

Evaluation of Planted Seedling Survival and Growth in Forested Mitigation Wetlands in Marquette Michigan, USA

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Mitigation Wetland Project & Site History

Purpose and Background

Mitigation project to fulfill a Michigan Department of Environment, Great Lakes, and Energy permit to restore 2.1 acres of forested palustrine wetlands.

Study Area Description

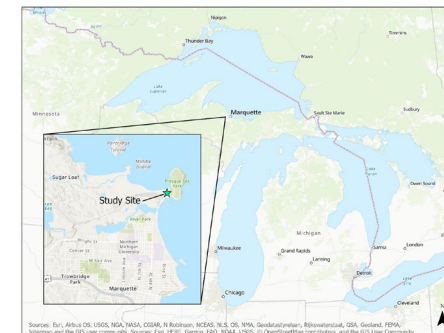
Some of the historically present seasonally saturated palustrine persistent emergent and shrub/scrub broad-leaved deciduous wetlands remain intact.

- Several feet of sandy-gravel fill was placed on top of a portion of the pre-existing wetland area circa 1920.
- It is possible this area should actually be classified as a coastal swamp due to its proximity to and possible hydrological connection with Lake Superior.

(See K. Robinson "Examining Hydrologic Connectivity of Mitigated Forested Wetlands in Marquette Michigan, USA" poster)



Figure 1. Study area location relative to the Great Lakes region and the City of Marquette (right), and the mitigation wetland study site boundaries (above).



Objectives and Methods

The purpose of this study was to evaluate the relative growth rates and survivorship of planted seedlings within two forested mitigation wetlands.



Planted Seedling Monitoring

A few hundred tree seedlings, including balsam fir, red maple, silver maple, tamarack, white spruce and white cedar were planted in sites B and C in 2015 and 2016.

- 253 seedlings were tagged with unique IDs in 2017, and baseline height measurements were recorded.
- Seedling height and survivorship were monitored in 2018 and 2019, respectively.

Relative height growth was calculated according to equation 1 where RH = relative height (cm), H = height (cm) and t = time (year)

Equation 1

$$RH = \frac{(H_2 - H_1)}{\frac{H_1}{t_2 - t_1}}$$

Results: Planted Seedling Survival

Common Name	Scientific Name	n	Survival (%)
Balsam fir	<i>Abies balsamea</i> (L.) Mill	30	100
Red Maple	<i>Acer rubrum</i> L.	33	90.9
Silver maple	<i>Acer saccharinum</i> L.	5	100
Tamarack	<i>Larix laricina</i> K. Koch	40	37.5
White spruce	<i>Picea glauca</i> (Moench) Voss	19	52.6
White cedar	<i>Thuja occidentalis</i> L.	54	77.8

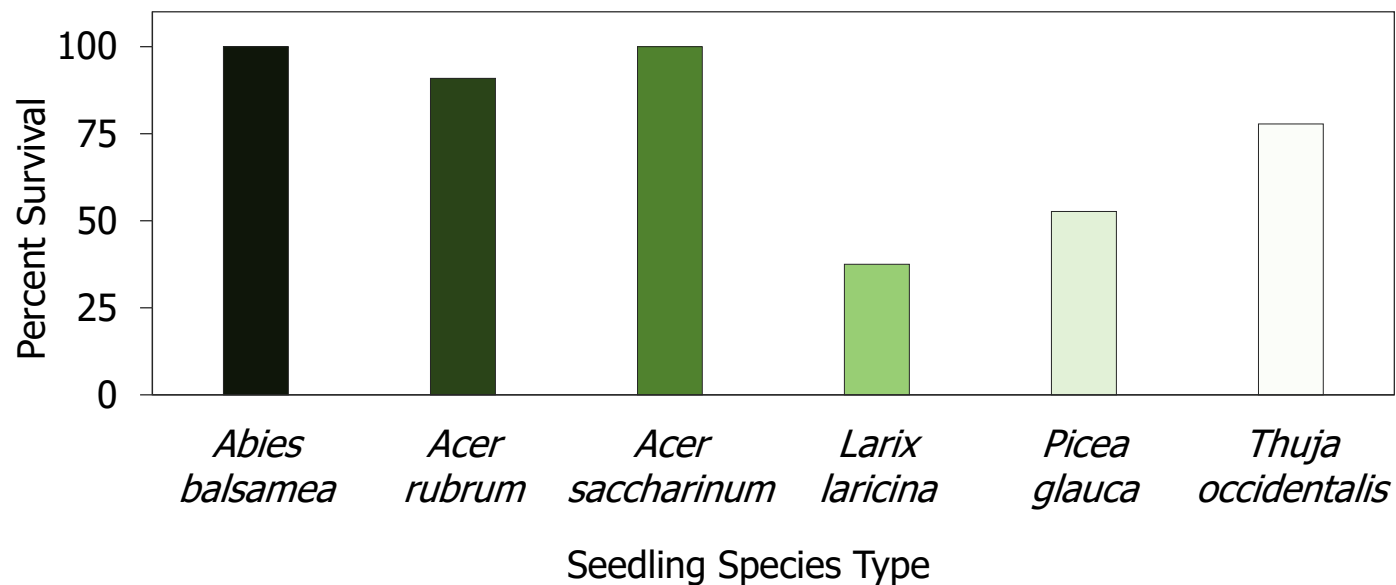


Table 1. Survival (%) of planted tree species in site B and site C mitigation wetlands between 2018 and 2019 where n is the number of observations.

