Biennial Monitoring Evaluation Report
for the Bitterroot National Forest

Forest Service Bitterroot National Forest February 2022

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The biennial monitoring evaluation report is not a decision document.

The data and recommendations in this report are available to the responsible official for consideration for future actions.

Summary of Findings and Results

The Bitterroot National Forest has 26 monitoring questions in the forest plan monitoring program (updated in August 2016). All items except for the visuals monitoring item were evaluated for this monitoring evaluation report.

Table 1: Summary of findings for Forest 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 [2] *If a change may be warranted, where may the change be needed?*[2]
MON-WLF-01 What is the quantity of old growth?	Collected up to 2015, compiled in 2021	Yes - The general trend based on FIA data suggests that the amount and distribution of old growth is adequate to maintain habitat to support viable wildlife populations and maintain vegetative diversity, which reflects the plan intent. However, it is difficult to directly compare to the old growth standards due to the issues with management area scale and the scale at which FIA data is collected.	No	None
MON-WLF-02 Is habitat for elk providing the ecological needs to ensure elk populations remain in desired ranges?	2021	Yes - The number of elk observed now exceeds FWP elk population objectives across the entire Bitterroot drainage and in most hunting districts.	No	None
MON-WLF-03 Is habitat for pine marten providing for ecological needs to ensure these populations remain in desired ranges?	Data last collected in 2020, compiled in 2021	Yes – marten distribution and detections have trended upwards	Yes - Improved survey methodologies have become available.	Change in indicator
MON-WLF-04 Is habitat for pileated woodpecker providing for ecological needs to ensure these populations remain in desired ranges?	2018	Yes – pileated woodpecker detections have remained relatively stable.	No	None
MON-AQT-01	2020	Yes – Most of the stream habitat metrics are either improving or being maintained. The	The status/trend of stream temperatures on the	The current rate of eliminating aquatic passage barriers is slow (1 or 2 projects

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What is the status and trend of stream habitat?		exception is stream temperature which continues to warm in all types and sizes of streams across the Forest. The factor driving this warming is the warming climate. he status/trend of the PIBO stream habitat metrics suggests that most of the metrics have improved or are being maintained. Statistically significant desired changes have occurred in five metrics: (1) habitat index score, (2) bank stability, (3) large woody debris, (4) percent surface fines < 6 mm, and (5) residual pool depth. Non-significant changes have occurred in four metrics (macroinvertebrates, percent undercut bank, d50 median particle size, and percent pools), and only one metric (bank angle) has shown a statistically significant undesired change. An overriding Forest Plan goal is to maintain or restore riparian and aquatic habitat. Overall, the PIBO data indicates progression towards that goal. The Forest Plan did not specifically mention aquatic passage barriers; however, eliminating man-made barriers to aquatic organism passage is consistent with the Forest Plan's goals to restore and enhance habitat for native and desired non-native aquatic species.	Bitterroot National Forest is not progressing as desired because temperatures continue to increase. The rising temperatures are being driven by the climate, not by forest management practices. As a result, there is little the Forest can do other than maintain existing levels of shade and increase/maintain year-round access to cold water refugia habitats. The Forest Plan does not specifically mention stream temperatures, but the maintenance of cold water suitable for native trout species is implied in the direction to maintain or enhance suitable habitat for native and desired aquatic species.	per year). At its current rate, it will take more than 50 years to eliminate all the remaining aquatic passage barriers on the Forest. Funding is the limiting factor. To speed up the rate of eliminating passage barriers, the Forest should either divert more funds into AOP projects or do a better job of obtaining partner dollars from outside sources. Another option is to be more aggressive in removing culvert barriers (a relatively inexpensive technique), instead of spending large sums of money to replace culverts. The Forest is essentially powerless to reverse stream temperature warming caused by climate change. However, it can mitigate the harmful effects of rising stream temperatures by ensuring that its watersheds are in as healthy a condition as possible. To do so, Forest projects should emphasize eliminating all aquatic passage barriers, reducing road sediment sources, retaining all existing shade in riparian areas, and reducing the negative effects of non-native trout species.

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		The elimination of aquatic passage barriers is progressing, but slowly. Since 2000, 99 aquatic passage barriers (culverts) have been eliminated. However, there are still 71 culvert replacements or removals that have NEPA completed but have not been implemented. Funding shortages are the primary reason why progress has been slow. The eventual goal is to eliminate all the man-made fish passage barriers on the Forest.		
MON-AQT-02 What is the status and trend of native aquatic species?	2020	No, though results indicate that habitat for westslope cutthroat trout are being provided; data also suggest that bull trout, steelhead, chinook salmon, and Pacific lamprey habitat are not moving towards goals and objectives due to influences from increased stream temperatures, non-native trout, and downstream impacts of fish hatcheries. Additionally, there is uncertainty if habitat is being provided for amphibians and western pearlshell mussels due to lack of robust data.	Yes	Monitoring plan: broaden sampling scheme applied across the entire Forest for eDNA sampling would provide increased data set needed to evaluate mussels and amphibians. Management Activities: To the degree possible, recommend the Forest work with FWP to maintain instream flows and reduce the number and distribution of non-native trout species, particularly brown trout. These would be the most beneficial types of actions to improve the viability of native trout populations on the Montana portion of the Forest. An example of the type of project that could be more broadly applied is the Upper Overwhich Fish Removal project, which was conducted in 2017-19. In that project, Forest and FWP fisheries staff removed Yellowstone cutthroat trout from the upper portion of the Overwhich Creek

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				watershed using the piscicide rotenone. It was the first chemical removal project completed in the Bitterroot River drainage Management Activities: For the anadromous species (steelhead, chinook salmon, and Pacific lamprey), there is not much the Forest can do to help these species other than reduce man-made sediment inputs to the Selway River and its tributaries. The decline of the anadromous fish species is largely due to major downstream issues (dams and hatcheries) associated with the Columbia River hydropower system. If the fish are able to make it to the Bitterroot NF, their habitat is nearly all wilderness and is generally in reference condition.
MON-AQT-03 What is the condition of riparian areas following management activities?	2020	Yes. The monitoring results described in the "Results and Discussion" section suggest that in most instances, management activities are maintaining the status of riparian areas and are complying with Forest Plan/INFISH standards and guidelines.	No	None
MON-VEG-01 Are silvicultural prescriptions being implemented as planned?	2020	Uncertain	Yes	Recommend change monitoring question to align with Forest Plan goals and objectives
MON-VEG-02	2020	Yes	Yes	Recommend change monitoring question to align with Forest Plan goals and objectives

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Are forest stands moving towards desired future conditions?				
MON-VEG-03 What is the status and change of vegetation disturbance?	2015	Yes.	No	None
MON-INV-01 What is the change in terrestrial invasive plant species area?	2018	Yes – The national database of record (TESP-IS) does not require percent cover as a means to show a reduction with treated acres; therefore, it is not the method used to track changes in area. See Table I1-1 for an explanation of infested acres and total area.	Yes	Monitoring Plan: Recommend adding indicators tracking effectiveness of treatments. A standardized control code from the National TESP-IS Protocol will be used to approximate the most accurate control level. This information is submitted with the Annual Accomplishment Reporting; however, efficacy ratings are only for that fiscal year.
MON-WTR-01 Is management improving or maintaining watershed conditions that support desired riparian and stream characteristics?	2018-2019	Yes	Yes	Recommend change monitoring question and indicator to align with R1 Broader Scale Monitoring Strategy questions and indicators. Also, prioritize erosion control improvements along the OHV Loop 1 trail in the Lower Rye Creek and Upper Sleeping Child watersheds.
MON-SOILS-01 Are management activities impairing soil productivity?	2019	Yes. Implementation of Plan Component(s) are trending, progressing, and/or conducted as desired. Based on this previous monitoring and historical averages, vegetation management operations on the Bitterroot NF continue to meet the R1 SQS and FP standard for soil productivity over the last 10 years.	No	None

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		At this time, the consistent compliance shown by the past 8 years of monitoring supports that current project design and implementation adheres to the Bitterroot Forest Plan soil standards.		
MON-REC-01 What actions have been taken to change ground conditions to attain ROS objectives? What actions have impacted ROS objectives?	2018	Yes, based on 1) expansion of rec opportunities, 2) changes to ground not impacting ROS objectives, 3) increase in use in facility all facility types 4) recreation rentals with high occupancy rates.	Yes	Monitoring Program: Modify indicators to only use those evaluated for this report and drop the remaining currently listed Management Activities: Though progress is being made, some improvements are recommended. 1) improving infrastructure and providing increased customer service to the visiting public which alleviate the associated impacts caused by a higher visitation and recreation demand, 2) implementation of the Lake Como Master Plan, 3) continue to closely monitor undeveloped areas for potential increase that may trigger a need for management actions to attain SPNM and SPM ROS class objectives.
MON-REC-02 Are management activities effective in reducing resources concerns related to off-road vehicle use, other trail use or recreation site use?	2018	Uncertain due to need to have more time to assess "the effectiveness of education and enforcement, the need for additional education and enforcement efforts, and a way to monitor the issues and identify areas where resource damage may be occurring.	Yes	Indicators need to be modified.
MON-RDLS-01	2018	Yes - Based on no new roads or change in roadless base.	Yes	Monitoring Plan:

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What is the change in the roadless base? What activities have occurred in roadless areas to change their roadless character?				Modify indicators to those identified in the methods section and remove the remainder.
MON-RNG-01 Are livestock managed for the carrying capacity of the land?	2017	Yes. Active allotments are managed to standards set up in the Environmental Assessments and Allotment Management Plans with changes made to meet long term goals.	No	None
MON-RDS-01 Do roads meet construction standards and BMPs?	2019	Yes	No	None
MON-MIN-01 What effect are: forest management activities having on mineral activities / mineral activities having on forest management resources?	2018	Yes	No	None
MON-ECON-01 Are projects marketable and being purchased when offered?	2020	Yes	No	None
MON-VIS-01 Is visual quality being met after project implementation?		Uncertain	Yes	This item was not completed for this monitoring report due to vacancy in landscape architect position, recommendation is to fill the position and complete monitoring during next cycle.
MON-FIRE-01	2020	Yes	No	None

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What is the number of fires managed in approved areas?				
MON-FIRE-02 Are fuel reduction treatments effective at reducing the potential of uncharacteristically intense fire and increasing capabilities to protect life and property when a wildfire occurs within an area with previous fuel treatments?	2020	Yes	Yes	MON-FIRE-02 and MON-FIRE-03 are very similar monitoring questions and should be collapsed into one question. An additional monitoring question is needed to address the amount of ecological restoration and/or the protection of values (homes, timber, bridges, infrastructure, etc.) accomplished with prescribed fire. The indicator for this monitoring question will be acres of prescribed fire applied.
MON-FIRE-03 Are fuels treatments effective when a wildfire occurs in the area?	2020	Yes.	Yes	See MON-FIRE-02
MON-SOC-01 How do Bitterroot National Forest activities affect adjacent land owners and communities?	2020	Yes	No	None
MON-PROC-01 During project analysis and public outreach, emerging issues and social values are highlighted and addressed in project design, mitigation.	2020	Yes	Yes	This item should be dropped from future monitoring reports. For all projects required by law, the Bitterroot adequately scopes with the public and our partners and incorporates the feedback we receive into our project designs and mitigations. Public comments are posted to our

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** [2] *If a change may be warranted, where may the change be needed?*[2]
				webpage and decision documents describe how this input is incorporated.

[1] **PLAN INTENT: (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 answer monitoring question.(**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.

1. Introduction

1.1 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 Bitterroot National Forest Plan Monitoring Program was updated in August 2016 for consistency with the 2012 planning regulations [36 CFR 219.12 (c)(1)]. The Bitterroot National Forest Land Management Plan was administratively changed to include the updated plan monitoring program. A copy of the current monitoring program is available at this web link.

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)

Implementation monitoring is important for tracking progress and accomplishments. However, effectiveness and validation monitoring drive and support the adaptive management process. Effectiveness monitoring evaluates condition and trend 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 really accurate)?

1.2 Purpose of the Monitoring Evaluation Report

This report provides data and recommendations related to the three monitoring goals to help the responsible official determine a course of action. This report considers monitoring data in relation to forest plan components to evaluate potential need for changes in forest plan components, management activities, the monitoring program, and the forest assessment.

The biennial monitoring evaluation report is not a decision document; rather, it analyzes data from monitoring of management actions carried out in the plan area. This report's analysis evaluates this data in relation to monitoring questions and indicators in the plan monitoring program, which link the data to the forest plan. In the monitoring program, monitoring questions and key indicators track select resources to inform progress toward goals, objectives, desired conditions, and other components in the forest plan. The monitoring program does not include questions and indicators to track every plan component in the forest plan [36 CFR 219.12(a)(2)].

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 the forest plan monitoring program was updated in 2016.

1.3 Objectives

To achieve the goals and purposes outlined above, this monitoring evaluation report includes the following objectives (FSH 1909.12, chapter 30, section 34):

- Document implementation of the forest plan monitoring program, including changed conditions or status of key characteristics used to assess accomplishments and progress toward achievement of the selected forest plan components.
- Evaluate relevant assumptions, changed conditions, management effectiveness, and progress toward 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 they have 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.

2. Monitoring Evaluation and Adaptive Findings

The following sections present the most current information for all monitoring questions in the forest plan monitoring program. Each monitoring item includes 1) a summary of the monitoring question, its indicators, and the plan components the monitoring question is assessing; 2) monitoring findings, including methods, results, and discussion; and 3) evaluation of the results to determine an adaptive management finding on whether recommended management changes are warranted.

2.1 MON-WLF-01 – Old growth habitat

2.1.1 Monitoring item summary

- *Monitoring question: What is the quantity of old growth?*

Table 2.1-1 lists forest and grassland plan goals and objectives, monitoring indicators, data sources and partners, the frequency of data collection and reporting, and any quantitative targets or thresholds related to this monitoring item. Table 2.1-2 lists the most recent and next dates for data collection and reporting for this monitoring item.

Table 2.1- 1: Forest plan components, monitoring indicators, data collection intervals, and data sources for MON-WLF-01.

Plan components	Indicators	Data collection interval	Data source/partner
Goals: Seek out opportunities for biologically appropriate management; maintain habitat to support viable populations. (page II-3) **Objectives:** Maintain habitat to support viable populations; maintain vegetative diversity. (page II-5) **Standards:** Amount and distribution of old growth used to ensure sufficient habitat for viable populations of species including pine marten and pileated woodpecker; stand condition in old growth will vary by habitat type and landform; all snags that are not a safety risk will be retained; old growth characteristics will be retained. (pages II-19, II-20)	Acres of old growth that meet Region 1, Old Growth Definition *(Green et al 2004 as amended)*	5 years	USDA Forest Service Forest Inventory and Analysis

Table 2.1- 2: Monitoring collection and reporting dates for MON-WLF-01.

Milestone	Year
Data last collected or compiled in:	Collected up to 2015, compiled in 2021
Next scheduled data collection and compilation:	Collected up to 2020, compiled in 2023
Last monitoring evaluation report covering this monitoring item:	n/a
Next scheduled monitoring evaluation report covering this monitoring item:	2023

2.1.2 Methods

To conduct analysis of forest attributes over large areas, it is infeasible to maintain an inventory of all vegetation on every acre, for the millions of acres of land within the Region. Forest Inventory and Analysis (FIA) data provides a statistically sound representative sample designed to provide unbiased estimates of forest conditions at broad- and mid-levels. A statistical sample provides the means to observe a randomly selected subset of the entire population and make inferences about the entire population. Since variability exists across a landscape, statistical sampling provides metrics to determine how accurately the estimates apply to the entire population. The variability of the attribute of interest, number of plots analyzed, and the size of the plots affect the reliability of the estimate.

This inventory design is appropriate for making estimates of a variety of attributes across large landscapes such as National Forests, geographic area or landscapes, and ecological section. The FIA sampling frame uniformly covers all lands, regardless of management emphasis. Therefore, wilderness areas, roadless areas, and actively managed lands all have the same probability of being sampled. More detail on the statistical foundation of using FIA data on National Forests is found in: Application of Forest Inventory and Analysis (FIA) Data to Estimate the Amount of Old Growth Forest and Snag Density in the Northern Region of the National Forest System.

An "FIA Analysis Dataset" is a set of FIA plots available for analysis using R1 analysis tools such as the R1 FIA Summary Database Estimator Form. An Analysis Dataset contains the most recent available measurement of each plot across the Region. A new analysis dataset is created each time a new set of FIA inventory data are brought into FSVeg and made available to the Region. The Hybrid FIA 2015 Analysis Dataset is the most complete set of FIA data currently available for the Northern Region.

2.1.3 Results

Table 2.1- 3: Region 1, W MT NFs and Bitterroot NF Estimated Old Growth Acres from 2021 Summary of FIA Data

Area or Broad Potential Vegetation Type (PVT)	Estimated OG Acres and (%)	90% CI Lower Bound	90% CI Upper Bound	Total # of Subplots Meeting Old Growth Criteria	Total # of PSUs Sampled	Total # of Subplots Sampled w/ Forested PVT
Region 1	2,691,682 (11.69%)	2,506,221 (11.06%)	2,813,521 (12.42%)	1,755	3,808	14,776
W MT NFs	730,432 (8.73%)	644,758 (7.83%)	799,793 (9.71%)	478	1,380	5,388
Bitterroot NF (all)	154,522 (9.90%)	117,336 (7.65%)	188,809 (12.31%)	100	255	993
Alpine	0			0	0	0
Cold	36,913 (10.53%)	20,006 (5.83%)	53,842 (15.70%)	24	57	223
Cool Moist	68,742 (13.72%)	44,990 (9.12%)	92,190 (18.68%)0	45	82	323
Mesic Grassland	0			0	0	0
Mesic Shrub	0			0	0	0
Riparian Wetland	0			0	0	0
Sparse	0			0	7	25
Warm Dry	39,895 (6.62%)	23,096 (3.76%)	59842 (9.75%)	26	102	400
Warm Moist	7,917 (25.00%)	0	15,043 (50.00%)	5	5	19
Xeric Grassland	0			0	0	0
Xeric Shrub Woodland	0			0	0	0

2.1.4 Discussion

This is the first monitoring and evaluation report that displays FIA estimates of old growth across the Bitterroot National Forest and within broad potential vegetation types (PVTs). As such, there is no

status change from the last report. FIA data is expected to continue to provide statistically valid estimates of old growth acres at broad to mid scales into the future.

FIA data cannot be used to estimate old growth percentages on the smaller scale of the intersection of management area and third order drainage specified in Forest Plan Management Area (MA) standards for old growth without an exponential increase in the number of plots installed**. However, the FIA estimates of old growth at broader scales appear to show that in general, old growth is within the Forest Plan standards of 3-8% old growth specified in the old growth standards for those MAs that include such standards**. **Existing old growth and mature forest habitats appear to be supplying adequate habitat diversity to support populations of marten and pileated woodpecker, as shown by relatively stable trends in detection rates for those species (see MON WLF-03 and 04).**

The amount of old growth across the Forest and within broad PVT groups is likely to change over time. Stochastic events such as wildfires and insect and disease outbreaks have the potential to reduce the amount of old growth by killing large numbers of old trees. The Forest likely lost tens of thousands of acres of old growth during the fires of 2000, and more to other fires and beetle outbreaks since then. Conversely, there are many stands that contain enough trees large enough to meet old growth criteria that are within 10 or 20 years of attaining the required age to be classified as old growth. These stands may add to the Forest's old growth percentages in the near future.

The Forest has generally avoided timber management activities in known old growth stands for many years. In some cases, this may have increased the risk of losing the large, old trees due to fire, insects or competition for water and nutrients from younger trees that increased the stand densities far beyond historic ranges. Some current Forest projects would reduce the vulnerability of old growth to these risk factors by thinning and/or burning the understory while retaining the large trees and other old growth components that result in designation as old growth.

2.1.5 Evaluation of Results for Adaptive Management Finding

Old growth monitoring is based on the Regional old growth definitions contained in Green et al. (1992, errata 2011), which is the best available scientific information on old growth characteristics for forest types found in the Northern Region. Consider amending the Forest Plan to specify using Green et al. (1992, errata 2011) definitions rather than the old growth definitions contained in the current Plan, which are not quantifiable using FIA and are not based on the best available scientific information for the Plan area. In 2016, the Bitterroot updated the monitoring program to transition to the requirements of the 2012 planning rule and at that time adopted the Green et al. (1992, errata 2011) definition of old growth as the monitoring indicator and changed the frequency of data collection to 5 years.

FIA data shows that the amount of old growth present across the Forest and in several broad vegetation types is providing vegetative diversity which is contributing to maintenance of habitat to support viable populations. MON WLF-03 and 04 support this by indicating that trends for marten and pileated woodpecker detections are relatively stable.

Table 2.1- 4: Summary of findings for MON-WLF-01

PLAN IMPLEMENTATION STATUS [1]	CHANGE WARRANTED?	WHERE IS CHANGE WARRANTED?
(E) Yes. The general trend based on FIA data suggests that the amount and distribution of old growth is adequate to maintain habitat to support viable wildlife populations and maintain vegetative diversity, based on stability of pileated woodpecker and marten detections. However, it is difficult to directly compare to the old growth standards due to the issue with the amount of old growth prescribed by management area and third order drainage scale and the scale at which FIA collects data.	No.	None.

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

2.2 MON-WLF-02 – Elk habitat

2.2.1 Monitoring item summary

- *Monitoring question: Is habitat for elk providing the ecological needs to ensure elk populations remain in desired ranges?*

This monitoring item tracks elk (*Cervus canadensis*) population status as an indicator of commonly hunted ungulate species and the status of their habitat (Forest Plan, page II-20). Elk trend count data collected by Montana Fish, Wildlife, and Parks biologists is an indirect measure of elk habitat quality, elk habitat effectiveness, and Montana Fish, Wildlife, and Parks hunting regulations as they affect elk populations on the Bitterroot National Forest. Table 2.2-1 lists forest and grassland plan goals and objectives, monitoring indicators, data sources and partners, the frequency of data collection and reporting, and any quantitative targets or thresholds related to this monitoring item. Table 2.2-2 lists the most recent and next dates for data collection and reporting for this monitoring item.

Table 2.2- 1: Forest plan components, monitoring indicators, data collection intervals, and data sources for MON-WLF-02.

Plan components	Indicators	Data collection interval	Data source/partner
Goals: Provide habitat to support viable populations. (page II-3) **Objectives:** Provide optimal habitat on elk winter range; maintain habitat to support viable populations; cooperate with the States of Idaho and Montana to maintain the current level of big game hunting and trout fishing opportunities. (page II-5) **Standards:** Manage roads to attain or maintain 50% elk habitat effectiveness in currently roaded 3rd order drainages; maintain 60% or higher elk habitat effectiveness in drainages where less than 25% of roads have been built. (page II-21)	**Elk numbers/hunting district** – Review of FWP elk trend count data and comparison to population objectives in the Montana Elk Management Plan (FWP 2004)	2 years	Montana Fish, Wildlife, and Parks elk trend count data USDA Forest Service project analysis results

Table 2.2- 2: Monitoring collection and reporting dates for MON-WLF-02.

Milestone	Year
Data last collected or compiled in:	2020
Next scheduled data collection and compilation:	2021
Last monitoring evaluation report covering this monitoring item:	N/A
Next scheduled monitoring evaluation report covering this monitoring item:	2023

2.2.2 Methods

Elk trend count data is collected by Montana Department of Fish, Wildlife and Parks biologists in the spring, when elk are still on winter ranges. Counts are done from a fixed-wing aircraft early in the morning or in the evening when elk tend to be out in open areas and are thus easier to count. FWP biologists count elk within established elk trend count units, and typically attempt to differentiate and report separate totals for cows, calves and bulls to help determine herd population dynamics over time. The FWP biologist then aggregates the trend count numbers into Hunting District totals and Bitterroot drainage totals. Herd population objectives come from FWP's latest Montana Elk Plan.

