Hydrological Impact Of Forest Fires And Climate Change In

Mediterranean forests are frequently subject to wildfires, inducing risks of runoff and loss of nutrient-rich topsoil. A recent fire in Biriya forest, northern Israel, and related post-fire observations set the stage for laboratory fire (manual) and rainfall (nozzle-type) simulation experiments to evaluate short-term effects of fire on soil hydrological and erodibility parameters by investigating (i) soil water repellency (WR) levels and distribution, (ii) surface cover features, and (iii) sat. hydraulic conductivity (Ksat), electrical conductivity and values of infiltration, runoff and erosion responses to simulated rain on control (bare and needle covered) and burned (with and without ash cover) samples. To link the laboratory observations to the field situation, WR, Ksat and surface cover measurements were executed in the forest. Field data showed strong surface WR levels throughout the rainy season, indicating the high severity of the fire. The fire-induced surface WR in the lab, tested by grid-wise Water Drop Penetration (WDPT) tests, was moderate but decreased for all treatments after rain. The responses to rain (33 mm h-1) differed for the two simulation runs. The rates of drainage and runoff of the burned samples showed in the first run values in between the values of cover (low runoff, high infiltration) and bare (high runoff, low infiltration). The drainage in the ash-covered samples was twice as high as in the samples where the ash was removed. In the second run both samples showed a similar response compared to bare conditions. After the first run most ash and organic material was washed off and Ksat was low, indicating crust formation. If upscaled, sediment yields reached in run 1 and 2 resp. 0.2 and 0.8 t ha-1 h-1. After the first run the EC values showed a significant drop, which represents the infiltration of the cation-binding organic matter, as this is not present for the bare samples. When field and laboratory observations are combined it can be stated that apart from soil crusting, WR and protection by ash are factors to consider in erosion susceptibility of a burned forest soil.

Of all the outputs of forests, water may be the most important. Streamflow from forests provides two-thirds of the nation's clean water supply. Removing forest cover accelerates the rate that precipitation becomes streamflow; therefore, in some areas, cutting trees causes a temporary increase in the volume of water flowing downstream. This effect has spurred political pressure to cut trees to increase water supply, especially in western states where population is rising. However, cutting trees for water gains is not sustainable: increases in flow rate and volume are typically short-lived, and the practice can ultimately degrade water quality and increase vulnerability to flooding. Forest hydrology, the study of how water flows through forests, can help illuminate the connections between forests and water, but it must advance if it is to deal with today's complexities, including climate change, wildfires, and changing patterns of development and ownership. This book identifies actions that scientists, forest and water managers, and citizens can take to help sustain water resources from forests.

This book describes the domain of research and investigation of physical, chemical and biological attributes of flowing water, and it deals with a cross-disciplinary field of study combining physical, geophysical, hydraulic, technological, environmental interests. It aims to equip engineers, geophysicists, managers working in water-related arenas as well as advanced students and researchers with the most up to date information available on the state of knowledge about rivers, particularly their physical, fluvial and environmental processes. Information from various but also interrelated areas available in one volume is the main benefit for potential readers. All chapters are prepared by leading experts from the leading research laboratories from all over the world.

This volume offers the first detailed description of 'composite swiddening, ' a traditional Southeast Asian upland agricultural system that combines shifting cultivation fields on the hillsides with irrigated paddy fields in the valleys. The book is a product of research over a 15-year period by natural and social scientists in Vietnam's Tat Hamlet, a Da Bac Tay ethnic minority community, and it challenges the conventional belief that shifting cultivation inevitably causes deforestation. It describes this complex agroecosystem in terms of its multiple individual components, structure, functioning, and sustainability; social and economic dimensions; adaptation to on-going demographic, economic, environmental, and policy changes; and wider use elsewhere in Vietnam's northern mountains. It will be of interest to Southeast Asian area studies specialists, agricultural ecologists, ethnologists, and upland development policymakers

