Vegetation Dynamics And Global Change

Global ecosystem changes are influenced by a combination of natural and anthropogenic factors. Ongoing changes in rainfall, temperature, and carbon dioxide in the atmosphere can affect natural or managed vegetation, such as forest, grassland, or farmland. Moreover, anthropogenic pressures, such as forest clearing, cattle grazing, increasing infrastructural development, intensive management, and expansion of cropland, can contribute to ecosystem degradation. This collection presents a wide range of studies examining natural and anthropogenic drivers in diverse ecosystems in Africa, Asia, and North America.

This book unveils forestry science and its policy and management that connect past and present understanding of forests. The aggregated knowledge is presented to cover the approaches adopted in studying forest structure, its growth, functioning, and degradation, especially in the context of the surrounding environment. The application of advance computation, instrumentation, and modelling has been elaborated in various chapters. Forest ecosystems are rapidly changing due to forest fires, deforestation, urbanization, climate change, and other natural and anthropogenic drivers. Understanding the dynamics of forest ecosystems requires contemporary methods and measures, utilizing modern tools and big data for developing effective conservation plans. The book also covers discussion on policies for sustainable forestry,

agroforestry, environmental governance, socio-ecology, nature-based solutions, and management implication. It is suitable for a wide range of readers working in the field of scientific forestry, policy making, and forest management. In addition, it is a useful material for postgraduate and research students of forestry sciences.

This book celebrates the relaunch of the African Pollen Database, presents state-of-the-art of modern and ancient pollen data from sub-Saharan Africa, and promotes Open Access science. Pollen grains are powerful tools for the study of past vegetation dynamics because they preserve well within sedimentary deposits and have a huge diversity in ornamentation that allows different taxa to be determined. The reconstruction of past vegetation from the examination of ancient pollen records thus can be used to characterize the nature of past landscapes (e.g. abundance of forests vs. grasslands), provide insights into changes in biodiversity, and gain empirical evidence of vegetation response to climatic change and human activity. In this, the 35th Volume of "Palaeoecology of Africa", we bring together new data and extensive synthetic reviews to provide novel insights into the relationships between human evolution, human activity, climate change and vegetation dynamics during the Quaternary, the last 2.6 million years. Current and ongoing climate and land-use change is exerting pressure on modern vegetation formations and threatening the livelihoods and wellbeing of many peoples in Africa. In this book the focus is on the Quaternary because it is during this geological period that the modern vegetation formations developed into their current

configurations against a backdrop of high magnitude global climate change (glacial-interglacial cycles), human evolution, and a growing human land-use footprint. In this book the latest information is presented and collated from around the African continent to parameterize past vegetation states, identify the drivers of vegetation change, and assess the vegetation resilience to change. To achieve this research from two broad themes are covered: (i) the present is the key to the past (i.e. studies which improve our understanding of modern environments so that we can better interpret evidence from the past), and (ii) the past is the key to the future (i.e. studies which unlock information on how and why vegetation changed in the past so one can better anticipate trajectories of future change). This Open Access book will provide a strong foundation for future research exploring past ecological, environmental and climatic change within Africa and the surrounding islands. The book is organized regionally (covering western, eastern, central, and southern Africa) and it contains specialized articles focused on particular topics (such as modern pollen-vegetation relationships and fire as a driver of vegetation change), as well as regional and pan-African syntheses drawing together decades of research to assess key scientific questions (including the role of climate in driving vegetation change and the role of vegetation change in human evolution). These articles will be useful to students and teachers from high school to the highest level of university who are interested in the origins and dynamics of vegetation in Africa. Furthermore, it is also meant to provide societally relevant information that can act as

an inspiration for the development of sustainable management practices for the future.

This book discusses the dynamics and resource management qualities of the peri-urban interface to address climate change consequences, focusing on the peri-urban region of the global city of Bengalaru. In 5 chapters, the authors document the unique challenges experienced in peri-urban areas, including soil-water vegetation dynamics, local and regional impacts on water bodies (surface and groundwater), food production issues, and the inhibited adaptive capacity of local communities. The book also provides knowledge on implementations of environmental management by local institutions, government interventions that have acted as catalysts in promoting community based adaptation strategies, and the physical, social and economic aspects of rural-urban dynamics. The book not only adds to the scarce existing literature on peri-urban contexts, but also addresses the role of culture in protecting ecological landscapes and how traditions play an important role in coping with climate change. Furthermore, the authors expand on these climate change coping mechanisms in peri-urban areas, taking into account local cultural factors and interesting governance interventions in the context of health. The book will be of interest to planners, policy makers, and students and researchers engaged in rural-urban dynamics and climate change adaptation.

experiments with the UVic earth system climate model

Understanding Northern Latitude Vegetation Greening and Browning

An Investigation at Multiple Scales

Quaternary Vegetation Dynamics
A Global Synthesis of Findings and Recommendations
Land cover change, vegetation dynamics and the global carbon cycle

