

## Stand 57 Regeneration reports for planted species only and all tree species

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July 26, 2023

## Stand 57 regeneration report – planted species only

July 25, 2023

### Background/methods

Mary Ulrich and Rachel Stepp performed a regeneration check in Stand 57 on 20230714 and 20230721. They used 12 1/50 acre (16.7') circular plots, one in each established research plot. They used the plot center rebar as the regen plot center. They used the CFC-modified version of the DNR regeneration worksheet with a focus only on planted species; they did not distinguish between planted and volunteer seedlings of the planted species. Species planted were white pine, jack pine, tamarack, red oak, paper birch, and bur oak. Seedlings were randomly planted in May 2020 to a target density of 450 trees per acre total, around 75 trees per acre per species.

The week prior to sampling, Kyle Gill and Rachel conducted test plots of various areas. They tried 1/500, 1/100, 1/50, and 1/30; all in Plot 10. One-fiftieth seemed to be the best balance of number of individuals found and time spent searching.

Mary and Rachel tracked the plot number in which they sampled so that we could summarize how regeneration varied by experimental conditions. The two experimental factors are light condition and herbivory protection. The light conditions are open, in the clearcut gaps, and matrix, where seedlings were planted under red pine canopies that were thinned. The herbivory treatments include group protection by fence, individual tree, and control. The group protection condition is achieved by having a half-acre area surrounded by eight-foot tall poly fencing mounted on wooden posts. Individual tree treatments include terminal-bud budcapping for conifers and terminal-bud ballooning for hardwoods. The control is a full control with no herbivory protection.

Results are reported for average trees per acre (TPA) and percent stocking by species and all species combined. Coefficient of variation (CV) is reported for the all-species TPA.

### Results/Discussion tables

Table 1. Planted seedling species regeneration average trees per acre (TPA) and stocking by species and total (N = 12).

Species	TPA	Stocking	Notes
LALA	38	58.3	
PIST	88	66.7	
PIBA	67	83.3	
QURU	21	25	
QUMA	8	16.7	
BEPA	546	100	
<i>Total (CV%)</i>	<i>767 (104)</i>	<i>100</i>	<i>Red pine not counted but noted as plentiful in at least one plot</i>

Table 2. Planted seedling species regeneration for open and matrix light conditions (n = 6). Open conditions are in clearcut gaps and matrix are in canopy-thinned areas.

Species	Open TPA	Open Stocking	Matrix TPA	Matrix Stocking
LALA	8	16.7	67	100
PIST	33	50	142	83.3
PIBA	75	83.3	58	83.3
QURU	0	0	42	50
QUMA	8	16.7	8	16.7
BEPA	100	100	992	100
<i>Total (CV %)</i>	<i>225 (51)</i>	<i>100</i>	<i>1308 (63)</i>	<i>100</i>

Table 3. Planted seedling species regeneration trees per acre (TPA) and stocking (%) by herbivory treatment (n = 4). Treatments included one-half-acre group protection (Group) with fencing, individual tree terminal-bud protection (Indv.) and a control.

Species	Group TPA	Group Stocking	Indv. TPA	Indv. Stocking	Control TPA	Control Stocking
LALA	63	75	25	50	25	50
PIST	113	75	113	75	38	50

PIBA	63	75	75	100	63	75
QURU	38	50	13	25	13	25
QUMA	0	0	13	25	13	25
BEPA	538	100	388	100	713	100
<i>Total (CV%)</i>	<i>813 (107)</i>	<i>100</i>	<i>625 (69)</i>	<i>100</i>	<i>863 (112)</i>	<i>100</i>

## Results/Discussion text

Regeneration across all planted species and treatments was 767 trees per acre (TPA) on average, with a coefficient of variation (CV) of 104%, with 100% stocking. The high stocking percent means that there are seedlings in every plot, though the high CV suggests there is high variability of seedling numbers between plots. Every planted species was encountered at least once.

