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Rapid City Service Center
8221 Mt. Rushmore Rd.
Rapid City, SD 57702

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Black Elk Limber Pine: 2015 to 2018

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This is an update in a series of reports[1,2,3,4] regarding the known limber pines (*Pinus flexilis* James) on and near Black Elk Peak (formerly Harney Peak) in the Black Hills National Forest of South Dakota. Limber pine was designated a Species of Local Concern (SOLC) on the forest in 2011. There are currently 33 documented live limber pine on the forest; seven of these were newly documented from 2015 to 2018. Many of the existing live limber pine are seedlings or saplings. Most of the larger trees have been 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/or James T Blodgett (Plant Pathologist) examined trees on and near Black Elk Peak on July 2, 21, and August 31, 2015; June 28, September 8, 19, and 23, 2016; June 21, July 10, and August 16, 2017; and July 30, August 9 and 21, 2018. The objectives were to assess changes in limber pine condition, look for additional limber pine, perform Black Hills National Forest forest-plan-monitoring, check cone numbers and maturity, collect cones, hang verbenone, and prune WPBR branch cankers when practical. In 2014 we started photographing and recording heights for seedlings. Photographs and DBH measurements started in 2009 for saplings and trees.

Observations, changes, and accomplishments since the 2014 report

2015: Many of the trees (T#) were examined for cankers and cones. Since few cones were found, no collections were attempted. Two new seedlings (T39 and T40) were found (**Table 1; Fig. 1 & 2**). WPBR killed T32; the canker was in the main stem. July 2, Cheryl added verbenone to T9 and T10, the only live trees with DBH >7 inches. Verbenone is a natural pheromone that beetles emit when the population in a tree has reached a high level. The pheromone is a signal to adult beetles to stay away.

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

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

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

[4] 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.

Table 1. List of live limber pine found in the Black Hills National Forest from 2015 to 2018 with size, date found, and location.

Number[a]	Size[b]	Date	Latitude[c]	Longitude[c]
39	seedling; 25"	8/31/15	43.875562	-103.521407
40	seedling; 4.5"	8/31/15	43.875334	-103.521897
41	tree; 6.3"	9/9/16	43.868702	-103.537700
42	seedling; 28"	9/19/16	43.866162	-103.533160
43	seedling; 5"	8/21/18	43.866915	-103.534697
44	seedling, 23"	8/21/18	43.866145	-103.534930
45	seedling; 55"	8/21/18	43.865786	-103.524783

[a] Trees were assigned consecutive numbers (1, 2, 3, etc.).
[b] Seedlings were < 4.5 ft tall, saplings were > 4.5 ft tall and < 4 inches DBH, and trees were ≥ 4 inches DBH. Measurements were seedling height or tree DBH.
[c] Projection: WGS 84.

