



Biennial Monitoring Evaluation Report (BMER)

for the Beaverhead-Deerlodge National Forest



Forest Service

Beaverhead Deerlodge National Forest March 2021



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Commonly Used Acronyms

ADS – Aerial Detection Surveys

AMA – Aquatic Macroinvertebrate Assemblage

AOP – Aquatic Organism Passage

ATV – All Terrain Vehicle

AUL – Annual Use Level

BDNF – Beaverhead-Deerlodge National Forest

BLM – Bureau of Land Management

BMER – Biennial Monitoring Evaluation Report

BMP – Best Management Practice

CDNST – Continental Divide National Scenic Trail

CIP – Capital Improvement Program

CCIP - Comprehensive Capital Improvement Plan

CWA – Clean Water Act

CWD – Course Woody Debris

DBH – Diameter at Breast Height

DD – *Drunella doddsii*

DSD – Detrimental Soil Disturbance

DEQ – Department of Environmental Quality

EA – Environmental Assessment

EM – Effectiveness Monitoring

EMC – Ecosystem Management Coordination

FACTS – Forest Service Activity Tracking System

FAR – Functioning at Risk

FIA – Forest Inventory and Analysis

FLREA – Federal Lands and Recreation Enhancement Act

FWP – Fish, Wildlife, and Parks

GIS - Geographic Information System

HUC – Hydrologic Unit Code

IM – Implementation Monitoring

INFRA – Infrastructure Tracking Database

IRM – Integrated Riparian Monitoring

K-V – Knutson-Vandenberg Act

LEIMARS – Law Enforcement Investigation Management Attainment Reporting System

LWCF – Land and Water Conservation Fund

LWD – Large Woody Debris

MIS – Management Indicator Species

MT – State of Montana

NEPA – National Environmental Policy Act

NF – National Forest

NFMA – National Forest Management Act

NFS – National Forest System

NC – No Change

NRM – Natural Resource Manager

NVUM – National Visitor Use Monitoring

WCT – Westslope Cutthroat Trout

WIT – Watershed Improvement Tracking Database

OMRTD – Open Motorized Road and Trail Density

PIBO – PACFISH/INFISH Biological Opinion Monitoring Program

PILT – Payment in Lieu of Taxes

R1 – Forest Service Region 1

RCA – Riparian Conservation Area

RMO – Riparian Management Objective

RMRS – Rocky Mountain Research Station

RO – Regional Office

PVT – Potential Vegetation Type

SIS – Heritage Site Identification Strategy

SQS – Soil Quality Standards

SRS – Secure Rural Schools Act

TESP-IS – Threatened, Endangered, Sensitive-Invasive Species Database

TMDL – Total Maximum Daily Load

VMAP – Vegetation Mapping Database

WCCAT – Watershed Condition Classification and Tracking

WCF – Watershed Condition Framework

WRAP – Watershed Restoration Action Plan

Summary of Findings and Results

Table 1. Summary of findings for all Plan Monitoring Items

MONITORING ITEM	YEAR UPDATED	PLAN IMPLEMENTATION STATUS ¹ Do monitoring results demonstrate intended progress (i.e. maintaining, trending, or advancing) of the associated plan components listed with this monitoring item?	RECOMMENDATION Based on the evaluation of monitoring results, may changes be warranted?	MANAGEMENT If a change may be warranted, where may the change be needed? ²
MON – 1: Watersheds What is the status of watershed ecological conditions on the forest?	2021	(B) Uncertain – More time is needed to assess the status or progress towards this plan component.	Yes	Monitoring Plan: Modify the question to be “What is the status and trend of watershed ecological conditions on the forest?” Management Activities: Identify more priority subwatersheds through the Watershed Condition Framework process and complete WRAPs for those priority subwatersheds.
MON – 2: Key Watersheds Have restoration activities resulted in	2021	(C) Uncertain – This monitoring question is difficult to answer with the	Yes	Monitoring Program: Information here can be adequately addressed in Monitoring Items 1 and

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improved watershed condition?		indicators provided.		4. Recommend dropping this monitoring item and combining the data with Item 1.
MON – 3: Watershed Analysis Are restoration and conservation activities focused in priority (key) watersheds?	2021	(E) Yes – although only 20% of the Restoration Key Watersheds have had restoration activity implemented, the forest has committed resources in approximately 40% of Fish Key Watersheds on the forest, which in a 11-year timeframe since the conception of the Forest Plan seems to be progressing well towards conservation of native trout on the forest.	Yes	Management Activities: The forest should identify specific restoration needs in all fish and Restoration Key Watersheds. This would help move towards the aquatic’s goals and objectives for Fish and Restoration Key Watersheds. The forest should assess whether restoration actions are complete in some key watersheds and if new watersheds should be considered.
MON – 4: Steam Channels What is the status of stream and riparian conditions?	2021	(B) Uncertain – The indicators/measures are sufficient, but the data set is not robust enough to fully answer the monitoring question at the Forest scale due to data being available for only 2 watersheds. As we complete more watersheds and summarize data,	Yes	Monitoring Program: Combine this monitoring item with Monitoring Item 1 because the condition of stream and riparian conditions are so closely associated watershed condition. Additionally, PIBO data will provide another metric for answering this question.

MONITORING ITEM	YEAR UPDATED	PLAN IMPLEMENTATION STATUS ¹ Do monitoring results demonstrate intended progress (i.e. maintaining, trending, or advancing) of the associated plan components listed with this monitoring item?	RECOMMENDATION Based on the evaluation of monitoring results, may changes be warranted?	MANAGEMENT If a change may be warranted, where may the change be needed? ²
		we will have a more complete assessment and better trend metrics in future reports to answer the question for the entire forest.		
MON – 5: Management Indicator Species Are management activities effectively maintaining conditions for native species reproduction?	2021	(B) Uncertain – More time is needed to assess the status or progress towards this plan component.	Yes	Monitoring Program: Data on macroinvertebrate assemblages is no longer readily available through the PIBO monitoring program and we suggest exploring other ways to monitor macroinvertebrate assemblages, such as Montana DEQ monitoring done for TMDL development. Status and trends in aquatic habitat are well represented through other metrics collected in the PIBO program and answers the monitoring question of “ <i>Are management activities effectively maintaining conditions for native species reproduction?</i> ”?
MON – 6: Best Management Practices Are soil and water conservation practices (BMPs) being implemented during project work and are they resulting in	2021	(B) Uncertain – More time is needed to assess the status or progress towards this plan component for some BMP	Yes	Management Activities: Improve consistency between BMPs described in planning documents and implementation of BMPs on-the-ground.

MONITORING ITEM	YEAR UPDATED	PLAN IMPLEMENTATION STATUS ¹ Do monitoring results demonstrate intended progress (i.e. maintaining, trending, or advancing) of the associated plan components listed with this monitoring item?	RECOMMENDATION Based on the evaluation of monitoring results, may changes be warranted?	MANAGEMENT If a change may be warranted, where may the change be needed? ²
protection of water quality and beneficial uses?		categories. Because of the limited number of samples, we cannot definitively determine trends at the forest level.		Watershed program to work with road and range management programs to ensure that BMPs that are implemented are effective in minimizing soil disturbance and erosion and sedimentation into nearby waterbodies. Follow-up on and prescribe corrective/adaptive management to ensure that those actions are being implemented.
MON – 7: Soil Productivity How are management actions maintaining soil quality?	2021	(E) Yes – based on 2020 survey results indicating recovery of soils and coarse woody debris.	No	N/A
MON – 8: Disturbance Have disturbance processes (fire, climate, insects, diseases, and management actions) occurred in order to create the mosaic of species and size diversity to create resilient vegetation communities?	2021	(B) Uncertain - More time is needed to assess the status or progress towards this plan component. (C) Uncertain - Methods inadequate to assess the status or progress toward achieving this plan component.	Yes	Monitoring Program: Modify indicators to follow quantitative forest composition objectives for Douglas-fir, lodgepole pine, aspen, whitebark pine/subalpine fir, and other forested vegetation types outlined in the Forest Plan vegetation section (p. 43-44).
MON – 9: Aspen Are management activities restoring aspen at the rate projected in the forest plan?	2021	(D) No – based on findings indicating that the pace of aspen restoration is not currently fast enough to achieve	Yes	Management Activities: Increase in the pace of mechanical aspen restoration is necessary to progress towards this objective.

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		this goal, assuming that the lifetime of the plan is roughly 15 years.		Monitoring Program: Recommend combining this with question MON-10; please see recommendation under that item.
MON – 10: Grasslands Are management activities restoring grassland/shrublands at a rate projected in the forest plan?	2020	(D) No – The current program of work is only accomplishing 50% of the annual rate to move towards projections outlined in the Forest Plan.	Yes	Monitoring Program: Combine MON – 9: Aspen with this monitoring item to track acres of conifer removal in grassland/shrubland, riparian, and aspen together. Change the indicator to acres of grassland/shrubland, riparian, and aspen treated for conifer removal.
MON – 11: Rare Plants What is the status of rare plants?	2021	(B) Uncertain – More data is needed to understand status of most species. Two species are showing downward trends.	Yes	Monitoring Program: More data is needed to identify if potential management changes are needed for maintenance of sensitive plants on the BDNF: 1)Monitoring of sensitive plant populations as well as data management should be prioritized 2) Monitoring of project design feature effectiveness at mitigating effects to populations and habitats.

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				3) Identification of specific restoration needs for species with downward trends. Management of Lemhi penstemon: prescribed fire may be needed in several populations to stimulate seedling establishment, and population persistence.
MON – 12: Sage Grouse Are management activities occurring near historic or active sage grouse leks?	2015	(B) Uncertain – based on lack of proper reporting tool to capture data for vegetation management activities that would contribute to improving or maintaining sage grouse habitat. This reporting will be available in FY23 at the next biennial monitoring evaluation cycle.	Yes	Monitoring Program: FACTS reporting needs to include implementation of projects that are impacting historic or active sage grouse leks as described in Forest Plan vegetation objectives. Change the question to: “Are forest management activities maintaining or improving active or historic sage grouse lek habitats?”
MON – 13: Elk What is the change in elk population?	2020	(E) Yes – Populations are increasing in the majority of FWP hunting districts and are at or above FWP population objectives.	No	N/A
MON – 14: Winter Habitat Are management activities effectively protecting high	2020	(C) Uncertain – Monitoring results are inadequate to	Yes	Change the monitoring question by asking two separate questions.

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elevation winter habitats for mountain goats and wolverines?		answer this question.		1) What management activities are occurring in winter habitat for mountain goats and wolverine? Indicators: the number and type of management actions (other than public over-snow approved use) that overlap with areas of mountain goat and wolverine habitat where presence is known. 2) What is the trend of illegal intrusions into the Mount Jefferson Recommended Wilderness boundary? Indicators: number of intrusions into the Mount Jefferson area compared to previous years.
MON – 15: Wildlife Security Are road and trail densities trending	2020	(D) No – As there was no change in open motorized road and trail	Yes	Management Activities: New projects should consider reduction in

MONITORING ITEM	YEAR UPDATED	PLAN IMPLEMENTATION STATUS ¹ Do monitoring results demonstrate intended progress (i.e. maintaining, trending, or advancing) of the associated plan components listed with this monitoring item?	RECOMMENDATION Based on the evaluation of monitoring results, may changes be warranted?	MANAGEMENT If a change may be warranted, where may the change be needed? ²
towards goals described by landscape?		density from 2015 to 2020.		OMRTD in the purpose and need.
MON – 16: Weeds What is the change in weed infestations?	2021	(B) Uncertain – More time is needed to address potential data discrepancies and improve reporting.	Yes	Monitoring Program: Suggest change to the monitoring item to include an indicator that addresses new species establishment. Also, improve accuracy of annual reporting data to avoid double counting remapped acres.
MON-17: THIS ITEM DOES NOT EXIST	N/A	N/A	N/A	N/A
MON – 18: Fuels Are fuels reduction projects being implemented in high-risk WUI areas?	2020	(E) Yes – because fuel reduction projects are being implemented in WUI areas with community wildfire protection plans.	Yes	Monitoring Program: Remove the term “high risk” from the monitoring question and remove the second indicator (acres of WUI with reduced fuel loadings and crown risk) as this is duplicative. This is already measured through acres of fuels reduction.
MON – 19: Recreation Is the BDNF providing desired recreation opportunities?	2021	(E) Yes – as results show recreation opportunities are well provided and visitor satisfaction remains high.	No	N/A
MON – 20: Recreation Are management actions resulting in the desired recreation settings?	2021	(E) Yes – Implementation of this plan component is trending as desired because the ROS	No	N/A

MONITORING ITEM	YEAR UPDATED	PLAN IMPLEMENTATION STATUS ¹ Do monitoring results demonstrate intended progress (i.e. maintaining, trending, or advancing) of the associated plan components listed with this monitoring item?	RECOMMENDATION Based on the evaluation of monitoring results, may changes be warranted?	MANAGEMENT If a change may be warranted, where may the change be needed? ²
		class has remained unchanged.		
MON-21: THIS ITEM DOES NOT EXIST	N/A	N/A	N/A	N/A
MON – 22: Heritage Are cultural resources being protected as the forest plan is implemented?	2021	(E) Yes – all projects are being evaluated/surveyed and consulted on with State Historic Preservation Office (SHPO) prior to implementation to ensure damage to cultural resources does not occur.	No	N/A
MON – 23: Economics What multiple use services have been provided?	2021	(E) Yes – The forest continues to support numerous jobs across a variety of industries.	No	N/A
MON – 24: Timber What are the changes of suitable timber lands?	2021	(E) Yes – As no changes to the suitable base have occurred.	Yes	Monitoring Program: Recommend removing this monitoring question. Changes in the suitable base do not often occur at the project level. Changes to the number of suitable acres would only occur if the Forest Plan is revised or amended.
MON – 25: Recreation Are we maintaining and reconstructing campgrounds and developed sites on schedule (30% [reconstruction] over the planning period)?	2021	(D) No – based on the low % of reconstructed developed recreation sites.	Yes	Management Activities: Evaluate the need to reconstruct 30% of the developed recreation sites over the planning period.

MONITORING ITEM	YEAR UPDATED	PLAN IMPLEMENTATION STATUS ¹ Do monitoring results demonstrate intended progress (i.e. maintaining, trending, or advancing) of the associated plan components listed with this monitoring item?	RECOMMENDATION Based on the evaluation of monitoring results, may changes be warranted?	MANAGEMENT If a change may be warranted, where may the change be needed? ²
MON – 26: Timber What is the status of stocking of lands and harvest unit size limits?	2021	(E) YES – as only 4% of harvested acres have not been certified as restocked within five years and all harvests over 40 acres did not require Regional Forester approval because they were the result natural catastrophic conditions such as fire, insect and disease attack, or windstorm.	Yes	Monitoring Program: Remove the indicator “ <i>Stocking of lands (trees/acre, over percent of area treated, by tree species)</i> ” for reasons stated in the discussion above and replace with metrics from Table 136.

¹ **PLAN IMPLEMENTATION STATUS:** (A) Uncertain - Interval of data collection beyond this reporting cycle (indicate date of next time this monitoring item will be evaluated); (B) Uncertain - More time/data are needed to understand status or progress of the Plan Component(s); (C) Uncertain - Methods inadequate to assess the status or progress toward achieving plan component(s). (D) NO - Implementation of Plan Component(s) ARE NOT trending, progressing, and/or conducted as desired; (E) YES - Implementation of Plan Component(s) ARE trending, progressing, and/or conducted as desired

² **[36 CFR 219.12(d)(2)]** - The monitoring evaluation report must indicate whether or not a change to the (1) plan, (2) management activities, (3) the monitoring program, or a (4) new assessment, may be warranted based on the new information. The monitoring evaluation report must be used to inform adaptive management of the plan area. See body of the report for more details regarding any specific recommendations/opportunities for change.

The Beaverhead-Deerlodge National Forest has been collecting sufficient monitoring data to inform this evaluation of Forest Plan performance. Several monitoring items are trending toward the desired conditions; however, there were other monitoring items whose trajectory could not be determined because there was uncertainty with the information. The uncertainty was not with the data themselves but with the timing (interval) at which the data were collected, how data were incorporated into databases and other collective storage areas, and the lack of long-term collections. The concerns with data quantity and collection timing will likely be alleviated with subsequent Biennial Monitoring Evaluation Reports (BMER) because resolution improves with more information. Issues with data coding and storage made it challenging for specialists to query specific data associated with individual monitoring indicators. Recommendations for coding and storing specific data will likely be made so that data is more readily available for the next BMER. There are a few monitoring items that were not able to be adequately addressed because the indicators or questions were not appropriate. Recommendations to change or combine questions and indicators are made in this report. Additionally, there are a couple of

items that are not trending as desired. For the most part, these items are moving in the correct direction but not at a pace that will meet Forest Plan objectives during the projected 15-year time frame of this Forest Plan. Recommendations have been made to increase the pace and scale of specific projects to move towards Forest Plan goals and objectives. This and subsequent BMERs will be used to inform adjustments of the annual program of work (the projects worked on) to improve movement toward the desired conditions in the Forest Plan.

Introduction

Policy and Regulations

Monitoring and evaluation requirements have been established through the National Forest Management Act (NFMA) at 36 CFR 219. Additional direction is provided by the Forest Service in Chapter 30 – Monitoring – of the Land Management Handbook (FSH 1909.12).

The Beaverhead-Deerlodge Forest Plan Monitoring Program (PMP) was updated in August 2016 for consistency with the 2012 planning regulations [36 CFR 219.12 (c)(1)]. The Beaverhead-Deerlodge National Forest Land Management Plan was administratively changed to include the updated 2016 plan monitoring program. Monitoring questions and indicators were selected to inform the management of resources on the plan area and not every plan component was determined necessary to track [36 CFR 219.12(a)(2)].

The monitoring evaluation implementation guide (monitoring guide) is part of the plan monitoring program and provides more specific direction for implementing the more strategic plan monitoring program and details monitoring methods, protocols, and roles and responsibilities. The Monitoring Guide is not part of the plan decision and is subject to change as new science and methods emerge. The Beaverhead-Deerlodge National Forest monitoring guide is available at: https://www.fs.usda.gov/Internet/FSE_DOCUMENTS/fseprd514781.pdf

Providing timely, accurate monitoring information to the responsible official and the public is a key requirement of the plan monitoring program. This report is the vehicle for disseminating this information.

In the context of forest management there are three main monitoring goals:

- Are we implementing the Land Management Plan properly? Are we meeting our management targets and project guidelines? (Implementation Monitoring)
- Are we achieving our Forest Plan management goals and desired outcomes? (effectiveness monitoring)
- Does our hypothesis testing indicate we may need to change the Forest Plan? (validation monitoring)

Purpose of the Biennial Monitoring Evaluation Report (BMER)

The Biennial Monitoring Evaluation Report (BMER) is designed to evaluate the three above monitoring goals for the purposes of providing this information to help the responsible official determine a course of action based on the recommended management adjustments of this MER. This report considers information related to forest plan components to evaluate if recommended

changes needed in forest plan direction, such as plan components or other plan content that guide management of resources in the plan area (e.g., forest plan, management activities, monitoring program or forest assessment).

The biennial monitoring evaluation report is not a decision document—it evaluates monitoring questions and indicators presented in the Plan Monitoring Program chapter of the forest plan, in relation to management actions carried out in the plan area.

Monitoring and evaluation are continuous learning tools that form the backbone of adaptive management. For this reason, we will produce an evaluation report every two years. This is our first written report of this evaluation since adopting the 2012 planning rule monitoring criteria to the Beaverhead-Deerlodge National Forest Plan Monitoring Program.

Implementation Monitoring is important for tracking progress and accomplishments; however, it is effectiveness and validation monitoring that drive and support the adaptive management process. Effectiveness monitoring evaluates condition and trends relative to desired conditions. Validation monitoring tests hypotheses and provides information that might necessitate changes to desired conditions in the plan (e.g., is what we think the desired state should be accurate)?

Objectives

To achieve the goals and purposes outlined above, this MER includes the following objectives (as guided by FSH 1909.12_34):

- Document implementation of the PMP, including changed conditions or status of key characteristics used to assess accomplishments and progress toward achievement of the selected LMP plan components.
- Evaluate relevant assumptions, changed conditions, management effectiveness, and progress towards achieving the selected desired conditions, objectives, and goals described in the Forest Plan.
- Assess the status of previous recommended options for change based on previous monitoring & evaluation reports.
- Document any scheduled monitoring actions that have not been completed and the reasons and rationale why it has not.
- Present any new information not outlined in the current plan monitoring program that is relevant to the evaluation of the selected monitoring questions.
- Incorporate broader scale monitoring information from the Regional Broader Scale Monitoring Strategy that is relevant to the understanding of the selected monitoring question.
- Present recommended change opportunities to the responsible official.

Monitoring Evaluation and Adaptive Findings

The following section present the most current information (data and evaluations) for all monitoring questions contained within the Beaverhead-Deerlodge National Forest Plan. Each monitoring item includes 1) a summary of the monitoring question, its indicator(s), and the plan components the monitoring question is assessing; 2) monitoring results and discussion; and 3)

evaluation of the results to determine an adaptive management finding on whether recommended management changes are warranted or not.

Monitoring Item 1 – Watersheds

Monitoring Item Summary

Table 2. Summary for Monitoring Item 1

Monitoring Question	Plan Component(s)	Indicators*	Data collection interval	Data Source / Partner	Point of Contact
What is the status of watershed ecological conditions on the forest?	Goal – Watersheds are maintained to ensure water quality, timing of runoff, and water yields necessary for functioning riparian, aquatic ecosystems, wetlands, and to support native aquatic species reproduction and survival. Watershed restoration projects promote long-term ecological integrity of ecosystems, conserve genetic integrity of native species, and contribute to attainment of desired stream function and support beneficial uses (Forest Plan, pg. 13).	1. Percent of watersheds in functioning status (Y). 2. Watershed Condition Class (number of watersheds in each Class, e.g., 1, 2 or 3) (Y).	Annually	Watershed Classification Assessment Tracking Tool (WCATT)	Jennifer Mickelson, Watershed Program Manager, Beaverhead-Deerlodge NF
* Indicator influenced by climate change? Y = Yes; N = No; U = Uncertain					

Table 3. Monitoring Item 1 - Monitoring Collection Summary

For monitoring item 1:	Year
Data was last collected or compiled in:	2020
Next scheduled data collection/compilation:	2021
Last BMER evaluation for this monitoring item:	n/a
Next scheduled BMER evaluation of this monitoring item:	2023

The Forest management goal to maintain watersheds to ensure water quality for functioning riparian, aquatic ecosystems, wetlands and to support native aquatic species is tracked through the Watershed Condition Framework (WCF). Watersheds are given a functional rating based on several elements (as described below). This monitoring question exists because it is important to track whether watersheds on the Beaverhead-Deerlodge National Forest are improving in condition class (Indicator #2) and if our management actions are leading to improvements in functioning status (Indicator #1).

Methods

The watershed monitoring item as outlined in the Beaverhead-Deerlodge Forest Plan is intended to track the status of watershed ecological conditions on the forest. The Watershed Condition Framework (WCF), a national framework established in 2011, is one tool through which the status of watersheds is being tracked. The WCF directed forests to identify the condition of forest watersheds, prioritizes treatments on watersheds, and provides a methodology for tracking watershed recovery.

The WCF classification and prioritization process occurs at what is referred to as the 6th-level or 6th-code HUC (Hydrologic Unit Code) scale, which translates to watersheds roughly 10,000 to 30,000 acres in area. The Beaverhead-Deerlodge National Forest contains all or part of 292 6th code HUCs, also called subwatersheds. Based upon a suite of 12 indicators representing aquatic physical, aquatic biological, terrestrial physical, and terrestrial biological watershed attributes, all subwatersheds on forest were classified as Class 1-Functioning Properly, Class 2-Functioning at Risk, or Class 3-Impaired function. Please see the publication at the website

https://www.fs.fed.us/sites/default/files/legacy_files/media/types/publication/field_pdf/watershed_classification_guide2011FS978_0.pdf for more detailed information on the classification process. The map located at <https://apps.fs.usda.gov/wcatt/> identifies the ranking for each watershed on the Beaverhead-Deerlodge National Forest.

Results

Indicator 1: Percent of Watersheds in Functioning Status

Functional ratings (Class 1 – Functioning Properly, Class 2 – Functioning at Risk, Class 3 – Impaired Function) were given to all subwatersheds within or part of the Beaverhead-Deerlodge NF. Figure 1 displays the percentage of watersheds in Condition Class 1 and 2 on the forest.

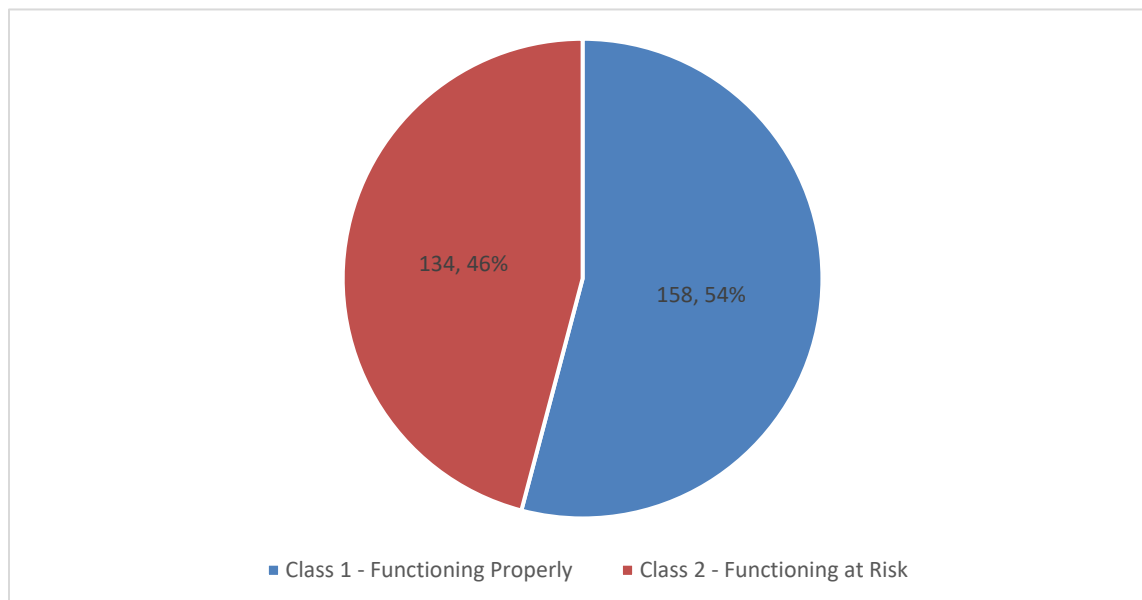


Figure 1. Percent of watersheds by functional status on the Beaverhead-Deerlodge National Forest.

Watersheds on the Beaverhead-Deerlodge NF are either Functioning Properly or Functioning at Risk. No watersheds are categorized as having impaired function. Fifty four percent of subwatersheds are categorized as Functioning at Risk, while 46% are Functioning Properly. For

watersheds that are Functioning at Risk, it appears that the following attributes are influencing watershed condition: Native Species, Aquatic Invasive Species, Impaired Waters, and Road Proximity to Water. Eighty-seven percent of watersheds that are Functioning at Risk had Exotic and/or Aquatic Invasive Species scores within the Impaired Function category. The 87% at risk outcome is directly linked to the high number of watersheds on the forest that have invasion of non-native salmonid species such as Brook and Rainbow Trout that are threatening persistence of native species such as Westslope Cutthroat Trout and Bull Trout. The same is true for Road Proximity to Water (75%), Impaired Waters (66%) and Native Species (37%) scores. In summary, watersheds that are Functioning at Risk are more likely to have non-native species that are negatively affecting native aquatic species and life histories, more road miles closer to water and more stream miles that are water quality limited.

Indicator 2: Watershed Condition Class (number of watersheds in each Condition Class; (e.g., 1, 2, or 3)

Figure 1 displays the number of watersheds on the Beaverhead-Deerlodge National Forest by condition class. Condition Class 1 (Functioning Properly) and Condition Class 2 (Functioning at Risk) contain 152 and 134 subwatersheds, respectively.

Discussion

This monitoring question is designed to look at the status of watershed ecological conditions on the forest and whether they are on an upward trajectory towards improvement. On the Beaverhead-Deerlodge NF, almost half of the subwatersheds on the forest are in a Properly Functioning status. This still leaves 134 watersheds on the forest in a Functioning at Risk condition. At this point in time, the results of the first assessment simply serves as a baseline. In subsequent monitoring reports, it will be helpful to look at if the forest is moving watersheds into a functional status over time through passive restoration (plan components designed to provide protection to watershed processes). The initiation of watershed restoration action plans (WRAPs), and implementation of essential projects identified within those WRAPs, helps to achieve watershed functional status. It is recommended this monitoring question be modified to read “What is the status and trend of watershed ecological conditions on the forest?” Additionally, it is recommended that the following indicator be added to this question: watershed condition class (number of watersheds moved from one Class to a higher functioning class) that is part of Monitoring Question #2. This will serve as an indicator of trend and how the forest is progressing in moving watersheds into a functioning properly condition.

Findings

Table 4. Summary of findings for Monitoring Item 1

MONITORING ITEM	YEAR UPDATED	PLAN IMPLEMENTATION STATUS ¹ Do monitoring results demonstrate intended progress (i.e. maintaining, trending, or advancing) of the associated plan components listed with this monitoring item?	RECOMMENDATION Based on the evaluation of monitoring results, may changes be warranted?	MANAGEMENT If a change may be warranted, where may the change be needed? ²
MON – 1: Watersheds What is the status of watershed ecological	2021	(B) Uncertain – More time is needed to assess the status or progress towards this plan component.	Yes	Monitoring Plan: Modify the question to be “What is the status and trend of watershed ecological

conditions on the forest?				conditions on the forest”?
				Management Activities: Identify more priority subwatersheds through the Watershed Condition Framework process and complete WRAPs for those priority subwatersheds.

1 PLAN IMPLEMENTATION STATUS: (A) Uncertain - Interval of data collection beyond this reporting cycle (indicate date of next time this monitoring item will be evaluated); (B) Uncertain - More time/data are needed to understand status or progress of the Plan Component(s); (C) Uncertain - Methods inadequate to assess the status or progress toward achieving plan component(s). (D) NO - Implementation of Plan Component(s) ARE NOT trending, progressing, and/or conducted as desired; (E) YES - Implementation of Plan Component(s) ARE trending, progressing, and/or conducted as desired

2 [36 CFR 219.12(d)(2)] - The monitoring evaluation report must indicate whether or not a change to the (1) plan, (2) management activities, (3) the monitoring program, or a (4) new assessment, may be warranted based on the new information. The monitoring evaluation report must be used to inform adaptive management of the plan area

Monitoring Item 2 – Key Watersheds

Monitoring Item Summary

Table 5. Summary for Monitoring Item 2.

Monitoring Question	Plan Component(s)	Indicators*	Data collection interval	Data Source / Partner	Point of Contact
Have restoration activities resulted in improved watershed condition?	Restoration Key Watershed: Fish habitat, riparian habitat, and water quality are recovered to desired conditions developed through watershed assessments (Forest Plan, p. 13).	PacFish/InFish Biological Opinion (PIBO) monitoring instream physical habitat (changes in pools, woody debris, bank angle, channel substrate, D50, aquatic invertebrates – in managed vs. unmanaged sites) (Y). Watershed Condition Class (number of watersheds moved from one Class to a higher functioning	Annually	PIBO Effectiveness Monitoring Program Metrics Watershed Condition Classification and Tracking (WCCAT) database	Jennifer Mickelson, Watershed Program Manager, Beaverhead – Deerlodge National Forest

		class, e.g., 3 to 2 or 2 to 1) (Y).			
* Indicator influenced by climate change? Y = Yes; N = No; U = Uncertain					

Table 6. Monitoring Item 2 - Monitoring Collection Summary.

For monitoring item 2:	Year
Data was last collected or compiled in:	2020
Next scheduled data collection/compilation:	2021
Last BMER evaluation for this monitoring item:	n/a
Next scheduled BMER evaluation of this monitoring item:	2023

The Forest management goal of having key watersheds and accomplishing restoration activities within them ensures that the forest is accomplishing restoration and conservation activities in prioritized areas on the forest for the benefit of aquatic species and their habitat. This monitoring report will highlight whether the forest is making progress towards improving instream physical habitat and watershed condition class in managed areas of the forest.

Methods

In the 2009 Forest Plan, the Beaverhead-Deerlodge NF designated both “fish” and “restoration” as key critical components for the watersheds on the Forest. Fish Key Watersheds are selected for focusing federal funds and personnel for the purpose of protecting, restoring, or maintaining habitat that contributes to the viability of threatened, endangered, and sensitive aquatic species. Restoration Key Watersheds are selected for focusing funds and personnel for the purpose of accelerating improvements in water quality and watershed conditions. There are 56 fish key watershed and 15 Restoration Key Watersheds. Key watersheds will often receive priority over non-key watersheds for watershed analyses and restoration work, but not always. As watershed analysis and subsequent restoration projects are completed restoration watersheds may be removed from the list and others added.

Management in Fish Key Watersheds emphasizes conservation of Westslope Cutthroat Trout and Bull Trout habitat by protecting and restoring processes that provide quality habitat. The objective for selecting Fish Key Watersheds was to prescribe this management direction to a well distributed group of watersheds supporting the strongest fish populations across the Forest at the time the plan was revised. At that time, the length of stream occupied by a population was used as the primary indicator for population strength. Watersheds with cutthroat populations which were, or nearly, genetically pure generally received greater consideration than those with lower percentages of purity. Achieving an adequate distribution was important. For this reason, some key watersheds were selected which have less robust populations than others on the Forest. Maintaining migratory life histories is an important element of conservation. Thus, where connected habitats were important in sustaining populations, groups of watersheds were selected. The result was the clumping of key watersheds in the Rock Creek drainage.

Management in Restoration Key Watersheds emphasizes restoration of integrated ecological processes at the watershed scale. A paper details methods and data used to identify priority restoration watersheds: *“A Method to Identify Priority Restoration Watersheds for Use in the Region 1 Integrated Restoration and Protection Strategy”* Bryce A. Bohn, Hydrologist,

Beaverhead-Deerlodge NF, 2007. The method was developed for Region 1 use and implemented on the BDNF.

Watersheds were prioritized by identifying, evaluating, and ranking anthropogenic activities known to influence watershed condition, as this assumes more activity in or near streams creates a higher risk to watershed function. The metrics used to assess watershed risk are included in Appendix H of the Forest Plan.

The PACFISH/INFISH Biological Opinion (PIBO) monitoring program was established in 1999 in response to the Pacific Anadromous Fish Strategy (PACFISH, 1995) and the Inland Native Fish Strategy (INFISH, 1995). These Biological Opinions and other consultation documents associated with subsequent amendments (1996-1998) advised federal agencies to maintain or improve riparian and aquatic conditions at both landscape and watershed scales on federal lands throughout the upper Columbia River basin. These documents also included requirements to monitor the implementation and effectiveness of these strategies. The PIBO monitoring program evaluates stream and riparian habitat status (i.e., current condition) and trends for a wide range of aquatic and riparian attributes, to assess these habitat conditions. Since its inception, the program has been geographically expanded to areas outside the original PACFISH/INFISH areas to address needs identified by federal land management agencies. Currently, the PIBO monitoring program provides data and data support to multiple federal and state agencies across a wide spatial extend, mostly in the interior Columbia and upper Missouri River basins.

PIBO collects effectiveness monitoring (EM) data for over 2,225 sites on the Forest, including randomly located Integrator, and selected Designated Monitoring Area sites. These data include attributes for stream habitat, riparian vegetation, aquatic macroinvertebrates, and stream temperature. There are 104 Integrator sites on the Beaverhead-Deerlodge NF. Implementation Monitoring (IM) data is also available for over 350 Designated Monitoring Area sites with attributes related to grazing management.

A useful approach for assessing the status of stream habitat condition, at a given stream reach, is to compare its habitat characteristics to those of streams likely to be functioning properly. The PIBO program uses this approach to evaluate status of stream habitat within portions of the interior Columbia River and Missouri River basins, and to also document changes in habitat conditions (e.g., “trend”) over the entirety of PIBO sampling (2001-2019).

Determining the condition or status of an individual, or group of stream reaches, is a difficult task because of the natural inherent variability in stream conditions due to geoclimatic and disturbance regimes. PIBO’s approach is to compare the status of stream habitat conditions at sites in ‘managed’ watersheds (watersheds exposed to disturbance from various management actions) to habitat conditions at sites within ‘reference’, or relatively pristine, watersheds, which are used as a benchmark of expected condition. Because all streams are affected by natural disturbance, in assessing status we are most interested in how the range of stream habitat conditions, expressed at managed sites, compares to what would be expected if the stream had experienced only natural disturbance. To ascertain the status of a given site an index of habitat conditions was created which accounts for some natural variability among sites and combines several stream habitat attributes. While an index is good for determining status, it may be less sensitive when detecting trend in habitat condition over time because it averages conditions of several attributes that may be more individually responsive. Therefore, trends were estimated by measuring changes in individual stream habitat metrics, such as bank stability or large wood frequency, at a site over the duration of PIBO sampling (2001-2019).

More information on the PIBO monitoring program can be found at:

<https://www.fs.usda.gov/detail/r4/landmanagement/resourcemanagement/?cid=stelprd3845865>.

The Watershed Condition Framework (WCF), a national framework established in 2011, is one tool through which the status of watersheds is being tracked. The WCF directed forests to identify the condition of forest watersheds, prioritizes treatments on watersheds, and provides a methodology for tracking watershed recovery.

The WCF classification and prioritization process occurs at what is referred to as the 6th-level or 6th-code HUC (Hydrologic Unit Code) scale, which translates to watersheds roughly 10,000 to 30,000 acres in area. The Beaverhead-Deerlodge National Forest contains all or part of 292 6th code HUCs, also called subwatersheds. Based upon a suite of 12 indicators representing aquatic physical, aquatic biological, terrestrial physical, and terrestrial biological watershed attributes, all subwatersheds on forest were classified as Class 1-Functioning Properly, Class 2-Functioning at Risk, or Class 3-Impaired function. Please see the publication at the website https://www.fs.fed.us/sites/default/files/legacy_files/media/types/publication/field_pdf/watershed_classification_guide2011FS978_0.pdf for more detailed information on the classification process. The map located at <https://apps.fs.usda.gov/wcatt/> identifies the ranking for each watershed on the Beaverhead-Deerlodge National Forest.

The Watershed Condition Classification and Tracking Tool (WCATT) is a Natural Resources Manager (NRM) tool used to classify and track watershed condition classes using a core set of aquatic and terrestrial, physical and biological, indicators and attributes. The WCATT tool is also useful in that it tracks progress made towards moving watersheds from one condition class to another as watershed restoration actions are completed.

Results

PACFISH/INFISH Biological Monitoring Physical Habitat Attributes

Changes in Pools

PIBO measures two attributes related to pools – residual pool depth and percent pools. Residual pool depth is used to monitor pool depths independently of discharge. Residual pool depth is the difference in depth or bed elevation between a pool and the downstream riffle crest. Residual pool depths represent extreme low flow conditions, which can limit a stream's capacity to support fish populations. The method also provides an unbiased way to easily distinguish pools from other reach types: pools are simply reaches having residual depths greater than zero.

Table 7 displays trends in residual pools depths by basin and sub-basin on the Beaverhead-Deerlodge NF at managed sites.

Table 7. Trend in residual pool depths across the Beaverhead-Deerlodge NF, split by basin and sub-basin. Time1 = mean during first visit; Time2 = mean value for last visit; Percent Change = Percent change in the mean values between the first and last visit; Sample size = number of observations with repeat visits; Negative Number = Number of sites where actual measurement was lower on last visit; Positive Number = Number of sites where actual measurement was higher in last visit; None Number = Number of sites where last visit and first visit values were equal; P-value = Significance test where p-value < 0.10 is significantly

different; Desired Direction = direction of change in the mean, which can either be + or -; Actual Change = actual direction of change in the mean, which can be no statistically significant (NS), + or -.

Basin/Sub-Basin	Time1 Value	Time2 Value	Percent Change	Sample Size	Negative Number	Positive Number	No Change Number	P-value	Desired Condition	Actual Change
Columbia River Basin	0.33	0.49	47.8	20	1	19	0	0	+	+
Flint-Rock Creek	0.36	0.43	19.6	10	1	9	0	0.007	+	+
Upper Clark Fork River	0.31	0.56	80.4	11	1	10	0	0.005	+	+
Missouri River Basin	0.33	0.33	-0.2	74	42	31	1	0.518	+	NS
Red Rock River	0.26	0.22	-14.7	12	10	2	0	0.019	+	-
Big Hole River	0.36	0.4	9.5	26	11	15	0	0.174	+	NS
Beaverhead River	Not enough managed sites for trend									
Ruby River	0.33	0.32	-1.3	7	3	4	0	0.866	+	NS
Jefferson River	0.29	0.28	-1.6	7	4	3	0	0.866	+	NS
Madison River	0.36	0.33	-9	11	6	4	1	0.333	+	NS
Boulder River	0.33	0.31	-4.7	8	7	1	0	0.161	+	NS

Based on data presented in Table 7, residual pool depths overall are improving (pools are getting deeper) in the Columbia River basin and associated subbasins. There were improvements in the Upper Clark Fork River subbasin, where residual pool depths increased by over 80%. Residual pool depths were mostly unchanged in the Missouri River basin, except in the Red Rock subbasin, where there is a downward trend in pool depths (pools are getting shallower).

The nomenclature “Percent pools” is also a metric used by PIBO. Percent pools are essentially the sum of all qualifying pool lengths divided by the reach length. The higher the pool percent is, the better-quality habitat for aquatic species. Table 8 displays trends in percent pools by basin and sub-basin on the Beaverhead-Deerlodge NF at managed sites.

Table 8. Trend in percent pools across the Beaverhead-Deerlodge NF, split by basin and sub-basin. Time1 = mean during first visit; Time2 = mean value for last visit; Percent Change = Percent change in the mean values between the first and last visit; Sample size = number of observations with repeat visits; Negative Number = Number of sites where actual measurement was lower on last visit; Positive Number = Number of sites where actual measurement was higher in last visit; None Number = Number of sites where last visit and first visit values were equal; P-value = Significance test where p-value < 0.10 is significantly

different; Desired Direction = direction of change in the mean, which can either be + or -; Actual Change = actual direction of change in the mean, which can be no statistically significant (NS), + or -.

Basin/Sub-Basin	Time1 Value	Time2 Value	Percent Change	Sample Size	Negative Number	Positive Number	No Change Number	P-value	Desired Condition	Actual Change
Columbia River Basin	45.9	47.5	3.4	20	10	10	0	0.765	+	NS
Flint-Rock Creek	44.3	41.3	-6.8	10	6	4	0	0.575	+	NS
Upper Clark Fork River	47.5	53.7	13	10	4	6	0	0.445	+	NS
Missouri River Basin	48.9	52.8	8.1	74	27	46	1	0.023	+	+
Red Rock River	43.9	41.4	-5.7	12	5	7	0	0.81	+	NS
Big Hole River	53.2	60.6	13.9	26	10	16	0	0.118	+	NS
Beaverhead River	Not enough managed sites for trend									
Ruby River	44.9	55.6	24	8	1	7	0	0.018	+	+
Jefferson River	40.4	43.7	8.2	7	2	5	0	0.31	+	NS
Madison River	40.8	42.0	2.8	11	6	4	1	0.959	+	NS
Boulder River	60.5	59.6	-1.5	8	4	4	0	0.889	+	NS

Based on data presented in Table 8, percent pools are unchanged across the Beaverhead-Deerlodge NF except in the Missouri River basin and the Ruby River subbasin, where pool percentage increased significantly. For example, there was a 24% increase in percent pools in the Ruby River subbasin. Everywhere else saw insignificant increases or decreases in percent pools.

Large Woody Debris (LWD)

PIBO measures large wood, which is important for instream habitat for aquatic species and stream form and function. PIBO characterizes large wood as being greater than 1 meter in length and at least 10 cm in diameter one-third of the way up from the base. Some portion of the stem must extend below the bankfull elevation and it must be dead. The frequency of large wood is then recorded as the number of pieces per kilometer. Table 9 displays trends in large wood frequency by basin and sub-basin on the Beaverhead-Deerlodge NF at managed sites.

Table 9. Trend in large wood frequency across the Beaverhead-Deerlodge NF, split by basin and sub-basin. Time1 = mean during first visit; Time2 = mean value for last visit; Percent Change = Percent change in the mean values between the first and last visit; Sample size = number of observations with repeat visits; Negative Number = Number of sites where actual measurement was lower on last visit; Positive Number = Number of sites where actual measurement was higher in last visit; None Number = Number of sites where last visit and first visit values were equal; P-value = Significance test where p-value < 0.10 is significantly

different; Desired Direction = direction of change in the mean, which can either be + or -; Actual Change = actual direction of change in the mean, which can be no statistically significant (NS), + or -.

Basin/Sub-Basin	Time1 Value	Time2 Value	Percent Change	Sample Size	Negative Number	Positive Number	No Change Number	P-value	Desired Condition	Actual Change
Columbia River Basin	62.1	76.4	30.2	20	4	16	0	0.004	+	+
Flint-Rock Creek	46.1	75.9	64.5	10	2	8	0	0.047	+	+
Upper Clark Fork River	78.0	76.8	-1.5	10	6	4	0	0.799	+	NS
Missouri River Basin	97.2	100.9	3.9	74	36	25	13	0.407	+	NS
Red Rock River	44.1	34.7	-21.4	12	6	1	5	0.128	+	NS
Big Hole River	111.5	113.0	10.3	26	13	11	2	0.841	+	NS
Beaverhead River	Not enough managed sites for trend									
Ruby River	54.2	47.5	-12.4	7	2	2	3	0.715	+	NS
Jefferson River	66.5	42.3	-36.3	7	6	1	0	0.043	+	-
Madison River	201.1	221.2	10	11	4	5	2	0.953	+	NS
Boulder River	84.7	96.6	14	8	4	4	0	0.401	+	NS

Based on data presented in Table 9, large wood frequency is unchanged across the Beaverhead-Deerlodge NF except in the Columbia River basin, Flint-Rock Creek subbasin (both with an increase in large wood frequency), and the Jefferson River subbasin where large wood frequency decreased significantly. There was a 64.5% increase in the Flint-Rock Creek subbasin, which is an improvement for instream aquatic habitat and channel form and function. Everywhere else saw insignificant increases or decreases in large wood frequency.

Bank Angle

Bank angle is an important metric measured by PIBO to look at the steepness of banks. The higher the angle of the bank, the more susceptible it is to erosion and instability. Table 10 displays trends in bank angle by basin and sub-basin on the Beaverhead-Deerlodge NF at managed sites. The lower the bank angle displayed indicates more desirable conditions. Bank angles <45 degrees are summarized as 45 degrees.

Table 10. Trend in bank angle across the Beaverhead-Deerlodge NF, split by basin and sub-basin. Time1 = mean during first visit; Time2 = mean value for last visit; Percent Change = Percent change in the mean values between the first and last visit; Sample size = number of observations with repeat visits; Negative Number = Number of sites where actual measurement was lower on last visit; Positive Number = Number of sites where actual measurement was higher in last visit; None Number = Number of sites where last visit and first visit values were equal; P-value = Significance test where p-value < 0.10 is significantly different;

Desired Direction = direction of change in the mean, which can either be + or -; Actual Change = actual direction of change in the mean, which can be no statistically significant (NS), + or -.

Basin/Sub-Basin	Time1 Value	Time2 Value	Percent Change	Sample Size	Negative Number	Positive Number	No Change Number	P-value	Desired Condition	Actual Change
Columbia River Basin	102.5	99.4	-3	20	11	8	1	0.615	-	NS
Flint-Rock Creek	101.9	96.1	-5.7	10	6	4	0	0.45	-	NS
Upper Clark Fork River	103.1	102.7	-0.4	10	5	4	1	0.953	-	NS
Missouri River Basin	100.3	102.3	2	74	29	44	1	0.027	-	+
Red Rock River	107.2	104.8	-2.3	12	7	5	0	0.637	-	NS
Big Hole River	97.3	101.3	4.2	26	9	16	1	0.017	-	+
Beaverhead River	Not enough managed sites for trend									
Ruby River	103.7	105.9	2.1	7	1	6	0	0.176	-	NS
Jefferson River	97.4	100	2.6	7	3	4	0	0.398	-	NS
Madison River	104.7	105.6	0.9	11	6	5	0	0.858	-	NS
Boulder River	94.6	98.6	4.3	8	2	6	0	0.107	-	NS

Based on data presented in Table 10, bank angle is unchanged across the Beaverhead-Deerlodge NF except in the Missouri River basin and the Big Hole River subbasin, where bank angle increased significantly, indicating that banks are becoming steeper and more prone to erosion and failure. For the most part, bank angle changed very little across the forest.

D50 (Median Substrate Size)

Channel substrate size is often characterized using the Wolman pebble count method by sampling particles across the stream channel, from bankfull to bankfull. A D50 (median substrate size) that is trending upwards indicates that stream particles are becoming larger, indicating less fines in the system that can fill pools and cause negative impacts to aquatic species. Table 11 displays trends in median substrate size by basin and sub-basin on the Beaverhead-Deerlodge NF at managed sites.