Savanna and grassland biomes cover more of the earth's surface than any other biome type, and yet they are still largely understudied. In recent decades, global savanna and grassland ecosystems have become more prominent in the literature focused on global change dynamics. Savanna and grasslands represent unique biomes with their own challenges, both in terms of their study and in terms of their complexity, leading to many contradictory and often controversial findings. The global threats to these systems are potentially significant, from climate change impacts to human management challenges, from possible degradation to complete desertification, which vary across disturbance regime shifts. This Special Issue of Applied Sciences, "Dynamics of Global Savanna and Grassland Biomes", is intended for a wide and interdisciplinary audience, and covers recent advances in: - drivers of vegetation dynamics - further understanding carbon interactions in these critical landscapes - advances in modeling both current and future system states - tipping points in savanna systems - human-environment interactions and challenges for management - biodiversity and ecosystem services

Climate change will affect Arctic plant communities directly, by altering growth and recruitment, and indirectly, by increasing the frequency of natural disturbance. Since the structure of northern vegetation influences global climate, understanding both temperature and disturbance effects on

vegetation is critical. Here, I investigate the influence of temperature and disturbance on Low Arctic vegetation at several spatio-temporal scales in the Mackenzie Delta Region, N.W.T. To disentangle the relative impact of temperature and disturbance on forest-tundra and tundra ecosystems, I sampled microenvironmental variability, plant community composition, and green alder abundance, growth, and reproduction on disturbed (burns and thaw slumps) and undisturbed sites across a regional temperature gradient. Disturbed areas showed increases in alder productivity, catkin production, and seed viability, as well as differences in plant community composition and microenvironment. The magnitude of plot-level responses to disturbance compared to variation across the temperature gradient suggests that in the short-term, increasing the frequency of disturbance may exert a stronger influence on tundra ecosystems than changes in temperature. At the plot level, increases in alder seed viability and recruitment at warmer sites point to the fine-scale mechanisms by which shrub abundance will change. To examine the relative influence of temperature and biophysical variables on landscape-level patterns of shrub dominance, I mapped Low Arctic vegetation using aerial photos. At this broader scale, correlations between temperature and the areal extent of shrub tundra suggest that warming will increase the dominance of shrub tundra. To assess the magnitude of changes in temperature and thaw slump activity, I analyzed climate records and mapped retrogressive thaw slumps using aerial photographs. An increase in thaw slump activity in recent decades, coincident with higher temperatures, suggests tha.

This book introduces an interdisciplinary framework to understand the interaction between terrestrial ecosystems and climate change. It reviews basic meteorological, hydrological and ecological concepts to examine the physical, chemical and biological processes by which terrestrial ecosystems affect and are affected by climate. The textbook is written for advanced undergraduate and graduate students studying ecology, environmental science, atmospheric science and geography. The central argument is that terrestrial ecosystems become important determinants of climate through their cycling of energy, water, chemical elements and trace gases. This coupling between climate and vegetation is explored at spatial scales from plant cells to global vegetation geography and at timescales of near instantaneous to millennia. The text also considers how human alterations to land become important for climate change. This restructured edition, with updated science and references, chapter summaries and review questions, and over 400 illustrations, including many in colour, serves as an essential student guide.

Africa is highly vulnerable to the impacts of climate change. In particular shortage of fresh water is expected to be the dominant water problem for West and Northwest Africa of the 21th century. In order to solve present and projected future problems concerning fresh water supply, a highly interdisciplinary approach is used in the book. Strategies are offered for a sustainable and future-oriented water management. Based on different scenarios, a range of management options is suggested with the aid of Information Systems and

Spatial Decision Support Systems for two river catchments in Northwest and West Africa: the wadi Drâa in south-eastern Morocco and the Ouémé basin in Benin. The selected catchments are representative in the sense: "what can be learnt from these catchments for other similar catchments?

Global Vegetation and Land Surface Dynamics in a Changing Climate

Climate Change Effects on Groundwater Resources

The African Pollen Database

Concepts and Applications

Biodiversity and Vulnerability to Climate Change

Contributions Toward Future Earth Initiatives

Vegetation Dynamics & Global ChangeSpringer Science & Business Media

The overall aim of this thesis is to investigate long-term (multi-century) vegetation development in a high-latitude setting, with a particular emphasis on the emergence and persistence of spatial structure in plant communities. The spatial distribution of plants within a community influences vegetation dynamics and the functioning of terrestrial ecosystems. Knowledge of the spatiotemporal dynamics of vegetation is therefore crucial to understanding ecosystem response to disturbance, and to successful ecosystem management. Studies of spatiotemporal dynamics from high-latitude settings are rare, despite these regions being among the most sensitive to warming and subject to ongoing environmental change. The study was based on a primary succession on Mt Hekla in

