



Frequently Asked Questions

about

A Scenario-Based Assessment to Inform Sustainable Ponderosa Pine Timber Harvest on the Black Hills National Forest (RMRS General Technical Report 422)

What are the report's key findings?

The primary finding is that the current volume of standing live sawtimber does not support a sustainable timber program at recent rates of harvest, under a wide range of scenarios considering growth and mortality rates. The report suggests that to be sustainable, harvest levels will need to be adjusted so they don't exceed net growth, which is the gross growth rate minus the mortality.

Additional key findings include:

- Depending on desired standing live sawtimber volume levels, an adjustment in harvest levels for some time will be needed to increase sawtimber volume recovery on the Black Hills National Forest. If the goal is to maintain a sustainable 181,000 CCF/year harvest level, standing live sawtimber volume will need to increase and would depend on future mortality and gross growth rates.
- The authors assumed a sustainable harvest level must (1) initially allow for positive net growth by accounting for mortality caused by disturbance, (2) harvest levels cannot exceed net growth but can be equal to net growth, and all suitable timberlands are available for harvest. Within this context:
 - The current standing live sawtimber volume of 5,995,428 CCF does not support the current ASQ of 181,000 CCF/year defined in the Forest Plan, regardless of rational mortality or growth rates evaluated.
 - Over the next several decades, if mortality rates stay below 1.04%, harvest levels of 72,400 and 90,500 CCF/year appear to be sustainable if all suitable timberlands are available for harvest.
 - Harvest levels of 126,700 CCF/year is possible when volume mortality rates are lower than 0.60% and volume growth rates are 2.73% or higher.
- Moving forward, monitoring volume mortality and growth will be necessary to inform and adjust current and future sustainable harvest levels.
- Forest management activities that focus on enhancing growth of small diameter ponderosa pine can help accelerate the production of sawtimber.

What review process was followed in finalizing this scientific report?

Research conducted by federal agencies is subject to the Data Quality Act, also sometimes referred to as the Information Quality Act. Publication reviews, including blind, peer, technical, editorial, and in this case public, are essential for research organizations to discover and develop knowledge that can be used to inform law, policy, and management. In addition to the normal technical and editorial reviews for publications, the USDA Forest Service provided an opportunity for interested parties and the public to review and provide written comment on this draft research publication from March 15 to May 1, 2020. More information about the review process is included in the [Peer Review Plan](#).

As outlined in the peer review plan, four technical reviewers and three external experts reviewed the draft in a blind peer review. Additionally, stakeholders and other members of the public provided comments.

How many comments were received and how were they analyzed and incorporated into the final report?

Rocky Mountain Research Station received over 350 comments on the draft report. The final report, *A Scenario-based Assessment to Inform Sustainable Ponderosa Pine Timber Harvest on the Black Hills National Forest* (GTR-422, Rocky Mountain Research Station, Fort Collins, Colorado), was expanded and revised to reflect the comments from stakeholders, technical and other expert reviewers.

Important changes include:

- The number of scenarios increased from 6 to 60 evaluating a wider range of mortality, growth, and harvest levels
- Clarifications on assumptions, terms, and rationale on how various growth and mortality rates were determined
- Additional information about disturbance history
- Additional appendices and figures to aid in understanding the analysis and findings

Will the comments and responses be provided?

A comment resolution document will be posted to the [USDA Forest Service Quality of Information website](#) in the near future. Commenters will not be identified, only the comment and the resolution response will be provided. In the interim, a summary of the main types of comments received and how they were addressed can be found [here](#).

What prompted intensified forest inventory of the Black Hills National Forest?

Over the last two decades, multiple disturbances have changed the forest characteristics of the Black Hills. Recognizing these changes, the Black Hills National Forest (Black Hills NF) convened a working group in June 2016 to develop questions about how these changes may impact the ability of the Black Hills NF to provide forest products. These questions centered on developing a comprehensive understanding of the forests growing on Black Hills NF suitable timberlands. This working group consisted of Black Hills NF staff, industry representatives, and representatives from the South Dakota and Wyoming State Foresters' offices.