Editorial: Tuyeni H Mwampamba, Rob Bailis, Adrian Ghilardi Urbanization, food, and water consumption trends in many tropical countries show that demand for charcoal (as a source of cooking energy), meat, grain and water will rise to proportions that surpass the ability of existing ecosystems to supply these services simultaneously and at desired qualities. Consequently, drastic changes to policy and practice are needed to improve ecosystem potential and/or alter demand trends. Traditional charcoal production in sub-Saharan Africa, South East Asia and Latin America often competes or co-exists with livestock keeping and agriculture and has a tendency to occur in water-limited woodlands. The co-occurrence of charcoal and food production results in complex landscapes characterized by strong interactions between subsystems, managed by multiple sets of actors, with potentially competing objectives. These social-ecological systems provide goods and services that are essential to millions of people throughout the global south. Nevertheless, there have been very few detailed studies of such systems, particularly on the individual and combined effects of charcoal, crop, and livestock production on the hydrological system that maintains them and vice versa. As a result, these multi-use landscapes are typically managed by short-sighted, highly generalized, mono-sectorial policies that ignore important tradeoffs and undercapitalize on synergies. A system-level approach could provide important insights that improve and expand current understanding of this energy-food-water nexus. Tackling urgent and complex problems composed of multiple and interrelated factors lies at the heart of nexus thinking - an approach that “examines the inter-relatedness and interdependencies of environmental resources and their transitions and fluxes across spatial scales and between compartments” (UNU-FLORES 2015) and relies on interdisciplinary research and multi-sector policy teams. It has attracted significant interest from international organizations, the private sector and governments as a way to develop

integrated equitable solutions that involve inputs from multiple stakeholders. However, this approach is notably absent in the research arena. Identifying appropriate interventions for achieving sustainable charcoal and food production and maintaining the underlying hydrological system on which they depend requires that the systems are considered simultaneously and that their biophysical, social, and political inter-relations are well understood. Taking charcoal as the nexus entry-point, this Research Topic aims to generate new understanding of charcoal production systems by incorporating agriculture and hydrology into the matrix. We were interested in empirical articles, reviews, meta-analytical articles and perspective papers that address at least two of the three nexus components and which offer provocative and insightful perspectives into the nexus as a whole. We hope that this Research Topic will 1) facilitate identification of research gaps, policy opportunities and priorities for the nexus, 2) kick-start the development of a community of researchers and practitioners working on the nexus, and 3) permit the development of a research agenda that explores the nexus globally across multiple study sites.

Using a systems analysis approach and extensive case studies, Environmental Remote Sensing and Systems Analysis shows how remote sensing can be used to support environmental decision making. It presents a multidisciplinary framework and the latest remote sensing tools to understand environmental impacts, management complexity, and policy implicatio

This book has been published a decade after Fires Effects on Ecosystems by DeBano, Neary, and Folliott (1998), and builds on their foundation to update knowledge on natural post-fire processes and describe the use and effectiveness of various restoration strategies that may be applied when human intervention is warranted. The chapters in this book, written by leading scientists, have been compiled to provide relevant and accessible information to students, land managers, and policy-makers as well as other scientists.

In spite of all the efforts made in fire prevention and suppression, every year about 45 000 forest fires occur in Europe, burning ca. 0.5 million hectares of forests and other rural lands. The management of these burned forests has been given much less attention than fire prevention or fire suppression issues, but the post-fire management of burned areas raises strong concerns (economic and social impacts, soil erosion and water quality, biodiversity loss, forest restoration). Although there are a few publications which address post-fire management, the focus of these has been either on general approaches to restoration or specific topics such as preventing post-fire soil erosion. This book is about the post-fire management of fire-prone forest types in southern Europe. It provides the first comprehensive overview of the topic, ranging from stand-level to landscape-level management, and from emergency actions to long-term restoration approaches.