south-central Iceland. The chronosequence approach was used to infer 850 years of vegetation development from a suite of 14 lava flows (five of which had been disturbed by the deposition of volcanic tephra). The thesis is organised around four main research themes: 1) Trajectories of development- How do the global (i.e. non-spatial) properties of a community (e.g. species diversity) change with terrain age in a primary succession? Plant species frequency data from 12 transect surveys (each comprising 400 contiguous 10 cm x 10 cm quadrats) were used to test the predictions of classical models of primary succession; 2) Initial colonisation- How do plants first establish on newly-created terrain? Photographic surveys and point-pattern analysis were used to assess the processes by which pioneer species colonised 'safe sites' on lava surfaces six and fifteen years old; 3) Spatial scale and structure- How and why does the spatial structure of vegetation vary over long timescales? Vegetation and soil data from transect surveys (item 1, above) were analysed using a variety of spatial statistics, in order to test three models of spatiotemporal dynamics; 4) Temporal changes in environmental gradients- To what extent does biotic reaction feed-back into the small- (metre-) scale distribution of plants? Randomised sampling of vegetation on 42 sites was combined with continuous microclimatic monitoring to assess the changing steepness

of environmental gradients, and the impact this process had on vegetation development. The analyses revealed a robust, multi-century trajectory of vegetation development on undisturbed sites. The development of vegetation on newly-emplaced flows was rapid, as colonists randomly exploited small- (millimetre) scale surface irregularities in the lava. A thick (up to 20 cm), spatially homogeneous 'carpet' of moss formed within 50 years of flow emplacement. Thereafter, the vegetation became progressively more structured with increasing terrain age, as patches of vegetation formed and expanded. On the oldest sites, differentiation of the vegetation according to metre-scale variations in elevation was apparent. Overall, the results emphasise the limitations of classical models of succession in high-latitude habitats and suggest widespread applicability for the nucleation model of primary succession. The study also suggests that the spatiotemporal response of vegetation to environmental gradients is mediated by short-range positive feedback. These findings have implications for modelling vegetation development on other primary substrates (e.g. glacial forelands) and the response of spatially patchy, high-latitude vegetation to future climate change.

During the summer of 1987, a series of discussions I was held at the International Institute for Applied Systems Analysis (nASA) in Laxenburg, Austria, to plan a study of

global vegetation change. The work was aimed at promoting the Interna tional Geosphere-Biosphere Programme (IGBP), sponsored by the International Council of Scientific Unions (lCSU), of which nASA is a member. Our study was designed to provide initial guidance in the choice of approaches, data sets and objectives for constructing global models of the terrestrial biosphere. We hoped to provide substantive and concrete assistance in formulating the working plans of IGBP by involving program planners in the development and application of models which were assembled from available data sets and modeling ap proaches. Recent acceptance of the "nASA model" as the starting point for endeavors of the Global Change and Terrestrial Ecosystems Core Project of the IGBP suggests we were successful in that aim. The objective was implemented by our initiation of a mathematical model of global vegetation, including agriculture, as defined by the forces which control and change vegetation. The model was to illustrate the geographical consequences to vegetation structure and functioning of changing climate and land use, based on plant responses to environmental variables. The completed model was also expected to be useful for examining international environmental policy responses to global change, as well as for studying the validity of IIASA's experimental approaches to environmental policy development.

The objective of this research is to gain a

better understanding of the biophysical processes, vegetation dynamics, and climate interactions on global and regional scales. Sahel is the major focus region for this research. Our methodology is based on the analysis of observations, as well as simulations by the National Centers for Environmental Prediction (NCEP) Atmospheric General Circulation Model (AGCM) coupled with the Simplified Simple Biosphere model version 2 (SSiB2) and an offline version of the SSiB4 coupled with a Dynamic Global Vegetation Model (DGVM) Top-down Representation of Interactive Foliage and Flora Including Dynamics (TRIFFID). We first examine the impact of vegetation biophysical processes (VBP) on climate from a long temporal scale point of view, specifically, the climate variability on inter-annual and inter-decadal time scales in the past six decades by using the NCEP AGCM coupled with two different land surface parameterizations: SSiB2 and the two-layer soil model. At the inter-annual time scale, the simulation with VBP decreases the root mean squared error by about 65%. Moreover, on inter-decadal time scale, VBP corrects the wet or dry biases over West Africa, South Africa, Amazon, and East Asia, through changing surface energy balances and the partitioning of surface latent and sensible heat fluxes, as well as changing atmospheric circulation and moisture flux convergence. In the second part, we systematically investigate the climate impact

