Late-Successional Old-Growth Forests in Kennebec County: Their Presence and Significance

Simon Pritchard

Kennebec Land Trust

Summer 2015

Historical Context

Maine has seen varying trends over the centuries in its land use, particularly regarding forests. Starting in the 1600s, when permanent colonies were first established in Maine, tall forests of spruce, pine, hemlock, and northern hardwoods provided excellent timber for houses and ships. Early New England settlers, eager to establish strong communities, cut heavily into those forests by clearing land for agriculture as well as for lumber and other forest products. While Maine's soils and climate have not been ideal for high-yield farming, the early wave of agricultural activity across New England included Maine, and by 1850, much of Southern Maine had been cleared for agriculture. The timber that had been cut was used throughout New England and sold overseas as well. Just as agriculture was peaking in New England, movement toward urban industry and western expansion increased, and many farms were abandoned, with their cropland and pastures reverting back to forest. Since then, much of Maine's forests have been harvested periodically, through both clearcutting and selective logging (Barton et al. 2010).

Definition and Identification

Today, just under 90% of Maine is forested, with 97% of that forest open to timber harvesting. Some of the forestland has not been harvested since it reverted back from farmland, leaving stands of late-successional forest, and an even smaller portion that was never converted to farmland in the first place, i.e. old-growth (virgin) forest.

The latter two types of forests total about 1% of Maine's total forest area and are categorized as late-successional old growth (LSOG). Attempts to define LSOG encounter several difficulties, namely differences between species prevent a single set of criteria from being established. One current working definition for late-successional old growth in Maine is "past economic maturity" (Laustsen 2015). While forests do reach biological maturity after economic maturity, such a definition may add a negative connotation to biological maturity, suggesting that the only value of forests comes from the profits of harvests. The definition is also vague for anyone who does not have preexisting knowledge of forest dynamics.

Another important factor in distinguishing LSOG forests is large live and dead tree density (Whitman and Hagan 2007). Maine northern hardwood forests require about 30 large live trees per acre to be considered high value late-successional, and pine forests require about 13 trees per acre to meet the standard (MNAP 2015). Other LSOG characteristics include the presence of snags and other large deadwood, pits and mounds created by falling trees rather than stumps, high biodiversity, vertical canopy differentiation, and the presence of certain species that only inhabit LSOG stands, such as the spotted owl and seven types of epiphytes (Whitman and Hagan 2007, Keeton 2006, Connors 2015).

Why keep LSOG stands intact?

While managed and harvested stands offer economic potential, undisturbed stands offer important ecosystem value. From a conservation perspective, they also offer attributes well aligned with the goals of a conservation organization such as KLT. Past research into forest dynamics have typically suggested that after a certain period, trees stop storing carbon and creating large amounts of new biomass and enter into a steady state, in which the net ecosystem productivity, or net flux of carbon into and out of the system, approaches zero. Managed stands

with a net in-flux of carbon are thus a more important resource from a climate change mitigation perspective. LSOG stands, while they may have reached this period of steady-state growth, actually still store high amounts of carbon, but very little in aboveground woody biomass. Studies in the past ten years have shown that after steady-state growth is reached, soil carbon storage continues to increase over the forest's lifetime, and the natural flux out of the forest is less than the amount released in harvested stands, even in longer management schemes of up to seventy years (Luyssaert et al. 2008, Keeton et al. 2011). From a direct ecosystem perspective, old growth forests also replenish soil organic matter frequently with deadwood, aerate and churn soil through root upheaval after windthrows, and develop vertical stratification of the canopy, all of which provide the opportunity for increased biodiversity, and, along with snags, offer varied habitat (Hunter 1990).

LSOG on KLT properties and around Kennebec County

KLT members and staff have identified potential LSOG stands on a number of KLT properties. To determine the approximate ages of portions of these forests, I used an increment borer at two properties to extract cores. I sanded down the cores and counted the rings to determine age. At Perkins Woods Preserve on Androscoggin Lake in Wayne, I sampled an eastern white pine (*Pinus strobus*), and at Mt. Pisgah Conservation Area in Winthrop I sampled an eastern hemlock (*Tsuga canadensis*) and a quaking aspen (*Populus tremuloides*) from a slope above Dexter Pond. Counts of the rings determined an approximate age of 180-200 (143 rings observed) years for the white pine, 130-140 years (119 rings observed) for the aspen, and 145-155 (149 rings observed) years for the hemlock. Breaks occurred in the white pine and aspen cores, resulting in partial cores and high variation in the age range. The hemlock core passes nearly through the center, so the certainty of the ring count is higher. Based on the comparable

size of the other trees in the stands, the presence of snags, and the pit and mound topography of the surrounding forest, these trees were not unique one-of-a-kind specimen trees, these two areas are likely LSOG stands. Two other KLT properties have been identified as having potential LSOG stands, Curtis Homestead Conservation Area in Leeds and Vaughan Woods Conservation Area in Hallowell, though no cores have yet been taken from either of those sites (Connors 2015, Cutko 2015).

