Anticipating the Next Forest

Peter Smallidge and Gary Goff

Many forest owners are interested in how to regenerate their forests, and why efforts to regenerate the forest sometimes fail. Private forest owners and their forests bear many pressures; these pressures often reduce the capacity of the forest to serve the owner. As NYFOA President Jim Minor discusses in his column, the 50th anniversary of NYFOA will launch with a programmatic focus on renewing and restoring NY's private forest. This article supports that initiative.

The NY Forest Owners Association is about to cross their 50-year milestone. This is an exciting accomplishment for the organization. The 50-year mark allows forest owners a long-term time frame to think about private forests specifically and broadly; how they used to look, how they have changed, and what future private forests will provide.

For most of our private forest lands, the soil will continue to grow plants. The question though is whether those future plants will provide the variety of benefits that the owners desire, including products for sale and ecological services and values that forest owners provide to society. The process of forest regeneration, if and how it happens, will determine what we can anticipate in the future forest.

A complimentary article by Jerry Michael in this issue provides a testimony to the concern for regeneration, more specifically the failure of forests to regenerate. That article illustrates the problem on a particular property, but also draws from a variety of independent studies which identify the frequency with which NY forests fail to regenerate. To highlight some recent information: (1) A study in which we participated surveyed foresters about their observations from the most recent stand (a working unit of the forest) they visited that should be capable of regenerating. These foresters reported moderate or successful regeneration in only 30% of those stands; a 70% failure rate. Successful regeneration was defined as desirable species at least 5 feet in height. (2) A study by The Nature Conservancy, based on a review U.S. Forest Service data, used a regeneration index and found that desirable timber species were regenerating on 43% of permanent monitoring plots. (3) SUNY ESF's Dr. Ralph Nyland reported in a ForestConnect webinar in February 2009 that the overwhelming predominance of exploitive cutting has often led to failed regeneration or significant complications with the regeneration process.

A Bit of Context and Background

In a simplistic way, we can think of the forest as two layers; the upper canopy and the understory. In forests less than about 40 to 50 years of age, we seldom worry about understory layer, or regeneration, because the forests have a long time horizon. At about 75-100 years old however, the concern for regeneration should heighten because some tree species may be approaching the end of their life cycle and/or sawtimber species maybe financially mature. At this point in a stand's development any natural or man-induced alteration of the upper canopy will provide sunlight to the plants in or on the forest floor and favor their expansion and abundance. An ice storm or prolonged insect defoliation, for example, might not fully destroy the overstory, but could provide sunlight to entrench the existing understory. Entrenching the existing understory is good if it has a desired mixture of quality seedlings. Unless the understory is changed, the species present at the time of a canopy disturbing event will

A 50 year old private forest in the Adirondacks. Little understory has developed in the oak/pine stand, but future years will bring changes. How will this stand look in 50 years and what pressures will bear on the next forest?

most likely become the next forest. Generally, "what you see is what you get."

Trees, shrubs, and herbaceous plants reproduce by distributing propagules such as seeds or spores, or by vegetative propagation (sprouts) from their roots or stems. Almost all plant species have the ability to distribute propagules, relatively fewer will reproduce through vegetative methods. Successful reproduction of a plant requires the propagule or vegetative structure and an adequate environment for the new plant to become established and survive long enough to reproduce itself.

As forest owners, trees are a significant part of our interest in the woods. As the forest grows we can harvest the volume of some trees that would otherwise die, and we may eventually plan for the re-establishment of large sections of our forest. Timber harvests must be sustainable to ensure continued flow of products and forest services. Regeneration of new forests is the first step in sustainability. Failure to ensure appropriate numbers, sizes and growth of desired species may disappoint some forest owners and may erode the confidence of society in our capacity for responsible and sustainable forestry. Regeneration thus requires that new trees become established, but also that those new trees represent the desired mixture of species and have a stem quality that will provide for future desired products

Tree regeneration, our focus here, requires the coincidence of (i) the availability of propagules, (ii) the receptivity of the site (the seed bed) for the seedling to become established, and (iii) adequate growing conditions at the site for the seedlings to grow toward maturity. If the timing or quality of one of these three factors doesn't align, regeneration fails. It may require years for trees to become sexually mature and for owners to conduct specific management activities to create an appropriate seed bed and growing conditions. Thus, regeneration is a process through time.

The life of a seedling is precarious. A tree may produce thousands of seeds, but only a small percentage usually germinate, establish, and grow. The long lives of trees allow for many years of failed regeneration needing only one or two successful years, but constraints on regeneration that are enduring and widespread can eventually change the nature of the forest.

Why do we Care About Tree Regeneration?

Trees define the forest. Given pressures in the forest (see below), doing nothing may lead to disappointing outcomes. Some owners started a forest from scratch in a former pasture, and some owners assumed responsibility for the trees present when they became the owner. Most owners will tend, or manage, and utilize one age-group of trees on any given acre. As trees are utilized, or the forest is otherwise disturbed, resources become available for trees and plants to establish. Owners will chose whether they will invest or not in helping to ensure that the next forest provides future owners with a comparable suite of opportunities. Forest owners from the full spectrum of interests will benefit from attention to regeneration of diverse and healthy forests.

When forest trees do not regenerate, through short and long time frames, the quality of the forest, and the opportunities it offers the owner, may decline. If we first consider the human benefits associated with trees, the lack of regeneration may change aesthetic qualities, habitat for hunting, and over a longer time frame the lack of forest products that provides revenue and local jobs. The future success of timber production, maple syrup production, mast producing trees for wildlife, and fence posts depends on the level of success of the regeneration process.