of large-scale land use land cover change (LULCC), and identify the mechanisms that control the response of climate to LULCC, by using the most recent LULCC data in an "idealized but realistic" way for the past six decades. LULCC leads to an increase in albedo and decrease in evaporation. The albedo effect (cooling) and evaporation effect (warming) compete with each other, resulting in warmer surface temperatures at tropics, and cooler surface temperatures at middle latitude. Over global land, the LULCC amplifies surface warming (0.11K over global land and 0.43K over degraded area respectively). LULCC cause a precipitation reduction globally (-0.15mm/day over global land and -0.35mm/day over degraded areas), with strongest signals over monsoon regions, resulting from evaporation reduction and less convergence from monsoon convergence zones. Finally, I systematically investigate how climate variability and anomalies in West Africa affect the regional terrestrial ecosystem, including spatial distribution and temporal variations of plant functional types' (PFT) and other vegetation characteristics, though biophysical and photosynthesis processes at different scales. The offline SSiB4/TRIFFID model is used in this study. The results show that the simulated PFT's spatial distribution and total leaf area index (LAI) correspond well to climate variability and are consistent with satellite derived vegetation conditions.

The simulated inter-decadal variability in vegetation conditions is consistent with the Sahel drought in the 1970s and the 1980s and partial recovery in the 1990s and the 2000s. The vegetation characteristics simulated by SSiB4/TRIFFID responds primarily to air temperature, soil moisture and radiative fluxes.

Patterns of Mountain Vegetation Dynamics and Their Responses to Environmental Changes in the South Ecuadorian Andes

Climate Change, Glacier Response, and Vegetation Dynamics in the Himalaya

Vegetation Dynamics & Global Change

Ecological Climatology

On the Coupled Effects of Global Climate Change, ENSO/IOD Teleconnections, and Local Land-use Change on Water Availability and Vegetation Dynamics in the Kilimanjaro Region

Remote Sensing Based Study on Vegetation Dynamics in Dry Lands of Kazakhstan

Reviews literature concerning the effects of global climate change on forest plants and communities, and provides opinions on the potential impacts that climate change may have on Ontario forests. Sections of the review discuss the following: the climate of Ontario in the 21st century as predicted by climate models; forest hydrology in relation to climate change; insects and climate change; impacts on fungi in the forest ecosystem; impacts on forest fires and their management; plant physiological responses; genetic implications of climate change; forest vegetation dynamics; the use of models in

global climate change studies; and forest management responses to climate change. This thesis explores the role of terrestrial vegetation in the global climate system in a series of modelling studies using the University of Victoria Earth System Climate Model (UVic ESCM). The ways that vegetation affects climate, as well as the feedbacks that operate between changing climate and vegetation distributions, are investigated within the framework of three foci: 1) historical land cover changes that have resulted from human modification of natural vegetation cover; 2) historical land cover change and the dynamics of terrestrial vegetation in the context of anthropogenic and natural climate change; and 3) the role of terrestrial vegetation in the global carbon cycle. First, the radiative effect of changing human land-use patterns on the climate of the past 300 years is discussed through analysis of a series of equilibrium and transient climate simulations using the UVic ESCM. These experiments highlight the biogeophysical effects of historical land cover change on climate: those that result from physical changes to the land surface under altered vegetation cover. Results show a global cooling in the range of -0.06 to -0.22 "C, though this effect is not found to be detectable in observed temperature trends. Using a global carbon cycle the climatic effects of land cover change emissions (the biogeochemical effect of historical land cover change) are assessed. The resultant warming is found to exceed the biogeophysical

cooling by 0.15 "C. Second, the effect of historical land cover change is compared with the effects of natural forcings (volcanic aerosols, solar insolation variability and orbital changes) and other anthropogenic forcings (greenhouse gases and sulphate aerosols). Transient model runs from the year 1700 to 2000 are presented for each forcing individually as well as for combinations of forcings. I find that the UVic model reproduces well the global temperature data when all forcings are included. In the context of these anthropogenic and natural climate influences, the response of vegetation distributions to changing climate is explored through the use of a dynamic global vegetation model coupled interactively to the UVic ESCM. Transient simulations of the past 300 years are repeated using this new model so as to isolate the biogeophysical feedbacks that operate between vegetation and climate. Dynamic vegetation is found to act as a positive feedback to climate, amplifying both warming and cooling climate trends. Third, the development of a global carbon cycle model allows for investigation of the role of terrestrial carbon cycle dynamics under past and future climate change. When forced by historical emissions of C02 from fossil fuels and land-use change, the coupled carbon cycle model accurately reproduces historical atmospheric C02 trends, as well as terrestrial and oceanic uptake for the past two decades. Under six 21St century C02 emissions scenarios, both terrestrial and oceanic carbon sinks continue to