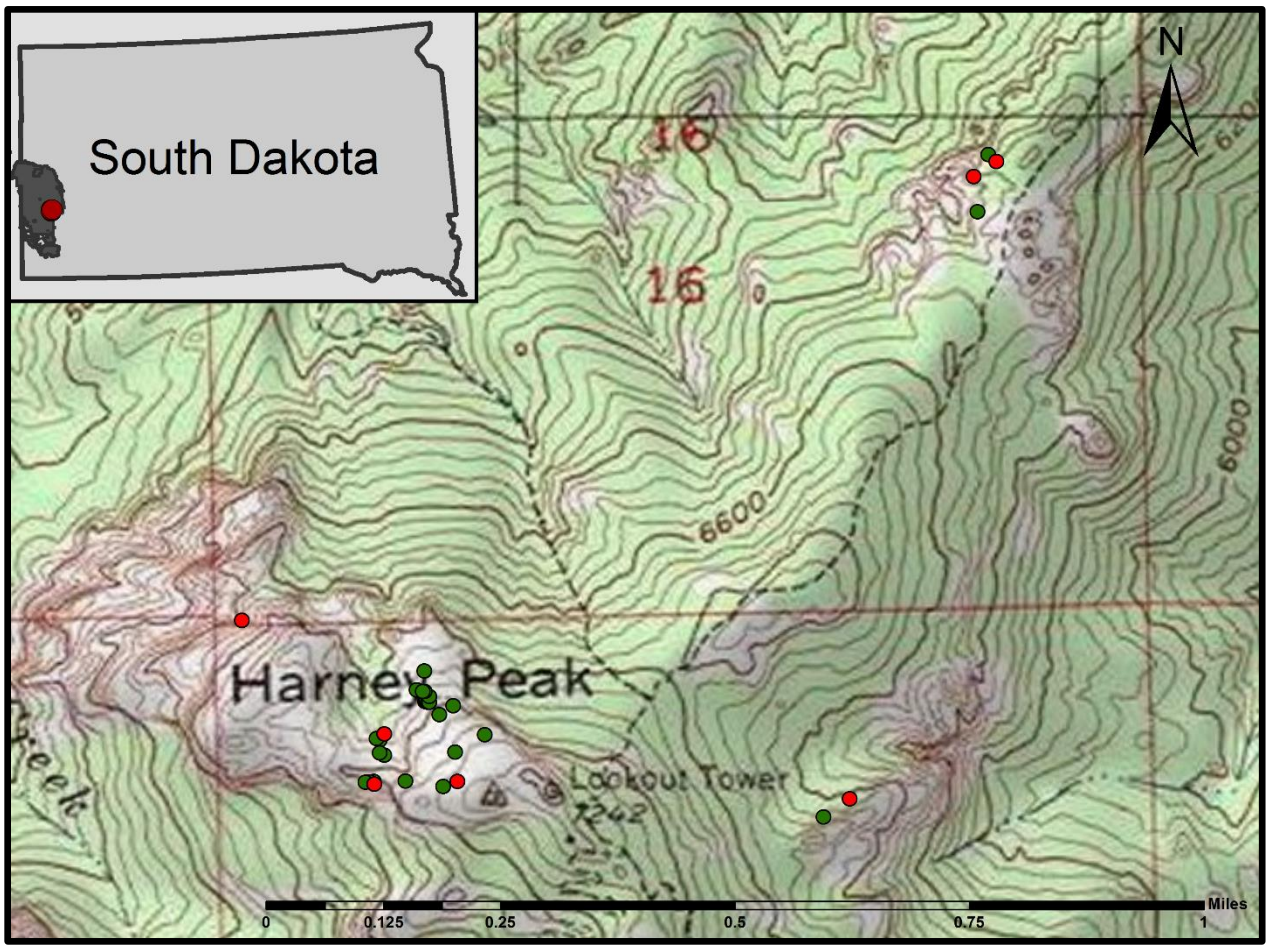

Figure 1. Limber pine locations on the Black Hills National Forest. Trees found from 2015 to 2018 are represented as red circles other live limber pine are represent as green circles.

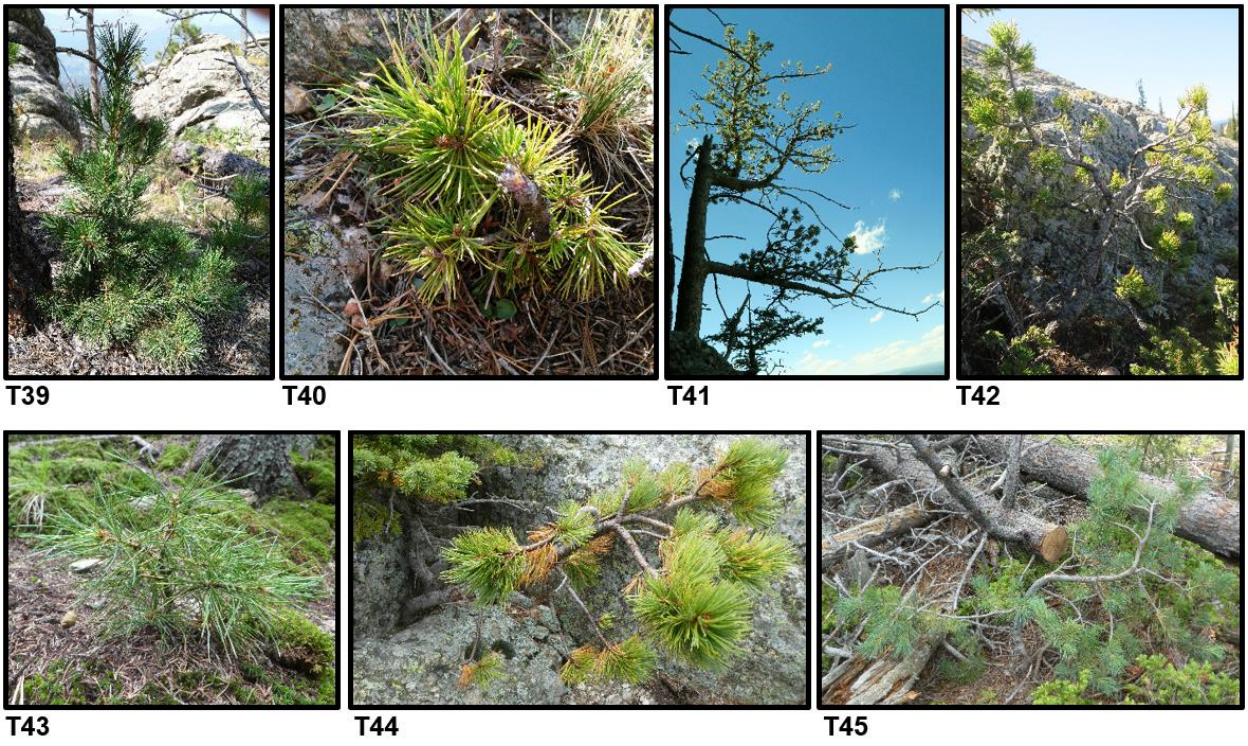

Figure 2. The seven limber pine found from 2015 to 2018 in the Black Hills National Forest; with tree numbers (T#) in the lower left.

