Family Forest Network

Restoration Silviculture Project

Technical Note #S1
Research Outline

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Background

Under the general guidance of ecological forestry recommendations contained in *An Independent Review of Forest Practices in Nova Scotia* (Lahey, 2018) the Family Forest Network (FFN) is working with partners, landowners, and contractors to demonstrate and document the costs and benefits of implementing ecologically sensitive harvest treatments on small private woodlands across a wide range of forest conditions. Results will be used to refine or develop management guidelines and tools for small private woodland owners, and to inform provincial policies related to ecological forest management.

As an addition to this project, the FFN has signed an agreement with the Nova Scotia Department of Natural Resources and Renewables (Department) to include research into restoration-oriented silviculture treatments that are not currently supported by provincial silviculture policy or funding. The main goals of this research are:

- To promote the establishment and/or growth of site appropriate, long-lived, shade-intermediate, and shade-tolerant (LIT) tree species.
- To help restore appropriate species mixes and stand structure on sites where past management may have been inappropriate or unsuccessful.
- To investigate new ways to use silviculture interventions to simultaneously address concerns about (i) future growth and value of the forest resource, (ii) biodiversity, (iii) climate adaptation, and (iv) carbon management.

Silviculture Treatments

The project will focus on three silviculture treatments:

1. Restoration Thinning – *A combination of* p*re-commercial thinning (PCT) and weeding of relatively even-aged, juvenile stands that are beyond the height criteria for current PCT funding (7m for softwoods and 9m for hardwoods)*.

   The goal of this treatment is to reduce overall stem density in these “too tall” stands while favoring LIT crop trees that can (i) provide increased economic value, (ii) provide more management options for continued restoration, and (iii) be more resilient to climate impacts by promoting species diversity wind-firmness in residual trees.

There are many stands that are beyond the height criteria for current PCT funding, but which would benefit from tending operations that speed up the transition to more desirable

conditions. However, because trees in these more developed stands are (on average) larger than those associated with typical PCT operations, and stand conditions are often more variable, restoration thinning will require a different treatment approach and operator skill set than traditional PCT work. For example, the use of both spacing saws and chainsaws will likely be needed for treatment efficiency, while some areas within a stand may require more or less intervention to meet overall objectives.

There may also be a mechanical option for this type of treatment whereby a small excavator with a shearing head can be used to thin multi-sized stems (Fig. 1). This option will be explored and compared with manual treatments as part of this research project.

Fig. 1. A small, tracked excavator with shearing-head that is potentially suitable for restoration thinning work.

2. Understory Thinning – *Pre-commercial thinning (PCT) of regenerating species under mature cover that can also include a component of crop tree release where feasible*.

   The goal of this treatment is to reduce overall stem density in understory layers while enhancing establishment and growth of LIT crop trees. This will speed up the transition to LIT species dominated, climate adapted, multi-age stands that increase economic value, biodiversity value, and climate change resiliency.

Traditionally, PCT is a component of even-aged management systems or as an initial treatment following a stand-level disturbance event. It is generally not something done in multi-age stands that have some level of continuous cover. However, there is no reason not to consider PCT and/or weeding treatments in multi-age stands where there are areas with dense regeneration (which is even more likely in gap silviculture systems). Where applicable, combining PCT with crop tree release (CTR) allows for a complete stand treatment with the benefits of both.

As with restoration thinning, understory thinning will require a different treatment approach and operator skill set, including the use of both spacing saws and chainsaws. Where a component of CTR is added, questions arise as to whether all potential crop trees should be found and marked ahead of time, or whether crop tree selection should be decided in real-time by the operator.[1] This question will be addressed as part of this research project.

3. Understory planting – *Planting of LIT and/or climate adapted species in stands with mature cover, but with little to no advanced regeneration of desired species*.

   The goal of this treatment is to speed up the transition to LIT species dominated, climate adapted, multi-age stands that increase economic value and climate resiliency. Planting stock may include traditional species (i.e., red spruce, white spruce, white pine), as well as hardwoods such as red oak, sugar maple, red maple, and yellow birch.

Understory planting, especially of hardwoods, is not something that has been routinely done in Nova Scotia, but the *Nova Scotia Silvicultural Guide for the Ecological Matrix* (McGrath et al. 2021) refers to "restoration planting" as an option to establish or increase LIT species cover on sites where these species are lacking. For this research project, we will mainly look at understory planting of hardwoods to promote climate adaptation and increase biodiversity. Planting of hardwoods does not have time constraints associated with debarking weevil (*Hylobius congener*), so planting can immediately follow a harvest treatment. However, browsing hazard is generally high for hardwood seedlings, so we will include judicious use of tree cages or grow tubes (Fig. 2) as part of our experimental design .

Fig. 2. Grow tube with red oak.

[1] CTR already qualifies as a funded treatment if trees are marked, a minimum of 125 trees/ha are treated, trees are on average 15 cm in diameter or greater, trees are released on three sides, and residual basal area is at least 15 m^2/ha. When CTR is added to an understory thinning treatment, it would likely not meet all of these specifications, and would only be an added component to the main treatment.

Project Description

We anticipate 40 treatments in total to be conducted between 2022-2026 (Table 1). If time and budget allow, we will increase these numbers based on initial results and perceived need.

Table 1. Target number of sites for each proposed silviculture treatment.

Treatment	Sites
Restoration thinning (manual)	12
Restoration thinning (machine)	6
Understory thinning	12
Understory planting	10

In all cases:

- Treatment sites will be fully classified using the latest forest ecosystem classification (FEC) guide (Neily et al. 2023).
- Research will include establishing pre- and post-treatment assessment protocols that allow for development of appropriate treatment prescriptions and accurate assessment of treatment outcomes.
- Biodiversity assessments will be conducted at each site before treatment with results integrated into treatment planning.
- Untreated control sections will be included in all stands for comparison purposes.
- FFN partners will be involved in the development of treatment prescriptions and follow-up assessments.
- Average costs will be calculated for each treatment/stand type combination studied. This will allow for estimation of treatment rates that may be scalable depending on stand conditions.

Results will be disseminated through annual reports to the Department and via FFN Technical Notes. We will also host field days to showcase and discuss treatments with woodland owners, contractors, and forest professionals. A final report will be prepared at the end of the project with complete data summaries, treatment outcomes, interpretations, and recommendations.

Literature

Lahey, W. 2018. *An independent review of forest practices in Nova Scotia: Executive summary, conclusions, and recommendations*.

McGrath, T., M. Pulsifer, R. Seymour, L. Doucette, G. Forbes, R. McIntyre, R. Milton, L. Cogan, M. Retallack, and T. Crewe. 2021. *Nova Scotia Silvicultural Guide for the Ecological Matrix*. Nova Scotia Department of Lands and Forestry.

Neily, P., S. Basquill, E. Quigley, K. Keys, S. Maston, and B. Stewart. 2023. *Forest ecosystem classification for Nova Scotia (2022): Field Guide*. Biodiversity Tech Report 2023-002. Nova Scotia Department of Natural Resources and Renewables.