2.2.3 Results

Table 2.2- 3: Elk Numbers and Bull/Cow Ratios by Hunting District (Data Source: MT FWP)

HD	FWP Obj.	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020*
204 # Elk	600	788	771	680	887	981	1056	642	1060	891	690
204 B/C Ratio	0.1	0.182	0.183	0.206	0.201	0.192	0.184	0.274	0.171	0.394	0.441
240 # Elk	1000	677	652	742	760	955	851	1129	962	1010	637
240 B/C Ratio	0.1	0.304	0.246	0.292	0.369	0.326	0.311	0.277	0.221	0.152	0.137
250 # Elk	1400	597	565	609	723	729	792	855	728	901	387
250 B/C Ratio	0.1	0.06	0.1	0.076	0.161	0.275	0.213	0.285	0.193	0.282	0.065
261 # Elk	700	612	609	725	764	842	947	882	883	857	485
B/C Ratio	0.1	0.237	0.258	0.159	0.315	0.182	0.237	0.138	0.279	0.264	0.233
270 # Elk	3800	3745	3522	4450	4109	4323	4018	3956	4779	4069	1431
270 B/C Ratio	0.15	0.082	0.117	0.096	0.17	0.136	0.146	0.215	0.151	0.136	0.069
River # Elk	N/A	106	116	143	142	224	199	304	173	123	69
River B/C Ratio	N/A	0.039	0.043	0.091	0.065	0.091	0.081	0.097	0.078	0.108	0.12
Total # Elk	7500	6525	6235	7349	7385	8054	7863	7768	8585	7851	3699

*2020 elk trend count was conducted largely from the ground due to Covid-19 restrictions. Ground counts generally underestimate elk numbers. Results are not directly comparable to previous years' counts conducted from the air. FWP's Bitterroot Area Wildlife Biologist feels that 2020 was a "bad data year" due to the severe limitations on aerial surveys.

2.2.4 Discussion

FWP elk trend counts were mostly conducted from the ground rather than from the air in 2020 due to Covid-19 restrictions. Ground-based observations generally underestimate elk numbers. The large reductions in observed elk numbers in most Bitterroot HDs in 2020 are likely a result of this less effective survey methodology, and probably do not reflect actual changes in elk populations. The 2020 elk numbers are not directly comparable to numbers in previous counts and should not be used to

determine population trends. For this reason, elk trend count numbers from 2019 were used for this analysis.

Observed elk numbers across the Bitterroot drainage in 2019 increased about 1.1% from 2017 when the previous Bitterroot National Forest Monitoring Report was compiled. There was a large increase to a record high of 8,585 elk observed in 2018, possibly due to good observing conditions. This continues a general upward trend in elk numbers over the 54 years that FWP has collected trend count data. FWP counted 2,419 elk in 1965. By 1987 when the Forest Plan was signed, FWP counted 3,537 elk in the Bitterroot drainage. Using the 2019 figures, observed elk numbers in the Bitterroot drainage have increased by 225% since the trend count started in 1965, and by 122% since the Forest Plan was signed in 1987. This exceeds the Forest Plan objective to maintain the current (1987) level of big-game hunting opportunities. Observed elk numbers exceed FWP management objectives for the entire drainage, and in all hunting districts except HD 250 (West Fork Bitterroot River). See current FWP Montana Elk Management Plan at: https://fwp.mt.gov/conservation/species/elk

BNF activities such as increasing elk habitat effectiveness by reducing open road densities and improving elk forage productivity on winter and summer ranges have supported the upward trend in elk numbers across the Bitterroot drainage. FWP hunting regulations are probably the biggest factor influencing elk numbers in the drainage. Limits on the number of cows and/or bulls that could be harvested legally allowed herd numbers to increase over time. Many elk have also shifted their distribution patterns to take advantage of reduced hunting pressure afforded by de facto refuges created by large ranches in elk winter range that prohibit or limit hunting. The combination of these factors has allowed elk populations to increase over time.

2.2.5 Evaluation of Results for Adaptive Management Finding

Table 2.2- 4: Summary of findings for Plan Monitoring Item MON-WLF-02

PLAN IMPLEMENTATION STATUS[1]	CHANGE WARRANTED?	WHERE IS CHANGE WARRANTED?
(E) Yes. The number of elk observed on FWP elk trend count flights has generally increased since the Forest Plan was signed and was 122% higher in 2019 than in 1987. The number of elk observed now exceeds FWP elk population objectives across the entire Bitterroot drainage and in all hunting districts except HD 250 (West Fork Bitterroot). This increase is a result of improving habitat on elk winter ranges, increasing elk habitat effectiveness by reducing open road densities, and FWP management of elk populations through hunting regulations.	No	None

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

2.3 MON-WLF-03 – Pine marten habitat

2.3.1 Monitoring item summary

- *Monitoring question: Is habitat for pine marten providing for ecological needs to ensure these populations remain in desired ranges?*

The forest plan states that the amount and distribution of old growth will be used to ensure sufficient habitat for the maintenance of two indicator species, pine marten (Martes americana) and pileated woodpecker (*Dryocopus pileatus*; USDA Forest Service 1987, page II-19). The original monitoring and evaluation plan proposed evaluating pine marten population change in relation to habitat changes by running three survey routes annually on several established transects. The number of marten tracks encountered serves as an indirect measure of marten habitat quality. Table 2.3-1 lists forest and grassland plan goals and objectives, monitoring indicators, data sources and partners, the frequency of data collection and reporting, and any quantitative targets or thresholds related to this monitoring item. Table 2.3-2 lists the most recent and next dates for data collection and reporting for this monitoring item.

Table 2.3- 1: Forest plan components, monitoring indicators, data collection intervals, and data sources for MON-WLF-03.

Plan components	Indicators	Data collection interval	Data source/partner
Goals: Provide habitat to support a viable population of native and desirable non-native wildlife and fish. (page II-3) **Objectives:** Maintain habitat to support viable populations of wildlife species; participate and cooperate in threatened and endangered species identification, recovery, and protection. (page II-5) **Standards:** Amount and distribution of old growth will be used to ensure sufficient habitat for maintenance of viable populations of species including pine marten and pileated woodpecker. (page II-19)	Population trend monitoring using established transects	2 years	USDA Forest Service records Defenders of Wildlife records Montana Natural Heritage Program records

Table 2.3- 2: Monitoring collection and reporting dates for MON-WLF-03.

Milestone	Year
Data last collected or compiled in:	2020
Next scheduled data collection and compilation:	2021
Last monitoring evaluation report covering this monitoring item:	N/A
Next scheduled monitoring evaluation report covering this monitoring item:	2023

2.3.2 Methods

The Forest Plan identified the “pine marten” as a Management Indicator Species. At the time the Plan was written, only one marten species (more properly referred to as American marten) was thought to

occur throughout North America. Recent genetic analysis indicates that there are two marten species in North America (Small et al. 2003, Dawson and Cook 2012). The American marten (*Martes americana*) generally inhabits the continent east of the Rocky Mountains, while the Pacific marten (*Martes caurina*) generally inhabits the area west of the Rockies. Some areas, including southern Montana, have genetics from both species. The National Genomics Center in Missoula started differentiating the two marten species with the results from the BNF's 2016-2017 forest carnivore monitoring program. All of the marten samples from bait stations throughout the Sapphire Mountains and the southern portion of the Bitterroot Mountains on the BNF were identified as Pacific marten. Individuals of both species were identified from the marten samples from the northern portion of the Bitterroot Mountains on the BNF. We assume that monitoring efforts apply to both species.

In practice, it was very difficult to run enough snow tracking transects to implement the monitoring. Winter track surveys are challenging due to lack of trained personnel and changing weather conditions that often make tracking difficult or impossible. The Forest rarely came close to completing the number of transects due to these limitations. The data was not sufficient to ascertain population densities or trends, but marten tracks were detected on all the established monitoring routes, indicating that marten were well distributed across the Forest.

The Forest began using a different monitoring methodology in 2014 by establishing multi-carnivore bait stations at approximately 50 sites each winter. These stations are a proven methodology designed to detect forest carnivores including marten, fisher, wolverine and lynx. Carnivores are attracted to the vicinity of the stations using a powerful olfactory lure, and then climb the bait tree to feed on frozen deer or elk meat attached to the tree. Animals that visit the stations are detected using motion-activated cameras trained at the bait tree, and/or by DNA analysis of hairs left by the animals as they climb the tree to reach the bait. Carnivore hairs can then be identified to species or even individual by the Rocky Mountain Research Station's National Genomics Center. Martens are by far the most commonly detected forest carnivore at these bait stations.

Beginning in 2015, the Forest partnered with the Defenders of Wildlife's Missoula office, who recruited and trained a large group of volunteers to establish and run bait stations in the northern half of the Forest. Some bait stations were installed in the same place more than one year, others were only installed one year. Photos and captured hair were retrieved every 3 to 4 weeks. A marten detection occurred if one or more marten was photographed at a site during that interval. Cameras sometimes malfunction and fail to record animal activity even when the bait has been completely consumed. Such malfunctions were counted as a station check with no marten detections. Therefore, it is likely that martens visited more bait stations than is indicated by these data. This methodology offers the potential of detecting marten and other forest carnivores 24/7 for 3 to 4 months each winter regardless of the weather. Photos are reviewed and catalogued, and hair samples are sent to the Rocky Mountain Research Station's National Genomics Center for Wildlife and Fish Conservation for DNA analysis. Marten are not identified to individual at this point, but we can use the results to develop an index of the percentage of visits to bait stations that detect at least one marten.

2.3.3 Results

Table 2.3- 3: Number and Percentage of Bait Stations Detecting Martens on the BNF

Year	# Bait Stations	# Station Checks	# Station Checks w/ Marten Detected	% Station Checks w/ Marten Detected
2013-14	54	108	50	46.3%
2014-15	50	145	82	56.6%
2015-16	54	162	89	54.9%
2016-17	51	185	128	69.2%
2017-18	61	184	138	75.0%
2018-19	48	136	95	69.9%
2019-2020	19	52	37	71.2%

2.3.4 Discussion

Multi-carnivore bait station data have been collected since 2014 but have not been used previously in this format to address monitoring plan questions. The percentage of bait station checks that detected at least one marten visit has generally trended upward from 2014 to present, with a rather large increase from 2016 to 2017. Reasons for this increase are not clear. **We may be able to use the results to evaluate trends in marten populations, but these data do indicate that marten are widely distributed in suitable habitat across the Forest.**

No new science or information collected outside of this monitoring program was considered in the evaluation of this monitoring question. It is unlikely that other USFS management activities influenced these monitoring results because most of the bait stations were in areas where little or no management activity occurred. Wildfires may have affected marten populations in the vicinity of some bait stations. Legal trapping likely reduced the number of marten in the vicinity of some bait stations, but the extent of any such reduction is unknown.

2.3.5 Evaluation of Results for Adaptive Management Finding

Table 2.3- 4: Summary of findings for Plan Monitoring Item MON-WLF-03

PLAN IMPLEMENTATION STATUS[1]	CHANGE WARRANTED?	WHERE IS CHANGE WARRANTED?
(E) Yes. Results of monitoring multi-carnivore bait stations indicate that marten continue to be well-distributed across the Forest, and that the trend in distribution may be increasing. New non-invasive survey methodologies will improve our ability to monitor marten distribution and populations.	Yes. Improved survey methodologies have become available.	Monitoring Plan: Change indicator from: Population trend monitoring using established transects To: Population distribution trend monitoring using non-invasive methods, including bait stations and eDNA from snow tracks and/or scat collection, or track transect surveys

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

2.4 MON-WLF-04 – Pileated woodpecker habitat

2.4.1 Monitoring item summary

- *Monitoring question: Is habitat for pileated woodpecker providing for ecological needs to ensure these populations remain in desired ranges?*

The forest plan states that the amount and distribution of old growth will be used to ensure sufficient habitat for the maintenance of two indicator species, pine marten and pileated woodpecker (USDA Forest Service 1987, page II-19). The original monitoring and evaluation in the plan proposed evaluating pileated woodpecker population change in relation to habitat changes by running three survey routes annually on several established transects. The number of detections per mile of survey serves as an indirect measure of pileated woodpecker habitat quality. Table 2.4-1 lists forest and grassland plan goals and objectives, monitoring indicators, data sources and partners, the frequency of data collection and reporting, and any quantitative targets or thresholds related to this monitoring item. Table 2.4-2 lists the most recent and next dates for data collection and reporting for this monitoring item.

Table 2.4- 1: Forest plan components, monitoring indicators, data collection intervals, and data sources for MON-WLF-04.

Plan components	Indicators	Data collection interval	Data source/partner
Goals: Provide habitat to support a viable population of native and desirable non-native wildlife and fish. (page II-3) **Objectives:** Maintain habitat to support viable populations of wildlife species; participate and cooperate in threatened and endangered species identification, recovery, and protection. (page II-5) **Standards:** Amount and distribution of old growth will be used to ensure sufficient habitat for maintenance of viable populations of species including pine marten and pileated woodpecker. (page II-19)	Population trend monitoring using established transects	2 years	USDA Forest Service records Integrated Monitoring in Bird Conservation Regions

Table 2.4- 2: Monitoring collection and reporting dates for MON-WLF-04.

Milestone	Year
Data last collected or compiled in:	2018
Next scheduled data collection and compilation:	2021
Last monitoring evaluation report covering this monitoring item:	2018
Next scheduled monitoring evaluation report covering this monitoring item:	2023

2.4.2 Methods

The BNF Forest Plan pileated woodpecker monitoring transects use a standardized call route methodology on established routes that are located in areas considered to contain high-quality pileated woodpecker habitat at the time the transects were set up. Transects are run by BNF wildlife personnel or qualified Bitterroot Audubon volunteers between early April and early June to coincide with the period when pileated woodpecker calling activity is highest. The surveyor either walks along an established transect and records all the pileated woodpeckers detected by call, drumming or visual observation, or drives along an established transect and gets out at established points and records all the pileated woodpeckers detected. At the end of the season the results of all transects run are compiled, and the number of pileated woodpecker detections per mile of transect run is calculated. Variation in detections can occur due to weather, time of year, observer abilities or habitat changes.

IMBCR (Integrated Monitoring in Bird Conservation Regions) transects use a standardized point count methodology in a spatially balanced, 4 X 4 grid of 16 points with 250 meters between points. Grids are generally selected without regard to habitat type. They are not specifically located in areas of high-quality pileated woodpecker habitat and are focused on detecting all the bird species around each point via vocalizations or by sight. Surveyors are qualified IMBCR field technicians. Pileated woodpeckers are only one of many species detected, but the results are statistically significant due to the standardized, repeatable methodology and the randomized placement of the grids. See http://rmbo.org/v3/avian/Home.aspx for details on IMBCR methodologies and results.

2.4.3 Results

Table 2.4- 3: Pileated Woodpecker Monitoring Transects

Year	# Transects Run	Miles of Transects	# PIWO Detected	# Miles/PIWO	# PIWO/Mile
1989	8	34	9	3.8	0.26
1990	14	81	43	1.9	0.53
1991	18	124	20	6.2	0.16
1992	20.5	150.2	18	8.3	0.12
1993	8	35	4	8.8	0.11
1994	5	34.5	5	6.9	0.14
1995	14	83	42	2	0.51
1996	6	29.5	5	5.9	0.17
1997	0	0	0	0	0
1998	0	0	0	0	0
1999	15	75.5	15	5	0.2
2000	13	94.5	11	8.6	0.12
2001	18	123	17	7.2	0.14
2002	19	126	22	5.7	0.17
2003	21	132.5	29	4.6	0.22
2004	18	107.5	21	5.1	0.2
2005	12	52.5	12	4.4	0.23
2006	22	134	26	5.2	0.19

Year	# Transects Run	Miles of Transects	# PIWO Detected	# Miles/PIWO	# PIWO/Mile
2007	21	141.5	25	5.7	0.18
2008	18	119.5	18	6.6	0.15
2009	19	138.4	19	7.3	0.14
2010	20	134.5	33	4.1	0.25
2011	16	114.5	28	4.1	0.24
2012	6	43	8	5.4	0.19
2013	24	163.5	43	3.8	0.26
2014	14	104	18	5.8	0.17
2015	22	155.5	39	4	0.25
2016	17	129.5	21	6.2	0.16
2017	18	139	29	4.8	0.21
Avg	15.8	103.7	21.5	4.8	0.21
Total	426.5	2799.6	580		

Table 2.4- 4: Pileated Woodpecker Trend at Several Scales (from IMBCR[1] 2010-2018 data)

Stratum	Mean[2]	SD	L95CI	L90CI	Median[2]	U90CI	U95CI	Trend Certainty
BNF in MT	0.9337	0.0912	0.7839	0.7962	0.9245	1.0897	1.1381	0.7791
BNF Entire	0.9107	0.261	0.5289	0.5853	0.8646	1.3881	1.514	0.7129
BCR10[3] MT part	0.9533	0.0398	0.8785	0.8872	0.9547	1.0214	1.0307	0.8855

[1] IMBCR = Integrated Monitoring in Bird Conservation Regions

[2] Mean or Median below 1.0 indicates declining trend; above 1.0 indicates increasing trend; at 1.0 indicates level trend

[3] BCR10 = Bird Conservation Region 10, the Northern Rockies BCR

2.4.4 Discussion

The BNF has run pileated woodpecker monitoring routes on established transects most years from 1989 through 2017. Lack of personnel to run the transects limited our ability to collect this data in 2018-2020. The long-term average result through 2017 is about 0.21 pileated woodpecker detections per mile of transect. Our results for 2017 matched the long-term average and were an increase from the 0.16 pileated woodpecker detections per mile in 2016. The trend over time has been relatively consistent around this average but has fluctuated somewhat from year to year. Overall, the average number of woodpeckers detected per mile of transect is slightly higher since 2010 than the average between 2000 and 2009.

Integrated Monitoring in Bird Conservation Regions (IMBCR) survey data from 2010-2018 (the most recent data currently available) indicates a slightly negative but non-significant trend in pileated woodpecker numbers on the entire BNF scale, the BNF in Montana scale and the scale of Bird Conservation Region 10 in Montana, which includes the Montana portion of the Northern Rockies BCR. This result appears to contradict the BNF results, but neither methodology has indicated substantial changes in population trends in either direction over that time. Possible reasons for the

different conclusions include that BNF transects are not located in areas that have burned recently, whereas some IMBCR transects may be in burned areas that pileated woodpeckers seem to avoid. Some IMBCR transects are at higher elevations, which pileated woodpeckers tend to use less frequently. Finally, IMBCR transects are usually run from mid-May to mid-July to coincide with the height of the breeding season for migratory songbirds. Although pileated woodpeckers do vocalize during this period, the most active calling period for the species tends to be in April and May, which is when the BNF transects are usually run. The combination of these factors makes it possible that pileated woodpeckers are more likely to be detected on a typical BNF pileated woodpecker transect than on a typical IMBCR transect.

Forest management activities may have affected the number of pileated woodpecker detections to some extent, since timber sales and/or prescribed burning have occurred along portions of some routes. Some routes have also been impacted by wildfire.

2.4.5 Evaluation of Results for Adaptive Management Finding

Table 2.4- 5: Summary of findings for Plan Monitoring Item MON-WLF-04

PLAN IMPLEMENTATION STATUS[1]	CHANGE WARRANTED?	WHERE IS CHANGE WARRANTED?
(E) Yes. Results of running established BNF call transects indicate that the overall trend in pileated woodpecker detections has been slightly positive since 2010. IMBCR survey data for this same period shows a slightly negative trend. These two data sources imply that pileated woodpecker populations on the BNF are relatively stable.	No	None

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

2.5 MON-AQT-01 – Stream habitat

2.5.1 Monitoring item summary

- *Monitoring question: What is the status and trend of stream habitat?*

Table 2.5-1 lists forest and grassland plan goals and objectives, monitoring indicators, data sources and partners, the frequency of data collection and reporting, and any quantitative targets or thresholds related to this monitoring item. Table 2.5-2 lists the most recent and next dates for data collection and reporting for this monitoring item.

Table 2.5- 1: Forest plan components, monitoring indicators, data collection intervals, and data sources for MON-AQT-01.

Plan components	Indicators	Data collection interval	Data source/partner
Goals: Provide habitat to support viable populations of native and desirable non-native wildlife and fish; maintain habitat for possible recovery of threatened and endangered species; maintain riparian flora, fauna, water quality, and recreation activities. (Forest plan, page II-3) **INFISH goals:** Maintain or restore water quality…stream channel integrity, channel processes, and sediment regime…instream flows…natural timing and variability of the water table…diversity and productivity of native and desired non-native riparian plant communities…riparian vegetation…riparian and aquatic habitats necessary to foster unique genetic fish stocks…habitat to support populations of well-distributed native and desired non-native plant, vertebrate, and invertebrate populations. (INFISH decision notice, pages A-1 to A-2) **Objectives:** Maintain habitat to support current populations of catchable trout; maintain or enhance fish habitat by maintaining riparian habitat; cooperate with state agencies and local organizations to determine the cumulative effects of public and private land management on the Bitterroot River. (Forest plan, page II-5) **INFISH objectives:** Maintain or restore riparian management objectives; riparian management objectives provide the criteria against which attainment or progress toward attainment of the riparian goals is measured.	Pacfish Infish Biological Opinion (PIBO) Metrics • Macroinvertebrates • Bank Angle • Wood Frequency • Percent Fines • Residual Pool Depth • Percent Pools • Median Substrate Size (D50) • Overall Habitat Indicators Improved • Stream temperatures • Aquatic organism passage at road crossings	2 years	USDA Forest Service Forest Activity Tracking System, INFRA database, Watershed Improvement Tracking database, project-level stream condition surveys, and aquatic organism passage structure surveys Pacfish Infish Biological Opinion metrics (macroinvertebrates) Biological Opinion Stream Function Rating Matrix (FUR to FAR to FA trend data)

Plan components	Indicators	Data collection interval	Data source/partner
(INFISH decision notice, pages A-2 to A-3) **Standards:** *Wildlife and Fish standards 7, 8, 10, and 16.* (Forest plan, pages II-19 through II-21) **INFISH standards:** *TM-1, RF-1, RF-2, RF-3, RF-4, RF-5, GM-1, GM-2, GM-3, GM-4, RM-1, RM-2, RM-3, MM-1, MM-2, MM-3, MM-4, MM-5, MM-6, FM-1, FM-2, FM-3, FM-4, FM-5, LH-1, LH-2, LH-3, LH-4, RA-1, RA-2, RA-3, RA-4, RA-5, WR-1, WR-2, FW-1, FW-2, FW-3, and FW-4.* (INFISH decision notice, pages A-7 to A-13)			

Table 2.5- 2: Monitoring collection and reporting dates for MON-AQT-01.

Milestone	Year
Data last collected or compiled in:	2020
Next scheduled data collection and compilation:	2021
Last monitoring evaluation report covering this monitoring item:	2016-2017
Next scheduled monitoring evaluation report covering this monitoring item:	2023

2.5.2 Methods

PIBO stream habitat metrics are being periodically (every 5 years) measured in 46 monitoring reaches on the Bitterroot National Forest. Data collection began on the Forest in 2001, and most of the reaches have been sampled three or four times since then. Sampling is conducted by PIBO field crews. The data is analyzed/compiled at the PIBO Effectiveness Monitoring Program in Logan, Utah. Methodology is described in Archer et al. 2017.

Bitterroot National Forest and Montana Fish, Wildlife, and Parks (FWP) fisheries biologists annually monitor stream temperatures in about 80-90 sites across the Bitterroot National Forest. The method of monitoring is deploying continuously recording thermographs manufactured by the Onset Computer Corporation. The thermographs are set to take a temperature reading every hour between the dates of July 18 and October 1. Temperatures are monitored year-round in a few sites. The data has been used to track long-term temperature and climate trends in streams across the Forest and to support regional research efforts such as the NorWeST model (Isaak et al. 2017) aand the Climate Shield model (Isaak et al. 2015). The data is compiled and managed by FWP biologists in the Bitterroot National Forest Supervisor's Office in Hamilton, Montana.
https://www.fs.fed.us/rm/boise/AWAE/projects/NorWeST.html

Since 2000, 99 culverts have been replaced or removed to improve aquatic organism passage (AOP) on the Bitterroot National Forest and adjacent state lands and highway corridors. Bitterroot National Forest fisheries biologists annually monitor as many of the AOP replacement sites as possible. The

method of monitoring is visual inspections and photo-points. The purpose of the monitoring is to ensure that stream simulation and fish passage conditions are being satisfactorily maintained.

