Plant Diversity in Managed Forests

Impacts of Forest Management on Plant Diversity[1]

More often than not, forest management is thought of as being inconsistent with maintaining plant diversity, since management objectives often are directed toward a limited number of tree species. Thus, it may seem reasonable, at first glance, to hypothesize that forest management invariably decreases plant diversity to a great degree. However, plant biodiversity of forest ecosystems is determined by more than just the dominant overstory species (i.e., species of other forest strata also contribute greatly), and forest management effects on the patterns and mechanisms of diversity may vary considerably among ecosystem types and management techniques. Therefore, in practice, there is little support for this generalization.

The papers of this special feature were presented as part of a symposium we organized and chaired at the 1993 Annual Meeting of the Ecological Society of America, University of Wisconsin, Madison, entitled "Impacts of Forest Management on Plant Diversity: Patterns and Mechanisms in Forest Ecosystems." The scope of the symposium was consistent with the general theme of the meeting, "Ecology and Global Sustainability." Certainly, any successful approach toward attaining global sustainability must include the responsible management of natural resources. One of the main objectives of global sustainability is the maintenance of biodiversity.

Accordingly, the goal of this special feature, as a direct result of the symposium, is to examine empirically the relationship between forest management and plant diversity in a variety of forest ecosystem types. All papers, with the exception of the final summary paper, provide direct answers to the general question, "What is the effect of forest management on plant diversity?" Each of the empirical papers addresses this question for a different forest ecosystem type, whereas the summary paper provides mechanistic explanations for the observed patterns.

[1] Reprints of this 67-page group of papers on plant diversity in managed forests are available for $9.00 each. Order reprints from the Office of the Executive Director, Ecological Society of America, 2010 Massachusetts Avenue NW, Washington, DC 20036.

Halpern and Spies answer this question for managed forests of the Pacific Northwest. They group management effects into two broad categories: initial effects of discrete disturbances (e.g., harvests) and longer-term effects of additional management activities (e.g., fertilization and herbiciding). They conclude that management practices that preclude the development of old-growth structural characteristics for forests of this region may delay the recovery of the forest understory and result in long-term loss in plant diversity. Meier et al. answer our question for managed southern Appalachian cove hardwood forests by comparing old-growth and secondary forests of varying age, focusing on species diversity of the herbaceous layer ("forest understory" of Halpern and Spies). Echoing some of the conclusions of Halpern and Spies, they conclude that intensive harvesting methods (such as clear-cutting) maintain lower species richness in the herb layer, whereas less intensive methods that mimic natural gap-phase dynamics for forests of this region will allow for both forest exploitation and maintenance of the naturally high herb-layer diversity. Gilliam et al. answer our question for central Appalachian hardwood forests, emphasizing interactions of species composition between the herb layer and the overstory. They conclude that, although plant diversity of clear-cut stands increases rapidly (<20 yr) toward that of mature secondary forests of the region, the linkage (interaction) of the two forest strata is minimal initially and continues to increase through successional time. Separate papers by Lugo and Denslow consider two different aspects of forest management in tropical forests. Lugo dispels some "myths" about the manageability of tropical forests and concludes that managed tropical forests can serve as plant species refugia in human-dominated landscapes. Denslow applies knowledge of gap dynamics of tropical forests toward management approaches and suggests that selective logging may be compatible with non-consumptive values, such as maintaining populations of non-target species, if canopy opening is not extreme and other ecosystem processes are not damaged during timber extraction.

Roberts and Gilliam provide a summary of the key points brought out by each of these papers in the context of management-mediated mechanisms that influence plant diversity of forest ecosystems. By reviewing current diversity models, they identify key processes that underlie diversity patterns across forest ecosystem types. Because forest management at any intensity represents a disturbance (indeed, the variety of forest management scenarios essentially represents a gradient of disturbance intensities), the authors emphasize the need to examine management effects as an interaction between disturbance regime and innate properties of the forest ecosystem, including site quality, successional status, and life history characteristics of forest species.

If the papers of this feature share a common theme, it is that forest management that is most consistent with the goals of global sustainability does two things. First, it must reflect an ecosystem approach to or perspective of the forest, placing a value on all species and processes, not just those that provide short-term economic returns. Second, it should closely resemble, to the extent possible, the natural disturbance regime under which these ecosystems evolved.

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Key words: disturbance; ecosystem management; forest ecosystems; global sustainability; herbaceous layer; life history characteristics; maintenance of diversity; resource management; succession; woody overstory.