increase, though terrestrial uptake slows in the latter half of the century. The modelled positive feedback between the carbon cycle and climate is relatively small, resulting in an increase in simulated C02 of 60 ppmv at the year 2100. Including non- C02 greenhouse gas forcing and increasing the model's climate sensitivity increases the effect of this feedback to 140 ppmv. The UVic model does not, however, simulate a switch from a terrestrial carbon sink to a source during the 2lSt century, as earlier studies have suggested. This can be explained by a lack of substantial reductions in simulated vegetation productivity due to climate changes. Additional resources for this book can be found at: a href="http://www.wiley.com/go/vandermaarelfranklin/vegetationecology"www.wiley.com/go/vandermaarelfranklin/vegetationecology/a. Vegetation Ecology, 2nd Edition is a comprehensive,integrated account of plant communities and their environments.Written by leading experts in their field from four continents, thesecond edition of this book: covers the composition, structure, ecology, dynamics,diversity, biotic interactions and distribution of plantcommunities, with an emphasis on functional adaptations; reviews modern developments in vegetation ecology in ahistorical perspective; presents a coherent view on vegetation ecology whileintegrating population ecology, dispersal biology, soilbiology, ecosystem ecology and global change studies; tackles applied aspects of vegetation ecology, includingmanagement of

communities and invasive species; includes new chapters addressing the classification and mappingof vegetation, and the significance of plant functional types Vegetation Ecology, 2nd Edition is aimed at advancedundergraduates, graduates and researchers and teachers in plantecology, geography, forestry and nature conservation. VegetationEcology takes an integrated, multidisciplinary approach and will bewelcomed as an essential reference for plant ecologists the worldover.

Vegetation change has been observed across Arctic and boreal regions. Studies have often documented large-scale greening trends, but they have also identified areas of browning or shifts between greening and browning over varying spatial extents and time periods. At the same time, though, there are large portions of these ecosystems that have not exhibited measurable trends in greening or browning. These findings have fueled many questions about the drivers of vegetation dynamics, how trends are measured, and potential implications of vegetation change at local to global scales. In December 2018, the National Academies of Sciences, Engineering, and Medicine, convened a workshop to discuss opportunities to improve understanding of greening and browning trends and drivers and the implications of these vegetation changes. The discussions included a close look at many of the methodological approaches used to evaluate greening and browning, as well as exploration of

newer technologies that may help advance the science. This publication summarizes the presentations and discussions from the workshop.

High-latitude Vegetation Dynamics

Coping Mechanisms for Climate Change in Peri-Urban Areas

From the Past to the Future

Ecosystem Dynamics

Holocene Climate Change and Environment

Structure and Function of Mountain Ecosystems in Japan

The book is structured into six core parts. The first part sets the scene and explains how the use of Aral basin water resources, primarily used for irrigation, have destroyed the Aral Sea. The team explains how spheres and events interact and the related problems. Part 2 examines the social consequences of the ecological catastrophe and the affect of the Aral Sea desiccation on cultural and economic conditions of near Aral region. Part 3 explores the scientific causes of the destruction using detailed analyses and data plus some of their own research spanning aquatic biology, terrestrial biology, hydrology, water management and biodiversity. They also share some of the latest archaeological discoveries and paleobotanical analysis to delineate past levels and characteristics of the Aral Sea. There is particular focus on modern remote sensing and GIS techniques and how they can monitor the Aral Sea and the environment. Part 4 discusses regional and international initiatives to mitigate human and ecological problems of the Aral Sea and the wider political and economic consequences.

With thorough insight of the total environment cost, the final chapters of the book will provide lessons for the future. There are insightful case studies throughout. Multidisciplinary by nature, all titles in our new reference book series will explore significant changes within the Earth's ecosystems and to some extent, and will tackle ways to think about our changing environment.
Describes current state-of-the-science for predicting the effects of global change on ecosystems.
The purpose of this book is to summarize new insights on the structure and function of mountain ecosystems and to present evidence and perspectives on the impact of climate change on biodiversity. This volume describes overall features of high-mountain ecosystems in Japan, which are characterized by clear seasonality and snow-thawing dynamics. Individual chapters cover a variety of unique topics, namely, vegetation dynamics along elevations, the physiological function of alpine plants, the structure of flowering phenology, plant – pollinator interactions, the geographical pattern of coniferous forests, terrestrial – aquatic linkage in carbon dynamics, and the community structure of bacteria in mountain lake systems. High-mountain ecosystems are characterized by unique flora and fauna, including many endemic and rare species. On the other hand, the systems are extremely vulnerable to environmental change. The biodiversity is maintained by the existence of spatiotemporally heterogeneous habitats along environmental gradients, such as elevation and snowmelt time. Understanding the structure and function of mountain ecosystems is crucial for the conservation of

mountain biodiversity and the prediction of the climate change impacts.The diverse studies and integrated synthesis presented in this book provide readers with a holistic view of mountain ecosystems. It is a recommended read for anyone interested in mountain ecosystems and alpine plants, including undergraduate and graduate students studying ecology, field workers involved in conservational activity in mountains, policymakers planning ecosystem management of protected areas, and researchers of general ecology. In particular, this book will be of interest to ecologists of countries who are not familiar with Japanese mountain ecosystems, which are characterized by humid summers, cold winters, and the snowiest climate in the world.

