

Report RCSC-20-02

November 1, 2019

Black Elk Limber Pine: 2019

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This is an update in a series of reports^{1,2,3,4,5} regarding the known limber pines (*Pinus flexilis*) on and near Black Elk Peak in the Black Hills National Forest of South Dakota. Limber pine was designated a Species of Local Concern on the forest in 2011. There are currently 32 documented live limber pine on the forest; one of these is newly documented in 2019 (**Figure 1**). Many of the existing live limber pine are seedlings or saplings. Most of the larger trees were killed by mountain pine beetle (*Dendroctonus ponderosae*, MPB) or white pine blister rust (*Cronartium ribicola*, WPBR), an invasive-exotic disease. Several of the seedlings and saplings have been killed by WPBR.

Cheryl Mayer (Black Hills National Forest Botany Technician) and Jim Blodgett (Plant Pathologist) examined trees on and near Black Elk Peak on August 27 and 29, and October 7, 2019. The objectives were to assess changes in limber pine condition, look for additional limber pine, check cone numbers and maturity, prune WPBR branch cankers when practical, measure all trees, and photograph all trees. Photographs and DBH measurements for saplings and trees began in 2009; photographs and height measurements of seedlings began in 2014; with plans to photograph and measure all limber pine every 5 years.

In 2019, all limber pine (T# = designated limber pine number) were examined for cones and cankers, size measurements were taken, and trees were photographed; except T14, which was not found. Since trees produced few cones in 2019, no cone collections were made. Cones were found in the following trees: T2 (2 cones), T3 (2 cones), T7 (1 cone), T8 (2 cones), and T10 (~ 30 cones, but most were unreachable). Several branch cankers were found and pruned from the following trees: T2 (21 cankers, this tree also

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

² Blodgett, J. T. 2014. Harney Peak Limber Pine-2014. USDA For. Serv., Rocky Mountain Region, For. Health Mgt., Rpt. RCSC-03-15.

³ Blodgett, J. T. 2012. Harney Peak Limber Pine, 2012. USDA For. Serv., Rocky Mountain Region, For. Health Mgt., Rpt. RCSC-02-13.

⁴ Blodgett, J. T. 2011. Harney Peak Limber Pine, 2011. USDA For. Serv., Rocky Mountain Region, For. Health Mgt., Rpt. RCSC-01-12.

⁵ Blodgett, J. T. 2009. Harney Peak and Custer State Park Limber Pine, 2009. USDA For. Serv., Rocky Mountain Region, For. Health Mgt., Rpt. RCSC-01-10.