2.5.3 Results

Indicator: PACFISH/INFISH Biological Opinion (PIBO) Metrics

Table 2.5-3 shows the trend in stream habitat attributes across the Bitterroot National Forest as measured by the PIBO Effectiveness Monitoring Program. The metrics in Table 2.5-3 include:

- Overall Habitat Index score
- O.E. (observed/expected macroinvertebrate score)
- VegStab (bank stability)
- UnCutPct (percent undercut banks)
- LWFrq (large wood frequency)
- Bank Angle
- PTFines6 (percent fines in pool tails)
- d50 (median substrate size)
- RPD (residual pool depth), and
- PoolPct (percent pools).

Time1 is the mean value that was measured in the first PIBO sampling visit. Time2 is the mean value that was measured in the most recent (last) PIBO sampling visit. Percent Change is the percent change in mean values between the first and last visits. Sample Size is the number of survey sites with repeat visits. Negative Number is the number of sites where the measurement was lower on the last visit. Positive Number is the number of sites where the measurement was higher on the last visit. No Change Number is the number of sites where the last and first visit values were equal. P-value = Significance test. Desired Direction is the desired direction of change in the mean value, which can be either positive (+) or negative (-). Actual Change is the actual direction of change in the mean value, which can be not statistically significant (NS), positively statistically significant (+) or negatively statistically significant (-).

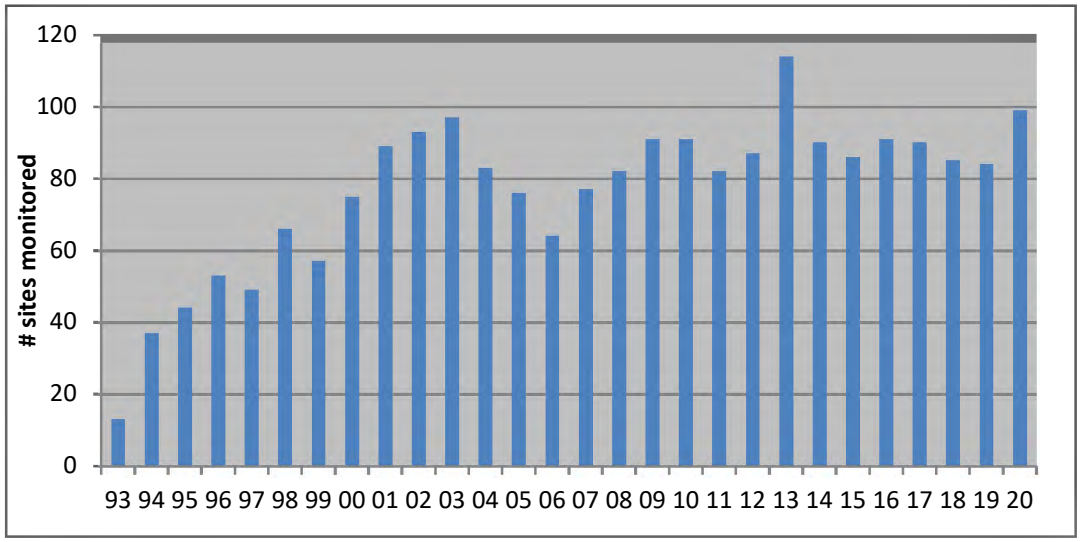
Table 2.5- 3: Trend in PIBO Metrics on the Bitterroot National Forest

Metric	Time1 Value	Time2 Value	Percent Change	Sample Size	Negative Number	Positive Number	No Change Number	P-value	Desired Direction	Actual Change
Overall	45.73	52.18	14.1	21	7	13	1	0.037	+	+
O.E.	0.95	0.99	3.9	21	10	11	0	0.741	+	NS
VegStab	67.08	81.87	22.0	21	6	15	0	0.017	+	+
UnCutPct	45.06	44.90	-0.3	21	9	12	0	0.715	+	NS
LWFrq	377.96	476.85	26.2	21	5	16	0	0.027	+	+
BankAngle	94.05	99.14	5.4	21	6	15	0	0.031	-	+
PTFines6	33.56	22.41	-33.2	21	15	6	0	0.019	-	-
d50	0.0506	0.0531	4.8	21	10	10	1	0.779	+	NS
RPD	0.33	0.37	12.5	21	7	14	0	0.027	+	+
PoolPct	44.78	42.23	-1.2	21	11	10	0	0.768	+	NS

Indicator: Stream Temperatures

Since 1993, the Bitterroot National Forest and Montana Fish, Wildlife, and Parks (FWP) have cooperatively developed an extensive system of stream temperature monitoring sites in streams across the Bitterroot National Forest. Figure 1 displays the number of sites that have been monitored since 1993.

Figure 1: Number of stream temperature monitoring sites on the Bitterroot National Forest



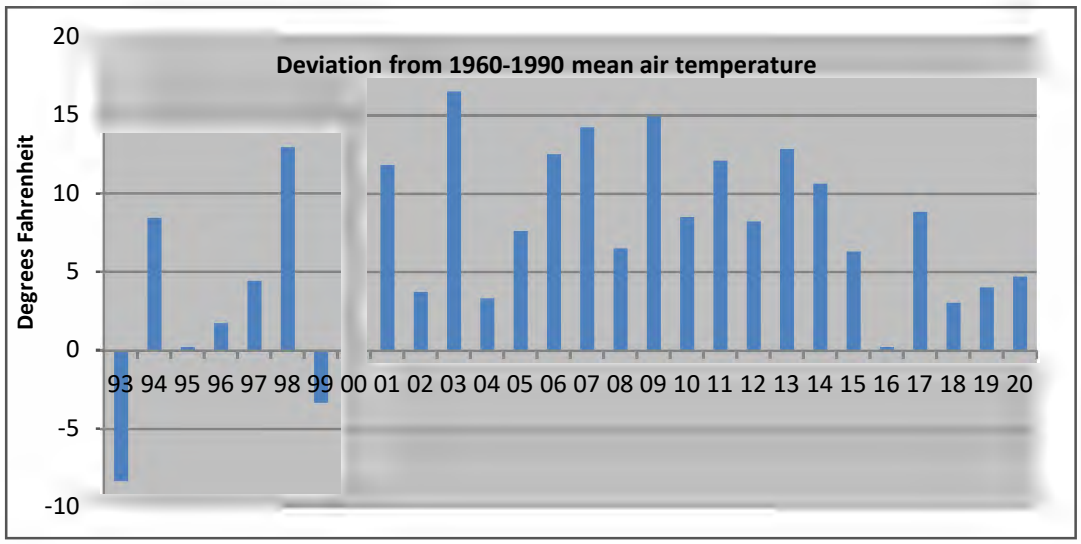
Our temperature monitoring period starts on July 18th and ends on October 1st. This 76-day monitoring period usually encompasses the warmest stream temperatures of the year and is the part of the year where temperatures likely have their greatest influence on native salmonids.

The unit of measure used to compare sites is the degree-day. The higher the number of degree-days that a site accumulates, the warmer the site. Degree-days are a useful variable because they standardize temperature data and allow comparisons between different years and different size streams. In general, higher degree day readings occur at lower elevations, during warmer summers, and in watersheds that have higher road densities and/or higher levels of equivalent clearcut area due to past harvest or fire.

There is a correlation between summer air temperatures and stream temperatures, and this affects the number of degree-days. For example, during hot summers like 2003, most of the monitoring sites on the Forest set their all-time highs for degree-days. During cold summers like 1993, most of the sites set their all-time lows.

Figure 2 displays how mean summer (July-September) air temperatures have varied from the 30-year (1960-1990) mean at the Stevensville Ranger Station weather station since 1993. The 30-year period used for reference is 1960-1990. The mean air temperature for the 1960-1990 period is represented by the "0" horizontal line in the graph. Each bar represents the sum of the deviations from the 30-year mean air temperature for the months of July, August, and September. The bars near the "0" line are the years where the July-September air temperatures were very close to the 30-year average. The bars above the "0" line are the years where the July-September air temperatures were warmer than average. The bars below the "0" line are the years where the July-September air temperatures were colder than average.

Figure 2: Deviation in mean summer (July-September) air temperatures from the 30-year (1960-1990) mean recorded at the Stevensville Ranger Station Weather Station

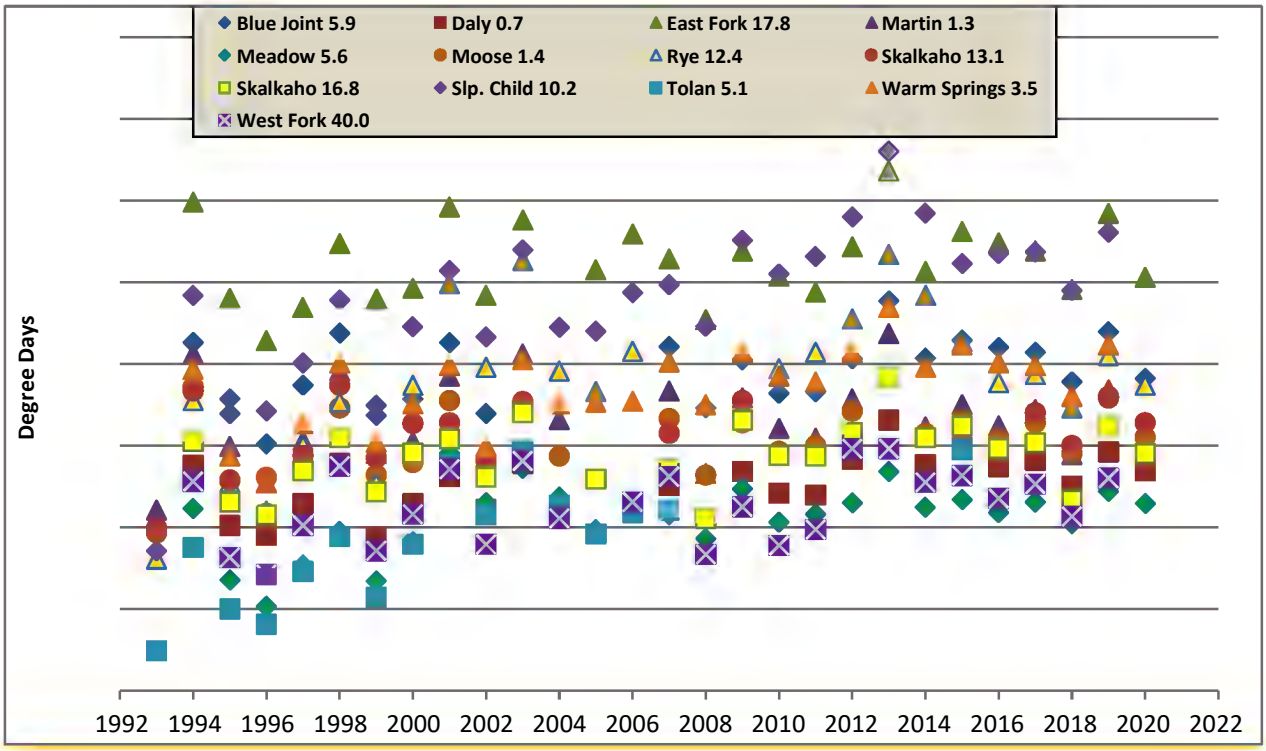


The trend in air temperatures over the past 27 years indicates that summers have gotten warmer on the Bitterroot National Forest (Figure 1). The frequency of hot days (> 90º F) is increasing, and the seasonal window in which hot days can occur is widening. These trends are similar to those reported by Pederson et al. (2010).

In the absence of fires, water diversions, or riparian timber harvest, weather is responsible for nearly all of the variability in degree-days that occurs at a given stream temperature monitoring site from year to year. To account for year-to-year variability, the Forest and MFWP established a network of 13 index sites on the Montana portion of the Forest and six index sites on the Idaho portion of the Forest. Index sites are sites whose temperatures are monitored every year. Except for Rye Creek 12.4, the index sites are located in watersheds that contain bull trout and are minimally managed or unmanaged upstream of the site. A few of the index sites (e.g. Rye Creek 12.4, Tolan Creek 5.1) have been substantially burned since their inception and currently do not function as good references. The index sites function as control sites and help to reduce some of the variability caused by the weather. By comparing the degree-day trends in managed sites against the degree-day trends in the index sites, we can reduce the variability caused by the weather and make some inferences about the influence of fire and/or management activities on stream temperatures.

Figure 3 plots the degree days that have been recorded at the Montana index sites since 1993. The key thing to notice in Figure 3 is the overall rising pattern of the data points – this indicates that there has been a gradual warming of streams across the Montana portion of the Forest over the last 27 years.

Figure 3: Degree days recorded at the Montana index sites since 1993



Figures 4-9 display the trend in degree days at the six index sites in the Selway River drainage in Idaho. All the sites are in reference condition with the exception of Deep Creek and the Selway River below Whitecap. The Whitecap Creek, Indian Creek, Little Clearwater River, and Selway River above Magruder Guard Station sites are reference sites that drain large wilderness watersheds.

