

CUMB.

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Silviculture

Sapling Target Density for Even-Aged Tolerant Hardwood Stands

INTRODUCTION

Even-aged silvicultural system (strip-clearcut, seed tree cut and shelterwood) are important regeneration methods used in northern hardwoods and mixed-woods stands where conditions are not suitable for uneven-aged regeneration methods. While a stocking guide has been developed for pole-timber and larger trees, it does not provide information on stands of less than 10cm in DBH (Gingrich 1967, Baral 2018). Minimum stocking levels (stems per hectare) are required at the sapling stage of even-aged hardwood stands to ascertain that a commercially viable overstory stand will develop. Currently, post-treatment stands are only visually assessed for sapling stocking levels. Therefore, a standard guide assessing sapling stocking thresholds of young even-aged hardwood stands is needed.

HIGHLIGHTS

- Forest landowners require targets and standards to ensure that regeneration outcomes are met.
- Prediction of long-term growth and yield is dependent on the recruitment of the right cohort of trees
- Target density of saplings as a function of time since treatment is helpful to determine success, plan remedial treatments and place stands on a growth and yield trajectory
- We recommend a strict minimum of 2000 healthy stems per hectare from commercial species of interest 10 years after treatment

METHODOLOGY

Measurements of saplings (trees \geq 1.3m tall and < 10cm diameter at breast height (DBH)) were conducted in clearcut blocks. The time since the last treatments in the stands ranged from 9 to 15 years. The saplings were tallied by species and the DBH recorded to the nearest 0.1cm in 3.57m radius fixed plots. We examined the patterns of sapling development among the stands as a function of time since the last harvest (in years) and as a quadratic mean diameter of the sapling cohort. We then developed minimum sapling density levels for each time since the last harvest. This will enable forest landowners to judge whether there is the need for intermediate treatments.

APPLICATION AND CONCLUSION

Equation (1): $SPH = -6432.271 + (925.740 \times TSLH) - (337.556 \times QMDS)$

Where:

SPH = Stems per hectare (stem/ha). We could also say saplings per hectare (sapling/ha).

TLSH = Time since last harvest (years)

QMDS = Quadratic mean diameter of saplings (cm)

With this equation, forest landowners can assess if there are enough saplings in the understory layer for the proper regeneration or the overstory. Within the range of years since the last harvest examined in this study, the average sapling density of commercial tree species ranged from 1000 to 6000 stems per hectare (Fig. 1). To meet the minimum sapling density in the first decade, the stand should contain at least 2000 stems per hectare (2.24 m spacing). By year 12, the sapling density could fall between the "B-line" and "A-line" of the stand density management guide. The minimum sapling density should be about 3500 stems per hectare (~1.70m spacing) as a result of recruitment from the seedling strata. At year 15, the sapling density should reach maximum stocking ("A-line" of the stand density management guide), with a minimum stems per hectare of 6000 (1.30m spacing). Generally, stand-tending operations are considered at this stage of even-aged stand development in the region.

This sapling stocking guide provides landowners with an important tool to predict future growth and yield of young even-aged hardwood stands. This simple guide is useful for stands in the precommercial thinning stage. The application of this guide is similar to the stocking guide calibrated for hardwood stands with mean DBH \geq 10cm in New Brunswick. The sapling target density for stands harvested between 9 and 15 years was superimposed on a modified stocking for stands with DBH means between 1cm and 9cm. However, to assess sapling density, this guide utilizes the time since the last the treatment. The minimum sapling density for each year will help forest landowners to predict future growth and yield at a given year since the last stand-replacing disturbance, or justify investments in intermediate treatments.



LIMITATIONS

The recommended sapling density in this guide is based on the assumptions that there is sufficient seedlings to ensure continuous recruitment into the sapling cohort. Therefore, if sapling target density is not met at any given time, the presence of seedlings in the lower cohort may remedy the situation in the future. In the event that both seedlings and saplings are below the minimum density, silvicultural interventions should be considered. This sapling density target might also change depending on species composition and or whether advanced regeneration was retained during the last harvest.

NOTE

- 1. This guide is focused on the sapling stage of even-aged stand development.
- 2. The recommended sapling density is for all commercial hardwood tree species at a given time. Therefore, the proportion of poor quality saplings in the stand might lower the overall sapling density target.
- 3. Regeneration success is about attaining the right density of the healthy seedlings and saplings of desired species within a specific window.
- 4. Further improvement based on pre-treatment stand type, site and treatment guide is needed to cover the broad range of stand types and sites found in New Brunswick.

REFERENCES

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