Table 11. Trend in D50 (median substrate size) across the Beaverhead-Deerlodge NF, split by basin and sub-basin. Time1 = mean during first visit; Time2 = mean value for last visit; Percent Change = Percent change in the mean values between the first and last visit; Sample size = number of observations with repeat visits; Negative Number = Number of sites where actual measurement was lower on last visit; Positive Number = Number of sites where actual measurement was higher in last visit; None Number = Number of sites where last visit and first visit values were equal; P-value = Significance test where p-value < 0.10 is significantly

different; Desired Direction = direction of change in the mean, which can either be + or -; Actual Change = actual direction of change in the mean, which can be no statistically significant (NS), + or -.

Basin/Sub-Basin	Time1 Value	Time2 Value	Percent Change	Sample Size	Negative Number	Positive Number	No Change Number	P-value	Desired Condition	Actual Change
Columbia River Basin	0.0312	0.0339	8.7	20	8	10	2	0.199	+	NS
Flint-Rock Creek	0.0292	0.0332	13.7	10	4	4	2	0.401	+	NS
Upper Clark Fork River	0.0331	0.0346	4.4	10	4	6	0	0.241	+	NS
Missouri River Basin	0.0309	0.0272	-11.9	74	38	27	9	0.064	+	NS
Red Rock River	0.0222	0.0168	-24.3	12	8	2	2	0.028	+	-
Big Hole River	0.0321	0.0321	0	26	14	10	2	0.539	+	NS
Beaverhead River	Not enough managed sites for trend									
Ruby River	0.0402	0.0433	7.6	7	1	6	0	0.236	+	NS
Jefferson River	0.0139	0.0122	-12.3	7	4	2	1	0.463	+	NS
Madison River	0.0383	0.0308	-19.7	11	6	2	3	0.123	+	NS
Boulder River	0.0342	0.0167	-51.2	8	5	2	1	0.091	+	-

Based on data presented in Table 11, median substrate size is unchanged across the Beaverhead-Deerlodge NF except in the Red Rock and Boulder River subbasins, where median substrate size decreased significantly, indicating that stream substrates are becoming smaller. All but one of the subbasins in the Missouri River basin showed decreases in the median substrate size, indicating stream substrates across the basin are becoming smaller. In the Columbia River basin, all subbasins showed an increase in substrate size, albeit not significant.

Aquatic Invertebrates

To assess the status of macro-invertebrates, the macro-invertebrate taxa ‘observed’ (O) in a reach are compared to the assemblages ‘expected’ (E) to be found in relatively pristine reference reaches. This metric is called the O/E score. The PIBO O/E model was developed using macro-invertebrate samples collected at 201 reference reaches between 2001 and 2005. The O/E index score for each reach is estimated by dividing the number of expected taxa by the number of observed taxa. A monitoring site with an O/E score of ‘1’ indicates that all the macro-invertebrate taxa expected at a reference site (with similar geographical setting and characteristics) were found at the site, while a value of ‘0’ indicates that none of the taxa expected were found. Scores > 0.8 are generally considered similar to reference reaches. Scores > 1 are either equivalent to what would be expected at a reference reach or may have an enhanced insect community as a result of some type of enrichment.

Table 12. Trend in O/E macroinvertebrate scores across the Beaverhead-Deerlodge NF, split by basin and sub-basin. Time1 = mean during first visit; Time2 = mean value for last visit; Percent Change = Percent change in the mean values between the first and last visit; Sample size = number of observations with repeat visits; Negative Number = Number of sites where actual measurement was lower on last visit; Positive Number = Number of sites where actual measurement was higher in last visit; None Number = Number of

sites where last visit and first visit values were equal; P-value = Significance test where p-value < 0.10 is significantly different; Desired Direction = direction of change in the mean, which can either be + or -; Actual Change = actual direction of change in the mean, which can be no statistically significant (NS), + or -.

Basin/Sub-Basin	Time1 Value	Time2 Value	Percent Change	Sample Size	Negative Number	Positive Number	No Change Number	P-value	Desired Condition	Actual Change
Columbia River Basin	0.82	0.93	13.4	19	7	12	0	0.059	+	+
Flint-Rock Creek	0.7	0.93	31.8	9	3	6	0	0.051	+	+
Upper Clark Fork River	0.93	0.94	0.9	10	4	6	0	0.575	+	NS
Missouri River Basin	0.79	0.73	-7.4	62	38	24	0	0.103	+	NS
Red Rock River	0.71	0.71	0.4	11	7	4	0	0.722	+	NS
Big Hole River	0.85	0.75	-11.9	24	16	8	0	0.116	+	NS
Beaverhead River	Not enough managed sites for trend									
Ruby River	0.72	0.76	5.1	5	2	3	0	0.686	+	NS
Jefferson River	0.65	0.65	0.1	6	3	3	0	0.917	+	NS
Madison River	0.9	0.78	-13.8	7	5	2	0	0.499	+	NS
Boulder River	0.8	0.69	-12.9	8	5	3	0	0.327	+	NS

Table 12 shows that there has been no statistically significant change in O/E macroinvertebrate scores across the forest except in the Columbia River Basin and Flint-Rock sub-basin, where there was a 13.4% and 31.8% improvement in scores over the period of survey, respectively. There was no significant change in the Madison River basin. There was a positive change (although not statistically significant) in 5 of the 8 sub-basins on the forest and a negative change in three sub-basins (Big Hole, Madison and Boulder River). It is noteworthy that all subbasins in the Missouri River basin showed scores less than 0.8, indicating these sites are deviating away from reference conditions.

Watershed Condition Class

Since the adoption of the Watershed Condition Framework in 2011, the Beaverhead-Deerlodge National Forest has moved two priority subwatersheds from one condition class to another – Upper Divide Creek and Selway Creek.

Upper Divide Creek is a tributary to the Big Hole River, which serves as an important water body for surrounding communities to use for both agricultural and recreational activities. Much of the Big Hole River tributary system, including Upper Divide Creek, are listed as an impaired water due to nutrient, sediment, and water temperature issues resulting from a history of agricultural practices and flow alterations from water diversions. Although the headwaters located on-Forest are not considered impaired, they had experienced diminished floodplain connectivity, loss of riparian woody vegetation, and natural water storage as beavers had been absent and dams fallen into disrepair. This affected the quality and complexity of aquatic and riparian habitat both on-Forest as well as those lands downstream from the Forest boundary. Accomplishments in the Upper Divide Creek subwatershed include: one wetland delineation

report, additional 12,900 ft³ of water storage, small but measurable increase in surface flow, 13 acres of meadow conifer encroachment treated, 12 beaver dam analogs constructed, 1 mile of stream habitat restored, and 2 miles of native Westslope Cutthroat Trout habitat restored. The Watershed Condition Class improved from 1.4 to 1.1 (based on a rating scale of 1.0 to 3.0). The forest completed this watershed restoration action plan in 2019.

The Selway Creek watershed is located south of the Big Hole Divide and is a headwater tributary of Horse Prairie Creek, one of the two major drainages that form the Beaverhead River in southwest Montana. This watershed is unique because the Forest Service acquired the valley bottom; usually valley bottoms are in private ownership. Selway Creek meadows was acquired from the Dragging Y Cattle Company by the Beaverhead – Deerlodge National Forest (BDNF) over 2006 and 2007 through LWCF (Land and Water Conservation Fund) funding and the Montana Trust for Public Lands. The acquisition brought approximately 1,280 acres into public ownership under BDNF management. Prior to public acquisition, was used as private summer pasture. The property has historically been flood irrigated to increase green summer forage for cattle. It has been incorporated into an adjacent grazing allotment with forage use directed by grazing standards prescribed by the 2009 Forest Plan. Flood irrigation has continued since acquisition of the property, with most water withdrawal occurring between mid-April and the end of June.

Native Westslope Cutthroat Trout is a Forest Service (FS) Northern Region (R1) sensitive species and is absent from the watershed. Non -native brook trout are the dominant fish species. Western Pearlshell mussel are also an R1 sensitive species. The population in Selway Creek has experienced substantial lapses in recruitment, resulting in a poor age class distribution, and a less than desirable population structure. Intermittent recruitment is believed to be caused by the absence of its preferred intermediate host; Westslope Cutthroat Trout.

There was a need to evaluate and understand effects of the existing water diversion and irrigation on meadow flora, wildlife and aquatic habitats. Selway Meadow was acquired in 1997, through purchase from a private landowner. Water diversion and irrigation for forage production have occurred there for many decades. During negotiations to acquire the property, the Forest agreed to continue irrigating.

This acquisition was given high priority due to the area's substantial wildlife and fisheries values. Understanding the significance of current resource trade-offs associated with water withdrawal and irrigation will allow us to refine our integrated restoration approach so it ensures an appropriate balance of benefits across resources. The irrigation infrastructure in Selway Meadow was failing and needed to be rehabilitated in many locations. Information gained from our evaluation of the irrigation system allowed us to optimize efficiencies while considering wildlife and aquatic resources and investment costs. Changes to the existing irrigation infrastructure were needed to maximize efficiencies in some places and reduce impacts in others.

Riparian areas lacked willows in many stream reaches within the Meadow. Vegetative recovery was needed to provide shade and lower stream temperatures. Improvements in grazing management since 2007 have resulted in the beginning of willow regeneration along many stream reaches. Additionally, road derived sediment is a problem in some areas. Road drainage and stream crossing upgrades were needed in key locations.

Eight essential projects were completed beginning in 2014 through 2020. They included: allotment infrastructure improvements (water developments, riparian fencing, etc.), riparian recovery monitoring (stream temperature, vegetative recovery), cutthroat barrier design and

installation, irrigation optimization (ditch reroutes, elimination, etc.), irrigation infrastructure improvements (head gate repairs, etc.), native species restoration and non-native removal, and road sediment reduction (cross drains and culverts).

Discussion

This monitoring question specifically asks: “*Have restoration activities resulted in improved watershed condition*”? It is difficult to answer this question with the indicators listed for this question. However, it is easier to quantify if management actions on the forest are resulting in improved watershed condition, especially with PIBO data. In this monitoring report we looked at five indicators across the forest and trends to determine if conditions are improving, while they are not tied directly to restoration actions, they are tied to management in general. Findings for the five indicators at the basin and subbasin level include:

- Columbia River basin – significant improvement in residual pool depth, large wood frequency and aquatic invertebrate assemblages.
- Missouri River basin – significant improvement in percent pools and declining trend in bank angle (banks are becoming steeper).
- Flint-Rock subbasin – significant improvement in residual pool depth, large wood frequency and aquatic invertebrate assemblages.
- Upper Clark Fork subbasin – significant improvement in residual pool depth.
- Red Rock subbasin – declining trend in residual pool depth and channel substrate (substrates are becoming smaller).
- Big Hole subbasin – declining trend in bank angle (banks are becoming steeper).
- Ruby subbasin – significant improvement in percent pools.
- Jefferson subbasin – declining trend in large wood frequency.
- Madison subbasin – no change.
- Boulder subbasin – declining trend in channel substrate (substrates are becoming smaller).

In general, aquatic habitat indicators appear to be improving in the Columbia River basin and associated subbasins on the forest, especially pool quality, large wood and aquatic invertebrate assemblages. There were no indicators with declining trends in the basin, so this is a good sign that either conditions are static or improving. In the Missouri River basin, most indicators are also unchanged, but there are signs of declining trends in the subbasin, especially bank angle and channel substrates. Again, most indicators in the basin are in a static trend, indicating that management is maintaining stream conditions on the forest.

The forest has only moved two subwatersheds into a “Properly Functioning” condition class through the Watershed Condition Framework process – Upper Divide and Selway Creek. This has been over a span of almost 10 years. The forest has 134 subwatersheds that are “Functioning at Risk”, so the forest has moved a little more than 1% of subwatersheds into a “Properly Functioning” class. The forest recognizes that more work can be done to identify priority subwatersheds, complete Watershed Restoration Action Plans (WRAPs) and move subwatersheds to Functioning Properly condition class.

The forest found it extremely difficult to answer the question: “*Have restoration activities resulted in improved watershed condition*” with the indicators identified? We currently do not

have a good set of data tied to our restoration actions that can show long-term that our restoration actions have resulted in improved watershed condition. Some PIBO sites overlap with watersheds where restoration has taken place, but there is no way to correlate whether that restoration is what improved conditions; or, that management is leading to improvements in physical habitat conditions. Our observation is that restoration actions are implemented as prescribed, and they are leading to overall benefits in the watershed. We believe that the indicators provided are sufficient, but either the question needs to be changed to “*Have management activities resulted in improved watershed conditions*”? or combine and revise this monitoring question with Monitoring Question #1 “*What is the status and trend of watershed ecological conditions on the Forest*”? It also makes more sense to move the summary of PIBO instream physical habitat to Monitoring Question #4 “*What is the status of stream and riparian conditions*”? We suggest dropping this monitoring question completely and combining the information into other monitoring questions.

Findings

Table 13. Summary of findings for Monitoring Item 2

MONITORING ITEM	YEAR UPDATED	PLAN IMPLEMENTATION STATUS ¹ Do monitoring results demonstrate intended progress (i.e. maintaining, trending, or advancing) of the associated plan components listed with this monitoring item?	RECOMMENDATION Based on the evaluation of monitoring results, may changes be warranted?	MANAGEMENT If a change may be warranted, where may the change be needed? ²
MON – 2: Key Watersheds Have restoration activities resulted in improved watershed condition?	2021	(C) Uncertain – This monitoring question is difficult to answer with the indicators provided.	Yes	Monitoring Program: Information here can be adequately addressed in Monitoring Items 1 and 4. Recommend dropping this monitoring item and combining the data with Item 1.

¹ **PLAN IMPLEMENTATION STATUS:** (A) Uncertain - Interval of data collection beyond this reporting cycle (indicate date of next time this monitoring item will be evaluated); (B) Uncertain - More time/data are needed to understand status or progress of the Plan Component(s); (C) Uncertain - Methods inadequate to assess the status or progress toward achieving plan component(s). (D) NO - Implementation of Plan Component(s) ARE NOT trending, progressing, and/or conducted as desired; (E) YES - Implementation of Plan Component(s) ARE trending, progressing, and/or conducted as desired

² **[36 CFR 219.12(d)(2)]** - The monitoring evaluation report must indicate whether or not a change to the (1) plan, (2) management activities, (3) the monitoring program, or a (4) new assessment, may be warranted based on the new information. The monitoring evaluation report must be used to inform adaptive management of the plan area

Monitoring Item 3 – Watershed Analysis

Monitoring Item Summary

Table 14. Summary for Monitoring Item 3

Monitoring Question	Plan Component(s)	Indicators*	Data collection interval	Data Source / Partner	Point of Contact
Are restoration and conservation activities focused in priority (key) watersheds?	Watershed analysis: Prepare and maintain a schedule for completing watershed analysis, with emphasis on key watersheds shown on page 58, or listed in Appendix H (Forest Plan, p. 16).	Projects completed in key and other watersheds (number and type of) (N).	Annually	Watershed Improvement Tracking (WIT) database, NRM	Jennifer Mickelson, Watershed Program Manager, Beaverhead – Deerlodge National Forest
* Indicator influenced by climate change? Y = Yes; N = No; U = Uncertain					

Table 15. Monitoring Item 3 - Monitoring Collection Summary

For monitoring item 3:	Year
Data was last collected or compiled in:	2020
Next scheduled data collection/compilation:	2021
Last BMER evaluation for this monitoring item:	n/a
Next scheduled BMER evaluation of this monitoring item:	2023

The Forest management objective to prepare and maintain a schedule for completing watershed analysis, with emphasis on key watersheds, is designed to ensure that the Forest is accomplishing restoration and conservation activities in key areas for the benefit of aquatic species and their habitat. This monitoring report highlights whether the forest is making progress towards desired conditions in key watersheds on the Forest.

Methods

In the 2009 Forest Plan, the Beaverhead-Deerlodge NF designated both fish and restoration parameters for key watersheds on the Forest. “Fish: Key Watershed” parameters are selected for focusing on federal funds and personnel for the purpose of protecting, restoring or maintaining viability of Threatened, Endangered and Sensitive aquatic species. “Restoration: Key Watersheds” are selected for focusing funds and personnel for the purpose of accelerating improvements in water quality and watershed conditions. There are 56 fish key watershed and 15 Restoration Key Watersheds. Key watersheds will often receive priority over non-key watersheds for watershed analyses and restoration work, but not always. As watershed analysis and subsequent restoration projects are completed restoration watersheds may be removed from the list and others added (Beaverhead-Deerlodge Forest Plan Appendix H, page 1).

Management in Fish Key Watersheds emphasizes conservation of Westslope Cutthroat Trout and Bull Trout by protecting and restoring components, processes, and landforms that provide quality habitat. The objective for selecting Fish Key Watersheds was to prescribe this management direction to a well distributed group of the strongest populations across the Forest. The length of stream occupied by a population was used as the primary indicator for population strength. Watersheds with cutthroat populations which are, or nearly are, genetically pure, tended to receive greater consideration than those with lower percentages of purity. Achieving an adequate distribution was important. For this reason, some key watersheds were selected which have less robust populations than some others on the Forest. Maintaining migratory life histories is an important element of conservation. Thus, where connected habitats were important in sustaining populations, groups of watersheds were selected. The result was the clumping of key watersheds in the Rock Creek drainage.

Management in Restoration Key Watersheds emphasizes restoration of integrated ecological processes at the watershed scale. A paper in the project file details methods and data used to identify priority restoration watersheds, “*A Method to Identify Priority Restoration Watersheds for Use in the Region 1 Integrated Restoration and Protection Strategy*,” Bryce A. Bohn, Hydrologist, Beaverhead-Deerlodge NF, 2007. The method was developed for Region One (R1) use and implemented on the BDNF.

Watersheds were prioritized by identifying, evaluating, and ranking anthropogenic activities known to influence watershed condition. This assumes more activity in or near streams translates to a higher risk to watershed function. The metrics used to assess watershed risk are included in Appendix H of the Forest Plan.

The Watershed Improvement Tracking (WIT) database is a Natural Resource Manager (NRM) tool used by the Forest Service to track watershed improvements across the landscape by Forest. It is also the database of record of accomplishment reporting for miles of stream habitat enhanced and acres of soil and watershed improved. For this exercise, watershed improvements recorded in the WIT database are overlaid with key watersheds to determine the number and type of projects completed in key and other watersheds.

Results

There are 56 fish key watershed and 15 Restoration Key Watersheds identified on the Beaverhead-Deerlodge NF. Table 16 lists fish and Restoration Key Watersheds where no watershed improvements were recorded in the WIT database. These projects go back to 2007 when the forest first started recording watershed improvement projects in WIT.

Table 16. Key watersheds where no watershed improvements were recorded in WIT.

Watershed	Resource Emphasis	District
Blacktail	Fisheries	Butte
Columbus Gulch	Fisheries	Butte
Andrus	Fisheries	Dillon
Bear-Lima	Fisheries	Dillon
Fox	Fisheries	Dillon
Nicholia Lower	Fisheries	Dillon
Painter	Fisheries	Dillon

Reservoir	Fisheries	Dillon
Boulder Lower	Fisheries	Jefferson
Boulder Upper	Fisheries	Jefferson
Little Boulder Upper	Fisheries	Jefferson
Burnt	Fisheries	Madison
California	Fisheries	Madison
Horse	Fisheries	Madison
Idaho	Fisheries	Madison
Soap	Fisheries	Madison
Bielenberg	Fisheries	Pintler
Copper-AP Wild	Fisheries	Pintler
EF Rock Upper	Fisheries	Pintler
Fred	Fisheries	Pintler
Lower Willow Cr	Fisheries	Pintler
Meadow-Philipsburg	Fisheries	Pintler
Rock Upper	Fisheries	Pintler
Ross Fork Rock	Fisheries	Pintler
Sand Basin	Fisheries	Pintler
SF Ross Fork	Fisheries	Pintler
SF Willow	Fisheries	Pintler
Stony	Fisheries	Pintler
Plimpton	Fisheries	Wisdom
Deep	Fisheries	Wise River
Jerry	Fisheries	Wise River
Squaw-Pioneers	Fisheries	Wise River
Birch	Restoration	Dillon
Lost-Pioneer	Restoration	Dillon
Saginaw	Restoration	Dillon
Willow Lower	Restoration	Dillon
Beaver (Little Boulder)	Restoration	Jefferson
Hells Canyon	Restoration	Jefferson
Little Boulder Lower	Restoration	Jefferson
North Fork Little Boulder	Restoration	Jefferson
South Willow	Restoration	Madison
Moosehorn	Restoration	Wisdom
Seymour	Restoration	Wisdom
Sullivan	Restoration	Wise River

Thirty-two of the 56 (57%) fish key watershed identified in the Forest Plan have not had any watershed improvements completed. Furthermore, 12 of the 15 (80%) Restoration Key Watersheds in the Forest Plan have not had any watershed improvements completed.

Table 17 lists fish and Restoration Key Watersheds on the forest where watershed improvements have taken place. Included in the table is a summary of work accomplished, estimated total funding for watershed improvement actions in the watershed, miles of stream enhanced, or acres of watershed improved, and any other pertinent information.

Table 17. Key watersheds where watershed improvements were recorded in WIT. Table includes type of projects accomplished, estimated funding, miles of stream enhanced, or watershed acres improved, and any other pertinent information such as partners.

Watershed	Emphasis Area	District	Project Type	Cost	Miles of Stream Enhanced	Watershed Acres Improved	Partnerships/Other Information
German Gulch	Fisheries	Butte	Norton Creek WCT Enhancement – Fish Population Suppression (2017)	\$5,950	4.9		Partnership with Montana FWP
			Norton Creek ATV Trail Construction – AOP Bridge (2011)	\$74,380			1.6 miles of trail construction
			Norton Creek Trail Improvements (2011)	\$27,678			2.2 miles of trail maintenance next to stream
Buffalo	Fisheries	Dillon	Brays Canyon WCT Restoration – Non-Native Fish Removal Project (2015-2018)	\$33,160	~10		Partnership with Montana FWP and BLM
Halfway	Fisheries	Jefferson	Halfway Creek Trail AOP Bridge – ATV trail bridge installation (2013)				
			Halfway Creek Trail Improvements (2013)				1.1 miles of trail maintained, drainage and silt fences installed along existing ATV trails
			Pipestone Trail Reconditioning (2013)	\$7,074			1.0 miles of new drainage installed along existing ATV trails
Whitetail Upper	Fisheries	Jefferson	South Arm Whitetail Reservoir Stream Crossing (2014)	\$9,000	3		Narrowing and hardening of wetland crossing to minimize future sediment input into genetically unaltered WCT habitat
Greenhorn	Fisheries	Madison	Greenhorn Creek WCT Restoration – includes chemical removal of non-natives & WCT reintroduction in Greenhorn (N Fk, Meadow Fk, South Fk) and Dark Hollow Creek (2014-2018)	\$50,740	~15		Partnership with Montana FWP, BLM and Turner Enterprises
			South Fork Greenhorn Creek Stream Channel/Road Crossing Restoration (2014)	\$3,200	1		
Indian-Tobacco root	Fisheries	Madison	Hill Reservoir Dam Decommission (2017)	\$23,675	2.2	11.6	

Watershed	Emphasis Area	District	Project Type	Cost	Miles of Stream Enhanced	Watershed Acres Improved	Partnerships/Other Information
Wall	Fisheries	Madison	English George Fish Barrier (2017)	\$17,200	2.1		Partnership with Montana FWP, Northwestern Energy
			Kelly Dam Decommission (WCT Conservation) (2017)		1.2		
Carpp	Fisheries	Pintler	Carpp Creek Trail Culvert Removal (2011)		0.1		
			Carpp Creek Trail 5106 and 8110 Trail Maintenance (2011)				4.7 miles trail maintenance
			Carpp Creek Trail 8024 Improvements (2011)			2	Turnpike and ford construction touch-ups
Copper-Boulder	Fisheries	Pintler	Boulder Lakes Bridge Replacement (3) – for WCT/Bull Trout Benefits (2015)	\$70,400		1	3 bridge replacement
Cottonwood	Fisheries	Pintler	East Deerlodge (EDLV) Road 9331 Obliteration (2020)	\$2,000			0.5 miles road obliteration
			EDLV Road 9332 Closure (2020)	\$14,900			0.8 miles road closure
			EDLV Road Decommissioning (2017-2020)	\$13,795		7	6.3 miles road decommissioning
			North Fork Cottonwood AOP (2020)	\$141,125	1.1		Partnership with Clark Fork Coalition
			Middle Fork Cottonwood Creek 5174 BMPs	\$5,770			2.4 miles of BMPs on road
Falls Fork Rock	Fisheries	Pintler	Middle Fork Rock Creek AOP (2012)	\$38,563			
Foster	Fisheries	Pintler	Foster Creek AOP Dam Removal (2009)		6.3		
Middle Fork Rock	Fisheries	Pintler	Green Canyon AOP Rd 5107 (2018)	\$39,375	5.8	1	Partnership with Trout Unlimited
			UR8-520 Road Decommission (2019)	\$732	1.3		0.3 miles of unauthorized road decommissioning
Middle Fork Rock Lower	Fisheries	Pintler	Senate Creek Rock Vanes (2018)	\$1,145	1	12.5	Partnership with Trout Unlimited
			Middle Fork Rock Creek Riparian Enhancement – Fencing (2007)		0.6		

Watershed	Emphasis Area	District	Project Type	Cost	Miles of Stream Enhanced	Watershed Acres Improved	Partnerships/Other Information
			Senate Creek LWD Additions, Fencing Removal Project (2016)	\$1,260	3.6		
North Fork Rock Lower	Fisheries	Pintler	North Fork Rock Creek Culvert Removal (2008)				Remove fish passage barrier and allow fish to access upstream habitat in North Fork Rock Creek & Mud Lake
North Fork Rock Upper	Fisheries	Pintler	Crystal Creek Culvert Hwy 38	\$128,998	0.1		
Racetrack	Fisheries	Pintler	Racetrack Creek Bank Stabilization (2018)	\$20,615	0.1	2.5	
			Racetrack Creek Bridge Replacement Rd 169 (2009)	\$24,900	0.1		
South Boulder	Fisheries	Pintler	South Boulder Creek Road 677 AOP Culvert Replacement (2010)	\$150,212	0.1		
			Wyman Gulch AOP Culvert Replacements (6 total) (2010)	\$195,704	0.6		
Twin Lakes	Fisheries	Pintler	Twin/4 Mile AOP Culvert Removal (2011)			0.1	
			Twin/4 Mile Rd 113 to Trail (2011)				1.6 miles of road to trail
			Twin/4 Mile Rd 44 Decommission (2011)				0.4 miles road decommission
			Twin/4 Mile Trail Reconstruction				0.5 miles trail reconstruction
Warm Springs	Fisheries	Pintler	Warm Springs Creek AOP – Bridge Placement (2017)	\$186,000	12.7	0.25	Bull Trout Recovery Action, Partnership with US Fish and Wildlife Service
			Road 78415 AOP Barrier Removal (2017)	\$10,403	1		Partnership with US Fish and Wildlife Service, Montana FWP and Trout Unlimited
			Warm Springs Creek Campground Removal (2016)	\$5,000	3.3	57	
			Warm Springs CERCLA Barrier Removal (2016)	\$2,916	9.5		

Watershed	Emphasis Area	District	Project Type	Cost	Miles of Stream Enhanced	Watershed Acres Improved	Partnerships/Other Information
West Fork Rock	Fisheries	Pintler	West Fork Conifer Slashing & Riparian Planting (2008)		2.1	32	Included planting willow along 2 miles of stream and felling lodgepole pine to limit animal access and protect streambanks
			Bowles Creek Debris Jam Removal (2017)	\$300	0.1		
Harvey	Fisheries	Pintler	Harvey Creek Riparian Fencing (2016)	\$1,000	1.1		Partnership with Trout Unlimited
Doolittle	Fisheries	Wisdom	Doolittle Creek (NF & SF) WCT Restoration – Barrier Construction & Non-Native Removal (2014-2020)	\$12,840	4.5		Partnership with Montana FWP and BLM
Cherry Pioneers	Fisheries	Wise River	Cherry Creek WCT Restoration – Non-Native Removal (2014-2020)	\$21,685	12.1		Partnership with Montana FWP and BLM
			Cherry Lake WCT Restoration (2014)	\$900		7.4	Partnership with Montana FWP and BLM
			Granite Lake WCT Restoration (2014)	\$900		7	Partnership with Montana FWP and BLM
Girard Gulch	Restoration	Butte	Perkins Gulch Tree Felling (2019)	\$1,500	1.8		Partnership with Clark Fork Coalition
			Perkins Gulch AOP Improvement (2014)	\$17,000			
Willow Upper	Restoration	Dillon	Gorge Lake Trail Reconstruction (2016)	\$180,000	1.8		3.4 miles of trail reconstruction
			Tendoy Lake Diversion Removal (2017)	\$3,500	11.3	26	26 acres lake habitat restored
Freezeout	Restoration	Madison	West Fork Madison Riparian Exclosure (2014)	\$13,500	2.5		Partnership with Madison River Foundation & Greater Yellowstone Coalition

Twenty-four of the 56 (43%) fish key watershed identified in the Forest Plan have had some type of watershed improvements completed. Three of the 15 (20%) Restoration Key Watersheds in the Forest Plan have had some type of watershed improvements completed. Over 124 miles of fish habitat and 167 acres of watershed restoration have been improved in fish and Restoration Key Watersheds on the forest since 2007 when the forest started reporting watershed improvements in WIT. In total, over \$1,582,000 has been spent on restoration projects in Fish Key Watersheds and \$215,500 in Restoration Key Watersheds. It is important to note that costs and miles/acres for several projects were not recorded in WIT so the estimate for funds spent and length/acres of watershed restoration is likely much more than these estimates.

Discussion

Fish and Restoration Key Watersheds were identified in the forest plan to help guide managers on prioritizing where actions are implemented on the forest. Management in Fish Key Watersheds emphasizes the conservation of Westslope Cutthroat Trout and Bull Trout by protection and restoring components, processes, and landforms that provide quality habitat. Restoration Key Watersheds emphasizes restoration of integrated ecological processes at the watershed scale. Based on projects displayed in Table 17, the forest has committed resources in approximately 40% of Fish Key Watersheds on the forest, which in a 11-year timeframe since the conception of the Forest Plan seems to be progressing well towards conservation of native trout on the forest. In terms of Restoration Key Watersheds, only 20% have had some sort of restoration action implemented, so activities are lagging in Restoration Key Watersheds as compared to Fish Key Watersheds. An impressive amount of funds has been put towards restoration in key watersheds on the forest. It is unclear as to whether the full intent of the Forest Plan is being implemented in terms of watershed analysis. Watershed analyses are not being completed in key watersheds, even though restoration actions are. It would be helpful for the forest to identify restoration actions in all key watersheds in the future to keep a running list of activities that need to be completed. Future Watershed Restoration Action Plans (WRAPS) should also be tiered towards key watersheds in the future, where appropriate. The forest is doing an adequate job of implementing projects in key watersheds and using partnerships to help leverage those projects.

Findings

Table 18. Summary of findings for Plan Monitoring Item 3.

MONITORING ITEM	YEAR UPDATED	PLAN IMPLEMENTATION STATUS ¹ Do monitoring results demonstrate intended progress (i.e. maintaining, trending, or advancing) of the associated plan components listed with this monitoring item?	RECOMMENDATION Based on the evaluation of monitoring results, may changes be warranted?	MANAGEMENT If a change may be warranted, where may the change be needed? ²
MON – 3: Watershed Analysis Are restoration and conservation activities focused in priority (key) watersheds?	2021	((E) Yes – although only 20% of the Restoration Key Watersheds have had restoration activity implemented, the forest has committed resources in approximately 40% of Fish Key Watersheds on the forest,	Yes	Management Activities: The forest should identify specific restoration needs in all fish and Restoration Key Watersheds. This

MONITORING ITEM	YEAR UPDATED	PLAN IMPLEMENTATION STATUS ¹ Do monitoring results demonstrate intended progress (i.e. maintaining, trending, or advancing) of the associated plan components listed with this monitoring item?	RECOMMENDATION Based on the evaluation of monitoring results, may changes be warranted?	MANAGEMENT If a change may be warranted, where may the change be needed? ²
		which in a 11-year timeframe since the conception of the Forest Plan seems to be progressing well towards conservation of native trout on the forest.		would help move towards the aquatic's goals and objectives for Fish and Restoration Key Watersheds. The forest should assess whether restoration actions are complete in some key watersheds and if new watersheds should be considered.

¹ **PLAN IMPLEMENTATION STATUS:** (A) Uncertain - Interval of data collection beyond this reporting cycle (indicate date of next time this monitoring item will be evaluated); (B) Uncertain - More time/data are needed to understand status or progress of the Plan Component(s); (C) Uncertain - Methods inadequate to assess the status or progress toward achieving plan component(s). (D) NO - Implementation of Plan Component(s) ARE NOT trending, progressing, and/or conducted as desired; (E) YES - Implementation of Plan Component(s) ARE trending, progressing, and/or conducted as desired

² **[36 CFR 219.12(d)(2)]** - The monitoring evaluation report must indicate whether or not a change to the (1) plan, (2) management activities, (3) the monitoring program, or a (4) new assessment, may be warranted based on the new information. The monitoring evaluation report must be used to inform adaptive management of the plan area

Monitoring Item 4 – Stream Channels

Monitoring Item Summary

Table 19. Summary for Monitoring Item 4.

Monitoring Question	Plan Component(s)	Indicators*	Data collection interval	Data Source / Partner	Point of Contact
What is the status of stream and riparian conditions?	Riparian Management Objectives. Standard 1 & 7 (see below).	Functional status of stream segments (Y).	Every 5 years for each 4th code HUC	Integrated Riparian Monitoring Program	Kevin Weiner, Hydrologist, Beaverhead – Deerlodge National Forest Jessie Salix, Botanist, Beaverhead-Deerlodge National Forest

* Indicator influenced by climate change? Y = Yes; N = No; U = Uncertain

Table 20. Monitoring Item 4 - Monitoring Collection Summary.

For monitoring item 4:	Year
Data was last collected or compiled in:	2021
Next scheduled data collection/compilation:	2023
Last BMER evaluation for this monitoring item:	n/a
Next scheduled BMER evaluation of this monitoring item:	2023

Standard 1 for aquatic resources deals for Riparian Conservation Areas (RCA): Any activity in RCAs shall be designed to enhance, restore, or maintain the physical and biological characteristics of the RCA by implementing the following requirements:

1. Activities in RCAs, that meet or exceed RMOs (Riparian Management Objectives), must be designed to maintain existing stream function. Activities in RCAs that are not meeting RMOs shall include a restoration component, commensurate with the scope of the activity affecting the fishery, which trends towards accomplishing desired stream function, as part of the project.
2. Activities in RCAs shall not result in long-term degradation to aquatic conditions. Limited short-term effects from activities in the RCA may be acceptable when outweighed by the long-term benefits to the RCA and aquatic resources.

Standard 7 for aquatic resources addresses grazing management. Standard 7 Guidance is defined in 16.2 – Section 1 (Permit Administration) of *Beaverhead-Deerlodge Supplement No. 2209.13-98-1*; which is a supplement to the Grazing Permit Administration Handbook Title 2209.13. Standard 7 will become mandatory rather than discretionary in Fish Key Watersheds when grazing contributes to degraded Westslope Cutthroat Trout or Bull Trout stream conditions. Standard 7 will also become mandatory when there is non-compliance with livestock grazing standards; or, other aspects of livestock grazing permits terms and conditions.

The Forest management objective to protect stream condition through grazing management is accomplished, in part, through application of annual use measures (AUMs). The long-term evaluation of stream condition is completed using the Beaverhead-Deerlodge Integrated Monitoring protocol. This measure is used to evaluate the effectiveness of the grazing program at the 4th code watershed level. This objective would be achieved by managing grazing use while protecting aquatic resources, where feasible, based on the framework of the Clean Water Act and Forest Plan standards.

Methods

The review of stream conditions in the context of Monitoring Item #4, serves as a check on the efficacy of grazing management. These reviews are used to assess whether grazing management is consistent with the legal framework laid out in the Forest Plan and Clean Water Act. The review of stream conditions in these watersheds will also address affects from activities such as timber management, road use, recreational trails, and other anthropomorphic impacts. The effects of these activities would be considered minor in these watersheds. These activities are considered minor in these watersheds because of the landscape and the fact that these activities are occurring but at a lesser intensity then grazing.

The Integrated Monitoring protocol was developed in 2003 and has been modified regularly to keep up with the best science available. The current protocol allows us to analyze stream

condition using the most relevant morphological indicators while allowing us to compare historical stream condition and determine trend through repeated stream measurements on the same reaches. Due to capacity challenges, we were not able to complete all of the measures in the protocol but were able to qualitatively evaluate the riparian management objectives of the stream reaches to provide a functional status assessment of the reaches. This was paired with a quantitative vegetation assessment that provide some indication of trend through the vegetative communities.

These stream reaches should not be extrapolated to the entire forest but should be sufficient to represent riparian conditions in the Ruby and Madison Watersheds. In future BMER reports we will include reports for additional 4th Code Watersheds as we read and summarize IRM (Integrated Riparian Monitoring) data in 5yr intervals. The PIBO dataset will also be used in future BMER reports to provide a more complete analysis of stream and riparian conditions across the Beaverhead Deerlodge National forest.

Results

A total of 18 streams were surveyed over multiple years and assessed in the 2021 Madison/Ruby Integrated Riparian Report. The results of these 18 streams provide a range in riparian conditions across the Ruby and Madison watersheds but are not meant to be used for allotment level decisions. Long-term monitoring provides a suitable assessment for general large-scale trends. However, with only two measurements completed for each reach in these watersheds, detailed trend information has limited utility especially given the amount of seasonal variability that occurs on these landscapes.

The following tables represent the results of the analysis completed in the Ruby/Madison Integrated Riparian Management report. These summary tables provide a comparison between the surveys conducted in 2012 and 2018 by the botany seasonal crews. Hydrology summary information compiled in Figure 4 was collected primarily in 2019-2020 and established the morphological functional status of the reaches through a series of qualitative questions designed to evaluate Forest Plan identified riparian management objectives. These questions are:

1. Is the vegetation adequate and in good condition to support banks from high flow events?
2. Is the reach representative of grazing conditions above and below the reach?
3. Is there evidence of water accessing the floodplain every 1-2 years?
4. Is the channel vertically stable, or is there evidence of headcuts or entrenchment?
5. Is the channel a transport or depositional channel type and what should it be given its location on the landscape?
6. Is there good pool habitat or is it limited by large wood recruitments or other pool scour structures?
7. Can stream carry and manage the natural sediment load from the upstream watershed or is there evidence of excess sediment?
8. Is there channel instability? If so, is it related to anthropomorphic (including grazing) or natural stressors?
9. Are there any effects to stream other than cattle grazing?

Figures 2 and 3 illustrate that most reaches had higher introduced species composition in 2018, with some reaches having 25% or more relative cover of introduced species: French Gulch,

Johnny Gulch, Sawlog Creek, and Tributary Creek. Several reaches had 25% or more relative frequency of introduced species: Burnt Creek, French Gulch, Johnny Gulch, and Tributary Creek.

It is apparent in Figure 4 that species richness was higher in 2018 than in 2012 across all sampled reaches. This is likely due to increased species identification and detection skills in the 2018 crew. What may have all been lumped into a single species in 2012, was broken out into one or two different species or varieties.

Species diversity was very high at several reaches (90+ species): Anthill, East Fork Granite, Poison, and Sawlog Creeks, while species diversity was quite low at North Meadow Creek (less than 50 species). The low diversity at North Meadow Creek is likely due to the grass/sedge dominated vegetation which often has lower diversity due to less diverse habitats (fewer treed areas).

Figure 5 depicts the overall functional status of the stream reaches we measured. To summarize the figure, 2/3 of the reaches were rated Functioning at Risk (FAR) to Properly Functioning and 1/3 of the reaches were on the low end of Functioning at Risk (no streams were rated non-functioning). The Forest Plan directs us to manage streams to move towards desired condition but does not necessarily expect all our streams to be at desired condition. Having 33% of streams at the lower end of FAR is an indicator that we have some areas where management may need to improve to move toward forest plan direction.

Ruby and Madison Watershed Reach Level Comparisons

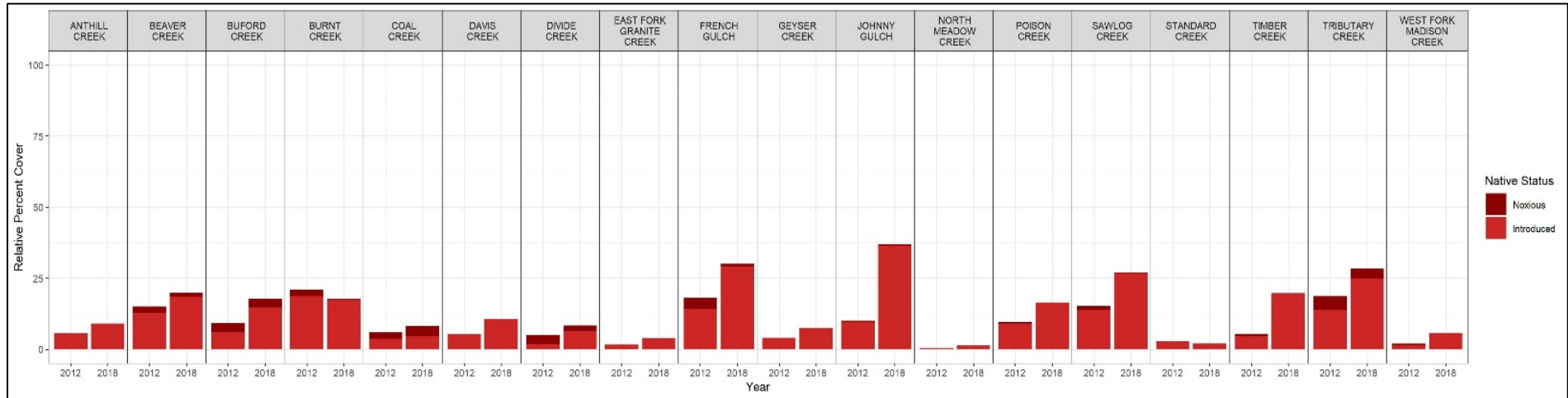


Figure 2. Relative cover of introduced species across reaches. Frequency of Introduced and Noxious Species

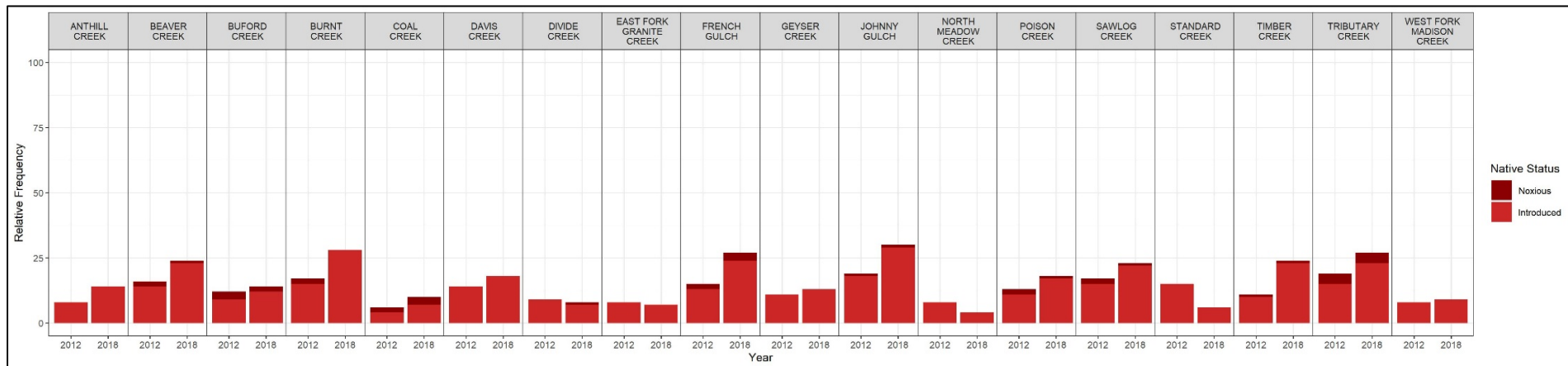


Figure 3. Relative frequency of introduced species across all reaches.

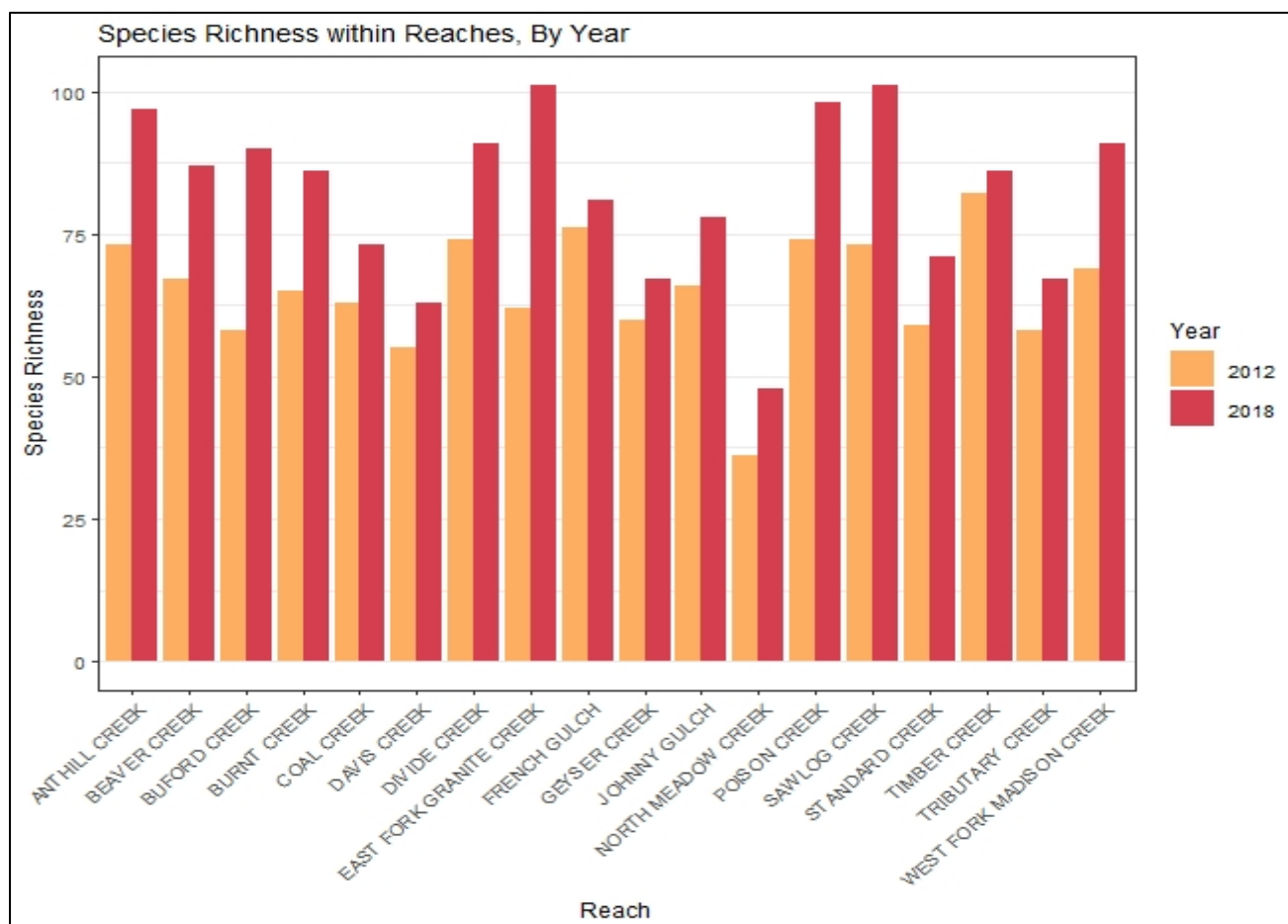


Figure 4. Species richness across all reaches in both 2012 and 2018

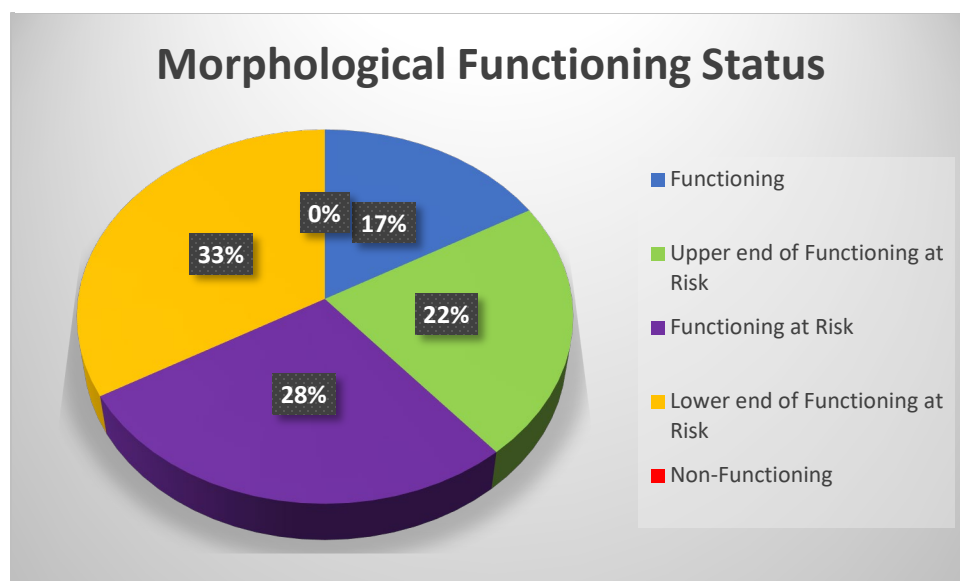


Figure 5. Morphological Functional Status

Discussion

The Integrated Riparian Monitoring program, fully implemented, provides the best long-term stream condition data available on the Beaverhead Deerlodge National Forest. However, recent forest needs, and lack of year-round seasonal help has limited capacity to accomplish this task. In 2019 we recognized these capacity issues and decided to just complete the qualitative portion of the hydrological survey so we could incorporate that information into the botany component of the program. This allowed us to make morphological stream condition calls based on an evaluation of the riparian management objective metrics. This was paired with the fully implemented botany survey that provide quantitative assessments of the vegetative communities that could inform significant trend in the stream reaches.

