

Foreword

In the mid 1980s I was asked to create a fire regime map of the Selway-Bitterroot Wilderness Area for the Bitterroot National Forest fire management staff. The well known fire historian Steve Barrett had already completed most of the work by synthesizing all available fire history results by forest habitat type, so I figured it would be easy to create a map of habitat types and then assign fire regimes to each habitat type. However, when the mapped fire regimes were compared to actual fire history field data, I found that the map's accuracy was disturbingly low, ranging from 40% to 60%. At first I thought that low accuracies were a result of inaccurate habitat type mapping, but subsequent revisions of the habitat type map that increased accuracies to over 80% did nothing to improve the accuracy of the fire regime map. I searched and searched for answers to this dilemma but in the end, I gave up and sent the map to the Bitterroot National Forest with a warning about its low accuracy. It wasn't until years later after reading Forman and Godron's *Landscape Ecology* book that I fully understood the profound influence of spatial and temporal context on fire regimes. It was clear that fire regimes are the manifestation of spatial factors, such as topography, wind, and patch characteristics, as they interact with antecedent climate, fuels, vegetation and humans across the landscape, and fire regimes would be difficult, if not impossible, to understand, let alone predict, without a spatiotemporal foundation.

Landscape ecology is the "glue" that holds ecosystem theory together and nowhere is that more evident than in the study of wildland fire ecology. Fire is one of those unique and complex processes that operates across multiple scales of space and time because its ignition and spread are dictated by diverse factors of climate, weather, fuels, and topography, which also operate at different scales. It wasn't until the field of landscape ecology burst onto the ecological scene in the early 1980s that the missing pieces of wildland fire dynamics fell easily into place. The concepts of scale, resolution, and extent fit perfectly into fire science and they helped explain new and exciting phenomena that would have never been discovered without a context of space. In my experience, it is only in the framework of landscape ecology that the many varied aspects of fire regimes can be explored and explained using the extensive body of fire history data collected by the many dedicated scientists. Moreover, as I learned in the Bitterroot project, it is difficult to map fire regimes

across a landscape without a basic knowledge of landscape ecology fundamentals, and the identification of the appropriate scale, landscape extent, time frame, and spatial variability allows a more accurate depiction and prediction of fire regimes across large areas.

It would be difficult to overemphasize the impact that landscape ecology has had on wildland fire science, yet there have been few comprehensive summaries or syntheses of the integration of landscape ecology and wildland fire in the literature. It is the concepts of landscape ecology that make fire science much easier to understand, interpret, and apply. Particularly valuable is a physical or mechanistic approach to landscape fire ecology, where biophysical drivers such as climate, energy flux, and plant ecophysiology are used to build a more “unified theory of the ecology of fire.” Fire processes and their interactions are dynamic and we should never assume that there is such a thing as an “equilibrium condition”; wildland fire ecology exhibits non-linear behavior that in turn produces non-equilibrium responses, which is important to consider when attempting to apply fire science to management issues.

I believe that the next major advances in the field of wildland fire science will be in two areas: (1) the study of the variability of fire across spatiotemporal scales, and (2) the linkage of fire regimes with the biophysical processes that control them. Scaling laws, self-organized criticality, and power laws, along with semi-variance and geostatistical analyses, represent exciting new advances in understanding fire’s spatial and temporal variability. But we must first understand the multi-scaled basic physical processes that influence fire dynamics if we are to understand wildland fire and manage its effects. This is more important than ever as we are faced with rapid and uncertain changes in climate, the coarsest and arguably most powerful driver of fire regimes.

In the end, the complexity of landscape fire dynamics must eventually be synthesized to a level where it can be understood and applied by natural resource management. Fire history and spatially explicit historical fire regimes are now being used by many managers to quantify the historical range and variability of landscape characteristics, and this envelope of variability is then used to prioritize, design, and implement management actions at multiple scales. This book presents essential information and some useful applications of landscape fire ecology for natural resource management. I only wish I had this book when I was spending long days and nights trying to improve that Selway-Bitterroot fire regime map.

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