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PREFACE

Disturbance dynamics and ecosystem-based forest management

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Ecosystem-based management is intended to balance ecological, social and economic values of sustainable resource management. The desired future state of forest ecosystem is usually defined through productivity, biodiversity, stability or other terms. However, ecosystem-based management may produce an unbalanced emphasis on different components. Although ecosystem-based management respects the ecology of individual ecosystem components or values, it may focus on individual objectives (Kimmins, 2004) rather than producing an integrated and balanced system (Boyce & Haney, 1997). An important part of understanding the complexity of the ecosystem is to understand the role that disturbance, natural and anthropogenic, plays in the proper functioning of that ecosystem.

From 27 to 29 May 2004, the Nordic Forest Research Co-operation Committee (SNS), the Estonian Agricultural University and IUFRO hosted the International Conference on Natural Disturbances and Ecosystem-Based Forest Management. This conference was an activity of the SNS network "Natural Disturbance Dynamics Analysis for Forest Ecosystem Management", which consists of forest researchers from the Nordic and Baltic countries. Researchers from nine countries attended the conference, held at Otepää, near Tartu, Estonia. Conference sessions focused on (1) forest biodiversity, (2) natural wind and fire disturbances, (3) natural defoliation, and (4) anthropogenic disturbance factors. The Estonian Agricultural University published proceedings of the conference, which provided extended abstracts of most presentations delivered at the conference (Kangur, 2004).

Society as a whole, and scientists in particular, are still discovering layers of complexity in forest ecosystems. This conference included presentations on integrating traditional topics of forest management with disturbances (e.g. Metslaid et al., Ozolincius et al.) and results of research on forest communities important to maintaining forest biodiversity (bryophytes, birds, insects) (see Ryömä & Laaka-Lindberg, Selonen et al. and Brazaitis et al.). To account for this complexity, new methods in forest disturbance and biodiversity assessment are very much needed (e.g. Püssa et al., Kohv & Liira). Few experiments have been done on restoration work in this region, and we welcomed the contributions on this topic (de Chantal et al., Lilja et al.).

The purpose of forest management is to achieve a desired future state of the ecosystem. Practical forest management concentrates on a profit and achieves its goals with the minimum amount of time, money or effort. The management style that best integrates natural processes encounters less resistance than intensive, obstinate, artificial-only production-orientated strategies. Historically, resource managers have implicitly recognized this fact by tailoring management and regeneration practices to sites and species. While this static viewpoint takes into account factors that are fairly stable in the short run, such as site productivity and average weather patterns, it fails to account for the role of dynamic processes, such as disturbance, in the life cycle of an ecosystem. Although we recognize the influence of disturbance in unmanaged wildlands, we resist the idea that disturbance has an important role in managed ecosystems.

What is the (appropriate) natural intensity, periodicity and variability of disturbances in a particular forest ecosystem, which are acceptable to foresters? When are disturbances unsustainable? If we under-

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stand the ecosystem processes and disturbance mechanisms, we assume that we can better prepare the forest for disturbances, or at least mitigate their effects on forest structure and production, at the same time preserving the natural functions of the system. If we fail to comprehend the concepts of disturbance and stand dynamics, we risk creating unnatural, unstable and unpredictable systems, the stability of which will depend on human care (Kuuluvainen, 2002; Suffling & Perera, 2004).

So, what is "natural" (Bradshaw, 2005)? This query leads to fundamental questions about the scale and pattern of dynamic changes in forested ecosystems. The natural condition of a forested ecosystem is one of reconstruction or response to the last disturbance. In today's landscape, divorcing human activity from these processes may be pleasant, but this is an unreal, theoretical construction. Accordingly, we should strive to integrate traditional management and an understanding of disturbance ecology so that they might assist us in progressing towards our goals (Suffling & Perera, 2004).

Managers of natural resources assume that they understand the resource and how human actions affect it. Yet, the impact of humans is not predetermined, as stochasticity in the response of the ecosystem to such impacts and outside events can create an infinite number of ecological results. Only when we fully understand the impacts of anthropogenic disturbances and act in such a way as to minimize the unexpected consequences can we hope to manage future ecosystems and their functions.

Risk assessment has been an implicit part of most management actions (Moser et al., 2003). While some have defined ecological risk as the conditional probability of an undesired event (Bartell, 1997), ecological risk assessment is a much more complex process. Understanding the uncertainty in an outcome hinges on two components: the likelihood of occurrence of a disturbance and assessment of the impact. Two components determine whether the response of ecosystems to disturbances has economically significant impacts: the scale and the intensity of the disturbance. Forest fragmentation is one example of disturbance caused by humans that possesses both of these components. Even areas with a forest composition close to natural, such as exist in parts of the Baltic countries, can be fragmented to a high degree.

Scientists have constructed models of ecosystem change to predict ecosystem responses to disturbances. Yet the understanding and modelling of ecosystem processes have rarely been applied for values other than biomass production. To be useful to forest managers, ecosystem-based forest management must focus on the quantitative character of disturbance dynamics and provide measurable variables with which to guide management actions (Vodde et al., 2002).

So, can one say that disturbance is management and vice versa? Management that emulates natural disturbances is an important practical prescription. It should be remembered that disturbances, even disturbances caused by management, are processes and thus a dynamic concept should be applied (Boyce & Haney, 1997).

Today, the practice of ecosystem management that emphasizes productivity and stability of trees is not sufficient. Practical forestry continually seeks new concepts to update its management schemes (Mitchell et al., 2002; Stanturf, 2004). Understanding the relationship between diversity and ecosystem stability, and between stability and disturbance, will enable us better to predict the consequences of our actions and, hopefully, make wiser choices, to maintain forest ecosystems and their functions for the next generations.

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