The working group and the leadership of the Black Hills NF identified a need for a more rigorous inventory of the forest resources of the Black Hills. They agreed that forest leadership should request the Forest Service's Forest Inventory and Analysis Program (FIA) assess the current trends in standing live volume, growth, and mortality of the Black Hills NF using the FIA sampling design and data collection protocol.

As a result, from 2017 through 2019, the Northern Research Station (NRS) and Rocky Mountain Research Station (RMRS) FIA programs inventoried the forests of the Black Hills NF. NRS-FIA sampled South Dakota and RMRS-FIA sampled Wyoming. NRS-FIA coordinated the compilation of the data to produce estimates of forest attributes. To provide a more accurate picture of forest conditions, the FIA units doubled the intensity of the inventory (one plot every 3,000 acres, rather than every 6,000 acres). To provide an expedited set of estimates, data collection was accelerated and completed over a three-year period, rather than the usual seven to ten years.

Where can people access the data?

The data summary, data access tool, and other documentation are available in the USDA Forest Service Research Data Archive: [Black Hills National Forest 2019 Forest Inventory and Analysis data](#).

Did calculating growth rates based on a shorter data window affect the results?

No. Growth rates were measured in the field by visiting 225 established plots, and the remeasurement period ranged from 3 to 9 years. The average annual growth rate was roughly consistent across all remeasurement periods.

Why did FIA use a factor for defects rather than measuring it?

FIA field crews are held to strict Measurement Quality Objectives, and the ocular estimation of defects on standing timber is difficult to do accurately and consistently. It was determined that using a fixed adjustment factor for defect was more appropriate; the selected adjustment for defect is consistent with defect observed on recent timber sales across the Black Hills National Forest.

Why is the FIA estimate of timbered area smaller than area of suitable timber base identified in the Black Hills National Forest Plan?

The suitable timber base from the Black Hills National Forest Plan is based on large-scale polygons that do not account for smaller inclusions of grasslands, rock, or other non-forested acres. The FIA crews ground truth the GIS data and account for these smaller inclusions of non-forested lands to more accurately estimate the area of land where timber is growing. Two documents are available on the Black Hills National Forest website further explaining these differences and addressing concerns expressed by stakeholders:

- [Comparison of Forest Inventory Analysis and FSVEG Area Estimates Suitable and Accessible Timberland](#)
- [Comparison of 1997 Forest Plan Revision Phase II and FSVEG inventory area estimates, Black Hills National Forest.](#)

Are accelerated FIA surveys normal?

Most FIA data are collected on a regular schedule planned well in advance. However, it is not uncommon to respond to a request from a national forest or state forester to collect additional data or compress the data collection period for specific projects or to address user needs.

Was the analysis limited to parts of the forest or to the entire forest?

Scientists drew samples from across the entire forest, including South Dakota and Wyoming. Scientists targeted Black Hills National Forest land. The sample area includes both the FIA base samples and intensified samples.

Was the double-intensity data specific to looking at ponderosa pine or other species?

The FIA program does not target specific species. Plot visits merely reflect randomly located sampling points on which a protocol is implemented at a specific point in time. Therefore, all recognized species

are tallied, including any white spruce species. The final general technical report focuses on ponderosa pine sawtimber.

What information was the Forest Service and working group hoping to find?

The work performed by the agency answered the following five questions about the forest:

1. What is the standing live volume estimate?

a. Total volume on timberlands

Ponderosa pine $\geq$ 5 inches dbh = 11,544,243 CCF

Ponderosa pine $\geq$ 9 inches dbh = 8,648,666 CCF

b. Total volume on suitable timberlands

Ponderosa pine $\geq$ 5 inches dbh = 7,958,314 CCF

Ponderosa pine $\geq$ 9 inches dbh = 5,995,428 CCF

c. Total volume on timberlands by diameter class

Ponderosa pine $\geq$ 5 inches dbh

5.0-6.9	7.0-8.9	9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9
387,682	1,147,496	1,589,743	1,755,853	1,671,683	1,664,142	1,260,366