This change in the assessment process was necessary with the current program staffing but limited our ability to confidently capture overall stream morphological trend. It also left us with a gap of completed annual reports that summarized our findings from the IRM program. We included the Ruby/Madison report data in this BMER cycle because it represents the current set of data from both botany and hydrology. This was the first combined report and a good starting point for answering this monitoring item. This will be a template for the future, with additional 4th code level watersheds being represented each cycle until we have the entire forest assessed. At that point we will be able to discuss this question fully at the forest level.

The PIBO dataset represents another tool with which to evaluate this question. It does not have the same resolution of sites on the forest but does have many sites East of the Continental Divide that can provide a good evaluation of stream condition on our forest. It was not used during this cycle but would be a good measure for the future. The sites selection on the forest is a mix of contract sites and regularly read sites which may dictate the frequency this measure is used. Additional internal discussions will be completed between cycles to determine how the PIBO data are utilized in the future.

Based on 10 years of looking at stream reaches across the Ruby and Madison watersheds, the results from this report appear to be consistent with what we are observing on unmeasured streams across the landscape, so the extrapolation of overall stream condition is accurate. Most of the impacts in these watersheds are associated with grazing management. However, we regularly noted stream conditions were influenced by historical beaver numbers, wildfire impacts, and natural geology. The Gravelly Range, where most of these surveys were completed, is a unique geological setting where natural landslides are common and natural sediment loads in the streams are up to an order of magnitude higher than other places on the forest.

The natural setting can make it difficult to evaluate stream condition, but we are fortunate to have a number of reference reaches with limited grazing impacts in the higher elevation of the Gravellys where bands of sheep are grazed. These streams provide a good baseline for desired condition from both a vegetation and morphology perspective.

Of the 18 streams that were evaluated, 2/3 of the reaches were rated Functioning at Risk (FAR) to Properly Functioning and 1/3 of the reaches were on the low end of Functioning at Risk (no streams were rated non-functioning). The 17% of streams that were Properly Functioning were evaluated to be in desired condition. This is the condition we would strive to meet with our management but likely an unrealistic outcome for all streams.

The increase in introduced species is troubling, it could lead to decreased stream function because introduced species typically do not have root masses capable of protecting sensitive banks. Treating noxious weeds can be a challenge due to proximity of water and herbicide

application restrictions. Introduced species can have a competitive advantage over native plants with consistent grazing so rest and proper management will be important to reverse this trend.

Although increases in species diversity is a positive indicator most can be attributed to sampling discrepancies (Figure 4). The species diversity is a testament to the management and resilience of this landscape. The diversity in this landscape is not only important to a healthy riparian environment, but all wildlife that use it and by maintaining this diversity; and, possibly even expanding it, supports proper management. These numbers do address the question and provide an overall assessment of riparian conditions across the Ruby and Madison Watersheds but do not cover the entire forest. Although not complete, it is a start to evaluating riparian conditions across the forest and future BMER reports will provide the complete answer to this question.

To conclude, the 18 stream reaches evaluated between 2012-2020 reviews were incorporated into the Ruby/Madison Integrated Riparian Report. Based on the evaluation of these stream reaches 2/3 of the reaches were rated Functioning at Risk (FAR) to Properly Functioning and 1/3 of the reaches were on the low end of Functioning at Risk (no streams were rated Non-Functioning). These results provide insight into stream and riparian conditions in the Ruby and Madison watersheds and highlight the need to improve grazing management in some areas to better move towards forest plan objectives.

These numbers provide a benchmark reflecting work needed to better implement the forest plan through improved grazing management. This area contains some of the largest allotments in the country and has a long history of grazing management. These data can be used to evaluate and recommend voluntary changes in grazing management and inform future allotment management plans to ensure management is moving towards forest plan direction.

The primary tool we use for grazing management are annual use levels (AUL's), measured by stubble height and bank trampling. To improve streams that are not moving towards desired condition, especially those on the lower end of Functioning at Risk, we need to better assess whether the AUL's for a particular stream reach are appropriate to move towards forest plan objectives. There is a need to better understand the correlation of AUL's and long-term stream function across the forest, which the scientific literature support. The forest plan has established default AUL's for permits that do not have individual AUL's established; however, there is considerable variation of AUL's being utilized across the forest and this discrepancy makes evaluating stream condition a challenge. Consistency in how we use AUL's, measure AUL's, and manage our riparian areas will improve the efficiency of the integrated riparian monitoring program and allow us to better inform grazing management decision in the future.

The answer to this monitoring item may be incomplete because the numbers discussed in this report do not extrapolate to the forest as a whole but the methodology for answering this question in the future is sound. Subsequent BMER reports will fill in the gaps of stream and riparian condition throughout the forest and each one can be used to inform grazing decisions and adjust practices to better move towards forest plan objectives.

Findings

Table 21. Summary of findings for Plan Monitoring Item 4.

MONITORING ITEM	YEAR UPDATED	PLAN IMPLEMENTATION STATUS ¹ Do monitoring results demonstrate intended progress (i.e.	RECOMMENDATION Based on the evaluation of monitoring results, may changes be warranted?	MANAGEMENT If a change may be warranted, where may
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		maintaining, trending, or advancing) of the associated plan components listed with this monitoring item?		the change be needed? ²
MON – 4: Steam Channels What is the status of stream and riparian conditions?	2021	(B) Uncertain – The indicators/measures are sufficient, but the data set is not robust enough to fully answer the monitoring question at the Forest scale due to data being available for only 2 watersheds. As we complete more watersheds and summarize data, we will have a more complete assessment and better trend metrics in future reports to answer the question for the entire forest.	Yes	Monitoring Program: Combine this monitoring item with Monitoring Item 1 because the condition of stream and riparian conditions are so closely associated watershed condition. Additionally, PIBO data will provide another metric for answering this question.

¹ **PLAN IMPLEMENTATION STATUS:** (A) Uncertain - Interval of data collection beyond this reporting cycle (indicate date of next time this monitoring item will be evaluated); (B) Uncertain - More time/data are needed to understand status or progress of the Plan Component(s); (C) Uncertain - Methods inadequate to assess the status or progress toward achieving plan component(s). (D) NO - Implementation of Plan Component(s) ARE NOT trending, progressing, and/or conducted as desired; (E) YES - Implementation of Plan Component(s) ARE trending, progressing, and/or conducted as desired

² **[36 CFR 219.12(d)(2)]** - The monitoring evaluation report must indicate whether or not a change to the (1) plan, (2) management activities, (3) the monitoring program, or a (4) new assessment, may be warranted based on the new information. The monitoring evaluation report must be used to inform adaptive management of the plan area

Monitoring Item 5 – Management Indicator Species

Monitoring Item Summary

Table 22. Summary for Monitoring Item 5.

Monitoring Question	Plan Component(s)	Indicators*	Data collection interval	Data Source / Partner	Point of Contact
Are management activities effectively maintaining conditions for native species reproduction?	Maintain habitat conditions for native species as reflected by changes in abundance of <i>Drunella doddsi</i> (Mayfly) as a Management Indicator Species (MIS) (Forest Plan, p. 16).	Aquatic macroinvertebrate assemblage including the mayfly (<i>Drunella doddsi</i>) (population changes in managed vs. unmanaged sites). This focal species assemblage is used to detect changing conditions of aquatic integrity (Y).	Annually	PIBO Effectiveness Monitoring Program Metrics	Jennifer Mickelson, Watershed Program Manager, Beaverhead – Deerlodge National Forest

		PacFish/InFish Biological Opinion (PIBO) monitoring (trend in aquatic habitat conditions in managed vs. unmanaged systems) (Y).			
* Indicator influenced by climate change? Y = Yes; N = No; U = Uncertain					

Table 23. Monitoring Item 5 - Monitoring Collection Summary.

For monitoring item 5:	Year
Data was last collected or compiled in:	2020
Next scheduled data collection/compilation:	2021
Last BMER evaluation for this monitoring item:	n/a
Next scheduled BMER evaluation of this monitoring item:	2023

The Forest management objective to maintain habitat conditions for native species is to ensure that management activities are effectively maintaining conditions for native species reproduction. Management indicator species (MIS) were selected to evaluate the effects of management activities because they are sensitive to changes in their environment; and changes in their populations are believed to indicate effects on other species and water quality.

According to the B-D Forest Plan, *Drunella dodsii* is used as an indication of changing sediment levels; however, the 2012 Forest Plan monitoring guidance recommended using the macroinvertebrate assemblage as the focal species indicator because it is more robust than a single species. This focal species assemblage of macroinvertebrates is used as an indicator to understand changes in aquatic integrity. PIBO has been collecting macroinvertebrate data (including *Drunella dodsii*) on the forest up until 2017. The results of this monitoring item help determine if the Forest is moving towards its Plan goals and objectives of maintaining conditions for native species reproduction.

Methods

The PACFISH/INFISH Biological Opinion (PIBO) monitoring program was established in 1999 in response to the Pacific Anadromous Fish Strategy (PACFISH, 1995), and the Inland Native Fish Strategy (INFISH, 1995). These Biological Opinions, and other consultation documents associated with subsequent amendments (1996-1998), directed federal agencies to maintain or improve riparian and aquatic conditions at both landscape and watershed scales on federal lands throughout the upper Columbia River basin. These documents also included requirements to monitor the implementation and effectiveness of these strategies. The PIBO monitoring program evaluates stream and riparian habitat status (i.e., current condition) and trend for a wide range of aquatic and riparian attributes, to assess these habitat conditions. The program has been geographically expanded to areas outside the original PACFISH/INFISH areas to address needs identified by federal land management agencies. Currently, the PIBO monitoring program provides data, and data support, to multiple federal and state agencies across a wide network, mostly in the interior Columbia and upper Missouri River basins.

The PIBO Monitoring Plan collects effectiveness monitoring (EM) data for over 2,225 sites, including randomly located Integrator and selected Designated Monitoring Area sites. These data include attributes for stream habitat, riparian vegetation, aquatic macroinvertebrates, and stream temperature. There are 104 Integrator sites on the Beaverhead-Deerlodge NF. Implementation Monitoring (IM) data is also available for over 350 Designated Monitoring Area sites with attributes related to grazing management. There are 9 Implementation Monitoring sites on the Beaverhead-Deerlodge NF.

The PIBO crews sample macroinvertebrates using the protocol recommended by the Center for Monitoring and Assessment of Freshwater Ecosystems at Utah State University. Macroinvertebrates are sampled from 8 fast-water habitats per site and combined into a composite sample. Macroinvertebrate taxa are identified by the Bureau of Land Management/Utah State University National Aquatic Monitoring Center in Logan, Utah.

Stream habitat can be assessed by comparing any stream reach's habitat characteristics to those of a stream functioning correctly. The PIBO program uses this comparative approach to evaluate status of stream habitat within portions of the interior Columbia River and Missouri River basins documenting changes in habitat conditions (e.g., "trend") over the entirety of PIBO sampling (2001-2019).

Determining the condition or status of an individual, or group of stream reaches is a difficult task because of the natural inherent variability in stream conditions due to geoclimatic and disturbance regimes. PIBO's approach is to compare the status of stream habitat conditions at sites in 'managed' watersheds (watersheds exposed to disturbance from various management actions) to habitat conditions at sites within 'reference', or relatively pristine, watersheds which are used as a benchmark of expected condition. All streams are affected by natural disturbance, status is assessed by looking at the range of habitat conditions in the streams within managed sites compared with sites that had only natural disturbance. An index of habitat conditions was created to assess managed stream sites, which accounts for some natural variability among sites and combines several stream habitat attributes. An index is good for determining status yet may be less sensitive when detecting trend in habitat condition over time because it averages attributes that may be more individually responsive to disturbance or change. Trends were further estimated by measuring changes in individual stream habitat metrics, such as bank stability or large wood frequency, at a site over the duration of PIBO sampling (2001-2019). More information on the PIBO monitoring program can be found at <https://www.fs.usda.gov/detail/r4/landmanagement/resourcemanagement/?cid=stelprd3845865>.

Results

Aquatic Macroinvertebrate Assemblages

The aquatic macroinvertebrate assemblage (AMA) is an aquatic management indicator species (MIS) for the Beaverhead Deerlodge NF. It was selected because it commonly occurs in streams across the Forest; and, because it is influenced by changes in water quality, including sedimentation. The Forest Plan recognized sedimentation as an impact common to aquatic systems from land management actions. High levels of fine sediment in stream reaches indicate degraded habitat conditions and poor stream function. Low fine sediments are an indication of a stream reaches positive health.

There are specific habitats with greater potential for hosting sensitive AMA than others. For example, some AMAs prefer higher stream gradients with larger substrate size. However, AMA

is also often present in lower gradient reaches where we survey to evaluate aquatic impacts from management. If fine sediment deposition is increasing, we expect to see sensitive AMA abundance to decline in moderate to low gradient reaches. This leaves the aquatic macroinvertebrate assemblage population centralized in higher gradient areas where sediment is transported to downstream reaches. Thus, AMA is probably more quickly influenced (and changes in its abundance more observable) in lower gradient reaches than in its steeper more preferred habitats.

Abundance of AMA, based on its ecology, should fluctuate depending on the influence land management is having on sediment introduction. Abundance of AMA should also indicate whether management activities are effectively maintaining, improving, or degrading conditions for desired aquatic species.

PIBO has been collecting macroinvertebrate data since 2002 and stopped analyzing macroinvertebrate data at reference and managed sites in 2017. Figure 6 displays *Drunella dobbsii* (DD; mayfly, a sensitive aquatic macroinvertebrate) density by square meter for reference reaches identified by PIBO on the Beaverhead-Deerlodge NF. Dashed trendlines are also displayed for each reference reach.

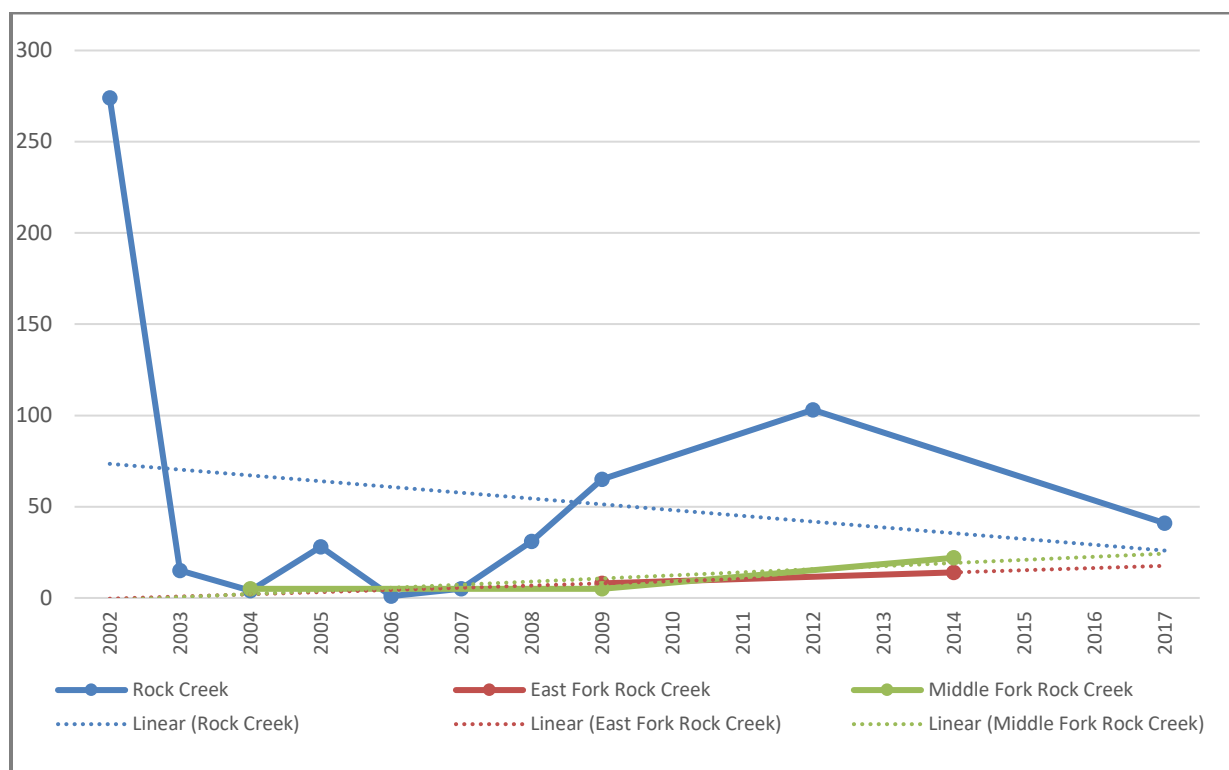


Figure 6. *Drunella dobbsii* (DD) densities (#/m2) in PIBO reference reaches, by year. Dashed lines are trendlines for each stream reach.

Densities of DD are either declining (Rock Creek) or are static (East Fork & Middle Fork Rock Creek) based on data at the three reference sites with more than one macroinvertebrate collection on the Beaverhead-Deerlodge NF. Of the three reference reaches surveyed, Rock Creek is the lowest gradient of the three, indicating it may be the most sensitive to changes in sedimentation.

Over 250 DD per square meter were detected in 2002, but densities appeared to plummet after 2002. The last survey in 2017 showed less than 50 DD per square meter. In East Fork and Middle Fork Rock Creek, densities were never over 30 DD per square meter, but did show a slight increase over the period of observation. Reduced densities in these reaches are not determined to be of significance because there is only two or three data points for comparison.

Managed sites that are part of the PIBO survey protocols provide more data than managed sites without these protocols. Table 24 displays general trend in DD densities in managed streams where more than one data point exists. For the purposes of this analysis, an improving or declining trend was defined as a change greater than 10% and no change (NC) was either a change less than 10% or R^2 less than 0.65. The R^2 value is a statistical measure of how close the data are to the fitted regression line. A higher R^2 value indicates a better fit for the model. Please note that this analysis is not statistically significant but is just used to identify a general trend.

Table 24. General trend in *Drunella doddssii* (DD) densities in managed streams on the Beaverhead-Deerlodge NF. + indicates an improving trend, - indicates a declining trend and NC indicates no change.

Stream Name	General Trend	Stream Name	General Trend
Beefstraight Creek	+	East Fork Granite Creek	+
Fish Creek	+	Trapper Creek	NC
Lowland Creek	NC	MF Warm Springs Creek	NC
Big Pipestone Creek	NC	Canyon Creek	NC
NF Lower Willow Creek	+	Fish Creek	+
South Fork Douglas Creek	NC	Gazelle Creek	NC
Foster Creek	+	Birch Creek	NC
Warm Springs Creek	NC	Indian Creek	+
NF Dry Cottonwood Creek	+	Wise River	NC
Tin Cup Joe Creek	+	Wyman Creek	-
Racetrack Creek	+	Willow Creek	-
Stony Creek	+	Rock Creek	NC
Copper Creek	NC	Wolf Creek	NC
Ross Fork of Rock Creek	NC	Ruby Creek	+
Eunice Creek	NC	Burnt Creek	+
Horse Prairie Creek	NC	Willow Creek	NC
Black Canyon Creek	+	Cherry Creek	-
Pioneer Creek	NC	Painter Creek	+
Bear Creek	+	Johnson Creek	+
Buffalo Creek	+	Mill Creek	NC
Fox Creek	NC	Elk Creek	+
Little Lake Creek	NC	Meridian Creek	-
Hamby Creek	NC	EF Blacktail Deer Creek	-
Andrus Creek	NC	MF Little Sheep Creek	NC
Big Lake Creek	NC	Alder Creek	NC
North Fork Gold Creek	NC	Sheep Creek	-

Fifty-two stream reaches have been surveyed for DD by PIBO survey crews from 2003 to 2017. The stream reaches displayed above represent surveys where more than one data point exists

during the sampling period. Of the 52 streams reaches on the forest, 19 reaches (36%) showed an improving trend in DD densities, 6 reaches (12%) showed a declining trend, and 27 reaches (52%) showed no detectable change in DD densities.

To assess the status of macro-invertebrates at each site, the macro-invertebrate taxa ‘observed’ (O) in a reach are compared to the assemblages ‘expected’ (E) to be found in relatively pristine reference reaches based on a modeling exercise. This metric is called the O/E score. The PIBO O/E model was developed using macro-invertebrate samples collected at 201 reference reaches between 2001 and 2005. The O/E index score for each reach is estimated by dividing the number of expected taxa by the number of observed taxa. A monitoring site with an O/E score of ‘1’ indicates that all the macro-invertebrate taxa expected at a reference site (with similar geographical setting and characteristics) were found at the site, while a value of ‘0’ indicates that none of the taxa expected were found. Scores > 0.8 are generally considered similar to reference reaches. Scores > 1 are either equivalent to what would be expected at a reference reach or may have an enhanced insect community as a result of some type of enrichment.

Table 25. Trend in O/E macroinvertebrate scores across the Beaverhead-Deerlodge NF, split by basin and sub-basin. Time1 = mean during first visit; Time2 = mean value for last visit; Percent Change = Percent change in the mean values between the first and last visit; Sample size = number of observations with repeat visits; Negative Number = Number of sites where actual measurement was lower on last visit; Positive Number = Number of sites where actual measurement was higher in last visit; None Number = Number of sites where last visit and first visit values were equal; P-value = Significance test where $p < 0.10$ is significant; Desired Direction = direction of change in the mean, which can either be + or -; Actual Change = actual direction of change in the mean, which can be no statistically significant (NS), + or -.

Basin/Sub-Basin	Time1 Value	Time2 Value	Percent Change	Sample Size	Negative Number	Positive Number	No Change Number	P-value	Desired Condition	Actual Change
Columbia River Basin	0.82	0.93	13.4	19	7	12	0	0.059	+	+
Flint-Rock Creek	0.7	0.93	31.8	9	3	6	0	0.051	+	+
Upper Clark Fork River	0.93	0.94	0.9	10	4	6	0	0.575	+	NS
Missouri River Basin	0.79	0.73	-7.4	62	38	24	0	0.103	+	NS
Red Rock River	0.71	0.71	0.4	11	7	4	0	0.722	+	NS
Big Hole River	0.85	0.75	-11.9	24	16	8	0	0.116	+	NS
Beaverhead River	Not enough managed sites for trend									
Ruby River	0.72	0.76	5.1	5	2	3	0	0.686	+	NS
Jefferson River	0.65	0.65	0.1	6	3	3	0	0.917	+	NS
Madison River	0.9	0.78	-13.8	7	5	2	0	0.499	+	NS
Boulder River	0.8	0.69	-12.9	8	5	3	0	0.327	+	NS

Table 25 shows that there has been no statistically significant change in O/E macroinvertebrate scores across the forest except in the Columbia River Basin and Flint-Rock sub-basin, where there was a 13.4% and 31.8% improvement in scores over the period of survey, respectively. There was no significant change in the Madison River basin. There was a positive change

(although not statistically significant) in 5 of the 8 sub-basins on the forest and a negative change in three sub-basins (Big Hole, Madison, and Boulder River).

PIBO Monitoring (trend of aquatic habitat conditions in managed vs. unmanaged systems)

Determining the condition or status of an individual stream reach, or group of stream reaches, is a difficult task because of the natural variability in stream conditions due each stream's unique nature and its geoclimatic and disturbance regimes. PIBO's approach is to compare the status of stream habitat conditions at sites in 'managed' watersheds (watersheds exposed to disturbance from various management actions) to habitat conditions at sites within 'reference', or relatively pristine, watersheds, which are used as a benchmark of expected condition. Because all streams are affected by natural disturbance, in assessing *status* we are most interested in how the range of stream habitat conditions expressed at managed sites compares to what would be expected if the stream had experienced only natural disturbance. To ascertain the status of a given site an index of habitat conditions was created which accounts for some natural variability among sites and combines several stream habitat attributes. While an index is good for determining status, it may be less sensitive when detecting trend in habitat condition over time because it averages conditions of several attributes that may be more individually responsive. Therefore, trend was estimated by measuring changes in individual stream habitat metrics, such as bank stability or large wood frequency, at sample sites over the duration of PIBO sampling (2001-2019).

Unfortunately, PIBO has not been used as a determining trend between managed and reference sites at the forest-level. The best information available, comparing trends at managed versus reference sites, is in a paper titled "*Did changes in western federal land management policies improve salmonid habitat in stream on public lands within the Interior Columbia River Basin?*". In the Interior Columbia River basin, scientists compared PIBO data for 10 habitat attributes at managed and reference sites. Comparative results in PIBO data suggest that in managed watersheds, conditions noted in nine of the ten stream attributes were either stable or improving. Streambank angle was found to be the only attribute declining in condition relative to its value to salmonids. The trend for streambank angle in managed watersheds, however, was parallel to those in reference reaches suggesting the mechanisms driving changes in this stream attribute's conditions were likely related to a trend in environmental conditions. The analysis indicates that the status and trends of stream conditions in a subset of managed watersheds, measured by their value to salmonids, and compared to reference conditions, were generally improving within the study area.

To estimate status of physical stream habitats at each site, we focus on stream channel attributes that (1) influence the production or survival of native salmonids; (2) are sensitive to land-use changes; and (3) can be measured consistently by observers. The physical habitat index score is compared against reference reaches and yields a score between 0 and 100, 100 being better than expected and 0 being lower than expected. A more thorough discussion on how the physical habitat index score to assess status is in the document "PIBO Report for the Beaverhead-Deerlodge NF 2020-January". Table 26 displays physical stream habitat indexes for managed and local reference reaches on the Beaverhead-Deerlodge NF, by basin and sub-basin.

Table 26. Status of physical habitat index scores across the Beaverhead-Deerlodge National Forest, by basin and sub-basin. Scores range from 0-100. Scores are split by managed sites, reference local (reference sites

within the area of evaluation), reference eco-region (reference sites within the ecoregion) and reference all (reference sites for the entire PIBO study area). NA indicates not enough reference sites available.

Basin/Sub-Basin	Managed	Reference Local	Reference Eco-Region	Reference All
Columbia River Basin	38.66	75.9	62.91	52.04
Flint-Rock Creek	38.78	NA	62.91	52.03
Upper Clark Fork River	38.53	NA	62.91	52.03
Missouri River Basin	37.66	NA	52.59	51.19
Red Rock River	32.12	NA	62.91	52.03
Big Hole River	42.39	NA	52.7	52.03
Beaverhead River	Not enough managed sites for status or trend			
Ruby River	32.72	NA	62.91	52.03
Jefferson River	21.34	NA	62.91	52.03
Madison River	46.14	NA	62.91	52.03
Boulder River	30.34	NA	62.91	52.03

Based on the values in Table 26, local reference sites, within the eco-region and within the PIBO study area, have higher physical habitat index scores than those in managed watersheds. Higher scores indicate better physical habitat conditions than expected. The Jefferson, Boulder and Red Rock River sub-basins had the lowest scores in terms of physical habitat index, while the Madison & Big Hole River sub-basins had the highest scores.

Table 27 displays trend in the overall stream habitat index score (as described above) by basin and sub-basin on the Beaverhead-Deerlodge NF.

Table 27. Trend in overall stream habitat index on the Beaverhead-Deerlodge NF, split by basin and sub-basin. Time1 = mean during first visit; Time2 = mean value for last visit; Percent Change = Percent change in the mean values between the first and last visit; Sample size = number of observations with repeat visits; Negative Number = Number of sites where actual measurement was lower on last visit; Positive Number = Number of sites where actual measurement was higher in last visit; None Number = Number of sites where last visit and first visit values were equal; P-value = Significance test where $p < 0.10$ is significant; Desired Direction = direction of change in the mean, which can either be + or -; Actual Change = actual direction of change in the mean, which can be no statistically significant (NS), + or -.

Basin/Sub-Basin	Time1 Value	Time2 Value	Percent Change	Sample Size	Negative Number	Positive Number	No Change Number	P-value	Desired Condition	Actual Change
Columbia River Basin	33.09	43.08	30.2	20	4	16	0	0.004	+	+
Flint-Rock Creek	29.9	40.77	36.4	10	1	9	0	0.047	+	+
Upper Clark Fork River	36.29	45.39	25.1	10	3	7	0	0.028	+	+
Missouri River Basin	37.76	33.21	-12	72	40	26	6	0.006	+	-
Red Rock River	37.28	25.98	-30.3	12	7	4	1	0.041	+	-

Big Hole River	40.52	40.6	0.2	25	13	11	1	0.841	+	NS
Beaverhead River	Not enough managed sites for trend									
Ruby River	32.68	35.7	9.2	7	3	4	0	0.866	+	NS
Jefferson River	19.49	15.48	-20.6	7	3	2	2	0.686	+	NS
Madison River	42.97	35.13	-18.3	10	6	2	2	0.036	+	-
Boulder River	38.01	23.22	-38.9	8	7	1	0	0.017	+	-

Table 27 shows statistically significant changes in overall stream habitat index scores across the forest in the Columbia River basin (and sub-basins within the Columbia River basin), and the Missouri River basin (as well as Red Rock, Madison and Boulder River sub-basins). Stream habitat indexes are improving across the board in the Columbia River basin. The basin itself saw a 30.2% improvement in its overall habitat index score, and Flint-Rock and Upper Clark For River sub-basins saw a 36.4 and 25.1% improvement in scores, respectively. The Missouri River basin is seeing a decline in overall stream habitat index scores (basin-wide there as a 12% decrease in scores). There were also statistically significant declines in scores in the Red Rock River (-30%), Madison River (-18.3%) and Boulder River (-38.9%) sub-basins. There was no significant change in the Big Hole, Ruby and Jefferson River sub-basins.

Because DD is used as an indication of changing sediment levels, we also looked at PIBO data and trends in percent fine sediment (<6 mm diameter in pool tails) and the D50 (median substrate particle size). Table 28 and Table 29 display percent fine sediment and D50 for basins and sub-basin on the Beaverhead-Deerlodge NF.

Table 28. Trend in percent fine sediment (<6mm diameter in pool tails) on the Beaverhead-Deerlodge NF, split by basin and sub-basin. Time1 = mean during first visit; Time2 = mean value for last visit; Percent Change = Percent change in the mean values between the first and last visit; Sample size = number of observations with repeat visits; Negative Number = Number of sites where actual measurement was lower on last visit; Positive Number = Number of sites where actual measurement was higher in last visit; None Number = Number of sites where last visit and first visit values were equal; P-value = Significance test where $p < 0.10$ is significant; Desired Direction = direction of change in the mean, which can either be + or -; Actual Change = actual direction of change in the mean, which can be no statistically significant (NS), + or -.

Basin/Sub-Basin	Time1 Value	Time2 Value	Percent Change	Sample Size	Negative Number	Positive Number	No Change Number	P-value	Desired Condition	Actual Change
Columbia River Basin	36.67	29.75	-18.9	20	14	6	0	0.135	-	NS
Flint-Rock Creek	34.59	31.87	-7.9	10	6	4	0	0.575	-	NS
Upper Clark Fork River	38.75	27.64	-28.7	10	8	2	0	0.169	-	NS
Missouri River Basin	29.7	37.4	25.9	72	27	45	0	0.021	-	+
Red Rock River	22.6	42.81	89.5	12	1	11	0	0.01	-	+
Big Hole River	26.91	27.67	2.8	25	15	10	0	0.638	-	NS
Beaverhead River	Not enough managed sites for trend									
Ruby River	29.33	28.24	-3.7	7	3	4	0	0.866	-	NS

Jefferson River	52.27	58.11	11.2	7	3	4	0	0.398	-	NS
Madison River	28.34	40.3	42.2	10	2	8	0	0.059	-	+
Boulder River	35.32	55.81	58	8	1	7	0	0.025	-	+

Table 29. Trend in D50 (median substrate size) on the Beaverhead-Deerlodge NF, split by basin and sub-basin. Time1 = mean during first visit; Time2 = mean value for last visit; Percent Change = Percent change in the mean values between the first and last visit; Sample size = number of observations with repeat visits; Negative Number = Number of sites where actual measurement was lower on last visit; Positive Number = Number of sites where actual measurement was higher in last visit; None Number = Number of sites where last visit and first visit values were equal; P-value = Significance test where $p < 0.10$ is significant; Desired Direction = direction of change in the mean, which can either be + or -; Actual Change = actual direction of change in the mean, which can be not statistically significant (NS), + or -.

Basin/Sub-Basin	Time1 Value	Time2 Value	Percent Change	Sample Size	Negative Number	Positive Number	No Change Number	P-value	Desired Condition	Actual Change
Columbia River Basin	0.0312	0.0339	8.7	20	8	10	2	0.199	+	NS
Flint-Rock Creek	0.0292	0.0332	13.7	10	4	4	2	0.401	+	NS
Upper Clark Fork River	0.0331	0.0346	4.4	10	4	6	0	0.241	+	NS
Missouri River Basin	0.0309	0.0272	-11.9	74	38	27	9	0.064	+	-
Red Rock River	0.022	0.0168	-24.3	12	8	2	2	0.028	+	-
Big Hole River	0.0321	0.0321	0	26	14	10	2	0.539	+	NS
Beaverhead River	Not enough managed sites for trend									
Ruby River	0.0402	0.0433	7.6	7	1	6	0	0.236	+	NS
Jefferson River	0.0139	0.0122	-12.3	7	4	2	1	0.463	+	NS
Madison River	0.0383	0.0308	-19.7	11	6	2	3	0.123	+	NS
Boulder River	0.0342	0.0167	-51.2	8	5	2	1	0.091	+	-

Percent surface fines increased significantly in the Missouri River basin, and within the Red Rock, Madison, and Boulder sub-basins. The median particle size (D50) decreased significantly in the Madison, Red Rock and Boulder sub-basins as well, indicating that stream substrates in these sub-basins are getting smaller, and more surface fines are present in pool tails. On the flip side, percent surface fines decreased (although not significantly) across the Columbia River basin, as well as the Ruby River sub-basin. The median particle size increased in these sub-basins but not significantly.

Discussion

Aquatic macroinvertebrate assemblage (AMA) are a management indicator and focal species referenced in the January 2009 *Beaverhead-Deerlodge National Forest Plan*. AMA are used as a focal species (as defined in the 2012 planning rule) to understand aquatic integrity. Based on results presented above, DD, an aquatic macroinvertebrate that is very sensitive to change, is either declining or in a stationary trend at PIBO reference sites on the forest. Results show better trends at managed sites: 36% of managed PIBO sites on the forest showed improving trends in

DD densities, while only 12% showed declining trends. Observed/expected macroinvertebrate indexes on the forest indicate that macroinvertebrate assemblages are improving towards reference conditions in the Columbia River basin, and the Flint-Rock Creek sub-basin, like what is expected at reference sites. All other basins and sub-basins on the forest saw no statistically significant changes in observed/expected macroinvertebrate indexes; meaning, macroinvertebrate assemblages across the rest of the forest are essentially unchanged over time.

In terms of physical habitat attributes, PIBO has not compared trends in overall habitat index scores between managed and reference sites. To compare overall habitat indexes between reference and managed sites, Table 27 displayed overall habitat index scores by sub-basin and basin. Overall, habitat index scores are lower at managed sites than at reference sites, which is to be expected. No other trend analysis is available to determine if reference sites are trending the same way as managed sites.

We did look at managed sites for trends in overall habitat index scores across basin and sub-basin on the Beaverhead-Deerlodge NF. There were positive changes in overall physical habitat scores in the Columbia River basin and sub-basins within it, while there were negative changes in the Missouri River basin and several sub-basins within it. Based on this information, physical habitat is trending upward in the Columbia River basin and is on a downward trend in the Missouri River basin and several sub-basins (Red Rock, Madison, and Boulder River).

DD is used as an indicator of changing sediment levels in low-gradient streams, so we also looked at changes at managed sites in percent surface fines at pool tail-outs and the median substrate size (D50). Percent surface fines increased and the D50 decreased significantly (stream substrates became smaller) in the Missouri River basin, as well as in the Red Rock, Madison, and Boulder River sub-basins which somewhat correlates to a decrease (although not significant) in observed/expected macroinvertebrate scores in these sub-basins as well. When looking at DD densities at managed sites, there was not a great correlation between sites where there was a general downward trend in DD densities (most sites where there was a general downward trend were in the Big Hole watershed).

The same is true for sub-basins where we saw improvements (although not significant) in percent surface fines at pool tail-outs and median substrate size. Percent surface fines appeared to decrease (although not significantly) in the Columbia River basin, Upper Clark Fork and Flint-Rock Creek sub-basins, which correlates with significant improvement in observed/expected macroinvertebrate scores over time at managed sites. The same is true in the Ruby River sub-basin, although not as many changes have occurred there over time in terms of stream substrates. More than half of the managed sites where DD densities are improving are in the Upper Clark Fork, Flint-Rock and Ruby River sub-basins.

In summary, DD densities at unmanaged reference sites under PIBO were either declining or static for the period of collection. General trends for DD densities at managed sites show approximately 1/3 of PIBO sites have generally improving trends in densities, while only 12% showed general decreases in densities. PIBO observed/expected macroinvertebrate scores significantly improved in the Columbia River basin, and the two sub-basins within the forest (Upper Clark Fork and Flint-Rock). This trend corresponds to decreases in percent surface fines and increase in median stream substrate size (although changes were not statistically significant). The same is true for the Ruby River sub-basin. There is a statistically significant increase in percent surface fines and decrease in median stream substrate size (substrates are getting smaller) in the Missouri River basin, as well as in the Red Rock, Madison, and Boulder River sub-basins. These trends coincide with decreases in observed/expected macroinvertebrate scores in these

sub-basins (although not statistically significant). Overall physical habitat index scores significantly improved in the Columbia River basin (and the Upper Clark Fork and Flint-Rock sub-basins). These positive trends correspond well with improving trends in percent surface fines, median substrate size, and observed/expected macroinvertebrate scores. Overall physical habitat index scores significantly declined in the Missouri River basin (and the Red Rock, Madison, and Boulder River sub-basins). At least for the Missouri River basin and the Madison and Boulder River sub-basins, these data reflect declining trends in percent surface fines, median substrate size and observed/expect macroinvertebrate scores (although sometimes declines were not statistically significant).

Findings

Table 30. Summary of findings for Monitoring Item 5.

MONITORING ITEM	YEAR UPDATED	PLAN IMPLEMENTATION STATUS ¹ Do monitoring results demonstrate intended progress (i.e. maintaining, trending, or advancing) of the associated plan components listed with this monitoring item?	RECOMMENDATION Based on the evaluation of monitoring results, may changes be warranted?	MANAGEMENT If a change may be warranted, where may the change be needed? ²
MON – 5: Management Indicator Species Are management activities effectively maintaining conditions for native species reproduction?	2021	(B) Uncertain – More time is needed to assess the status or progress towards this plan component.	Yes	Monitoring Program: Data on macroinvertebrate assemblages is no longer readily available through the PIBO monitoring program and we suggest exploring other ways to monitor macroinvertebrate assemblages, such as Montana DEQ monitoring done for TMDL development. Status and trends in aquatic habitat are well represented through other metrics collected in the PIBO program and answers the monitoring question of “ <i>Are management activities effectively maintaining conditions for native species reproduction?</i> ”?

¹ **PLAN IMPLEMENTATION STATUS:** (A) Uncertain - Interval of data collection beyond this reporting cycle (indicate date of next time this monitoring item will be evaluated); (B) Uncertain - More time/data are needed to understand status or progress of the Plan Component(s); (C) Uncertain - Methods inadequate to assess the status or progress toward achieving plan component(s). (D) NO - Implementation of Plan Component(s) ARE NOT trending, progressing, and/or conducted as desired; (E) YES - Implementation of Plan Component(s) ARE trending, progressing, and/or conducted as desired

² **[36 CFR 219.12(d)(2)]** - The monitoring evaluation report must indicate whether or not a change to the (1) plan, (2) management activities, (3) the monitoring program, or a (4) new assessment, may be warranted based on the new information. The monitoring evaluation report must be used to inform adaptive management of the plan area

Monitoring Item 6 – Best Management Practices

Monitoring Item Summary

Table 31. Summary for Monitoring Item 6.

Monitoring Question	Plan Component(s)	Indicators*	Data collection interval	Data Source / Partner	Point of Contact
Are soil and water conservation Best Management Practices (BMPs) being implemented during project work and are they resulting in protection of water quality and beneficial uses?	Objective (Soil Productivity): Protect soil productivity through site-specific prescriptions. The objective would be achieved by applying the most current soil and water conservation practices and other appropriate mitigation measures identified during project analysis and design, in order to meet the most current Region 1 Soil Quality Standards and riparian area standards (Forest Plan, p. 34).	Best Management Practices – BMP (total number of activities prescribed and implemented) (N). Per BMP effectiveness rating (sampling of BMP's implemented checked for effectiveness) (N).	Annually	National Best Management Practices (BMP) database	Jennifer Mickelson, Watershed Program Manager, Beaverhead – Deerlodge National Forest
* Indicator influenced by climate change? Y = Yes; N = No; U = Uncertain					

Table 32. Monitoring Item 6 - Monitoring Collection Summary.

For monitoring item 6:	Year
Data was last collected or compiled in:	2020
Next scheduled data collection/compilation:	2021
Last BMER evaluation for this monitoring item:	n/a
Next scheduled BMER evaluation of this monitoring item:	2023

Soil productivity is a forest management objective that is accomplished, in part, through site-specific prescriptions based on Best Management Practices (BMP). Implementation of BMPs reduces sedimentation run off impacts from active management into streams thereby improving water quality. Water quality objectives can be achieved by applying the latest soil and water conservation practices, BMPs, and other appropriate mitigation measures, identified during project design and analysis, in order to meet current Forest Service Northern Region (R1) soil quality and riparian area standards.

Methods

The National BMP Program was developed to improve agency performance and accountability in managing water quality to be consistent with the Federal Clean Water Act (CWA) and State water quality programs. Current Forest Service policy directs compliance with CWA permits and State regulations and

requires the use of BMPs to control nonpoint source pollution to meet applicable water quality standards and other CWA requirements.

The National BMP Program was adopted in the spring of 2012 and the [National Core BMP Technical Guide](#) was distributed that summer. This initiative was an effort to standardize BMP evaluation processes across the National Forest System. The intent was to better understand management activity shortcomings, improve accountability, and systematically evaluate trends in BMP implementation and effectiveness (e.g., between forests, between regions, etc.) within the agency. The Forest Service *National Core BMPs* are written in broad, non-prescriptive terms, focusing on 'what to do', not 'how to do it'. Applicable State, tribal, and local requirements and BMP programs, FS regional guidance, and unit Land Management Plans are expected to provide the criteria for site-specific BMP design. This approach recognizes the importance of existing state and tribal BMPs and provides for the integration of the national program with those existing BMPs. Data collection methods and protocols are within the *National Core BMP Technical Guide* link above. Data is collected by an interdisciplinary team on the forest.

Results

A total of twenty BMP reviews have been conducted within the Beaverhead-Deerlodge National Forest since 2015. Twelve were conducted during the 2015-2016 review cycle, and seven during the 2017-2018 review cycle, and one during the 2019-2020 review cycle. One review in the 2015-2016 cycle and the review in the 2019-2020 cycle were follow-up implementation/effectiveness monitoring. Per national direction, the Beaverhead-Deerlodge N.F. has been conducting BMP reviews using the nationwide BMP protocols since 2014. Table 33 displays monitoring categories by review cycle.

Table 33. Number and type of National Core BMP review types conducted by review cycle.

Category	2015-2016	2017-2018	2019-2020
Chemical Use Management	1		
Wildland Fire Management		1	
Rangeland Management	2		
Recreation Management	4	1	1*
Road Management	3 (1*)	3	
Mechanical Vegetation Management	1	1	
Water Uses Management	1	1	
TOTAL	12	7	1

* indicate follow-up implementation/effectiveness monitoring.

National Core BMP reviews consist of Implementation and Effectiveness Monitoring. Implementation Monitoring evaluates the degree to which planned BMP measures, for a given activity or project, have been carried out. Effectiveness monitoring evaluates whether implemented soil and water conservation practices avoided resource impacts. For reviews conducted during the two BMP review cycles, (2015/2016 and 2017/2018), eight of the 19 BMP reviews yielded “Fully Effective” ratings. Three reviews resulted in a “Mostly Effective” ratings, one resulted in a “Marginally Effective” rating and six reviews resulted in “Not Effective” ratings. See Figures 1-4 for Implementation and Effectiveness ratings. The BMP database generates ratings independent of the reviewer, making it difficult to determine what specifically led to the individual implementation and effectiveness ratings. In most cases, however, the minor deviation in rating (i.e., having one “no” answer to a question where all others are “yes”) was

deemed the most likely indicator of why sites received their constituent Implementation and Effectiveness ratings.

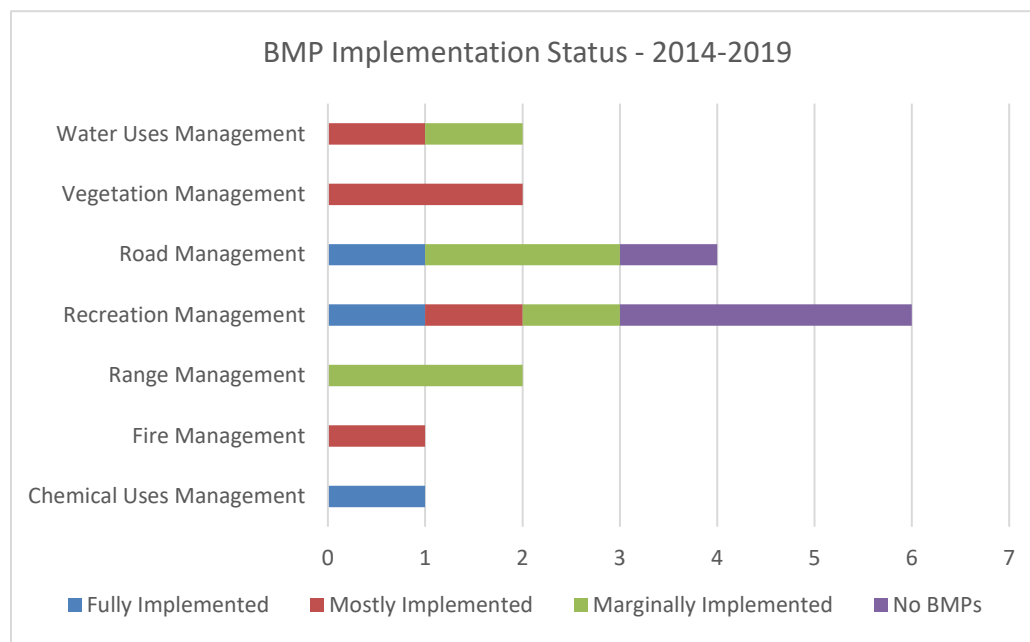


Figure 7. Implementation ratings for BMP reviews conducted using FS National Core BMP protocols during the 2014-2019 audit cycle.

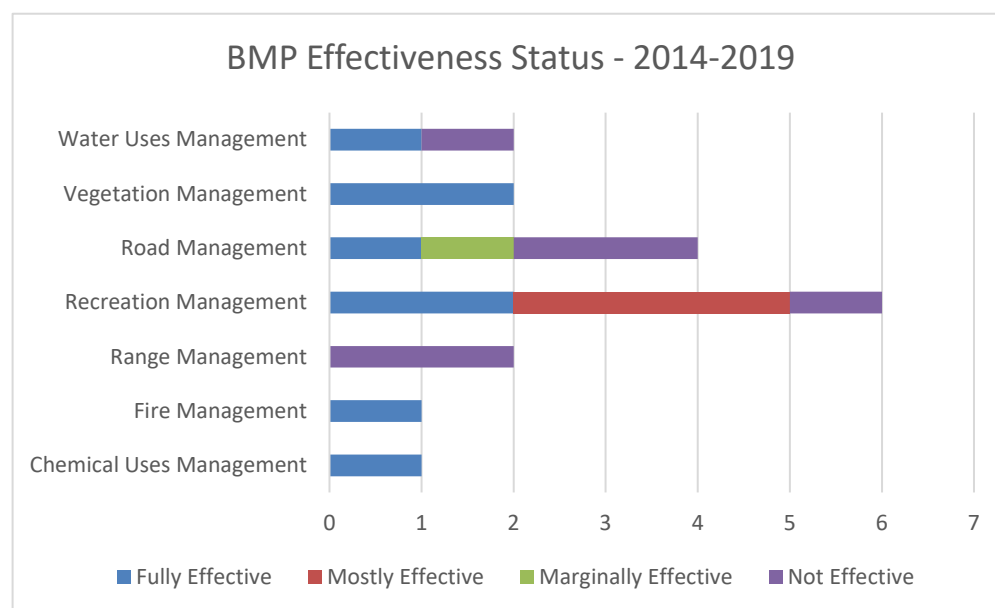


Figure 8. Effectiveness ratings for BMP reviews conducted using FS National Core BMP protocols during the 2014-2019 audit cycle.

