Continuous Change in the Forest
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**Understanding Forestry Concepts: A Forest Ecology Series for Loggers, Landowners and Foresters**

UNIT SEVEN

# CONTINUOUS CHANGE IN THE FOREST

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MICHIGAN STATE UNIVERSITY EXTENSION

## Introduction

The goal of this bulletin series is to briefly introduce information that loggers, landowners and foresters should be aware of in order to properly manage forest lands. Understanding how forest systems work and interact is important if long-term forest productivity is to be maintained. These bulletins do not provide an exhaustive discussion of all important forest ecology topics. Instead, they are intended to provide only a brief introduction for you to better understand the depth and breadth of knowledge necessary to properly manage forest stands. This seventh bulletin provides a general review of Lake States forest history and how a knowledge of tree species and forest successional patterns can effectively help us manage our forest resources.

Around 100 years ago marked the end of an era. That era was the widespread harvesting of virgin timber in the Lake States. This was a time of timber barons, logging camps, legends and innovations in harvesting. At that time there was little attempt to manage or conserve our forests. Why then do we have so much timber given our unmanaged harvesting of 100 plus years ago? Why has the amount of timberland continued to increase in the Lake States (8)? What has caused the transition from a harvested landscape into a forested landscape? Some of the credit goes to tree planting of thousands of acres in the 1930s by the Civilian Conservation Corps, but millions more acres made the transition back to forest naturally.

The transition process from clearcut areas (grasses, shrubs and small trees) to the mature forests of today is called secondary forest succession (7) (Fig. 1). Succession is defined as: "a series of things that follow one another" (Merrian-Webster Dictionary, 1970). In the case of forest succession, it is a series of plant species that follow one another such as from grasses and weeds, to trees such as aspen, white birch and jack pine, to longer-lived species such as sugar maple, white ash, and oak (4). It is this natural process we call secondary succession that leads to the slow but steady return of trees to the landscape of the Lake States following the tree removals of 100 years ago.

Although we have regained many acres of forest land, numerous catastrophic fires after early timber harvesting 100 years ago and repeated attempts at agriculture on some areas have reduced site productivity by reducing the amount of soil organic matter crucial to water and nutrient holding capacity in sandy forest soils (7). The removal of organic matter also makes soils prone to erosion. Many streams and rivers still show the effects of siltation, and stream bank erosion is continuing evidence of the log drives of long ago.

Today, poor logging practices can damage fisheries habitat through soil erosion and stream siltation, reduce site productivity through soil compaction, damage the residual forest, and reduce site productivity by removal of only the best stems and species from the forest. However, with the use of good management practices, the ill effects of timber harvesting can be minimized greatly.

Knowledge of forest succession is important to anyone working in the woods. This means knowing that removing only the best stems and species in a selection harvest does not leave a high quality forest for a future harvest (6). The lack of

