Synopsis of Comments and Reviews considered in preparing

A *scenario-based assessment to inform sustainable ponderosa pine timber harvest on the Black Hills National Forest* (RMRS-GTR-422)

A scientific and public review of a draft general technical report (GTR) that analyzed changes in timber conditions in the Black Hills National Forest was conducted in the spring of 2020, as outlined in the peer review plan. The authors received over 350 comments, leading to the expansion and revision of the April 2020 draft document (originally titled *Timber Growth and Yield in a Changing Forest, Black Hills*) to create the final RMRS-GTR-422: *A scenario-based assessment to inform sustainable ponderosa pine timber harvest on the Black Hills National Forest.*

Many of the comments received fell into four broad categories: (1) the data source and assumptions, (2) the mortality, growth, and harvest scenarios, (3) integrating other management objectives, and (4) integrating management strategies. Below is a synopsis of how the authors addressed the most prevalent types of comments.

**1) The data source and assumptions**

In response to the comments, the authors:

- Expanded the section titled “Assessing Past FIA Reports” and included an introductory paragraph identifying the distinctions associated with the different reports through time (please refer to this paragraph in the final GTR for specific details). FIA refers to Forest Inventory and Analysis.
- Added a paragraph that discusses the recent (2017-2019) inventory in more detail. In the section titled “Growth, Mortality, Harvests, and Standing Live Tree Inventory Over Time,” the second paragraph summarizes the distinctions/differences associated with the past FIA reports, further describing how these reports were used to provide context for the scenario development.
- Added Box 1 to describe how FIA calculates mortality, growth, and harvest volumes.
- Added Box 2 to provide definitions associated with sustainable harvest and in the Section titled “Scenario Outcomes” assumptions associated with sustainable harvest are more clearly stated.
- Added Appendix A to present differences between available and suitable lands for timber production. Authors also cite a detailed report provided by USDA Forest Service Northern Research Station FIA as to specific details associated with the data.

**2) Mortality, growth, and harvest scenarios**

In response to comments, the authors:

- Added a section titled “Understanding Disturbance and Tree Mortality” that includes discussions on various disturbances that have occurred in the Black Hills.
• Added an element of uncertainty associated with a changing climate (section titled “Changing Climate”) which considers the impacts of warmer temperatures, longer fire seasons, and increased fire frequency.

• Increased the number of scenarios from 6 to 60. The 60 scenarios, with a wider range of growth and mortality rates and harvest levels, provides the reader with a more comprehensive summary of what harvest levels are plausible within a range of gross growth and mortality rates.

• Instead of a specific growth rate, the authors used three gross growth rates (2.33%, 2.54%, and 2.73%) in the scenarios. These values were based on the low, average, and high growth rates reported in FIA resource bulletins from the 1960s to 2019.

• Changed the approach for the mortality rates. Instead of a specific mortality rate, authors considered five mortality rates (0.26%, 0.60%, 1.04%, 1.52%, and 2%) in the section titled “Scenario Development.” These values were based on the wide range of mortality rates reported in FIA resource bulletins from the 1960s to 2019.

• Used four harvest levels (181,000 CCF/year, 126,700 CCF/year, 90,500 CCF/year, and 72,400 CCF/year) within the context of the gross growth rates and mortality rates.

• Amended the establishment of reasonable and realistic mortality rates, informed by the evaluation of other FIA data collected in the Interior West states during similar annual inventories. These values are reported in the table titled “Interior West” (Table 2) in the revised GTR.

• Authors did not use the value of a 0.16% mortality rate previously reported for the 1962 periodic inventory, for several reasons:
  o The 0.16% mortality rate was reported under the periodic inventory methodology. With this inventory method, live volume is a direct “snapshot”, based on the standing live volume at the time a plot is visited and does not measure trees that died and fell on the ground.
  o Removals (harvests) were based on other sources of data (i.e. reports from sawmills), not from removals measured at the plot.
  o The periodic inventory method tends to underestimate mortality and removals.
  o In contrast, the annual inventory utilized after 2000 is a “true” remeasurement because it provides a full accounting of every tree >5 inches in diameter, even if mortality does not increase from one measurement to the next measurement period. Therefore, mortality rates quantified under the annual inventory is a better estimate of mortality.

3) Integrating other management objectives in scenario development

The objective of the GTR was to provide scenarios to evaluate harvest levels within the context of a range of gross growth and mortality rates that focus on addressing three questions. A) What impact does the current 2019 forest condition (i.e., standing volume, mortality, and growth) have on the out-year timber program of harvesting at current levels compared to other harvest level scenarios using probable growth and mortality estimates? B) What is a sustainable timber harvest estimate for the BHNF using the 2019 NRS-FIA data assuming rational tree mortality and growth rates informed by those of the past? C) What would be the standing inventory volume necessary using reasonable growth and mortality estimates to sustain a sawtimber allowable sale quantity (ASQ) of 181,000 CCF? Therefore, the objective of the GTR was to assess only one aspect of forest management – timber.
In response to comments, the authors:

- Recognized and acknowledged the many comments stating the lack of incorporating other management objectives into the draft. The authors added sections in the introduction and within the section titled “Moving Forward” that discussed other values that are important when discussing forest management in the Black Hills.

4) Integrating active management treatments into the scenarios

In response to comments, the authors:

- Did not include specific treatments such as thinning and other parameters associated with project analysis in the scenarios as requested in several sets of comments. The assessment and scenarios are too broad a scale to include specific management strategies, which are better addressed within individual projects.
- Note that annual inventories (started in 2000) are a spatially balanced sample. Ingrowth and increased growth rate of trees under recent management treatments is already reflected in FIA reported gross growth rates. The gross growth rates used in the scenarios were informed by data from those past FIA reports, so they indirectly account for management activities.
- Did not include culmination of mean annual increment (CMAI) directly into scenarios. The authors assumed that if harvests are occurring on the Black Hills National Forest, then CMAI has been reached. Typical CMAI in the Black Hills is reached in Black Hills ponderosa pine forests around 95 to 105 years of age (Graham et al. 2019). Thinned stands where trees have ample growing space with sawtimber sized trees (> 9" d.b.h.) have typically met this management threshold.