Brings together plant ecophysiology, remote sensing and modelling of vegetation and landscape function for advanced students and researchers.

850 Years of Vegetation Development on Mt Hekla, Iceland

Global Warming

Vegetation Ecology

Vegetation Dynamics

Studies from the North American Boreal Forest

During the International Botanical Congress in Edinburgh, 1964, Mrs. 1. M. WEISBACH-J UNK of The Hague discussed a plan for preparation by her publishing company (Dr. W. Junk b.v.) of an international Handbook of Vegetation

Science. She proposed a series that should give a comprehensive survey of the varied directions within this science, and their achievements to date as well as their objectives for the future. The challenge of such an enterprise, and its evident value for the further development of vegetation research, induced the undersigned after some consideration to accept the offer of the honorable but also burdensome task of General Editor. The decision was encouraged by a well formulated and detailed outline for the Handbook worked out by the Dutch phytosociolo gists J. J. BARKMAN and V. WESTHOFF. A circle of scholars from numerous countries was invited by the Dr. Junk Publishing Com pany to The Hague in January 1966 to draw up a list of editors and contributors for the parts of the Handbook. The outline and list have served since for the organization of the Handbook, with no need for major change. The different burdens of editors and authors have compelled quite different timings for completion of the individual sections.

The natural environment of drylands is highly vulnerable and fra¬gile, variations of climate conditions here are the highest among all terrestrial ecosystems and that

is why they are expected to be strongly influenced by the current climate change. Remote sensing and GIS play an important role in a better understanding about the nature of climate impacts on the drylands as a whole system and on the vegetation cover as the most important component of this ecosystem at all scales from global to regional and local. This book is one of the first to examine the dynamics of drylands in Kazakhstan using time series of remote sensing derived data and climate records over the last 20 years. The author investigated the problem from different views and combined analyses at multiple time and spatial scales. The entire spectrum of the interrelationship between climate and vegetation cover - spatial and temporal, on the regional, subregional and local scale, interannual and within the growing season -, has been analysed, described and discussed. A new monitoring approach was presented which enables discrimination between climatic and anthropogenic forces in the complex of dryland dynamics. The text improves the understanding of the nature and mechanisms of the ecosystem dynamics in the internal Eurasia and provides the basis for predicting changes in vegetation productivity that accompany changes in

climate and human activities. Taken as a whole, the results of this study present indispensable information for ecological and socio-economic research and may be used by scientists, landscape managers, and decision makers interested in this region.

Holocene Climate Change and Environment presents detailed, diverse case studies from a range of environmental and geological regions on the Indian subcontinent which occupies the central part of the monsoon domain. This book examines Holocene events at different time intervals based on a new, high-resolution, multi-proxy records (pollen, spores, NPP, diatoms, grain size characteristics, total organic carbon, carbon/nitrogen ratio, stable isotopes) and other physical tools from all regions of India. It also covers new facilities in chronological study and luminescence dating, which have added a new dimension toward understanding the Holocene glacial retreats evolution of coastal landforms, landscape dynamics and human evolution. Each chapter is presented with a unified structure for ease of access and application, including an introduction, geographic details, field work and sampling techniques, methods, results and discussion. This detailed

examination of such an important region provides key insights in climate modeling and global prediction systems. Provides data and research from environmentally and geologically diverse regions across the Indian subcontinent Presents an integrated and interdisciplinary approach, including considerations of human impacts Features detailed case studies that include methods and data, allowing for applications related to research and global modeling MC1 is a widely used dynamic global vegetation model (DGVM) that has been used to simulate potential vegetation shifts in National Parks (NPs) such as Wind Cave NP and Yosemite NP, across various states such as California and Alaska, over the entire continent of North America, and even over the entire globe, under a variety of climate change scenarios. Global Vegetation Dynamics: Concepts and Applications in the MC1 model describes the creation in the mid-1990s, architecture, uses, and limitations of the MC1 DGVM that is being used by an increasing number of research groups around the world. The scientific foundation of most models is often poorly documented and difficult to access, and a centralized source of information for MC1, including the complete list of over eighty

