

Report RCSC-20-09

June 18, 2020

## Limber Pine Planting in the Black Hills National Forest (2020 Update)

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In South Dakota, limber pine (*Pinus flexilis*; a Black Hills National Forest species of local concern) occurs in isolated areas scattered over a small geographic area of about 2 square miles in the Black Elk Wilderness of the Black Hills National Forest and adjacent Custer State Park<sup>1</sup>. Recently many of these pines were killed by mountain pine beetle (MPB; *Dendroctonus ponderosae*) and white pine blister rust (WPBR; *Cronartium ribicola*), an exotic, invasive disease of 5-needle pines. A new limber pine population was established in 2017 in the Norbeck Wildlife Preserve of the Black Hills National Forest<sup>23</sup>. Two-year-old limber pine seedlings were planted in 2017 and in 2018 at 7 areas just off Trail #2 in the preserve (**Figure 1**).

Areas 1 to 6 are ponderosa pine (*Pinus ponderosa*) sites that experienced extensive mortality from MPB. These areas have relatively deep soil and a northerly aspect. Vexar tubes (*i.e.*, animal protectors) were staked around all seedlings to protect them from herbivory. Area 7 is a rocky, thin-soiled ridge top where Vexar tubes could not be installed. This area is typical of the sites where limber pine naturally occurs on the forest. The area supports few trees and many of the small ponderosa pines in area 7 have died or have yellow needles. This ponderosa pine mortality was not caused by MPB.

On May 6 and 13, 2020, Cheryl Mayer (Black Hills National Forest Botany Technician) and Jim Blodgett (Plant Pathologist) evaluated seedling mortality, measured present seedling height, and estimated height at planting (2-year old) based on stem nodes. Height measurements assumed a 1-cm apical bud. Seedlings selected for monitoring (128 seedlings) are a representative sample of the 276 limber pine planted in the preserve.

No additional mortality was observed since the 2019 report (**Figure 2**). However, potential WPBR symptoms were observed on a very-small percentage (<1%) of seedlings. The rocky area (area 7) experienced more mortality in the past.

Exponential height growth was measured in all areas for the first 4 years (**Figure 3**). Year 5 data also suggest an exponential growth curve. However, points at years 4 and 5 for areas 1 to 4 represent trees planted in 2018 and 2017, respectively (*i.e.*, trees from

<sup>1</sup> Blodgett, J. T. 2018. Black Elk Limber Pine: 2015 to 2018. USDA For. Serv., Rocky Mountain Region, For. Health Mgt., Rpt. RCSC-18-11.

<sup>2</sup> Blodgett, J. T. 2019. Limber Pine Planting in the Black Hills National Forest (2019 Update). USDA For. Serv., Rocky Mountain Region, For. Health Mgt., Rpt. RCSC-20-01.