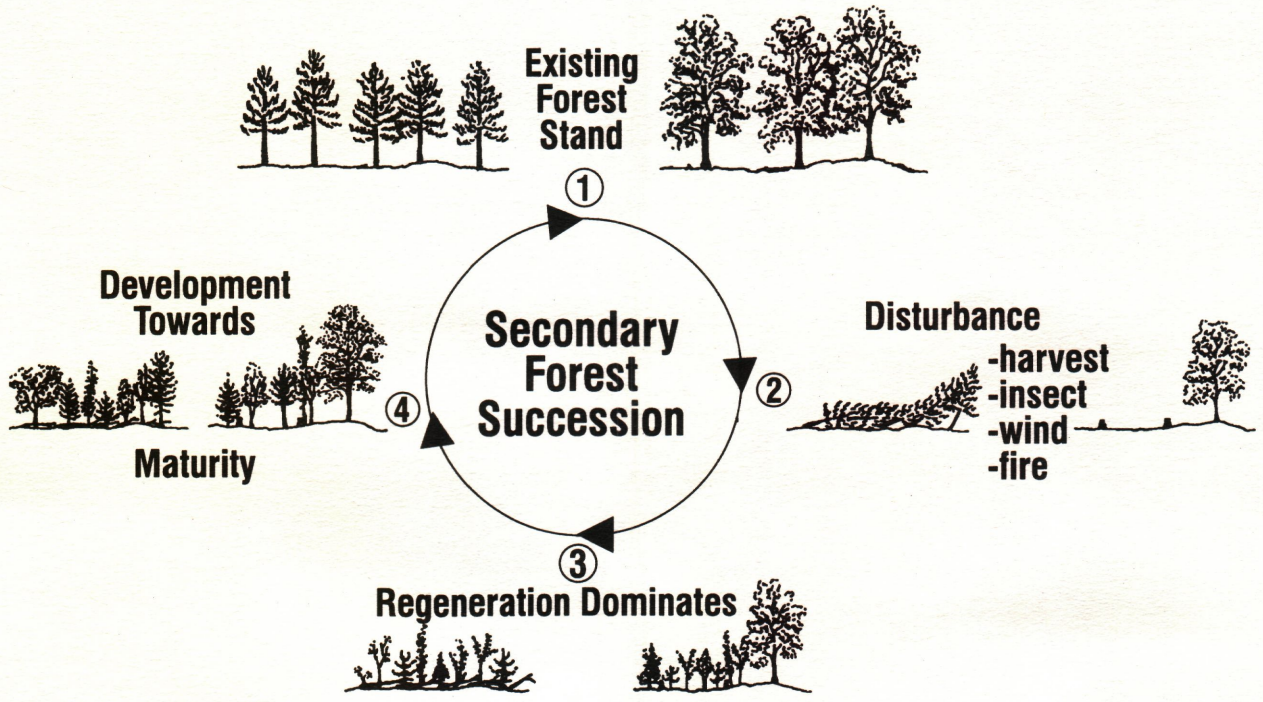


**Figure 1: Secondary forest succession is the development of a new forest following a disturbance in the original forest. This disturbance can be the result of large scale insect-induced and disease-induced mortality, fire, wind or timber harvest.**

strong, straight trees in such a stand leaves little room for stand improvement. The remaining trees, whether of low or high quality, attempt to expand their dominance on the site through seeding, sprouting and growth.

Depending upon stand condition, poor quality trees may dominate the site for many years to come. The severity of the cut, that is, the quantity and quality of remaining trees after the harvest, greatly influences whether it may take 20, 40 or 150 years before the forest has harvestable stems again. The goal of forest management is to balance an economic harvest while leaving a healthy and productive site (6). In a well managed forest and with the proper application of good forest practices, the passage of 10 to 15 years is usually sufficient to allow another thinning harvest (6).

Clearcutting is an appropriate means of regenerating some forest sites and is widely used in the Lake States. While clearcut harvests result in the even-aged regeneration of a forest (regeneration occurs once in each rotation), clearcut areas are sometimes thinned on several occasions before the regeneration harvest occurs to extract products and enhance the quality, size and value of the trees to be removed in the final harvest. Clearcut rotations can span 40 years or more for aspen and 80 years or more for some hardwoods. Clearcuts, when applied correctly, are a more desirable method than improperly applied selective harvests and can produce predictable results in terms of quantity and quality from the forest (6).

A knowledge of tree growth, the reproductive characteristics of trees and the natural direction of forest succession helps foresters develop forest management plans that allow planned harvests on a regularly sustained basis (6). Tree removal without a plan for the future condition of the forest can result in years of wasted time waiting for new timber to establish itself adequately on a site.

Timber management plans are developed to ensure the growth of quality trees for future economical harvests. By applying good forest management plans for landowners, loggers are provided with economically attractive wood volumes, landowners have a means of reaching management objectives and the professional reputation of loggers improves (6).

For forest management plans to succeed, a knowledge about natural forest successional pathways is needed. The first step in understanding forest succession is to learn about the characteristics of individual tree species (1, 2). One important characteristic is a tree specie's shade tolerance, or its ability to become established and grow under shade (7) because tree species that need full sunlight for regeneration do not establish themselves in the understory of existing forest stands. Table 1 provides a listing of shade tolerance for selected tree species. To illustrate the usefulness of this table note the entry for aspen. Low shade tolerance (cannot survive and grow in shade of other trees) is one reason this species cannot establish a new forest under itself without harvesting or other disturbances occurring. However, following a disturbance, shade intolerant species such as aspen are the first trees found on the site.