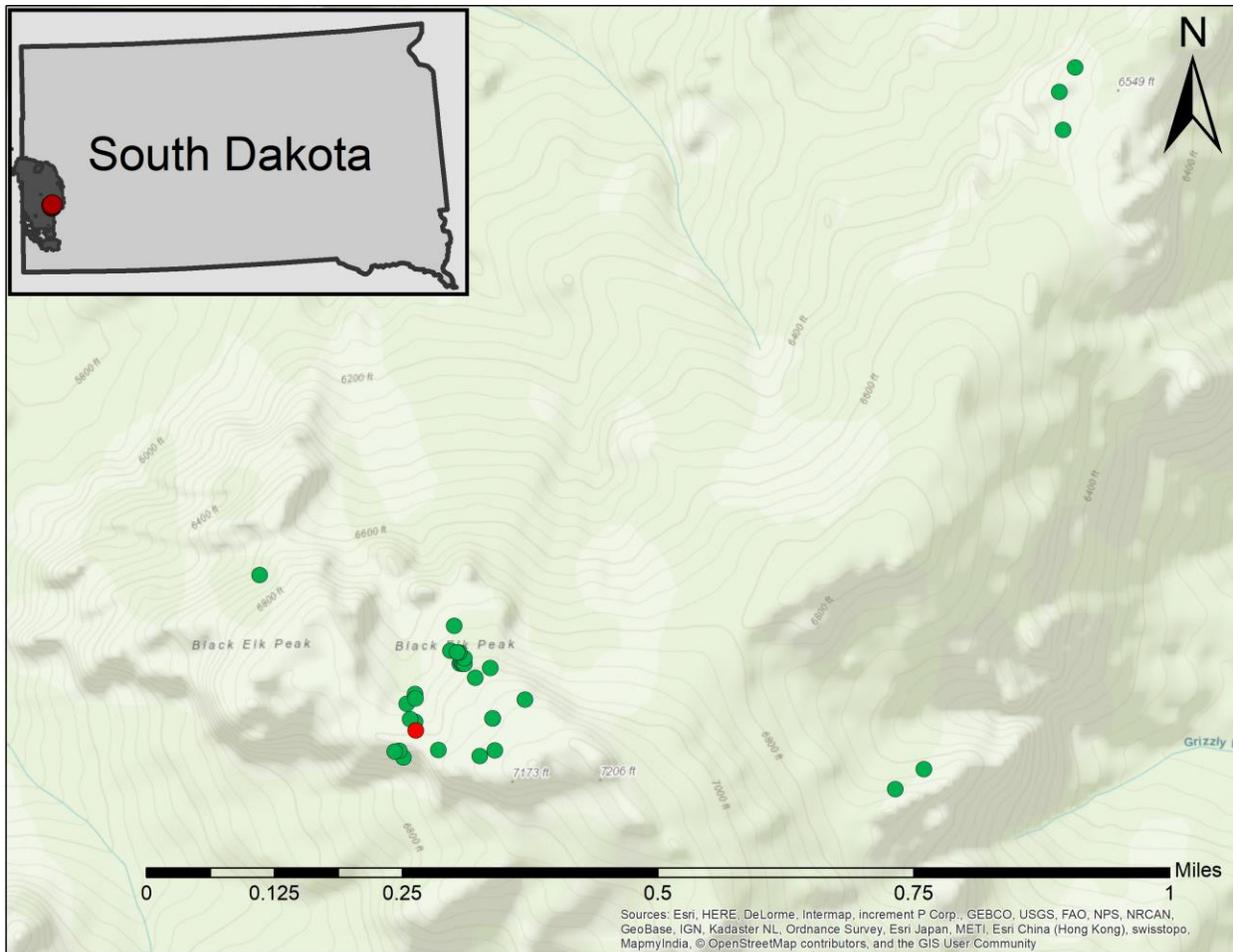


Figure 1. Locations of limber pine in the Black Hills National Forest. The seedling found in 2019 is represented as a red circle; other live limber pine are represent as green circles.

has a stem canker that cannot be pruned), T3 (1 canker), T7 (2 cankers), T8 (1 canker), T9 (a stem canker in the upper crown), T16 (1 canker and a few stem cankers were pruned by removing the main top), T29 (3 cankers, but will die soon from a stem canker), T30 (1 canker), T31 (15 cankers and a few stem cankers were pruned by removing the main top), T34 (5 cankers), and T38 was still green, but fading with a stem canker at the base that cannot be pruned. WPBR killed T39, with 2 stem cankers entering from a needle on the main stem (**Figure 2**). Height measurements were taken for seedlings (**Table 1**) and DBH was measured for saplings (**Table 2**) and trees (**Table 3**). The growth rates for many of these limber pines are low, likely due the harsh site.



Figure 2. A limber pine (T39) was recently killed by white pine blister rust (**left**) and another limber pine (T31) was found with rust (**right**).

The new seedling reported in 2018 (T44) was really T33, a seedling previously found in 2014. A new seedling was found this year (2019) and T44 was used as the designation for the new seedling (**Table 1; Figure 3**). This highlights the importance of photographing and measuring trees. GPS points are not 100% reliable for identifying individual trees in this area. Another example of a GPS issue: T14 was not found this year. Since we did not find a dead limber pine in the area, it is assumed T14's GPS location is also off by a few feet. Photographs confirm it is a distinct individual, not a duplicate of an existing designated seedling.



Figure 3. The new limber pine sapling (T44) found in 2019 in the Black Hills National Forest (**left**); and the previous photograph of T33 (**center**) and the duplicated T33 photograph that was accidentally called T44 in the 2018 report (**right**).

Table 1. List of documented live limber pine seedlings^a (19 total) in the Black Hills National Forest with size, growth rate, and date found.

Number ^b	Height in 2019 (inches)	Growth rate ^c (inches/year)	Date seedling was found
11	23.0	0.80	9/27/10
12	30.0	0.80	9/27/10
13	5.4	0.38	8/31/11
14	not measured	not measured	8/31/11
15	51.0	2.80	8/31/11
16	7.0	stem pruned, -2.00	8/31/11
17	8.3	0.26	8/31/11
18	14.0	1.00	8/31/11
28	17.0	0.40	6/25/14
30	16.0	0.80	8/18/14
31	43.0	stem pruned, -1.00	8/18/14
33	25.0	1.40	10/15/14
35	7.7	0.34	10/15/14
36	21.0	0.80	10/15/14
40	4.9	0.10	8/31/15
42	39.5	3.83	9/19/16
43	4.4	top browsed, -0.60	8/21/18
44	24.0	found in 2019	10/7/19
45	56.0	1.00	8/21/18

^a Seedlings were < 4.5 ft tall; measurements are from soil to tip of highest terminal bud.