19.0-20.9	21.0-22.9	23.0-24.9	25.0-26.9	27.0-28.9	29.0-30.9	31.0-32.9	All classes
978,167	648,681	206,894	74,733	78,106	35,350	45,347	11,544,243

Ponderosa pine $\geq$ 9 inches dbh

Diameter class												
9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-22.9	23.0-24.9	25.0-26.9	27.0-28.9	29.0-30.9	31.0-32.9	All classes
1,172,387	1,429,661	1,447,730	1,497,293	1,159,779	913,582	610,813	195,746	70,877	74,146	33,574	43,077	8,648,666

d. Total volume on timberlands suitable base by diameter class

Ponderosa pine $\geq$ 5 inches dbh

Diameter class												
5.0-6.9	7.0-8.9	9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-22.9	23.0-24.9	25.0-26.9	27.0-28.9	All classes
273,822	753,614	1,071,112	1,182,942	1,127,835	1,203,750	932,874	699,122	520,846	112,553	54,632	25,211	7,958,314

Ponderosa pine $\geq$ 9 inches dbh

Diameter class										
9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-22.9	23.0-24.9	25.0-26.9	27.0-28.9	All classes
789,636	961,532	976,804	1,083,564	858,356	652,932	490,381	106,478	51,813	23,932	5,995,428

2. What is the annual gross growth estimate?

a. On timberlands

Ponderosa pine ≥ 5 inches dbh = 247,141 CCF

Ponderosa pine ≥ 9 inches dbh = 201,145 CCF

b. Within the suitable base

Ponderosa pine ≥ 5 inches dbh = 185,049 CCF

Ponderosa pine ≥ 9 inches dbh = 150,694 CCF

c. By diameter class on timberlands

Ponderosa pine ≥ 5 inches dbh

Diameter class												
5.0-6.9	7.0-8.9	9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-22.9	23.0-24.9	25.0-26.9	27.0-28.9	All classes
1,727	19,422	20,849	26,960	29,304	70,560	17,380	17,238	35,881	7,213	-17,483	18,090	247,141

Ponderosa pine ≥ 9 inches dbh

Diameter class											
9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-22.9	23.0-24.9	25.0-26.9	27.0-28.9	All classes	
16,714	22,077	24,928	63,725	16,203	16,253	33,824	6,827	-16,580	17,174	201,145	

d. By diameter class in suitable base

Ponderosa pine ≥ 5 inches dbh

Diameter class												
5.0-6.9	7.0-8.9	9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-22.9	23.0-24.9	25.0-26.9	27.0-28.9	All classes
2,034	13,247	20,391	22,209	24,945	43,247	14,837	7,199	30,511	6,857	-8,140	7,712	185,049

Ponderosa pine ≥ 9 inches dbh

Diameter class										
9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-22.9	23.0-24.9	25.0-26.9	27.0-28.9	All classes
16,327	18,114	21,519	39,207	13,828	6,841	28,762	6,489	-7,715	7,322	150,694

e. What is the annual gross growth projection (commercial) for the next decade?

See various scenarios in Graham, R.T., Battaglia, M.A., and Jain, T.B. 2021. *A Scenario-Based Assessment to Inform Sustainable Ponderosa Pine Timber Harvest on the Black Hills National Forest*. GTR-422 Forest Service, Rocky Mountain Research Station. Fort Collins, Colorado.