Several stands of old growth in Kennebec County have been officially inventoried. In the 1980s the Maine Critical Areas Program identified four sites to be recommended as old-growth: five acres of eastern white pine in Vaughan Woods (a KLT easement property), about thirty acres of white pine and northern hardwoods on Cobbosseecontee Lake in Monmouth, a tenth-of-an-acre stand of white oak in Waterville, and five acres of northern hardwoods on Beech Hill in Pittston. Two other sites were inventoried but were not recommended as old-growth, including one acre of northern hardwoods on Mt. Philips in Rome and ten acres of hemlock imbedded in a summer camp on Ellis Pond in Belgrade.

With the exception of Vaughan Woods, the conservation status of the other identified stands is unclear (MCAP 1985). Comparable data is not available for late-successional stands, but current U.S. Forest Service data using sample plots with extrapolation indicates 6,170 acres of stands in Kennebec County that are one hundred years or older, a common age threshold for LSOG (USFS 2015).

Managing for LSOG

Due to the low numbers of LSOG stands in Maine, much of the recent research has focused on how to develop such stands through management. Three kinds of strategies exist for achieving increased numbers of LSOG stands: reservation, retention, and restoration (Ducey et

al. 2013). Reservation and retention, the strategy of keeping LSOG or younger non-managed forests intact for the creation and eventual migration into an LSOG stand, at least from an age basis, resembles the land conservation tactics that KLT and other land trusts use, provided that public access does not negatively impact the forest. Prospective properties should be viewed with this strategy in mind: that if reserved, the stand could progress into LSOG without active management. Of the 5,000 acres that KLT has conserved to date (fee and easement lands) currently 2,100 are fully considered "reserve lands" with no management aside from trail and boundary maintenance and invasive species control. Of the remaining 2,900 acres, properties exist where LSOG stands are present or could grow, but other parts of the property are managed in some way. For example, Curtis Homestead Conservation Area has a thirty five acre demonstration forest as well as stands exhibiting LSOG characteristics that are not managed for timber products, but the property as a whole falls under the management category rather than reserve. As long as reserved areas in managed properties remain reserved, such classifications will not present a problem when these stands are characterized as LSOG.

Restoration, the active and passive management of forests to manufacture LSOG characteristics such as high basal area, vertical differentiation, and deadwood has been studied and to determine the most practical ways of turning a managed forest into a LSOG. Restoration methods include selection harvesting, fertilization, and prescribed burns (Hunter 1990). From a conservation perspective, these tactics may be applied to former fields reverted to forests in an early-successional stage on conservation land. For conservation purposes, LSOG restoration presents an appealing strategy, but more research is needed to determine the costs and benefits of such management. The current draft of KLT's latest forest management policy aims to "foster diverse, structurally complex forests of native species, with an emphasis when appropriate on

maintaining/enhancing late-successional forest stands," a goal which leaves the option to include all three tactics for LSOG stand creation (Kerchner 2015). Simply conserving tracts of forest will increase LSOG stands in some cases, and through the use of forest management plans and with the consultation of ecologists and foresters (as stated in the policy), KLT may effectively add new stands with proper management strategies.

References

Barton, Andrew, White, Alan, and Cogbill, Charles. *The Changing Nature of the Maine Woods*. Durham: University of New Hampshire Press, 2012.

Connors, Jim. Personal communication. July 8, 2015.

Cutko, Andy. Maine Natural Areas Program. Personal communication. June 30, 2015.

Ducey, Mark, Gunn, John, and Whitman, Andrew. 2013. "Late-Successional and Old-Growth Forests in the Northeastern United States: Structure, Dynamics, and Prospects for Restoration." Forests 4, 1055-1086

Hunter, Malcolm. Wildlife, Forests, and Forestry: The Principles of Managing Forests for Biological Diversity. Englewood Cliffs: Prentice Hall, 1990.

Keeton, William. 2006. "Managing for Late-Successional/Old-Growth Characteristics in Northern Hardwood-Conifer Forests." Forest Ecology and Management 235, 129-142.

Keeton, William, Whitman, Andrew, McGee, Gregory, and Goodale, Christine. 2011. "Late-Successional Biomass Development in Northern Hardwood-Conifer Forests of the Northeastern United States." Forest Science 57 (6), 489-505.

Kerchner, Theresa. " DRAFT KLT Forest Management Policy." Kennebec Land Trust. May 2015.

Laustsen, Ken. Maine Forest Service. Personal communication. July 8, 2015.

Luyssaert, Sebastiaan, Schulze, Detlef, Borner, Annett, Knohl, Alexander, Hessenmoller, Dominik, Law, Beverly, Ciais, Philippe, and Grace, John. 2008. "Old-growth forests as carbon sinks." Nature 455, 213-215.

Maine Critical Areas Program. "A Summary of Old-Growth Forests Stands in Maine." Maine State Planning Office, 1985.

Maine Natural Areas Program. "Late-Successional Index Field Form". 2015.

US Forest Service. "EVALIDator Version 1.6.0.02" US Department of Agriculture. Web, accessed July 28, 2015.

Whitman, Andrew, and Hagan, John. "An Index to Identify Late-successional Forest in Temperate and Boreal Zones."