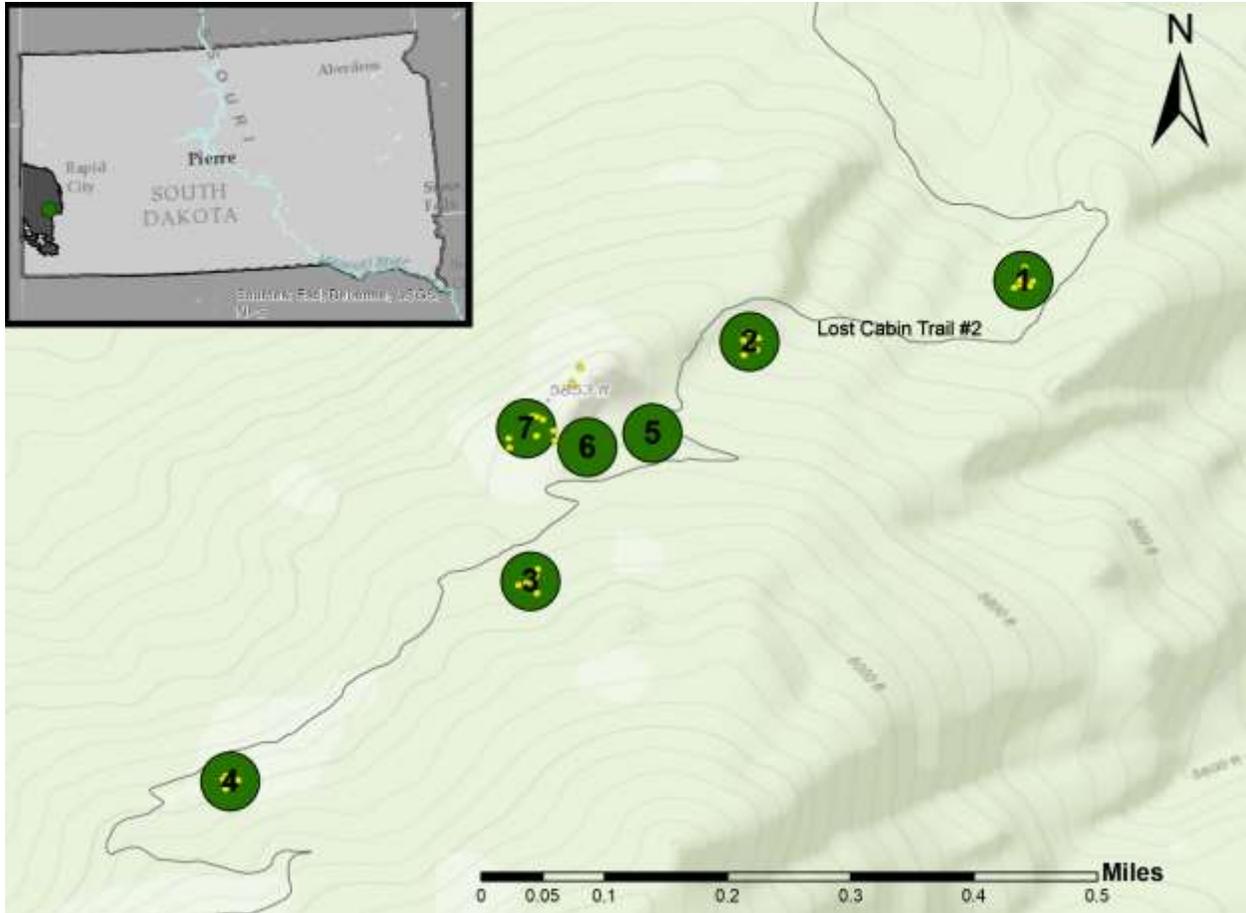
<sup>3</sup> Blodgett, J. T. 2018. Limber Pine Planting in the Black Hills National Forest. USDA For. Serv., Rocky Mountain Region, For. Health Mgt., Rpt. RCSC-18-10.



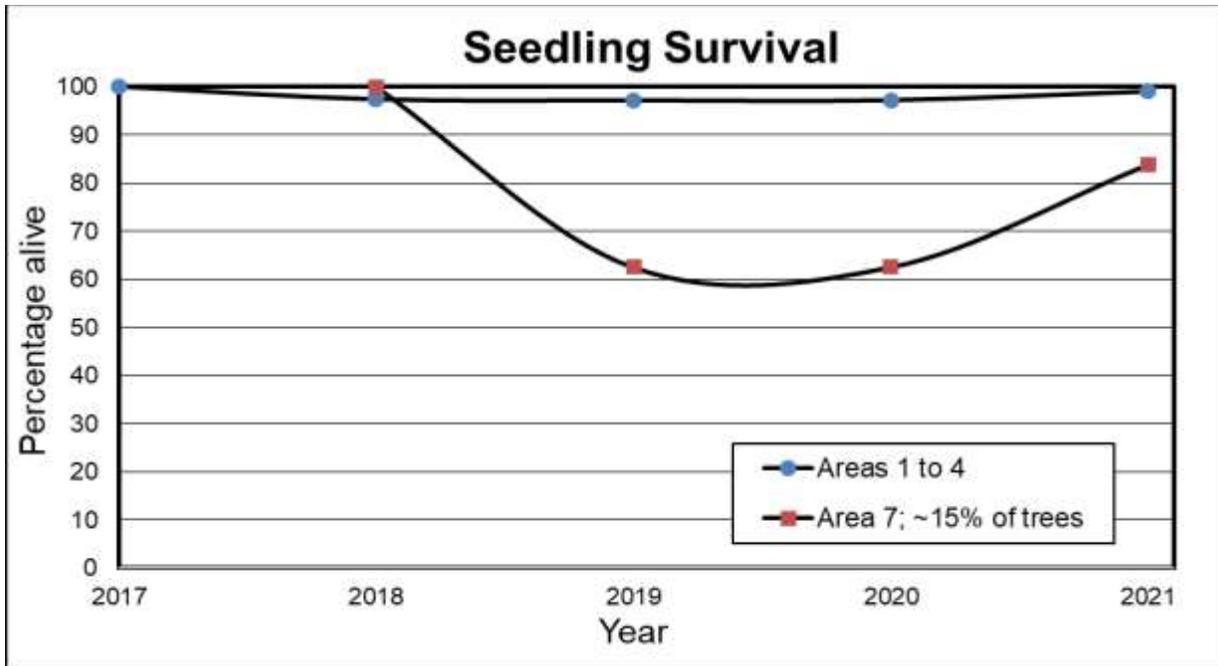
different planting years). When comparing all 5 areas and adjusting for year planted (height growth/year) sites 1 to 4 have similar growth rates (**Figure 4**). For trees planted in 2018, area 7 trees are shorter and more branched than trees planted at areas 1 to 4. Site conditions, and possibly the lack of the Vexar tubes, might explain the shorter, more branched seedlings at area 7.