2016: All trees were examined for cankers and cones. Since few cones were found, no collections were attempted. Cankers were only found and pruned from T2. One new tree (T41) and one new seedling (T42) were found. June 28, Cheryl added verbenone to T9 and T10.

2017: Many of the trees were examined for cankers and cones. One potential branch canker was pruned from T4. Cones (61 total) were collected from 5 mother trees including: T2 (4 cones), T3 (8 cones), T4 (43 cones), T5 (3 cones), and T38 (3 cones); the mean collection elevation was 7,011 feet, mean latitude 43.867296, and mean longitude -103.533527. Cones were saved individually for each mother tree and were sent to Richard Gilbert (Nursery Manager) at the Bessey Nursery in Halsey, NE, on August 17, 2017. A few of the cones had rodent and/or insect damage, but the damaged cones likely contained some good seeds.

2018: Many of the trees were examined for cankers and cones. Several branch cankers were found and pruned from the following trees: T2 (40 cankers, this tree also has a potential stem canker that cannot be pruned), T3 (23 cankers), T4 (9 cankers), T5 (8 cankers, and 1 stem canker was pruned by removing one of the main tops). T38 was still green, but clearly fading (*i.e.*, likely dead). A WPBR canker was in the main stem of T38 and could not be pruned earlier. Cones (98 total) were collected from 6 mother trees including: T2 (10 cones), T3 (31 cones), T4 (23 cones), T5 (13 cones), T10 (16

cones), and T38 (5 cones); the mean collection elevation was 6,965 feet, mean latitude 43.866999, and mean longitude -103.532164. Cones were saved individually for each mother tree and were sent to Richard Gilbert on August 27, 2018. Most of the cones looked healthy.

In an agreement with John Ball (Professor, South Dakota State University) 58 limber pine cones were collected from Custer State Park, South Dakota on August 23, 2018. The mean collection elevation was 6,682 feet, mean latitude 43.849324, and mean longitude -103.531156. These cones were shipped with the cones collected form USDA-Forest Service land. Cones were saved in two bulk collections from 13 mother trees (37 cones from trees with WPBR and 21 cones from trees with no WPBR). Many of the trees in the area have dead tops and most of the trees have scattered dead branches likely caused by WPBR. The disease was confirmed on several of the trees and on *Ribes* plants in the area.

Management recommendation updates

Recommendations provided in previous reports are still suggested. Verbenone pouches were not used in 2017 or 2018 as a preventive treatment for MPB since beetle populations are low. Such treatments are not suggested for the near future. Branch pruning to control WPBR spread and prevent the diseases from reaching the main stems has been applied since 2011. Seeds were collected in 2009, 2011, 2014, 2017, and 2018. Forest plan monitoring started in 2011 (**Table 2**).

Table 2. Forest health summary of the limber pine found in the Black Hills National Forest since 2009 by size class.

	Number of trees[a]					
Size[b]	**alive[c]**	**killed by MPB[d]**	**killed by WPBR[e]**	**killed; unknown cause[f]**	**that had WPBR cankers[g]**	**with WPBR cankers[h]**
Seedling	20	0	2	0	0	0
Sapling	9	0	2	0	7	2
Tree	4	5	5	3	2	1
Total	**33**	**5**	**9**	**3**	**9**	**3**

[a] The numbers for killed limber pine might be low (*i.e.*, some limber pine were likely missed) 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 were < 4.5 ft tall, saplings were > 4.5 ft tall and < 4 inches DBH, and trees were ≥ 4 inches DBH.

[c] Known limber pine that were alive in 2018.

[d] Limber pine that were likely killed by mountain pine beetle.

[e] Limber pine that were killed by white pine blister rust or that had rust when they died.

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

[g] Live limber pine that had white pine blister rust cankers before pruning.

[h] Live limber pine that still have white pine blister rust cankers in 2018 (*i.e.*, with stem cankers).

Additional management recommendation

Successful natural regeneration on the forest is uncertain. Previously it was suggested that this small population, which has been severely diminished by beetles and the invasive-exotic disease, could be increased by planting. The suggestion was to reintroduction this SOLC from the local seed collected from this area (*i.e.*, no outside seed sources would be used). It had been recommended to plant directly in the existing natural population area. However, since this area is in wilderness, there are management concerns regarding preserving the wilderness character. Therefore, as part of the *Limber Pine Restoration Project*, a new limber pine population was started in 2017 in the Norbeck Preserve, Black Hills National Forest[5]. Continued consideration of future plantings within the natural population is recommended.

The Norbeck Preserve planting site was selected since it is close to the original limber pine population. It is suggested the seed collected from Custer State Park be used to increase the genetic diversity of this new population, since few cone-bearing trees exist in the original population (only 6 cone-bearing trees in the forest). Richard Gilbert, Bessey Nursery Manager, would need to be contacted regarding the collected seed and producing limber pine nursery stock.

It is suggested that individual mother tree seed collections continue. The seed collected from forest land could be used for genetic testing of WPBR resistance and for additional seed preservation.

[5] 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.