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Fire Ecology

BOOK REVIEW

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Review of *Fire ecology and management: past, present, and future of US forested ecosystems* by Cathryn H. Greenberg and Beverly Collins (editors) and 75 contributing authors

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Abstract

Background: Fire is a multifaceted force. Fire activity and risk of fire incidence across US forested ecosystems have accelerated over the last two decades. At the same time, human land-use choices and climate change interacted with fire, in an era we are called to meet specific sustainability goals of reducing CO_2 emissions and protecting biodiversity, ecosystems, and their resources. To understand the development of the traits and functions of organisms, and the processes and drivers of natural and human-induced events that cause fire, it is essential to study the fire ecology in the context of human land-use history in the forested ecoregions of the USA.

Results: This book is a research synthesis of the fire ecology in the US forest ecosystems at the regional level. Two main pillars are analyzed across all ecoregions and forest types covered in the book, the drivers and linkages that form fire history and interactions initiated by recurring fire events, and the interdependence of fire with the forest ecosystem dynamics and humans.

Conclusions: The research, policy, and management tools available for managing fire as a disturbance and as prevention and mitigation treatment need cross-boundary revision. It is fundamental to realize the precise role of fire at present and to redefine the role of fire in the short and long term. This book is an invitation to change our perspective and methods towards these directions.

Keywords: US forest ecosystems, Ecoregions, Forest fire management, Applied terrestrial ecology, Climate change, Vegetation dynamics drivers, Fire and human history, Fire regime, Future fire role

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Resumen

Antecedentes: El fuego es una fuerza multifacética. La actividad del fuego y el riesgo de incidencia de incendios a través de los EEUU se ha acelerado en las últimas décadas. Al mismo tiempo, las alternativas sobre los distintos usos de la tierra por el ser humano y el cambio climático han interactuado con los incendios, en una era en la que estamos llamados a cumplir con metas objetivas y sustentables de reducción de emisiones de CO_2, proteger la biodiversidad, los ecosistemas y sus recursos. Para entender el desarrollo de las características y funciones de los organismos, los procesos y trayectorias de los eventos naturales o inducidos por el hombre que causan los incendios, es esencial estudiar la ecología del fuego en el contexto humano de la historia del uso de la tierra en las regiones boscosas de los EEUU.

Resultados: Este libro presenta una síntesis de la ecología del fuego en los ecosistemas boscosos de los EEUU a nivel regional. Dos pilares principales son analizados a través de las eco-regiones y tipos forestales cubiertos por este libro, las trayectorias y los aglutinantes que conforman la historia del fuego y las interacciones iniciadas por eventos de fuego recurrentes, como así también la interdependencia del fuego con la dinámica de los ecosistemas forestales y humanos.

Conclusiones: La investigación, las políticas y las herramientas de manejo disponibles para manejar el fuego como un disturbio y como un tratamiento de prevención y mitigación necesita de una revisión que traspase las actuales fronteras. Es fundamental darse cuenta del rol preciso del fuego en la actualidad, y redefinir el rol del fuego en el corto y largo plazo. Este libro es una invitación a cambiar nuestra perspectiva y métodos hacia esas direcciones.

Book details

Cathryn H. Greenberg and Beverly Collins (Eds.)