papers and reports with MC1 results will be useful to scientists and users who want to better understand the model and the output it generates. The topics in this volume include general descriptions of the original model design, including the fire model, which was the first of its kind among dynamic global vegetation models; a brief history of the model creation; summaries of model results at the continental (North America), regional (Pacific Northwest), and local (Wind Cave NP and Sierra Nevada) scales; a description of its use to transform a state and transition model into its climate-smart version to help managers prepare for climate change challenges; and the description of an on-line tool (databasin.org) that provides snapshots as well as animated time series of its results. Finally, a complete bibliography (as of spring 2015) lists over 80 publications that include MC1 results. Global Vegetation Dynamics: Concepts and Applications in the MC1 model will be a valuable resource for students and researchers in the fields of climate change science, conservation science, and biogeochemistry and ecology, as well as for land managers looking for a better understanding of the projections of

climate change impacts and of the tools that have been developed to produce them.
Results of an IIASA Summer Workshop
Assessing Grassland Distributions and Spatio-temporal Variations in the U.S. Great Plains with MODIS Imagery
Workshop Summary
A Global Change Study
Climate Change and Terrestrial Ecosystem Modeling
The Impacts of Climate Change on Ontario's Forests

Provides an essential introduction to modeling terrestrial ecosystems in Earth system models for graduate students and researchers.

This book provides information essential for anyone interested in climate and environmental change of the Himalayan region, including land and resource managers, environmental planners, conservationists, environmentalists, geographers, climatologists, ecologists, and students. The book is unique in its coverage of the current understanding of the science of climate change in the Himalayan mountain system and of the major impacts on physical systems and ecosystems. The book gives an overview of the physical science basis of climate change and explains drivers and processes of glacier and vegetation dynamics. The book covers relevant aspects of accelerated climate

change observed in the Himalayan mountain system, and highlights the regional differentiation of climatic changes and associated environmental modifications. The focus is on climate variability and change, and how physical systems and ecosystems respond to climate change impacts. Consequences include impacts on physical systems such as glacier shrinkage, glacial lake outburst floods, altered hydrological characteristics, permafrost warming and thawing, and mass movements on slopes. Climate change is also a powerful stressor on ecosystems and induces range shifts of plant and animal species and alterations in terms of phenology, biomass, plant cover, plant group dominance and species composition. Thus, ecosystem structure and functioning will be strongly affected. The book has an introductory chapter followed by a section on climate change, a section on impacts on glaciers and hydrology, and a section on vegetation dynamics. Each section has several chapters presenting key concepts, major drivers and key processes of environmental change in the Himalayan region from different perspectives. Climate change impacts in the Himalaya have not been studied in much detail, and respective findings were not presented so far in a comprehensive overview. This book

summarizes the current knowledge of interactions between climate change and the dynamics of glaciers, hydrology, and vegetation. Ecosystem Dynamics focuses on long-term terrestrial ecosystems and their changing relationships with human societies. The unique aspect of this text is the long-time scale under consideration as data and insights from the last 10,000 years are used to place present-day ecosystem status into a temporal perspective and to test models that generate forecasts of future conditions. Descriptions and assessments of some of the current modelling tools that are used, along with their uncertainties and assumptions, are an important feature of this book. An overarching theme explores the dynamic interactions between human societies and ecosystem functioning and services. This book is authoritative but accessible and provides a useful background for all students, practitioners, and researchers interested in the subject.

The South Ecuadorian Andes harbour an outstandingly high species-richness. Many different environmental factors influence one another in a most limited space and create unique and complex ecosystems. This area is highly endangered because of growing human impact through the intensification of land-use

and global change. Only little is known about palaeoecological history and landscape dynamics of this area. The information about why and how ecosystems changed in the past is crucial for the development of innovative strategies for conservation and future climate predictions. In this study, w...

Global and Sahel Regional Biophysical Processes, Vegetation Dynamics, and Climate Interactions

Soil Geochemistry, Vegetation Dynamics, and Precipitation in North-eastern Brazil

Forest Dynamics and Conservation

The Application of Patch Models of Vegetation Dynamics to Global Changes Issues

Fire and Vegetation Dynamics

The Devastation and Partial Rehabilitation of a Great Lake

The North American Great Plains is the primary grassland in the United States. Both cool season grasses (CSG) and warm season grasses (WSG) grow in the Great Plains, with their distributions vary with environmental conditions and climate dynamics. As global climate change is being a hot topic today, there is a need of detailed maps of these grass functional types in the Great Plains to enhance our understanding of grassland ecosystems and their responses to climate change. This study delineates CSG and WSG based on their unique phenology features that could be extracted from time-series satellite imagery; and preliminarily examines their inter-annual variation responding to the changing climate

conditions in this region. Several spatial analysis methods are examined in this study. I have 1) built user-defined programs to perform time series analysis of 10 years' MODIS imagery, and extracted useful phenological parameters as innovative inputs of image classification; 2) Developed a sequential multivariate regression algorithm in SAS to classify crop and grass maps in the Great Plains; 3) compared the 10-year climatic data with the classified grass distributions to examine the relationship between climate change and vegetation dynamics. The achievements filled the gap of lacking detailed distribution of grass functional types in the Great Plains, and reported the credible analysis in climate-induced land cover changes.