Figure 4: Degree days recorded at the mouth of Deep Creek

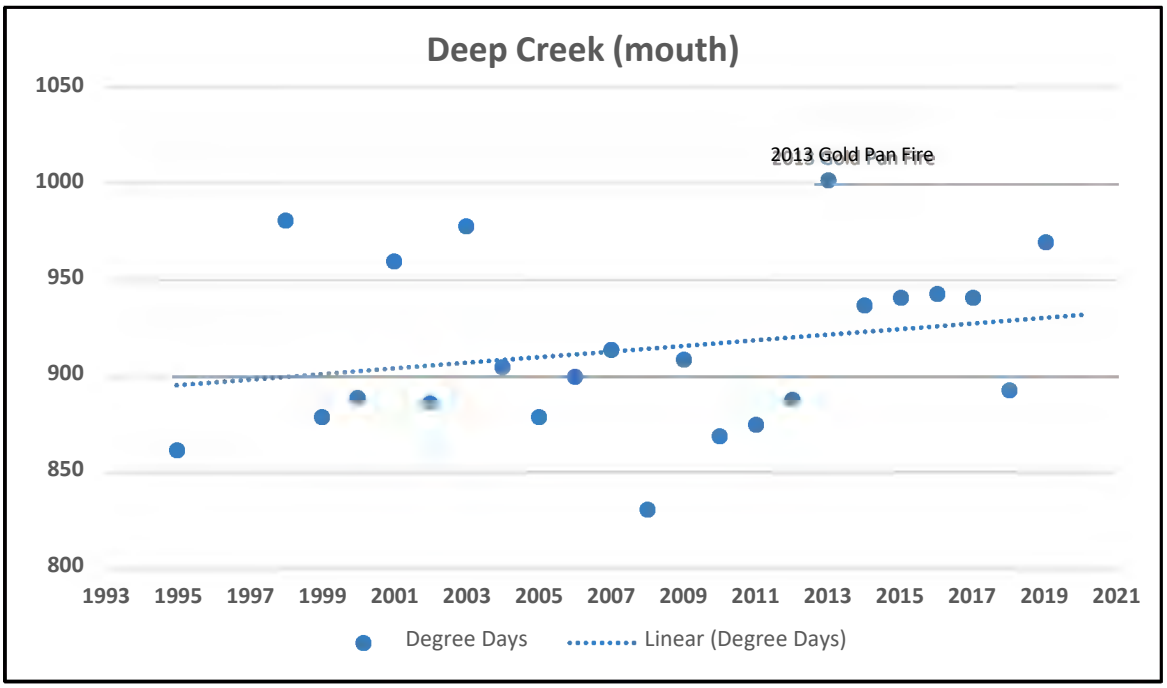


Figure 5: Degree days recorded at the mouth of Indian Creek

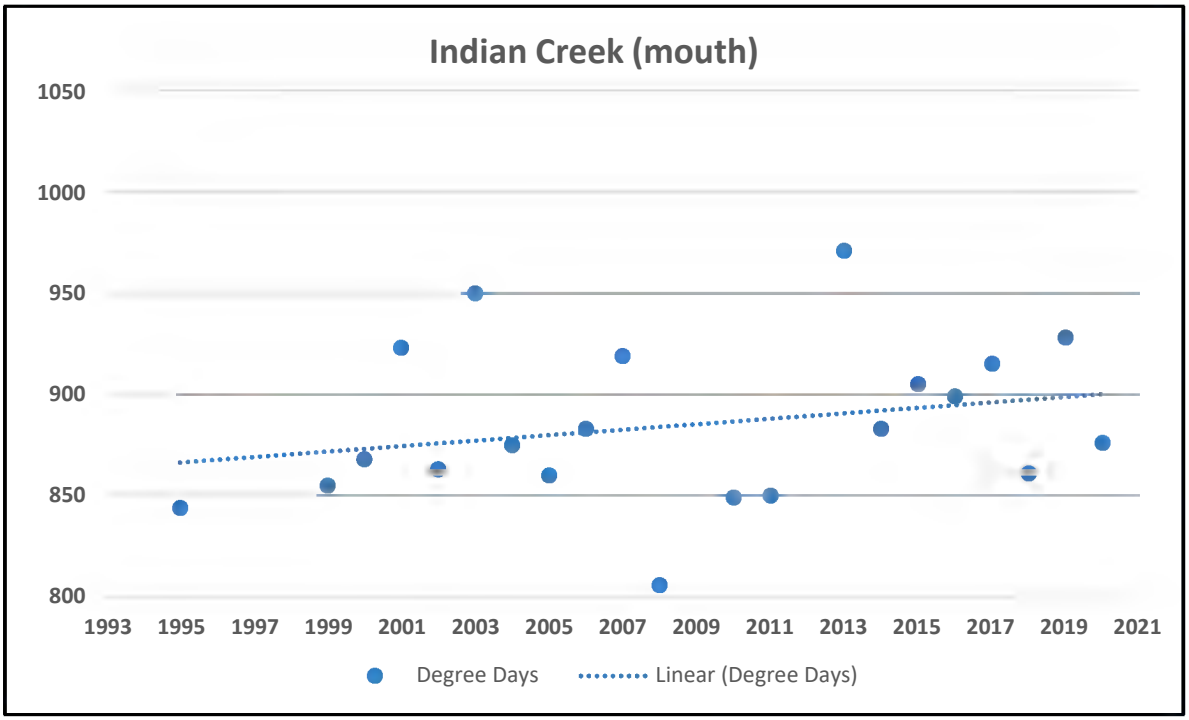


Figure 6: Degree days recorded at the mouth of the Little Clearwater River

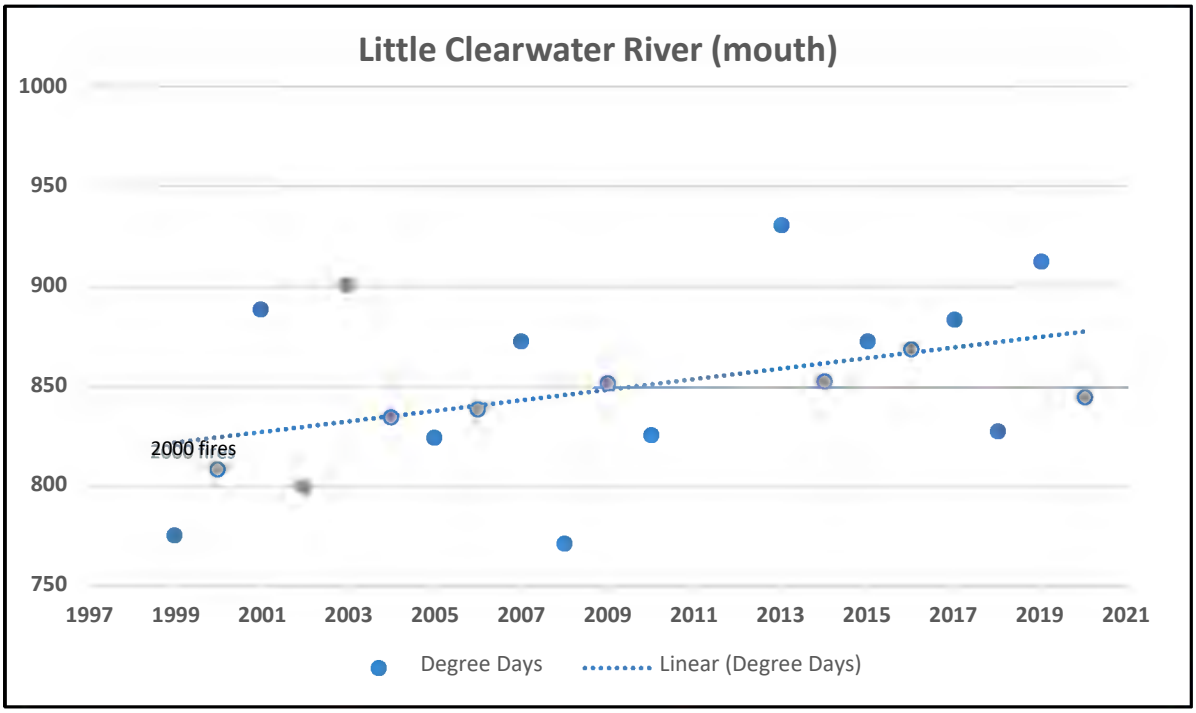


Figure 7: Degree days recorded at the mouth of Whitecap Creek

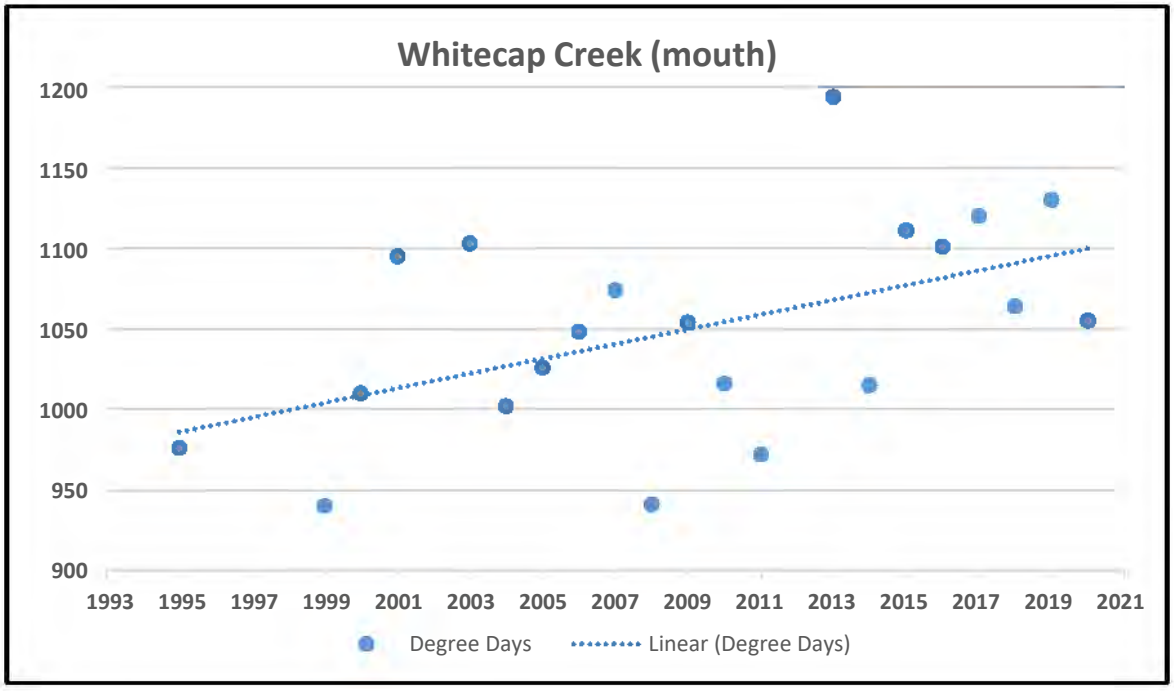


Figure 8: Degree days recorded at the Selway River at Magruder Guard Station

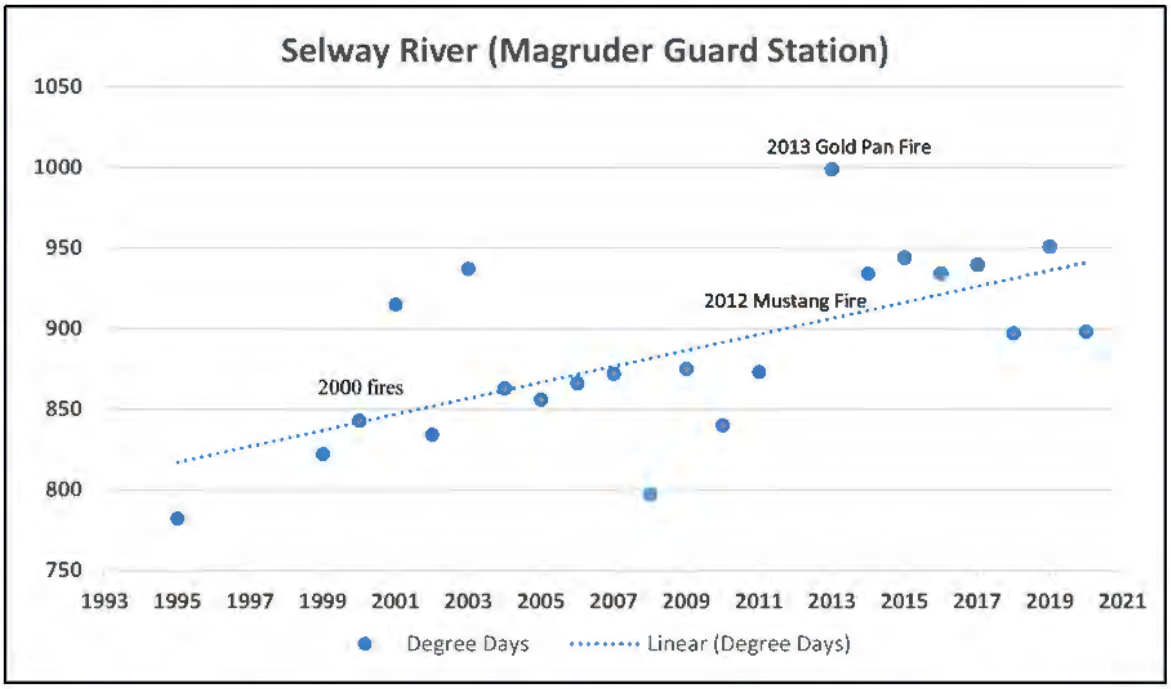
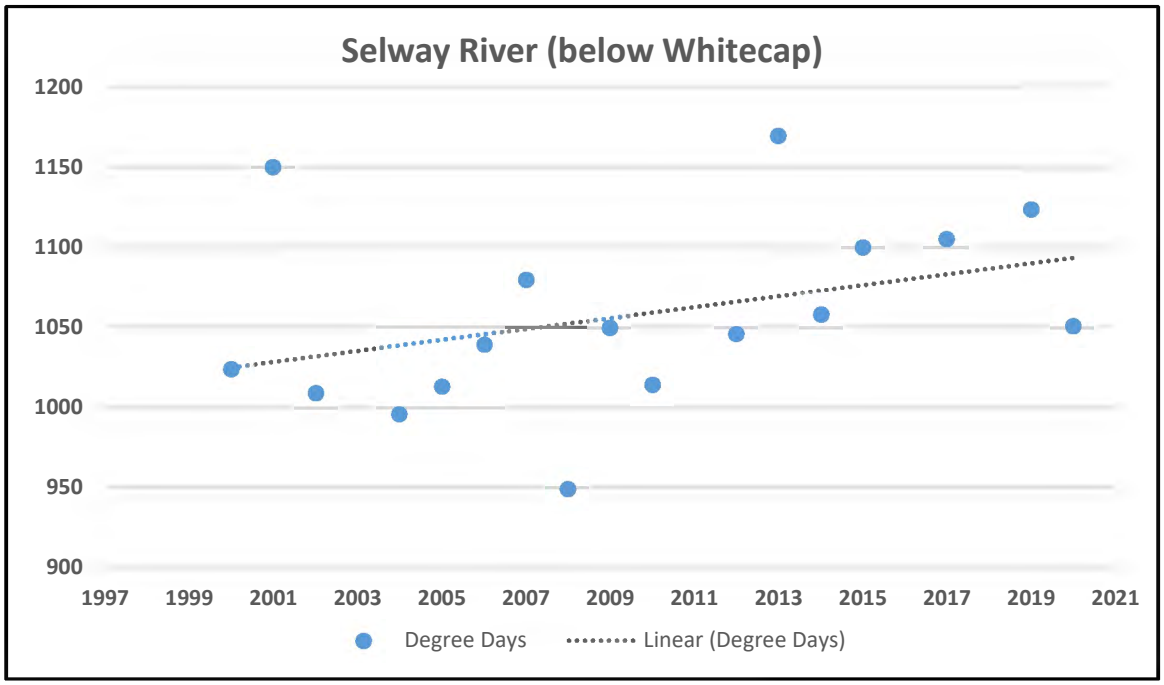


Figure 9: Degree days recorded at the Selway River below Whitecap Creek



Indicator: Aquatic Organism Passage at Road Crossings

The Forest Plan as amended by INFISH and PACFISH directs the Forest to "provide and maintain fish passage at all road crossings on existing and potential fish-bearing streams" (INFISH standard RF-5; PACFISH standard RF-5). To achieve these standards, Forest fisheries biologists and engineers have focused much of their attention in recent years on the identification and elimination of fish passage barriers at culverts.

Culvert Inventories: During the 2003 field season, the majority (> 80%) of the fish-bearing culverts on the Bitterroot National Forest were surveyed with the Fish Crossing protocol to assess whether or not they function as a passage barrier to trout. The FishXing model predictions were checked and validated by Forest fisheries biologists. Most of the fish-bearing culverts that did not receive a Fish Crossing survey in 2003 have been field checked by Forest biologists on at least one occasion.

During the 2007 field season, 43 fish-bearing culverts on five Forest highways were surveyed with the Fish Crossing protocol. The highways surveyed included: (1) U.S. Highway 93 between Darby and Lost Trail Pass; (2) the East Fork Highway; (3) the West Fork Highway; (4) the Skalkaho Highway; and (5) the paved portion of the Nez Perce Road. The results indicate that 58% of the highway culverts are an upstream barrier to juvenile trout during some time of the year, 21% are potential barriers, and 21% provide year-round passage. The results for adult trout were similar, with 51% of the culverts identified as barriers, 28% as potential barriers, and 21% providing year-round passage.

Table 2.5-4 summarizes our most current knowledge of fish culvert passage status on the Forest. The numbers in the table may differ from past years reports because they get adjusted as new information becomes available, or as barriers are eliminated through replacement or removal.

Table 2.5- 4: Fish Passage Barriers at Culverts

Location	# of fish-bearing culverts	# known or suspected to be passage barriers	# unknown – not seen or surveyed	# likely to be offering suitable fish passage conditions
Sula and West Fork Districts	104	56 (54%)	0 (0%)	48 (46%)
Stevensville and Darby Districts	55	40 (73%)	0 (0%)	15 (27%)
Montana DNRC land	6	1 (17%)	0 (0%)	5 (83%)

Culvert Replacements or Removals: Since 2000, 99 culverts have been replaced or removed to improve fish passage on Bitterroot National Forest and adjacent state lands and highway corridors (Table 2.5-5). The Bitterroot National Forest has replaced or removed 90 crossings. Sula State Forest lands have replaced or removed 55 crossings, Federal highways has replaced 3 crossings on U.S. Highway 93 during the Sula North/South reconstruction phase), and one crossing has been replaced on the West Fork Highway (Slate Creek).

Table 2.5-5 lists the fish passage culvert replacements and removals that have occurred since 2000 and summarizes their current fish passage status based on our most recent monitoring visits. The current fish passage status of each culvert was classified as “fully functioning”, “partially functioning”, or “not functioning”. These categories are defined as:

- *Fully functioning* = native substrates are present throughout the culvert barrel and appear to be stable; there may be some thinning of substrate material since installation but substrate still covers the entire bottom of the culvert barrel; there are no prohibitive vertical drops on the inlet or outlet; all sizes and species of fish can pass through the culvert at high and low flows; if a structure is passable for fish, it is also considered to be passable for other aquatic species.
- *Partially functioning* = since replacement, some of the substrate material has been flushed from the culvert barrel and now at least half of the barrel has been scoured bare or contains minimal substrate material; there are no prohibitive vertical drops on the inlet or outlet; culverts that provide fish passage at high flows but lose their surface water at low flows fall into this category, as do culverts that are undersized but still maintain a roughened bottom of larger substrates throughout their culvert barrel; adult fish can still pass through the culvert at the majority of flows, but passage of juvenile fish is probably restricted at higher flows due to prohibitive water velocities inside of the barrel or at lower flows due to loss of surface water.
- *Not functioning* = since replacement, all or most of the substrate material has been scoured from the culvert barrel or prohibitive vertical drops may have developed on the inlet or outlet (in some cases they haven’t, but the barrel is still bare of substrate); the majority of adult and juvenile fish probably cannot pass through the culvert at high or low flows.

Table 2.5- 5: Status of culverts replaced or removed to eliminate fish passage barriers, 2000 to present.

District	Stream	Road	Year replaced or removed?	Fully functioning	Partially functioning	Not functioning
D4	Little Blue Joint Creek #	5658	Replaced, 2000 & 2015	X		
D4	Sheep Creek #	6223	Replaced, 2001 & 2017	X		
D4	Washout Creek	6223	Replaced, 2001	X		
D4	Two Creek	732	Replaced, 2001		X	
D4	Trout Creek	Tr #674	Removed, 2001	X		
D4	Nelson Creek	468	Replaced, 2002	X		
D4	Gemmell Creek	468	Replaced, 2002	X		
D4	Sentimental Creek	13482	Replaced, 2003	X		
D4	Sand Creek	362	Replaced, 2003 (BAR)	X		
D4	Magpie Creek	362	Replaced, 2003 (BAR)	X		
D4	Took Creek	362	Replaced, 2003 (BAR)		X	
D4	Took Creek	1303	Replaced, 2003 (BAR)		X	
D4	Gabe Creek	468	New bridge, 2004	X		
D4	Scimitar Creek	Non-syst	Removed, 2007	X		
D4	Coal Creek	5662	Replaced, 2007 (BAR)	X		
D4	Castle Creek (lower)	49	Replaced, 2008 (BAR)	X		
D4	East Piquett Creek	731	Replaced, 2009 (BAR)	X		
D4	Mine Creek	5688	Replaced, 2010 (BAR)	X		
D4	Elk Creek (lower)	13833	Removed, 2010 (BAR)	X		
D4	Elk Creek (upper)	13833	Removed, 2010 (BAR)	X		
D4	Pierce Creek	5629	Replaced, 2011	X		
D4	Castle Creek (middle)	49	Replaced, 2011	X		
D4	Pete Creek	468	New bridge, 2011	X		

District	Stream	Road	Year replaced or removed?	Fully functioning	Partially functioning	Not functioning
D4	Baker Creek (north)	5629	Replaced, 2011	X		
D4	Baker Creek (south)	5629	Replaced, 2011	X		
D4	Woods Creek	5672	Removed, 2012	X		
D4	Woods Creek trib 5.4	5672	Removed, 2012	X		
D4	Little Boulder Creek	1130	Replaced, 2013	X		
D4	Halfway Creek	468	Replaced, 2013	X		
D4	Schumaker Creek	468	Replaced, 2013		X	
D4	Scimitar Creek	468	Replaced, 2013			X
D4	East Piquett Creek trib 2.0	13411	Removed, 2013	X		
D4	Pierce Creek	13466	Removed, 2013	X		
D4	West Creek trib 2.0	13410	Removed, 2013	X		
D4	Sheep Creek	5677	Replaced, 2015	X		
D4	Soldier Creek	091	Replaced, 2015	X		
D4	Johnson Creek	091	New bridge, 2016	X		
D3	Gilbert Creek	370	Replaced, 2000	X		
D3	Laird Creek	370	Replaced, 2000		X	
D3	Laird Creek	5615	Replaced, 2000	X		
D3	Reimel Creek	727	Replaced, 2000	X		
D3	Needle Creek	724	Replaced, 2001		X	
D3	WF Camp, trib 0.1 (lower)	729-B	Replaced, 2001			X
D3	WF Camp, trib 0.1 (upper)	729-B	Replaced, 2001			X
D3	Cameron Creek	311	Replaced, 2001	X		
D3	Bugle Creek	725	Replaced, 2003 (BAR)	X		
D3	Crazy Creek	370-A	Replaced, 2003 (BAR)	X		
D3	West Fork Camp Creek	729	Replaced, 2003 (BAR)	X		
D3	West Fork Camp, trib 0.9	8112	Replaced, 2003 (BAR)	X		
D3	West Fork Camp, trib 1.0	8112	Replaced, 2003 (BAR)	X		

District	Stream	Road	Year replaced or removed?	Fully functioning	Partially functioning	Not functioning
D3	Diggins Creek	727	Replaced, 2003	X		
D3	Springer Creek	Non-syst	Removed, 2006	X		
D3	West Fork Camp, trib 0.1	13340	Removed, 2006	X		
D3	Lyman Creek, trib 1.8	13304	Removed, 2006	X		
D3	Lyman Creek, trib 1.8	13304	Removed, 2006	X		
D3	Moose Creek	726	New bridge, 2007 (BAR)	X		
D3	Hart Creek	311	Replaced, 2008	X		
D3	Hart Creek	73180	Replaced, 2008	X		
D3	Mink Creek	5753	Replaced, 2008	X		
D3	Meadow Creek	5758	New bridge, 2008	X		
D3	Meadow Creek	725	New bridge, 2009	X		
D3	Warm Springs Creek	370	New bridge, 2011	X		
D3	West Fork Camp, trib 0.1	729	Replaced, 2011	X		
D3	Lodgepole Creek	73279	Removed, 2013	X		
D3	Bush Creek	726	Replaced, 2019	X		
D3	Reynolds Creek	432	Replaced, 2020	X		
D2	North Rye Creek, trib 2.1	321	Replaced, 2000			X
D2	Rye Creek, trib 9.1 (lower)	311	Replaced, 2001		X	
D2	Rye Creek, trib 9.1 (upper)	5613	Replaced, 2001	X		
D2	Gird Creek	1365	Replaced, 2001		X	
D2	Railroad Creek	75	Replaced, 2005 (BAR)	X		
D2	Hog Trough Creek	75	Replaced, 2005 (BAR)	X		
D2	Weasel Creek	75	Replaced, 2005 (BAR)	X		
D2	Rye Creek, trib 12.3	75	Replaced, 2005 (BAR)	X		
D2	Rye Creek, trib 12.3	5607	Replaced, 2005 (BAR)	X		

District	Stream	Road	Year replaced or removed?	Fully functioning	Partially functioning	Not functioning
D2	Cathouse Creek	Non-syst	Removed, 2006	X		
D2	Cathouse Creek, trib 0.9	Non-syst	Removed, 2006	X		
D2	North Rye Creek	321	Replaced, 2006 (BAR)	X		
D2	Cathouse Creek	1126	Replaced, 2007	X		
D2	Two Bear Creek	85D	New bridge, 2010	X		
D2	South Fork Chaffin Creek	374	Replaced, 2012	X		
D2	South Fork Chaffin Creek	374-A	Replaced, 2012	X		
D2	Skalkaho Creek	75	New bridge, 2013	X		
D2	South Fk Skalkaho Creek	75	Replaced, 2018	X		
D2	South Fork Skalkaho Creek, trib 5.8	75	Replaced, 2018	X		
D1	North Fork Willow Creek	13131	Removed, 2009	X		
D1	Sawmill Creek	62384	Removed, 2010	X		
D1	Sawmill Creek	62127	Removed, 2014	X		
D1	Arasta Creek	640	Removed, 2014	X		
D1	Willow Creek	364	Replaced, 2020	X		
DNRC	North Cameron Creek	1397	Replaced, 2000	X		
DNRC	North Cameron Creek	73160	Replaced, 2000	X		
DNRC	Lyman Creek	DNRC	Replaced, 2000	X		
DNRC	Praine Creek	DNRC	Replaced, 2001	X		
DNRC	Andrews Creek	DNRC	Replaced, 2007	X		
MDOT	Warm Springs Creek	Hwy 93	Replaced, 2002		X	
MDOT	Andrews Creek	Hwy 93	Replaced, 2002		X	
MDOT	Praine Creek	Hwy 93	Replaced, 2002		X	
FHA	Slate Creek	WF Hwy	Replaced, 2003	X		

D1-Stevensville District, D2 – Darby District, D3 – Sula District, D4 – West Fork District, DNRC – Montana Department of Natural Resources, MDOT – Montana Department of Transportation, FHA – Federal Highway Administration

= these culverts were replaced twice because the initial replacement failed. The Road 6223 culvert on Sheep Creek (2001 and 2017), and the Road 5658 culvert on Little Blue Joint Creek (2000 and 2015).

Barrier Culverts Awaiting Implementation: The Forest has NEPA analysis completed for nearly all of its known fish barrier culverts. There are currently 71 fish barrier culvert replacements or removals on the Forest that have NEPA analysis completed but are awaiting implementation (Table 2.5-6). Seventeen of the culverts listed in Table 2.5-6 have survey and design completed but lack funding to implement. The Forest is pursuing opportunities to survey, design, and contract these culverts as opportunities arise but it is a slow process because the work is expensive and implementation funds are very limited. The list of culverts needing replacement or removal is annually reviewed, prioritized, and modified by Forest aquatics and engineering personnel so that the highest priority culverts are treated first, and funds are most efficiently used.

Table 2.5-6 lists the culvert replacements or removals that have NEPA analysis completed and are awaiting implementation.

Table 2.5- 6: Fish barrier culverts awaiting implementation (NEPA analysis is completed)

Stream	Road #	NEPA Document and Date of Decision
North Rye Creek	Road 8111	Burned Area Recovery FEIS/ROD, 2001
Pierce Creek	Road 363	Frazier Interface EA/DN, 2003
Threemile Creek	Road 640	Threemile Bridge and Culvert EA, 2005
Bertie Lord Creek	Road 5786	Middle East Fork FEIS/ROD, 2006
Bertie Lord Creek, trib 3.5	Road 5786	Middle East Fork FEIS/ROD, 2006
Springer Creek	Road 13302	Middle East Fork FEIS/ROD, 2006
Spoon Creek	Road 13225	Trapper Bunkhouse FEIS/ROD, 2008
North Fork Willow Creek	Road 969-A	NF Willow Creek Culvert Replacements For Fish Passage DM, 2008
Beavertail Creek	Road 361-A	West Fork District Fish Culverts EA/DN, 2010
Beavertail Creek	Road 361	West Fork District Fish Culverts EA/DN, 2010
Beavertail Creek	Road 5719	West Fork District Fish Culverts EA/DN, 2010
Blue Joint Creek, trib 3.8	Road 362	West Fork District Fish Culverts EA/DN, 2010
Britts Creek	Road 49	West Fork District Fish Culverts EA/DN, 2010
Coal Creek, trib 2.1	Road 5660	West Fork District Fish Culverts EA/DN, 2010

Stream	Road #	NEPA Document and Date of Decision
Devil Creek	Road 091	West Fork District Fish Culverts EA/DN, 2010
Flat Creek	Road 468	West Fork District Fish Culverts EA/DN, 2010
Gemmell Creek (lower)	Road 5633	West Fork District Fish Culverts EA/DN, 2010
Gentile Creek	Road 5703	West Fork District Fish Culverts EA/DN, 2010
Johnson Creek	Road 5685	West Fork District Fish Culverts EA/DN, 2010
Lavene Creek (lower)	Road 5630	West Fork District Fish Culverts EA/DN, 2010
Nez Perce Fork (lower)	Road 468	West Fork District Fish Culverts EA/DN, 2010
Nez Perce Fork (upper)	Road 468	West Fork District Fish Culverts EA/DN, 2010
Rombo Creek	Road 13462	West Fork District Fish Culverts EA/DN, 2010
Rombo Creek	Road 5715	West Fork District Fish Culverts EA/DN, 2010
Salt Creek	Road 5683	West Fork District Fish Culverts EA/DN, 2010
Sand Creek	Road 1307	West Fork District Fish Culverts EA/DN, 2010
Thunder Creek	WF highway	West Fork District Fish Culverts EA/DN, 2010
Tough Creek	Road 13804	West Fork District Fish Culverts EA/DN, 2010
Two Creek	Road 732	West Fork District Fish Culverts EA/DN, 2010
Two Creek	Road 5650	West Fork District Fish Culverts EA/DN, 2010
Woods Creek, trib 3.8	Road 5669	West Fork District Fish Culverts EA/DN, 2010
Woods Creek, trib 4.5	Road 5669	West Fork District Fish Culverts EA/DN, 2010
Lavene Creek (middle)	Road 5630	Lower West Fork FEIS/ROD, 2010
Lavene Creek (upper)	Road 5630	Lower West Fork FEIS/ROD, 2010
Ward Creek (lower)	Road 373	Lower West Fork FEIS/ROD, 2010
Ward Creek (upper)	Road 373	Lower West Fork FEIS/ROD, 2010

Stream	Road #	NEPA Document and Date of Decision
Sleeping Child Creek	Road 75	North Zone Fish Culverts DM, 2010
Sleeping Child Creek, trib 20.1	Road 13235	North Zone Fish Culverts DM, 2010
Sleeping Child Creek, trib 3 of 20.1	Road 13234	North Zone Fish Culverts DM, 2010
Divide Creek	Road 75	North Zone Fish Culverts DM, 2010
Threemile Creek	Road 640	North Zone Fish Culverts DM, 2010
Threemile Creek, trib 12.4	Road 640	North Zone Fish Culverts DM, 2010
Butterfly Creek	Road 364	North Zone Fish Culverts DM, 2010
Deep Creek	Road 364	North Zone Fish Culverts DM, 2010
Bear Trap Creek	Road 364	North Zone Fish Culverts DM, 2010
Little Sleeping Child Creek	Road 5604	North Zone Fish Culverts DM, 2010
Ambrose Creek	Road 62179	North Zone Fish Culverts DM, 2010
Ambrose Creek	Road 428	North Zone Fish Culverts DM, 2010
Lick Creek	Road P-1286	North Zone Fish Culverts DM, 2010
Sawmill Creek (lower)	Road 710	North Zone Fish Culverts DM, 2010
Sawmill Creek (upper)	Road 710	North Zone Fish Culverts DM, 2010
Daly Creek, trib 3.3	Road 711	North Zone Fish Culverts DM, 2010
North Rye Creek, trib 2.1	Road 321	North Zone Fish Culverts DM, 2010
North Rye Creek, trib 4.3	Road 321	North Zone Fish Culverts DM, 2010
North Rye Creek, trib 4.3	Road 1128	North Zone Fish Culverts DM, 2010
North Rye Creek, trib 4.3	Road 62435	North Zone Fish Culverts DM, 2010
North Rye Creek, trib 4.3	Road 13251	North Zone Fish Culverts DM, 2010
Grizzly Creek	Road 312	North Zone Fish Culverts DM, 2010

Stream	Road #	NEPA Document and Date of Decision
Arastra Creek	Road 312	North Zone Fish Culverts DM, 2010
Cameron Creek	Road 1398	Sula District Fish Culverts EA/DN, 2011
Camp Creek	Sula RD, north	Sula District Fish Culverts EA/DN, 2011
Camp Creek	Sula RD, south	Sula District Fish Culverts EA/DN, 2011
Dick Creek	Road 729	Sula District Fish Culverts EA/DN, 2011
East Fork Camp Creek	Road 729	Sula District Fish Culverts EA/DN, 2011
Laird Creek	Road 370	Sula District Fish Culverts EA/DN, 2011
Lick Creek	Road 432	Sula District Fish Culverts EA/DN, 2011
Lick Creek	Road 5771	Sula District Fish Culverts EA/DN, 2011
Needle Creek	Road 724	Sula District Fish Culverts EA/DN, 2011
Sign Creek	Road 432	Sula District Fish Culverts EA/DN, 2011
West Fork Camp Creek, trib 0.1	Indian Trees CG, lower	Sula District Fish Culverts EA/DN, 2011
West Fork Camp Creek, trib 0.1	Indian Trees CG, upper	Sula District Fish Culverts EA/DN, 2011

Effectiveness Monitoring

South Fork Skalkaho Creek. During summer 2019, Forest fisheries staff conducted a simple experiment to test the effectiveness of two AOP culvert replacements on the South Fork of Skalkaho Creek and a nearby tributary to the South Fork (tributary 5.8). The original culverts were steep and undersized, and both were barriers to upstream fish passage. Both culverts were replaced with bottomless arches in May of 2018.