Wildland fires are occurring more frequently and affecting more of Earth's surface than ever before. These fires affect the properties of soils and the processes by which they form, but the nature of these impacts has not been well understood. Given that healthy soil is necessary to sustain biodiversity, ecosystems and agriculture, the impact of fire on soil is a vital field of research. Fire Effects on Soil Properties brings together current research on the effects of fire on the physical, biological and chemical properties of soil. Written by over 60 international experts in the field, it includes examples from fire-prone areas across the world, dealing with ash, meso and macrofauna, smouldering fires, recurrent fires and management of fire-affected soils. It also describes current best practice methodologies for research and monitoring of fire effects and new methodologies for future research. This is the first time information on this topic has been presented in a single volume and the book will be an important reference for students, practitioners, managers and academics interested in the effects of fire on ecosystems, including soil scientists, geologists, forestry researchers and environmentalists.

This international rigorously peer-reviewed volume critically synthesizes current knowledge in forest hydrology and biogeochemistry. It is a one-stop comprehensive reference tool for researchers and practitioners in the fields of hydrology, biogeoscience, ecology, forestry, boundary-layer meteorology, and geography. Following an introductory chapter tracing the historical roots of the subject, the book is divided into the following main sections: · Sampling and Novel Approaches · Forest Hydrology and Biogeochemistry by Ecoregion and Forest Type · Hydrologic and Biogeochemical Fluxes from the Canopy to the Phreatic Surface · Hydrologic and Biogeochemical Fluxes in Forest Ecosystems: Effects of Time, Stressors, and Humans The volume concludes with a final chapter that reflects on the current state of knowledge and identifies some areas in need of further research.

Fire in California’s Ecosystems describes fire in detail—both as an integral natural process in the California landscape and as a growing threat to urban and suburban developments in the state. Written by many of the foremost authorities on the subject, this comprehensive volume is an ideal authoritative reference tool and the foremost synthesis of knowledge on the science, ecology, and management of fire in California. Part One introduces the basics of fire ecology, including overviews of historical fires, vegetation, climate, weather, fire as a physical and ecological process, and fire regimes, and reviews the interactions between fire and the physical, plant, and animal components of the environment. Part Two explores the history and ecology of fire in each of California's nine bioregions. Part Three examines fire management in California during Native American and post-Euro-American settlement and also current issues related to fire policy such as fuel management, watershed management, air quality, invasive plant species, at-risk species, climate change, social dynamics, and the future of fire management. This edition includes critical scientific and management updates and four new chapters on fire weather, fire regimes, climate change, and social dynamics.

Hydrologic Effects of a Changing Forest LandscapeNational Academies Press

A comprehensive exploration of the effects of fires--in forests and other environments--on soils, watersheds, vegetation, air and cultural resources.

The proceedings is a collection of papers and posters presented at the Symposium on Effects of Fire Management of Southwestern Natural Resources held in Tucson, Arizona, November 15-17, 1988. Included are papers, poster papers and a comprehensive list of references on the effects of fire on: plant succession, cultural resources, hydrology, range and wildlife resources, soils, recreation, smoke management, and monitoring techniques pertinent to prescribed fire management in the southwestern United States.

This open access book synthesizes leading-edge science and management information about forest and rangeland soils of the United States. It offers ways to better understand changing conditions and their impacts on soils, and explores directions that positively affect the future of forest and rangeland soil health. This book outlines soil processes and identifies the research needed to manage forest and rangeland soils in the United States. Chapters give an overview of the state of forest and rangeland soils research in the Nation, including multi-decadal

programs (chapter 1), then summarizes various human-caused and natural impacts and their effects on soil carbon, hydrology, biogeochemistry, and biological diversity (chapters 2-5). Other chapters look at the effects of changing conditions on forest soils in wetland and urban settings (chapters 6-7). Impacts include: climate change, severe wildfires, invasive species, pests and diseases, pollution, and land use change. Chapter 8 considers approaches to maintaining or regaining forest and rangeland soil health in the face of these varied impacts. Mapping, monitoring, and data sharing are discussed in chapter 9 as ways to leverage scientific and human resources to address soil health at scales from the landscape to the individual parcel (monitoring networks, data sharing Web sites, and educational soils-centered programs are tabulated in appendix B). Chapter 10 highlights opportunities for deepening our understanding of soils and for sustaining long-term ecosystem health and appendix C summarizes research needs. Nine regional summaries (appendix A) offer a more detailed look at forest and rangeland soils in the United States and its Affiliates.