There were substantially more seedlings surviving in the matrix light condition than in the open light condition. The average TPA in the matrix was 1308 (CV = 63%) and in the open was 225 (CV = 51%). This trend was consistent for tamarack, white pine, red oak, and paper birch. Jack pine and bur oak were found in nearly equal numbers in each light condition. The open plots have a much higher presence of competition for light and root space in the form of raspberry and other low shrubs and grasses that may be contributing to the survival. However, because the survey was conducted at near peak growing season foliage, it could be that seedlings were simply harder to find.

Individual herbivory protection appears to be negatively impacting seedlings, on average, but is species dependent. All species seedling TPA for control, group, and individual conditions was 863 (CV = 112%), 813 (CV = 107%), and 625 (CV = 69%), respectively. Paper birch was the only species that had significantly different TPA rates in each of the treatments. They were found in highest numbers in the full control and lowest numbers in the individual protection treatment. White pine was the most benefitted by herbivory protection, regardless of individual or group protection was used. Tamarack and red oak were most represented in the group protection treatment. Jack pine did not demonstrate differences by herbivory treatment. Bur oak had low representation across groups but showed highest presence in individual protection and control treatments.

The total numbers were heavily influenced by paper birch. Paper birch was found to be regenerating in every plot and, on average, at a higher rate than planted; basal stump sprouting from mature trees cut during the 2016 harvest, was not encountered during the survey. These results suggests there has been a good amount of volunteer recruitment, especially in the matrix light condition. Birch regeneration in the matrix light condition was quite a bit higher than in the open condition; even so, there was more birch regeneration than any other species in the open. When compared with the 2022 all-species regeneration results, the average trees per acre numbers are very similar, 546 in 2023 and 643 in 2022, but the stocking percent was much higher in 2023 than in 2022, 100% and 28.6 %, respectively.

# Stand 57 regeneration report – all tree species

October 5, 2022

## Background/methods

Kyle Gill performed a regeneration check in Stand 57 on October 5, 2022. He used 14 plot centers 1/1000 acre circular plots. He established one plot one in each of the 12 one-half-acre research plots, one in the NE area that does not have research plots, and one between the NE area and research plot six. When in the research plots, he used the plot center rebar, when relatively quickly located, as the regen plot center; if the rebar could not be quickly located, he randomly tossed the swing stick from where he was standing and marked the plot center where the pointed end landed. He used the CFC-modified version of the DNR regeneration worksheet.

Species planted were white pine, jack pine, tamarack, red oak, paper birch, and bur oak; only bur oak was not picked up in the regeneration plots though some were observed in the stand. Non-planted species observed in check plots included red maple, red pine, balsam fir, quaking aspen, and pin cherry; big-toothed aspen was observed but not in plots. Of the planted species, non-planted white pine, paper birch, and jack pine were observed; when these species were counted in regeneration plots their planted or not-planted origin was not clear. Seedlings of both planted and non-planted species were observed in many areas even though not every plot had seedlings within.

## Results

The average seedlings per acre (SPA) was 2929 SPA for all species. Red maple had 789 SPA, followed closely by red pine and paper birch at 643 TPA. Seedling stocking was 79% for all species. Red pine had the highest stocking at 43%. Paper birch was counted in 29% of plots and red maple and balsam fir were in 21% of plots. Three plots did not have any seedlings, these were all in clearcut blocks.

Table 4. Average seedlings per acre (SPA) and stocking percent by species and total.

Species	SPA	Stocking percent
Red maple	786	21.4
Red pine	643	42.9
Paper birch	643	28.6
Balsam fir	214	21.4
Pin cherry	214	7.1

Jack pine	143	14.3
White pine	71	7.1
Quaking aspen	71	7.1
Red oak	71	7.1
Tamarack	71	7.1
Bur oak	0	0
<i>Total</i>	<i>2929</i>	<i>78.6</i>

## Discussion

The density and stocking of unplanted tree species is noticeably higher than those of planted species. Paper birch is the exception, though it is hypothesized that a simple majority of the paper birch identified in the sample were volunteers. This appears to be related to the sampling method used, higher than expected natural regeneration, relatively low planting density, and some planted species mortality. Conducting a planted-species-only sample is warranted to better understand their presence and survival.

## Datasets and plots map

[Stand 57 regeneration check planted species 20230721](#)

[Stand 57 Regeneration check 20221005](#)

[Stand 57 Plots Map](#) with treatment conditions