BNF fisheries staff used a mark-recapture approach to evaluate fish passage through the new bottomless arches. On July 17, 2019, bull trout and westslope cutthroat trout were captured using an electrofisher above the arches, marked with a caudal fin clip, and released below the arches. The presence of marked fish above the arches during a later sampling run would indicate that the designs were successful in providing upstream passage for fish.

In tributary 5.8, 28 cutthroat trout and three bull trout were captured above the new arch, marked, and released below the new structure. In the South Fork of Skalkaho Creek, 23 cutthroat and three bull trout were likewise captured, marked, and released. Staff returned on August 19th (32 days later) and electrofished the same reaches above both arches. In tributary 5.8, 14 cutthroat and four bull trout were captured. Of these, three cutthroat and one bull trout were marked. In the South Fork of Skalkaho

Creek, 13 cutthroat and four bull trout were captured. Of these, seven cutthroat and one bull trout were marked.

During the second electrofishing pass, the numbers of fish captured in both streams was roughly half the number captured during the first electroshocking pass. Sampling efficiency during the second pass was substantially affected by difficult sampling conditions (dense overhanging/obstructing vegetation and high levels of instream wood compounded by low water). Staff were frequently unable to net numerous stunned fish due to obstructions and observed many fish swimming into covered areas inaccessible to sampling

Low numbers of marked fish among those captured could be due to a variety of factors including: a portion of the marked fish remained below the culvert (e.g., did not migrate); marked fish may have migrated upstream past the 150 meter sampling reach above the road; or poor sampling efficiency as noted previously. However, in both streams, marked cutthroat and bull trout that had previously been released downstream of the arches were re-located upstream of the crossings, indicating that the designs effectively provided upstream passage for both species. Marked fish that were recaptured ranged in size from 70-215 mm, indicating that the flow conditions created by the new bottomless arches allowed upstream passage by a variety of sizes and age-classes.

Lodgepole Creek. In August 2013, a suspected fish barrier culvert was removed on the Road 73279 crossing of Lodgepole Creek (tributary to Meadow Creek). The removal was conducted as part of the Martin Sleeping Child Watershed Improvement Project. The first 100 m of Lodgepole Creek above the Road 73729 crossing was electrofished on three previous occasions in 2005, 2009, and 2014, but fish were never found above the crossing. The 100 m above the crossing was electrofished again in July 2020. This time, four westslope cutthroat trout were found above the crossing, indicating that removing the Road 73729 culvert allowed westslope to expand their upstream distribution in Lodgepole Creek.

2.5.4 Discussion

PIBO Metrics

The data in Table 2.5-3 suggests that fish habitat has improved across the Bitterroot National Forest since PIBO began monitoring in 2001. Of the ten metrics, five show statistically significant desired changes (habitat index score, bank stability, large woody debris, percent fines < 6 mm, and residual pool depth), four show non-significant changes (macroinvertebrates, percent undercut bank, d50 median particle size, and percent pools), and only one metric shows a statistically significant undesired change (bank angle).

Stream Temperatures

Stream temperatures are increasing across the Forest in response to the warming climate. Increases have been observed in all types of streams (big and small), and on all parts of the Forest (wilderness and managed, Montana and Idaho). Degree days have increased by 75 to 150 units in most streams since 1993, which roughly correlates to around a 1-2º C increase in the mean daily water temperature.

The decline of bull trout populations that has occurred in some streams since 2006 is related to stream temperature increases, as is the concurrent expansion of non-native competitors such as brown trout (*Salmo trutta*). The most vulnerable reaches occur at the lower elevations where the lower limit of bull trout distribution currently exists and overlaps with non-native trout competitors that are more numerous. If water temperatures continue to rise in future years, bull trout distribution will continue to shrink across the Bitterroot National Forest, with the populations at the lowest elevations disappearing

first. This declining trend is consistent with the findings of Isaak et al. 2015 (Climate Shield model). A couple of recent research projects conducted on the Forest also support this trend. Eby et al (2014) re-surveyed (with electrofishing) mid-1990's bull trout sites in the East Fork Bitterroot River drainage and found that over a 20-year period (1994-2014), site extirpations of bull trout exceeded site colonization's and were more frequent at warm, low elevation sites than at higher elevation sites. Lemoine et al (2020) re-surveyed (with electrofishing) a broader set of 280 sites across the Bitterroot River drainage and found that over a 20-year period (1993-2013), bull trout experienced a 9.2% (95% CI = 8.3% - 10.1%) reduction in site occupancy, mostly in the warmer, low elevation stream reaches.

Stream warming is likely a key factor driving the ongoing expansion of brown trout populations in the East Fork Bitterroot River, West Fork Bitterroot River, Sleeping Child Creek, Piquett Creek, and lower Camp Creek. A cursory comparison of our fish distribution and water temperature data indicates that brown trout are more likely to occur at higher numbers in stream reaches that accumulate more than 800 degree days per summer. However, brown trout will also attempt to invade and colonize colder waters when large populations occur in warmer waters downstream. This has been occurring in Daly and Meadow creeks in recent years. Both streams are suitably cold and are considered bull trout strongholds; however, low numbers of brown trout have been found in the lower reaches of both streams in recent years.

The most conservative climate models predict warming in the range of 1.6º C over the next 50 years, which could result in suitable bull trout habitat being reduced by 30-40% on the Forest. Some of the more aggressive models predict warming in the range of 6º C over the next 50 years, which could eliminate suitable bull trout habitat from all but the highest elevations of the Forest.

The USFS Rocky Mountain Research Station has developed a stream temperature model called the NorWeST model that predicts the probability of occupancy by juvenile bull trout in future decades over a range of climate scenarios (Isaak et al. 2017). The NorWeST model assumes that streams with a mean August temperature < 11º C have a high probability of providing suitable habitat for juvenile bull trout. Unfortunately, even under a moderate climate warming scenario, NorWeST predicts that by the year 2040 only a few headwater drainages on the Bitterroot National Forest will have > 75% probability of containing suitably cold water for juvenile bull trout. These cold patches of habitat are predicted to occur in the upper portions of the Burnt Fork, Daly, Skalkaho, Warm Springs, Blue Joint, Overwhich, Hughes, and upper West Fork Bitterroot River drainages. Notably, NorWeST predicts that large chunks of the Bitterroot National Forest such as the entire Idaho portion of the Forest and all of the westside canyon streams on the Montana portion of the Forest will be too warm to provide suitable habitat for juvenile bull trout in the year 2040 (Isaak et al. 2017).

The operation of reservoirs (Painted Rocks) and headwater wilderness dams (westside canyon streams) affects stream temperatures to varying degrees depending on the drainage. The influence is site specific because the dams vary in depth and operational procedures, and the amount of cold water influx from tributaries below the dams varies by drainage. The effect on downstream temperature is usually pronounced immediately below the dam, but may or may not be measurable a few miles downstream. In general, large reservoirs such as Painted Rocks have a greater influence on downstream temperatures than the small impoundments that occur on alpine lakes in the headwaters of the westside canyon streams.

The status/trend of stream temperatures on the Bitterroot National Forest is not progressing as desired because temperatures continue to increase. The rising temperatures are being driven by the climate, not by forest management practices. As a result, there is little the Forest can do other than maintain existing levels of shade and increase/maintain year-round access to cold water refugia habitats.

The Forest Plan does not specifically mention stream temperatures, but the maintenance of cold water suitable for native trout species is implied in the direction to maintain or enhance suitable habitat for native and desired aquatic species.

Aquatic Organism Passage at Road Crossings

The majority of the culvert replacements have been successful at eliminating barriers to aquatic organism passage. Success depends on five criteria: (1) the culvert is sized large enough to capture the bankfull width of the stream channel; (2) native material is present and stable throughout the culvert barrel; (3) there are no prohibitive drops on the culvert inlet and outlet; (4) the approach and exit grades of the stream channel near the culvert approximate the natural grade of the channel, with no formation of headcut barriers above and below the culvert; and (5) adequate surface flow (depth and volume) is maintained through the barrel at all discharges. When those five criteria are met, passage will be provided for aquatic species to the same extent as the unaltered stream sections in the area.

Where culverts have been ineffective or only partially effective, the main reasons have been: (1) undersizing the diameter of the culvert (this confines the channel and increases water velocities inside of the culvert, which flushes the substrate out of the barrel); (2) not installing the culvert deep enough into the streambed (this contributes to the flushing of substrate and the formation of vertical drops on the inlet and/or outlet); (3) not matching the grade of the culvert with the grade of the stream channel (this can cause the formation of headcut barriers); or (4) water flowing subsurface through the barrel at base flows (this is caused by not mixing enough fines into the substrate that is placed inside the barrel).

An important lesson we have learned while implementing aquatic passage culvert replacement projects on small streams is that a considerable amount of fines must be mixed into the substrate that is placed inside the culvert barrel. Otherwise, the water will flow subsurface through the barrel at base flows (i.e. the French drain effect), forming an impassable seasonal barrier that can last for as long as a decade. Eventually enough fines will get worked into the cracks in the substrate to keep enough water flowing on the surface of the stream bottom through the culvert barrel; however, this may take years to occur.

Aquatic organism passage projects are expensive. As a result, obtaining sufficient funding for survey, design, and contract award is a major bottleneck to implementing these projects on the Bitterroot National Forest.

2.5.5 Evaluation of Results for Adaptive Management Finding

Table 2.5- 7: Summary of findings for Plan Monitoring Item MON-AQT-01

PLAN IMPLEMENTATION STATUS[1]	CHANGE WARRANTED?	WHERE IS CHANGE WARRANTED?
(E) Yes The status/trend of the PIBO stream habitat metrics suggests that most of the metrics have improved or are being maintained. Statistically significant desired changes have occurred in five metrics: (1) habitat index score, (2) bank stability, (3) large woody debris, (4) percent surface fines < 6 mm, and (5) residual pool depth. Non-	YES	Management Activities: The current rate of eliminating aquatic passage barriers is slow (1 or 2 projects per year). At its current rate, it will take more than 50 years to eliminate all of the remaining aquatic passage barriers on the Forest. Funding is the limiting factor. In order to speed up the rate of eliminating passage barriers, the Forest

PLAN IMPLEMENTATION STATUS[1]	CHANGE WARRANTED?	WHERE IS CHANGE WARRANTED?
significant changes have occurred in four metrics (macroinvertebrates, percent undercut bank, d50 median particle size, and percent pools), and only one metric (bank angle) has shown a statistically significant undesired change. An overriding Forest Plan goal is to maintain or restore riparian and aquatic habitat. Overall, the PIBO data indicates progress toward goals and objectives of the Plan. The Forest Plan did not specifically mention aquatic passage barriers; however, eliminating man-made barriers to aquatic organism passage is consistent with the Forest Plan's goals to restore and enhance habitat for native and desired non-native aquatic species. The elimination of aquatic passage barriers is progressing, but slowly. Since 2000, 99 aquatic passage barriers (culverts) have been eliminated. However, there are still 71 culvert replacements or removals that have NEPA completed but have not been implemented. Funding shortages are the primary reason why progress has been slow. The eventual goal is to eliminate all the man-made fish passage barriers on the Forest.		should either divert more funds into AOP projects or do a better job of obtaining partner dollars from outside sources. Another option is to be more aggressive in removing culvert barriers (a relatively inexpensive technique), instead of spending large sums of money to replace culverts. The Forest is essentially powerless to reverse stream temperature warming caused by climate change. However, it can mitigate the harmful effects of rising stream temperatures by ensuring that its watersheds are in as healthy a condition as possible. To do so, Forest projects should emphasize eliminating all aquatic passage barriers, reducing road sediment sources, retaining all existing shade in riparian areas, and reducing the negative effects of non-native trout species

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

2.6 MON-AQT-02 – Aquatic species

2.6.1 Monitoring item summary

- *Monitoring question: What is the status and trend of native aquatic species?*

Table 2.6-1 lists forest and grassland plan goals and objectives, monitoring indicators, data sources and partners, the frequency of data collection and reporting, and any quantitative targets or thresholds related to this monitoring item. Table 2.6-2 lists the most recent and next dates for data collection and reporting for this monitoring item.

Table 2.6- 1: Forest plan components, monitoring indicators, data collection intervals, and data sources for MON-AQT-02.

Plan components	Indicators	Data collection interval	Data Source / Partner
See Below	Presence/Absence, Distribution, Abundance, Trend, and/or Genetic Status of: • Westslope Cutthroat Trout • Bull Trout • Anadromous Fish • Western Pearlshell Mussel • Native Amphibians • Macroinvertebrates • Other fish and aquatic species	Annual	Electro-shocking surveys Snorkel surveys (Idaho Fish & Game) Redd counts eDNA samples Pacfish Infish Biological Opinion (PIBO) Metrics (macroinvertebrates). Montana FWP, Montana Fisheries Information System (MFISH) (http://fwp.mt.gov/fishing/mFish/) Montana FWP, Angling Pressure Surveys (http://fwp.mt.gov/fishing/anglingData/anglingPressureSurveys/default.html) Montana FWP, Fish Stocking Plans and Reports (http://fwp.mt.gov/fishing/planAFishingTrip/fishStocking/default.html)

Plan Components:

Goals: Provide habitat to support viable populations of native and desirable non-native wildlife and fish. Maintain habitat for possible recovery…Maintain riparian flora, fauna, water quality… (p. II-3). Maintain or restore water quality…stream channel integrity, channel processes, and sediment regime…instream flows…natural timing and variability of the water table…diversity and productivity of native and desired non-native riparian plant communities…riparian vegetation…riparian and aquatic habitats necessary to foster unique genetic fish stocks…habitat to support populations of well-distributed native and desired non-native plant, vertebrate, and invertebrate populations (INFISH Decision Notice, pps. A-1 to A-2).

Objectives: Maintain habitat to support current populations of catchable trout. Maintain or enhance fish habitat by maintaining riparian habitat… Cooperate with state agencies… (p. II-5). Maintain or restore Riparian Management Objectives (RMOs). RMOs provide the criteria against which attainment or progress toward attainment of the riparian goals is measured (INFISH Decision Notice, pps. A-2 to A-3).

Standards: Numbers 7, 8, 10, 16. (p. II-19 through 21). INFISH standards RF-5, LH-1, LH-3, FW-1, and FW-4 (INFISH Decision Notice, pps. A-7 to A-13).

Table 2.6- 2: Monitoring collection and reporting dates for MON-AQT-02.

Milestone	Year
Data last collected or compiled in:	2020
Next scheduled data collection and compilation:	2021
Last monitoring evaluation report covering this monitoring item:	2016-2017
Next scheduled monitoring evaluation report covering this monitoring item:	2023

2.6.2 Methods

- Mark-recapture electrofishing estimates, single-pass presence-absence electrofishing surveys, snorkel surveys, eDNA sampling, and redd counts.
- Data is collected by Bitterroot National Forest, Montana Fish, Wildlife, and Parks (FWP), and Idaho Fish and Game (IDFG) fisheries biologists using common protocols, methods, and sample sites.
- Data collected in the Montana portion of the Forest is compiled in shared databases used by Bitterroot National Forest and FWP fisheries biologists. FWP biologists manage the databases. Snorkel survey data collected in the Idaho portion of the Forest is compiled and managed by IDFG.

2.6.3 Results

Indicator: Presence/Absence, Distribution, Abundance, Trend, and/or Genetic Status

Westslope Cutthroat Trout and Bull Trout

The 1987 Forest Plan recommends monitoring fish populations in six streams annually to move towards Forest Plan objectives. Forest biologists, working in cooperation with FWP biologists, typically monitor fish populations with mark/recapture estimates in 10-15 streams per year. In 2018-20, the number of mark/recapture estimates conducted was nine (2017), 11 (2019), and 15 (2020)

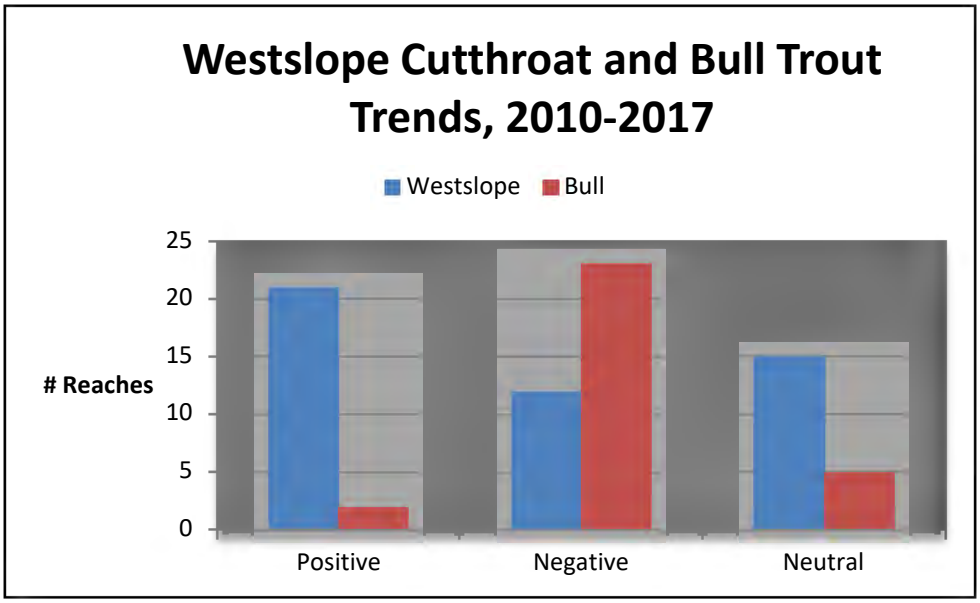
At each monitoring reach, we have set a goal of monitoring the fish populations (using mark/recapture estimates) for at least three years to develop a baseline for assessing future trends. This “pulsed” monitoring technique is necessary for assessing long-term changes in fish populations (Bryant, 1995). Complete methods are described in Clancy (1998). At present, there are 86 monitoring reaches on or adjacent to the Bitterroot National Forest with at least three years of mark/recapture fish population estimates. Westslope cutthroat trout estimates are available in nearly all of the 86 reaches, while bull trout estimates are less available due to the smaller distribution and lower density of the species.

The 1987 Forest Plan identified the following fish population viability thresholds of concern: a decline in aquatic habitat quality and/or fish populations for more than one year (Item 21); and a 10% decline in westslope cutthroat trout numbers (Item 41). Research and analysis of fish populations over the past three decades has shown that these thresholds of concern are too narrow because fish populations commonly vary annually by more than 10% under natural conditions. We have learned that the only way to define the upper and lower bounds of the natural variation in fish populations is through numerous years of population monitoring.

Between 2010 and 2017, Forest and MFWP biologists sampled 48 fish population monitoring reaches where enough westslope cutthroat trout were captured to calculate a statistically valid population estimate and there were enough years of population estimates to consider the site “long-term”.

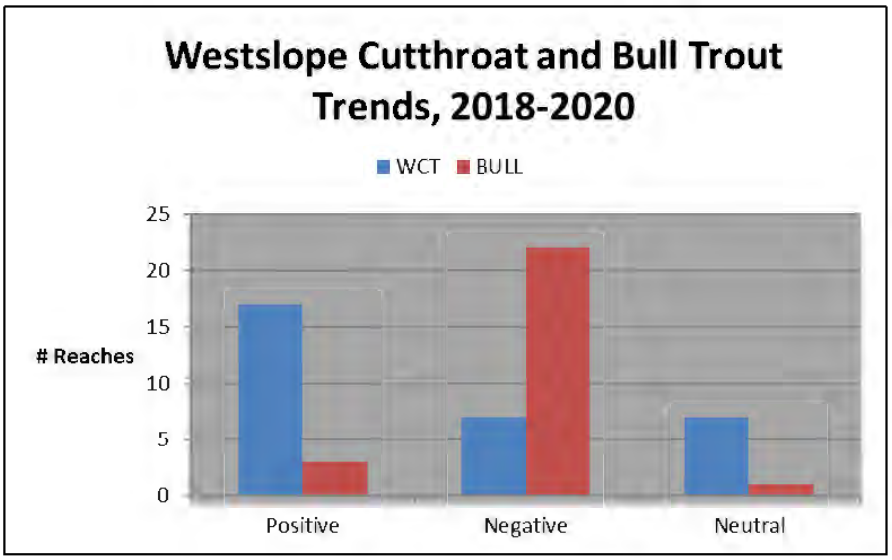
Westslope cutthroat trout numbers were up by more than 10% of the long-term average in 21 reaches, within 10% of the long-term average in 15 reaches, and down by more than 10% of the long-term average in 12 reaches (Figure 1). For bull trout, there were 30 reaches sampled between 2010 and 2017 that either had estimable bull trout populations or a long-term data set that allowed comparison of catch per unit effort. Bull trout population trends were positive in two reaches, neutral in five reaches, and negative (declining) in 23 reaches (Figure 10).

Figure 10: Westslope Cutthroat Trout and Bull Trout Population Trends on or near the Bitterroot National Forest between 2010 and 2017



A similar comparison was conducted for the time period 2018-20. In those three years, 31 fish population monitoring reaches were sampled where enough westslope cutthroat trout were captured to calculate a statistically valid population estimate and there were enough years of population estimates to consider the site "long-term". Westslope cutthroat trout numbers were up by more than 10% of the long-term average in 17 reaches, within 10% of the long-term average in seven reaches, and down by more than 10% of the long-term average in seven reaches (Figure 2). For bull trout, there were 26 reaches sampled in 2018-20 that either had estimable bull trout populations or a long-term data set that allowed comparison of catch per unit effort. Bull trout population trends were positive in three reaches, neutral in one reach, and negative (declining) in 22 reaches (Figure 11).

Figure 11: Westslope Cutthroat Trout and Bull Trout Population Trends on or near the Bitterroot National Forest between 2018 and 2020



This data in Figures 10 and 11 suggests a stable trend for westslope cutthroat trout populations and a declining trend for bull trout populations.

The majority (60 of 79) of westslope cutthroat trout populations that were sampled between 2010 and 2020 were either higher or within their long-term average (Figures 1 and 2). An estimated 63% of the westslope cutthroat trout populations that have been tested on the Forest are genetically unaltered. Despite the presence of healthy populations in most Forest tributaries, the overall viability of westslope cutthroat trout in the Bitterroot River basin is considered to be "depressed", primarily because of the habitat fragmentation that occurs on private land between the Bitterroot River and its tributaries, and the reduced numbers of migratory adult fish in the river. A key problem is the lack of year-round connectivity between the Bitterroot River and its spawning and rearing tributaries on the east and west sides of the valley. Considerable efforts and funds have been expended to screen irrigation ditches, eliminate fish passage barriers, and secure instream flows in Skalkaho Creek, a key spawning and rearing tributary near Hamilton. Monitoring data collected since the installation of three fish screens and two siphons on Skalkaho Creek indicates that the response by the westslope cutthroat trout population has been less than hoped for.

Bull trout populations are declining in most streams on the Forest, and the data in Figures 1 and 2 support this assertion. At best, bull trout population trends may be neutral in a few of the stronghold streams such as Skalkaho and Daly creeks. Along with the decline in bull trout has been a concurrent expansion of brown trout populations. Since about 2000, brown trout populations have expanded their numbers and distributions in the East Fork Bitterroot River, West Fork Bitterroot River, Camp Creek (Figure 5), Piquett Creek, and most strikingly in Sleeping Child Creek (Figure 4). Pioneering brown trout individuals have also been found in several tributaries to the East and West Fork Bitterroot Rivers for the first time in recent years. The nature of interaction between brown trout and bull trout is complex. Bull trout are declining while brown trout are expanding, but the evidence does not indicate that displacement is the mechanism driving the changes. Warming stream temperatures (from climate and fire) are believed to be a key mechanism.