Due to its height, density, and thickness of crown canopy; fluffy forest floor; large root system; and horizontal distribution; forest is the most distinguished type of vegetation on the earth. In the U.S., forests occupy about 30 percent of the total territory. Yet this 30 percent of land area produces about 60 percent of total surface runoff, the major water resource area of the country. Any human activity in forested areas will inevitably disturb forest floors and destroy forest canopies, consequently affecting the quantity, quality, and timing of water resources. Thoroughly updated and expanded, Forest Hydrology: An Introduction to Water and Forests, Third Edition discusses the concepts, principles, and processes of forest and forest activity impacts on the occurrence, distribution, and circulation of water and the aquatic environment. Brings water resources and forest-water relations into a single, comprehensive textbook Focuses on the concepts, processes, and general principles in forest hydrology Covers functions, properties, and science of water; water distribution; forests and precipitation, vaporization, stream flow, and stream sediment Discusses watershed management planning and practical applications of forest hydrology in resource management In a single textbook, Forest Hydrology: An Introduction to Water and Forests, Third Edition comprehensively covers water and water resources issues, forest characteristics relevant to the environment, forest impacts in the hydrological cycle, watershed research, watershed management planning, and hydrologic measurements. With the addition of new chapters, new issues, and appendices, this new edition is a valuable resource for upper-level undergraduates in forest hydrology courses as well as professionals involved in water resources management and decision-making in forested watersheds.

Forests, Water and People in the Humid Tropics is the most comprehensive review available of the hydrological and physiological functioning of tropical rain forests, the environmental impacts of their disturbance and conversion to other land uses, and optimum strategies for managing them. The book brings together leading specialists in such diverse fields as tropical anthropology and human geography, environmental economics, climatology and meteorology, hydrology, geomorphology, plant and aquatic ecology, forestry and conservation agronomy. The editors have supplemented the individual contributions with invaluable overviews of the main sections and provide key pointers for future research. Specialists will find authenticated detail in chapters written by experts on a whole range of people-water-land use issues, managers and practitioners will learn more about the implications of ongoing and planned forest conversion, while scientists and students will appreciate a unique review of the literature.

Probably, the most well-documented, and at the same time, simple conceptual method for predicting runoff depth from rainfall depth is the Soil Conservation Service curve number (SCS-CN) method. This Special Issue presents the latest developments in the SCS-CN methodology, including, but not limited to, novel applications, theoretical and conceptual studies broadening the current understanding, studies extending the method’s application in other geographical regions or other scientific fields, substantial evaluation studies, and ultimately, key advancements towards addressing the key remaining challenges, such as: improving the SCS-CN method runoff predictions without sacrificing its current level of simplicity; moving towards a unique generally accepted procedure for CN determination from rainfall-runoff data; improving the initial abstraction estimation; investigating the integration of SCS-CN method in long-term continuous hydrological models and the implementation of various soil moisture accounting systems; extending and adopting the existing CNs documentation in a broader range of regions, land uses and climatic conditions; and utilizing novel modeling, geoinformation systems, and remote sensing techniques to improve the performance and the efficiency of the method.