Fire ecology and management: past, present, and future of US forested ecosystems

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Main text

Fire, irrespective of its cause (human-induced or natural force), is an issue of global interest or concern in science, policy, and society. Nowadays, the term "fire" is conceptually, evidently, and increasingly interlinked with our earth's history, health, climate, and future. Elements of the Earth's ecosystem are the forests with their resources, functions, and complexes. This also applies to the forested regions in the USA, which in the last years are experiencing extreme fire activity and therefore higher fire risk. This situation is accurately perceived by the forest-fire ecologists and managers in the USA as it is reflected by the *Fire ecology and management: past, present, and future of US forested ecosystems*, a book published as a volume in the series edition *Managing Forest Ecosystems*. This book narrates the history of the USA forested ecoregions in a scientific synthesis framed by fire ecology. It retains an extensive collection of historical and up-to-date topics of forest fire management that require continuous investigation and prompt resolutions. At the same time, the reader is given the opportunity to enhance or update knowledge on the ecology of forests across the USA continental areas from the Pacific Northwest to the Southeastern Coastal Plain through the eyes of specialized experts and their work for many years in data collection, analysis, and interpretation. In this sense, this book is published without any "discounts" but with twelve chapters compiled after a thorough and coordinated effort to enable the reader to understand *the driving forces, historical patterns, and future management challenges of fire in forested ecoregions across the continental USA* as the authors themselves emphasize (Greenberg et al. 2021).

The first chapter is an introduction which presents in summary what is common to every single forested ecoregion covered in each of the following ten chapters in the book. It describes the historical and ecological drivers shaping the to-date differentiated fire regime of increased severity across the USA continent. Potential correlations or interactions among these drivers were investigated using datasets and model predictions available from research inventories and public institutions over the decades. A review is presented on the evidence-based and expert judgment approaches identifying the drivers and linkages that formulated fire histories. In the following pages, a coherent overview of the interdependence between plant communities and fire illustrates the strategies and traits that result in specific regeneration, recovery, and resistance of plant species in response to fire. Fire regimes and subsequent plant communities' formation are influenced by Native Americans and Euro-American settlers, and such influence also varies across forest types and ecoregions, something well-referenced in the scientific literature for America and therefore a rather expected implication. But the interesting point is that

today's forests are defined by the authors as *the legacy of the past,* and this past—either exposed as age class or as stand structure—also includes evidence on how the current forest types reflect the former land-use and natural disturbance history including fire, but not limited to only that. In the next chapters, such drivers and linkages are elaborated for each forest ecoregion with emphasis on specific driver of high importance per forest type. After all, fire causes are an interplay between human and ecological factors, and this highlights the need for a different approach in forest management within the context of fire ecology.

To meet this goal, the next ten chapters speak the story of the forests in Piedmont (ch.2), the Southeastern Coastal Plain (ch.3), the Eastern and Appalachian mounts (ch.4), the Western Central Hardwoods and Prairie-Forest Border (ch.5), the Floodplain Forests of the Southeast (ch.6), the Great Lakes-Northeastern Forest Region (ch.7), the Rocky Mountain (ch.8), the North American Mediterranean-Climate Zone (ch.9), the Pacific Northwest Zone (ch.10), and the Southwestern Plain (ch.11). The ecologies of the common forest types and dominant plant communities are explained in relation to the dual role (natural force or management tool) that fire played in vegetation dynamics, in the presence and influence of people, indigenous or not. Every chapter includes an appraisal of whether the historical role of fire is clear enough to shed light on the composition of the past vegetation communities. This information is then integrated into an evaluation of the available research and management tools in order to identify the knowledge gaps and policy needs and to realize a new clear role of forest fire in the long term.

The chapters do not vary in the depth of each topic or issue that is dealt with, but they do differ in the complexity of the driving forces' linkages per ecoregion. For instance, the prehistoric role of fire is investigated in Piedmont (ch.2), the Eastern Broadleaf and Appalachian Forests (ch.4), and the Pacific Northwest (ch.10); the invasiveness in the Southeastern Floodplain Forests (ch.6) and in Hardwood and Conifer Forests of the Great Lakes-Northeastern Forest Region (ch.7); and the climate change interactions with fire for the Southern Pine Ecosystems (ch.3) and Rocky Mountains (ch.8). Likewise, fire exclusion policy is analyzed in the Eastern Broadleaf and Appalachian Forests (ch.4), the Western Central Hardwoods and Prairie-Forest Border (ch.5), and the Southwestern Forests (ch.11). The severity and frequency of fire are particularly surveyed for the North American Mediterranean Climate (ch.9) and the Pacific Northwest Zone (ch.10). These topics are not exclusively elaborated in this book, as they have been and are being extensively examined by other researchers elsewhere and are cited openly. What I appreciated through these chapters is that the authors demonstrate the evidence sufficient enough to enable the reader to comprehend that fire today takes place in forest ecoregions, where tree mortality, logging and land conversion, altered hydrology, sea level rise, forest fragmentation and degradation, nonnative invasiveness, altered insect, and disease effects, have interacted and interact with fire. Thus, in my eyes, chapter 8 could be considered as a starting point for rethinking the present and planning the future fire regimes.