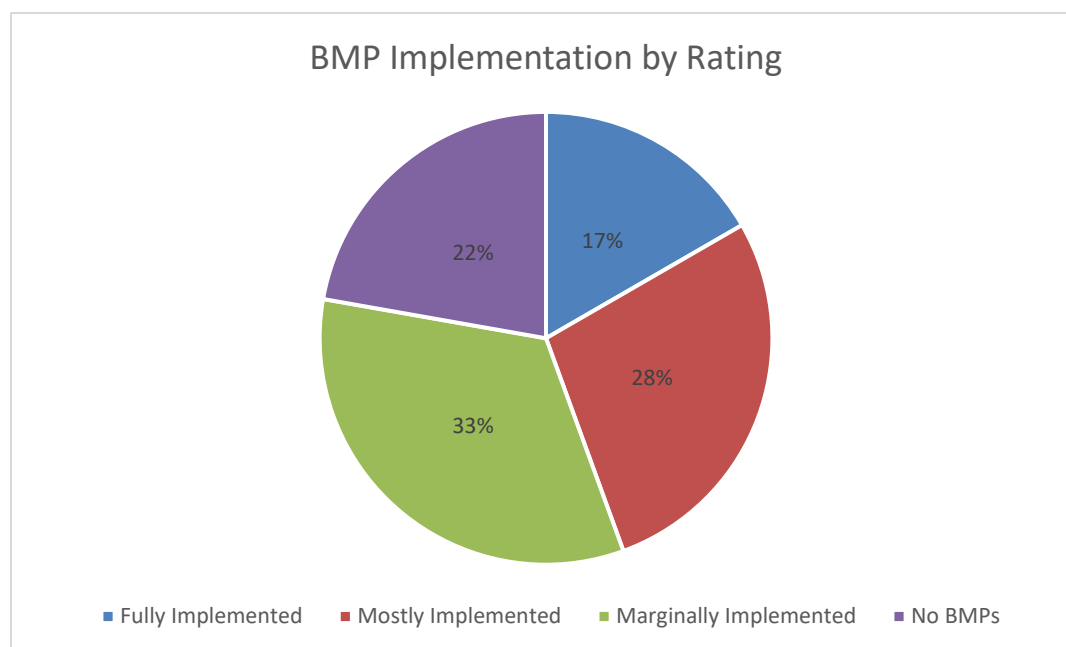


Figure 9. Implementation percentage by rating for BMP reviews conducted using FS National Core BMP protocols during the 2014-2019 audit cycle.

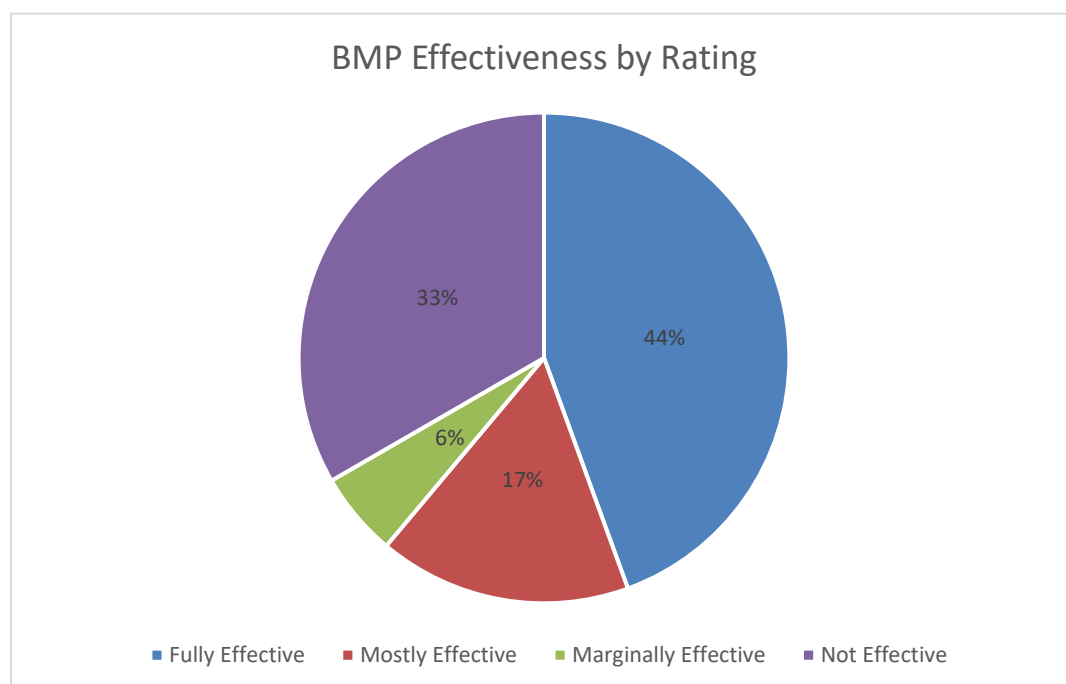


Figure 10. Effectiveness percentage by rating for BMP reviews conducted using FS National Core BMP protocols during the 2014-2019 audit cycle.

Chemical Uses Management

One “chemical uses” BMP review was completed during the FY15/16 review cycle. BMPs were rated as “fully implemented”, indicating that all BMPs were prescribed, BMPs were

implemented on-the-ground and all project oversight was completed. BMPs that were implemented were considered “fully effective”.

Fire Management Category

The Trapper Creek Vegetation Management Project Unit 30 prescribed burn was visited during the FY17/18 review cycle under the Fire A (Use of Prescribed Fire) protocol for both implementation and effectiveness. Review of the data suggests that BMPs were rated as “mostly implemented” because water control structures/feature, revegetation and road closures were not included in the burn plan (only some of the BMPs prescribed were included). However, it is unclear as to whether these BMPs were required per the decision document and not included in the burn plan, or if possibly these BMPs were not needed due to the small size of the burn. In this case, “not applicable” should have then been selected. Regardless, BMPs that were implemented were “fully effective” and no corrective actions were necessary.

Recreation Facilities Category

FY15/16

There were four recreation facilities visits during the FY15/16 time period under the following protocols: Recreation A (developed recreation sites), Recreation C (completed construction or re-routing of motorized or nonmotorized trails), Recreation D (motorized and non-motorized trail operation and maintenance), and Recreation G (active construction or operation and maintenance of watercraft launches). The Recreation A, D, and G reviews had no BMPs implemented, while the Recreation C review indicated all BMPs were fully implemented, indicating that all BMPs were prescribed, BMPs were implemented on-the-ground and all project oversight was completed. For the Recreation A & G evaluation, no BMPs were prescribed. For the Recreation D evaluation, no BMPs were prescribed and no BMPs were implemented on-the-ground. BMPs for the Recreation C and D evaluations were fully effective, while BMPs for the Recreation A and G evaluations were mostly effective. Interestingly, the BMP review for Recreation D found no BMPs were prescribed or implemented; however, the work that was implemented was effective at reducing sedimentation into nearby waterbodies leading to the conclusion use of BMP’s were effective.

FY17/18

There were two recreation facilities visits during the FY15/16 time period, both under the Recreation D (motorized and nonmotorized trail operation and maintenance) protocol for both implementation and effectiveness. Review of the data suggests that BMPs were rated for one review as “mostly implemented” and one as “marginally implemented”. All BMPs were prescribed, but one evaluation indicated that only some of the BMPs were executed on the ground, and both evaluations indicated that only some of the project oversight was implemented. In terms of BMP effectiveness, one BMP review was rated as “mostly effective” and the other was rated as “not effective”.

The BMP evaluation on Trail #4810 (Placer Trail) indicated that the operation and maintenance plan for the trail does contain provisions for the protection of water, aquatic, and riparian resources. No adaptive management measures were needed in terms of implementation of BMPs; however, there was evidence of sediment transport and/or deposition in a perennial stream/river along with evidence of changes in waterbody morphology originating from this trail. One or two locations of concern were identified along the trail due to bank trampling or compaction, from people and dogs accessing the creek. No corrective actions were identified for BMP

effectiveness. BMPs that were implemented were considered effective, but further issues were noted at the one or two locations.

The BMP evaluation on the Eagle's Nest Extension Trail indicated that the operation and maintenance plan for the trail does contain provisions for protection of water, aquatic, and riparian resource and that no adaptive management measures were needed in terms of implementation of BMPs. For BMP effectiveness, there was no evidence of erosion or sedimentation from the trail or at trail crossings, and no corrective actions for effectiveness were identified.

FY19/20

During the FY19/20 time period a follow-up implementation and effectiveness review was conducted on Jon's Gulch Trail #4806. The installation of an approximately 200-foot puncheon through a wet area was reviewed. The puncheon was previously monitored, and actions needed to fix problem wet areas were identified. No further corrective or adaptive management actions were identified for implementation on the follow-up review. All BMPs had been properly implemented, leading to no evidence of erosion or sedimentation from the trail. The installation of a boardwalk/puncheon across a wetland/wet meadow led to improvements in vegetation trampling and rutting through the wet area. This corrective action from the prior survey was implemented properly and was effective, leading to no active sedimentation into nearby waterbodies.

Road Management Category

FY15/16

There were two road management visits during the FY15/16 review cycle, under the following forest plan protocols: Road A (active road or waterbody crossing construction or reconstruction) and Road C (road operation and maintenance). There were no BMPs prescribed or implemented for the active road or waterbody crossing construction or reconstruction project, while BMPs were marginally implemented on the road operation and maintenance review. For the road construction/reconstruction review, no BMPs were prescribed and there was no project oversight. For the road operation and maintenance review, some BMPs were prescribed and some BMPs were implemented on-the-ground and some project oversight occurred. In terms of BMP effectiveness, they were not effective for the road/waterbody crossing construction or reconstruction project (because they were not prescribed or implemented), while they were marginally effective for the road operation and maintenance project.

FY17/18

There were two road management reviews during the FY17/18 review cycle, one under the Road B forest plan protocol (completed road or waterbody crossing construction or reconstruction) and one under the Road F (completed road decommissioning) protocol for both implementation and effectiveness. The BMP review for road construction/reconstruction was rated as "fully implemented", while the review for road decommissioning was rated as "marginally implemented". For the road decommissioning review, only some of the BMPs were prescribed, and implemented on-the-ground. Furthermore, only some of the project oversight was implemented, which lead to a "marginally implemented" score. In terms of effectiveness, BMPs were fully effective for the completed road or waterbody crossing construction/reconstruction project, while BMPs were not effective on the completed road decommissioning project.

There were no issues identified with the completed waterbody crossing construction project on FS Road 5107, and the BMPs were included in the project contract/plan and were fully implemented. Supplemental erosion control was also applied (wood to store sediment and dissipate energy) to FS Road 5107. No corrective or adaptive management actions were identified for BMP effectiveness. It was noted that overall, the culvert replacement looked good, but some disturbance areas could have used grass seeding but it was not critical. Additionally, it was noted that the culvert should have been moved upstream 2-5 feet and that the downstream segment of the road was too steep.

For the road decommissioning project, there was no approved erosion control plan. Implementation was deficient for this project because not enough material was removed from the roadbed at stream crossings and slopes were too steep and needed to be laid back more. From an effectiveness standpoint, there were 102 areas where erosion/sedimentation occurred (at the stream crossing locations where road fill was not fully removed). The road does have diversion potential for approximately 100 feet. There was evidence of localized sediment deposition in the waterway and changes to substrate in the waterbody. Corrective actions for effectiveness include removing more road fill at stream crossing locations and to lay back road slopes further so they are not too steep.

Range Management Category

Best management practices for range management are evaluated by reviewing requirements for livestock grazing in the allotment (e.g., season of use, number and kind of animals, livestock grazing system, monitoring requirements, and measurable objectives for water resources affected by livestock grazing). There were two range management visits in the FY15/16 review cycle. Both reviews determined that BMPs were “marginally implemented”. BMPs were properly prescribed and there was good project oversight, but only some BMPs were implemented on-the-ground. Of the BMPs that were implemented on-the-ground, it was determined that those BMPs were not effective from a water quality protection standpoint.

Vegetation Management Category

There was one vegetation management review during the FY15/16 review cycle under the ground-based skidding and harvesting protocol. The review indicated that BMPs were “mostly implemented”. BMPs were properly prescribed and all BMPs were implemented on-the-ground, but only some project oversight occurred, resulting in a rating of “mostly implemented”. BMPs were fully effective in preventing erosion and sedimentation into nearby waterbodies.

There was one vegetation management review during the FY17/18 review cycle under the ground-based skidding and harvesting protocol on the Girard Perkins Salvage Unit #77. The review indicated that BMPs were “mostly implemented”. No corrective or adaptive management actions were identified from an implementation standpoint. BMPs were fully effective in preventing erosion and sedimentation into nearby waterbodies.

Water Uses Category

There was one water uses review during the FY15/16 review cycle under the operation and maintenance of spring-source facilities. The review indicated that BMPs were “mostly implemented”. Only some BMPs were prescribed, but all BMPs were implemented on-the-ground and full project oversight occurred. BMPs were fully effective in preventing erosion and sedimentation into nearby waterbodies.

There was one water uses review during the FY17/18 review cycle under the completed reconstruction/repair or operation and maintenance of water sources (drafting). This review looked at a diversion structure on an unnamed tributary to Swamp Creek. At this site, there was reconstruction/repair of a diversion for irrigation. The review indicated that BMPs were “marginally implemented”. From an implementation standpoint, the stream needed work to handle diversion flow which had not had water for many years. Corrective actions identified included stabilization of a headcut to improve the stream channel. BMPs were considered “not effective” in preventing erosion and sedimentation into nearby waterbodies. There was evidence of sediment transport to or deposition in a waterbody at 1-2 locations. Evidence included localized sediment deposition into the waterbody, changes to substrate composition, changes to waterbody geometry, bank instability, vegetation damage or bare ground and headcutting. Additional stabilization was needed at the site, along with revegetation.

Discussion

This discussion will be split into two parts, one for the implementation of BMPs and one for the effectiveness of BMPs that were implemented.

BMP Implementation

Figure 9 displays overall BMP implementation from 2014-2019 reviews. Only 17% of BMP reviews yielded a “fully implemented” rating (3 of the 19 BMP reviews conducted). Over half of BMP reviews indicated that BMPs were either marginally implemented or not prescribed. Trends were not readily observed; however, it is important to note that there were four surveys in the FY14-16 that did not have BMPs implemented while in the FY16-18 review cycle BMPs were implemented in all projects that were reviewed, which indicates an improvement in prescribing BMPs and ensuring that they are implemented. Overall, when BMPs are prescribed they are being implemented on the ground and project oversight is occurring. The issue that seems to be driving BMP implementation review scores lower is that BMPs are not being prescribed in these cases.

From a project category perspective, no category yielded a rating of “fully implemented” except for the chemical uses category (but only one BMP review occurred during the review period). BMPs were mostly implemented in the vegetation and fire management categories, indicating that the forest is more successful at prescribing BMPs and implementing them on-the-ground than other project categories. Range, recreation, and road management appear to be the categories where the forest is less successful in prescribing BMPs and implementing those BMPs on-the-ground. For example, half of the recreation management reviews that were conducted had no BMPs prescribed, leading to no BMPs implemented on-the-ground.

BMP Effectiveness

Figure 10 displays overall BMP effectiveness from 2014-2019 reviews. During this period, 44% of BMP reviews yielded a “fully effective” rating (8 of the 19 reviews conducted), while 33% indicated that BMPs were not effective (6 of the 19 reviews conducted). Over half of BMP reviews indicated that BMPs were either fully or mostly effective. Again, trends were not readily observed.

From a project category perspective, BMPs were fully effective for all reviews in the vegetation, fire, and chemical uses category, indicating that those BMPs that are implemented are fully effective in preventing sedimentation and erosion into nearby waterbodies. Of the limited projects reviewed, BMPs were not effective in range management and not effective in half of

reviews in water uses and road management. Only one review in recreation management indicated that BMPs were not effective; the remainder were either fully or mostly effective.

In summary, 19 BMP reviews were conducted on the Forest for the review period from 2014-2019. These reviews indicated that of the projects sampled BMPs were not prescribed or implemented effectively in some cases, especially with those projects associated with recreation, roads, and range management. However, when BMPs are implemented they tend to be effective, leading to benefits in terms of preventing sedimentation and erosion into nearby waterbodies. Additionally, of the projects sampled data indicate that BMPs are not being prescribed and are not being fully implemented on-the-ground as intended in some cases.

Other than particle size characterization and allotment monitoring, BMP reviews rely largely on qualitative assessments at the site level to infer whether management activities are posing a threat to, or are directly affecting, soil productivity or water quality. If qualitative assessment of project efficacy using BMP reviews is generally representative or whether water quality and soil productivity are being maintained, evaluations suggest that of the projects reviewed:

- BMPs and mitigations associated with timber sale, prescribed burning, and chemical uses implementation are effectively mitigating or avoiding sediment delivery to waterbodies on forest and are minimizing short-term impacts to soil productivity.
- BMPs are generally not being prescribed or implemented for recreation management activities. However, BMPs that are implemented on-the-ground are effective at avoiding sediment delivery to waterbodies.
- BMPs are generally not being prescribed or implemented for road management activities. Additionally, BMPs that are implemented are ineffective at avoiding sediment delivery to waterbodies and minimizing short-term impacts to soil productivity.
- Range management reviews yielded BMP implementation that was only marginally implemented, and those BMPs that were implemented were not effective in avoiding sediment delivery.

It is unclear as to whether corrective and adaptive management actions are being implemented after BMP reviews are completed. There were several instances where corrective and adaptive management actions were recommended, but no documentation as to whether those actions were implemented.

Findings

Table 34. Summary of findings for Plan Monitoring Item 6.

MONITORING ITEM	YEAR UPDATED	PLAN IMPLEMENTATION STATUS ¹ Do monitoring results demonstrate intended progress (i.e. maintaining, trending, or advancing) of the associated plan components listed with this monitoring item?	RECOMMENDATION Based on the evaluation of monitoring results, may changes be warranted?	MANAGEMENT If a change may be warranted, where may the change be needed? ²
MON – 6: Best Management Practices	2021	(B) Uncertain – More time is needed to assess the status or progress towards this plan component for some BMP	Yes	Management Activities: Improve consistency between BMPs described in planning documents and

Are soil and water conservation practices (BMPs) being implemented during project work and are they resulting in protection of water quality and beneficial uses?		categories. Because of the limited number of samples, we cannot definitively determine trends at the forest level.		implementation of BMPs on-the-ground. Watershed program to work with road and range management programs to ensure that BMPs that are implemented are effective in minimizing soil disturbance and erosion and sedimentation into nearby waterbodies. Follow-up on and prescribe corrective/adaptive management to ensure that those actions are being implemented.
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¹ **PLAN IMPLEMENTATION STATUS:** (A) Uncertain - Interval of data collection beyond this reporting cycle (indicate date of next time this monitoring item will be evaluated); (B) Uncertain - More time/data are needed to understand status or progress of the Plan Component(s); (C) Uncertain - Methods inadequate to assess the status or progress toward achieving plan component(s); (D) NO - Implementation of Plan Component(s) ARE NOT trending, progressing, and/or conducted as desired; (E) YES - Implementation of Plan Component(s) ARE trending, progressing, and/or conducted as desired

² **[36 CFR 219.12(d)(2)]** - The monitoring evaluation report must indicate whether or not a change to the (1) plan, (2) management activities, (3) the monitoring program, or a (4) new assessment, may be warranted based on the new information. The monitoring evaluation report must be used to inform adaptive management of the plan area

Monitoring Item 7 – Soil Productivity

Monitoring Item Summary

Table 35. Summary for Monitoring Item 7.

Monitoring Question	Plan Component(s)	Indicators*	Data collection interval	Data Source / Partner	Point of Contact
How are management actions maintaining soil quality?	Goal (Soil Productivity): Soil productivity is maintained or restored.	Percent Detrimental Soil Disturbance (DSD) measured in activity areas as determined by Region 1 Soil Criteria (N).	Biennial	Field data collected by FS personnel	Sara Rouse and Pam Fletcher
* Indicator influenced by climate change? Y = Yes; N = No; U = Uncertain					

Table 36. Monitoring Item 7 - Monitoring Collection Summary.

For monitoring item 7:	Year
Data was last collected or compiled in:	2021
Next scheduled data collection/compilation:	2023
Last BMER evaluation for this monitoring item:	n/a

Next scheduled BMER evaluation of this monitoring item:	2023
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Maintenance or restoration of soil productivity is a goal in the forest plan (Chapter 3, page 34). This monitoring question addresses whether progress towards this goal is occurring.

The Rat Creek Fire Salvage (<https://go.usa.gov/xAv2S>) project was selected because it is the only project to date with sufficient soil monitoring data using the appropriate methods to address this monitoring item. This project serves as a case study to reflect ongoing timber harvest activities. Since timber salvage has potentially higher impacts on soils with removed groundcover, the project was a more conservative example as litmus test for monitoring. The lack of pre-project management disturbance also provided a good test of forest operations protections measures for soil productivity. Finally, the project provided a long term look on efficacy of dry versus snow covered conditions which is an ongoing resource dilemma of cost benefit when addressing sensitive soil concerns.

Rat Creek Fire Salvage is located within the Rat Creek Wildfire perimeter (burned in 2007) on the Wisdom Ranger District. Most of the soils in the project area have developed in granite on gentle to moderate stream-dissected mountain slopes. These soils are generally sandy-textured, poorly developed, and contain at least 35% rock fragments. They are resistant to mass wasting, compaction and rutting but have a high-moderate erosion risk rating.

Methods

Soil Quality Standards state that 85 percent of activity areas (timber harvest units) must have soil in satisfactory condition, thus meeting the intent of the National Forest Management Act (NFMA). Areas of detrimental soil disturbance are not in satisfactory condition. The SQS define detrimental soil disturbance (DSD) thresholds for compaction, rutting, displacement, severely burned soil, erosion and mass movement.

The [Forest Soil Disturbance Monitoring Protocol](#) (Page-Dumroese et al, 2009) was followed to assess soil disturbance in the harvest units. The protocol is applied to areas disturbed by management activities and is a presence/absence (1=present, 0=absent) method of collecting visual attribute data in order to assess soil disturbance. Attributes evaluated are forest floor impacts, surface soil displacement, mixed surface soil/subsoil, rutting, burning (only management prescribed burning is assessed), compaction, and platy or massive structure.

The [Rat Creek Salvage Decision Notice and Finding of No Significant Impact](#) (July 22, 2009) states “a minimum of 10 percent of the harvest units (4 units minimum) will be monitored following the most recent version of the Soil Quality Disturbance Monitoring Protocol. Soil monitoring will include units 30b, 30c, 18b, and 18d.” Units 18b and 18d were not harvested, so timber harvest units 2b, 27, 27a, 30b, and 30c were monitored to determine the effects of the project on soil quality as defined by the [Northern Region Soil Quality Standards](#) (SQS). A minimum of thirty random plots were taken along transects through each of units. Units 27 and 27a were harvested with dry soil conditions in the fall of 2009, and units 2b, 30b and 30c were harvested in the winter of 2009/2010 with snow and frozen ground conditions. Initial post-harvest monitoring was completed on June 26-27, and September 27, 2012 and repeated July 21-24, 2020. Measurements of coarse woody debris (CWD), wood 3 inches in diameter or larger, were also taken in 2012 and again in 2020 using methods described in [Brown \(1974\)](#). Measurements were obtained along transects with random azimuths at a minimum of 5 random locations in each unit.

Results

Detrimental Soil Disturbance

Table 37, below, shows DSD and CWD measured in units 2b, 27, 27a, 30b and 30c in 2012 and 2020. No DSD was noted in any proposed harvest unit during pre-timber harvest monitoring completed in summer of 2009. Post-harvest DSD ranged from 0 to 8.6% (with an average of 6.3%) in 2012, well below DSD predicted in the EA. Detrimental soil disturbance was attributed to compaction from temporary roads and landings in all but one plot; Unit 27a also had DSD due to rutting that occurred in a very small area when a tracked machine slipped during harvest activities. No DSD was found in 2020, indicating recovery from detrimental soil compaction has occurred in the 10-11 years since harvest (see below for further discussion).

Table 37. Detrimental soil disturbance and coarse woody debris (CWD) measured at the Rat Creek Fire Salvage sale in 2012 and 2020.

Unit #	% Detrimental Soil Disturbance Predicted in EA	% Detrimental Soil Disturbance Measured in 2012	% Detrimental Soil Disturbance Measured in 2020	CWD (tons/acre) Measured in 2012	CWD (tons/acre) Measured in 2020
2b	11.9	6.4	0	12.9	18.7
27	11.8	10	0	4.4	15.6
27a	12.4	6.6	0	7.5	11.7
30b	11.8	0	0	12.3	22.0
30c	13.4	8.6	0	12.4	22.7

Coarse Woody Debris

Coarse woody debris measurements show recruitment of CWD, likely due to leave trees blowing over between 2012 and 2020. The 2009 [Rat Creek Salvage Decision Notice and Finding of No Significant Impact](#) required 12 tons per acre of CWD. Post-harvest monitoring in 2012 found all units to be short of the required 12 tons; however, all units have achieved the requirement.

Compaction

All but one instance of DSD measured in 2012 was compaction. To further examine recovery that has occurred since 2012 in the harvest units, we compared compaction measured in 2012 and 2020 at 0-10 cm and 10-30 cm depths (Table 38). Please note that plots where compaction was noted did not indicate compaction severe enough to be considered detrimental. Much of the compaction measured in 2012 was detrimental; none of the compaction noted in 2020 was detrimental. The only compaction measured in 2020 was in Unit 30c, from 0-10cm. This unit had more detrimental disturbance post-harvest than the other units, because it is a small unit (4 acres) and the temporary road accessing it, and Unit 30b, is a proportionally larger percentage of the unit. This means more DSD plots landed on the temporary road than for the much larger Unit 30b at 20 acres. One plot on the temporary road in Unit 30c had thick grass growing on it in 2020 and though it was still compacted, it was not detrimental. Plant growth and freeze-thaw cycles are helping to rehabilitate soils that were detrimentally compacted in 2012.

Table 38. Percentage of plots showing soil compaction at 0-10cm and 10-30cm depths measured in 2012 and 2020.

Unit #	% Plots Compacted, 0-10 cm, 2012	% Plots Compacted, 0-10 cm, 2020	% Plots Compacted, 10-30 cm, 2012	% Plots Compacted, 10-30 cm, 2020
2b	6.5%	0%	4.8%	0%
27	6.7%	0%	6.7%	0%
27a	3.3%	0%	3.3%	0%
30b	3.1%	0%	0%	0%
30c	17%	8.3%	5.7%	0%

Discussion

Data collected in 2012 shows soils in units harvested under dry conditions in the fall (unit 27 and 27a) and in the winter (2b, 30b and 30c) were detrimentally compacted with the fall harvested units initially having higher DSD than winter harvested units (Table 37), which is expected because winter conditions involve snow cover and frozen ground, both of which protect soils from disturbance. While some non-detrimental compaction was found at 0-10 cm in Unit 30c, no detrimental compaction was observed in 2020 (Table 38), indicating significant recovery of compaction has taken place in all units in the 10-11 years since harvest.

Predicted detrimental soil disturbance was overestimated in the *Rat Creek EA* when compared to observed DSD for all units except 27 (Table 37).

Soil disturbance monitoring of a past timber sale a few years after implementation, and again 8 years later, demonstrates recovery of detrimentally disturbed soils is occurring over time (approximately 10 years). Monitoring methodology is effective in capturing changes, and soil productivity is being maintained. No changes to management or monitoring methodology are needed. We will continue monitoring soil disturbance to determine recovery rates in different soil types.

The trend of falling down snags in a burn area was tracked with the monitoring. Initially, coarse wood was lower than desired, but increased over the next 8 years as predicted. Ten years after the salvage sale, the coarse wood loads exceed the desired minimum condition. Higher CWD loads benefit soil productivity by providing additional microsites for holding water and buffering diurnal temperature swings in this area where temperature can limit growth. At least in this case study, the outcomes met our predictions for the project.

Findings

Table 39. Summary of findings for Plan Monitoring Item 7.

MONITORING ITEM	YEAR UPDATED	PLAN IMPLEMENTATION STATUS ¹	RECOMMENDATION	MANAGEMENT
		Do monitoring results demonstrate intended progress (i.e. maintaining, trending, or advancing) of the associated plan components listed with this monitoring item?		
			Based on the evaluation of monitoring results, may changes be warranted?	If a change may be warranted, where may the change be needed? ²

MON – 7: Soil Productivity How are management actions maintaining soil quality?	2021	(E) Yes – based on 2020 survey results indicating recovery of soils and coarse woody debris.	No	N/A
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¹ **PLAN IMPLEMENTATION STATUS:** (A) Uncertain - Interval of data collection beyond this reporting cycle (indicate date of next time this monitoring item will be evaluated); (B) Uncertain - More time/data are needed to understand status or progress of the Plan Component(s); (C) Uncertain - Methods inadequate to assess the status or progress toward achieving plan component(s). (D) NO - Implementation of Plan Component(s) ARE NOT trending, progressing, and/or conducted as desired; (E) YES - Implementation of Plan Component(s) ARE trending, progressing, and/or conducted as desired

² **[36 CFR 219.12(d)(2)]** - The monitoring evaluation report must indicate whether or not a change to the (1) plan, (2) management activities, (3) the monitoring program, or a (4) new assessment, may be warranted based on the new information. The monitoring evaluation report must be used to inform adaptive management of the plan area

Monitoring Item 8 – Disturbance

Monitoring Item Summary

Table 40. Summary of Monitoring Item 8.

Monitoring Question	Plan Component(s)	Indicators*	Data collection interval	Data Source / Partner	Point of Contact
Have disturbance processes (fire, climate, insects, diseases, and management actions) occurred in order to create the mosaic of species and size diversity to create resilient vegetation communities?	<p>GOAL (Biodiversity)</p> <p>A variety of disturbance processes are managed or allowed to occur that produce resilient vegetation communities able to sustain diversity in the face of uncertain climate-influenced disturbances. Resilient vegetation communities will have a mosaic of species and age classes of trees, shrubs, grasses, and forbs for animal forage and cover, and perpetuate the diversity of plants and the microbial and insect communities upon which they are dependent. Old growth is managed on a forest wide basis and is well distributed (Forest Plan, p. 43).</p>	<p>Proportion of forest types (percentage of total acres) Forest-wide and by biophysical setting for each of these measures:</p> <p>01. Dominance type (i.e., cover type) note: for the rest of this analysis, R1 cover types will be a surrogate for dominance types (Y).</p> <p>02. Species presence (Y).</p> <p>03. Size class (Y).</p> <p>04. Tree canopy cover (Y).</p> <p>Very large trees:</p> <p>05. Very large tree subclass – proportion of area Forest-wide and by biosetting (Y).</p> <p>06. Very large tree density, trees per acre. Snag density, snags per acre. For >15-inch DBH., >20-inch DBH., in/out Wilderness/roadless (Y).</p> <p>07. Sage brush Forest-wide within non-forest types (proportion of) (Y).</p>	5 years	FIA/FIA Summary database	Johanna Nosal – acting Forest Silviculturist

* Indicator influenced by climate change? Y = Yes; N = No; U = Uncertain

Table 41. Monitoring Item 8 – Monitoring Collection Summary.

For monitoring item 8:	Year
Data was last collected or compiled in:	Collected up to 2015, compiled in 2021
Next scheduled data collection/compilation:	Collected up to 2020, compiled in 2023
Last BMER evaluation for this monitoring item:	n/a
Next scheduled BMER evaluation of this monitoring item:	2023

One measure of landscape resiliency is the diversity of the landscape- including species, size of trees, and tree density. Having a variety of vegetation conditions across the landscape will reduce impacts of forest insects and diseases and allow the landscape to maintain forest cover even after a potential insect or disease outbreak. A diversity of conditions also can make a landscape more resilient to wildfire impacts.

Methods

The national Forest Inventory and Analysis (FIA) program provides a congressionally mandated, continuous inventory of the forest resources of the United States. The FIA inventory design is based on a spatially balanced sample of inventory plots. The FIA sampling frame uniformly covers all forested lands, regardless of management emphasis; therefore, wilderness areas, roadless areas, and actively managed lands all have the same probability of being sampled and data collection standards are strictly controlled by FIA protocols. Descriptive statistics can be calculated for most FIA attributes. The most current FIA dataset is the R1 Hybrid 2015 version (updated January 2021), using data collected from 2006-2015, on 363 FIA plots scattered across the Forest.

Snag estimates were used using a hybrid 2011 FIA analysis dataset. Estimates of Snag and Live-Tree Densities for Eastern Montana Forests in the Northern Region based on FIA Hybrid 2011 Analysis Dataset.

The wording of the Indicators was interpreted as having 1.) a proportion of forested cover, and 2.) a breakdown of each indicator by broad PVT (Potential Vegetation Type). The term biophysical setting was not defined in the Forest Plan. Broad PVT was used due to the lack of definition of “biophysical setting,” the accessibility of data related to PVTs, and the Regional Office support in providing estimates.

“Very large tree” is not defined in the Forest Plan.

Results

Indicator 1 (Dominance Type)

Table 42. Cover type forest-wide and the percentage of forested acres by dominance type.

R1 Cover Types	Estimate Acres	Percent of Forested Acres
Aspen hardwood	16,554	1
Dry Douglas fir	406,323	16
Dry shrub	6,020	0
Lodgepole pine	1,057,944	41
Mixed mesic conifer	260,348	10
Ponderosa pine	46,652	2
Spruce fir	480,063	19
Whitebark subalpine larch	279,911	11

Table 43. Cover type by broad potential vegetation type (PVT) and percentage of each cover type by PVT.

R1 Broad PVT	R1 Cover Types	Estimate Acres	Percent of Broad PVT
Alpine	Aspen hardwood	0	0.0
	Dry Douglas fir	0	0.0
	Dry shrub	0	0.0
	Lodgepole pine	0	0.0
	Mixed mesic conifer	0	0.0
	Ponderosa pine	0	0.0
	Spruce fir	0	0.0
	Whitebark subalpine larch	2,976	100.0
Cold	Aspen hardwood	1,500	0.1
	Dry Douglas fir	0	0.0
	Dry shrub	0	0.0
	Lodgepole pine	537,023	52.2
	Mixed mesic conifer	39,002	3.8
	Ponderosa pine	3,000	0.3
	Spruce fir	207,009	20.1
	Whitebark subalpine larch	241,510	23.5

R1 Broad PVT	R1 Cover Types	Estimate Acres	Percent of Broad PVT
Cool Moist	Aspen hardwood	3,009	0.4
	Dry Douglas fir	1,504	0.2
	Dry shrub	0	0.0
	Lodgepole pine	350,539	47.0
	Mixed mesic conifer	117,348	15.7
	Ponderosa pine	1,504	0.2
	Spruce fir	257,262	34.5
	Whitebark subalpine larch	15,045	2.0
Mesic Grassland	Aspen hardwood	0	0.0
	Dry Douglas fir	0	0.0
	Dry shrub	0	0.0
	Lodgepole pine	0	0.0
	Mixed mesic conifer	0	0.0
	Ponderosa pine	0	0.0
	Spruce fir	1,488	33.3
	Whitebark subalpine larch	2,976	66.7
Mesic Shrub	Aspen hardwood	0	0.0
	Dry Douglas fir	0	0.0
	Dry shrub	0	0.0
	Lodgepole pine	1,488	100.0
	Mixed mesic conifer	0	0.0
	Ponderosa pine	0	0.0
	Spruce fir	0	0.0
	Whitebark subalpine larch	0	0.0
Riparian Wetland	Aspen hardwood	8,929	66.7
	Dry Douglas fir	1,488	11.1
	Dry shrub	0	0.0
	Lodgepole pine	0	0.0
	Mixed mesic conifer	0	0.0
	Ponderosa pine	0	0.0
	Spruce fir	2,976	22.2

R1 Broad PVT	R1 Cover Types	Estimate Acres	Percent of Broad PVT
	Whitebark subalpine larch	0	0.0
Sparse	Aspen hardwood	0	0.0
	Dry Douglas fir	0	0.0
	Dry shrub	0	0.0
	Lodgepole pine	1,654	20.0
	Mixed mesic conifer	0	0.0
	Ponderosa pine	0	0.0
	Spruce fir	3,307	40.0
	Whitebark subalpine larch	3,307	40.0
Warm Dry	Aspen hardwood	1,501	0.2
	Dry Douglas fir	402,386	55.0
	Dry shrub	6,006	0.8
	Lodgepole pine	165,158	22.6
	Mixed mesic conifer	99,095	13.6
	Ponderosa pine	40,539	5.5
	Spruce fir	6,006	0.8
	Whitebark subalpine larch	10,510	1.4
Xeric Shrub Woodland	Aspen hardwood	1,488	14.3
	Dry Douglas fir	0	0.0
	Dry shrub	0	0.0
	Lodgepole pine	0	0.0
	Mixed mesic conifer	4,465	42.9
	Ponderosa pine	1,488	14.3
	Spruce fir	1,488	14.3
	Whitebark subalpine larch	1,488	14.3

Indicator 2 (Species Presence)

Table 44. Species presence forest-wide and the percentage of total Forest acres.

Species	Percentage of Forested Acres
Aspen (POTR5)	1.3
Cottonwood (POPUL)	0.0
Douglas fir (PSME)	30.1
Lodgepole pine (PICO)	47.7
Ponderosa pine (PIPO)	0.0
Spruce (PIEN)	21.8
Subalpine fir (ABLA)	30.9
Whitebark pine (PIAL)	22.4

Table 45. Species presence by broad PVT and the percentage of each PVT.

Species	R1 Broad PVT	Percentage of PVT
Aspen (POTR5)	Alpine	0.0
	Cold	0.3
	Cool Moist	1.6
	Mesic Grassland	0.0
	Mesic Shrub	0.0
	Riparian Wetland	21.4
	Sparse	0.0
	Warm Dry	1.9
	Warm Moist	0.0
	Xeric Grassland	0.0
	Xeric Shrub Woodland	0.5
Cottonwood (POPUL)	Alpine	0.0
	Cold	0.0
	Cool Moist	0.0
	Mesic Grassland	0.0
	Mesic Shrub	0.0
	Riparian Wetland	0.0
	Sparse	0.0

Species	R1 Broad PVT	Percentage of PVT
	Warm Dry	0.0
	Warm Moist	0.0
	Xeric Grassland	0.0
	Xeric Shrub Woodland	0.0
Douglas fir (PSME)	Alpine	0.0
	Cold	10.7
	Cool Moist	27.7
	Mesic Grassland	0.0
	Mesic Shrub	0.0
	Riparian Wetland	7.1
	Sparse	0.0
	Warm Dry	76.7
	Warm Moist	0.0
	Xeric Grassland	0.0
	Xeric Shrub Woodland	2.8
Lodgepole pine (PICO)	Alpine	0.0
	Cold	67.1
	Cool Moist	62.5
	Mesic Grassland	0.0
	Mesic Shrub	50.0
	Riparian Wetland	0.0
	Sparse	2.5
	Warm Dry	38.0
	Warm Moist	0.0
	Xeric Grassland	0.0
	Xeric Shrub Woodland	0.0
Ponderosa pine (PIPO)	Alpine	0.0
	Cold	0.0
	Cool Moist	0.0
	Mesic Grassland	0.0

Species	R1 Broad PVT	Percentage of PVT
	Mesic Shrub	0.0
	Riparian Wetland	0.0
	Sparse	0.0
	Warm Dry	0.2
	Warm Moist	0.0
	Xeric Grassland	0.0
	Xeric Shrub Woodland	0.0
Spruce (PIEN)	Alpine	0.0
	Cold	28.5
	Cool Moist	45.4
	Mesic Grassland	1.5
	Mesic Shrub	0.0
	Riparian Wetland	7.1
	Sparse	7.5
	Warm Dry	2.5
	Warm Moist	0.0
	Xeric Grassland	0.0
	Xeric Shrub Woodland	0.5
Subalpine fir (ABLA)	Alpine	0.0
	Cold	53.9
	Cool Moist	50.4
	Mesic Grassland	1.5
	Mesic Shrub	0.0
	Riparian Wetland	0.0
	Sparse	7.5
	Warm Dry	0.7
	Warm Moist	0.0
	Xeric Grassland	0.0
	Xeric Shrub Woodland	0.0

Species	R1 Broad PVT	Percentage of PVT
Whitebark pine (PIAL)	Alpine	50.0
	Cold	48.2
	Cool Moist	18.7
	Mesic Grassland	4.4
	Mesic Shrub	0.0
	Riparian Wetland	0.0
	Sparse	5.8
	Warm Dry	3.9
	Warm Moist	0.0
	Xeric Grassland	0.0
	Xeric Shrub Woodland	0.5

Indicator 3 (Size Class)

Table 46. Size class forest-wide and percentage of forested cover. Size classes are diameter at breast height (DBH).

Size Class (inches)	Estimate Acres	Percent Forested Cover
Seedling	90,294	4
00.1-04.9	206,171	8
05.0-09.9	1,337,855	52
10.0-14.9	630,553	25
15.0-19.9	198,647	8
20.0-24.9	66,216	3
25.0+	24,078	1

Table 47. Size class by broad PVT and percentage of each PVT. Size classes are diameter at breast height.

R1 Broad PVT	Size Class (inches)	Estimate Acres	Percent of Broad PVT
Alpine	Seedling	1,488	50

R1 Broad PVT	Size Class (inches)	Estimate Acres	Percent of Broad PVT
	00.1-04.9	1,488	50
	05.0-09.9	0	0
	10.0-14.9	0	0
	15.0-19.9	0	0
	20.0-24.9	0	0
	25.0+	0	0
Cold	Seedling	37,502	4
	00.1-04.9	84,004	8
	05.0-09.9	658,528	64
	10.0-14.9	202,509	20
	15.0-19.9	31,501	3
	20.0-24.9	10,500	1
	25.0+	4,500	0
Cool Moist	Seedling	19,558	3
	00.1-04.9	78,232	10
	05.0-09.9	367,088	49
	10.0-14.9	197,084	26
	15.0-19.9	51,152	7
	20.0-24.9	25,576	3
	25.0+	7,522	1
Mesic Grassland	Seedling	0	0

R1 Broad PVT	Size Class (inches)	Estimate Acres	Percent of Broad PVT
	00.1-04.9	1,488	33
	05.0-09.9	1,488	33
	10.0-14.9	1,488	33
	15.0-19.9	0	0
	20.0-24.9	0	0
	25.0+	0	0
Mesic Shrub	Seedling	0	0
	00.1-04.9	1,488	100
	05.0-09.9	0	0
	10.0-14.9	0	0
	15.0-19.9	0	0
	20.0-24.9	0	0
	25.0+	0	0
Riparian Wetland	Seedling	5,953	44
	00.1-04.9	0	0
	05.0-09.9	1,488	11
	10.0-14.9	1,488	11
	15.0-19.9	1,488	11
	20.0-24.9	1,488	11
	25.0+	1,488	11
Sparse	Seedling	3,307	40

R1 Broad PVT	Size Class (inches)	Estimate Acres	Percent of Broad PVT
	00.1-04.9	1,654	20
	05.0-09.9	3,307	40
	10.0-14.9	0	0
	15.0-19.9	0	0
	20.0-24.9	0	0
	25.0+	0	0
Warm Dry	Seedling	15,014	2
	00.1-04.9	37,536	5
	05.0-09.9	300,288	41
	10.0-14.9	226,717	31
	15.0-19.9	112,608	15
	20.0-24.9	28,527	4
	25.0+	10,510	1
Xeric Shrub Woodland	Seedling	5,953	57
	00.1-04.9	0	0
	05.0-09.9	2,976	29
	10.0-14.9	0	0
	15.0-19.9	1,488	14
	20.0-24.9	0	0
	25.0+	0	0

Indicator 4 (Tree Canopy Cover)

Table 48. Tree canopy cover Forest-wide and percentage of forested acres.

Canopy Cover (%)	Estimate Acres	Percent of Forested Acres
0-39.9%	1,622,281	48
40-59.9%	847,258	25
≥60%	887,890	26

Table 49. Tree canopy cover by broad PVT and percentage of each PVT.

R1 Broad PVT	Canopy Cover 0.0 - 39.9%		Canopy Cover 40.0 - 59.9%		Canopy Cover ≥ 60.0%	
	Estimate Acres	Percent of Broad PVT	Estimate Acres	Percent of Broad PVT	Acres	Percent of Broad PVT
Alpine	4,465	75	1,488	25	0	0
Cold	408,018	36	370,516	33	352,515	31
Cool Moist	290,360	35	236,200	29	300,891	36
Mesic Grassland	101,199	100	0	0	0	0
Mesic Shrub	4,465	75	1,488	25	0	0
Riparian Wetland	40,182	96	1,488	4	0	0
Sparse	57,875	97	0	0	1,654	3
Warm Dry	381,366	45	234,225	28	229,720	27
Xeric Grassland	5,953	100	0	0	0	0
Xeric Shrub Woodland	319,968	100	0	0	1,488	0

Indicator 5 (Very Large Trees)

Table 50. Very large trees Forest-wide and percentage of forested cover.

Large Tree Structure	Estimate Acres	Percent Forested Cover
None	2,218,559	76
Large	464,530	16
Very Large	0	0
Both	251,685	9

Table 51. Very large trees by broad PVT and percentage of each PVT.

R1 Broad PVT	Large Tree Structure	Estimate Acres	Percentage of PVT
Alpine	None	0	0
	Large	0	0
	Very Large	0	0
	Both	0	0
Cold	None	941,286	83
	Large	138,557	12
	Very Large	0	0
	Both	51,206	5
Cool Moist	None	601,231	73
	Large	139,680	17
	Very Large	0	0
	Both	86,541	10
Mesic Grassland	None	13,394	75
	Large	4,465	25
	Very Large	0	0
	Both	0	0
Mesic Shrub	None	5,953	100
	Large	0	0
	Very Large	0	0
	Both	0	0
Riparian Wetland	None	11,906	67
	Large	0	0
	Very Large	0	0
	Both	5,953	33
Sparse	None	59,529	100
	Large	0	0

R1 Broad PVT	Large Tree Structure	Estimate Acres	Percentage of PVT
	Very Large	0	0
	Both	0	0
Warm Dry	None	560,950	66
	Large	175,588	21
	Very Large	0	0
	Both	108,772	13
Warm Moist	None	0	0
	Large	0	0
	Very Large	0	0
	Both	0	0
Xeric Grassland	None	0	0
	Large	0	0
	Very Large	0	0
	Both	0	0
Xeric Shrub Woodland	None	17,859	75
	Large	5,953	25
	Very Large	0	0
	Both	0	0

Table 52. Trees per acre >15" and >20" DBH, in and out of Roadless/Wilderness.

Wilderness/Roadless	Trees per acre >15"	Trees per acre >20"
In	44.4	10.6
Out	44.4	9.7

Table 53. Snags per acre >15" and >20" DBH, in and out of Roadless/Wilderness.

Wilderness/Roadless	Snags per acre >15"	Snags per acre >20"
In	16.7	4.2
Out	13.1	2.6

Indicator 6 (Sagebrush)

As of 2020, sagebrush makes up nearly 60 percent of non-forested lands on the B-D.

Discussion

The Beaverhead-Deerlodge Forest Plan defines resiliency as: *“The capacity of forests and grassland/shrublands to return to prior conditions after disturbance. Resilient forests are those that not only accommodate gradual changes, related to climate, but tend to return toward a prior condition after disturbance either naturally or with management assistance. Within the BDNF, maintaining a diversity of tree species or dominance types, age or size class diversity within dominance types, and forest density similar to what historic disturbance regimes produced are considered underpinnings of a resilient forest”*. Missing from this definition are species distribution percentages that would qualify as resilient; and, how fire exclusion has played into the current species distribution.

This dataset in the tables above serve as a baseline to ascertain shifts in forest composition into the future due to management or natural disturbances. It is difficult to articulate the Forest’s present status regarding resiliency without a clear definition of what set of vegetation conditions, in terms of percentages of species distributions, make a resilient forest means for the BDNF and the forest types within its boundaries. The results of the indicators will be discussed, but the recommendation will be made to either: change this monitoring question and indicators to include the Vegetation Objectives in the Forest Plan (p.43-44) that are quantitative measures of desired vegetation trends for Douglas-fir, lodgepole pine, aspen, whitebark pine/subalpine fir, and other forested vegetation types. Either option will require forest level modeling and involvement of Regional Office (RO) and possibly the Rocky Mountain Research Station (RMRS) staff. Old growth, which is indicated in the goal, is not necessarily tied to large tree structure as is done in this iteration of monitoring.

In the calendar year 2021 the Forest is predominately lodgepole pine (48%) and in the 5-9.9” size class (52%), and lodgepole pine is the predominate cover type within most broad PVTs (Tables 42, 43, 45, and 46). This indicates that large-scale mountain pine beetle outbreaks are still possible across much of the Forest, and that resiliency to mountain pine beetle is relatively low.

Tree species presence is somewhat homogenous across the forest, indicating species diversity is present in most areas and that some areas may be resilient to affects from certain insects or diseases that only affect one species of trees so that loss of forest cover may not occur if those stressors occurred in just one species (Table 44). It is difficult to ascertain on a spatial scale how much of the Forest has diverse species composition. Table 45, which shows species presence by broad PVT, indicates that species presence may be limited to certain PVTs and may not be well-distributed across the Forest.

Tree density, measured by canopy cover, is somewhat well distributed (Table 48). Table 49 shows that the cold and cool-moist PVTs, which contain most of the lodgepole pine on the Forest, have very even distributions between the canopy cover groupings. Tree density can make a stand more or less susceptible to insect and disease stressors and can have different fire severities in the event of a wildfire. An even distribution of canopy covers shows a diversity of tree densities across the Forest.

Tables 50 and 51 show that roughly $\frac{3}{4}$ of the Forest does not have large tree or very large tree structure. This does not necessarily show a non-resilient status but indicates the current composition of large trees across the Forest.