### **Summary/Conclusion:**

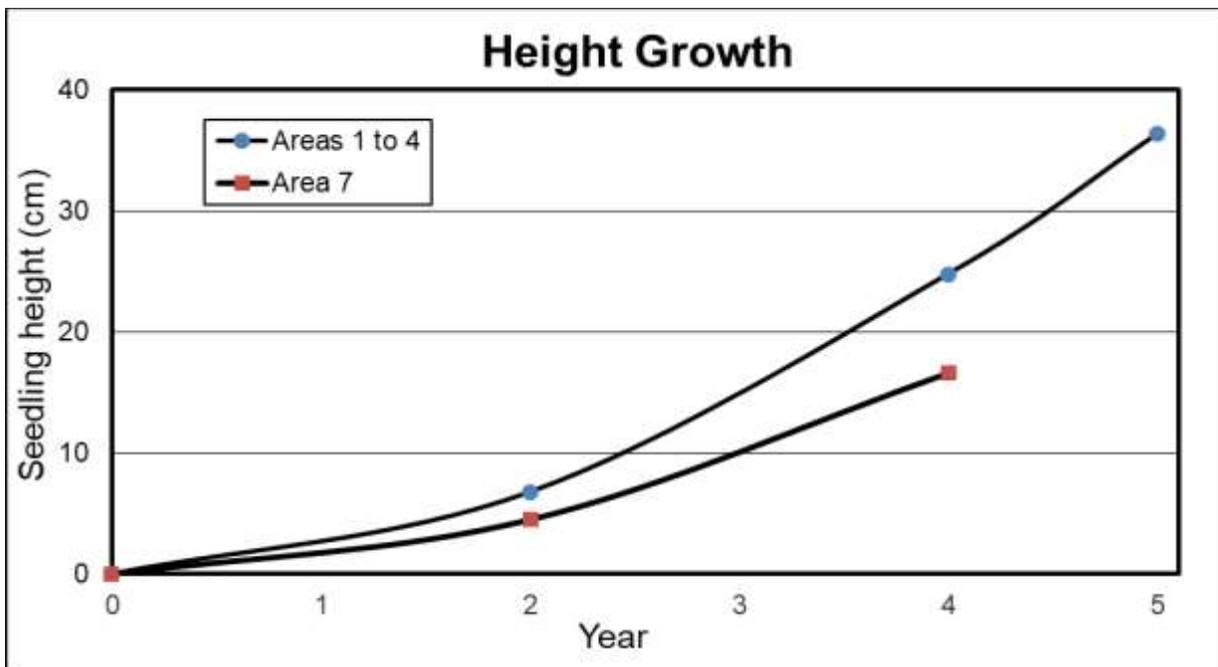
- No additional mortality occurred from spring 2019 to spring 2020; suggesting trees are established or have past the initial planting-shock.
- The lack of overall mortality at the site is likely due to:
  - Higher than average precipitation in 2018/2019.
  - Selection of good planting sites, especially the ponderosa pine areas.
  - Planting seedlings near "nurse objects" (*i.e.*, stumps/snags/logs) to potentially reduce water stress.
  - The extensive mortality from MPB combined with pruning trees within 12 ft of plantings; this reduced interspecific competition.
  - Protection by Vexar tubes (from browse-related damage and mortality).
  - High ponderosa pine mortality in the area resulted in many logs and dead branches which likely reduced ungulate activity in the area.
  - The use of healthy, high-quality, 2-year seedlings from Charles E Bessey Nursery.
  - Gentle planting methods.
- Most seedlings are growing well (**Figure 5**) with good average growth.
- As in the previous report, results suggest limber pine grows better on "good" sites (*i.e.*, ponderosa pine sites) with deep soil and no competition, versus harsh, rocky, thin-soil sites.
- We will be planting about 220 additional limber pine at the site in spring 2021.