In 2017-19, Forest and MFWP fisheries biologists completed the first chemical fish removal project ever conducted in the Bitterroot River drainage. The project was called the Upper Overwhich Fish

Removal, and its goal was to remove all of the fish in the Overwhich Creek watershed upstream of Overwhich Falls. The portion of the watershed above the falls is believed to be historically fishless, but prior to treatment, about five miles of streams were occupied by Yellowstone cutthroat trout (a non-native) that originated from past stockings. The Yellowstone cutthroat were a threat to the genetically purity of the native westslope cutthroat that occur below the falls. Yellowstone cutthroat were periodically washing over the falls and interbreeding with the westslope cutthroat below the falls. Fisheries staff along with about a dozen volunteers applied rotenone via drip stations for 3-4 days over three consecutive Augusts (2017, 2018, and 2019). Three treatments were necessary to kill (we believe) all of the fish above the falls. No live or dead fish were visually observed during and following the third treatment in August 2019. The native westslope cutthroat trout and bull trout that occur below Overwhich Falls were protected by detoxifying the rotenone as it went over the falls. Fish monitoring in sentinel cages below the falls during the rotenone treatments detected no signs of rotenone poisoning. Fisheries staff conducted eDNA sampling at a dozen sites above the falls in August 2020 to confirm/refute our suspicion that all of the fish were killed above the falls. The eDNA samples are currently being analyzed at the laboratory and results are not available at the time of this report.

Counting bull trout redds in designated monitoring reaches is another way to monitor the trend of bull trout populations. Starting in 1994, Forest and MFWP biologists have annually counted bull trout redds in three designated monitoring reaches: (1) Meadow Creek on the Sula Ranger District; (2) Deer Creek on the West Fork Ranger District; and (3) Daly Creek on the Darby Ranger District. Two other monitoring reaches (East Fork Bitterroot River on the Sula Ranger District and Chicken Creek on the West Fork Ranger District) have been counted in a few years. Figure 12 and Table 2.6-3 display the number of bull trout redds counted in the Meadow Creek, Deer Creek, Daly Creek, Chicken Creek, and East Fork Bitterroot River monitoring reaches.

Figure 12: Number of Bull Trout Redds Counted, 1994 to 2020

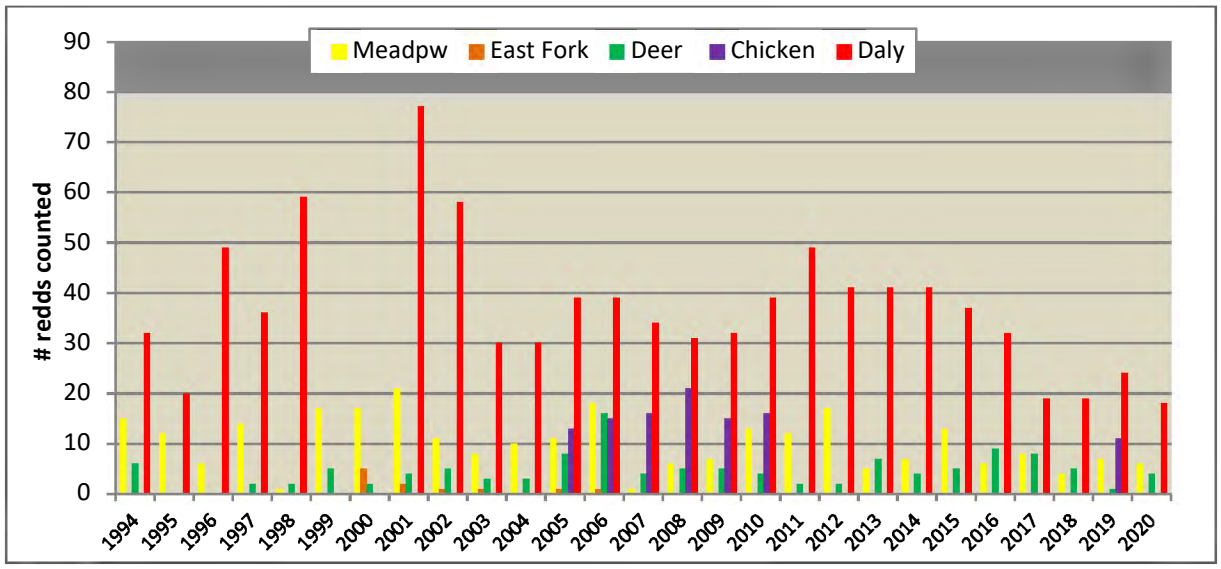


Table 2.6- 3: Number of Bull Trout Redds Counted, 1994 to 2020

Year	Daly Creek (D2)	Meadow Creek (D3)	East Fork Bitt River	Deer Creek (D4)	Chicken Creek (D4)
1994	32	15	Not surveyed	6	Not surveyed
1995	20	12	Not surveyed	0	Not surveyed
1996	49	6	Not surveyed	0	Not surveyed
1997	36	14	Not surveyed	2	Not surveyed
1998	59	1	Not surveyed	2	Not surveyed
1999	Not surveyed	17	Not surveyed	5	Not surveyed
2000	Not surveyed	17	5	2	Not surveyed
2001	77	21	2	4	Not surveyed
2002	58	11	1	5	Not surveyed
2003	30	8	1	3	Not surveyed
2004	30	10	0	3	Not surveyed
2005	39	11	1	8	13
2006	39	18	1	16	15
2007	34	1	0	4	16
2008	31	6	Not surveyed	5	21
2009	32	7	Not surveyed	5	15
2010	39	13	Not surveyed	4	16
2011	49	12	Not surveyed	2	Not surveyed
2012	41	17	Not surveyed	2	Not surveyed
2013	41	5	Not surveyed	7	Not surveyed
2014	41	7	Not surveyed	4	Not surveyed
2015	37	13	Not surveyed	5	Not surveyed
2016	32	6	Not surveyed	9	Not surveyed
2017	19	8	Not surveyed	8	Not surveyed
2018	19	4	Not surveyed	5	Not surveyed
2019	24	7	Not surveyed	1	11
2020	18	6	Not surveyed	4	Not surveyed

Overall, the redd count data has been inconclusive. Except for Daly Creek where redd numbers are higher, the rest of the reaches have fluctuated at low numbers of generally < 10 redds per year (Figure 12, Table 2.6-3). Meadow Creek contains the most years of mark-recapture population estimates and the best fish population monitoring data, but the correlation between the number of redds counted and the number of juvenile bull trout captured in the mark-recapture estimates is not very strong. Since 2013, redd counts have been lower than they were in previous years, and the number of juvenile bull trout captured in the last mark-recapture survey in Meadow Creek (2019) was considerably lower than previous years. In Deer Creek, bull trout are outnumbered by brook trout, and hybrids are present, so we cannot say for certainty what species of fish is making the low numbers of redds we count. The same is true for Chicken Creek where the vast majority of the redds we have counted were likely made by brook trout.

In summary, counting redds is not a reliable method for monitoring bull trout population trends on the Bitterroot NF. Redds made by resident bull trout, which make up the vast majority of bull trout on the Forest, are small and difficult to discern. Factor in the presence of brook trout and hybrids in some

streams and the situation gets really murky. Also, because of the difficulty in identifying small redds, the amount of bias that occurs when different surveyors count redds could be greater than the actual difference in the number of redds that are present from year to year. Finally, we may be looking in the wrong places (e.g. what we think is good bull trout spawning habitat is not what most of the bull trout are using for spawning), or looking in the right places but unable to identify the redds that are present (the more likely scenario). Daly Creek is the best and most repeatable redd count reach that we currently have on the Forest – brook trout are not present and the redds are easier to see because of the darker color of the stream bottom. However, even in Daly Creek the number of redds has shown a lot of variability over the years (Figure 12). It is unknown how much of this variability is attributable to actual change or to observer bias.

Anadromous Fish

Four anadromous fish species are known or suspected to occur in the Bitterroot NF portions of the Salmon and Selway river drainages. These species are:

1. Snake River Steelhead (ESA threatened species)
2. Snake River Spring Chinook Salmon (ESA threatened species in the Salmon River drainage; USFS Region One sensitive species in the Selway River drainage)
3. Snake River Sockeye Salmon (ESA endangered species – only occurs in the Salmon River)
4. Pacific Lamprey (USFS Region One sensitive species in the Selway River drainage)

Snake River Steelhead. Historically, the Salmon and Selway river drainages were major producers of summer steelhead trout. At present, steelhead are still widely distributed throughout both drainages, but at numbers that are much lower than historic conditions. In most subwatersheds, the status of the steelhead populations is considered to be “depressed” (Selway) or “functioning at risk” (Salmon). Most of the steelhead that migrate into the Bitterroot NF portions of the Salmon and Selway river drainages are hatchery fish. Wild steelhead that are not of hatchery origin are very uncommon.

Snake River Spring Chinook Salmon. The spring chinook salmon in the Salmon and Selway river drainages consist of a mix of hatchery fish and wild naturalized fish of hatchery origin. The present distribution of spring chinook salmon is much reduced when compared to historic conditions, and numbers are severely depressed. Considerable declines have occurred since the 1960’s. Key factors to the decline of spring chinook salmon include predation and competition from introduced fish, blocked access to historical habitat, passage mortality at main stem dams on the Columbia and Snake rivers, habitat degradation, hatchery interactions, and overharvest.

Snake River Sockeye Salmon. Historically, sockeye salmon used the Salmon River as a migratory corridor to access spawning and rearing lakes within the Stanley Basin/Sawtooth Valley area. Sockeye salmon are believed to be historically absent from the Selway River drainage. Snake River sockeye salmon have declined dramatically as a result of fishery management policy, overharvest, hydropower-caused mortality, and irrigation water withdrawals. Population declines have been attributed primarily, however, to main stem dams on the Columbia and Snake rivers that have blocked access to spawning and rearing areas and caused high mortalities to outmigrants. A hatchery-based captive brood stock program on the upper Salmon River has been in operation since 1984 in an attempt to prevent extinction of the Snake River sockeye salmon. The only sockeye salmon habitat on the Bitterroot NF is the Salmon River which is used as a migratory corridor. There is no spawning or rearing habitat on the Forest. The overall status of the species is considered to be “functioning at unacceptable risk”, with high potential for extinction.

Pacific Lamprey. Historically, Pacific lamprey may have had a distribution in the Salmon and Selway river drainages similar to that of salmon and steelhead. The current distribution and abundance of Pacific lamprey in the Salmon and Selway river drainages is severely reduced, and the number of lamprey entering Idaho appears to be in a precipitous decline. Adult lamprey have poor success swimming upstream past the dams on the Columbia and Snake rivers. Low numbers of lamprey ammocoetes and macrothalmia are known to occur in portions of the Salmon and lower Selway rivers. On the Bitterroot NF, the nearest confirmed sighting of Pacific lamprey was in the Selway River near the Bitterroot/Nez Perce NF boundary.

Bitterroot NF fisheries biologists only conducted one presence/absence survey (single pass electrofishing) in the Salmon or Selway river drainages in 2018-20, and that was on Scimitar Creek in 2020. Scimitar Creek is a very small tributary to Deep Creek. Prior to the Gold Pan fire debris flows in August 2014, Scimitar Creek contained a small population of westslope cutthroat trout. The debris flows killed all of the fish in Scimitar Creek. Surveys conducted since then, including the 2020 survey, have failed to find any fish in Scimitar Creek.

On the Bitterroot NF, IDFG fisheries biologists annually monitor fish presence/absence and relative abundance in 16 long-term monitoring transects in the Selway River and some of its larger tributaries. The transects range in length from 42 m to 173 m, and in width from 7 m to 43 m. The method of sampling is single-pass snorkeling with 1 or 2 swimmers. The monitoring transects are located on the Selway River (7), Deep Creek (2), Little Clearwater River (2), Whitecap Creek (3), and Running Creek (2).

Tables 2.6-4 and 2.6-5 display the results of the 2018 and 2019 IDFG snorkel surveys. Surveys were not conducted in 2020 because of COVID.

Table 2.6- 4: Results of 2018 IDFG Snorkel Surveys (# fish observed)

Reach	Steelhead	Bull trout	Chinook salmon	Westslope cutthroat	Mountain whitefish
Selway River @ Hells Half	6	0	5	6	14
Selway River @ Magruder	20	0	19	26	25
Selway River @ Beaver Point	1	1	52	16	11
Selway River @ Little	17	1	28	16	19
Selway River @ Bad Luck Cr	2	0	0	20	18
Selway River @ Running Cr	7	0	12	12	6
Selway River @ North Star Cr	2	0	0	25	40
Deep Creek (Cactus)	30	0	0	18	0
Deep Creek (Scimitar)	33	1	0	9	0
Little Clearwater River #1	7	0	2	3	4
Little Clearwater River #2	16	0	0	9	0
Whitecap Creek #1	50	0	0	7	17
Whitecap Creek #2	30	0	0	4	4
Whitecap Creek #3	4	0	0	4	1
Running Creek #1	7	0	1	11	0
Running Creek #2	8	0	0	0	0

Table 2.6- 5: Results of 2019 IDFG Snorkel Surveys (# fish observed)

Reach	Steelhead	Bull trout	Chinook salmon	Westslope cutthroat	Mountain whitefish
Selway River @ Hells Half Acre Cr	3	0	3	5	13
Selway River @ Magruder Crossing	11	0	2	22	18
Selway River @ Beaver Point	9	0	56	16	10
Selway River @ Little Clearwater	13	0	36	18	27
Selway River @ Bad Luck Cr	No data	No data	No data	No data	No data
Selway River @ Running Cr	No data	No data	No data	No data	No data
Selway River @ North Star Cr	No data	No data	No data	No data	No data
Deep Creek (Cactus)	22	0	6	19	0
Deep Creek (Scimitar)	9	0	0	11	0
Little Clearwater River #1	11	0	0	5	2
Little Clearwater River #2	7	0	0	10	3
Whitecap Creek #1	22	0	2	10	13
Whitecap Creek #2	15	0	0	16	3
Whitecap Creek #3	4	0	0	5	1
Running Creek #1	No data	No data	No data	No data	No data
Running Creek #2	No data	No data	No data	No data	No data

No data = not surveyed in 2019

Steelhead (juveniles) were detected in every reach that was surveyed in 2018 and 2019. Numbers varied widely. The highest numbers were found in the two Deep Creek reaches and the lower two reaches in Whitecap Creek. Overall. fewer steelhead are observed now than they were in the 1980's when the snorkel monitoring first began.

The distribution of westslope cutthroat trout generally overlaps that of steelhead. Westslope were detected in every reach but one (Running Creek #2 in 2018), usually at numbers similar to those of steelhead. Westslope numbers appear to be stable.

Mountain whitefish are widely distributed throughout the Selway River and the lower ends of its larger tributaries. Whitefish were detected in every reach except for those in Deep and Running creeks. Whitefish numbers appear to be stable.

The chinook salmon in the snorkel reaches were predominantly age 0 young-of-the-year fish with a low numbers of age 1 juveniles mixed in. Chinook salmon were most frequently observed in the Selway River in the Beaver Point and Little Clearwater reaches. Lower numbers were seen in the Selway River above and below those reaches. At least a few chinook salmon were observed in most of the Selway River reaches that were surveyed in 2018 and 2019. Chinook salmon were uncommon in the tributary reaches (Little Clearwater River, Deep, Whitecap, and Running creeks). Overall, fewer chinook salmon are observed now then they were in the 1980's when the snorkel monitoring first began.

Only three bull trout were observed in 2018, and none were observed in 2019. The lack of bull trout sightings is not surprising given the sampling method (single-pass snorkeling). Bull trout are a cryptic species that usually occur at low densities. They tend to be undercounted by snorkeling because of their preference for hiding in large woody debris jams or the interstitial spaces between/under boulder

substrates. Too few bull trout have been observed over the years to discern a trend in the snorkel reaches.

Western Pearlshell Mussel

The western pearlshell mussel was added to the Bitterroot National Forest's sensitive species list in 2010. It is the only native mussel that occurs west of the Continental Divide in Montana. The preferred habitat is cool to cold water running streams with stable pebble and gravel substrates and low to moderate gradients (1-2%). These types of streams are generally equivalent to the Rosgen C4 channel type. Western pearlshell mussels appear to be declining in many watersheds across western Montana (Stagliano, 2010, 2015).

Since 2007, limited and sporadic mussel surveys have been conducted in Bitterroot NF streams. So far, western pearlshell mussels have only been found in six streams on or near the Bitterroot NF. The six streams are:

1. Cameron Creek (mouth to upper end of Shining Mountain Ranch)
2. Little Sleeping Child Creek (lower reaches downstream of private ponds)
3. East Fork Bitterroot River (near mouths of Laird and Cameron creeks)
4. West Fork Bitterroot River (Conner Cutoff Road to FR 5644 bridge - eDNA)
5. Bitterroot River (near Darby)
6. Selway River (near Running Creek)

The viability of the western pearlshell mussel populations in Cameron Creek and Little Sleeping Child Creek are rated as "good/fair", while the populations in the East and West Forks of the Bitterroot River are rated as having "poor" viability (Stagliano, 2015). The viability of the Bitterroot River population is rated as "fair/poor" (Stagliano, 2015). The Selway River population is not included in Stagliano's reports (2010, 2015), but is the healthiest population on the Bitterroot NF.

The status and trend of western pearlshell mussels on the Bitterroot NF is unknown. Mussels have only been found in a few streams on the Forest, and where sizeable populations exist (Cameron Creek, Little Sleeping Child Creek), the mussels are residing in habitat that is degraded (elevated water temperatures and sediment levels), at least by salmonid standards. If our survey methods are reasonably accurate, then mussels do not occupy many streams on the Montana portion of the Forest.

Prior to 2019, the only way to survey for the presence of western pearlshell mussels was with snorkeling or a plexiglass-bottomed bucket. The mussels tend to be cryptic and difficult to see, and neither method was very reliable. In 2019, a much more powerful new technology became available for detecting the presence of western pearlshell mussels. That technology is called environmental DNA (eDNA), and it involves pumping five liters of stream water through a very fine filter and then analyzing the filter for fragments of DNA that are specific only to the western pearlshell mussel.

In November 2019, eDNA samples were collected from 13 sites on the West Fork Bitterroot River and some of its tributaries. The collection sites are listed below in Table 2.6-6, along with the results of the laboratory analysis that was conducted by the Rocky Mountain Research Station's National Genomics Center for Wildlife and Fish Conservation (Missoula, MT).

Table 2.6- 6: Western Pearlshell Mussel eDNA Collection Sites and Results, November 2019

Stream	Location	Mussels Detected?
West Fork Bitterroot River	WW White boat launch	Yes
West Fork Bitterroot River	Job Corps boat launch	Yes
West Fork Bitterroot River	FR 49 bridge	Yes
West Fork Bitterroot River	Applebury boat launch	Yes
West Fork Bitterroot River	Canoe boat lauch	Yes
West Fork Bitterroot River	Marti's Bridge boat launch	No
West Fork Bitterroot River	Bonnie Blue boat launch	Yes
Nez Perce Fork	Above mouth of Nelson Creek	No
Nez Perce Fork	FR 732 bridge	No
Nez Perce Fork	FR 5644 bridge	No
Little West Fork	FR 468 bridge	No
Blue Joint Creek	FR 5656 bridge	No
Piquett Creek	FR 49 bridge	No

Analysis of the eDNA samples was conducted in April, 2020 by the Rocky Mountain Research Station's National Genomics Center for Wildlife and Fish Conservation, which is located on the University of Montana campus in Missoula, MT. The analysis detected western pearlshell mussels at six of the seven sample sites in the West Fork Bitterroot River (Table 2.6-6), but did not detect mussels in any of the tributaries that were sampled. The eDNA data indicates that western pearlshell mussels are widely distributed throughout the West Fork Bitterroot River below Painted Rocks Dam, but are absent in the Nez Perce Fork, the Little West Fork, Blue Joint Creek, and Piquett Creek. Interestingly, 20+ years of fisheries surveys in the West Fork Bitterroot River have failed to detect even one live mussel or shell fragments. The only sighting of a specimen (a live mussel) occurred in 2008 by an angler at the Applebury boat launch.

Only a limited number of samples (about 30) were collected and analyzed during 2018-20. Although the results were very helpful in identifying western pearlshell mussel presence/absence in select locations for specific projects, a broader sampling scheme applied across the entire Forest would be extremely helpful to answer the monitoring question for mussels and amphibians.

Native Amphibians

There are six species of native amphibians that are known or suspected to occur on the Bitterroot NF. Those are:

- Columbia spotted frog (*Rana luteiventris*)
- Tailed frog (*Ascaphus truei*)
- Western toad (*Bufo boreas*)
- Long-toed salamander (*Ambystoma macrodactylum*)
- Idaho giant salamander (*Dicamptoden aterrimus*)
- Couer d'Alene salamander (*Plethodon idahoensis*)

The presence of these species is noted during fish surveys, but we do not survey for them, nor do we have data on their status or trend. From most frequently seen to least frequently seen, the amphibian species rank as (1) tailed frog; (2) Columbia spotted frog; (3) western toad; (4) long-toed salamander; (5) Idaho giant salamander; and (6) Couer d'Alene salamander.

Macro-invertebrates

Macro-invertebrates are sampled by PIBO crews during their effectiveness monitoring surveys. The PIBO data is the only macro-invertebrate data that is currently being collected on the Bitterroot NF. The PIBO crews sample macro-invertebrates using the protocol recommended by the Center for Monitoring and Assessment of Freshwater Ecosystems, Utah State University (Hawkins et al. 2000). Macro-invertebrates are sampled from eight fast-water habitats per site and combined into a composite sample. Macro-invertebrate taxa are identified by the Bureau of Land Management/Utah State University National Aquatic Monitoring Center in Logan, Utah.

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 described in Hawkins et al. 2000. 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 of 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 references 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 2.6-7 summarizes the current trend in O/E scores on the Bitterroot NF.

Table 2.6- 7: Trend in O/E Scores

Metric	Time1 Value	Time2 Value	Percent Change	Sample Size	Negative Number	Positive Number	No Change Number	P-value	Desired Direction	Actual Change
O/E	0.95	0.99	3.9	21	10	11	0	0.741	+	NS

Time1 is the mean value that was measured in the first sampling visit; Time2 is the mean value that was measured in the most recent (last) sampling visit. Percent Change is the percent change in mean values between the first and last visits. Sample Size is the number of observations with repeat visits. Negative Number is the number of sites where the measurement was lower on the last visit. Positive Number is the number of sites where the measurement was higher on the last visit. No Change Number is the number of sites where the last and first visit values were equal. P-value = Significance test. Desired Direction is the direction of change in the mean value, which can be either positive (+) or negative (-). Actual Change is the actual direction of change in the mean value, which can be not statistically significant (NS), positively statistically significant (+) or negatively statistically significant (-).

O/E scores have shown a mostly positive, but not statistically significant trend on the Bitterroot NF.

Other fish and aquatic species

Three non-native trout species (brown trout, *Salmo trutta*, rainbow trout, *Oncorhynchus mykiss*, and brook trout, *Salvelinus fontinalis*) dominate the fish communities of the Bitterroot River, the East and West Forks of the Bitterroot River, and the private land portions of streams. This has been the case for at least the last half century. When the Forest Plan was written in 1987, Forest and FWP biologists considered brook trout to be the biggest threat to native bull trout and westslope cutthroat trout populations. In recent years, however, our thinking has changed. Brown trout are now considered to be the primary threat. Brown trout have been increasing their numbers and upstream distribution in Forest stream reaches in the post-2000 fires era, and probably pose a greater long-term threat to the viability

of native trout populations (particularly bull trout) than brook trout do. Warming water temperatures are suspected to be the mechanism fueling the expansion of brown trout populations. Two streams in particular (Sleeping Child Creek, Figure 13; and Camp Creek, Figure 14) have experienced substantial increases in brown trout since the 2000 fires.