Shade tolerant species (can survive and grow in shade of other trees) can become established in the understory of an existing forest (7). As the shade intolerant overstory matures and dies, the forest undergoes succession to more shade tolerant tree species. However, if a clearcut or other major disturbance results in full sunlight and a species such as aspen is present, the aspen suckers can number in the thousands of stems per acre shortly after harvest. This regeneration may overwhelm the regeneration of any shade tolerant species on the site for many years, returning this site to what ecologists call an early stage of succession (shade intolerant species come to dominate the overstory) (7).

**Table 1: Shade tolerance of selected tree species in the Lake States (Burns and Houkala, 1990).**

| Shade Tolerance | Softwood | Hardwood |
|---|---|---|
| **Extremely tolerant (capable of regenerating under a dense canopy)** | Balsam fir<br>Eastern hemlock | Ironwood<br>Sugar maple<br>American beech |
| **Tolerant** | Black spruce<br>White spruce<br>Northern white cedar | Basswood<br>Red maple |
| **Intermediate (mid-tolerant)** | Eastern white pine | Most oaks<br>Hickories<br>Yellow birch<br>White ash<br>Elms |
| **Intolerant** | Red pine | Black cherry<br>Yellow poplar<br>Sycamore<br>Black walnut<br>Black ash |
| **Extremely intolerant (require full sunlight to regenerate and grow)** | Jack pine<br>Tamarack | Paper (white) birch<br>Aspen<br>Alders<br>Black locust |

Ecologists have identified several stages in the successional sequence, from the early stage of succession to a late stage, where shade tolerant species are predominant and the plant species that are typically dominant within each stage (4). There are common stages for secondary forest succession: herbs and grasses, shrubs, shade intolerant trees, mid-tolerant trees and shade tolerant trees (7). Shade intolerant trees are called pioneers or early successional species. Mid-tolerant trees can also be called early successional species, or mid-successional species. Tolerant trees are typically thought of as climax species because they can replace themselves through the development of their shade tolerant regeneration (7).

A term associated with the stages of forest succession, as well as other ecosystems, is biodiversity (4). Biodiversity is used to highlight the need for or the existence of a wide-range of plant and animal species that are important to maintain a balance within the forest ecological system. In the forest, different plant and animal species are adapted to different forest conditions. As succession proceeds from the early pioneer stages to the climax stages, the ecosystems become more complex but not necessarily more diverse (4). In general, the level of biological

diversity, or number of different plants and animals (biodiversity), found on a site is higher in the early pioneer stages of succession than in the later climax stages. However, the complexity of interactions between the components in the climax forest may well be greater than that found in the earlier successional stages (4).

Disturbances such as harvesting impact the forest by changing light levels and altering species composition, two important considerations in succession. Clearcutting a pioneer species such as aspen results in the regeneration of aspen, maintaining the site in an early successional stage. Clearcutting a sugar maple forest leaves this site in an early successional stage, but this climax species will remain the dominant species because of its ability to sprout and maintain seedlings in the shade of its own overstory. Clearcutting a mixed aspen/sugar maple site creates intense competition between the sprouts of each species until a new balance develops. This new balance can be controlled by how the forest is harvested. If aspen alone is harvested a few years early, it will not sprout in the shade of the existing maple overstory. Later, when the sugar maple is harvested, the amount and vigor of the aspen will be eliminated or reduced greatly.

## Summary

The process of forest succession is always occurring in nature. Forestry is based upon knowledge of succession and managing disturbances for the production of goods and services (6). Timber harvesting is the tool often used to create these successional disturbances to maintain a forest in a particular forest stage. A forest stewardship plan combines the landowner's goals with the current forest condition to help maintain a productive forest for a range of uses far into the future.

## Acknowledgment

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