Large tree structure and large snag density are somewhat consistent inside and outside of Roadless and Wilderness areas (Tables 52 and 53), suggesting that management is not affecting the overall level of large tree/large snag structure.

Information on sage presented above will act as a baseline from which to calculate change over time for future iterations of this report.

In the future, this data can be used to determine trends and shifts in forest composition. At this iteration, trends in vegetation cannot be determined.

Findings

Table 54. Summary of finding for Plan Monitoring item 8.

MONITORING ITEM	YEAR UPDATED	PLAN IMPLEMENTATION STATUS ¹ Do monitoring results demonstrate intended progress (i.e. maintaining, trending, or advancing) of the associated plan components listed with this monitoring item?	RECOMMENDATION Based on the evaluation of monitoring results, may changes be warranted?	MANAGEMENT If a change may be warranted, where may the change be needed? ²
MON – 8: Disturbance Have disturbance processes (fire, climate, insects, diseases, and management actions) occurred in order to create the mosaic of species and size diversity to create resilient vegetation communities?	2021	(B) Uncertain - More time is needed to assess the status or progress towards this plan component. (C) Uncertain - Methods inadequate to assess the status or progress toward achieving this plan component.	Yes	Monitoring Program: Modify indicators to follow quantitative forest composition objectives for Douglas-fir, lodgepole pine, aspen, whitebark pine/subalpine fir, and other forested vegetation types outlined in the Forest Plan vegetation section (p. 43-44).

¹ **PLAN IMPLEMENTATION STATUS:** (A) Uncertain - Interval of data collection beyond this reporting cycle (indicate date of next time this monitoring item will be evaluated); (B) Uncertain - More time/data are needed to understand status or progress of the Plan Component(s); (C) Uncertain - Methods inadequate to assess the status or progress toward achieving plan component(s). (D) NO - Implementation of Plan Component(s) ARE NOT trending, progressing, and/or conducted as desired; (E) YES - Implementation of Plan Component(s) ARE trending, progressing, and/or conducted as desired

² **[36 CFR 219.12(d)(2)]** - The monitoring evaluation report must indicate whether or not a change to the (1) plan, (2) management activities, (3) the monitoring program, or a (4) new assessment, may be warranted based on the new information. The monitoring evaluation report must be used to inform adaptive management of the plan area

Monitoring Item 9 – Aspen

Monitoring Item Summary

Table 55. Summary of Monitoring Item 9.

Monitoring Question	Plan Component(s)	Indicators*	Data collection interval	Data Source / Partner	Point of Contact
Are management activities restoring aspen at the rate projected in the forest plan?	OBJECTIVE (Forested vegetation) Aspen Component: Increase the aspen component within	Acres of conifer removal within aspen stands by: 01. Wildfire (Y) 02. Insects (bark beetle or	2 years	Restoration and Resiliency Report, Aerial Detection Surveys, Wildfire data, R1 VMAP	Johanna Nosal-acting Forest Silviculturist

	lodgepole pine and other types, on 67,000 acres (Forest Plan, p. 44).	western spruce budworm) (Y) 03. Management (U)			
* Indicator influenced by climate change? Y = Yes; N = No; U = Uncertain					

Table 56. Monitoring Item 9 - Monitoring Collection Summary.

For monitoring item 9:	Year
Data was last collected or compiled in:	2021
Next scheduled data collection/compilation:	2023
Last BMER evaluation for this monitoring item:	n/a
Next scheduled BMER evaluation of this monitoring item:	2023

Aspen is a deciduous tree that contributes to ecological diversity, supports a variety of plant associations, and provides important habitat for many species of wildlife. Aspen and riparian areas are considered the most biologically diverse communities in the West. These communities are rich in insect and plant diversity, both of which contribute directly to the diet of grizzly bears. Ungulate species such as moose and elk rely heavily on young aspen shoots for forage. These areas, therefore, provide important foraging areas for grizzly bears, gray wolves and their prey species. Migratory bird species also rely heavily on aspen communities.

Aspens thrive only if they can obtain the proper combination of sunlight, soil warmth, and adequate soil moisture. Conifer removal through natural or artificial means can create the proper growth environments to improve aspen health and promote aspen sprouting and clone expansion.

Methods

Acres of conifer removal via insect/disease or wildfire was assessed using Forest Service Region 1 (R1) VMAP data integrated with aerial detection survey (ADS) and wildfire history. Disturbances were assessed post-2009 (after the signing of the Forest Plan).

The 2018 R1 VMAP product, developed by the Forest Service Region One Geospatial Services Group, was used to estimate existing stand conditions. VMAP classifies vegetation into spatially distinct polygons with attributes related to life form, dominance type, size class, and canopy cover. The VMAP version utilized was based on 2016/2017 imagery and documentation can be found at: [VMAP Imagery](#).

R1 VMAP does not provide information on aspen occurrence, it provides information on where the canopy cover of hardwoods is greater than 40%. Since aspen is the dominant hardwood species on the BD, these polygons are assumed to be aspen.

VMAP polygons that have >40% aspen canopy cover and/or were surveyed as part of the Forest-wide *Aspen Decision Memo* (ADM) project were included in this analysis.

Aerial Detection Survey (ADS) for insect and disease are conducted annually using fixed wing aircraft and sketch mapping technology. ADS is not always flown over the entire National Forest.

Fire history exists in the corporate GIS library and is updated annually with new wildfire perimeters. It was assumed for this analysis that areas within the fire perimeter had some level of conifer removal.

VMAP aspen polygons merged with ADM polygons, as described above, were overlaid with ADS (western spruce budworm and bark beetle) and fire history. Where there was overlap, it was assumed that some insect, disease, or fire conifer mortality occurred, which probably favored aspen.

Mechanical conifer removal was assessed with the *Restoration and Resiliency Report*. Since 2012, the *Restoration and Resiliency Report* documents treatments the US Forest Service has accomplished each year that trend vegetation towards resilient desired conditions. The intent of the report is to show where the Forests of the Northern Region of the Forest Service are managing for (restore or maintain) a range of forest and non-forest vegetation desired conditions (commensurate with current disturbance regimes). These desired conditions include the improvement or maintenance of resilient, native wildlife habitat where such vegetation types have decreased in extent throughout the Forest and Region. This report is updated annually and available here: [Restoration and Resiliency Report](#).

Since information in the *Restoration and Resiliency Report* is available from 2012 on, conifer removal treatments in 2010 and 2011, if they occurred, are not included in this report. It was assumed that “mechanical” treatment includes hand work done with chainsaws.

Results

Table 57. Acres of conifer removal within aspen stands via wildfire.

Year	Acres Affected by Wildfire	Wildfire Name
2010	0.0	n/a
2011	4.9	North Meadow
2012	4.9	Nineteen Mile, Pony
2013	27.5	Eureka
2014	0.0	n/a
2015	0.0	n/a
2016	0.0	n/a
2017	29.3	Little Hogback, Meyers
2018	0.4	Wigwam
2019	10.4	McClusky
2020	53.7	Bear Creek, Sourdough, Slate Creek
Total	131.2	

Table 58. Acres of conifer removal within aspen stands via insects. It was assumed that any area with western spruce budworm impacts experience some level of conifer mortality. The lower acreage documented in 2020 is due to ADS survey coverage being reduced drastically due to Covid-19.

Year	Acres Disturbed by Bark Beetle or Western Spruce Budworm
2010	2404
2011	1872
2012	875
2013	459
2014	754

2015	1570
2016	1351
2017	473
2018	1677
2019	1162
2020	1
Total	12597

Table 59. Acres of conifer removal within aspen stands via mechanical treatment.

Year	Acres Treated	Treatment Type
2010	No Data	n/a
2011	No Data	n/a
2012	0	n/a
2013	738	Thinning, release/weeding, jackpot burning
2014	95	Piling, pile burning
2015	0	n/a
2016	55	Piling, pile burning
2017	0	n/a
2018	108	Lop and scatter
2019	138	Improvement cut, certification of natural regeneration
2020	0	n/a
Total	1134	

Table 60. Presence of aspen based on FIA data.

Species	Presence of Species				Presence of Species $\geq 5"$ DBH				Presence of Species $< 5"$ DBH				Total # of PSUs Sampled	Total # of Subplots Sampled
	Mean	90% CI - Lower Bound	90% CI - Upper Bound	# of Subplots	Mean	90% CI - Lower Bound	90% CI - Upper Bound	# of Subplots	Mean	90% CI - Lower Bound	90% CI - Upper Bound	# of Subplots		
Aspen (POTR5)	1.29	0.71	1.91	29	0.58	0.27	0.98	13	1.02	0.53	1.60	23	564	2,231

Table 61. Acres of Aspen hardwood Cover Type based on FIA data.

R1 Cover Types	Estimate Acres	90% CI - Lower Bound	90% CI - Upper Bound	# of Subplots	Total # PSUs With At Least One Lifeform=Tree Subplot	Total # of Subplots With Lifeform=TREE
Aspen hardwood	16,554	4,465	31,258	11	481	1,697

Discussion

The total estimated acreage of conifer removal within aspen stands, since the signing of the Forest Plan, is 13,862 acres. This is likely an overestimation- acres that are affected by the defoliator western spruce budworm do not always experience tree mortality. This data does indicate that 13,862 acres have had conifer mortality or weakened states of conifers within aspen stands.

No thresholds have been crossed by these findings. The Forest Plan objective is to increase the aspen component on 67,000 acres within the lifetime of the plan. These findings indicate that the pace of aspen restoration is not currently fast enough to achieve this goal, assuming that the lifetime of the plan is roughly 15 years. It is possible that mountain pine beetle mortality and other injurious agents to conifers have led to more aspen restoration, but this is not quantified at this time,

Mechanical treatments are the most predictable and controllable active aspen restoration treatments implemented. Wildfire use is less predictable and passive but can lead to conifer removal and subsequent improved aspen health. The rate of both methods of treatments needs to increase to move towards the forest plan objective of 67,000 treated acres during the life of the Forest Plan.

Although these results indicate that the pace of mechanical aspen restoration needs to be increased, the objective itself of 67,000 acres over 15-20 years of the Forest Plan may not be achievable due to limited capacity and funds to do mechanical work, and the more uncertain possibilities of wildfire and insect impacts immediately within aspen stands. A reduced acreage objective, or an objective specifically tied to mechanical restoration, may be more appropriate and achievable.

This monitoring item and Forest Plan objective tie into the overarching goal of vegetation diversity and increasing the variation in tree species and tree cover across the Forest.

Data sources to answer this question may change over time. VMAP products are updated roughly every 5-7 years, so a new set of VMAP data may indicate change in aspen coverage and may include refined data to detect aspen presence (but not dominance) in conifer stands. ADS surveys do not always cover the entire National Forest- in years where this is the case the acres affected by bark beetle and budworm may be under-estimated.

Findings

Table 62. Summary of Findings for Plan Monitoring Item 9.

MONITORING ITEM	YEAR UPDATED	PLAN IMPLEMENTATION STATUS ¹ Do monitoring results demonstrate intended progress (i.e. maintaining, trending, or advancing) of the associated plan components listed with this monitoring item?	RECOMMENDATION Based on the evaluation of monitoring results, may changes be warranted?	MANAGEMENT If a change may be warranted, where may the change be needed? ²
MON – 9: Aspen Are management activities restoring aspen at the rate projected in the forest plan?	2021	(D) No – based on findings indicating that the pace of aspen restoration is not currently fast enough to achieve this goal, assuming that the lifetime of the plan is roughly 15 years.	Yes	Management Activities: Increase in the pace of mechanical aspen restoration is necessary to progress towards this objective. Monitoring Program: Recommend combining this with question MON-10; please see recommendation under that item.

¹ **PLAN IMPLEMENTATION STATUS:** (A) Uncertain - Interval of data collection beyond this reporting cycle (indicate date of next time this monitoring item will be evaluated); (B) Uncertain - More time/data are needed to understand status or progress of the Plan Component(s); (C) Uncertain - Methods inadequate to assess the status or progress toward achieving plan component(s). (D) NO - Implementation of Plan Component(s) ARE NOT trending, progressing, and/or conducted as desired; (E) YES - Implementation of Plan Component(s) ARE trending, progressing, and/or conducted as desired

² **[36 CFR 219.12(d)(2)]** - The monitoring evaluation report must indicate whether or not a change to the (1) plan, (2) management activities, (3) the monitoring program, or a (4) new assessment, may be warranted based on the new information. The monitoring evaluation report must be used to inform adaptive management of the plan area

Monitoring Item 10 – Grasslands/Shrublands

Monitoring Item Summary

Table 63. Summary of Monitoring Item 10.

Monitoring Question	Plan Component(s)	Indicators*	Data collection interval	Data Source / Partner	Point of Contact
Are management activities restoring grassland/shrublands at a rate projected in the forest plan?	OBJECTIVE (Forested vegetation): Grassland/Shrubland/Riparian: Reduce conifer encroachment on 74,000 acres of riparian areas, shrublands, and grasslands.	Encroachment species treated (all methods) or converted by wildfire (acres of) (Y).	Monthly	*District Fuels specialists *FACTS database *Local fire managers	B-D Fuels
* Indicator influenced by climate change? Y = Yes; N = No; U = Uncertain					

Table 64. Monitoring Item 10 - Monitoring Collection Summary.

For monitoring item 10:	Year
Data was last collected or compiled in:	2020
Next scheduled data collection/compilation:	2021
Last BMER evaluation for this monitoring item:	n/a
Next scheduled BMER evaluation of this monitoring item:	2023

This monitoring question exists because it is a Vegetation Objective in the Forest Plan (pg. 44) under the Forestwide Direction section.

Methods

To answer the two indicators listed above, conifer removal methods were queried along with wildfire data from the *Natural Resources Manager (NRM) Forest Activity Tracking System (FACTS) Web Reports* webpage. This is an on-line database which chronicles every activity that has occurred in every stand on National Forest System (NFS) land since inception of record keeping. Every activity is assigned a numerical code.

For treatment acres, each report was sorted by FACTS activity code. Records were removed if the activities were determined not representative of restoration work, for example salvage, girdling, fuel

breaks etc. Results were then sorted and calculated by year and treatment type and reported by district to create the table in the results section.

Wildfire data was pulled, sorted, and calculated from the yearly wildfire tracking spreadsheet maintained by the Dillon Dispatch Center. This Dillon tracking spreadsheet was not available for 2016 so the Fire History regional GIS attribute table data was used to report wildfires for that year.

Results

Table 65. Acres of Restoration Treatments by District and Year.

Treatment Acres Contributing Towards Grassland/Shrubland Restoration					
	2016	2017	2018	2019	2020
Dillon	718	261	391	717	176
Wisdom/Wise River	998	1048	1140	926	691
Butte/Jefferson	211	520	560	216	725
Madison	403	430	264	115	139
Pintler	107	346	456	409	314
Total Acres	2437	2605	2811	2383	2045

FACTS reports were pulled for Fire/Fuels for each district. Each district report was sorted by FACTS code. Activities determined to not be representative of restoration work, for example salvage, girdling, burning of piles etc. were removed. That set of results were then combined and sorted by year and treatment type. Total acres were used to populate Table 63 .

Table 66. Wildfire Acres Contributing to Restoration by District and Year.

Wildfire Acres Contributing Towards Grassland/Shrubland Restoration					
	2016	2017	2018	2019	2020
Dillon	0	0	7807		12150
Wisdom/Wise River	0	0	2194	343	0
Butte/Jefferson	699	9	13	2932	4400
Madison	98	0	10701	0	490
Pintler	0	56514	205	0	0
Total Acres	797	56523	20920	3275	17040
Total Restoration	199	14131	5230	819	4260

Wildfire acres were summarized for the past five years by district. Local fire managers were surveyed to generalize what percentage of wildfires burned in grassland/shrublands over the previous five years. The answer ranged from 10-40% depending on location as vegetation varies widely across the Forest. The wildfire acres (Table 64) have been calculated to reflect what wildfire acres contribute to restoration of grassland/shrublands based on input of local experience and knowledge. Twenty five percent was used as a broad generalized average value even though this could be an over-estimate and an under-estimate for different locations of the Forest. Confidence in the wildfire acres contributing towards grassland/shrubland restoration is moderate at the Forestwide scale because of the potential variation in professional opinions and qualitative data collection methods across districts and landscapes.

Discussion

Table 63 depicts acres of restoration activities spanning the years 2016-2020 by district. The B-D accomplishes an average of 2,450 acres per year towards grassland/shrubland restoration, which is about one-half of the annual restoration needed to move towards the Forest Plan objective (5,000 acres per year assuming a Forest Plan life of 15 years).

Table 64 clearly shows that wildfire is an important tool for accomplishing restoration objectives; however, wildfires are unpredictable. Therefore, wildfires are unreliable for consistent tool for the grassland/shrubland objectives unlike planned conifer reduction projects.

General findings include 1) The B-D prescribed fire and fuels program contributes approximately 50% of the annual acres towards achieving the Forest Plan objective for grasslands/shrublands and this monitoring item; 2) Wildfires provide an important contribution towards this goal but with some assumptions and limitations. 3) Acres of wildfires have increased significantly in the last four years.

This was a somewhat difficult monitoring question to answer because data specific to conifer encroachment into grasslands/shrublands is not easily separated from the other co-mingled habitat types. Treatments often are administered in areas where grasslands/shrublands mix with riparian areas and aspen stands and the FACTS database does not currently provide us with the information.

It would be valuable to develop a multi-disciplinary methodology as maintenance of these declining habitats is important for several species as described in the *B-D Forest Plan FEIS*.

It is important to note that conifer removal treatments benefit multiple, co-mingled vegetation types, all of which are declining due to conifer encroachment. Much of the conifer removal work occurring on the ground uses the fire and fuels program to implement these treatments, including conifer encroachment in other declining vegetation types such as aspen. Although aspen is not identified in this objective some grasslands/shrublands benefit from the work being accomplished in adjacent, co-mingled aspen stands. We recommend combining this item with monitoring item 9 that tracks conifer removal from aspen stands for these reasons.

Findings

Table 67. Summary of findings for Plan Monitoring Item 10.

MONITORING ITEM	YEAR UPDATED	PLAN IMPLEMENTATION STATUS ¹ Do monitoring results demonstrate intended progress (i.e. maintaining, trending, or advancing) of the associated plan components	RECOMMENDATION Based on the evaluation of monitoring results, may changes be warranted?	MANAGEMENT If a change may be warranted, where may the change be needed? ²
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		listed with this monitoring item?		
MON – 10: Grasslands Are management activities restoring grassland/shrublands at a rate projected in the forest plan?	2020	(D) No – The current program of work is only accomplishing 50% of the annual rate to move towards projections outlined in the Forest Plan.	Yes	Monitoring Program: Combine MON – 9: Aspen with this monitoring item to track acres of conifer removal in grassland/shrubland, riparian, and aspen together. Change the indicator to acres of grassland/shrubland, riparian, and aspen treated for conifer removal.

¹ **PLAN IMPLEMENTATION STATUS:** (A) Uncertain - Interval of data collection beyond this reporting cycle (indicate date of next time this monitoring item will be evaluated); (B) Uncertain - More time/data are needed to understand status or progress of the Plan Component(s); (C) Uncertain - Methods inadequate to assess the status or progress toward achieving plan component(s). (D) NO - Implementation of Plan Component(s) ARE NOT trending, progressing, and/or conducted as desired; (E) YES - Implementation of Plan Component(s) ARE trending, progressing, and/or conducted as desired

² **[36 CFR 219.12(d)(2)]** - The monitoring evaluation report must indicate whether or not a change to the (1) plan, (2) management activities, (3) the monitoring program, or a (4) new assessment, may be warranted based on the new information. The monitoring evaluation report must be used to inform adaptive management of the plan area

Monitoring Item 11 – Rare Plants

Monitoring Item Summary

Table 68. Summary of Monitoring Item 11.

Monitoring Question	Plan Component(s)	Indicators*	Data collection interval	Data Source / Partner	Point of Contact
What is the status of rare plants?	Monitor G1 thru G3 ranked sensitive plants, perform conservation assessments, and develop conservation strategies for species showing downward trends (Forest Plan, p.44).	Occurrences (# of stems and acres of occupancy) (Y). Surveys (presence/Absence) (Y).	Annual	Internal and MTNHP	Jessie Salix
* Indicator influenced by climate change? Y = Yes; N = No; U = Uncertain					

Table 69: Monitoring Item 1-Monitoring Collection Summary.

For monitoring item 11:	Year
Data was last collected or compiled in:	2021

Next scheduled data collection/compilation:	2022
Last BMER evaluation for this monitoring item:	n/a
Next scheduled BMER evaluation of this monitoring item:	2023

The Beaverhead-Deerlodge Forest Plan Components for Sensitive Plants are as follows:

GOAL Sensitive Plants: Sensitive plant populations and their habitat are maintained or restored. Large core populations or fringe-of-range populations of sensitive plants are conserved in research natural areas, botanical special interest areas, or protected as populations in conservation strategies, or project design specifications (Scale - Populations).

OBJECTIVE Reference populations of sensitive plants: Monitor G1 thru G3 ranked sensitive plants, perform conservation assessments, and develop conservation strategies for species showing downward trends (Scale - BDNF populations).

Note: The “G1-G3” refers to the global ranking of a species where G1 species are at high risk of becoming extinct; G2 species are at risk; and G3 species have potential risk. Risk is due to limited and/or declining numbers, range and/or habitat (MTNHP 2021).

The Regional Forester’s sensitive species list was last updated in 2011 (USDA FS 2011). Forty sensitive plant species are identified for the Beaverhead-Deerlodge National Forest (BDNF). Of these 40 species, only 35 are known to occur on the forest, while the remaining 5 are suspected to occur but no population are currently known.

Methods

Trend monitoring:

In the 1980’s and 90’s trend and demographic monitoring was established for several sensitive plant species on the forest by the Forest Ecologist, Montana Natural Heritage Program Botanists, and other contract Botanists (Lesica 2010; Elzinga 1994; Shelly and Heidel 1992; Heidel and Shelly 2001). Those historic monitoring plots have continued to be used for assessing current population trends. Between 2010 and 2012, an additional flush of trend monitoring was established in response to the signing of the 2009 BDNF Forest Plan.

In 2013 and comprehensive BDNF Sensitive Plant Monitoring Plan was developed by the Forest Botanist for meeting the needs of the Forest Plan monitoring question (USDA FS 2013-unpublished). Monitoring strategies were outlined for each of the ten G1-G3 sensitive species, utilizing historic monitoring sites and establishing new ones. The monitoring objective for each species was to “determine population trend.”

Methodology consisted of one of the following:

- **Belt transect:** multiple monitoring frames were placed contiguous to one another, along permanently marked transects to form a belt transect. The number of individuals or cover estimates were recorded. Frame size was either 1-meter x 1-meter or 20-centimeter x 50-centimeter.
- **Macroplot:** multiple monitoring frames were placed contiguous to one another within a grid and the number of individuals counted or cover estimates recorded.
- **Census:** counting the number of individuals within a population by passing through the entire population (typically involving several people, depending on the size of the populations). This method was typically paired with historic data.

New monitoring sites continued to be established between 2013 and 2016 following one of the above methods.

After the 2016 modification to the Forest Plan Monitoring Program, no change was made to the current BDNF Sensitive Plant Monitoring Plan, and no additional species (G4-G5) received tailored trend monitoring that were not already receiving it.

Treatment Effects: In addition to trend monitoring, and in response to the Forest Plant Goal “*Sensitive plant populations and their habitat are maintained or restored.... or protected as populations in...project design specifications*” new monitoring was established to assess vegetation treatment effects to sensitive plants and whether project design specifications were having the expected outcomes. The belt transect protocol was used as the sampling method for analyzing these effects.

Results

Table 70. Beaverhead-Deerlodge National Forest Sensitive Plant Species: Previous and Current Global and State Ranking; Status; and Population Comments.

Beaverhead-Deerlodge Sensitive Plant Monitoring 2011-2020					
<p>Item #11: What is the status of rare plants?</p> <p>Indicators: Occurrences (number of stems/acres of occupancy), cover, or surveys (presence/absence).</p> <p>The “G1-G3” refers to the global ranking of a species (where G1 species are at high risk of becoming extinct; G2 species are at risk; and G3 species have potential risk. Risk is due to limited and/or declining numbers, range and/or habitat (MTNHP 2021).</p> <p>Methodology consisted of one of the following:</p> <p>Belt transect: monitoring frames were placed along permanently marked transects and the number of individuals counted or cover estimates recorded. Frame size was either 1-meter x 1-meter or 20-centimeter x 50-centimeter.</p> <p>Macroplot: monitoring frames were placed within a grid and the number of individuals counted or cover estimates recorded.</p> <p>Census: counting the number of individuals/stems within a population by passing through the entire population (typically involving several people, depending on the size of the populations). This method was typically paired with historic data.</p>					
G1-G3 Sensitive Plant Monitoring					
Alkali Primrose (<i>Primula alcalina</i>)-G2					
Species Notes: Only one population is known to occur on the Beaverhead-Deerlodge National Forest. Monitoring was initiated at the Cabin Creek site in 2010, following a Bureau of Land Management (BLM) Protocol that was being implemented on adjacent BLM populations. There is concern that grazing may be impacting the population, and more monitoring is needed.					
Population Name	Monitoring Purpose	Monitoring Method	Year: # of Individuals	Trend: Static, Up, Down, or Undetermined	REMARKS
Cabin Creek	Trend	Macroplot: counting	2010: 4756 2011: 5321 2018: 6983	Static	Population trend is static.
Beautiful Bladderpod (<i>Physaria pulchella</i>)-G3					
Species Notes: Fifteen to 20 populations are known on the forest. Beautiful bladderpod prefers open and historically disturbed soils. The plant has been found growing on abandoned mine openings, two-tracks, and naturally eroding slopes. Conifer encroachment may be a potential threat to the populations on the forest (but is not confirmed).					

Population Name	Monitoring Purpose	Monitoring Method	Year: # of Individuals	Trend: Static, Up, Down, or Undetermined	REMARKS
Black Mountain	Trend and Treatment Effects	Belt Transect: counting	2011: 1021	Undetermined	No repeat data has been collected. Data collection is planned for 2021.
Argenta Cave	Trend	Census	1998: no count 2013: 10,000-100,000	Undetermined	The population occurs adjacent to the road, south of Argenta cave. The population was very robust.
Bitterroot Milkvetch (<i>Astragalus scaphoides</i>)-G3					
Species Notes: Two populations are known to occur on the Beaverhead-Deerlodge National Forest. No threats are known for these two populations.					
Population Name	Monitoring Purpose	Monitoring Method	Year: # of Individuals	Trend: Static, Up, Down, or Undetermined	REMARKS
Kate Creek	Trend	Census	1994: 500-1000 2013: 1,500	Undetermined	More years of data is needed to before indicating an upward trend.
Reservoir Creek	Trend	Census	2004: 70 2013:1,000	Undetermined	The drastic increase in numbers suggests and upward trend, though with only two years of data it's a bit risky to call it (possibly it has to do with survey intensity).
Dense-leaved Pussy-toes (<i>Antennaria densifolia</i>)-G4G5 (Previously G3)					
Species Notes: One population occurs on the Beaverhead-Deerlodge National Forest, along the CDT trail on Goat Flat. No threats are known to the population.					
Population Name	Monitoring Purpose	Monitoring Method	Acres occupied	Trend: Static, Up, Down, or Undetermined	REMARKS
Goat Flat	Define population	Mapping	2016: 137 acres	Undetermined	The population had previously been mapped as an oversized blob in habitats where it did not occur.

Lemhi Penstemon (<i>penstemon lemhiensis</i>)-G3					
Species Notes: Over 100 populations occur on the forest. Demographic studies have found this species to have yearly fluctuations in population numbers, as well as decline with increasing cover of surrounding vegetation; hence natural disturbance such as land movement (e.g., landslides) and wildfire may be necessary to maintain habitat (also prescribed fire). Weeds and conifer encroachment may threaten this species on the forest.					
Population Name	Monitoring Purpose	Monitoring Method	Year: # of Individuals *=Treatment Date	Trend: Static, Up, Down, or Undetermined	REMARKS
Badger Pass North Quadrat	Treatment Effects	Quadrat: counting	1995: 23 1996: 17 *1997: 75 1998: 161 1999: 151 2000: 179 2013: 11	Downward	Population numbers increased remarkably after prescribed burn treatment (1997). However, 16 years after fire treatment, population numbers were the lowest recorded. This study found that Lemhi penstemon populations respond positively to fire treatments and may require them for recruitment.
Badger Pass North Transect	Demographic/Trend and Treatment Effects	Belt Transect: counting	1989: 118 1990: 109 1991: 49 1992: 19 1993: 75 1994: 5 1995: 13 1996: 6 *1997: 60 1998: 214 1999: 187 2000: 175 2013: 8	Downward	See above. Similarly, low numbers were recorded 16 years later.
Canyon Creek East Quadrat	Treatment Effects	Quadrat: counting	*1995: 22 1996: 13 1997: 80 1998: 79	Static	Population numbers increased a 2-3 years after treatment,

			1999: 45 2013: 66		
Canyon Creek West Quadrat	Treatment Effects	Quadrat: counting	*1995: 62 1996: 58 1997: 65 1998: 93 1999: 47 2013: 28	Downward	The population appears to be on a downward trajectory.
French Creek Park Mine	Demographic/Trend	Belt Transect: counting	1989: 88 1990: 62 1991: 20 1992: 18 1993: 32 1994: 42 2013: 9 2019: 10	Downward	The French Creek population is the second largest population in the state. Conifer encroachment is an observed threat to the population. The last two years' worth of data show a downward trend with the lowest numbers being recorded.
French Creek Discovery Mine	Demographic/Trend	Belt Transect: counting	1989: 35 1990: 47 1991: 35 1992: 41 1993: 59 1994: 56 2013: 44 2019: 27	Downward	The French Creek population is the second largest population in the state. Conifer encroachment is an observed threat to the population. 2019 had the lowest recorded numbers and may be on a downward trajectory, but more data is needed since two previous years had similar numbers (35) and rebounded.
Highlands Upper Moose Creek	Demographic/Trend	Belt Transect: counting	1994: 118 1996: 231 1997: 355 1998: 355 1999: 187 2013: 235	Static	Recent data show a static trend

Highlands Upper Fish Creek	Demographic/Trend	Quadrat: counting	1994: 118 1996: 197 1997: 646 1998: 437 1999: 380 2013: 363	Static	Recent data show a static trend
Pintler Lake Road	Treatment Effects	Belt Transect: counting	2017: 153 2018: 170 2019: 174	Static	Monitoring was established to study effects of conifer reduction. Treatment has not occurred.
York Gulch	Treatment Effects	Belt Transect: counting	2017: 24 2018: 27 2019: 23	Static	Monitoring was established to study effects of conifer reduction. Treatment has not occurred.
Trapper Creek Unit #19	Treatment Effects	Belt Transect: counting	2015: 16 *2016: 18	Undetermined	Monitoring was established in a lop and scatter treatment unit. Treatment was done in the fall of 2016. Only one individual was buried by a pile of scattered limbs. The one plant remained in vegetative form for a couple years. Burning occurred in spring of 2017. There was no sign of the individual in 2019. The treatment should have an overall benefit on the population by reducing canopy cover.
Argenta	Trend	Census	South 1986: 22 2017: 10 Middle 1986: 1,845 2017: 1,208 North 2005: no count 2017: 134	Undetermined	A large effort was made in 2017 to do a thorough survey of the Argenta population, since it is the second largest population within the state. The survey was conducted by 11 people in the field, combing the hillsides. Conifer encroachment and weeds were identified as potential threats to this population.
Quartz Hill Gulch	Trend	Census	1986: 203	Undetermined	More data is needed to determine if this is a downward trend.

			2015: 26 2013: 137		
Vipond Park Proper	Trend	Census	1986: 252 2013: 165	Undetermined	Two years' worth of data is not sufficient to assess trend.
Canyon Creek Kilns	Trend	Census	2005: 300 2013: 169	Undetermined	Two years' worth of data is not sufficient to assess trend.
Fishtrap East	Trend	Census	1992: 26 2005: 0 2013: 22	Static	Population appears to be static
Fishtrap West	Trend	Census	1992: 14 2005: 0 2013: 9	Static	Population appears to be static
Pintler Creek	Trend	Census	1996: 6+ 2009: 15 2011: 7 2013: 46	Upward	Population appears to be on an upward trend.
Miner Lakes	Trend	Census	1989: 17 2005: 12 2012: 31	Static	Population appears to be on an upward trend, but more data is needed with similar survey intensity as in 2012.
Missoula phlox (<i>Phlox kelseyi</i> var. <i>missoulensis</i>)-G3					
Species Notes: Currently, three population areas are known to occur on the forest; however, this species is now thought to only occur in Missoula County, MT. Populations on the Beaverhead-Deerlodge National Forest and adjacent forests may be other closely related species (yet to be determined). Weeds threaten the population at Emerine Gulch.					
Population Name	Monitoring Purpose	Monitoring Method	Summed Average Cover	Trend: Static, Up, down, or Undetermined	REMARKS
Emerine Gulch	Trend	Belt Transect: Cover Estimation	2012: 0.535%	Undetermined	This pilot monitoring study with random 10 plot location proved to be inadequate at capturing enough Phlox within the transects. Purposive sampling will be used in the future to locate plots.

Slash Pile Recovery	Recovery	Belt Transect: Cover Estimation	2013: 20.75% 2014: 40% 2019: 43.5%	Upward	In 2012, slash piles from a roadside hazard treatment were placed directly on top of a known Missoula phlox population. The slash was then moved off the phlox before burning elsewhere. This monitoring was established in the three slash pile locations to monitor the recovery of phlox.
Sapphire rockcress (<i>Boechera fecunda</i>)-G2					
Species Notes: Roughly 20 populations occur on the Beaverhead-Deerlodge National Forest. Weeds and conifer encroachment have been identified as potential threats to the species on the Forest.					
Population Name	Monitoring Purpose	Monitoring Method	Year: # of Individuals	Trend: Static, Up, down, or Undetermined	REMARKS
Lime Gulch Transect	Trend	Belt Transect: counting	1989: 364 1990: 444 1991: 522 1992: 494 1993: 664 2009: 526 2012: 581	Static	
Vipond Park Transect	Trend	Belt Transect: counting	1989: 354 1990: 500 1991: 417 1992: 569 1993: 603 2009: 215	Downward	2009 had the lowest recorded number, while the previous reading in 1993 had the highest number. Crews attempted to re-monitor this site in 2012, but could only find one of the transects, so we had to abandon the data. Peter Lesica showed us the transect location in 2019, and data collection is planned in 2021.
Quartz Hill	Trend	Census	1989: 375-500 2013: 2000	Upward	Upward trend may be a result of survey intensity. Conifer encroachment at this population was noted as a potential threat.
Vipond Park	Trend	Census	1989: 38 2013: 3	Undetermined	In 2013 the site was noted as having too much competition from sagebrush and conifers and potentially not in the same location as in 1989.

Lime Gulch Treatment Transects	Treatment Effects	Belt Transect: Counting	2011: 673	Undetermined	The proposed project was dropped, and so no further data has been collected.
Canyon Creek Treatment Transects	Treatment Effects	Belt Transect: Counting	2011: 2013	Undetermined	Treatment has not occurred yet
Cattle Gulch	Trend	Census	1989: 127 2013: 2 2016: 300	Upward	It's likely that in 2013 the crew was not in the correct location
Charcoal Kilns	Trend	Census	1988: 10,000+ 2005: 24 2013: 650	Downward	Survey intensity and accuracy may be responsible for the large change in numbers. Cheatgrass was noted as a potential threat to the population
Highland Mine	Trend	Census	1992: 2000 2013: 1000	Undetermined	More census data is needed to determine trend.
Storm Saxifrage (<i>Micranthes tempestiva</i>)-G2G3					
Species Notes: Eight populations occur on the Beaverhead-Deerlodge National Forest. All in high elevation subalpine/alpine habitats.					
Population Name	Monitoring Purpose	Monitoring Method	Year: # of Individuals	Trend: Static, Up, down, or Undetermined	REMARKS
Goat Flat	Trend	Belt Transect: counting	2012: 93 2016: 219	Undetermined	In 2012, the site was very dry and trying to get accurate counts of dried plants that are already tiny was very difficult and may not have been an accurate count. In 2016, we tested our methodology and had two people read the first 10 frames independently and came up with different numbers (114 vs. 178). It has been determined that recording needs to happen in July (not August). Climate change may be a threat to this population as the persistent snowbank retreats sooner with warming temperatures.

Wavy Moonwort (<i>Botrychium crenulatum</i>)-G4 (previously G3)					
Species Notes: Roughly 10 populations are thought to occur on the forest. This species is very difficult to identify and requires genetic testing to verify species. In 2014 the Beaverhead-Deerlodge hosted a moonwort training for all Region 1 Botanists and had expert Steve Popovich providing identification. He concluded that what we were calling wavy moonwort in two treatment monitoring sites was not actually wavy moonwort due to the habitat. No monitoring for this species is available due to species identification issues.					
Weber's saw-wort (<i>Saussurea weberi</i>)-G3					
Species Notes: One population occurs on the Beaverhead-Deerlodge National Forest in an alpine habitat.					
Population Name	Monitoring Purpose	Monitoring Method	Year: # of Individuals	Trend: Static, Up, down, or Undetermined	REMARKS
Goat Flat	Trend	Belt Transect: counting	2012: 422 2016: 289	Undetermined	In 2016, we tested our methodology and had two different groups read transect #2 independently and came up with different numbers (333 vs. 412). It was determined that scoring each frame by the number of individuals within a range may be more appropriate. No threats were observed.
Additional Sensitive Plant Monitoring: G4-G5 Species					
In 2016, the Beaverhead-Deerlodge National modified their Forest Plan Monitoring Program, adjusting the monitoring question for sensitive plants. 2016 Modified Forest Plant Monitoring Item #11: What is the status of rare plants? Indicators: number of stems/acres of occupancy; or surveys (presence/absence) Monitoring data available for these remaining species is included below.					
Alpine meadowrue (<i>Thalictrum alpinum</i>)-G5					
Species notes: Roughly 20 populations are known to occur on the forest.					
Population Name	Monitoring Purpose	Monitoring Method	Year: # of Individuals	Trend: Static, Up, down, or Undetermined	REMARKS
Cabin Creek	Trend	Macroplot: cover estimation	2010: 4.4% 2011: 1% 2018: 3.9%	Static	This population is monitored along with alkali primrose in the same macroplot.

Payson's bladderpod (<i>Physaria carinata</i>)-G3G4					
Species notes: Five populations are known to occur on the forest.					
Population Name	Monitoring Purpose	Monitoring Method	Year: # of Individuals	Trend: Static, Up, down, or Undetermined	REMARKS
Emerine Gulch	Trend	Belt transect: counting	2012: 402	Undetermined	Weeds threaten this population in the West Fork Buttes Botanical Special Interest Area (Emerine Gulch).
Peculiar moonwort (<i>Botrychium paradoxum</i>)-G5					
Species notes: Eleven to 15 populations are known on the forest.					
Population Name	Monitoring Purpose	Monitoring Method	Year: # of Individuals	Trend: Static, Up, down, or Undetermined	REMARKS
Windy Ridge RNA	Trend	Census	1993: 1,000+ 2014: 24	Undetermined	Over 10 people spend several hours surveying in 2014, so the fact that they only found 24 was very alarming. More data is needed to assess trend.
Whitebark pine (<i>Pinus albicaulis</i>)-G3G4					
Species notes: According to the Region 1 VMAP data, whitebark pine occurs in 757,684 acres forest wide; and is dominant in 131,511 acres (dominant vegetation with 40% or greater cover). Whitebark pine also occurs in mid-elevation mixed-conifer forests as seedling-sapling size individuals, which are not detected by VMAP. Currently, whitebark pine is proposed for listing as Threatened.					
Population Name	Monitoring Purpose	Monitoring Method	Sampling date range: % Dead	Trend: Static, Up, down, or Undetermined	REMARKS
FIA Plot data	Trend	FIA plot: number of dead trees /plot	2003-08: 25% 2008-17: 43%	Downward	Data is based on 145-148 FIA plots on the Beaverhead-Deerlodge National Forest. Since trees do not show yearly fluctuations in mortality, we can read this as a downward trend.

Discussion

Table 68 displays the available sensitive plant monitoring data for the BDNF sensitive plant species 1989-2020. Survey intensity can vary between groups, and oftentimes survey intensity is not known for historic census data. Variation in survey intensity for census counts can lead to misrepresentative trend calls. In addition, historic mapping was often inaccurate (no GPS) and relocating to the exact location was not always done, which can also lead to misrepresentative trend calls. For these reasons, current trend calls based on census should be taken cautiously if historic data is included.

Whitebark pine (*Pinus albicaulis*) is the only species showing a clear downward trend. Whitebark pine is currently proposed for federal listing as threatened due to several factors: white pine blister rust, mountain pine beetle, altered fire regimes, and/or the effect of climate change. Forest management is not one of the primary stressors causing whitebark pine decline. Forest Inventory and Analysis (FIA) has 145 plots on the BDNF for assessing whitebark pine, which are read on a five-to-ten-year rotation.

Lemhi beardtongue (*Penstemon lemhiensis*) has the most monitoring sites, and the longest time-period for monitoring (1996-present). Several Lemhi beardtongue monitoring sites are showing a downward trend. Lack of natural disturbance (such as fire) and weed invasion are two known stressors for the species (Ramstetter 1983; Moseley et al, 1990), though yearly fluctuations in population numbers due to climatic factors has also been documented (Shelly and Heidel 1992). On the forest, the lack of wildfire in sagebrush habitats where Lemhi penstemon occurs, is likely the cause of these declines. Fire has been shown to stimulate seedling germination (Heidel and Shelly 2001); whereas lack of fire or natural disturbance has been shown to cause populations to decline (Ramstetter 1983). An effort should be made to increase fire within declining Lemhi penstemon populations.

Sapphire rockcress (*Boechera fecunda*) has a couple populations showing downward trends, and several others listed as “undetermined” due to lack of the third recording of data. This species occurs in open limestone soils. Spotted knapweed has been shown to cause population declines in Ravalli county (Lesica and Shelly 1996) but does not appear to be a factor in declining trends on the BDNF, as populations are primarily weed free. More current data is needed to determine an overall trend for the species on the Forest.

All other species are showing “upward” or “undetermined” trends across the forest.

Based on this assessment, most monitoring sites are still needing a third round of data collection to assess trend.

The two greatest threats observed to sensitive plants on the BDNF are weed invasion and lack of fire. Therefore, in the next round of data collection, the following two items will also be assessed for each population/project monitored:

1. Are project design features having the intended result of maintaining viable populations and habitat?
2. Are restoration activities needed to maintain viable population or habitat?

Findings

Table 71: Summary of findings for Plan Monitoring Item 11.

MONITORING ITEM	YEAR UPDATED	PLAN IMPLEMENTATION STATUS ¹ Do monitoring results demonstrate intended	RECOMMENDATION Based on the evaluation of monitoring results, may changes be warranted?	MANAGEMENT If a change may be warranted, where may the change be needed? ²
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		progress (i.e. maintaining, trending, or advancing) of the associated plan components listed with this monitoring item?		
MON – 11: Rare Plants What is the status of rare plants?	2021	(B) Uncertain – More data is needed to understand status of most species. Two species are showing downward trends.	Yes	<p>Monitoring Program:</p> <p>More data is needed to identify if potential management changes are needed for maintenance of sensitive plants on the BDNF:</p> <p>1) Monitoring of sensitive plant populations as well as data management should be prioritized</p> <p>2) Monitoring of project design feature effectiveness at mitigating effects to populations and habitats.</p> <p>3) Identification of specific restoration needs for species with downward trends.</p> <p>Management of Lemhi penstemon: prescribed fire may be needed in several populations to stimulate seedling establishment, and population persistence.</p>

¹ **PLAN IMPLEMENTATION STATUS:** (A) Uncertain - Interval of data collection beyond this reporting cycle (indicate date of next time this monitoring item will be evaluated); (B) Uncertain - More time/data are needed to understand status or progress of the Plan Component(s); (C) Uncertain - Methods inadequate to assess the status or progress toward achieving plan component(s). (D) NO - Implementation of Plan Component(s) ARE NOT trending, progressing, and/or conducted as desired; (E) YES - Implementation of Plan Component(s) ARE trending, progressing, and/or conducted as desired

² **[36 CFR 219.12(d)(2)]** - The monitoring evaluation report must indicate whether or not a change to the (1) plan, (2) management activities, (3) the monitoring program, or a (4) new assessment, may be warranted based on the new information. The monitoring evaluation report must be used to inform adaptive management of the plan area

Monitoring Item 12 – Sage Grouse

Monitoring Item Summary

Table 72. Summary of Monitoring Item 12.

Monitoring Question	Plan Component(s)	Indicators*	Data collection interval	Data Source / Partner	Point of Contact
Are management activities occurring near historic or active sage grouse leks?	Sage Grouse Goal: Sagebrush habitat supports sage grouse and pygmy rabbit populations by providing suitable sage grouse brood-rearing	Sagebrush cover affected by scheduled vegetation treatments on BDNF lands within 18 km of historic or	Annual	GIS corporate data: wildlife layer, FIA, and FACTS	Jennifer Gatlin

	habitat on at least 40% of the sagebrush habitat within 18 kilometers of documented active or inactive sage grouse leks and the area mapped as potential pygmy rabbit habitat (Forest Plan, pg. 45).	active leks (acres) (Y).			
* Indicator influenced by climate change? Y = Yes; N = No; U = Uncertain					

Table 73. Monitoring Item 12 - Monitoring Collection Summary.

For monitoring item 12:	Year
Data was last collected or compiled in:	2015
Next scheduled data collection/compilation:	2020
Last BMER evaluation for this monitoring item:	n/a
Next scheduled BMER evaluation of this monitoring item:	2023

In 2015, *The Greater Sage-Grouse Idaho and Southwest Montana Forest Plan Amendment* modified the Beaverhead-Deerlodge Forest Plan. It was proposed in response to the Fish and Wildlife Service's conclusion that the greater sage-grouse was warranted but precluded from Federal listing as a threatened or endangered species at a range-wide scale. The Forest Service recognized the need to incorporate explicit objectives and concrete conservation measures into their land management plans to conserve sage-grouse habitat and potentially avoid the need to list the species under the ESA. These measures complement the existing Plan components that address sage grouse in the BDNF Forest Plan (pages 45, 47, 49). The goal of incorporating these specific conservation measures into management plans is to protect, enhance, and restore sage-grouse and its habitat and to provide additional regulatory certainty such that the need for federally listing the species can be avoided.

Greater sage-grouse are dependent on sage brush communities that provide for concealment, lekking, brood-rearing, and winter habitats. In general, sagebrush and associated herbaceous vegetation are important for breeding and brood-rearing. Breeding occurs on leks which consist of flat clearings proximate to sagebrush cover and sage grouse typically have high lek fidelity. However, lek abandonment can occur when conifer canopy cover is less than 1 percent within 5 kilometers of a lek. Projects that reduce heavy canopy cover or other vegetation to promote or enhance sagebrush communities are beneficial to this species and contribute to moving towards the Plan components listed above.

Methods

This monitoring question requires the following information: 1) locations of active and historic sage grouse leks; 2) vegetation cover type data, specifically sagebrush; and 3) forest vegetation management activities since 2015. Five years is a reasonable amount of time to determine the trend of vegetation management projects occurring near active and historic sage grouse leks so 2015 was chosen as a starting point.

Active and historic sage grouse lek locations are part of a Forest Service corporate database. In Geographic Information Systems (GIS), historic and active lek locations are buffered by 18 kilometers to create an area that could intersect with Forest Service vegetation projects.

Although the Forest utilizes “VMAP”, Version 18 (VMAP-18) data that classifies existing vegetation into cover types, the current iteration is three years old and does not discretely identify “sagebrush” as a cover type. Instead, “xeric shrub” is an attribute that may or may not contribute to sagebrush cover. Thus, using VMAP is not a good measure to assess this monitoring question as it could over-estimate the amount of sagebrush altered during vegetation treatments.

The national Forest Inventory and Analysis (FIA) program provides a congressionally mandated, statistically-based, continuous inventory of the forest resources of the United States. The FIA inventory design is based on a spatially balanced sample of inventory plots. The FIA sampling frame uniformly covers all forested lands, regardless of management emphasis; therefore, wilderness areas, roadless areas, and actively managed lands all have the same probability of being sampled and data collection standards are strictly controlled by FIA protocols. The most current FIA dataset is the R1 Hybrid 2015 version (updated January 2021), using data collected from 2006-2015, on 363 FIA plots scattered across the Forest (refer to Monitoring Item 8 for a more detailed description). However, sagebrush information is not currently available at this time as the data has not been synthesized in time for this report.

Vegetation management activities are tracked in the Forest Service Activity Tracking System (FACTS). FACTS is the current database of record that tracks activities related to fire and fuels, silviculture, and invasive species, among others (refer to Monitoring Item 26). Information can be queried from this database based on the implementation type. Although the Forest has a field that would enable easy data querying for projects contributing to sage brush or conifer removal treatments in sagebrush, the data entry for this option has been used sparingly as it is a new addition. Determining vegetation management activities that would contribute to improving or maintaining sage grouse habitat is not available at this time but should be available in the future as this implementation field is utilized more often.

Results

Due to a lack of both FIA and appropriate FACTS query data, it is not possible to ascertain results at this time that would answer this monitoring question for sage grouse.

Discussion

In the future, the use of FIA data and the proper implementation selection in FACTS when vegetation activities are reported would assist with answering this question.