Figure 13: Number of bull trout, brook trout, and brown trout in Sleeping Child Creek near the Sleeping Child Hot Springs.

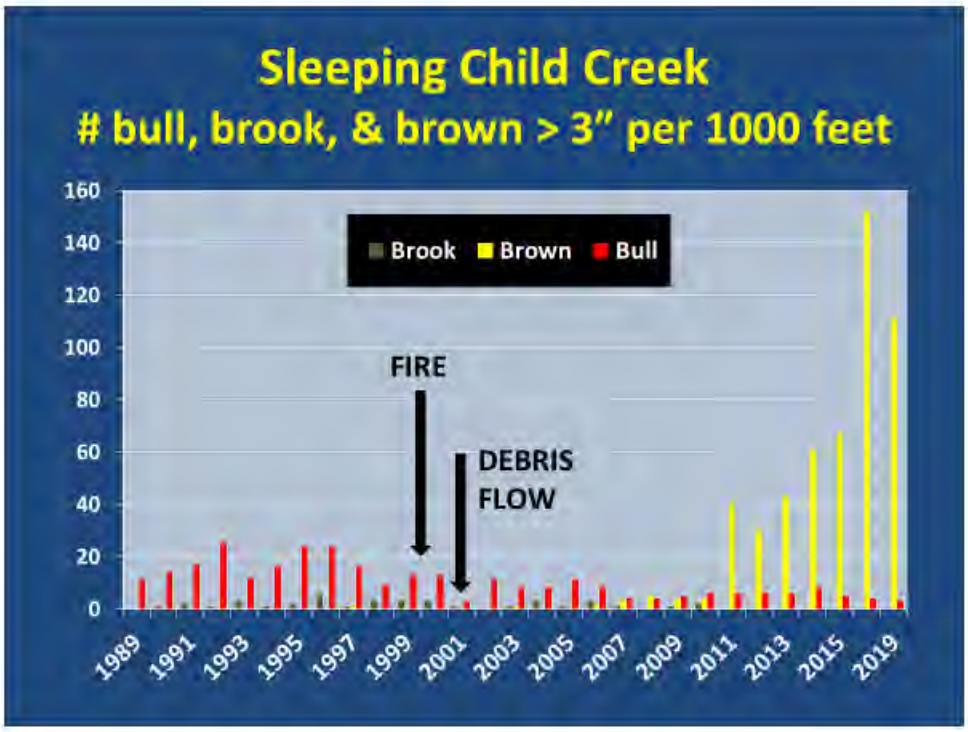
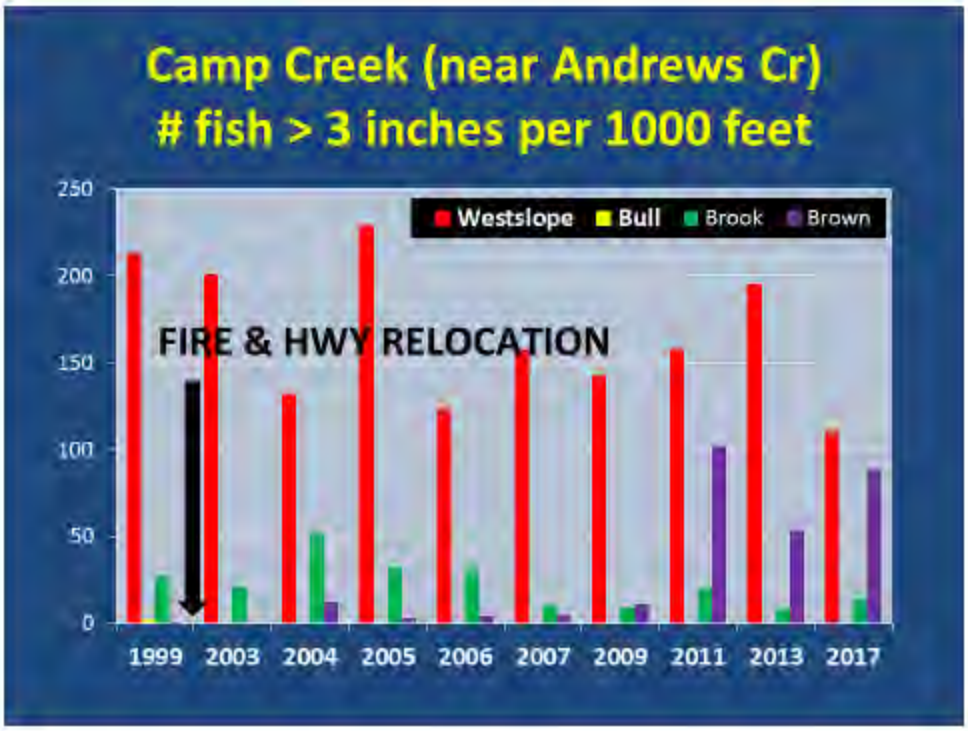


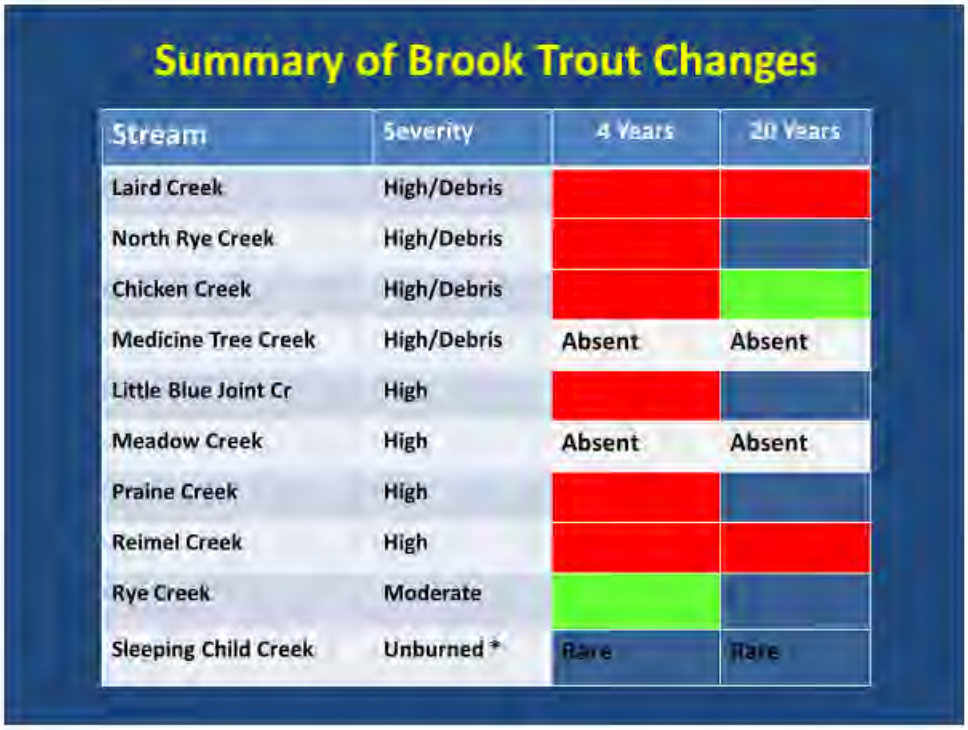
Figure 14: Number of westslope cutthroat trout, bull trout, brook trout, and brown trout in Camp Creek near Andrews Creek.



The current distribution and abundance of brook trout on the Bitterroot NF has not substantially changed over the past 30 years. The 2000 fires severely and temporarily reduced the number of brook trout in nearly all of the streams that were burned at high severity, and those populations remained suppressed for over a decade before they began to recover back to their pre-fire levels. By 2020, Laird and Reimel creeks are the only severely burned streams with brook trout populations that are still well below their pre-2000 fire level. Brook trout populations have recovered back to near their pre-fire level in Rye, North Rye, Little Blue Joint, Praine, and Sleeping Child creeks, and are now higher than their pre-fire level in Chicken Creek. Ironically, habitat quality in the severely burned streams has markedly improved (much more large wood, pools, and complex hiding cover, and less sediment) over the past 20 years with the exception of water temperatures, which are gradually getting cooler as riparian shade cover gets denser. Apparently, brook trout are not well suited for the highly unstable streamflow and channel changes that occur during the first decade following a severe burn. They do not exhibit the rapid post-fire recovery that westslope cutthroat trout do.

Figure 15 summarizes the changes that have occurred in brook trout populations since the 2000 fires. The column labeled “4 Years” denotes the condition of the brook trout populations in 2004. The column labeled “20 Years” denotes the condition of the populations in 2020. A red-colored cell indicates population numbers are lower than pre-fire levels. A blue-colored cell indicates numbers are similar to pre-fire levels. A green-colored cell indicates numbers are higher than pre-fire levels. The monitoring reach in Sleeping Child Creek was unburned, but there was a large amount of severely burned acreage (with multiple large debris flows) located a short distance upstream of the monitoring reach.

Figure 15: Comparison of brook trout populations in streams burned by the 2000 fires at 4 years post-fire (2004) and 20 years post-fire (2020).



Rainbow trout primarily occur in the Bitterroot River, the West Fork Bitterroot River below Painted Rocks Dam, and the East Fork Bitterroot River below Tolan Creek. They are locally common in the lower ends of the larger tributaries on private land on the valley floor, but they generally do not occur on the Forest with the exception of the portions of the East and West Forks described above.

2.6.4 Discussion

See above section.

2.6.5 Evaluation of Results for Adaptive Management Finding

Table 2.6- 8: Summary of findings for Plan Monitoring Item MON-AQT-02

PLAN IMPLEMENTATION STATUS[1]	CHANGE WARRANTED?	WHERE IS CHANGE WARRANTED?
(D) No, though results indicate that habitat for westslope cutthroat trout are being provided; data also suggest that bull trout, steelhead, chinook salmon, and Pacific lamprey habitat are not moving towards goals and objectives due to influences from increased stream temperatures, non-native trout, and downstream impacts of fish hatcheries. Additionally, there is	Yes.	Monitoring plan: Broaden sampling scheme applied ac ross the entire Forest for eDNA sampling would provide increased data set needed to evaluate mussels and amphibians. Management Activities: To the degree possible, recommend the Forest work with FWP to maintain instream flows and

PLAN IMPLEMENTATION STATUS[1]	CHANGE WARRANTED?	WHERE IS CHANGE WARRANTED?
uncertainty if habitat is being provided for amphibians and western pearlshell mussels due to lack of robust data.		reduce the number and distribution of non-native trout species, particularly brown trout. These would be the most beneficial types of actions to improve the viability of native trout populations on the Montana portion of the Forest. An example of the type of project that could be more broadly applied is the Upper Overwhich Fish Removal project, which was conducted in 2017-19. In that project, Forest and FWP fisheries staff removed Yellowstone cutthroat trout from the upper portion of the Overwhich Creek watershed using the piscicide rotenone. It was the first chemical removal project completed in the Bitterroot River drainage Management Activities: For the anadromous species (steelhead, chinook salmon, and Pacific lamprey), there is not much the Forest can do to help these species other than reduce man-made sediment inputs to the Selway River and its tributaries. The decline of the anadromous fish species is largely due to major downstream issues (dams and hatcheries) associated with the Columbia River hydropower system. If the fish are able to make it to the Bitterroot NF, their habitat is nearly all wilderness and is generally in reference condition.

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

2.7 MON-AQT-03 – Riparian areas

2.7.1 Monitoring item summary

- *Monitoring question: What is the condition of riparian areas following management activities?*

Table 2.7-1 lists forest and grassland plan goals and objectives, monitoring indicators, data sources and partners, the frequency of data collection and reporting, and any quantitative targets or thresholds related to this monitoring item. Table 2.7-2 lists the most recent and next dates for data collection and reporting for this monitoring item.

Table 2.7- 1: Forest plan components, monitoring indicators, data collection intervals, and data sources for MON-AQT-03. RHCA = Riparian Habitat Conservation Area

Plan components	Indicators	Data collection interval	Data Source / Partner
Goals: Maintain riparian flora, fauna, water quality and recreation activities. (p. II-3). Maintain or restore water quality…stream channel integrity, channel processes, and sediment regime…instream flows…natural timing and variability of the water table…diversity and productivity of native and desired non-native riparian plant communities…riparian vegetation…habitat to support populations of well-distributed native and desired non-native plant, vertebrate, and invertebrate populations (INFISH Decision Notice, pps. A-1 to A-2). **Objectives:** Manage riparian areas to prevent adverse effects on channel stability and fish habitat. (p. II-6). Maintain or restore Riparian Management Objectives (RMOs). RMOs provide the criteria against which attainment or progress toward attainment of the riparian goals is measured (INFISH Decision Notice, pps. A-2 to A-3). **Standards, Roads in Riparian:** Long list of items related to road construction and maintenance and riparian health. (BRT II-20 #8 and II-5) (p. II-32 and 33). INFISH standards TM-1, RF-1, RF-2, RF-3, RF-4, RF-5, GM-1, GM-2, GM-3, GM-4, RM-1, RM-2, RM-3, MM-1, MM-2, MM-3, MM-4, MM-5, MM-6, FM-1, FM-2, FM-3, FM-4, FM-5, LH-1, LH-2, LH-3, LH-4, RA-1, RA-2, RA-3, RA-4, RA-5, WR-1, WR-2, FW-1, FW-2, FW-3, and FW-4	• RHCA conditions following timber projects • RHCA conditions following prescribed fire and manual fuel reduction projects • RHCA conditions following Burned Area Recovery activities • RHCA conditions following riparian restoration projects • RHCA conditions within grazing allotments • RHCA conditions following weed treatments	Annual	Implementation and effectiveness monitoring of the aquatic design elements identified in project NEPA documents and BA/BEs

Table 2.7- 2: Monitoring collection and reporting dates for MON-AQT-03.

Milestone	Year
Data last collected or compiled in:	2020
Next scheduled data collection and compilation:	2021
Last monitoring evaluation report covering this monitoring item:	2016-2017
Next scheduled monitoring evaluation report covering this monitoring item:	2023

2.7.2 Methods

Evaluation of "conditions" was conducted through implementation and effectiveness monitoring of project aquatic design elements conducted by Forest fisheries biologists and hydrologists.

2.7.3 Results

Riparian Habitat Conservation Area (RHCA) Conditions following Timber Projects

In 2018-20, Forest fisheries biologists monitored the following timber sales:

- Westside (timber portion completed in 2019; watershed portion ongoing)
- Tabor Mountain (started in 2020; all portions ongoing)
- Springer Firewood (started in 2018; completed in 2019)
- Meadow Vapor (started in 2019; ongoing)

The purpose of our monitoring was to:

- verify that RHCAs were properly delineated and marked;
- verify that RHCAs were protected from harvest and logging equipment;
- look for indications of sediment delivery to streams;
- monitor the condition of log haul roads;
- document the application and effectiveness of aquatic design elements; and
- compare our field observations with the effect predictions made in project NEPA documents and biological assessments/evaluations.

The results of our monitoring were documented in individual unit logs for each visit, which are available upon request. The monitoring results for each of the sales are summarized below.

Westside Timber Sale (Darby Ranger District)

The Westside timber sale occurred in 2018-19. Aquatics monitoring of the sale focused on Road 5620, a near-stream road segment that was used for winter hauling. Road 5620 closely parallels Moose Creek and has been a significant source of sediment to that stream for many years. The near-stream segment of Road 5620 was proposed for decommissioning/recontouring in the Westside Decision Notice pending construction of a new segment which would bypass the near-stream segment. BMPs were added to the near-stream segment of Road 5620 in 2018. Monitoring indicated that the BMPs that were installed in 2018 reduced sediment delivery from levels observed after winter haul; however, there were several locations where the road was outsloped and continued to deliver sediment to Moose Creek. The new culverts that were installed functioned properly. As of the start of 2021, the new

segment of Road 5620 that would bypass the near-stream segment has yet to be built. Also, the near-stream segment has yet to be decommissioned/recontoured.

Tabor Mountain Timber Sale (Darby Ranger District)

The Tabor Mountain timber sale originated from the Darby Lumber Lands Phase II Decision Notice. The only activity in the sale that has occurred so far is the construction of new specified roads in the Harlan and Roan Gulch watersheds. In September and October 2020, the North Zone fisheries biologist and watershed specialist monitored conditions on a recently constructed segment of specified road adjacent to Roan Gulch. The lowermost 2,100 feet of the new road is located entirely within the Roan Gulch RHCA (100-foot RHCA), with most of the road occurring within 50 feet of Roan Gulch. Roan Gulch flows into Harlan Creek near the beginning of the new road segment. Both streams are intermittent and non-fish bearing. The new road along Roan Gulch will be used for log hauling in the Tabor Mountain timber sale. During construction, a slash-filter windrow was placed along the toe of the fill slope for most of the road's length in the RHCA; however, portions of the road extended closer to Roan Gulch than was described in the Environmental Assessment. It was later determined by Montana DNRC to be a violation of the SMZ law because most of the 2,100 feet of new road was constructed in the SMZ too close to Roan Gulch. Monitoring will continue in the future to ensure the effectiveness of the slash filter windrow as well as any other mitigations required. At present, the slash-filter windrow appears to be effective in intercepting and trapping sediment originating from the road construction and incidental vehicle traffic (log hauling has yet to commence).

Springer Firewood Timber Sale (Sula Ranger District)

The Springer Firewood timber sale predominantly occurred during the winter of 2018-19. The sale was unique in that a limited amount of salvage harvest was allowed to occur in the outer halves (i.e. the outer 150 feet) of 300-foot RHCAs in nine units. Only dead or dying trees were harvested in the outer halves of the RHCAs, and the harvest occurred under winter conditions using tractor yarding.

The Springer Firewood sale contained a total of nine RHCAs. All were properly delineated, marked, and protected. In the units where salvage of dead/dying trees was allowed to occur within 150 to 300 feet of streams, those RHCAs were properly delineated and adhered to. Yarding occurred under good winter conditions and there were no indications of erosion or sediment movement into the RHCAs.

Five log landings (one in unit 5, three in unit 7, one in unit 8A) were located within RHCAs in existing openings. Per project design element, the landing locations were field reviewed and approved by Forest fisheries biologists and hydrologists prior to their use. The landings were used in winter and did not deliver sediment to streams.

A key design element was the installation of straw bale sediment traps at haul road crossings of streams and at the outlets of ditch relief culverts on near-stream haul road segments (Roads 432 and 724). These sediment traps were installed on Roads 432 and 724 in October 2018, prior to the start of hauling. Hauling was completed at the end of March 2019. Inspection of the sediment traps in May 2019, following the completion of hauling, indicated no evidence of sediment delivery from the haul road surfaces. The haul roads maintained good winter driving surfaces throughout the period of hauling with no significant rutting or movement of melt water. Snow plowing on the haul roads was monitored on seven occasions during winter 2018-19. The plowing properly followed project design elements.

Monitoring observations on the Springer Firewood timber sale supported the aquatic effects predictions made in the Meadow Vapor EA/DN and the fisheries biological assessment/evaluation.

Meadow Vapor Timber Sale (Sula Ranger District)

The Meadow Vapor timber sale commenced in the spring of 2019 and is ongoing. No RHCA harvest is allowed in the sale.

The skyline portion of the sale was completed in autumn, 2020. The skyline units contained a total of 26 RHCAs. Buffer widths were correctly delineated in 23 of the 26 RHCAs. Three RHCAs were marked too narrow in spots.

The first was along an intermittent tributary to Lick Creek in unit 7D. We measured the width of the RHCA at two random locations. Our measurements were 78 feet and 90 feet. They should have been at least 100 feet. The second was along an intermittent stream in unit 10. We measured the width of the RHCA at seven random locations. Our measurements were 105 feet, 78 feet, 87 feet, 85 feet, 75 feet, 60 feet, and 115 feet. All of the measurements should have been at least 100 feet. The third was along the 300-foot RHCA on the East Fork Bitterroot River in unit 10B. We measured the width of the RHCA at four random locations. Our measurements were 265 feet, 340 feet, 250 feet, and 330 feet. All should have been at least 300 feet.

There was no cutting of trees in the skyline unit RHCAs, and no entry of logging equipment. There was no evidence of sediment moving from the skyline units into any of the RHCAs.

Per project design element, log landings should be located outside of RHCAs. Existing openings within RHCAs can be used for landings if first field reviewed and approved by Forest fisheries biologists or hydrologists prior to their use. A violation of this design element occurred in November 2019 when the sale administrator allowed some logs to be decked in the outer half of a 100-foot RHCA surrounding a wetland in unit 10B. The wetland was frozen at the time of the decking, and the deck was located in an existing clearing (a fuel break created during the 2017 Myers Fire). Had aquatic personnel reviewed the location prior to use, it would have been approved. The landing did not affect any actual wetland habitat. The rest of the landings in the skyline portion of the sale were located outside of RHCAs.

A project design element directs the Forest to install and maintain straw bale sediment traps at the inlets and/or outlets of the ditch relief culverts on the near-stream segment of Road 725 (East Fork Highway to Road 5764) anytime that hauling is active. Log trucks are allowed to haul on that road segment between June 1 and November 1. The sediment traps were installed in May 2019, prior to the start of hauling. The traps were installed at the inlets and/or outlets of 13 ditch relief culverts. Traps were not installed at the Road 725 bridge crossing of the East Fork Bitterroot River. The bridge crossing is not a sediment delivery threat because of a flat road gradient and sufficient vegetative filter in the surrounding ditches. The sediment traps were inspected following the 2019 and 2020 log haul seasons. In 2019, one trap on the inlet of a ditch relief culvert captured about three gallons of road sediment; the rest of the traps received no sediment. In 2020, all of the traps received no sediment. The results indicate that log hauling on Road 725 has produced insignificant amounts of sediment, with no evidence of delivery to Meadow Creek. Road 725 is the only haul road in the sale area south of the East Fork Highway that is a sediment delivery risk to fish habitat.

So far, monitoring observations on the Meadow Vapor timber sale have supported the aquatic effects predictions made in the Meadow Vapor EA/DN and the fisheries biological assessment/evaluation.

Riparian Habitat Conservation Area (RHCA) Conditions following Prescribed Fire and Manual Fuel Reduction Projects

In 2018-20, Forest fisheries biologists monitored the following prescribed fire and manual fuel reduction projects:

- Canyon Creek Fuels (started in 2018; all portions ongoing)
- Nee-Me-Poo Waugh Gulch Fuels (completed in 2020)
- Middle East Fork, units 2, 45, 68R, and 245 (burned in April 2018)
- Tepee Face, unit 2 (burned in September 2018)
- Lower West Fork, units 2 and 3 (burned in April 2018), 9 and 62 (burned in October 2018), and 1 (burned in May 2019)
- School Point, units Echo (burned in April 2018) and Charlie (burned in May 2019)
- Overwhich Creek Fuels (piles partially burned in 2020, rest scheduled for 2021)
- Nez Perce Ranch Clean-up Fuels (completed in 2020)

The purpose of our monitoring was to:

- observe the post-burn condition of the RHCAs;
- look for indications of sediment delivery to streams;
- document the application and effectiveness of the design elements in the project NEPA documents and the U.S. Fish and Wildlife Service's Programmatic Biological Assessment for Prescribed Burning (U.S. Fish and Wildlife Service, 2001).
- compare our field observations with the effect predictions made in project NEPA documents and biological assessments/evaluations.

The results of our monitoring were documented in individual unit logs for each visit, which are available upon request. The monitoring results for each of the prescribed burns are summarized below.

Canyon Creek Fuels (Darby Ranger District)

The Canyon Creek Fuels project included hand thinning and pile burning in portions of the RHCAs adjacent to Canyon and Brooks creeks and their unnamed channels. The North Zone fisheries biologist walked the thinning units that encompassed all three channels to see if treatments were carried out according to project plans (implementation monitoring), and to evaluate whether the retained buffer adequately intercepted any soils that may have been dislodged by the work and to qualitatively evaluate potential effects of near-stream riparian thinning (effectiveness monitoring). The work carried out in the area was exactly as described in the proposed action. In particular, there were no trees felled within the 50-foot flagged buffer of Canyon Creek. All felled trees appeared to be within the designated size class (<4"). No slash piles slated for burning were placed within the 50-foot RHCA buffer. Slash piles were very small.