^b Designated limber pine number.

^c Growth rate = current size minus the size when first measured divided by years since first measured.

Table 2. List of documented live limber pine saplings^a (9 total) in the Black Hills National Forest with size, growth rate, and date found.

Number ^b	DBH in 2019 (inches)	Growth rate ^c (inches/year)	Date sapling was found
1	3.1	0.08	9/2/09
2	2.5	0.02	9/2/09
3	2.3	0.06	9/2/09
4	4.3	0.20	9/2/09
5	2.1	0.12	9/2/09
7	0.9	0.05	8/31/11
29	0.5	0.06	6/25/14
34	1.0	0.12	10/15/14
38	2.8	0.22	10/15/14

^a Saplings were > 4.5 ft tall and < 4 inches DBH.

^b Designated limber pine number.

^c Growth rate = current size minus the size when first measured divided by years since first measured.

Table 3. List of documented live limber pine trees^a (4 total) in the Black Hills National Forest with size, growth rate, and date found.

Number ^b	DBH in 2019 (inches)	Growth rate ^c (inches/year)	Date tree was found
8	5.6	0.01	8/31/11
9	10.4	0.04	6/25/14
10	13.7	0.00	8/24/12
41	not measured	not measured	9/9/16

^a Trees were ≥ 4 inches DBH.

^b Designated limber pine number.

^c Growth rate = current size minus the size when first measured divided by years since first measured.

Several of the limber pines at these sites have died (29%, **Table 4**). Only 32 documented live limber pines remain on the forest, and many may never produce cones (**Figure 4**). Much of the mortality was caused by MPB and WPBR. Fifty percent of the limber pines at these sites have been infected by WPBR. However, all visible cankers have been pruned from 39% of those trees (161 total cankers removed since 2011). In almost all cases this has prevented further canker spread. Individual limber pines have been pruned so some might survive to cone-bearing age. Some of these trees may produce WPBR-resisting seed.

Table 4. Numbers of live and recently dead limber pines in the Black Hills National Forest by size class and mortality agent^a.

Size ^b	Alive ^c	Killed by MPB ^d	Killed by WPBR ^e	Killed unknown cause ^f	Percentage dead
Seedling	19	0	3	0	14%
Sapling	9	0	2	0	18%
Tree	4	5	0 ^e	3	67%
Total	32	5	5	3	29%

^a The numbers for dead limber pine might be low since we started checking trees in 2009 and started checking seedlings and saplings in 2011. We never looked for old-dead seedlings and saplings.

^b Seedlings are <4.5 ft tall, saplings are >4.5 ft tall and <4 inches DBH, and trees are ≥ 4 inches DBH.

^c Limber pine that were alive in 2019.

^d Limber pine that were likely killed by mountain pine beetle.

^e Limber pine that were killed by white pine blister rust. Three of the trees listed as killed by MPB also had several WPBR cankers, which may have contributed to mortality. Those trees would have been killed by WPBR if they were not infested with MPB.

^f Limber pine that were killed by an unknown cause. These were old-dead trees in 2009.



Figure 4. Many of the seedlings likely will not become trees due to shading (**left**) and/or they are growing in rock (**right**).

Management activities at these sites (2009 to 2019, and future):

- 2009 - First survey and bulk seed collections.
- 2011 - The official forest plan monitoring started, limber pine was designated a “species of local concern,” branch pruning for WPBR started, and bulk seed collections.
- 2011 to 2016 - Verbenone pouches were used for MPB protection.
- 2014, 2017, and 2018 - Individual "mother tree" seed collections. Two hundred and fifty two cones have been collected on the forest since 2009.
- 2017 and 2018 - Seeds from these sites were planted in the Norbeck Wildlife Preserve.
- 2021 - Additional planting is planned in the Norbeck Wildlife Preserve.
- Future - Continued management at these sites is suggested. Since beetle populations are low, verbenone pouches as a preventive treatment for MPB is not suggested in the near future. Branch pruning to control WPBR spread and prevent the diseases from reaching the main stems (thus killing trees) should continue. This has allowed some trees and saplings to reach cone-bearing age. Cone collections should continue in good cone bearing years.