This synthesis of post-fire treatment effectiveness reviews the past decade of research, monitoring, and product development related to post-fire hillslope emergency stabilization treatments, including erosion barriers, mulching, chemical soil treatments, and combinations of these treatments. In the past ten years, erosion barrier treatments (contour-felled logs and straw wattles) have declined in use and are now rarely applied as a post-fire hillslope treatment. In contrast, dry mulch treatments (agricultural straw, wood strands, wood shreds, etc.) have quickly gained acceptance as effective, though somewhat expensive, post-fire hillslope stabilization treatments and are frequently recommended when values-at-risk warrant protection. This change has been motivated by research that shows the proportion of exposed mineral soil (or conversely, the proportion of ground cover) to be the primary treatment factor controlling post-fire hillslope erosion. Erosion barrier treatments provide little ground cover and have been shown to be less effective than mulch, especially during short-duration, high intensity rainfall events. In addition, innovative options for producing and applying mulch materials have adapted these materials for use on large burned areas that are inaccessible by road. Although longer-term studies on mulch treatment effectiveness are on-going, early results and short-term studies have shown that dry mulches can be highly effective in reducing post-fire runoff and erosion. Hydromulches have been used after some fires, but they have been less effective than dry mulches in stabilizing burned hillslopes and generally decompose or degrade within a year.

Flood risk management policy across the European Union is changing, partly in response to the EU Floods Directive and partly because of new scientific approaches and research findings. It involves a move towards comprehensive flood risk management, which requires bringing the following fields/domains closer together: the natural sciences, social sc

Wildland fire is an integral part of ecosystem management and is essential in maintaining functional ecosystems, but air pollutants emitted from those fires can be harmful to human health and welfare. Because of the public and governmental concerns about the possible risk of wildland fire smoke to public health and safety, as well as nuisance, visibility, ozone generation, and regional haze impacts, increasingly effective smoke management programs and air quality policies are being implemented with support from research and land management agency programs. This state-of-knowledge review of what is known about the effects of fire on air quality has been prepared to assist those in the fir and air quality management communities for future discussion of management, policy, and science options for managing fire and air quality.

This is a print on demand edition of a hard to find publication. Water from forested watersheds provides irreplaceable habitat for aquatic and riparian species and supports our homes, farms, industries, and energy production. Yet population pressures, land uses, and rapid climate change combine to seriously threaten these waters and the resilience of watersheds in most places. Forest land managers are expected to anticipate and respond to these threats and steward forested watersheds to ensure the sustained protection and provision of water and the services it provides. Contents of this report: (1) Intro.; (2) Background: Forests and Water; Climate Change: Hydrologic Responses and Ecosystem Services; (3) Moving Forward: Think; Collaborate; Act; (4) Closing; (5) Examples of Watershed Stewardship. Illus.

For the last three centuries forests have been recognised as providing the best water catchments and valued for their sustained output of high quality water. In Australia, work which was commenced fifty years ago has come to fruition and is providing new information on forest hydrology issues. The book focusses on the issues of small streams, including catchment definition, slope, hydrograph formation, water quality measurement, and annual water yield. The world-wide management issues of sustaining riparian forests are examined, using the River Murray forests as an example. Finally a large amount of information is drawn together to examine the management of forested catchments for water supplies. This book presents an incisive, disciplined, quantitative approach to dealing with forest hydrology matters. Although world-wide in application, the book particularly draws on Australian studies. It is written with the needs of students and forest practitioners in mind.

Forests cover approximately 26% of the world's land surface area and represent a distinct biotic community. They interact with water and soil in a variety of ways, providing canopy surfaces which trap precipitation and allow evaporation back into the atmosphere, thus regulating how much water reaches the forest floor as through fall, as well as pull water from the soil for transpiration. The discipline "forest hydrology" has been developed throughout the 20th century. During that time human intervention in natural landscapes has increased, and land use and management practices have intensified. The book will be useful for graduate students, professionals, land managers, practitioners, and researchers with a good understanding of the basic principles of hydrology and hydrologic processes.