Understanding ecosystem structure and function requires familiarity with the techniques, knowledge and concepts of the three disciplines of plant physiology, remote sensing and modelling. This is the first textbook to provide the fundamentals of these three domains in a single volume. It then applies cross-disciplinary insights to multiple case studies in vegetation and landscape science. A key feature of these case studies is an examination of relationships among climate, vegetation structure and vegetation function, to address fundamental research questions. This book is for advanced students and researchers who need to understand and apply knowledge from the disciplines of plant physiology, remote sensing and modelling. It allows readers to integrate and synthesise knowledge to produce a holistic understanding of the structure, function and behaviour of forests, woodlands and grasslands.

A technical introduction to the behaviour of fire and its ecological consequences, using examples from the North

American boreal forest.

This book is intended to introduce the reader to examples of the range of practical problems posed by "Global Warming". It includes 11 chapters split into 5 sections. Section 1 outlines the recent changes in the Indian Monsoon, the importance of greenhouse gases to life, and the relative importance of changes in solar radiation in causing the changes. Section 2 discusses the changes to natural hazards such as floods, retreating glaciers and potential sea level changes. Section 3 examines planning cities and transportation systems in the light of the changes, while section 4 looks at alternative energy sources. Section 5 estimates the changes to the carbon pool in the alpine meadows of the Qinghai-Tibet Plateau. The 11 authors come from 9 different countries, so the examples are taken from a truly international set of problems.

Concepts and Applications in the MC1 Model

The Application of Patch Models of Vegetation Dynamics to Global Change Issues

The Aral Sea

Proceedings of a Workshop

Global Vegetation Dynamics

Impacts of Global Change on the Hydrological Cycle in West and Northwest Africa

Climate change is expected to modify the hydrological cycle and affect freshwater resources. Groundwater is a critical source of fresh drinking water for almost half of the world's population and it also supplies irrigated agriculture. Groundwater is also important in sustaining streams, lakes, wetlands, and associated ecosystems. But despite this, knowledge about the impact of climate change on groundwater quantity and quality is limited.

Direct impacts of climate change on natural processes (groundwater recharge, discharge, storage, saltwater intrusion, biogeochemical reactions, chemical fate and transport) may be exacerbated by human activities (indirect impacts). Increased groundwater abstraction, for example, may be needed in areas with unsustainable or contaminated surface water resources caused by droughts and floods. Climate change effects on groundwater resources are, therefore, closely linked to other global change drivers, including population growth, urbanization and land-use change, coupled with other socio-economic and political trends. Groundwater response to global changes is a complex function that depends on climate change and variability, topography, aquifer characteristics, vegetation dynamics, and human activities. This volume contains case studies from diverse aquifer systems, scientific methods, and climatic settings that have been conducted globally under the framework of the UNESCO-IHP project Groundwater Resources Assessment under the Pressures of Humanity and Climate Change (GRAPHIC). This book presents a current and global synthesis of scientific findings and policy recommendations for scientists, water managers and policy makers towards adaptive management of groundwater sustainability under future climate change and variability.

There has been a recent surge of interest in remote sensing and its use in ecology and conservation but this is the first book to focus explicitly on the NDVI (Normalised Difference Vegetation Index), a simple numerical indicator and powerful tool that can be used to

assess spatio-temporal changes in green vegetation. The NDVI opens the possibility of addressing questions on scales inaccessible to ground-based methods alone; it is mostly freely available with global coverage over several decades. This novel text provides an authoritative overview of the principles and possible applications of the NDVI in ecology, environmental and wildlife management, and conservation. NDVI data can provide valuable information about temporal and spatial changes in vegetation distribution, productivity, and dynamics; allowing monitoring of habitat degradation and fragmentation, or assessment of the ecological effects of climatic disasters such as drought or fire. The NDVI has also provided ecologists with a promising way to couple vegetation with animal distribution, abundance, movement, survival and reproductive parameters. Over the last few decades, numerous studies have highlighted the potential key role of satellite data and the NDVI in macroecology, plant ecology, animal population dynamics, environmental monitoring, habitat selection and habitat use studies, and paleoecology. The chapters are organised around two sections: the first detailing vegetation indices and the NDVI, the principles behind the NDVI, its correlation with climate, the available NDVI datasets, and the possible complications and errors associated with the use of this satellite-based vegetation index. The second section discusses the possible applications of the NDVI in ecology, environmental and wildlife management, and conservation.

A Synthesis of Plant Ecophysiology, Remote Sensing and Modelling

Science, Innovations and Policies
Relative Influence of Temperature and Disturbance on Vegetation Dynamics in the Low Arctic
Dynamics of the Global Savanna and Grassland Biomes
Global Change and Terrestrial Ecosystems
The Normalized Difference Vegetation Index