FIA data for sagebrush should be available during the next assessment of this monitoring question. The Regional Office synthesizes this data and is aware that this is a need for upcoming monitoring reports.

In addition, the Forest would need to input the correct implementation project type when reporting in FACTS to allow for data queries during the next reporting cycle.

It would benefit the Forest to alter the question to determine if management actions are improving or maintaining habitat for sage grouse. The BDNF could assess whether habitat management activities are altering habitat for sage grouse. As previously mentioned, FIA and FACTS information could be used as indicators to answer the question, especially if activities such as conifer removal were documented within active or historic sage grouse leks.

Findings

Summary of findings for all Plan Monitoring Items

Table 74. Summary of findings for Plan Monitoring Item 12.

MONITORING ITEM	YEAR UPDATED	PLAN IMPLEMENTATION STATUS ¹ Do monitoring results demonstrate intended progress (i.e. maintaining, trending, or advancing) of the associated plan components listed with this monitoring item?	RECOMMENDATION Based on the evaluation of monitoring results, may changes be warranted?	MANAGEMENT If a change may be warranted, where may the change be needed? ²
MON – 12: Sage Grouse Are management activities occurring near historic or active sage grouse leks?	2015	(B) Uncertain – based on lack of proper reporting tool to capture data for vegetation management activities that would contribute to improving or maintaining sage grouse habitat. This reporting will be available in FY23 at the next biennial monitoring evaluation cycle.	Yes	Monitoring Program: FACTS reporting needs to include implementation of projects that are impacting historic or active sage grouse leks as described in Forest Plan vegetation objectives. Change the question to: “Are forest management activities maintaining or improving active or historic sage grouse lek habitats?”

¹ **PLAN IMPLEMENTATION STATUS:** (A) Uncertain - Interval of data collection beyond this reporting cycle (indicate date of next time this monitoring item will be evaluated); (B) Uncertain - More time/data are needed to understand status or progress of the Plan Component(s); (C) Uncertain - Methods inadequate to assess the status or progress toward achieving plan component(s). (D) NO - Implementation of Plan Component(s) ARE NOT trending, progressing, and/or conducted as desired; (E) YES - Implementation of Plan Component(s) ARE trending, progressing, and/or conducted as desired

² **[36 CFR 219.12(d)(2)]** - The monitoring evaluation report must indicate whether or not a change to the (1) plan, (2) management activities, (3) the monitoring program, or a (4) new assessment, may be warranted based on the new information. The monitoring evaluation report must be used to inform adaptive management of the plan area

Monitoring Item 13 – Elk

Monitoring Item Summary

Table 75. Summary of Monitoring Item 13.

Monitoring Question	Plan Component(s)	Indicators*	Data collection interval	Data Source / Partner	Point of Contact
What is the change in elk population?	GOAL (Elk Security) Elk security is managed to provide quality elk habitat, provide a variety	Elk – numbers of, by hunting district (U).	Annual, although not every hunting district is surveyed every year.	MT FWP	Jennifer Gatlin

	of recreational hunting opportunities, and provide support for Montana's fair chase emphasis (Forest Plan, pg. 46).				
* Indicator influenced by climate change? Y = Yes; N = No; U = Uncertain					

Table 76. Monitoring Item 13 - Monitoring Collection Summary.

For monitoring item 13:	Year
Data was last collected or compiled in:	2020
Next scheduled data collection/compilation:	2022
Last BMER evaluation for this monitoring item:	N/A
Next scheduled BMER evaluation of this monitoring item:	2023

Public concern for elk security habitat, especially during big game hunting season, is a common issue on the Beaverhead-Deerlodge National Forest. In general, elk security areas result from limiting road access to allow large mammals to move across the forest without major disturbance. These areas are defined as areas larger than 10 acres that are more than one-third of a mile from a route open to motorized vehicles (Forest Plan, pg. 302), as measured from October 15th - December 1st. The Forest Plan manages open motorized road and trail density by Montana Fish, Wildlife, and Parks (MTFWP) hunting units as of 2006 on National Forest System Lands as part of the forest plan goal for wildlife security (Wildlife Habitat - Elk Security Goal).

More specifically, the Elk Security Goal states “*elk security is managed to provide quality elk habitat, provide a variety of recreational hunting opportunities, and provide support for Montana's fair chase emphasis*” (FP pg. 46).

Methods

Montana Fish, Wildlife, and Parks counts elk in either winter or spring by aircraft. Numbers reported here are “observed elk” rather than an actual population estimate. MT FWP compiles and releases the data in an annual population chart. Desired numbers for each district come from the 2004 Elk Management Plan (MT FWP) and are compared to the number of observed elk to determine if each hunting district meets, exceeds, or is under the desired number within a given year.

Elk are generally counted by hunting district, although district boundaries and combinations of counts therein change over time. The Beaverhead-Deerlodge National Forest does not track changes in these boundaries and how that may affect the number of elk counted; however, hunting units are grouped together in this report for the sake of simplicity in order to compare elk numbers over time. There are 30 hunting districts on the Forest (Figure 11). Of these districts, several are combined with others, previously combined but separated, contain counts from districts outside of the Forest, or boundaries changed over time (Table 75). For purposes of this analysis, elk observed numbers are reported as they are listed in the most current state report. If districts were previously counted together and then separated, there is no way to determine the number of elk within a combined district during that year.

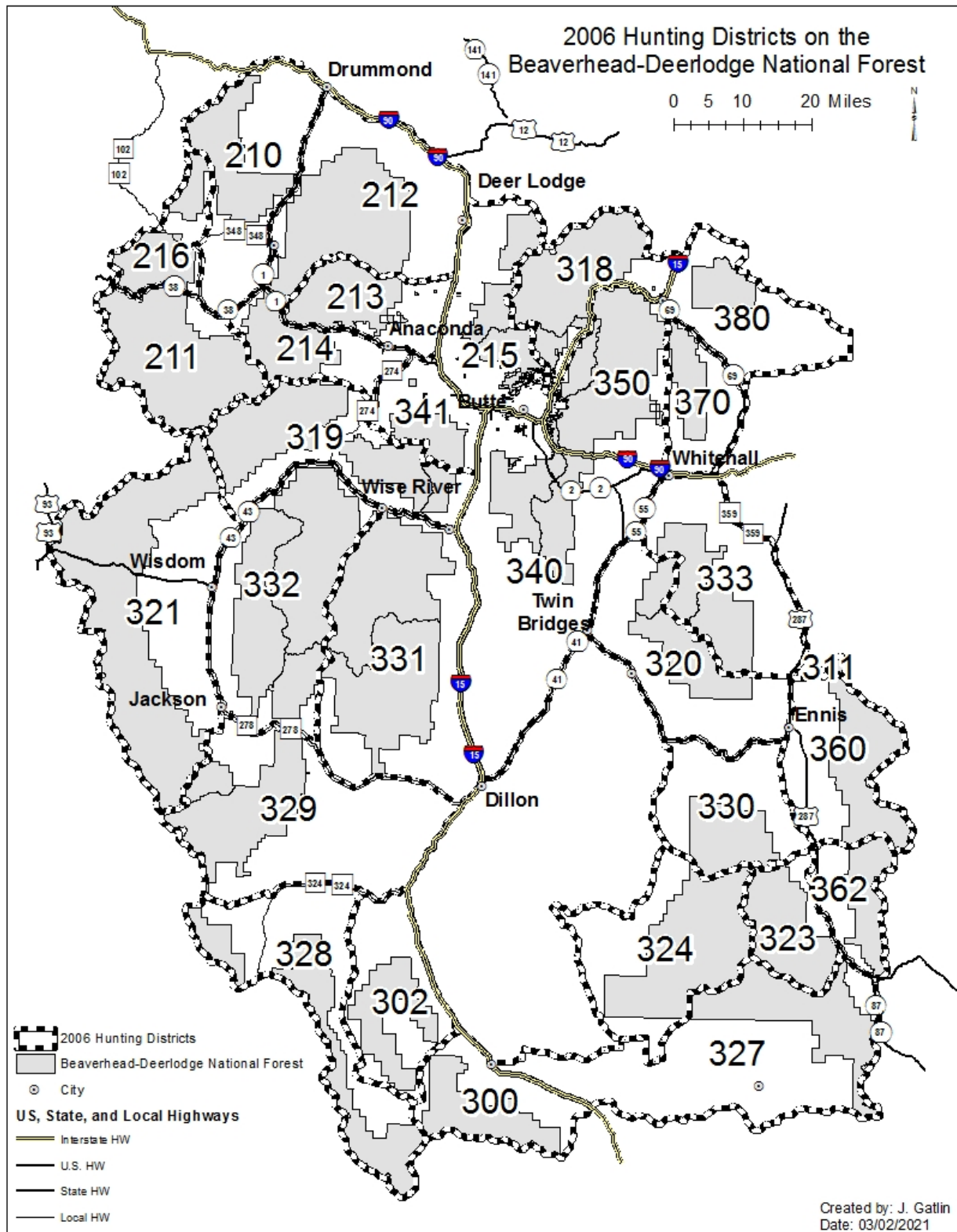


Figure 11. 2006 Hunting districts on the Beaverhead-Deerlodge National Forest. Although some boundaries changed or may change in the future, these districts serve as the basis for comparison for elements in the Forest Plan.

Table 77. Hunting districts that contribute to data within this report that contain combinations or separations of districts or other issues.

Hunting District(s)	Issue	As displayed in this report
210, 211	Combined in 2012.	210, 211 appear as a combined count since 2008. Counts were simply added together prior to 2012.
212	Boundary and elk desired objective changed in 2016.	212: reported counts since 2008. However, the desired count shows the current objective and does not reflect the change in objective in 2016.
323, 324, 327, 330	Combined and includes districts 322, 325, and 326 which are not on the BDNF.	323, 324, 327, 330, (322, 325, 326): numbers in parenthesis represent districts that contribute to the observed elk but do not overlap with the BDNF.
340, 350	Counted together with 370 (not on the BDNF) until separated in 2019.	340, 350, (370): numbers in parenthesis represent districts that contribute to the observed elk but do not overlap with the BDNF. Since 340 was separated from 350 and 370 so recently, trend data does not exist for 340 as a standalone unit or 350, (370) as a combined unit. The three combined units have data from 2008-2016 which is documented in this report. 2019 numbers are reported for 340 and 350, (370) although not enough time has passed to determine a trend.
360, 362	360 was separated into North 360 and South 360 after 2012. S360 was then combined with 362 in 2019.	N360 is reported as a standalone since 2014 (first reported data). S360, 362 are reported together since 2014. Data prior to 2012 is not included as it was previously combined in counts prior to that year.

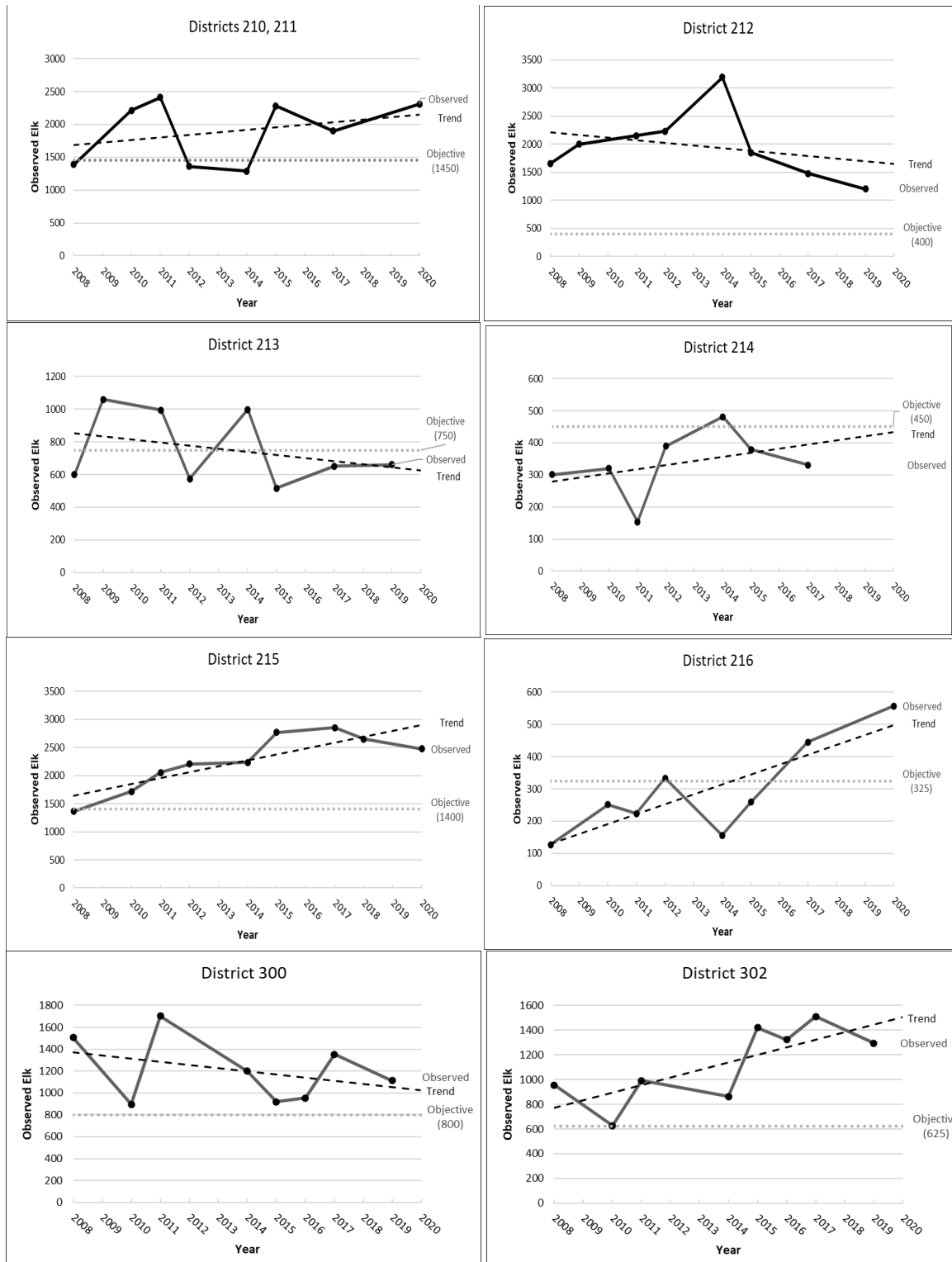
Since the Forest Plan was signed in 2009, data were obtained from state reports starting in 2008 to determine elk observation trend data except for years 2018, 2013, and 2009 (MT FWP changed their website so reports were no longer readily available). One district, 321, does not contain any wintering elk so population numbers are not reported. Some district counts also include those outside of the Forest (Table 75). Since those districts are counted and grouped together, it is not possible to discern how many observed elk exist within the districts that overlap with the BDNF. The number of observed elk by hunting district (or groups of districts) were graphed and compared to the status of the district (below, at, or over objective) as indicated by the most recent MT FWP state report.

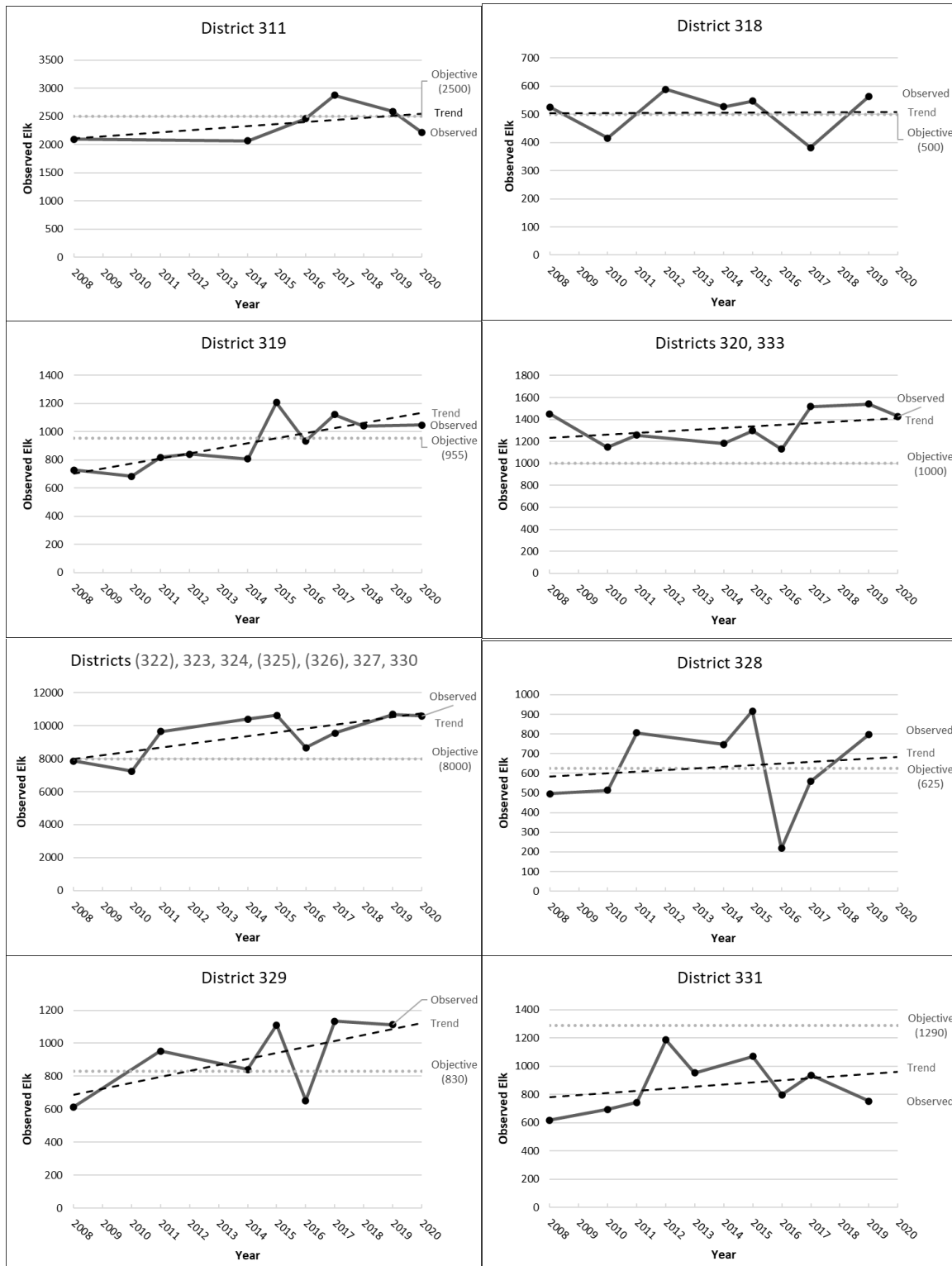
Results

There are some limitations to this survey method and data comparison: 1) not all elk within a hunting district are counted during a survey; 2) counting is an inexact method that is subject to variables that may affect accuracy, such as weather, timing, and elk movement; 3) counts in some years may not accurately reflect actual elk numbers; 4) hunting districts are not surveyed every year; and 5) hunting district boundaries change, which makes it challenging to compare elk numbers within a defined district over time. Despite these limitations, numbers, trends, and comparisons presented here are the best available information to assess the monitoring question in the Forest Plan and MT FWP invests considerable time and effort to conducting surveys.

In some cases, data is presented within groups of hunting districts due to the survey methods. For this analysis, the 30 hunting districts are grouped into 24, with hunting district 321 omitted because there are no wintering elk. The overall observed elk trend is increasing across a majority (19) of the hunting districts, with 3 experiencing decreased observation trends and 1 with a consistent trend (Figure 13). Of

the hunting district groups, 16 are considered over the objective for elk, 4 are at the objective number, and 3 are below (Table 76).





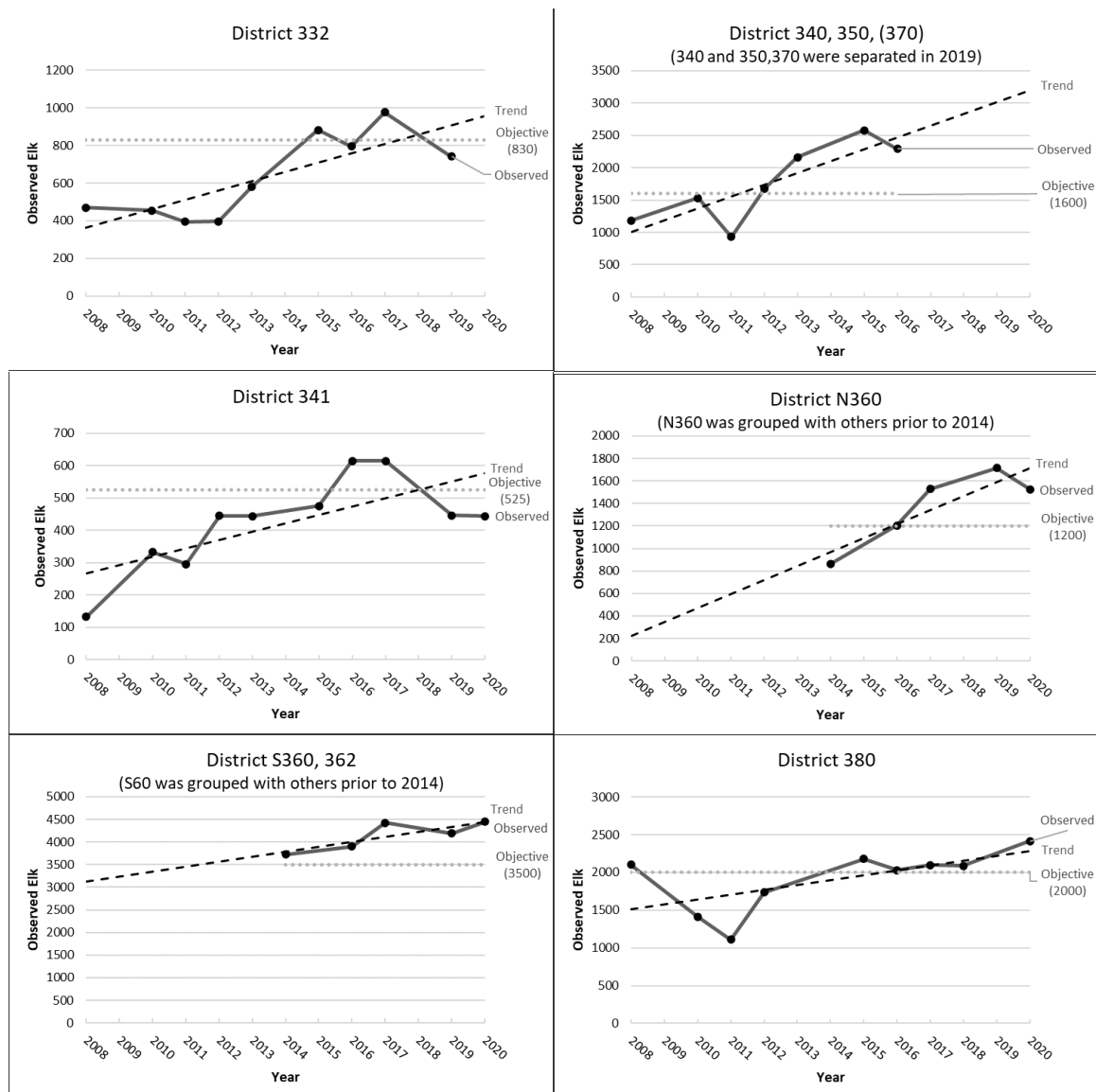


Figure 12. Observed elk, trends, and objectives for hunting districts or groups on the Beaverhead-Deerlodge National Forest. Data provided by Montana Fish, Wildlife, and Parks. Hunting districts separated in 2019 (340 and 350, 370) are not included as a single year of data will not display a trend.

Table 78. Hunting district or groups and status compared to the elk objective number.

Hunting District(s)	Elk Objective (number)	Status (Below, at, or over objective)
210, 211	1450	Over
212	400	Over
213	750	At
214	450	Below
215	1400	Over
216	325	Over
300	800	Over

Hunting District(s)	Elk Objective (number)	Status (Below, at, or over objective)
302	625	Over
311	2500	At
318	500	At
319	955	At
320, 333	1000	Over
321	Not applicable	None, no wintering elk
(322), 323, 324, (325), (326), 327, 330	8000	Over
328	625	Over
329	830	Over
331	1290	Below
332	830	Below
340, 350, (370)	1600	Over as of 2016, groups then separated
340	1000	Over (separated from group in 2019). 1,224 elk observed in 2020.
350, (370)	600	Over (separated from group in 2019). 799 elk observed in 2020.
N360	1200	Over
S360, 362	3500	Over
380	2000	Over

Discussion

Montana Fish, Wildlife, and Parks sets the objectives and hunting regulations to best manage elk populations in the state of Montana. The Beaverhead-Deerlodge National Forest is a partner in achieving those goals by managing hunter access, habitat, or other influential factors (e.g., special use permits). Overall, most of the hunting districts or hunting district groups on the Forest are over objective or have increasing numbers of elk observed since 2008. Of the three hunting districts where numbers are below objectives (214, 331, and 332), the number of observed elk have increased over time. Based on the data, elk are prevalent across the landscape and it is likely a variety of recreational hunting opportunities exist for this species. Populations appear to be increasing in some areas and decreasing in others which may occur based on a multitude of factors, including hunting pressure, habitat modifications, depredation, or other environmental variables.

Data on elk populations may reflect how successful the Forest is at addressing the goal of wildlife secure areas and connectivity and managing for the density of open motorized roads and trails by landscape. Currently the density of roads within landscapes has not changed significantly since 2015 (see monitoring item 15), and elk populations are on an upward trend forest wide. This implies that elk may have enough secure habitat to meet life history needs. Future projects may address closing linear miles of roads which would improve elk security. However, the number of observed elk and secure habitat may not be directly correlated as other factors could influence the number of observed elk in an area, but it is not possible to ascertain with the available data.

Findings

Table 79. Summary of findings for Plan Monitoring Item 13.

MONITORING ITEM	YEAR UPDATED	PLAN IMPLEMENTATION STATUS ¹ Do monitoring results demonstrate intended progress (i.e. maintaining, trending, or advancing) of the associated plan components listed with this monitoring item?	RECOMMENDATION Based on the evaluation of monitoring results, may changes be warranted?	MANAGEMENT If a change may be warranted, where may the change be needed? ²
MON – 13: Elk What is the change in elk population?	2020	(E) Yes – Populations are increasing in the majority of FWP hunting districts and are at or above FWP population objectives.	No	N/A

¹ **PLAN IMPLEMENTATION STATUS:** (A) Uncertain - Interval of data collection beyond this reporting cycle (indicate date of next time this monitoring item will be evaluated); (B) Uncertain - More time/data are needed to understand status or progress of the Plan Component(s); (C) Uncertain - Methods inadequate to assess the status or progress toward achieving plan component(s). (D) NO - Implementation of Plan Component(s) ARE NOT trending, progressing, and/or conducted as desired; (E) YES - Implementation of Plan Component(s) ARE trending, progressing, and/or conducted as desired

² **[36 CFR 219.12(d)(2)]** - The monitoring evaluation report must indicate whether or not a change to the (1) plan, (2) management activities, (3) the monitoring program, or a (4) new assessment, may be warranted based on the new information. The monitoring evaluation report must be used to inform adaptive management of the plan area

Monitoring Item 14 – Winter Habitat

Monitoring Item Summary

Table 80. Summary of Monitoring Item 14.

Monitoring Question	Plan Component(s)	Indicators*	Data collection interval	Data Source / Partner	Point of Contact
Are management activities effectively protecting high elevation winter habitats for mountain goats and wolverines?	<p>GOAL (Wildlife Security)* Secure areas and connectivity for ungulates and large carnivores are provided, while recognizing the variety of recreational opportunities (Forest Plan, p. 45).</p> <p>OBJECTIVE (Management Indicator Species) Maintain habitat conditions for elk security and winter habitat integrity for wolverine and mountain goat as reflected by changes in abundance of these Management Indicator Species (Forest Plan, p. 47).</p> <p>*The Mount Jefferson Recommended Wilderness</p>	<p>Mountain goats – numbers of Snowmobile entries into non-motorized high elevation units protected for wolverines and mountain goats (U).</p> <p>Wolverines – presence or absence in high elevation habitats (Y).</p>	Annual	<p>Mountain goats: MT FWP; Snowmobile entries: FS Law Enforcement and snow rangers; Wolverines: MT-Natural Heritage and the Mesocarnivore monitoring report.</p>	Jennifer Gatlin

Monitoring Question	Plan Component(s)	Indicators*	Data collection interval	Data Source / Partner	Point of Contact
	<p>boundary will be monitored for illegal snowmobile intrusions into the wolverine habitat closure. Illegal use will be monitored during the period open to snowmobiles December 2 to May 15 and any other time of the year snow conditions make snowmobiling possible. The number and distance of intrusions into the closed area will be recorded. A reassessment of the decision to allow snowmobile use will be triggered if:</p> <ol style="list-style-type: none"> 1. Illegal intrusions are documented throughout the closure period. 2. Illegal intrusions penetrate the closed area. 3. Illegal intrusions extend as far as the BLM Wilderness Study Area. 				
* Indicator influenced by climate change? Y = Yes; N = No; U = Uncertain					

Table 81. Monitoring Item 14 - Monitoring Collection Summary.

For monitoring item 14:	Year
Data was last collected or compiled in:	2021
Next scheduled data collection/compilation:	2023
Last BMER evaluation for this monitoring item:	n/a
Next scheduled BMER evaluation of this monitoring item:	2023

Based on public comment during the forest planning efforts, winter non-motorized allocations were designed to protect low-elevation winter range for deer, elk, and moose and high-elevation secure habitat for mountain goat and wolverine. Both mountain goats and wolverines were selected as indicators of effects of disturbance on high elevation winter range.

More specifically, the Mount Jefferson area (located on the southern edge of the Madison Ranger District) is managed to protect undeveloped (roadless) character, provide recreation opportunities in a remote alpine setting, and secure wildlife habitat. In response to public comment, the Mount Jefferson Recommended Wilderness boundary will be monitored for illegal snowmobile intrusions into the wolverine habitat closure. Illegal use will be monitored during the period open to snowmobiles December 2 through May 15 and any other time of the year snow conditions make snowmobiling possible (Forest Plan, Plan Component 14).

Methods

This monitoring question requires three sources of data: 1) mountain goat numbers from Montana Fish, Wildlife, and Parks; 2) the number of snowmobile entries into non-motorized high-elevation units, especially Mount Jefferson; and 3) wolverine presence information from Montana Fish, Wildlife, and Parks, Montana Natural Heritage and the regional multi-species mesocarnivore monitoring effort.

Mountain goat numbers were obtained from biologists at MT FWP. MT FWP conducts aerial surveys to count numbers of mountain goats in various areas on the Beaverhead-Deerlodge National Forest. These surveys are generally conducted in summer or fall and may or may not overlap with areas considered “non-motorized high-elevation units”. Due to the habitat requirements for this species, it is assumed they were likely observed in high-elevation areas. Due to the lack of exact location data, observed numbers of mountain goats and the associated trend is reported by either mountain range (2 reports: Tobacco Roots and Snowcrest) or hunting district (4 districts: 324, 327, 328, 362; in 1962 mountain goats were introduced into district 340, but surveys have not been conducted since 2000). Data starting from 2009 is utilized within this report as that is the year the Forest Plan was signed. It is important to note that the Forest uses the 2006 MT FWP hunting district boundaries (see monitoring item 13) and boundaries change over time. Thus, the boundaries represented in this report may not reflect current hunting district boundaries.

In the west Big Hole (hunting district 321), comprehensive surveys on both the Montana and Idaho side within a close proximity of time (to minimize double counting) is the best assessment for mountain goat populations in that area (V. Boccardori, pers. comm). However, this only occurred in 2019. No trend data is available due to lack of consistent surveys as a result of the coordination needed to assess the mountain goat population in this area. Thus, the observed mountain goat number is displayed in this report.

The number of snowmobile entries into non-motorized units was derived from Forest Service Law Enforcement Officers and snow rangers. Annual data from 2009 was requested, although precise documentation is lacking due to reduced capacity and a lack of patrols specifically to monitor winter motorized access in non-motorized areas. However, some data is reported by querying the Law Enforcement Investigation Management Attainment Reporting System (LEIMARS) database for incursions specific to Mount Jefferson. Although data from the snow ranger monitoring the Mount Jefferson area was documented over the last five years, it is not available due to a computer failure. However, anecdotal numbers are reported.

Wolverine observations were obtained from Montana Natural Heritage Program and from the 2016-2020 Multispecies Mesocarnivore Monitoring report. The Montana Natural Heritage Program provides information on species observations and locations, as reported by a variety of individuals. This data was queried from the Heritage Program database to only include observations since 2009 and within the forest boundary.

Additional wolverine data was derived from the 2016-2020 Mesocarnivore Monitoring report. This report includes monitoring efforts for multiple forests in Region 1. Specifically, on the Beaverhead-Deerlodge National Forest, the monitoring effort addressed fisher, wolverine, and Canada lynx and specifically asked “are wolverine present”? within the Pioneer Range. Although this effort recorded multiple species, only observations of wolverine are used for this analysis. Methods for detection, including track surveys and bait stations are detailed in the monitoring report.

Results

Mountain goat observations are reported for hunting districts 324, 327, 328, and 362 and the Tobacco Root (hunting district 320 from the 2006 hunt boundary) and Snowcrest mountain ranges (Figure 13). The

trend for mountain goat observations is generally increasing in all areas except for hunting district 328. However, it is important to note that trend information may not be accurate as survey efficiency has improved significantly over the last five years (i.e., helicopter versus fixed-wing aircraft) (J. Cunningham, pers. comm.). In addition, between Idaho and Montana state wildlife agencies, a total of 66 mountain goats were counted in the west Big Hole in 2019 (hunting district 322). Since mountain goats move within entire mountain ranges, effort between states is needed to best estimate the population in that area.

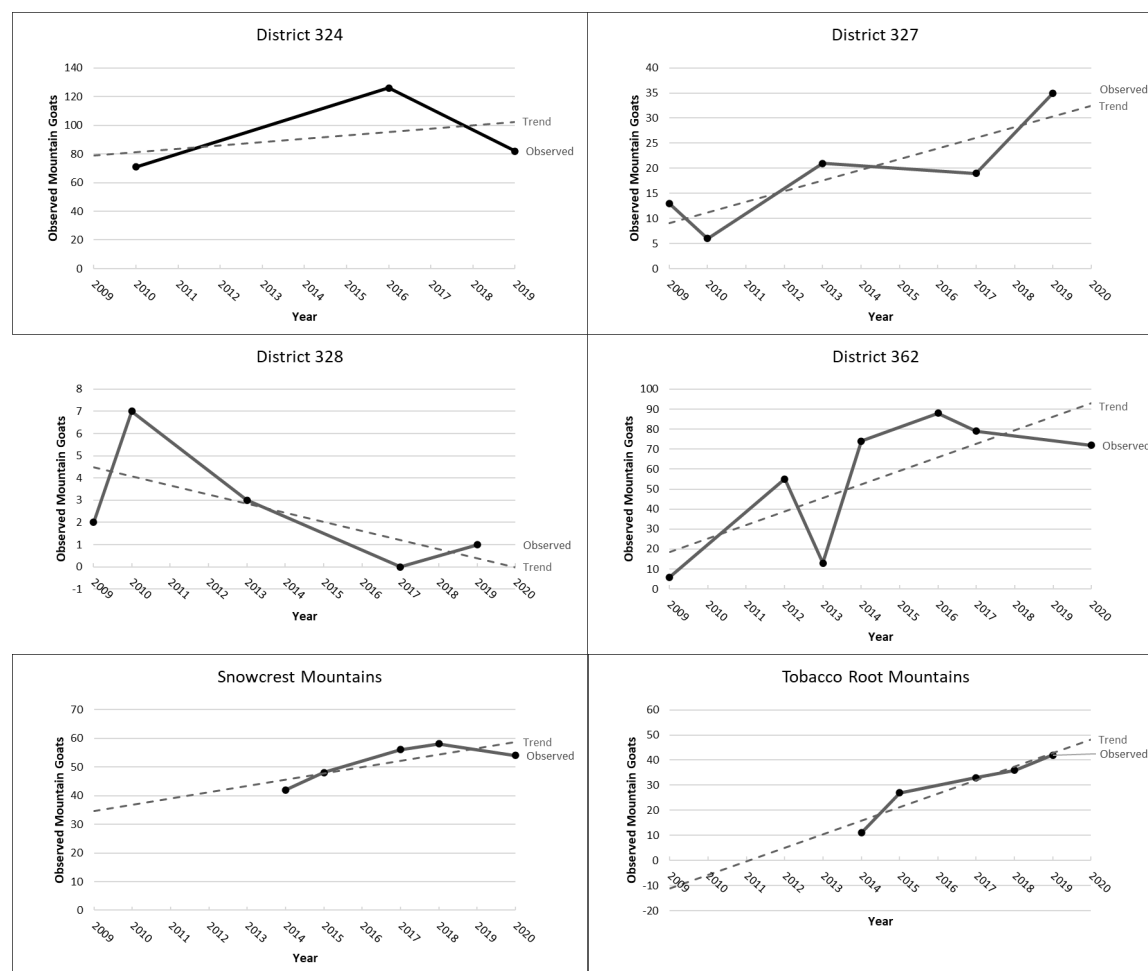


Figure 13. Number of observed mountain goats by year within certain areas on the Beaverhead-Deerlodge National Forest.

Unfortunately, although recorded, data regarding motorized intrusions into the Mount Jefferson area is not available from the snow ranger due to a computer failure. Law enforcement provided some data specific to this area (Table 80). The level of intrusions in the Mount Jefferson non-motorized area since 2016 are between 6-12 per year and has been decreasing due to consistent patrolling efforts (C. Hericks, pers. comm.).

Table 82. Number of intrusion incidents reported by law enforcement in the Mount Jefferson area since 2009. This does not include numbers reported by snow ranger patrols.

Year	Incidents (number)
2009	1

Year	Incidents (number)
2020	2
2011	3
2012	1
2013	0
2014	0
2015	1
2016	2
2017	2
2018	0
2019	0
2020	0

Since 1958, there have been 146 documented wolverines in the Montana Natural Heritage program. Wolverine presence has been documented on all landscapes on the Beaverhead-Deerlodge National Forest, except for the Upper Clark Fork Landscape near Butte. Of these observations, 12 have occurred since 2009, which does not include the efforts from MT FWP or mesocarnivore surveys conducted on the Beaverhead-Deerlodge National Forest. There are no documented wolverines within the specific Mount Jefferson recommended wilderness area, although wolverines have been detected within the Gravelly Landscape (which contains the Mount Jefferson area).

Wolverine presence in a variety of areas was documented through bait stations, camera traps, tracking, and environmental DNA collection efforts from the Beaverhead-Deerlodge National Forest, MT FWP, and the Rocky Mountain Research Station for regional mesocarnivore monitoring (Lukacs et al. 2020). These efforts confirmed that wolverine are present on the Forest, although population trends are not monitored for this species (which would require surveys in the same areas over time for comparison).

Discussion

Although some data are available for each of the indicators in this monitoring question, there are challenges associated with using the data to help understand the status of “secure areas and connectivity for ungulates and large carnivores are provided, while recognizing the variety of recreational opportunities”. The limitations include: 1) a lack of a clear definition of “non-motorized high elevation units protected for wolverines and mountain goats” (but for our purposes of this document, “units” is assumed to mean all winter non-motorized allocations because that was how the term was used in the Forest Plan FEIS); 2) surveys or efforts to detect mountain goats and wolverines may or may not intersect with non-motorized high elevation units; and 3) mountain goat numbers and wolverine presence or absence does not necessarily indicate whether management activities are protecting high elevation winter habitats.

The snowmobile entries indicator states “number of entries into non-motorized high elevation units protected for wolverines and mountain goats”. The use of “unit”, except for the Mount Jefferson area, is unclear. It can be inferred that “unit” means “winter non-motorized allocations” as outlined in the Forest Plan, but specific units designated for protection for wolverines and mountain goats is not identified.

Data for other winter motorized access into restricted areas was not obtained for this report, although it is possible it may exist. The number of incidents would not likely represent actual intrusions, though, as the number of documented incidents relies heavily on enforcement officers intersecting with recreationists.

Therefore, obtaining the number of incidents of illegal motorized access into winter restricted areas would not likely provide the existing conditions or trends of intrusions unless personnel capacity enabled the Forest to patrol these areas outside of Mount Jefferson.

Unfortunately, some monitoring data from Mount Jefferson patrols were lost due to a technological mishap. Although anecdotal observations suggest patrols are decreasing the number of intrusions in the Mount Jefferson area despite increasing attempts to enter other restricted areas, it is not possible to examine the current intrusion trend.

Efforts to survey for mountain goats and wolverines may or may not overlap with the Beaverhead-Deerlodge winter non-motorized allocations. Due to the lack of data for where exact surveys occurred through time and the lack of location information for snowmobile entries outside of Mount Jefferson, it is not possible to infer the relationship between snowmobile entries and mountain goat numbers and wolverine presence or absence. However, there is still value in monitoring the effectiveness of patrolling efforts in the Mount Jefferson area to determine if Forest patrols contribute to a decreasing trend of motorized entries into non-motorized areas.

Recently published research on the effects of motorized winter recreation activities and mountain goats does not exist. However, a literature review from Boyd (2020) determined that cumulative effects of recreational land use within goat habitat could decrease the availability of high-quality habitat, increase energetic loads during biologically taxing seasons and life phases, alter behavior, increase vulnerability to predation, or cause direct mortality. For purposes of the monitoring plan, it would be more valuable to assess the population trends of mountain goats on the Forest as a whole, regardless of motorized status in winter, to ensure habitat and forest management actions are not contributing to detrimental population decreases.

Wolverines are sensitive to motorized and non-motorized recreation and may avoid areas with increased off-road winter use, although they maintain multi-year home ranges within landscapes that support winter activities (Heinemeyer et al., 2019). Assessing presence or absence of wolverines is not a good measure of the effects of the number of snowmobile entries into non-motorized high elevation areas because this species has been documented widely across the Forest and may still persist in areas with winter activities. Population trend data may better answer the question regarding the effects of winter motorized entry, although methods to examine this question would require a substantial and challenging effort. Data to assess populations within high elevation areas does not currently exist. For these reasons, wolverine habitat should be used as an indicator. However, the Forest will continue assisting with efforts to detect this species as there is value in understanding their distribution across the landscape.

In summary, this monitoring question cannot be answered completely due to issues with data overlap, missing data, or data that does not contribute to answering the question. For future iterations of this report, the following changes are suggested:

Change the monitoring question by asking two separate questions.

1. What management activities are occurring in winter habitat for mountain goats and wolverine? Indicators: the number and type of management activities (other than public over-snow approved use) that overlap with known areas of mountain goat and wolverine habitat where presence is known. Mountain goat known areas can be obtained from FWP and wolverine denning habitat and/or detected locations layers can serve as a proxy for wolverine.

2. What is the trend of illegal intrusions into the Mount Jefferson Recommended Wilderness boundary? (Indicators: number of intrusions into the Mount Jefferson area compared to previous years).

Findings

Table 83. Summary of findings for Plan Monitoring Item 14.

MONITORING ITEM	YEAR UPDATED	PLAN IMPLEMENTATION STATUS ¹ Do monitoring results demonstrate intended progress (i.e. maintaining, trending, or advancing) of the associated plan components listed with this monitoring item?	RECOMMENDATION Based on the evaluation of monitoring results, may changes be warranted?	MANAGEMENT If a change may be warranted, where may the change be needed? ²
MON – 14: Winter Habitat Are management activities effectively protecting high elevation winter habitats for mountain goats and wolverines?	2020	(C) Uncertain – Monitoring results are inadequate to answer this question.	Yes	Change the monitoring question by asking two separate questions. 1) What management activities are occurring in winter habitat for mountain goats and wolverine? Indicators: the number and type of management actions (other than public over-snow approved use) that overlap with areas of mountain goat and wolverine habitat where presence is known. 2) What is the trend of illegal intrusions into the Mount Jefferson Recommended Wilderness boundary? Indicators: number of intrusions into the Mount Jefferson area compared to previous years.

¹ **PLAN IMPLEMENTATION STATUS:** (A) Uncertain - Interval of data collection beyond this reporting cycle (indicate date of next time this monitoring item will be evaluated); (B) Uncertain - More time/data are needed to understand status or progress of the Plan Component(s); (C) Uncertain - Methods inadequate to assess the status or progress toward achieving plan component(s). (D) NO - Implementation of Plan Component(s) ARE NOT trending, progressing, and/or conducted as desired; (E) YES - Implementation of Plan Component(s) ARE trending, progressing, and/or conducted as desired

² **[36 CFR 219.12(d)(2)]** - The monitoring evaluation report must indicate whether or not a change to the (1) plan, (2) management activities, (3) the monitoring program, or a (4) new assessment, may be warranted based on the new information. The monitoring evaluation report must be used to inform adaptive management of the plan area

Monitoring Item 15 – Wildlife Security

Monitoring Item Summary

Table 84. Summary of Monitoring Item 15.

Monitoring Question	Plan Component(s)	Indicators*	Data collection interval	Data Source / Partner	Point of Contact
Are road and trail densities trending towards goals described by landscape?	GOAL (Wildlife Secure Areas and Connectivity) Manage density of open motorized roads and trails by landscape year-round, except fall rifle big game season, to achieve levels at or below the following (see Table 13 on p. 45 of the Forest plan).	Open motorized road and trail density – changes in density for general season by landscape (N).	Every 4-5 years	Internal - GIS	Jennifer Gatlin, Tim O’Neil
* Indicator influenced by climate change? Y = Yes; N = No; U = Uncertain					

Table 85. Monitoring Item 15 - Monitoring Collection Summary.

For monitoring item 15:	Year
Data was last collected or compiled in:	2020
Next scheduled data collection/compilation:	2021
Last BMER evaluation for this monitoring item:	n/a
Next scheduled BMER evaluation of this monitoring item:	2023

To address additional wildlife secure areas and connectivity concerns, the Forest Plan established a desired open motorized road and trail density (OMTRD) on eleven landscapes. The Plan defines open motorized roads and trails as motorized routes open to use as measured at the competition of project implementation in miles per square mile. These consist of motorized roads and trails that fall within the external forest boundary and are open to public motorized use, open for permitted and/or administrative use and remain on the landscape, temporary unless obliterated at project completion, or motorized routes on private inholdings. Managing for lower open motorized road densities may allow large mammals to move across the Forest without major disturbance from vehicles by providing secure areas. In addition, secure areas address concerns about “linkages” across large landscapes that permit species to travel undisturbed.

A variety of projects on the Forest contribute to changing road densities on the landscapes. Although permanent roads are rarely established, some roads are decommissioned, others may be moved, or season and use type may change. The Beaverhead-Deerlodge National Forest tracks these changes to ensure projects move the Forest towards the OMTRD goals by landscape as identified in the Forest Plan.

Methods

The Forest documents changes to open motorized roads or trails within Forest Service corporate databases on an annual basis. More specifically, the infrastructure database (INFRA) is the official record for system route additions, decommissions, or changes and the Natural Resource Manager Watershed Improvement Tracking (NRM-WIT) tracks non-system road decommissions. On-the-ground verification during projects or field inventories contribute to this information. This data is then queried to obtain the miles of open motorized road and trail information that is available for the Forest. The Geographic Information System (GIS) coordinator on the Forest maintains a spreadsheet that documents change to open motorized roads and trails compared to the values established in the Forest Plan. The GIS coordinator updates to the spreadsheet when significant changes occur, such as field inventories or multiple completed projects.

The most recent tracking spreadsheet was used to document current and past values of road densities by landscape. Initial values for comparison were established in 2009, although values established in 2015 are utilized as a starting point for comparison. In 2015, additional inventory improved the accuracy of open motorized roads and trails data. Another update event is likely to occur again in the future as the Forest continues to collect ground-condition data to support projects. For purposes of this analysis, data from 2015 (January) and 2020 (August) are used for comparison.

Results

The Forest recognizes that geospatial data may contain errors or may not accurately represent on-the-ground conditions in all cases. Effort is made commensurate with available personnel and resources to improve existing datasets to represent actual conditions.

As stated in the methods, changes to densities and linear road miles result from completing projects or inventories. Future inventory efforts will improve the accuracy of available OMRTD information, as evidenced by the updates made between 2009 and 2015. If significant changes to baselines occur again, future iterations of monitoring reports may consider comparing status and trends to the most recent baseline instead of comparing to 2015.

Since 2015, the open motorized road and trail density has not changed on any landscape (Table 86). Four landscapes exceed the desired densities as listed in the Forest Plan: Big Hole, Boulder River, Jefferson River, and Upper Rock Creek. The rest of the landscapes are at or below the OMRTD goal and therefore achieving desired conditions.

Table 86. Open motorized road and trail densities by landscape and density status compared to Forest Plan goals on the Beaverhead-Deerlodge National Forest.

Landscape	Density status compared to Forest Plan (below, at, above)	Open motorized road and trail density (miles/mile ²)		
		Forest Plan Goal	2020	2015
Big Hole	Above	1.2	1.4	1.4
Boulder River	Above	1.9	2.2	2.2
Clark Fork – Flints	At	1.9	1.9	1.9
Gravelly	At	0.7	0.7	0.7
Jefferson River	Above	1.6	1.9	1.9
Lima Tendoy	Below	1.0	0.9	0.9
Madison	At	0.0	0.0	0.0
Pioneer	Below	1.5	1.2	1.2
Tobacco Roots	Below	1.3	1.2	1.2
Upper Clark Fork	Below	2.0	1.9	1.9
Upper Rock Creek	Above	0.9	1.1	1.1

Discussion

Although the number of linear miles of open motorized roads and trails may change within landscapes over time, the density of roads within a landscape (as measured by the miles of open motorized roads and trails per square mile) may not change unless the miles of open motorized roads or trails significantly increases or decreases within a given landscape. Both the length of the open motorized road or trail and its location contribute to the density value within a specific landscape.