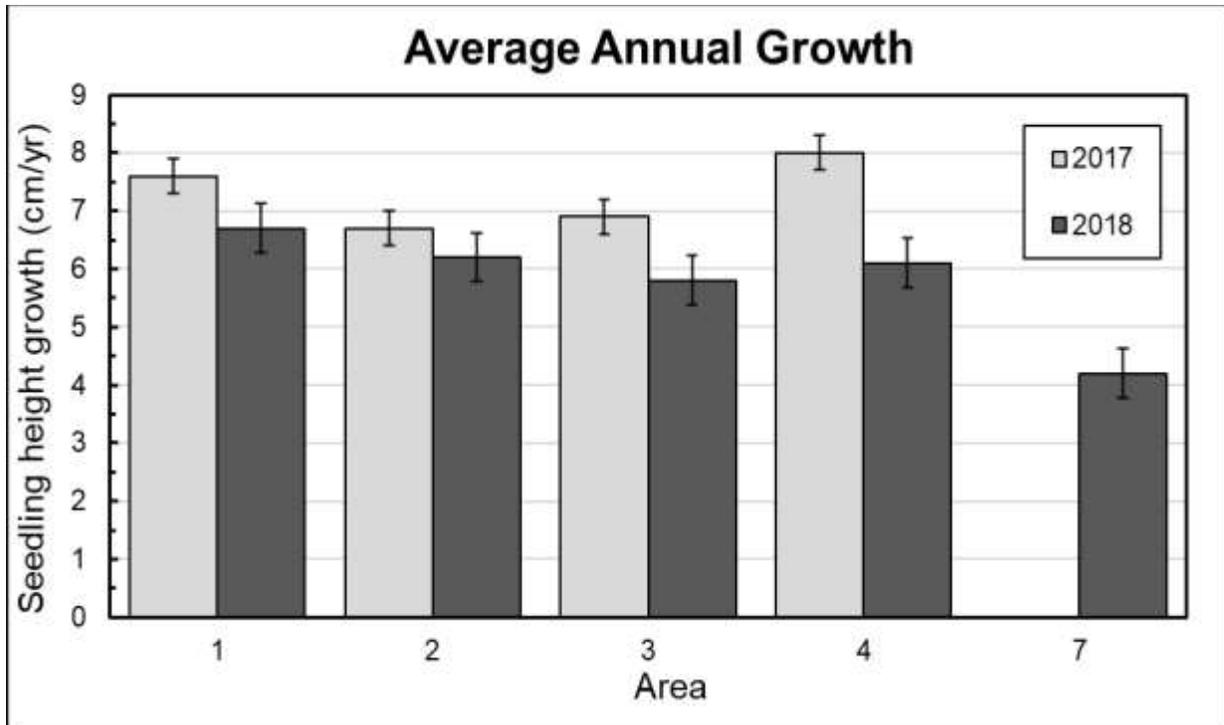
**Figure 1.** Limber pine planting site in the Norbeck Wildlife Preserve, Black Hills National Forest. Seedlings were planted at areas 1 to 4 in 2017; and at all areas in 2018 (green circles). Seedlings are being monitored at areas 1 to 4 and 7 (yellow dots represent groups of monitored trees).



**Figure 2.** Percentage of live limber pine by year at the Norbeck Wildlife Preserve planting site in the Black Hills National Forest (based on seedlings selected for long-term monitoring). The graph compares areas 1 to 4 and the rocky area 7. The 2021 points are assuming no additional mortality and 220 newly planted limber pine.



**Figure 3.** Limber pine height growth at the Norbeck Wildlife Preserve planting site in the Black Hills National Forest (based on seedlings selected for long-term monitoring). The graph compares areas 1 to 4 and the rocky area 7. The points at years 4 and 5 for areas 1 to 4 represent trees planted in 2018 and 2017, respectively (*i.e.*, trees from different planting years).



**Figure 4.** Limber pine height growth per year at the Norbeck Wildlife Preserve planting site in the Black Hills National Forest (based on seedlings selected for long-term monitoring). The graph compares areas and planting years.



**Figure 5.** A five-year-old limber pine at the Norbeck Wildlife Preserve planting site in the Black Hills National Forest. From left-to-right: photo of a limber pine with a Vexar tube, same tree with tube removed, measuring 2-year growth, and measuring 5-year growth (bottom of ruler is 30 cm above soil).