Chapter 12 is the conclusion. This chapter first filters the likely effects of future fire regimes on boreal, southwest and southeast forest fire-prone ecosystems in view of the observed and anticipated changes in the climate. This is followed by a sufficient analysis of the interactions of the future fire regimes with stressors and disturbances other than fire. The final part of this chapter elaborates the resilience management, clarifying the concept, and considering it as a way of managing the wildlife, employing prevention and mitigation treatments (e.g., plantation of key tree species or treating fuel) across spatial and temporal scales, and more notably *across boundaries* (agencies, institutions, land ownership). Therefore, it calls for holistic collaboration to adjust the existing resilience strategies.

Fire ecology and management: past, present, and future of US forested ecosystems is targeted at researchers, scientists, students, policymakers, managers, and professional practitioners. It is devoted to the next generations of fire ecologists and managers who work for the USA forest ecoregions and elsewhere. It is a publication that requires thorough studying, especially by students having already a standard level of knowledge of forest fire ecology topics, and thus, it is essentially useful for early-stage career professionals that aim at developing further their expertise in the field. This is not a book to be read once, this is a book written with transparent technical scientific terminology aimed to deepen understanding. Despite the complexity of the topic, each chapter is constructed as one survey report with keywords, abstract, introduction, evidence, and references that can be independently considered. At once, every single chapter and the book as a whole, are an evidence synthesis, a science-based critical narrative explaining and justifying why the force of fire evolved into a regional and global threat and why it accompanies and is accompanied by other disturbances of similar extent or extremity (changing climate, resource depletion, long-term severe drought but short-term vegetation conversions). This is one reason why such a multi-parametric topic becomes understandable at the end having realized the potentially flawed or deficient perceptions, policies, and practices of the past (e.g., long-lasting fire exclusion). A legacy to the youth is the vision that the contributors of *Fire ecology and*

management: past, present, and future of US forested ecosystems have achieved. This book was published to educate and advise to reset the research and policy priorities by clarifying the dual nature of fire, either as a force that can pose risk or as a management tool that can be used to tackle its own or other stressors' severity, and to assess or reduce its currently increasing likelihood to happen.

With *Fire ecology and management: past, present, and future of US forested ecosystems*, a distinct journey begins within the foliage of the USA forests. The scientific field of fire ecology and forest management is approached in relation to the state of the forest resources and the challenges to preserve them with changing policies. In turn, recurring issues interlinked with forest dynamics, traits, ecosystem services and resources, their conservation or restoration, and climate change are explored. Including in one publication these specific topics of relevance, with a strategic structure on how forest fire ecology evolved "hand-by-hand" with human land-use history, has an added value also from a systems-thinking viewpoint. Thus, this book is a proof and the outcome of a shared effort to jointly address the subject of how to deal with the today's fire patterns, seasonality, cause, occurrence, severity, frequency, density, extent, duration, regime, and nature and magnitude of subsequent effects. This was accomplished by using the traditional way of "thinking and applying" the forest fire sciences but approaching them like a "system." The book is a publication of deep-rooted scientific know-how balanced with superior editorial quality, and as such, professionals and scholars in forest fire ecology and management should consider it as well worth studying and not just "must read."

Abbreviation
ch.: Chapter.

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