Two projects, Red Rocks and Pintler Face, include actions to reduce motorized roads or trails on the Forest. The change will be realized once these projects are implemented, which will affect OMRTD values and move the Forest closer towards desired conditions. The Red Rocks project includes actions to reduce miles of open motorized route and will reduce the Boudier River Landscape OMRTD to 2.1 moving the landscape in the direction of the Plan goal. The Pintler Face project is predicted to reduce the Big Hole OMRTD to 1.2 which would achieve the Plan goal for this landscape.

To date, although some linear miles of roads have changed, the Forest has not made progress towards goals in the Forest Plan. However, the Forest is working to reduce or maintain desired road densities but change in values may not be apparent unless the miles of open motorized roads or trails significantly changes within a landscape. The projects mentioned above will contribute towards Forest Plan goals, although the change in OMRTD from the linear road reductions did not occur by the time of this writing.

Findings

Table 87. Summary of findings for Plan Monitoring Item 15.

MONITORING ITEM	YEAR UPDATED	PLAN IMPLEMENTATION STATUS ¹ Do monitoring results demonstrate intended progress (i.e. maintaining, trending, or advancing) of the associated plan components listed with this monitoring item?	RECOMMENDATION Based on the evaluation of monitoring results, may changes be warranted?	MANAGEMENT If a change may be warranted, where may the change be needed? ²
MON – 15: Wildlife Security Are road and trail densities trending towards goals described by landscape?	2020	(D) No – As there was no change in open motorized road and trail density from 2015 to 2020.	Yes	Management Activities: New projects should consider reduction in OMRTD in the purpose and need.

¹ **PLAN IMPLEMENTATION STATUS:** (A) Uncertain - Interval of data collection beyond this reporting cycle (indicate date of next time this monitoring item will be evaluated); (B) Uncertain - More time/data are needed to understand status or progress of the Plan Component(s); (C) Uncertain - Methods inadequate to assess the status or progress toward achieving plan component(s). (D) NO - Implementation of Plan Component(s) ARE NOT trending, progressing, and/or conducted as desired; (E) YES - Implementation of Plan Component(s) ARE trending, progressing, and/or conducted as desired

² **[36 CFR 219.12(d)(2)]** - The monitoring evaluation report must indicate whether or not a change to the (1) plan, (2) management activities, (3) the monitoring program, or a (4) new assessment, may be warranted based on the new information. The monitoring evaluation report must be used to inform adaptive management of the plan area

Monitoring Item 16 – Weeds

Monitoring Item Summary

Table 88. Summary of Monitoring Item 16.

Monitoring Question	Plan Component(s)	Indicators*	Data collection interval	Data Source / Partner	Point of Contact
What is the change in weed infestations?	Prevent, reduce, or eliminate infestations of non-native or noxious weed species with emphasis on areas where there is a high likelihood of establishment and spread. Manage noxious weeds through Integrated Pest Management as described in the most current Beaverhead-Deerlodge Noxious Weed Control Record of Decision.	<p>Weed Infestations (acres of known infestations) (Y).</p> <p>New species (Number of sites and extent) (Y).</p> <p>Inventoried noxious weed infestations (Y).</p>	Annually	TESP-IS	Jan Bowey
* Indicator influenced by climate change? Y = Yes; N = No; U = Uncertain					

Table 89. Monitoring Item 16 - Monitoring Collection Summary.

For monitoring item 16:	Year
Data was last collected or compiled in:	2021
Next scheduled data collection/compilation:	2023
Last BMER evaluation for this monitoring item:	None
Next scheduled BMER evaluation of this monitoring item:	2023

Addresses 2012 Planning Element:

(ii) - status of select ecological conditions including key characteristic of terrestrial and aquatic ecosystems, and

(vii) - progress toward desired conditions and objective in the plan, including providing multiple use opportunities.

Noxious weed presence decreases the ecological integrity of vegetative communities. If left untreated, noxious weeds will replace native vegetation with a monoculture of invasive, non-native species leading to a decline in vegetative diversity, soil productivity, watershed stability and desirable wildlife forage especially on big game winter range.

Methods

Data entry

Invasive inventory, treatment, and monitoring data is entered into the Natural Resource Manager (NRM) / Forest Activity Tracking System (FACTS) database via the Threatened and Endangered Species & Invasive Species (TESP-IS)/Arc Map tool by trained staff. Because treatment and inventory data are often collected simultaneously, reviewers should not interpret the results as a complete inventory of all BDNF lands. Treatment of new infestations are generally reported by other agency personnel or interested stakeholders with priority for inventory and treatment given to primary access routes, areas of concentrated human use, gravel pits and agency horse pastures.

Data Analysis

TESP-IS (Threatened, Endangered, Sensitive-Invasive Species) invasive plant species inventory data was queried in January 2021 for the BDNF. Data collected 2000 or later were included if mapped infestations remain on the inventory list and sorted by species. Invasive plant species not listed as noxious by Montana or a County that includes the BDNF (example: cheatgrass) were removed from the data set. The data included numerous records for the genus *Cirsium* (thistle) without a species identifier so the reviewer could not determine if the record referenced a noxious weed thistle (specifically *Cirsium arvense* or *Cirsium vulgare*) or a desirable native species. Therefore, all *Cirsium* genus records missing a species identifier were removed. Acres for the remaining current invasive species inventory were summed by “infested area” (note: quotations are queried column) and reported as acres of known weed infestations.

The same data described in the above paragraph were queried for 2000-2018. These data were then compared with the January 2021 data (reflecting the 2019 and 2020 growing seasons) to determine what new species were inventoried on the BDNF during the prior 2-year time period. Species occurring on the list in 2021 but not 2018 were considered new infestations.

Results

Total known noxious weed infestations on the Beaverhead-Deerlodge National Forest as of January 2021: 120,440 acres.

Table 90. New noxious weed species found on the Beaverhead-Deerlodge National Forest in 2019 or 2020.

New Species (2019-2020)	Number of Infestations	Total Acres Known Infestation
Blueweed (<i>Echium vulgare</i>)	1	0.1 acres
Orange Hawkweed (<i>Hieracium aurantiacum</i>)	19	12 acres

Changes in size of known noxious weed infestations on the Beaverhead-Deerlodge National Forest are inventoried as they are treated or observed. Annual changes in size may reflect differences in annual growing conditions, prior treatment effectiveness and seasonal timing of observation.

Reported data likely overestimates the total known acres of weed infestations for the following reasons:

Often, multiple species infest the same area. For example, a small patch of houndstongue may be growing within a larger patch of spotted knapweed. If both species are separately inventoried, the overlapping acres may have been double counted. If houndstongue is mapped at 20 acres within a 40-acre infestation dominated by spotted knapweed, the data might display as a 60-acre infestation when the actual extent should be 40 acres. Changes/clarifications have been made to TESP-IS data quality rules to correct this

issue over time. Corrections are slow and tedious and dependent on an accurate understanding of data quality rules by the recorder and whether the infestation has been re-inventoried by a recorder who understands the clarified rule.

Additionally, data quality issues occur (in a currently unknown amount) when an infestation changed size over time and was remapped. Occasionally, data entry did not note the updated polygon as a change to an existing polygon so both polygons remain in the data and acres infested are double counted. Range specialists are correcting these errors when recognized.

Data for known new noxious weed species infestations appears accurate. Range specialists and partners (Forest users knowledgeable about noxious weeds) are quick to report and respond when a new species is found. Presence of orange hawkweed was difficult to verify since it is similar in appearance to a native hawkweed. Districts had numerous reports of infestations that were actually the native species. However, this indicates education/information efforts are effective and employees and other Forest users are recognizing potential establishment.

Discussion

This is the first year the data has been reported as a *Biennial Monitoring Report* for the *Beaverhead-Deerlodge National Forest Plan*. Monitoring items, tracked over time, will provide the BDNF information to determine if existing management is effective or needs adjusted. Infestations of new species were given treatment priority to prevent spread of the species to different locations and attempt to eradicate the new infestation.

Findings

Table 91. Summary of Findings for Plan Monitoring Item 16.

MONITORING ITEM	YEAR UPDATED	PLAN IMPLEMENTATION STATUS ¹ Do monitoring results demonstrate intended progress (i.e. maintaining, trending, or advancing) of the associated plan components listed with this monitoring item?	RECOMMENDATION Based on the evaluation of monitoring results, may changes be warranted?	MANAGEMENT If a change may be warranted, where may the change be needed? ²
MON – 16: Weeds What is the change in weed infestations?	2021	(B) Uncertain – More time is needed to address potential data discrepancies and improve reporting.	Yes	Monitoring Program: Suggest change to the monitoring item to include an indicator that addresses new species establishment. Also, improve accuracy of annual reporting data to avoid double counting remapped acres.

¹ **PLAN IMPLEMENTATION STATUS:** (A) Uncertain - Interval of data collection beyond this reporting cycle (indicate date of next time this monitoring item will be evaluated); (B) Uncertain - More time/data are needed to understand status or progress of the Plan Component(s); (C) Uncertain - Methods inadequate to assess the status or progress toward achieving plan component(s). (D) NO - Implementation of Plan Component(s) ARE NOT trending, progressing, and/or conducted as desired; (E) YES - Implementation of Plan Component(s) ARE trending, progressing, and/or conducted as desired

² **[36 CFR 219.12(d)(2)]** - The monitoring evaluation report must indicate whether or not a change to the (1) plan, (2) management activities, (3) the monitoring program, or a (4) new assessment, may be warranted based on the new information. The monitoring evaluation report must be used to inform adaptive management of the plan area

Monitoring Item 18 – Fuels

Monitoring Item Summary

Table 92. Summary of Monitoring Item 18.

Monitoring Question	Plan Component(s)	Indicators*	Data collection interval	Data Source / Partner	Point of Contact
Are fuels reduction projects being implemented in high-risk WUI areas?	Objectives Wildland Urban Interface (WUI): Reduce the risk from wildfire to communities and resources in the following order of priority: 1. Areas where a community wildfire protection plan has been developed. 2. High risk areas adjacent to communities, for example: condition classes 2 and 3 in fire regimes 1, 2, & 3. 3. Areas in condition class 2 and 3 in fire regimes 4 & 5. 4. Areas to be maintained in condition class 1.	Acres of WUI treated (N).	Annually	*District Fuels Specialists *FACTS	B-D Fuels
* Indicator influenced by climate change? Y = Yes; N = No; U = Uncertain					

Table 93. Monitoring Item 18 - Monitoring Collection Summary.

For monitoring item 1:	Year
Data was last collected or compiled in:	2021
Next scheduled data collection/compilation:	2021
Last BMER evaluation for this monitoring item:	n/a
Next scheduled BMER evaluation of this monitoring item:	2023

This monitoring question exists because it is a Fire Management Objective in the Forest Plan (pg. 22) under the Forestwide Direction section.

Methods

The Regional Office provided data sourced from a FACTS database for the Beaverhead-Deerlodge Forest, which compiled data from various sources dating 2016-2020. These data were queried for answers that could help address the monitoring question. Each district's data were sorted and organized by treatment types and by year to produce the table in the Results section.

Results

The data source used to populate (Table 94) were obtained from the FACTS database query identified above. Confidence in these data is high. All areas identified as WUI have been developed through the creation of a community wildfire protection plans as recommended by the Forest Plan objective (Table 92).

Table 94. Fuel Treatment Acres in the WUI by Method of Mechanical and Fire.

Acres of Fuels Treatments in WUI					
Mechanical	2016	2017	2018	2019	2020
Biomass Removal	733	1093	0	55	0
Chipping	0	0	0	0	94
Lop & Scatter	541	266	386	569	503
Machine Pile	236	113	383	180	131
Thinning	427	802	1265	1191	1425
Total Acres	1937	2274	2034	1995	2153
Fire	2016	2017	2018	2019	2020
Broadcast Burn	92	217	767	67	0
Fire Use	699	56514	4114	0	0
Jackpot Burn	403	40	16	531	77
Machine Pile Burn	136	346	12	398	242
Total Acres	1330	57117	4909	996	319

Discussion

Table 94 depicts acres treated by type spanning the years 2016-2020. It separates mechanical fuels treatments from treatments using fire, and further breaks down the type of treatment within those two categories.

General findings from the FACTS query data includes 1) The majority of acres treated in WUI was from fire use; 2) Mechanical fuels treatments were more widely used than fire during this time but treated fewer acres; 3) Of the mechanical treatments, thinning is the only treatment with averages increasing over time, and 4) Fire accomplishments in 2020 do not represent a typical year due to Covid-19 restrictions that prevented prescribed burning from occurring. However, climatic conditions created an extra late wildfire season, which may have impacted our ability to implement prescribed burning regardless.

It is recommended to remove the term “high risk” from the monitoring question. There are numerous approaches to the definition of “high risk”. There are different kinds of risk, various agencies have their approach to risk, and to further add to the complexity associated with using this term it has greatly

changed over time. Therefore, the new monitoring question will be “Are fuels reduction projects being implemented in WUI areas”.

The Forest Plan WUI Objectives were created in 2009 with an ecological focus using fire regime and condition class. These metrics regarding risk are nearly obsolete today. The definition and methodology of risk is still evolving and currently include fire likelihood, intensity, and susceptibility modeled as components involved in Strategic Wildfire Risk Planning. Proximity to homes and population density are also considered in this methodology.

Findings

Table 95. Summary of findings for Plan Monitoring Item 18.

MONITORING ITEM	YEAR UPDATED	PLAN IMPLEMENTATION STATUS ¹ Do monitoring results demonstrate intended progress (i.e. maintaining, trending, or advancing) of the associated plan components listed with this monitoring item?	RECOMMENDATION Based on the evaluation of monitoring results, may changes be warranted?	MANAGEMENT If a change may be warranted, where may the change be needed? ²
MON – 18: Fuels Are fuels reduction projects being implemented in high-risk WUI areas?	2020	(E) Yes – because fuel reduction projects are being implemented in WUI areas with community wildfire protection plans.	Yes	Monitoring Program: Remove the term “high risk” from the monitoring question and remove the second indicator (acres of WUI with reduced fuel loadings and crown risk) as this is duplicative. This is already measured through acres of fuels reduction.

¹ **PLAN IMPLEMENTATION STATUS:** (A) Uncertain - Interval of data collection beyond this reporting cycle (indicate date of next time this monitoring item will be evaluated); (B) Uncertain - More time/data are needed to understand status or progress of the Plan Component(s); (C) Uncertain - Methods inadequate to assess the status or progress toward achieving plan component(s). (D) NO - Implementation of Plan Component(s) ARE NOT trending, progressing, and/or conducted as desired; (E) YES - Implementation of Plan Component(s) ARE trending, progressing, and/or conducted as desired

² **[36 CFR 219.12(d)(2)]** - The monitoring evaluation report must indicate whether or not a change to the (1) plan, (2) management activities, (3) the monitoring program, or a (4) new assessment, may be warranted based on the new information. The monitoring evaluation report must be used to inform adaptive management of the plan area

Monitoring Item 19 – Recreation

Monitoring Item Summary

Table 96. Summary of Monitoring Item 19.

Monitoring Question	Plan Component(s)	Indicators*	Data collection interval	Data Source / Partner	Point of Contact
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Is the BDNF providing desired recreation opportunities?	<p>Goal: Recreation Opportunities: High quality diverse outdoor recreation opportunities are provided, including (pg. 30): Day use activities within a 30-minute drive of communities for motorized and nonmotorized trails, picnicking and interpretive sites. Winter use areas near communities for ski touring, snowshoeing and snowmobiling, Trails and routes for autos, four-wheel-drive vehicles, ATVs, motorcycles, mountain bikes, horses, and hikers to high mountain lakes and other features; and, Developed and dispersed camping.</p> <p>Objectives: Increase opportunities for non-motorized winter activities, such as ski touring and snowshoeing, where highway access points and parking are available (pg. 31).</p>	<p>Number of developed sites Dev Scale 1-5, with constructed features (N).</p> <p>Number of campgrounds Dev Scale 2-5 (N).</p> <p>Number of inventoried dispersed recreation sites Dev Scale 0-1(N).</p> <p>Number of rental cabins (N).</p> <p>Site occupancy and revenue from fee recreation sites (N).</p> <p>Number of ski areas permitted (U).</p> <p>Number and miles of winter recreation trails (N).</p> <p>Miles of trails by trail type (N).</p> <p>Number of recreation user events (U).</p> <p>Number of guide permits issued and service days (U).</p> <p>Number of visitors to the BDNF, including in Wilderness (U).</p> <p>Surveyed visitor activities, demographics, and satisfaction (N).</p>	2 years	<p>Forest Plan; Natural Resource Management (INFRA/NRM) Forest Transportation Atlas (INFRA Database) Special Use Data System (SUDS Database) National Visitor Use Monitoring Surveys (NVUM) National Recreation Reservation System</p>	Noelle Meier, Forest Recreation, Wilderness, Trails and Recreation Special Uses Program Manager
* Indicator influenced by climate change? Y = Yes; N = No; U = Uncertain					

Table 97. Monitoring Item 19 - Monitoring Collection Summary.

For monitoring item 19:	Year
Data was last collected or compiled in:	2020
Next scheduled data collection/compilation:	2021
Last BMER evaluation for this monitoring item:	n/a
Next scheduled BMER evaluation of this monitoring item:	2023

Changes in available recreation facilities, trails and areas, visitor use, and visitor satisfaction can affect whether the BDNF is providing desired recreation opportunities.

Methods

Data were reviewed to assess whether opportunities are being provided or have changed during the planning period (15 years). Monitoring is completed through a review of the appropriate database of record containing the most accurate data on the forest's recreation opportunities, including various kinds of recreation facilities, trails and areas, as well as data on visitor use and satisfaction.

Data used in this report was obtained through local-level and regional office provided data, stored in the National Resources Management (NRM) database and National Visitor Use Monitoring (NVUM) reports. The NRM maintains core Forest Service data used for analysis, creating reports and products in day-to-day business, upward reporting for performance accountability, year-end reporting, strategic planning, congressional inquiries, and providing data to partners and stakeholders. Several reports used as references for this monitoring report are internal and were compiled from data stored in the NRM. These reports are internal and not public. The National Visitor Use Monitoring (NVUM) program provides reliable information about recreation visitors to NFS lands including activity participation, demographics, visit duration, measures of satisfaction, and trip spending connected to the visit. NVUM data is displayed on a public-facing portion of the NRM: <https://apps.fs.usda.gov/nvum/results>

This data review is used to determine whether changes have occurred to desired recreation opportunities on the BDNF.

Results

Recreation Sites on the BDNF: The forest plan states a forest-wide desired condition that “*Visitors benefit from a range of primitive to developed recreation settings and opportunities. Most of the BDNF continues to offer uncrowded motorized and non-motorized backcountry opportunities*”. This desired condition applies to Monitoring Question 19. Monitoring for this question begins with a review of the recreation sites available on the BDNF. The following table shows various types of recreation sites located on the BDNF:

Table 98. Recreation Sites on the BDNF (FY2020 Data).

Recreation Site Type	Dillon RD	Wisdom RD	Butte RD	Madison RD	Pintler RD	Total
Developed Recreation Sites Dev. Scale 1-5 with constructed features	23	58	27	31	43	182
Developed Campgrounds Dev. Scale 2-5	6	17	7	12	12	54

Inventoried Dispersed recreation sites Dev Scale 0-1	153	385	360	296	295	1489
Rental Cabins	3	5	4	8	5	24

Source: [RHR Integrated Business Systems \(fs.fed.us\)](https://www.fs.fed.us/rhr/).

The following chart displays the classification of recreation sites that distinguish the degree of site amenities, and alteration present, within a spectrum based on resource protection and user comfort (FSM 2309.13_10.8).

Table 99. Recreation Site Development Scale (with ROS).

Development Scale	Typical Recreation Opportunity Spectrum (ROS) Consistency	Typical Site & Facility Characteristics	Typical Management Emphasis
0	May occur in any ROS setting	User-created dispersed use No FS investment or amenities	May include monitoring of resource conditions
1	May occur in any ROS setting	Primarily user-created dispersed use area Informal vehicle circulation and parking Minimal FS investment, may include signage	Resource protection
2	May occur in any ROS setting	Defined vehicle circulation and parking with minimal FS investment to accommodate user-created dispersed use area Limited amenities may include signage, tables, fire rings. In rare instances may include vault toilet	Resource protection
3	Roaded Natural	Designed developed site with significant FS investment and delineation Amenities may include signage, fire rings, tables, toilet, waste collection, potable water Roads are surfaced; maintenance level 3 or 4	Visitor comfort & Resource protection
4	Roaded Natural, Rural, Urban	Designed developed site with significant FS investment and delineation Amenities include signage, interpretive materials, fire rings, grills, tables, waste collection, potable water, flush toilets Roads, parking, and paths are surfaced and may be paved; maintenance level 4 or 5	Visitor comfort, Resource protection
5	Rural, Urban	Designed developed site with significant FS investment and delineation Amenities typically include signage, interpretive displays, fire rings, grills, tables, waste collection, potable water, flush toilets. May include utility hook-ups, showers, and laundry facilities.	Visitor comfort, Resource protection

		Roads, parking, and pathways are clearly delineated and are often paved; maintenance level 4 or 5.	
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Note: Dispersed Site Scales 0-2 can occur across all ROS setting settings, however Developed Site Scales 3-5 are limited to more developed ROS setting settings.

Recreation Site Occupancy and Revenue: While site occupancy data on sites across the forest was not available for this report, fee site revenue data can be used as a proxy to provide a sense of levels of recreation use. The table below shows revenue figures for 2016 through 2020. Overall, revenue has been relatively steady, with some drops and some gains. There was a 30% increase in fee revenue between 2019 and 2020, and a 48% increase in 2020 from 2016. Much of this increase is attributable to high volumes of recreation use related to the COVID-19 pandemic, and that several campgrounds on the Madison RD were returned to agency operation from previously being concessionaire operated.

Table 100. Recreation Sites Revenue on the BDNF (FY2016-2020 Data).

Recreation Sites	Dillon RD	Wisdom RD	Butte RD	Madison RD	Pintler RD	Total	% Change
2016	\$47,455.00	\$50,128.00	\$22,074.00	\$30,605.00	\$12,809.50	\$163,071.50	
2017	\$36,639.00	\$50,120.00	\$22,997.00	\$30,590.00	\$14,619.00	\$154,965.00	-5%
2018	\$41,797.00	\$43,476.00	\$23,681.00	\$32,195.00	\$18,290.00	\$159,439.00	3%
2019	\$42,107.00	\$43,145.00	\$23,235.00	\$89,64.00	\$17,663.00	\$215,796.00	35%
2020	\$67,685.00	\$62,884.00	\$18,742.00	\$108,412.00	\$22,480.00	\$280,203.00	30%

Source: WO-generated report using Point-of-Sale-System (POSS) and reservations (recreation.gov) data.

The source data used for the table above included revenue data for some, but not all, of the concessionaire operated sites on the Pintler RD. There was no adequate information on the Pintler RD's concessionaire sites to be included in the table above. However, site occupancy data was available for several Pintler concessionaire operated sites shown below.

Table 101. FY20 Recreation Sites Occupancy on the Pintler RD.

Name	Type	Percent Occupied
Lodgepole Campground (MT)	STANDARD NONELECTRIC	34%
PHILIPSBURG BAY CAMPGROUND	STANDARD ELECTRIC	87%
PHILIPSBURG BAY CAMPGROUND	STANDARD NONELECTRIC	59%
PINEY CAMPGROUND AND BOAT LAUNCH	RV NONELECTRIC	51%
PINEY CAMPGROUND AND BOAT LAUNCH	STANDARD NONELECTRIC	47%
SPRING HILL CAMPGROUND	STANDARD NONELECTRIC	35%

Several day use recreation sites are located within a 30-minute drive of communities for motorized and nonmotorized trails, picnicking and interpretive sites.

Recreation Sites Within 30-Minute Drive of Communities (Overnight campgrounds are included if the site has an associated picnic area or if the campground receives day use)

Dillon Ranger District Area

Community Name	Recreation Site Name	Type of Site
Dillon	ASPEN PICNIC AREA	PICNIC SITE
Dillon	BIRCH CREEK CCC CAMP - NATIONAL HISTORIC LANDMARK	INTERPRETIVE SITE
Jackson, Polaris	BLUE CREEK TRAILHEAD	TRAILHEAD
Polaris	CRYSTAL PARK	PICNIC SITE
Lima, Dell	EAST CREEK CAMPGROUND	CAMPGROUND
Jackson, Polaris	GRASSHOPPER CAMPGROUND	CAMPGROUND/ PICNIC AREA
Polaris	HARRISON TRAILHEAD	TRAILHEAD
Polaris	PRICE CREEK CAMPGROUND	CAMPGROUND
Wisdom Ranger District Area		
Community Name	Recreation Site Name	Type of Site
Wise River	BOULDER CREEK CAMPGROUND	CAMPGROUND
Melrose, MT	CANYON CREEK KILNS	INTERPRETIVE SITE
Wisdom	DOOLITTLE TRAILHEAD	TRAILHEAD
Wise River	FOURTH OF JULY CAMPGROUND	CAMPGROUND
Wise River	HOMESTEADERS LEGACY	INTERPRETIVE SITE
Wise River	JOE MAURICE	INTERPRETIVE SITE
Wise River	LODGEPOLE CAMPGROUND	CAMPGROUND
Wise River	LUPINE GROUP AREA	SNOWPARK
Wisdom	MAY CREEK CAMPGROUND	CAMPGROUND
Jackson	NORTH VAN HOUTEN CAMPGROUND	CAMPGROUND
Wise River	PETTENGILL CAMPGROUND	CAMPGROUND
Wise River	PETTENGILL CREEK TRAILHEAD	TRAILHEAD
Wise River	PETTENGILL WINTER PARKING	SNOWPARK
Polaris	RAISING PIONEERS	INTERPRETIVE SITE
Wise River	SHEEP CREEK TRAILHEAD	TRAILHEAD
Jackson	SOUTH VAN HOUTEN CAMPGROUND	CAMPGROUND
Wisdom	STEEL CREEK CAMPGROUND	CAMPGROUND
Wisdom	STEEL CREEK TAILHEAD	TRAILHEAD
Wise River	STINE CREEK TRAILHEAD	TRAILHEAD
Wise River	VIPOND PARK	INTERPRETIVE SITE
Wise River	WILD MAN OF WISE RIVER	INTERPRETIVE SITE
Wise River	WILLOW CAMPGROUND	CAMPGROUND
Butte Ranger District Area		
Community Name	Recreation Site Name	Type of Site
Basin	BASIN CANYON CAMPGROUND	CAMPGROUND
Butte	BEAVERDAM CAMPGROUND	CAMPGROUND
Butte	BEAVERDAM PICNIC AREA	PICNIC SITE
Butte	BLACKTAIL CANYON TRAILHEAD	TRAILHEAD

Whitehall	DELMOE LAKE BOAT LAUNCH	BOATING SITE
Whitehall	DELMOE LAKE PICNIC AREA	PICNIC SITE
Boulder	ELDER CREEK PICNIC AREA	PICNIC SITE
Boulder	ELKHORN PICNIC AREA	PICNIC SITE
Butte, Basin	FREEDOM POINT	GROUP PICNIC SITE
Butte, Whitehall	HOMESTAKE PICNIC AREA	PICNIC SITE
Butte, Whitehall	HOMESTAKE TRAILHEAD	TRAILHEAD
Butte, Whitehall	LIONS DEN	PICNIC SITE
Butte, Whitehall	LOWER EAGLES NEST	GROUP PICNIC SITE
Butte, Basin	LOWLAND PICNIC AREA	GROUP PICNIC SITE
Butte, Basin	MANEY LAKE PICNIC AREA	PICNIC SITE
Butte	MOULTON TRAILHEAD	TRAILHEAD
Whitehall	PIGEON CREEK CAMPGROUND	CAMPGROUND
Butte, Whitehall	SAGEBRUSH FLATS	GROUP PICNIC SITE
Basin	SARATOGA MINE TRAILHEAD	TRAILHEAD
Butte, Basin	SHEEPSHEAD	GROUP PICNIC SITE
Butte, Whitehall	TOLL MOUNTAIN CAMPGROUND	CAMPGROUND
Basin	WHITEHOUSE CAMPGROUND	CAMPGROUND
Madison Ranger District Area		
Community Name	Recreation Site Name	Type of Site
Sheridan, Twin Bridges	BALANCED ROCK CAMPGROUND	CAMPGROUND
Ennis	BEAR CREEK CAMPGROUND	CAMPGROUND
Sheridan, Twin Bridges	BRANHAM LAKES CAMPGROUND	CAMPGROUND
Ennis	INDIAN CREEK TRAILHEAD	TRAILHEAD
Ennis	KIRBY/EAGLE'S NEST FISHING ACCESS SITES	FISHING SITE
Ennis	LYONS BRIDGE	BOATING SITE
Ennis	MADISON RIVER CAMPGROUND	CAMPGROUND
Sheridan, Twin Bridges	MILL CREEK CAMPGROUND	CAMPGROUND
Ennis, Harrison, Pony	NORTH WILLOW CREEK TRAILHEAD	TRAILHEAD
Ennis	PAPOOSE TRAILHEAD	TRAILHEAD
Harrison, Pony	POTOSI CAMPGROUND	CAMPGROUND
Ennis	RIVERVIEW CAMPGROUND	CAMPGROUND
Pintler Ranger District Area		
Community Name	Recreation Site Name	Type of Site
Anaconda, Philipsburg	BADGER BAY FISHING ACCESS	FISHING SITE
Anaconda, Philipsburg	CABLE MOUNTAIN CAMPGROUND	CAMPGROUND

Anaconda, Philipsburg	COMERS POINT FISHING ACCESS	FISHING SITE
Philipsburg	EAST FORK CAMPGROUND	CAMPGROUND
Philipsburg	EAST FORK SNOWMOBILE TRAILHEAD	TRAILHEAD
Philipsburg	EAST FORK TRAILHEAD	TRAILHEAD
Philipsburg	EASTFORK OVERLOOK	OBSERVATION SITE
Deerlodge	ECHO LAKE PICNIC AREA	PICNIC SITE
Anaconda, Philipsburg	EMILY SPRING	WILDLIFE VIEWING SITE
Anaconda, Philipsburg	FLINT CREEK CAMPGROUND	CAMPGROUND
Anaconda, Philipsburg	GRASSY POINT BOAT LAUNCH	BOATING SITE
Anaconda, Philipsburg	GRASSY POINT PICNIC AREA	PICNIC SITE
Anaconda, Philipsburg	LODGEPOLE CAMPGROUND	CAMPGROUND
Deerlodge	OROFINO CAMPGROUND	CAMPGROUND
Deerlodge	OROFINO PICNIC AREA	PICNIC SITE
Anaconda, Philipsburg	PEBBLE BEACH FISHING ACCESS	FISHING SITE
Anaconda, Philipsburg	PETERSON SNOWMOBILE SHELTER	SNOWPARK
Anaconda, Philipsburg	PHILIPSBURG BAY BOAT LAUNCH	BOATING SITE
Anaconda, Philipsburg	PHILIPSBURG BAY CAMPGROUND	CAMPGROUND
Anaconda, Philipsburg	PINEY BOAT LAUNCH	BOATING SITE
Anaconda, Philipsburg	PINEY CAMPGROUND	CAMPGROUND
Anaconda, Philipsburg	PINEY PICNIC AREA	PICNIC SITE
Anaconda	RACETRACK CAMPGROUND	CAMPGROUND
Anaconda, Philipsburg	RAINBOW BAY PICNIC AREA	PICNIC SITE
Anaconda, Philipsburg	RAINBOW GROUP PICNIC AREA	GROUP PICNIC SITE
Anaconda, Philipsburg	RAINBOW OVERLOOK	OBSERVATION SITE
Anaconda, Philipsburg	RED BRIDGE BOAT LAUNCH	BOATING SITE
Anaconda, Philipsburg	RED LION SNOWPARK	SNOWPARK

Anaconda, Philipsburg	SPRING HILL CAMPGROUND	CAMPGROUND
Anaconda, Philipsburg	SPRING HILL PICNIC AREA	PICNIC SITE
Drummond, Philipsburg	STEWART LAKE FISHING ACCESS	FISHING SITE
Philipsburg	STONY CAMPGROUND	CAMPGROUND
Anaconda, Philipsburg	SUNNYSIDE FISHING ACCESS	FISHING SITE

Source: [RHR Integrated Business Systems \(fs.fed.us\)](https://fs.fed.us/); [Google Maps](https://www.google.com/maps/); [Beaverhead-Deerlodge National Forest - Recreation \(usda.gov\)](https://www.beaverhead-deerlodge.com/); [Montana's Official Tourism, Travel & Vacation Info Site \(visitmt.com\)](https://www.visitmt.com/)

Winter Recreation Opportunities: During the planning period, ownership of one alpine (downhill) ski area has changed, leading to increased advertisement of alpine skiing opportunities on the BDNF. Both alpine ski areas have actively increased advertising. Likewise, Nordic (x-country) skiing and snowmobiling opportunities have increased during the planning period due to more focus on Nordic ski trail management and providing information on Nordic skiing and snowmobiling opportunities on the BDNF public-facing webpage.

Alpine Skiing: Two commercial alpine (downhill) ski areas are authorized by the BDNF to operate under a special use permit. Discovery Basin is located north of Georgetown Lake between Anaconda and Philipsburg, and Maverick Mountain is located north of Polaris, MT on the south end of the Pioneer Scenic Byway. Backcountry skiing may occur on several high-mountain slopes throughout the forest.

Nordic Skiing/ Snowshoeing: Several Nordic (x-country) ski areas are located on across the BDNF. Snowshoeing and Nordic skiing may occur anywhere on the forest where the snow is suitable. Snowshoeing is generally not allowed on Nordic ski trails, in particular the groomed portions. Snowshoeing may be allowed alongside the ski tracks on certain trails (rules may vary). Several campgrounds and rental cabins may be used in conjunction with Nordic skiing and snowshoeing. The following table lists the formally recognized Nordic ski areas on the forest.

Table 102. Nordic (x-country) ski areas located on the BDNF.

Dillon Ranger District Area	
Nearest Community	Recreation Site Name
Dillon, Jackson, Polaris	Elkhorn Hot Springs Trail
Dillon	Birch Creek Trail
Wisdom Ranger District Area	
Nearest Community	Recreation Site Name
Wisdom	Anderrick Ski Trail
Wisdom	Anderson Mountain Road Ski Trail
Wisdom	Cabinet Creek Ski Trail
Wisdom	Chief Joseph Trails
Wisdom	Gibbons Pass Road Ski Trail

Wisdom	May Creek Ridge Ski Trail
Wisdom	Shoofly Ski Trail
Butte Ranger District Area	
Nearest Community	Recreation Site Name
Butte, Whitehall	Homestake Lodge Ski Trails (authorized under special use permit)
Butte	Moulton Reservoir Ski Trails
Madison Ranger District Area	
Nearest Community	Recreation Site Name
Ennis	Wade Lake Ski Trail
Pintler Ranger District Area	
Nearest Community	Recreation Site Name
Anaconda, Philipsburg	Cable Mountain Ski Trail
Anaconda, Philipsburg	Discovery Basin/ Echo Lake Ski Trails
Anaconda, Philipsburg	Lodgepole Ridge Ski Trail

Source: [Beaverhead-Deerlodge National Forest - Winter Sports: XC Skiing/Snowshoeing \(usda.gov\)](https://www.usda.gov/land-management/land-use/land-use-planning/land-use-planning-reports/beaverhead-deerlodge-national-forest-winter-sports-xc-skiing-snowshoeing); [Montana's Official Tourism, Travel & Vacation Info Site \(visitmt.com\)](https://www.visitmt.com/).

Snowmobiling: Several snowmobiling trails and areas are located on across the BDNF. Snowmobiling may occur anywhere on the forest where legally allowed and the snow is suitable. Several campgrounds, warming huts and rental cabins are located and may be used along the trails. Snowshoeing and Nordic skiing may occur on snowmobile trails, as well as fat tire bikes, where legally allowed. The following table lists the formally recognized snowmobile trails and areas on the forest.

Table 103. Snowmobiling trails and areas located on the BDNF.

Dillon Ranger District Area	
Nearest Community	Snowmobile Trail or Area Name
Dillon, Wise River	Pioneer Mountains National Scenic Byway/ National Recreation Snowmobile Trail
Dillon	Comet Ridge Trail
Dillon, Wise River	Price Creek-Mono Creek Trail
Wisdom Ranger District Area	
Nearest Community	Recreation Site Name
Wisdom	Big Hole - Bitterroot Road Snowmobile Trail
Wisdom	Bloody Dick Snowmobile Trail
Wisdom	Gibbonsville Snowmobile Trail
Wisdom	Miner Lake Snowmobile Trail
Dillon, Wise River	Pioneer Mountains National Scenic Byway/ National Recreation Snowmobile Trail

Wisdom	Schultz-Johnson Snowmobile Trail
Wisdom	Twin Lakes - Ajax Lakes Snowmobile Trail
Wise River	Wyman Odell Lacy Creek Snowmobile Trail
Butte Ranger District Area	
Nearest Community	Recreation Site Name
Butte	Elk Park Snowmobile Trail
Basin	Rimini-Elliston-Basin Snowmobile Trail System
Madison Ranger District Area	
Nearest Community	Recreation Site Name
Butte	Antelope Basin Snowmobile Trail
Basin	Black Butte-Lobo Mesa Snowmobile Loop
Ennis, McAllister	Twin Lakes Snowmobile Trail
Virginia City	Virginia City-Clover Meadows Snowmobile Trail
Pintler Ranger District Area	
Nearest Community	Recreation Site Name
Deerlodge	Continental Divide-Leadville Snowmobile Trail
Anaconda, Philipsburg	Georgetown Lake Snowmobile Loop
Anaconda, Philipsburg	Red Lion Snowmobile Trail

Source: [Beaverhead-Deerlodge National Forest - Winter Sports: Snowmobiling \(usda.gov\)](https://www.usda.gov/land-management/land-use-and-management/winter-sports/snowmobiling); [Montana's Official Tourism, Travel & Vacation Info Site \(visitmt.com\)](https://www.visitmt.com/).

Trails: A wide array of trail opportunities are located on across the BDNF. Trails include motorized routes for autos, four-wheel-drive vehicles, ATVs, motorcycles, as well as non-motorized trails for mountain bikes, horses, and hikers to high mountain lakes and other features are located throughout the forest, too numerous to list. Non-Motorized and motorized trail opportunities on the BDNF are about evenly split. The following tables provide miles of National Forest System Trails (NFST) on the BDNF, by district and by type of trail.

Table 104. Trails located on the BDNF, by Type.

Total NFST Miles	Standard/Terra Trail		Snow Trail		Water Trail		Wilderness		Non-Wilderness	
	Miles	%	Miles	%	Miles	%	Miles	%	Miles	%
3,310.65	2,562.90	77.41%	747.75	22.58%	0	0.00%	134.70	12.13%	974.86	87.86%

Source: <http://fsweb.wo.fs.fed.us/rhwr/ibsc/tr-reports.shtml>

Table 105. Trails located on the BDNF, by District and Type of Trail.

District	NFST Miles	Wilderness Miles
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	Total Miles	Standard/Terra Miles	Snow Miles	Water Miles	Standard/Terra Miles
Dillon RD	364.89	236.35	128.54	0	0
Wisdom RD	1,009.71	811.28	198.42	0	101.75
Butte RD	545.88	391.28	154.60	0	0
Madison RD	837.35	709.04	128.31	0	119.87
Pintler RD	552.82	414.95	137.87	0	92.84
Total	3,310.65	2,562.90	747.75	0	314.46

Source: <http://fsweb.wo.fs.fed.us/rhwr/ibsc/tr-reports.shtml>

Table 106. Motorized and Non-Motorized Trails located on the BDNF, by District and Type of Trail.

District	Motorized Miles				Non-Motorized Miles			
	Total Miles	Standard/Terra Miles	Snow Miles	Water Miles	Total Miles	Standard/Terra Miles	Snow Miles	Water Miles
Dillon RD	177.73	61.32	116.41	0	187.16	175.03	12.13	0
Wisdom RD	501.52	328.10	173.42	0	508.18	483.19	24.99	0
Butte RD	343.82	199.82	144.00	0	202.06	191.46	10.60	0
Madison RD	389.79	261.48	128.31	0	447.56	447.56	0	0
Pintler RD	141.69	19.24	122.45	0	411.13	395.71	15.42	0
Total	1,554.56	869.95	684.60	0	1,756.09	1,692.95	63.15	0

Source: <http://fsweb.wo.fs.fed.us/rhwr/ibsc/tr-reports.shtml>

Visitation to the BDNF: The Forest Service estimates visitor use by conducting national visitor use monitoring (NVUM) every five years. The last completed NVUM on the BDNF occurred in 2015. Because of improved reliability in the data beginning in 2010, this analysis looks at only the 2010 and 2015 NVUM data. Unfortunately, the 2020 NVUM was disrupted by the COVID-19 pandemic and is not expected to result in monitoring that is as complete as that which was conducted in 2010 and 2015. Regardless, data that was collected in 2020 will not be available for several months from the time of this writing. For the purposes of this monitoring, 2010 and 2015 NVUM data were used.

The NVUM is nationwide, systematic monitoring process that has been developed to provide improved estimates of recreation visitation on National Forest System lands. The NVUM provides estimates of site visits and national forest visits based on an onsite sampling design of site-days and last-exiting recreationists. Data is collected in the field on a schedule site types and use level under a process designed to improve the estimates by reducing variability. The table below displays an estimate of visits to the BDNF, along with the 90-percent confidence interval.

A confidence interval is a range of values that is likely to include an unknown population value. Confidence intervals are always accompanied by a confidence level, which tells the degree of certainty that the value lies in the interval. Used together, these two terms define the reliability of the estimate, by defining the range of values that are needed to reach the given confidence level, in this case 90%. The BDNF 2015 visitation estimate is 697,000 visits, with a 90% confidence interval of +/-19%. Based on the

2015 NVUM data, our best estimate of visitation on the BDNF is 697,000 visits, and given the underlying data, we are 90% certain that the true number of visits is between 564,570 and 829,430.

Due to large confidence intervals involved with NVUM data, determining a trend using NVUM data can be challenging; however, visitation estimates show an increase on the BDNF of about 16% from 2010 to 2015. Anecdotally, substantially increased levels of recreation use was observed in FY20, related to the COVID-19 pandemic. The following table displays visitation data from the 2010 and 2015 NVUM surveys.

Table 107. Visitation on the Beaverhead-Deerlodge National Forest based on NVUM survey results.

NVUM Survey Year	Estimated Visits ^a	90% confidence level (percent)	Number of completed survey interviews
2010	583,000	±26.9	659
2015	697,000	±19.0	468

Source: <http://www.fs.fed.us/recreation/programs/nvum>

^a A visit is the entry of one person onto the National Forest to participate in recreation activities for an unspecified amount of time.

The following table displays visitor activity data from the 2015 NVUM survey, in order of highest to lowest reported participation. The table shows that visitors to the BDNF find opportunities and participate in a wide array of recreation activities on the BDNF, in a range of settings. Discussion on recreation settings on the BDNF is found under Monitoring Question 20.

Table 108. Visitor Activities on the Beaverhead-Deerlodge National Forest based on NVUM survey results.

Activity	% Participation	% Main Activity	Avg Hours Doing
Hiking / Walking	40.8	6.6	4.8
Relaxing	31.3	5.6	25.0
Viewing Natural Features	30.9	7.4	1.4
Driving for Pleasure	30.5	8.6	1.8
Viewing Wildlife	24.6	1.7	1.3
Hunting	23.0	19.0	12.9
Fishing	15.9	9.4	4.9
Developed Camping	11.9	7.2	42.2
Gathering Forest Products	11.2	4.6	3.4
Downhill Skiing	8.9	8.9	4.6
Picnicking	8.0	1.8	3.4
Motorized Trail Activity	7.4	2.3	4.6
Primitive Camping	6.8	1.5	64.9
Visiting Historic Sites	5.0	0.9	4.0
Nature Study	4.9	1.4	5.3
Other Non-motorized	4.8	1.4	1.9
Non-motorized Water	4.7	0.8	2.4
OHV Use	4.3	0.3	4.0

Some Other Activity	4.1	2.6	3.0
Motorized Water Activities	3.9	1.7	3.3
Bicycling 3.5	1.9	4.6	
Snowmobiling	3.4	3.4	5.7
Cross-country Skiing	1.6	1.3	2.7
Resort Use	0.7	0.2	24.0
Backpacking	0.6	0.2	19.2
Horseback Riding	0.6	0.6	3.0
Nature Center Activities	0.5	0.0	0.0
Other Motorized Activity	0.0	0.0	0.0
No Activity Reported	0.0	0.1	

Source: <http://www.fs.fed.us/recreation/programs/nvum>

Visitor Demographics: There was slight variation in the origin of respondents (reported home zip code) between 2010 and 2015, which is the only demographic measure reviewed for this monitoring question. The top five origin of respondents (visitors) in both the 2010 and 2015 NVUMs were Silver Bow County, Beaverhead County, Deerlodge County, Missoula County, Ravalli County and Gallatin County, all in Montana. The following table displays the top five origin of respondents in 2010 and 2015 survey years.

Table 109. Demographics: Origin of Respondents Who Visited the BDNF, based on 2010 and 2015 NVUM survey results.

Year	Origin of Respondents	Percent of Total Respondents
2015	Silver Bow County, MT	18.4%
2010	Silver Bow County, MT	23.4%
2015	Beaverhead County, MT	7.5
2010	Deer Lodge County, MT	7.3
2015	Deer Lodge County, MT	5.1
2010	Beaverhead County, MT	7.3
2015	Missoula County, MT	4.9
2010	Ravalli County, MT	4.2
2015	Ravalli County, MT	3.4
2010	Missoula County, MT	3.3
2015	Gallatin County, MT	3.2
2010	Gallatin County, MT	2.4

Source: <http://www.fs.fed.us/recreation/programs/nvum>

Visitor Satisfaction: There was a drop in respondent's satisfaction with developed facilities, access, services and feeling of safety between 2010 and 2015, which is the only satisfaction measure reviewed for this monitoring question.

Table 110. Satisfaction: Percent of Satisfied Survey Respondents Who Visited the BDNF, based on NVUM survey results.

2015 Satisfaction Element	Satisfied Survey Respondents (%)		
	Developed Sites	Undeveloped Areas	Designated Wilderness
Developed Facilities	81.5	68.4	44.7
Access	91.7	72.5	99.1
Services	88	65.2	53.1
Feeling of Safety	98.1	87.4	100.0
2010 Satisfaction Element	Satisfied Survey Respondents (%)		
	Developed Sites	Undeveloped Areas	Designated Wilderness
Developed Facilities	89.2	83.1	85.3
Access	92.3	82.3	91.7
Services	81.5	65.6	66.4
Feeling of Safety	98.5	94.5	96.1

Source: <http://www.fs.fed.us/recreation/programs/nvum>

After a review of the preceding data on recreation opportunities across the BDNF, it appears that no changes in available recreation opportunities have occurred during the planning period since approval of the Forest Plan, and that desired recreation opportunities continue to be met on the BDNF.

Discussion

The review of data above illustrates that the BDNF is providing the desired recreation opportunities. Overall visitation has grown, perhaps due to improved information or advertising, but also believed to be due to word-of-mouth through social media. Demographic data from 2015 shows that visitors continued to come from the same home locations (origins) as before. Use in recent years seems to include more visitors coming from origins further away. A slight increase in available recreation facilities, trails and areas has occurred during the planning period. Visitor satisfaction remains high across satisfaction elements, and across settings, although there may be an expectation of higher levels of service in undeveloped and Wilderness areas according to the 2015 data. High availability of services in those areas are incongruent with the setting.

Findings

Table 111. Summary of findings for Plan Monitoring Item 19

MONITORING ITEM	YEAR UPDATED	PLAN IMPLEMENTATION STATUS ¹	RECOMMENDATION	MANAGEMENT
		Do monitoring results demonstrate intended progress (i.e. maintaining, trending, or advancing) of the associated plan components listed with this monitoring item?	Based on the evaluation of monitoring results, may changes be warranted?	If a change may be warranted, where may the change be needed? ²
MON – 19: Recreation Is the BDNF providing desired recreation opportunities?	2021	(E) Yes – as results show recreation opportunities are well provided and visitor satisfaction remains high	No	N/A

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¹ **PLAN IMPLEMENTATION STATUS:** (A) Uncertain - Interval of data collection beyond this reporting cycle (indicate date of next time this monitoring item will be evaluated); (B) Uncertain - More time/data are needed to understand status or progress of the Plan Component(s); (C) Uncertain - Methods inadequate to assess the status or progress toward achieving plan component(s). (D) NO - Implementation of Plan Component(s) ARE NOT trending, progressing, and/or conducted as desired; (E) YES - Implementation of Plan Component(s) ARE trending, progressing, and/or conducted as desired

² **[36 CFR 219.12(d)(2)]** - The monitoring evaluation report must indicate whether or not a change to the (1) plan, (2) management activities, (3) the monitoring program, or a (4) new assessment, may be warranted based on the new information. The monitoring evaluation report must be used to inform adaptive management of the plan area

Monitoring Item 20 – Recreation

Monitoring Item Summary

Table 112. Summary of Monitoring item 20.