Many species of wildlife benefit from successful regeneration. In a mature forest, the presence of desirable forest tree seedlings is important to maintain micro-environmental conditions. These mature forest seedlings also provide nutritious browse, nesting habitat, and escape cover. Other wildlife species depend on different environmental conditions provided by successful regeneration in early successional habitats. An important consideration for wildlife is that the unique growth form and fruit production of various plant species makes them more or less suitable for various wildlife species. Because of deer pressure (more on this topic later), some unpalatable plant

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What you see is what you get. American beech has become established and dominant in the understory of this 80 year old red pine plantation. Without owner intervention, the next forest is likely to become a beech forest.

species can dominate and the habitat can become unsuitable for some desired wildlife.

What limits forest tree regeneration? Why is there a problem?

Trees are long-lived and some forest owners may call a forest home for several decades and legitimately not become involved in the process of forest regeneration. In a section of woods, barring any manipulations to the canopy or seed bed, the number of trees will decline through time but the remaining trees are the same as when these owners started. In many ownerships, anytime an opening is made in the forest canopy and the forest floor has a prolonged exposure to sunlight, a new plant may become established. But, is it the plant that will serve the needs and desires of the owners, or one that might interfere?

Recall the earlier discussion about the necessary timing and overlap for propagules, seed bed, and seedling establishment and growth. Any constriction on any of these three conditions can limit successful regeneration. Some constrictions or barriers are common but infrequent or of short duration. Also, if the site provides only limited soil or light resources, typically only a few plant species can survive in those conditions. The list of potential barriers to regeneration is immense, and includes late frosts that damage tree flowers, a peak in the woodland vole population that eats the seeds, an overly wet spring and widespread damping-off fungus, an outbreak of forest tent caterpillars that reduces tree energy reserves, and more. However, there are three primary factors that restrict desirable regeneration when they occur as sustained and widespread phenomena; other factors may develop as our environment changes.

First, most woodlands lack sufficient browse to support the resident deer herd. In these cases, deer disproportionately consume desired seedlings. Deer limit the adequacy of the seedling's environment to grow and develop. Deer consume palatable seedling species, usually the most desirable for human needs, and avoid the less palatable species. This selective pressure results in a reduction in species diversity and a shift in the mixture of species. Other than beech and in some circumstances black cherry, deer will preferentially browse the seedlings of all our upper canopy tree species (e.g., oaks, maples, cherry, ash, basswood, pine). Visualize this process through time; each year the seedlings of desirable upper canopy trees are consumed and undesirable species are retained. Consequently, any sunlight favors the growth of the undesirable species. The impacts of deer on forest regeneration can be limited by controlling the number of deer or restricting the access of deer to desirable seedlings.

Second, most tree species require a specific quality and quantity of light for the seeds to germinate and the seedlings to develop. Shade close to the ground limits the suitability of the seed bed and the adequacy of the seedling's environment. Dense understories of shrubs, grasses and ferns (often what the deer leave behind) will absorb the energy rich red wavelengths and allow the lower quality far-red wave lengths to pass. The lower quality and quantity of light prevents some seeds from germinating and some species from surviving. Understories of shrubs, subcanopy trees, grasses, sedges and ferns that intercept light and inhibit tree regeneration are collectively called interfering vegetation. Species that commonly interfere with desirable hardwoods include American beech, striped maple, hophornbeam, ferns, grasses, sedges, and in some cases raspberry. In some areas, non-native shrubs can play a similar role, species such as multiflora rose, bush honeysuckle, European buckthorn, autumn olive, and Japanese barberry. Dense and abundant understories of interfering vegetation need to be managed to prevent them from reducing light quality and quantity.

Finally, because tree regeneration depends primarily on seeds, parent trees of appropriate genetic quality need to be present or have been recently present. Often however, as described by Dr. Nyland, exploitive cutting removes the

best quality and largest trees and shifts the potential for seed production to fewer species of poorer quality and capacity to produce seed. Exploitive cutting, also known as high-grading, has the potential to eliminate some species from a stand and thus prevents that species from providing propagules and effectively regenerating. In some circumstances, such as a properly executed clearcut, seed and propagules are known to be in the soil seed bank or available from adjacent trees and seedlings establish successfully after the overstory is removed. Exploitive cutting is distinct from clearcutting; the high-grading activity will typically limit owner options for regeneration. Owners who have acquired a high-graded forest will need to find good technical assistance to provide for desirable tree regeneration.

Recommendations

The next several issues of the *NY Forest Owner* will carry articles on different aspects of forest regeneration and restoration. Look in those issues for more detailed analysis of regeneration constraints and strategies to ensure successful regeneration. Spend some time in your woods. Learn how to identify desirable and undesirable species. In areas where a dense understory of undesirable species has become established, look for desirable species. Assess any desirable seedlings for evidence of deer browsing, particularly multiple stems. If you are planning a harvest, work with your forester to ensure that the harvest has a deliberate and defensible silvicultural prescription. Talk with your logger and forester to identify ways to encourage and favor desirable seedlings.

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Peter Smallidge and Gary Goff. Cornell University Cooperative Extension, Department of Natural Resources. Bruckner Hall, Ithaca, NY 14853. (607) 592 – 3640. Pjs23@cornell.edu grg3@cornell.edu www.ForestConnect.info