and threshold effects will be observed.

The data presented here covers some of the most important mountain ranges in the world including the Himalayas, Andes, Altai's, Tien-Shan, Caucasus, Taurus, Amanos, and other high altitude mountains of Turkey from the Black Sea region as well as Central and East Anatolian regions.

This work discusses the ecosystem health and climate change, ecosystem productivity, climate change and threats to high altitude ecosystems, soils and other limiting environmental factors at high altitudes. It also focuses on improving our understanding on the effects of climate change on biodiversity and is trying to give a thorough insight to the young researchers on these fragile ecosystems for their future evaluation.

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