Fire plays a key role in Earth system processes. Wildfiresinfluence the carbon cycle and the nutrient balance of our planet,and may even play a role in regulating the oxygen content of ouratmosphere. The evolutionary history of plants has been intimatelytied to fire and this in part explains the distribution of ourecosystems and their ability to withstand the effects of naturalfires today. Fire Phenomena and the Earth System brings together thevarious subdisciplines within fire science to provide a synthesisof our understanding of the role of wildfire in the Earth system.The book shows how knowledge of fire phenomena and the nature ofcombustion of natural fuels can be used to understand modernwildfires, interpret fire events in the geological record and tounderstand the role of fire in a variety of Earth system processes.By bringing together chapters written by leading internationalresearchers from a range of geological, environmental, chemical andengineering disciplines, the book will stimulate the exchange ofideas and knowledge across these subject areas. Fire Phenomenaand the Earth System provides a truly interdisciplinary guidethat can inform us about Earth’s past, present andbeyond. Readership: Advanced students and researchers across awide range of earth, environmental and life sciences, includingbiogeochemistry, paleoclimatology, atmospheric science,palaeontology and paleoecology, combustion science, ecology andforestry.

"Fire in California's Ecosystems provides a rigorous synthesis and review of the role of fire in California's tremendously variable natural environments. The authors have made a substantial contribution to the fields of fire ecology, natural history, and land stewardship. With this volume, California again shines as a model for other states and regions."—Dr. J. Morgan Varner, Humboldt State University "Fire in California's Ecosystems proficiently explains the complex nature of the effects of wildfire, wildfire suppression, and fuels treatments on our state's diverse fauna and flora. This book is a useful tool for biologists seeking to develop effective management measures to maintain fire-dependent ecosystems or to conduct further research."—Monica Bond, Wildlife Biologist, Center for Biological Diversity

It has become clear that soil water repellency is much more wide-spread than formerly thought. Water repellency has been reported in most continents of the world for varying land uses and climatic conditions. Soil water repellency often leads to severe runoff and erosion, rapid leaching of surface-applied agrichemicals, and losses of water and nutrient availability for crops. At present, no optimum management strategies exist for water repellent soils, focusing on minimizing environmental risks while maintaining crop production. The book starts with a historical overview of water repellency research, followed by seven thematic sections covering 26 research chapters. The first section discusses the origin, the second the assessment, and the third the occurrence and hydrological implications of soil water repellency. The fourth section is devoted to the effect of fire on water repellency, section five deals with the physics and modeling of flow and transport in water repellent soils, section six presents amelioration techniques and farming strategies to combat soil water repellency, and section seven concludes the book with an extensive bibliography on soil water repellency.

Fire is a major agent of disturbance in many biomes of the world but is a particularly important feature of tropical savannas. Up to 50% of the ext- sive tropical savanna landscapes of northern Australia are burnt each year. This includes prestigious conservation reserves such as World Heritage— listed Kakadu National Park, in the Top End of the Northern Territory. As in other savanna regions of the world, the responses of biota to different ?re regimes are poorly understood, such that ?re management represents one of the greatest challenges to conservation managers and researchers alike. This is the context within which a landscape-scale ?re experiment was established at Kapalga Research Station in Kakadu,which aimed to provide a sound scienti?c basis for conservation management in the region. The experiment was established by The Australian Commonwealth Scienti?c and Industrial Research Organization (CSIRO),but involved collaborators from a range of universities and government agencies, including the m- agers of Kakadu,the Australian Nature Conservation Agency (ANCA:now Parks Australia North). This book summarizes the ?ndings from the Kapalga ?re experiment and explores the implications for conservation management. We believe that Kapalga has provided important insights into the ?re ecology of tropical savannas and has broad relevance for the conservation management of ?- prone landscapes in general. This book should be of interest to researchers, graduate students, and land management agencies. vii viii Preface We are extremely grateful to all our collaborators,both inside and outside CSIRO, for their involvement in the Kapalga experiment.