3. What is the annual net growth estimate? (Net growth is defined as gross growth minus mortality)

a. On timberlands

Ponderosa pine $\geq$ 5 inches dbh = -94,558 CCF

Ponderosa pine $\geq$ 9 inches dbh = -54,328 CCF

b. Within the suitable base

Ponderosa pine $\geq$ 5 inches dbh = -59,654 CCF

Ponderosa pine $\geq$ 9 inches dbh = -27,715 CCF

c. By diameter class on timberlands

Ponderosa pine $\geq$ 5 inches dbh

Diameter class												
5.0-6.9	7.0-8.9	9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-22.9	23.0-24.9	25.0-26.9	27.0-28.9	All classes
-5,640	-15,866	-29,502	-38,428	-27,181	17,636	-13,094	-9,764	35,881	-2,614	-17,483	11,496	-94,558

Ponderosa pine $\geq$ 9 inches dbh

Diameter class										
9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-22.9	23.0-24.9	25.0-26.9	27.0-28.9	All classes
-20,505	-31,081	-23,802	16,169	-11,850	-8,946	33,824	-2,472	-16,580	10,915	-54,328

d. By diameter class in suitable base

Ponderosa pine $\geq$ 5 inches dbh

Diameter class												
5.0-6.9	7.0-8.9	9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-22.9	23.0-24.9	25.0-26.9	27.0-28.9	All classes
-3,846	-15,629	-20,360	-28,131	-13,052	11,000	2,389	-12,544	30,511	-2,970	-8,140	1,118	-59,654

Ponderosa pine $\geq$ 9 inches dbh

Diameter class										
9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-22.9	23.0-24.9	25.0-26.9	27.0-28.9	All classes
-13,760	-22,848	-11,354	10,205	2,339	-11,597	28,762	-2,810	-7,715	1,063	-27,715

e. What is the annual net growth projection (commercial) for the next decade?

See various scenarios in Graham, R.T., Battaglia, M.A., and Jain, T.B. 2021. A Scenario-Based Assessment to Inform Sustainable Ponderosa Pine Timber Harvest on the Black Hills National Forest. GTR-422 Forest Service, Rocky Mountain Research Station. Fort Collins, Colorado.

4. What is the net growth to removal ratio?

There are many metrics available to evaluate the impacts of wood removals. Net growth, calculated by subtracting removals from gross growth and reported as a volume, estimates what might be considered the accumulating “interest” (growth) on the “principal” (standing inventory). The net growth-removal ratio is a similar metric but expressed as a ratio. It is also referred to as growth-to-drain ratio. Wood removal occurs through harvest, mortality and land use changes. The data below appends these ratios to the reported forest data for growth, harvest, and mortality, but does not include losses/gains through land use changes.

Species & Diameter Limit	Inventory CCF	Net Growth CCF	Harvest Levels CCF	% Net Growth of Inventory	% Removal of Inventory	% Change in Inventory	Net Growth/Removals
a. Within the suitable base							
Ponderosa pine ≥ 5 inches dbh	7,958,314	-59,654	183,592	-0.7%	2.3%	-3.1%	-0.32
Ponderosa pine ≥ 9 inches dbh	5,995,428	-27,715	153,534	-0.5%	2.6%	-3.0%	-0.18
b. Within timberlands							
Ponderosa pine ≥ 5 inches dbh	11,544,243	-94,558	191,387	-0.8%	1.7%	-2.5%	-0.49
Ponderosa pine ≥ 9 inches dbh	8,648,666	-54,328	159,713	-0.6%	1.8%	-2.5%	-0.34

5. What is the ability to produce an available sustained yield on the Forest (timberlands/suitable base) for the next decade?

Analysis indicates there are less than 6 million hundred cubic feet (CCF) of standing sawtimber volume on Black Hills National Forest suitable timberlands. Continued harvest at the recent level of 181,000 CCF of sawtimber annually would deplete a significant portion of standing and projected sawtimber volume. The report suggests that to be sustainable, harvest levels will need to be adjusted so they don't exceed net growth (gross growth – mortality).

Based on the scenarios evaluated, a sustainable timber harvest would range between 72,400 to 90,500 CCF/year (50 to 60% reduction from the current Forest Plan ASQ) if mortality levels stay below 1.04%. These harvest levels would allow for standing live sawtimber volume to increase. The rate of this increase in volume is dependent on future mortality and growth rates. Furthermore, the scenario outcomes assume that all the standing live tree volume on the suitable timberlands is available for harvesting, but other management objectives in the current Black Hills Forest plan may bound what is possible.