Monitoring Question	Plan Component(s)	Indicators*	Data collection interval	Data Source / Partner	Point of Contact
Are management actions resulting in the desired recreation settings?	Goal: Recreation Settings: Offer a choice of recreation settings ranging from remote backcountry to more developed front country areas. Recreation allocations use Recreation Opportunity Spectrum (ROS) concepts and definitions (allocations are described on (pg. 29).	Change in acres in each recreation allocation (N).	2 years	Forest Plan; FEIS	Noelle Meier, Forest Recreation, Wilderness, Trails and Recreation Special Uses Program Manager
* Indicator influenced by climate change? Y = Yes; N = No; U = Uncertain					

Table 113. Monitoring Item 20 - Monitoring Collection Summary.

For monitoring item 20:	Year
Data was last collected or compiled in:	2020
Next scheduled data collection/compilation:	2023
Last BMER evaluation for this monitoring item:	n/a
Next scheduled BMER evaluation of this monitoring item:	2023

Management actions that change recreation settings (settings that provide quiet, non-motorized settings, remote and challenging motorized settings, and more developed settings offering amenities for user

comfort and opportunities to socialize) can affect whether the BDNF is providing desired recreation settings.

Methods

A change to recreation allocations would require a Forest Plan amendment. Data was reviewed to assess whether the recreation settings allocated by the Forest Plan in 2009 continue to be provided or have changed during the planning period (15 years). Monitoring is completed by determining whether a Forest Plan amendment has been issued that would modify the recreation settings allocated by the Forest Plan.

Results

Recreation Settings on the BDNF: The forest plan states a forest-wide desired condition that “*Visitors benefit from a range of primitive to developed recreation settings and opportunities. Most of the BDNF continues to offer uncrowded motorized and non-motorized backcountry opportunities*”. This desired condition applies to Monitoring Question 20.

The Beaverhead-Deerlodge National Forest provides a range of outdoor recreation opportunities in a variety of settings. Recreation settings on the BDNF are delineated and characterized in the Forest Plan as *recreation allocations*. The Forest Service uses a system called Recreation Opportunity Spectrum (ROS) to match recreation activities to a range of settings illustrated along a continuum, or spectrum, with five different classes: Primitive, Semi-Primitive Non-Motorized, Semi-Primitive Motorized, Roaded Natural, Rural, and Urban. No urban recreation setting exists on the BDNF.

The Recreation Opportunity Spectrum (ROS) is defined by perceivable modifications to the natural environment, such as presence of roads and trails or the existence of buildings, facilities, and conveniences. Settings may vary from no modification to the natural environment to highly modified environments. Settings may also be influenced by social factors such as remoteness, size of the space, evidence of human activity, social encounters, and managerial presence. A description of ROS classes on the BDNF can be found in the Forest Plan on pg. 298 and in the FEIS on pg. 344. Activities that are consistent and available in each ROS class are displayed in the FEIS on pg. 345.

The Forest Plan uses ROS to develop a range of settings and opportunities on the BDNF in the form of summer and winter/ motorized and non-motorized *recreation allocations*. ROS concepts and definitions were used to describe recreation settings ranging from remote backcountry to more developed front country areas. The summer and winter recreation allocations for the BDNF can be found on pg. 297 of the Forest Plan and in the FEIS on pg. 345. The recreation allocations are shown in maps displayed on pgs. 54-55 of the Forest Plan, and in greater detail by landscapes and management areas beginning on pg. 63. Activities that are consistent and available in each recreation allocation are displayed in the Forest Plan on pg. 30. The following table shows the recreation allocations on the BDNF.

Table 114. Summer and Winter Recreation Allocations on the BDNF, Forest Plan 2009.

Summer Recreation Allocation	Wilderness	Recommended Wilderness	WSA		Summer Non-Motorized	Backcountry	Road Based
			Motorized	Non-Motorized			
BDNF Acres	219,128	330,983	374	211,315	802,499	631,809	1,162,488
Winter Recreation Allocation	Wilderness	Recommended Wilderness	WSA		Winter Non-Motorized	Winter Motorized	
			Motorized	Non-Motorized			
BDNF Acres	219,128	330,983	173,854	37,484	752,981	1,844,345	

Source: [Final Environmental Impact Statement \(usda.gov\)](#).

After a review of the preceding data on recreation opportunities across the BDNF, it appears that no changes to recreation settings have occurred during the planning period since approval of the Forest Plan.

Discussion

A review of Forest Plan allocations data has determined that no Forest Plan amendment has been issued to modify the recreation settings allocated by the Forest Plan during the planning period. Therefore, no change has occurred to the recreation settings that were allocated by the BDNF Forest Plan in 2009.

Findings

Table 115. Summary of findings for all Plan Monitoring Item 20.

MONITORING ITEM	YEAR UPDATED	PLAN IMPLEMENTATION STATUS ¹ Do monitoring results demonstrate intended progress (i.e. maintaining, trending, or advancing) of the associated plan components listed with this monitoring item?	RECOMMENDATION Based on the evaluation of monitoring results, may changes be warranted?	MANAGEMENT If a change may be warranted, where may the change be needed? ²
MON – 20: Recreation Are management actions resulting in the desired recreation settings?	2021	(E) Yes – Implementation of this plan component is trending as desired because the ROS class has remained unchanged.	No	N/A

¹ **PLAN IMPLEMENTATION STATUS:** (A) Uncertain - Interval of data collection beyond this reporting cycle (indicate date of next time this monitoring item will be evaluated); (B) Uncertain - More time/data are needed to understand status or progress of the Plan Component(s); (C) Uncertain - Methods inadequate to assess the status or progress toward achieving plan component(s). (D) NO - Implementation of Plan Component(s) ARE NOT trending, progressing, and/or conducted as desired; (E) YES - Implementation of Plan Component(s) ARE trending, progressing, and/or conducted as desired

² **[36 CFR 219.12(d)(2)]** - The monitoring evaluation report must indicate whether or not a change to the (1) plan, (2) management activities, (3) the monitoring program, or a (4) new assessment, may be warranted based on the new information. The monitoring evaluation report must be used to inform adaptive management of the plan area

Monitoring Item 22 – Heritage

Monitoring Item Summary

Table 116. Summary of Monitoring Item 22.

Monitoring Question	Plan Component(s)	Indicators*	Data collection interval	Data Source / Partner	Point of Contact
Are cultural resources being protected as the forest plan is implemented?	Standard 1: Heritage resources determined eligible for listing in the	Number of projects that protect cultural resources (N).	Project by Project, pre-implementation surveys	BDNF Heritage	BDNF Heritage

	<p>National Register of Historic Places will be preserved in place, or a consensus determination of “no adverse effect” will be reached with the Montana SHPO, the Advisory Council on Historic Preservation, and appropriate Indian tribes.</p> <p>Standard 2: Unplanned discoveries of heritage resources during project implementation shall cause project operations in the area of discovery to cease until analysis and evaluation of the heritage resources are completed, including consultation with the Montana SHPO and appropriate Indian tribes.</p> <p>Standard 3: Heritage protection measures will be added to all appropriate contracts, sales documents, and special use permits.</p>				
* Indicator influenced by climate change? Y = Yes; N = No; U = Uncertain					

Table 117. Monitoring Item 22 - Monitoring Collection Summary.

For monitoring item 22:	Year
Data was last collected or compiled in:	2021
Next scheduled data collection/compilation:	2023
Last BMER evaluation for this monitoring item:	n/a
Next scheduled BMER evaluation of this monitoring item:	2023

Forest Plan Monitoring Item 22 exists to try and capture the implementation of the BDNF FP with the regulatory framework laid out in Table 118. The monitoring question can then be answered in a yes/no fashion, as any project posing a threat to cultural resources must be redesigned to avoid threatened sites or mitigations negotiated with Montana State Historical Preservation Office (MT-SHPO) and the American Council on Historic Preservation (ACHP) prior to a decision document being signed and a project being implemented.

Table 118. BDNF Heritage Program Standard Project Indicators and Measures.

Project Analysis Question Indicator/Measures - Heritage					
Regulatory Framework	Analysis Questions	Resource Indicators	Measures Used to Form Basic Conclusions	Methods used for Measures	Ultimate Conclusions Based on Basic Conclusions
Antiquities Act of 1906(AA1906)	Quantitative				
National Historic Preservation Act of 1966 (NHPA)	Are Cultural Resources present in the project area?	Presence of Cultural Resources eligible for listing under NHPA	Presence/Absence	Archival and field research	Yes/No
National Environmental Protection Act of 1970 Sec. 101 (b) 4 (NEPA)	Qualitative				
	Will the proposed alternative adversely affect NHPA eligible sites*?	Overall Site Condition	Measured difference among alternatives.	Comparison of ground level impacts to NHPA eligible sites	Yes, No, Maybe
Archaeological Resource Protection Act of 1979 (ARPA), Forest Plan (FP)	Qualitative				
	Will the proposed alternative adversely affect NHPA eligible Traditional Cultural Properties (TCP)*?	Overall TCP/Landscape Condition	Measured difference among alternatives.	Comparison of ground level impacts to NHPA eligible TCPs/Landscapes	Yes, No, Maybe

*All sites/TCPs not yet specifically evaluated by the Montana State Historic Preservation Office (SHPO) must be managed as eligible for listing under the NHPA

Methods

As projects are brought forward, the first step for the BDNF Heritage program is to conduct program to program Tribal THPO consultation and pre-field archival research. Archival review includes, among other

assets: the heritage program files, historic GLO plats, historic maps, as well as the program's geospatial database showing the locations of known sites and areas of past archaeological survey.

Following the initial stage of research, the project areas are modeled in a GIS program and overlaid with confidential data layers reflecting the probability of historic site location. These probability layers allow us to determine how much of the project area requires further ground study in order to implement the BDNF Heritage Site Identification Strategy (SIS). SIS is a tiered survey methodology focusing precious field time on the areas mathematically most likely to contain previously unknown cultural resources. Pedestrian survey is generally conducted using terrain driven 20-30 meter parallel transects covering areas of highest probability as identified by the SIS modeling within the Area of Potential Effect (APE) for all project areas. The APE is generally the areas just outside the project boundary but include areas that may receive some ground disturbance such as temporary roads, landings, waste piles etc. further from the project boundary. Projects less than 40 acres are generally intensively surveyed unless there are environmental safety hazards or topographic features such as cliffs or very steep ground which is considered very low probability.

Following completion of field work an inventory report with recommended findings of effect to heritage resources is submitted to the MT-SHPO for their review and possible concurrence. If the proposed undertaking has no effect to historic properties, a heritage clearance letter is sent with a copy of the concurrence letter from MT-SHPO to the project proponent for entry into the project file and the public record. The consultation report and site-specific information, however, are kept confidential to protect cultural resources and not subject to FOIA under exemption 3 specifically falling under 16 U.S.C. § 470hh.

If it is determined the undertaking will have an adverse effect to historic properties, a legally binding Memorandum of Agreement (MOA) with mitigations is negotiated between the BDNF, MT-SHPO and ACHP. This document must be signed by all parties prior to implementation.

Results

Cultural resources are being protected as the forest plan is being implemented as required by the regulatory framework. There have been no projects with adverse effects to heritage resources that were not mitigated prior to the implementation of the project.

Discussion

Forest Plan Monitoring Item 22 tries to capture the implementation of the BDNF FP with the regulatory framework laid out previously in Table 118. The monitoring question can then be answered in a yes/no fashion, as any project posing a threat to cultural resources, by statute and regulation, must be redesigned to avoid threatened sites or mitigations negotiated with Montana State Historical Preservation Office (MT-SHPO) and the American Council on Historic Preservation (ACHP) prior to a decision document being signed and a project implemented. Our regulatory framework dictates that we protect or provide mitigations for cultural resources, alleviating the need for post Implementation Monitoring.

Findings

Table 119. Summary of Findings for Plan Monitoring Item 22.

MONITORING ITEM	YEAR UPDATED	PLAN IMPLEMENTATION STATUS ¹ Do monitoring results demonstrate intended progress (i.e. maintaining, trending, or advancing) of the associated	RECOMMENDATION Based on the evaluation of monitoring results, may changes be warranted?	MANAGEMENT If a change may be warranted, where may the change be needed? ²
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		plan components listed with this monitoring item?		
MON – 22: Heritage Are cultural resources being protected as the forest plan is implemented?	2021	(E) Yes – all projects are being evaluated/surveyed and consulted on with State Historic Preservation Office (SHPO) prior to implementation to ensure damage to cultural resources does not occur.	No	N/A

¹ **PLAN IMPLEMENTATION STATUS:** (A) Uncertain - Interval of data collection beyond this reporting cycle (indicate date of next time this monitoring item will be evaluated); (B) Uncertain - More time/data are needed to understand status or progress of the Plan Component(s); (C) Uncertain - Methods inadequate to assess the status or progress toward achieving plan component(s). (D) NO - Implementation of Plan Component(s) ARE NOT trending, progressing, and/or conducted as desired; (E) YES - Implementation of Plan Component(s) ARE trending, progressing, and/or conducted as desired

² **[36 CFR 219.12(d)(2)]** - The monitoring evaluation report must indicate whether or not a change to the (1) plan, (2) management activities, (3) the monitoring program, or a (4) new assessment, may be warranted based on the new information. The monitoring evaluation report must be used to inform adaptive management of the plan area

Monitoring Item 23 – Economics

Monitoring Item Summary

Table 120. Summary of Monitoring Item 23.

Monitoring Question	Plan Component(s)	Indicators*	Data collection interval	Data Source / Partner	Point of Contact
What multiple use services have been provided?	Goal (Economy Contribution) Contribute to the social and economic well-being of local communities by promoting sustainable use of renewable natural resources. Provide timber for commercial harvest, forage for livestock grazing, exploration and development opportunities for mineral resources, and recreation settings consistent with other resource goals (Forest Plan, p. 21).	1) Goods and Services (quantities, cost of producing them compared to plan predictions) (Y). 2) Revenue sharing with state and local governments (dollars) (N). 3) Contribution of employment and labor income to the 8-county impact area attributed to goods and services provided by the forest (dollars) (U).	Annual	Regional Office	Michael Gatlin, Inventory and Monitoring Coordinator

		Federal Payments (dollars) (N).			
* Indicator influenced by climate change? Y = Yes; N = No; U = Uncertain					

Table 121. Monitoring Item 23 - Monitoring Collection Summary.

For monitoring item 1:	Year
Data was last collected or compiled in:	2021
Next scheduled data collection/compilation:	2023
Last MER evaluation for this monitoring item:	n/a
Next scheduled MER evaluation of this monitoring item:	2023

The economic monitoring item outlines the important economic impact that the Beaverhead-Deerlodge National Forest and associated activities have on the surrounding communities. The Beaverhead-Deerlodge National Forest supports rural economies through goods and services, revenue sharing with state and local governments, and employment opportunities (direct and indirect). This monitoring item details the goods and services, revenue sharing, and contributions from employment and labor income.

Methods

The Nation's forests and grasslands are a fundamental part of the American landscape and are a legacy that the Forest Service holds in trust for present and future generations. Forests provide clean air and water, forest and rangeland products, mineral and energy resources, jobs, quality habitat for fish and wildlife, recreational opportunities, and memorable experiences. The Forest Service mission includes serving the American people who live in and around national forests and helping these communities thrive economically.

National Forests and Grasslands contribute to economic activity nation-wide by providing recreational opportunities as well as commodities such as timber, energy and minerals, and grazing. Payments to states and counties from programs such as Secure Rural Schools Act (SRS), Payment in Lieu of Taxes (PILT), 25% Fund, and minerals and energy royalty payments to states and counties, also support: schools, road maintenance, stewardship management projects and county government operations. Forest Service investments in infrastructure, ecosystem and watershed restoration, forest health, and workforce salaries further support jobs that generate income and spur economic activity across local economic sectors. The Forest Service plays a particularly valuable role in rural economies where the economic base may be limited. For these reasons (in addition to legislative / agency mandates), it is useful to quantify the economic contributions of national forests to the American public.

Ecosystem Management Coordination (EMC) provides "At-A-Glance" reports for economic contributions on 122 national forest and grassland units in the National Forest System (NFS) as well as the nine Forest Service Regions. These reports detail the contributions these resources make to local economies. Project and planning-specific benefits may be different. For example, management may propose an allowable level of use and thus economic activity would be an "impact" different than the existing economic contribution associated with existing use at the time of the report generation. Economic "contributions" is used to describe the role Forest Service natural resource management plays in the local market economy as measured by jobs and income.

For a brief description of the methods used to conduct this economic contribution and impact analysis, including the concept of Input-Output modeling and the protocol for analysis area delineation please see

Estimating Economic Contributions and Impacts from National Forests and Grasslands: An Overview of Methods and Data (Anderes et al. 2019).

Data for this report were collected and tabulated by the Region 1 economists and then provided to the Beaverhead-Deerlodge National Forest. The most complete and recent economic data available for this report are from 2019. It is not unusual for lag time to exist for reporting purposes. Furthermore, to provide context and trend information we used detailed economic data from 2016 which can be reviewed here: https://www.fs.usda.gov/Internet/FSE_DOCUMENTS/fseprd725768.pdf. Some methods may have been updated between 2016 and 2019 data analyses but the effect to trends between years is likely insignificant.

Results

Table 122. Changes to Forest Service Resource Outputs by Program for the Beaverhead-Deerlodge National Forest between 2016 and 2019.

Activity	Units of Measure	Output in 2016	Output in 2019	Change
Wildlife and Fish - Locals	Visits	137,206	137,206	0
	Expenditures (Thousands of \$)	\$3,510	\$8,065	\$4,555
Non-residents	Visits	73,880	73,880	0
	Expenditures (Thousands of \$)	\$9,996	\$15,701	\$5,705
Downhill ski/snowboarding - Locals	Visits	35,561	35,561	0
	Expenditures (Thousands of \$)	\$1,392	\$2,719	\$1,327
Non-residents	Visits	26,827	26,827	0
	Expenditures (Thousands of \$)	\$2,599	\$7,685	\$5,086
All Other Rec Activities - Locals	Visits	302,834	302,834	0
	Expenditures (Thousands of \$)	\$5,204	\$15,226	\$10,022
Non-residents	Visits	123,693	123,693	0
	Expenditures (Thousands of \$)	\$7,578	\$18,533	\$10,955
Cattle, Horses, Sheep, Goats	AUMs	197,912	184,117	-13,795
Sawtimber	CCF	2,930	13,254	10,324
Fuelwood	CCF	17,132	21,945	4,813
Pulp, Poles, All Other	CCF	21	0	-21
Energy (coal, oil, gas, geothermal)	(Thousands of \$)	\$0	\$0	\$0
Minerals	\$	\$0	\$104	\$104

Activity	Units of Measure	Output in 2016	Output in 2019	Change
25% fund, Secure Rural Schools, Royalties	(Thousands of \$)	\$2,564	\$2,338	-\$226
Payments in Lieu of [property] Taxes	(Thousands of \$)	\$2,884	\$3,177	\$293

Table 123. Jobs by Economic Sector Supported by the Forest Service and Associated Labor Income between 2016 and 2019.

Major Economic Sector	2016		2019	
	FS Supported Jobs (Avg. annual)	FS Supported Labor Income (in \$1,000)	FS Supported Jobs (Avg. annual)	FS Supported Labor Income (in \$1,000)
Total	1,510	\$55,072	1,104	\$44,532
Accommodation & Food Servs	230	\$5,422	100	\$2,318
Admin, Waste Mgt & Rem Servs	30	\$1,127	26	\$986
Agriculture	360	\$8,338	263	\$6,181
Arts, Entertainment, and Rec	50	\$802	34	\$664
Construction	20	\$777	15	\$816
Private Educational Services	20	\$495	12	\$302
Finance & Insurance	30	\$1,526	19	\$1,012
Health Care & Social Assistance	60	\$3,321	40	\$2,409
Information	10	\$502	7	\$404
Local, State, & National Gov't	300	\$17,490	199	\$11,515
Manufacturing	20	\$1,175	83	\$4,773
Mining	0	\$191	1	\$68
Mgt of Companies	0	\$183	4	\$167
Other Services	50	\$1,762	36	\$1,470
Prof, Scientific, & Tech Services	60	\$2,377	57	\$2,426
Real Estate & Rental & Leasing	50	\$888	41	\$1,006
Retail Trade	130	\$3,897	101	\$3,710
Transportation & Warehousing	40	\$2,113	31	\$1,954
Utilities	0	\$433	2	\$254
Wholesale Trade	40	\$2,253	33	\$2,097

Table 124. Total Jobs Supported and Associated Labor Income by Forest Service Resource Area Between 2016 and 2019.

Total Jobs	Total Labor Income (in \$1,000)
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Program	Forest Plan Estimate (Alt 6)	Year 2016	Year 2019	Forest Plan Estimate (Alt 6)	Year 2016	Year 2019
Recreation ¹	600	400	207	\$14,061	\$11,135	\$6,869
Minerals and Energy	0	0	0	\$0	\$0	\$24
Forest Products/Timber	318	110	209	\$8,085	\$4,816	\$10,612
Grazing	93	470	294	\$1,135	\$13,575	\$7,776
FS Expenditures	520	410	322	\$14,962	\$19,856	\$15,670
Payments to States/Counties	21	120	72	\$609	\$5,692	\$3,614

¹Data for recreation and wildlife and fish from the Forest Plan were combined for to create a total estimate for recreation.

Discussion

Data were compiled from previously published reports and information provided to the Forest from the Regional Office. When making comparisons across years we did not account for any changes to dollar value based on inflation or depreciation. Because of this, the comparisons may contain some level of error; however, we feel as though they provide enough clarity to evaluate how the Beaverhead-Deerlodge National Forest Plan is implemented. It is important to note that visitation numbers between years appear to be identical in some cases (see Table 120). This is likely due to the data collection interval for visitor use being every 5-years, which would explain why no change occurred between 2016 and 2019. However, the value associated with those visits changed considerably during the same time (Table 120), which would suggest that expenditure data were updated more recently than visitation.

The Beaverhead-Deerlodge National Forest continues to support numerous jobs across a variety of industries, and visitation associated expenditures valued in the hundreds of millions of dollars (Table 120 and Table 121). Approximately 400 fewer jobs were reported in 2019 than 2016 which would account for the loss in total labor income between reporting years (Table 121). While most industries reported fewer jobs in 2019 Agriculture, Government, and Accommodations & Food Services made up 80% of the total job reductions between 2016 and 2019.

To determine how well the Beaverhead-Deerlodge is moving towards the economic goals outlined in the Forest Plan we used estimated outputs from the Forest Plan Final EIS (p. 212) and compared them to 2016 and 2019 economic contribution estimates (Table 122). The Forest is outperforming job estimates in “Grazing and Payments” to Counties and States; however, falling short in other categories.

As we continue to collect and compile data regarding economic contributions to the surrounding communities it will be important to ensure that collection intervals are in sync with each other so that the data can be interpreted appropriately.

Findings

Table 125. Summary of Findings for Plan Monitoring Item 23.

MONITORING ITEM	YEAR UPDATED	PLAN IMPLEMENTATION STATUS ¹	RECOMMENDATION	MANAGEMENT If a change may be warranted, where may
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		Do monitoring results demonstrate intended progress (i.e. maintaining, trending, or advancing) of the associated plan components listed with this monitoring item?	Based on the evaluation of monitoring results, may changes be warranted?	the change be needed? ²
MON – 23: Economics What multiple use services have been provided?	2021	(E) Yes – The forest continues to support numerous jobs across a variety of industries.	No	N/A

¹ **PLAN IMPLEMENTATION STATUS:** (A) Uncertain - Interval of data collection beyond this reporting cycle (indicate date of next time this monitoring item will be evaluated); (B) Uncertain - More time/data are needed to understand status or progress of the Plan Component(s); (C) Uncertain - Methods inadequate to assess the status or progress toward achieving plan component(s). (D) NO - Implementation of Plan Component(s) ARE NOT trending, progressing, and/or conducted as desired; (E) YES - Implementation of Plan Component(s) ARE trending, progressing, and/or conducted as desired

² **[36 CFR 219.12(d)(2)]** - The monitoring evaluation report must indicate whether or not a change to the (1) plan, (2) management activities, (3) the monitoring program, or a (4) new assessment, may be warranted based on the new information. The monitoring evaluation report must be used to inform adaptive management of the plan area

Monitoring Item 24 – Timber

Monitoring Item Summary

Table 126. Summary for Monitoring Item 24.

Monitoring Question	Plan Component(s)	Indicators*	Data collection interval	Data Source / Partner	Point of Contact
What are the changes of suitable timber lands?	GOAL (Lands Suitable for Timber Production) Manage lands suitable for timber production for the growth and yield of saw timber, crop trees, pulpwood, and other forest products, including salvage harvest (Forest Plan, p. 38).	Suitable timber lands (total acres, acres taken out of, and acres put into) (Y).	2 years	Forest Plan; NEPA Decisions	Johanna Nosal-acting Forest Silviculturist
* Indicator influenced by climate change? Y = Yes; N = No; U = Uncertain					

Table 127. Monitoring Item 24 - Monitoring Collection Summary.

For monitoring item 24:	Year
Data was last collected or compiled in:	2021
Next scheduled data collection/compilation:	2023

Last BMER evaluation for this monitoring item:	n/a
Next scheduled BMER evaluation of this monitoring item:	2023

Changes in the suitable base affect management strategies on a project level and may change the quantity of wood for sale.

Methods

Current timber suitability was assessed from the *2009 Beaverhead-Deerlodge Forest Plan* (p.3). In addition, NEPA Decisions and silviculture prescriptions were analyzed to determine if any additions or subtractions to the suitable base occurred.

Results

Page 3 of the *Beaverhead-Deerlodge Forest Plan* shows that 299,000 acres are suitable for timber production. Timber harvest is allowed on another 1,614,000 acres to achieve other resource objectives.

After a review of NEPA documents and silviculture prescriptions, no changes in the suitable base have occurred since the signing of the Forest Plan.

Discussion

Major changes in timber suitability generally occur during Forest Plan Revision. Timber suitability is not often changed on a project basis. No changes in the timber suitable base have occurred on the Beaverhead-Deerlodge since the signing of the current Forest Plan.

Findings

Table 128. Summary of findings for Plan Monitoring Item 24.

MONITORING ITEM	YEAR UPDATED	PLAN IMPLEMENTATION STATUS ¹ Do monitoring results demonstrate intended progress (i.e. maintaining, trending, or advancing) of the associated plan components listed with this monitoring item?	RECOMMENDATION Based on the evaluation of monitoring results, may changes be warranted?	MANAGEMENT If a change may be warranted, where may the change be needed? ²
MON – 24: Timber What are the changes of suitable timber lands?	2021	(E) Yes – As no changes to the suitable base have occurred.	Yes	Monitoring Program: Recommend removing this monitoring question. Changes in the suitable base do not often occur at the project level. Changes to the number of suitable acres would only occur if the Forest Plan is revised or amended.

¹ **PLAN IMPLEMENTATION STATUS:** (A) Uncertain - Interval of data collection beyond this reporting cycle (indicate date of next time this monitoring item will be evaluated); (B) Uncertain - More time/data are needed to understand status or progress of the

Plan Component(s); (C) Uncertain - Methods inadequate to assess the status or progress toward achieving plan component(s). (D) NO - Implementation of Plan Component(s) ARE NOT trending, progressing, and/or conducted as desired; (E) YES - Implementation of Plan Component(s) ARE trending, progressing, and/or conducted as desired

² [36 CFR 219.12(d)(2)] - The monitoring evaluation report must indicate whether or not a change to the (1) plan, (2) management activities, (3) the monitoring program, or a (4) new assessment, may be warranted based on the new information. The monitoring evaluation report must be used to inform adaptive management of the plan area

Monitoring Item 25 – Recreation

Monitoring Item Summary

Table 129. Summary for Monitoring Item 25.

Monitoring Question	Plan Component(s)	Indicators*	Data collection interval	Data Source / Partner	Point of Contact
Are we maintaining and reconstructing campgrounds and developed sites on schedule (30% [reconstruction] over the planning period)?	Goal: Infrastructure/Facilities: Administrative and/or recreation facilities are constructed, managed, and maintained to meet land and resource objectives and address recreation demand (pg. 23). Objective: Recreation Facilities: Monitor and use and reconstruct sites as needed, construct additional recreation facilities to meet demand, and convert existing sites to dispersed to dispersed use areas if warranted. Reconstruct 30% of existing developed sites (pg. 24).	Number of campgrounds and other developed recreation sites reconstructed (N). Number of campgrounds and developed sites maintained to standard (N).	2 years	Forest Plan. Review of capital improvement of campgrounds and other developed recreation sites. Natural Resource Management (INFRA/NRM) for developed recreation sites maintained to standard.	Noelle Meier, Forest Recreation, Wilderness, Trails and Recreation Special Uses Program Manager
* Indicator influenced by climate change? Y = Yes; N = No; U = Uncertain					

Table 130. Monitoring Item 25 - Monitoring Collection Summary.

For monitoring item 25:	Year
Data was last collected or compiled in:	2021
Next scheduled data collection/compilation:	2023
Last BMER evaluation for this monitoring item:	n/a

Next scheduled BMER evaluation of this monitoring item:	2023
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This monitoring item will help the Forest determine if we are maintaining and reconstructing campgrounds and developed sites on schedule (30% [reconstruction] over the planning period) to ensure the BDNF is providing desired recreation settings.

Methods

Data was reviewed to assess whether the BDNF is maintaining and reconstructing campgrounds and developed sites on schedule. Monitoring is completed by reviewing data on developed recreation site maintenance, and recreation site reconstruction/construction, on the BDNF. Recreation facilities are inspected for condition on a five-year rotation, with approximately 20% of recreation sites inspected each year. Data on condition is entered into the National Resources Management (NRM) database. Developed site maintenance, for the purposes of this report, was assessed by reviewing a spreadsheet called Recreation Site Facility Condition Index, which can be filtered and sorted, and made available via the NRM database. The spreadsheet is used to view the “Recreation Sites Maintained to Standard” performance measure.

The NRM maintains core Forest Service data used for: analysis, creating reports and products in day-to-day business, upward reporting for performance accountability, and year-end reporting, strategic planning, congressional inquiries, and providing data to partners and stakeholders. Reports used as references for this monitoring report are internal and were compiled from data stored in the NRM.

Data on recreation site reconstruction/construction include a review of internal design and contract files, and communication with design and contracting staff, to identify projects that occurred during the planning period.

Results

Developed Site Reconstruction: The forest plan states a forest-wide desired condition that “*Visitors benefit from a range of primitive to developed recreation settings and opportunities. Most of the BDNF continues to offer uncrowded motorized and non-motorized backcountry opportunities*”. This desired condition applies to the reconstruction (and maintenance) portion of Monitoring Question 25. Numbers and types of developed site maintenance are displayed in Table 132.

Flint Creek Campground was scheduled for rehabilitation and reconstruction in FY13 under special Capital Improvement Program (CIP) funding, and the Boulder River Recreation Area was scheduled for reconstruction in FY14. CIP funding was used in the preceding years for NEPA and survey and design of these projects. The recreation portion of the CIP program was discontinued in Region 1 before these projects could be completed. Flint Creek campground received extensive refurbishment in FY20, utilizing district personnel and forest road crew.

Following FY13, the BDNF continued to put \$25,000 of recreation facilities maintenance allocations toward smaller construction and reconstruction projects in an effort to keep up with developed recreation needs while the recreation portion of the CIP program was on hiatus. Over the period of FY12, FY13, and FY14 forest allocations in recreation facilities funding, and collected fees retained under the Federal Lands and Recreation Enhancement Act (FLREA), were applied toward the following items: rental cabin repairs, installation of bear-proof trash receptacles and food-storage boxes, the replacement of deteriorating site furnishings, sign replacement, and the removal of public hazards. One such public hazard removed was the Maney Lake fishing dock (Butte District, FY13), a large platform that had detached from its foundation and was slipping into the lake. In FY14, recreation facilities funding was

used to fund contracts to replace the Moose Lake dock (Pintler District); and, to install a new accessible concrete toilet at the Seymour trailhead (Wise River District).

In 2009-2012 recreation facilities funding was used, in addition to fee collections, to reconstruct several sites. This work rehabilitated of several rental cabins including reconstruction of Thompson Park (Butte District, in cooperation with Butte Silver Bow County, FY11), the replacement of a water system at Lodgepole Campground (Pintler District, FY10-FY12), and the design and reconstruction of Grasshopper Campground (Dillon District, FY10-FY11).

Recreation facilities funding continued to cover large purchases of replacement picnic tables and components, fire rings, bulletin boards, fencing, gravel, signs and cabin repairs. In recent years, the \$25,000 in recreation facilities funding was directed toward other priorities in recreation, administrative facilities, and funding of staff. Beginning in FY21, the Great American Outdoors Act will provide additional funding to address the backlog of deferred maintenance in BDNF recreation facilities. Information on the Great American Outdoors Act can be found at: [Great American Outdoors Act | US Forest Service \(usda.gov\)](https://www.usda.gov/great-american-outdoors-act).

Collected fees were used to replace firewood storage sheds at the Canyon Creek and Horse Prairie rental cabins (Dillon District) and to fund major repairs to the roofs of the Hogan and May Creek rental cabins (Wisdom District). FDDS also provided for maintenance needs at rental cabins and developed recreation sites. Collected fees covered the forest-wide purchase and installation of several bear-proof food storage lockers and trash receptacles, Bear-Aware signs, bird-proof toilet vent screens, picnic table and plank replacements, replacement fencing, a hydrant replacement at the Reservoir Lake Campground (Dillon District), and the purchase of supplies and materials.

Continental Divide National Scenic Trail (CDNST) funding provided for the design, fabrication and installation of information/ interpretive sign kiosks at several CDNST trailheads, as well as improvements at the Seymour trailhead in 2016 (Wisdom District) and relocation/ construction of the Pipestone Pass trailhead (Butte District) in 2019. Heritage funding provided for a new wayside exhibit and interpretive signage at Skinner Meadows on the Nez Perce NHT (Nee-Me-Poo Trail).

Collections from recreation fee sites are used to reconstruct, or make improvements, at the site. Reporting on the use of collected fees under Federal Lands and Recreation Enhancement Act-FLREA can be found at: [Region 1 - Recreation \(usda.gov\)](https://www.usda.gov/region-1-recreation). Information on the Forest Service's Comprehensive Capital Improvement Program can be found at: [final_report_sent_to_hill_ccip.pdf \(usda.gov\)](https://www.usda.gov/forest-service/comprehensive-capital-improvement-program).

Developed Recreation Site Maintenance: The desired condition discussed above applies to this portion of Monitoring Question 25, as well.

Table 131. Recreation Site Development Scale

Development Scale	Typical Site & Facility Characteristics	Typical Management Emphasis
0	User-created dispersed use No FS investment or amenities	May include monitoring of resource conditions
1	Primarily user-created dispersed use area Informal vehicle circulation and parking Minimal FS investment, may include signage	Resource protection
2	Defined vehicle circulation and parking with minimal FS investment to accommodate user-created dispersed use area	Resource protection

	Limited amenities may include signage, tables, fire rings. In rare instances may include vault toilet	
3	Designed developed site with significant FS investment and delineation Amenities may include signage, fire rings, tables, toilet, waste collection, potable water Roads are surfaced; maintenance level 3 or 4	Visitor comfort & Resource protection
4	Designed developed site with significant FS investment and delineation Amenities include signage, interpretive materials, fire rings, grills, tables, waste collection, potable water, flush toilets Roads, parking, and paths are surfaced and may be paved; maintenance level 4 or 5	Visitor comfort, Resource protection
5	Designed developed site with significant FS investment and delineation Amenities typically include signage, interpretive displays, fire rings, grills, tables, waste collection, potable water, flush toilets. May include utility hook-ups, showers, and laundry facilities. Roads, parking, and pathways are clearly delineated and are often paved; maintenance level 4 or 5.	Visitor comfort, Resource protection

Table 132. Site Maintenance by Development Scale

Development Scale Sites Maintenance	Number of Sites	Number Maintained to Standard	Number Not Maintained to Standard	Percent Maintained to Standard
All Developed Recreation Sites	182	140	42	76%
Development Scale 3 and Higher Sites	139	107	32	77%
Development Scale 2 Sites	24	14	10	58%
Development Scale 1 Sites	19	1	0	100%

Discussion

Developed Site Reconstruction: The BDNF is not keeping up with a schedule of 30% of the 182 developed recreation sites reconstructed during the 15-year planning period. Counting Grasshopper Campground, Pipestone Pass Trailhead and five developed sites in the Thompson Park complex, seven (7) developed sites have been fully reconstructed on the BDNF during the planning period (15 years). Lodgepole CG and Flint Creek CG on the Pintler RD each received partial rehabilitation/ reconstruction projects, as did several rental cabins. The rest of the work described above included repair/ replacement or new installment of site furnishings, including picnic tables, fire rings, bulletin-board kiosks, and a limited number of boat docks and SST concrete toilets. Seven fully reconstructed sites are only 3.8% of the 182

developed recreation sites across the BDNF. Partial refurbishment and replacement of furnishings/amenities do boost that number, but not nearly to the 30% reconstructed under the forest plan.

Under Region 1 Capital Improvement Program (CIP) funding, the BDNF historically reconstructed recreation facilities, or components, on an annual basis. CIP provided funding for planning and survey/design, as well as construction, so projects remained in a sustained rotation that accommodated each phase of a project. That process changed in FY13, when construction and maintenance funding dramatically declined on a national level and Region 1 redirected all recreation facilities capital improvement funding toward priority administrative facilities in the region. Since FY13, no recreational CIP funding was available to Region 1 units for recreation facilities, except for Comprehensive Capital Improvement Plan (CCIP) funding. The BDNF has received no capital improvement funding for recreation facilities since FY13.

Few developed recreation sites have been improved on the BDNF since the 1990s apart from some trailheads, Wolverine and Norton, interpretive sites/kiosks, and many toilet replacements across the forest. The Pioneer Scenic Byway sites were reconstructed in the 1990s, along with improvement work completed at recreation sites surrounding Georgetown Lake. Most of the forest's developed recreation facilities were well beyond their 30-year life expectancy when the Forest Plan was approved in 2009 and have not yet been reconstructed during the planning period.

Because developed recreation sites range widely in development scale and monetary value, not all warrant the same level of work to bring a site up to a reconstructed standard. For example, many recreation sites can be brought to this standard by installing an accessible toilet or replacing deteriorated furnishings yet may not meet modern needs or eliminate all the deferred maintenance that a site may have. Other sites require full reconstruction to meet current standards, serve modern users and to eliminate deferred maintenance for the site. Priorities for the BDNF have included addressing a large, deferred maintenance backlog (especially for historic cabins) and bringing sites to meeting current accessibility standards. As explained above, declining budgets have greatly affected the BDNF's ability to address these needs in an ongoing manner.

While certain features and furnishings of a developed site may last 50 years (paving, concrete toilets and table components, and fire rings), a 30-year life expectancy is appropriate for reconstruction of developed recreation facilities per FSH 7313.3 ([18456.doc \(sharepoint.com\)](#)). A thirty-year reconstruction schedule for aging sites could therefore be considered "on schedule", depending on the condition of individual sites and the dates they were last reconstructed.

At a rate of 30% over the planning period (15-years), 55 of the 182 developed recreation sites (with a development scale of 1-5 and having constructed features) would need to be reconstructed. Seven developed recreation sites have been fully reconstructed during the planning period. It appears that it will not be possible to reconstruct 30% of the 182 developed recreation sites on the BDNF by FY24 (the 15-year planning period).

Developed Recreation Site Maintenance: After a review of the data on developed recreation site maintenance on the BDNF, it appears that the BDNF is maintaining sites to standard and on schedule at a high rate, 76% of developed recreation sites, especially those Development Scale sites of 3 or higher.

Findings

Table 133. Summary of findings for all Plan Monitoring Items.

MONITORING ITEM	YEAR UPDATED	PLAN IMPLEMENTATION STATUS ¹	RECOMMENDATION	MANAGEMENT
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		Do monitoring results demonstrate intended progress (i.e. maintaining, trending, or advancing) of the associated plan components listed with this monitoring item?	Based on the evaluation of monitoring results, may changes be warranted?	If a change may be warranted, where may the change be needed? ²
MON – 25: Recreation Are we maintaining and reconstructing campgrounds and developed sites on schedule (30% [reconstruction] over the planning period)?	2021	(D) No – based on the low % of reconstructed developed recreation sites.	Yes	Management Activities: Evaluate the need to reconstruct 30% of the developed recreation sites over the planning period.

¹ **PLAN IMPLEMENTATION STATUS:** (A) Uncertain - Interval of data collection beyond this reporting cycle (indicate date of next time this monitoring item will be evaluated); (B) Uncertain - More time/data are needed to understand status or progress of the Plan Component(s); (C) Uncertain - Methods inadequate to assess the status or progress toward achieving plan component(s). (D) NO - Implementation of Plan Component(s) ARE NOT trending, progressing, and/or conducted as desired; (E) YES - Implementation of Plan Component(s) ARE trending, progressing, and/or conducted as desired

² **[36 CFR 219.12(d)(2)]** - The monitoring evaluation report must indicate whether or not a change to the (1) plan, (2) management activities, (3) the monitoring program, or a (4) new assessment, may be warranted based on the new information. The monitoring evaluation report must be used to inform adaptive management of the plan area

Monitoring Item 26 – Timber

Monitoring Item Summary

Table 134. Summary of Monitoring Item 26.

Monitoring Question	Plan Component(s)	Indicators*	Data collection interval	Data Source / Partner	Point of Contact
What is the status of stocking of lands and harvest unit size limits?	TIMBER MANAGEMENT, STANDARD 2: On lands suitable for timber production, the maximum size of openings created by one regeneration harvest operation should not exceed 40 acres. Exceptions can be made where a natural event, such as fire, insect, disease, or wind throw created an undesirable opening. A regeneration harvest larger than 40 acres may be allowed after public notice, and review and approval by the officer one level above the responsible official. This only applies to	Stocking of lands (trees/acre, over percent of area treated, by tree species) on greater than 40-acre regeneration harvest units (Y).	2 years	FACTS, R1 Reforestation Timeframe Report	Johanna Nosal-acting Forest Silviculturist

	<p>harvest on suitable timber lands for timber production activities.</p> <p>STANDARD 5: When trees are cut to achieve timber production objectives the cuttings shall be made in such a way as to assure that the technology and knowledge exists to adequately restock the lands (Forest Plan, p. 39).</p> <p>STANDARD 6: The following Timber Harvest Classification Protocol establishes where timber harvest is not allowed and where timber harvest is permitted to meet other resource objectives (see p. 39 of the Forest Plan for the protocol).</p>				
* Indicator influenced by climate change? Y = Yes; N = No; U = Uncertain					

Table 135. Monitoring Item 26 - Monitoring Collection Summary.

For monitoring item 26:	Year
Data was last collected or compiled in:	2021
Next scheduled data collection/compilation:	2023
Last BMER evaluation for this monitoring item:	n/a
Next scheduled BMER evaluation of this monitoring item:	2023

The National Forest Management Act of 1976 (NFMA) is a ruleset for regeneration harvests on National Forest lands. This monitoring question is in place to ensure that forest management practices are following the requirements set forth in the NFMA.

Methods

Harvest unit size information was generated by the Forest Service Activity Tracking System (FACTS). FACTS is an activity tracking application for all levels of the Forest Service. FACTS is the current database of record for the Forest Service to track certain activities. The application allows tracking of activities related to fire/fuels, silviculture, and invasive species as well as monitor NEPA decisions and create and manage K-V trust fund plans at the timber sale level. The application tracks on-the-ground activities from NEPA to accomplishment tabularly and spatially. All regeneration harvests that have occurred since the authorization of the Forest Plan were compiled and their acreages reviewed.

Information on species, trees per acre, and percent of area treated is not data that can currently be synthesized and is not available for this iteration of BMER. When stocking surveys (surveys of naturally regenerated or planted seedlings to ensure site stocking) are conducted, information of species and trees per acre are entered into FACTS, however, there are currently no reports or queries that can display this data for all regeneration harvests of interest.

A surrogate for this is to look at the R1 Reforestation Timeframe Report. This report displays the time from harvest until satisfactory stocking and certification based on data reported in the FACTS database. The report provides the basis for assuring restocking when planning regeneration harvest, as required by NFMA (which requires restocking within five years of harvest). The detailed report displays the activity units which met the criteria for each restocking category allowing silviculturists to determine trends or causes of successful or delayed regeneration. The report is run through the R1 Depot User Interface.

Regeneration harvests that occurred after the signing of the Forest Plan were reviewed. Typically, minimum stocking standards (the minimum number of trees per acre and percentage of the area stocked) used on the Beaverhead-Deerlodge is 150 trees per acre and at least 75% of stockable area stocked (i.e., rocky areas, roads, etc. don't count towards the area). Stands that have been certified as stocked post-harvest have at least 150 trees per acre over 75% of the stockable area. Tree species is not usually a limiting criterion on the Beaverhead-Deerlodge, and any tree species will count towards stocking requirements.

Results

Since the signing of the Forest Plan, there have been 35 regeneration harvests greater than 40 acres in size. These range from 43-286 acres. All of these regeneration harvests were a result of wildfires or mountain pine beetle mortality. Because of this, Regional Forester approval was not required in order to implement these larger openings, as per FP Timber Management Standard 2 and the National Forest Management Act was adhered to.

As mentioned in the Methods section, information on species, trees per acre, and percent of area treated is not data that can currently be synthesized and is not available for this iteration of BMER. Using the R1 Reforestation Timeframe Report, we can assume that all units that are certified as restocked have a minimum of 150 trees per acre over 75% of the stockable area. All tree species count towards this minimum stocking standard.

The National Forest Management Act dictates that regeneration harvest should occur only where “*there is assurance that such lands can be adequately restocked within five years after harvest*” Information from the Reforestation Timeframe Report is summarized with this timeframe (Table 136).

Table 136. Results from the R1 Reforestation Timeframe Report showing the stocking status of harvested lands. It is assumed that areas that are certified as restocked have a minimum of 150 trees per acre over 75% of the stockable area.

	Acres
Total Regeneration Harvest (2010-2020)	4584
Acres Restocked within 5 years	2871
Acres Restocked >5 years	431
Acres Not Stocked Post-Harvest	200
Acres Currently Progressing Towards Stocking	1082

Discussion

Harvest unit size complies with the National Forest Management Act. As mentioned, the 35 regeneration harvests that are greater than 40 acres did not require Regional Forester approval as those were a result of “*natural catastrophic conditions such as fire, insect and disease attack, or windstorm*”.

Data regarding species, trees per acre, and percent of area treated cannot currently be synthesized and is not available for this iteration of BMER. The National Forest Management Act does not dictate minimum stocking standards (trees per acre, tree species, percent of area stocked); rather these are prescribed on a stand-by-stand basis by a certified silviculturist. NFMA does dictate that regeneration harvests are only allowed where “*there is assurance that such lands can be adequately restocked within five years after harvest*”. We recommend revising the indicator to include only the timeframes in which units are restocked and removing the details on tree species and density.

Table 136 shows that 72% of regeneration units have been restocked, 63% of which occurred within five years. Reasoning behind delays in restocking are likely stands where natural regeneration did not occur as expected and planting needed to occur. Since it takes time to grow tree seedlings to plant, and ensure the plantation’s survival, these areas can stretch out past five years. There are currently 1,082 acres, or 24% of regen harvest acres, that are within 5 years of harvest and are currently progressing towards stocking.

Two hundred acres, or 4% of regenerated acres, are beyond five years of harvest and have not been certified as restocked. This is likely a planning oversight; these units are scheduled to have stocking surveys conducted in 2021 to ensure that stocking was successful. If surveys find these areas to be below minimum stocking standards, these areas will be scheduled for planting of seedlings.

Findings

Table 137. Summary of findings for Plan Monitoring Item 26.

MONITORING ITEM	YEAR UPDATED	PLAN IMPLEMENTATION STATUS ¹ Do monitoring results demonstrate intended progress (i.e. maintaining, trending, or advancing) of the associated plan components listed with this monitoring item?	RECOMMENDATION Based on the evaluation of monitoring results, may changes be warranted?	MANAGEMENT If a change may be warranted, where may the change be needed? ²
MON – 26: Timber What is the status of stocking of lands and harvest unit size limits?	2021	(E) YES – as only 4% of harvested acres have not been certified as restocked within five years and all harvests over 40 acres did not require Regional Forester approval because they were the result of natural catastrophic conditions such as fire, insect and disease attack, or windstorm	Yes	Monitoring Program: Remove the indicator “ <i>Stocking of lands (trees/acre, over percent of area treated, by tree species)</i> ” for reasons stated in the discussion above and replace with metrics from Table 136.

¹ **PLAN IMPLEMENTATION STATUS:** (A) Uncertain - Interval of data collection beyond this reporting cycle (indicate date of next time this monitoring item will be evaluated); (B) Uncertain - More time/data are needed to understand status or progress of the Plan Component(s); (C) Uncertain - Methods inadequate to assess the status or progress toward achieving plan component(s). (D) NO - Implementation of Plan Component(s) ARE NOT trending, progressing, and/or conducted as desired; (E) YES - Implementation of Plan Component(s) ARE trending, progressing, and/or conducted as desired

² **[36 CFR 219.12(d)(2)]** - The monitoring evaluation report must indicate whether or not a change to the (1) plan, (2) management activities, (3) the monitoring program, or a (4) new assessment, may be warranted based on the new information. The monitoring evaluation report must be used to inform adaptive management of the plan area

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