Figure 2 Percent survival (%) of planted tree species in site B and site C mitigation wetlands between 2018 and 2019.

- The 72.9% survivorship for all species between 2018-2019 was considerably greater than the 37.9% survivorship reported for the same sites between 2017-2018.

Results: Mean Relative Height Growth

Common Name	Scientific Name	n	MRGR (cm y ⁻¹)	SE MRGR (cm y ⁻¹)
Balsam fir	<i>Abies balsamea</i> (L.) Mill	30	0.2652	0.1385
Red Maple	<i>Acer rubrum</i> L.	30	0.0514	0.0521
Silver maple	<i>Acer saccharinum</i> L.	5	0.0045	0.2061
Tamarack	<i>Larix laricina</i> K. Koch	15	1.3168	0.3723
White spruce	<i>Picea glauca</i> (Moench) Voss	10	0.5802	0.2674
White cedar	<i>Thuja occidentalis</i> L.	42	1.9270	0.1414

Table 2. Mean relative growth rate (MRGR; cm y⁻¹) of planted tree species in site B and site C mitigation wetlands between 2018 and 2019 where n is the number of observations and SE is the standard error (cm).

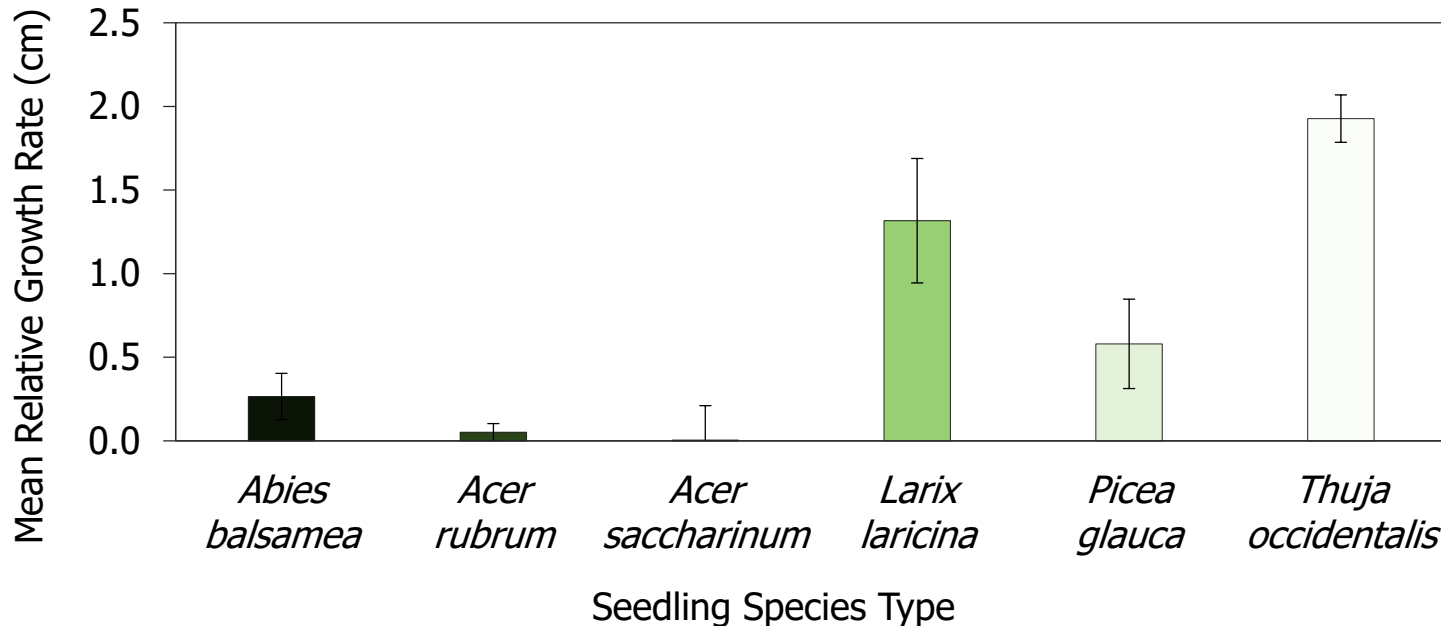


Figure 3 Mean relative growth rate (MRGR; cm y⁻¹) of planted tree species in site B and site C mitigation wetlands between 2018 and 2019 where whiskers represent ± 1 standard error (cm).

- Tamarack demonstrated the second largest relative growth rate, however it conversely exhibited the lowest survivorship.

Discussion & Conclusion



- Survivorship for all planted tree species was considerably greater between 2018 – 2019 when compared to 2017 – 2018
- Based upon both survivorship and mean relative height growth, white cedar was a top performing species with a 1.9 (cm y⁻¹) and 78% survivorship. Red maple and silver maple also demonstrated strong survivorship among species.
- These results will support future wetland mitigation efforts in the area by providing a targeted list of best and poorest performing tree species.