Preface

The role of natural disturbances in community dynamics has not always been clearly recognized, even though ecologists have thought of communities as dynamic and undergoing succession since the early years of the science. However, by the 1970s, there were a number of important studies showing that communities were subject to a variety of natural disturbances that occurred often enough to have significant ecological effects. This understanding of disturbances as recurrent natural events required a rethinking of succession, because it was becoming obvious that the idea of directional succession toward some stable endpoint was no longer as realistic as it once seemed. Out of this concern arose the gap phase dynamics argument which, in its simplest version, had succession occurring in gaps of varying sizes or, in its more complex form, that the community consisted of a spectrum of life histories adapted to different-sized gaps. In 1985, the Pickett and White book *Ecology of Natural Disturbance and Patch Dynamics* summarized these emerging viewpoints. This book was immensely influential because it came at the right time, calling attention to the disparate evidence for the role of disturbance in communities and providing an alternative way of thinking about community dynamics from traditional succession.

Considerable literature has been generated since the Pickett and White book by ecologists interested in elucidating disturbance dynamics as both a

community process and a metapopulation process. However, most ecologists still have only a vague understanding of *how* natural disturbances operate and, consequently, have only an incomplete understanding of the ecological effects of these disturbances. The approach taken by ecologists has generally been to describe some aspects of a disturbance (e.g., size, frequency, severity, or season) and then to correlate this with the vegetation response (e.g., composition of the regenerating plant community). There have generally been few attempts to understand the disturbance processes and how they affect ecological processes. Because of this, the study of disturbance ecology has lost some of its forward momentum and has been reduced to simply giving the disturbance regime in terms of descriptive rather than causal variables. Furthermore, with only a vague understanding of the disturbance process, the variables used to describe disturbance regimes are sometimes arbitrary and often are unclear if the variable is of the disturbance or of the ecological effects (e.g., severity).

A way to overcome this descriptive tradition is to ask how the disturbance actually *causes* an ecological effect. The key is to understand those parts of the disturbance mechanism that are causally connected to the specific ecological process of interest. For example, if we are interested in tree mortality caused by wind, what we need first is an understanding of the specific wind phenomenon of interest (e.g., gusts, downbursts, hurricanes, etc.). Then we need to know how the wind will apply pressure to the tree canopy. This pressure will create a moment arm that will cause the trunk to bend quite rapidly (dynamic loading). The tree may then fail by breakage of the stem or uprooting or not, depending on the loading and on the physical properties of the tree. Of course, a local population consists of individuals with differences in their physical properties affecting their responses of bending, breaking, and uprooting given specific loadings.

This book will be useful to both physical scientists who want to know how their expertise could be useful in ecological and environmental areas and plant ecologists, environmental scientists, environmental managers, and foresters who want to have an up-to-date understanding of the physical processes involved in natural disturbances. The book is organized into sections, each of which deals with a particular type of disturbance process: wind, ice storm, geomorphic, hydrologic, combustion, and biotic. Each section includes one or two chapters providing background on the physical or biotic processes involved in the disturbance coupled with one or two chapters on how the disturbance causes necrosis or death to individuals and their effects on population or community processes. We have not tried to

cover every type of disturbance affecting plant communities. One will immediately notice that there is a much more sophisticated understanding of the disturbances than of how the disturbance is causing specific ecological effects.

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