Removal of the material did not appear to create substantial openings in the canopy that would increase solar radiation to Canyon or Brooks creeks. In fact, near Canyon Creek, project activities were largely invisible from the trailhead and along the trail. None of the activities created ground disturbance that resulted in off-site movement of soil towards streams.

Nee-Me-Poo Waugh Gulch Fuels (Sula Ranger District)

The Nee-Me-Poo Waugh Gulch Fuels project included hand thinning and pile burning in portions of the RHCAs adjacent to Waugh Creek and a couple of unnamed intermittent streams between Indian Trees campground and Waugh Creek. In October 2020, the South Zone fisheries biologist monitored the thinning units to see if treatments were carried out according to project plans (implementation monitoring) and to evaluate whether the retained buffers adequately intercepted any soils that may have been dislodged by the work and to qualitatively evaluate potential effects of near-stream riparian thinning (effectiveness monitoring).

Project design elements were properly followed. No thinning occurred within the 50-foot flagged buffers around Waugh Creek and the unnamed intermittent streams. The Waugh Creek riparian exclosure fence was located within the 50-foot buffer around Waugh Creek. No activity occurred inside the fence. No slash piles were located within the 50-foot buffers. The slash piles were small and were burned in October 2020.

Removal of the material did not create openings in the canopy that would increase solar radiation to Waugh Creek or the intermittent streams. None of the activities created ground disturbance that resulted in off-site movement of soil towards streams. These findings were consistent with the effects predictions made in the fisheries biological assessment/evaluation.

Middle East Fork Prescribed Burns (Sula Ranger District)

Units 2, 45, 68R, and 245 (total of 569 acres) were ignited by helicopter on April 25-26, 2018.

There were only a couple of RHCAs in these units. One was a small wetland draw (50-foot RHCA) northeast of the Jennings campground. Low severity fire burned scattered patches of upland habitat surrounding the small wetland but did not burn into the wetland itself. The other RHCA was a 300-foot RHCA on the west side of Bertie Lord Creek near the East Fork Highway. Most of this RHCA consists of a wide, grassy meadow with a 2-track road running through it and a couple of areas used for dispersed camping. Low severity fire burned scattered patches of the grassy valley bottom, with most of the burn occurring in the outer half of the RHCA near the base of the slope. In a couple of spots, low severity fire crept to within 10-20 feet of the edge of Bertie Lord Creek but did not reach the water's edge.

Post-burn mortality of the overstory trees in the RHCAs was essentially zero. There were no indications of sediment delivery to any water bodies.The design elements were properly implemented and were effective in minimizing effects to RHCAs and aquatic habitats.

Monitoring observations supported the aquatic effects predictions that were made in the Middle East Fork FEIS and bull trout biological assessment. The burns did not contribute sediment to fish habitat, nor did they affect water temperatures.

Tepee Face Prescribed Burns (Sula Ranger District)

Unit 2 (100 acres) was ignited by hand on September 18, 2018.

There were three RHCAs in unit 2. The East Fork Bitterroot River (300 foot RHCA), Tepee Creek (300 foot RHCA), and an unnamed intermittent tributary to the East Fork Bitterroot River (100 foot RHCA). The RHCAs were not ignited but fire was allowed to back through the RHCAs. Fire severity and most of that was in the outer half of the RHCAs. Fire did not burn to the edge of the East Fork Bitterroot River, Tepee Creek, or any intermittent tributaries. In the Tepee Creek RHCA, low severity burn was restricted to areas uphill from Forest Road 5778.

Post-burn mortality of the overstory trees in the RHCAs was essentially zero. There was no evidence of overland flow and/or surface erosion from the burned soils. Duff layers were preserved and functioning effectively during rains that occurred following completion of the burns. No indications of sediment delivery to streams was observed.

The design elements were properly implemented and were effective in minimizing effects to RHCAs and aquatic habitats.

The fisheries biological assessment/evaluation for the Tepee Face project predicted that prescribed burning would have a negligible and undetectable effect on the fish habitat. Monitoring observations in unit 2 supported this prediction.

Lower West Fork Prescribed Burns (West Fork Ranger District)

Units 2 and 3 (180 acres) were ignited by hand crews on April 24-26, 2018. Units 9 and 62 (149 acres) were ignited by hand crews on October 22-23, 2018. Unit 1 (95 acres) was ignited by hand crews on May 3, 2019.

There were five RHCAs in the Lower West Fork burn units. Three were intermittent streams (50 to 100 foot RHCAs), one was a perennial non-fish bearing stream (Troy Creek, 150 foot RHCA), and one was a wetland draw (50 foot RHCA). Two of the intermittent streams and the wetland draw have seasonal connections to downstream westslope cutthroat trout habitat in Lavene and Pierce creeks. The RHCAs were not ignited but fire was allowed to back through the RHCAs. Low severity fire burned the outer halves of the RHCAs in a patchy manner. In scattered spots, fingers of low severity fire crossed stream channels, but this was not common. Fire tended to go out somewhere within 25-50 feet from the edge of stream channels.

Post-burn mortality of the overstory trees in the RHCAs was essentially zero. There was no evidence of overland flow and/or surface erosion from the burned soils. Duff layers were preserved and functioning effectively during rains that occurred following completion of the burns. No indications of sediment delivery to streams was observed.

The design elements were properly implemented and were effective in minimizing effects to RHCAs and aquatic habitats.

Monitoring observations supported the aquatic effects predictions that were made in the Lower West Fork FEIS and bull trout biological assessment. The burns did not contribute sediment to fish habitat, nor did they affect water temperatures.

School Point Prescribed Burns (West Fork Ranger District)

Unit Echo (70 acres) was ignited by hand crews on April 27, 2018. Unit Charlie (272 acres) was ignited by hand crews on May 4-6, 2019. An additional 12 acres of slop over burned on the west side of Nelson Creek on May 14, 2019.

There were three RHCAs in these units. Two were 300-foot RHCAs surrounding Nelson and Gemmell creeks (fish-bearing streams); one was a 100-foot RHCA surrounding Halford Creek, an intermittent non-fish bearing stream. The RHCAs were not ignited but fire was allowed to back through the RHCAs. Along Nelson Creek, low severity fire generally went out before it could enter any significant distance inside the 300-foot RHCA. An exception was about an acre that burned at moderate-to-high severity along the banks of Nelson Creek on May 14th. Apparently, a finger of low severity fire managed to get into a slash accumulation that was left behind by a hand line used in the 2017 Nelson Creek Fire. After burning hot along the banks of Nelson Creek, the fire jumped the creek and made

about a 12-acre high severity run up the opposite slope. The Gemmell Creek RHCA was burned at low severity in the outer half of the RHCA (outer 150 feet), and mostly unburned in the inner half of the RHCA (inner 150 feet). In three places, low severity fire backed down to the edge of the stream, but did not cross the stream. The strips where fire backed down to the edge of the stream were about 20-40 feet wide. The Halford Creek RHCA (150-foot) was mostly unburned.

The School Point burns killed two patches of riparian overstory trees bordering Nelson and Gemmell creeks. The high severity slop over along Nelson Creek burned 1-2 acres of riparian overstory, killing several dozen mature spruce/fir trees. A cluster (about six) of mature spruce/fir trees were also torched and killed along Gemmell Creek. In both patches, some of the dead trees will eventually be recruited to the stream channel which should result in improved hiding cover at the habitat unit scale.

Bank erosion and associated increased sediment delivery were observed in the immediate area where high severity fire burned across Nelson Creek. Elsewhere, sediment delivery was not observed along Gemmell and Halford creeks. Fire severity was low and the duff layer was not consumed.

The design elements were properly implemented and were effective in minimizing effects to RHCAs and aquatic habitats. The slop over along Nelson Creek was an anomaly caused by a left-over accumulation of slash.

The fisheries biological assessment/evaluation for the School Point project predicted that the prescribed burns would have insignificant effects on water quality and fish habitat. Monitoring observations supported this prediction in all areas except for the site of the high severity slop over across Nelson Creek. At that site, fire caused measurable amounts of bank erosion and 1-2 acres of overstory tree mortality in the RHCA.

Overwhich Creek Fuels (West Fork Ranger District)

The Overwhich Creek Fuels project included hand thinning and pile burning in the 300-foot RHCA around Overwhich Creek between the Forest boundary and the Road 5703/5706 junction, a distance of about 1.5 miles. Thinning and piling occurred in autumn 2019. The piles on the north side of Overwhich Creek were burned in November 2020. The piles on the south side of the creek are planned for burning in autumn 2021.

In summer and autumn 2020, the South Zone fisheries biologist monitored the thinning units to see if treatments were carried out according to project plans (implementation monitoring) and to evaluate whether the retained buffers adequately intercepted any soils that may have been dislodged by the work and to qualitatively evaluate potential effects of near-stream riparian thinning (effectiveness monitoring).

Project design elements were properly followed. No thinning occurred within the 50-foot flagged buffer around Overwhich Creek. No slash piles were located within the 50-foot buffer. The piles were small.

Removal of the material did not create openings in the canopy that would increase solar radiation to Overwhich Creek. None of the activities created ground disturbance that resulted in off-site movement of soil towards streams. These findings were consistent with the effects predictions made in the fisheries biological assessment/evaluation.

Nez Perce Ranch Clean-up Fuels (West Fork Ranger District)

The Nez Perce Ranch Clean-up Fuels project included hand thinning and pile burning in the 300-foot RHCA on the west side of Nelson Creek between Road 468 and the Nez Perce Fork, a distance of

about 0.25 miles. Prior to the start of thinning, the South Zone fisheries biologist flagged off 50-foot buffers along Nelson Creek and the Nez Perce Fork. Thinning and piling occurred in August and September 2019. The piles were burned in November 2020.

In autumn 2020, the South Zone fisheries biologist monitored the thinning units to see if treatments were carried out according to project plans (implementation monitoring) and to evaluate whether the retained buffers adequately intercepted any soils that may have been dislodged by the work and to qualitatively evaluate potential effects of near-stream riparian thinning (effectiveness monitoring).

Project design elements were properly followed. No thinning occurred within the 50-foot flagged buffers around Nelson Creek and the Nez Perce Fork. No slash piles were located within the 50-foot buffers. The slash piles were small and were burned in November 2020.

Removal of the material did not create openings in the canopy that would increase solar radiation to Nelson Creek and the Nez Perce Fork. None of the activities created ground disturbance that resulted in off-site movement of soil towards streams. These findings were consistent with the effects predictions made in the fisheries biological assessment/evaluation.

Riparian Habitat Conservation Area (RHCA) Conditions following Burned Area Recovery Activities

At the end of 2020, the only work that remains in the Burned Area Recovery (BAR) project per the BAR Settlement Agreement (February 2002) is:

- 1.2 miles of road storage
- 23 miles of road BMP upgrades
- Replacement or removal of one fish culvert (North Rye Creek, Road 8111)

The objectives of BAR monitoring are to:

- ensure that Best Management Practices (BMPs) are properly applied to minimize sediment production during the replacement of fish culverts and the decommissioning and storage of roads,
- ensure that the Forest move towards management obligations for threatened, endangered, and sensitive fish species,
- ensure that culvert replacement and watershed improvement activities move towards the Forest Plan goals and objectives as amended by INFISH, and
- ensure that state water quality standards are being met.

In order to move towards these objectives, we focused our monitoring efforts to answer two questions:

Question 1. Were BMPs properly applied to minimize sediment production during the replacement of fish culverts and the decommissioning and storage of roads?

There were no BAR fish culvert replacements or road decommissioning/storage activities in 2018-20. The activities that did occur consisted of road BMP upgrades. 8.2 miles of BMP upgrades were completed in 2018, and 18.5 miles in 2019. The BMP upgrades consisted of installing water bars to improve surface drainage, cleaning ditches and catch basins, and applying gravel to near-stream road segments (Road 321) and stream crossings. Monitoring indicated that BMPs were properly applied to minimize sediment production during the upgrade work.

Long-term effectiveness monitoring continued in 2018-20 on the following roads that were decommissioned or stored in previous years:

- Road 13833 in the Elk Creek drainage, West Fork Ranger District. This road was stored in 2010, and two fish culvert barriers on Elk Creek were removed.
- The Road 7367x and 7368x system in the Gilbert Creek drainage, Sula Ranger District. This road system was decommissioned in 2008.
- Road 73213 in the Medicine Tree Creek drainage, Sula Ranger District. This road was decommissioned in 2006-07.

These roads have been monitored every year since implementation. Photo points and visual observations are the methods being used. Unit logs and powerpoint files that document our monitoring findings for these projects are available in electronic or hard copy format upon request from the Bitterroot National Forest Supervisor's Office.

There have not been any completed BAR road treatments where BMPs were found to be improperly applied. The majority of the decommissioning and storage treatments have not involved many live stream crossings. Where culverts have been removed on live streams, sediment mitigation BMPs (clean water diversion, use of straw bale check dams, seeding and mulching disturbed soils, etc) were properly applied. Erosion and sediment effects have been within the bounds analyzed and described in the BAR FEIS and bull trout biological assessment effects analyses. We have observed no significant sediment and erosion problems or BMP application concerns during the road decommissioning or road storage activities. Project mitigation measures and ESA terms and conditions have adequately protected threatened (bull trout) and sensitive (westslope cutthroat trout) fish species from short-term sediment effects.

Question #2. Were Forest Plan and State water quality standards met during the replacement of fish culverts and the decommissioning and storage of roads?

No BAR fish culvert replacements or road decommissioning/storage activities were conducted in 2018-20. The Forest plans on completing the last of the BAR road storage (Road 62800, 1.2 miles) in 2021. All of the BAR road decommissioning was completed in 2009. One fish culvert replacement remains (Road 8111, North Rye Creek), but there are no plans to complete that replacement at this time because of a lack of funds.

The Forest annually sends a Burned Area Recovery Fish Monitoring Report and Terms and Condition letter to the U.S. Fish and Wildlife Service which documents our progress in meeting the terms and conditions in the Burned Area Recovery Biological Opinion. The 2018, 2019, and 2020 Burned Area Recovery Fish Monitoring Reports and Term and Condition letters are available in electronic or hard copy format upon request from the Bitterroot National Forest Supervisor's Office.

Riparian Habitat Conservation Area (RHCA) Conditions following Riparian Restoration Projects

Railroad Creek Dispersed Recreation Area (Darby Ranger District)

Railroad Creek is a spawning and rearing tributary of Skalkaho Creek for bull trout and westslope cutthroat trout. The area received various treatments in 2015-17 to prevent expansion of dispersed recreation impacts and to restore floodplain and streambank vegetation. The most extensive treatments occurred in the spring of 2016 when a section of damaged stream bank along Railroad Creek was

reconstructed using bio-engineering techniques. Fisheries staff continue to monitor the area to determine if additional treatments are necessary. The area includes two primary dispersed camping sites.

Site 1 is a small site on the west side of Road 75 near the mouth of Railroad Creek. Observations of the site in 2018-20 found that:

- The majority (>90%) of planted shrubs and spruce seedlings are surviving and growing slowly;
- Braided channels continue to be stable although foot traffic is impeding vegetative establishment;
- Use by the public continues to be moderate. Soil compaction and streambank soughing along Skalkaho Creek are continuing at about the same rate/level; no new foot trails were seen; and
- Two large pine trees had numerous bullet holes and will likely die soon (these will likely be cut for firewood in the near future).

Site 2 is is actually a complex of smaller sites on the east side of Road 75 along Railroad Creek. A rough, user-created 2-track road provides access to the complex of sites. Observations of the site in 2018-20 found that:

- The reconstructed stream bank along Railroad Creek (constructed in spring 2016) is stable with strong shrub recovery (from willow and dogwood cuttings) occurring on the bio-engineered bank;
- Bare erosive soils are no longer present on the bio-engineered bank;
- The decompacted meadow and access road adjacent to the reconstructed stream banks have recovered decent grass and forb cover with only signs of very light ATV traffic observed on the obliterated road prism. Full size vehicles have not driven on the obliterated access road
- People are walking into the meadow and using the user-created fire ring (beer cans were found in the ring during all monitoring visits); and
- At least a third of the planted shrub seedlings have survived.

The 2016 restoration work at Railroad Creek improved 0.3 miles of spawning and rearing habitat for bull trout and westslope cutthroat trout.

West Fork Highway Dispersed Camping Rehab (West Fork Ranger District).

In 2018-20, three areas used for dispersed camping and their associated user-created two track roads along the West Fork Bitterroot River between Piquett and Applebury creeks were obliterated and blocked off to prevent illegal firewood cutting and its associated riparian resource impacts in the West Fork RHCA (300-foot RHCA). The three sites were located at highway mileposts 9.1 (user-created 2-track road obliterated in May 2020), 10.9 (boulders placed to define a parking area and restrict vehicle access in May 2018), and 12.0 (user-created 2-track road obliterated in May 2018). In total, about 2,000 feet of user-created 2-track roads were obliterated and revegetated in the West Fork RHCA at the three sites. Recovery of grass on the obliterated 2-tracks has been strong, and no vehicles have been driving on the obliterated prisms.

At the milepost 12.0 site, about seven acres of mixed Douglas fir/ponderosa pine forest was manually thinned, piled, and burned in the West Fork RHCA during summer 2018. A large quantity of firewood-cutter slash was cleaned up in the process. Project design elements were properly followed. No thinning occurred within the 50-foot flagged buffer surrounding the West Fork Bitterroot River. No slash piles were located within the 50-foot buffer. The slash piles were small and were burned in

autumn 2018. Fisheries staff conducted burn pile rehab (raking, seeding with grass, and fertilizing) in summer 2019 with excellent results.

Riparian Habitat Conservation Area (RHCA) Conditions within Grazing Allotments

Prior to 2018, Forest fisheries biologists and/or range specialists annually monitored and maintained seven riparian exclosure fences or drift fences in grazing allotments on the Sula and West Fork Ranger Districts. All of these fences are now located in allotments or portions of allotments that have either been permanently removed from scheduled grazing (Meadow Tolan, Waugh Gulch), or are currently vacant (Reimel, Coal Creek). The most recent status of the riparian exclosures and/or drift fences is described below.

Meadow Creek Exclosure Fence (Sula Ranger District)

The Meadow Creek exclosure fence was dismantled in 2019-20. Livestock grazing no longer occurs in the area.

Waugh Creek Exclosure Fence (Sula Ranger District)

Fisheries objectives were met inside the Waugh Creek exclosure fence in 2018-20. There were no livestock effects inside or outside of the fence. Because livestock grazing no longer occurs in the area, Forest fisheries staff plans on dismantling the fence in 2021.

Bugle Creek Exclosure Fence (Sula Ranger District)

The Bugle Creek exclosure fence was dismantled in 2019-20. Livestock grazing no longer occurs in the area.

Reimel Creek Exclosure Fence (Sula Ranger District)

Fisheries objectives were met inside the Reimel Creek exclosure fence in 2018-20. There were no livestock effects inside or outside of the fence. Livestock have not grazed the area since 2008, and the allotment is currently vacant. The exclosure fence has not been maintained in over a decade and will require major reconstruction if and when livestock ever return to the area.

Meadow Creek Drift Fence (Sula Ranger District)

This fence is being allowed to naturally dilapidate. Livestock grazing no longer occurs in the area.

Coal Creek Drift Fence (Sula Ranger District)

This fence is being allowed to naturally dilapidate. The allotment is vacant with no plans to reinitiate grazing in the future.

The fences listed above have seen no livestock activity in the past eight years, and minimal use over the past 15+ years. The riparian vegetation and stream banks inside of the fences have recovered nicely. Stream channels that were degraded prior to fencing have narrowed and healed, and shrub recovery along the banks has been robust.

Paradise Campground Drift Fence (West Fork Ranger District)

The Paradise Campground drift fence was initially constructed in June, 2000, and reconstructed with treated posts and rails in 2018. The fence is affected by recreational stock use but is not located within a grazing allotment. The Paradise Campground drift fence has two goals: (1) prevent stock from being able to graze the stream banks along Whitecap Creek; and (2) restore the native riparian community of ponderosa pine trees and hawthorn shrubs to the stream banks. Goal #1 has been achieved in all years except 2013 when stock grazing occurred on the stream banks for two months. Goal #2 has been

partially achieved. Hawthorn shrubs were planted on the stream banks in 2009 and about half of them have survived and are growing. However, none of the 40 or so ponderosa pine seedlings that were planted on the banks in previous years have survived. Goal #2 will be fully achieved when ponderosa pine trees become established on the stream banks, which will require additional planting.

Medicine Tree Grazing Allotment (Darby and Sula Ranger Districts)

There is no monitoring plan for the Medicine Tree allotment. Grazing generally occurs annually in portions of the Medicine Tree Creek and Robbins Gulch watersheds between the months of June and September. Since 2008, Forest fisheries biologists have monitored end-of-season conditions with photo points at the recontoured Road 73213 crossing of Medicine Tree Creek. This crossing serves as an index site to assess the overall trend in riparian conditions in the Medicine Tree allotment. There is a stock tank near the crossing, and the crossing is a livestock watering area with several cow trails leading into it.

The desired condition at the Medicine Tree Creek crossing is a narrow stream channel with minimal bank trampling and riparian shrub and forb cover that mimics what occurs in ungrazed or lightly grazed areas above and below the crossing. In most years, the crossing has not met desired conditions due to an excess of bank trampling. However, in 2020 the crossing area received lighter grazing was closer to attaining the desired condition.

The amount of bank trampling that occurs at the Medicine Tree Creek crossing varies considerably from year to year. Wetter summers (such as 2020) typically have less trampling, while droughtier summers have more. A large ponderosa pine snag fell across the crossing area in 2018 and that has helped to reduce livestock access to portions of the crossing, resulting in less bank trampling at the crossing itself. Since the snag fell, the most impacted area has occurred in a small wetland a short distance below the crossing. Higher sediment delivery occurs in the immediate area of the Medicine Tree Creek crossing due to livestock trampling; however, the channel gradient below the crossing is low and the nearest fish habitat (westslope cutthroat trout) is more than half a mile downstream. For those reasons, it is unlikely that significant quantities of sediment are being transported downstream into occupied westslope habitat.

The stock tank on the south side of the crossing was functioned properly in 2020. Having a functioning tank at this site is important for reducing pressure on the stream crossing.

Bunch Gulch Grazing Allotment (Sula Ranger District)

Forest biologists and hydrologists annually measure bank trampling and stream channel cross-section on a 200-foot long reach of Bunch Gulch within the Meadow Tolan/Bunch Gulch/Shirley Mountain grazing allotment. The reach has been monitored every year since 1999. This monitoring is part of the monitoring plan in the Meadow Tolan/Bunch Gulch/Shirley Mountain Environmental Assessment (EA) and Decision Notice (June 1998).

Between 1999 and 2007, trampling from both permitted and trespass cattle severely affected channel function and form with a marginal channel degrading to a thoroughly trampled riparian area. The riparian area contained a very uneven ground surface with numerous changes in elevation due to hoofprints. Between 2008 and 2011, gradual recovery occurred but trespass cattle complicated conditions by creating impacts after the permitted livestock had been moved to other areas of the allotment. The greatest and most rapid improvements occurred when the area was rested for several years beginning in 2012. Conditions improved quickly and a defined stream channel with a substrate formed. Water years 2016-2019 were relatively wet and resulted in flows in Bunch Gulch continuing throughout the year and defining and narrowing the channel to a greater extent. It is likely that higher

spring runoffs in 2017 and 2018 formed the stream channel and the improved ground water storage allowed for year-round flows to continue. Riparian vegetation and root mass have responded by thickening and becoming more robust.

The 1999 conditions were a result of decades of grazing at levels higher than sustainable in Bunch Gulch. As a result of the rest period and recovery, should livestock use (at levels identified in the 1998 EA and Decision Notice) return to the allotment, it is likely that riparian conditions would be maintained at acceptable levels and not degrade to the 1999 level. Future grazing should follow the mitigations in the EA and continue the riparian monitoring to provide for adaptive management as needed. As of 2020, riparian conditions have improved at the Bunch Gulch monitoring site and are approaching the desired conditions described in the EA.

Riparian Habitat Conservation Area (RHCA) Conditions following Weed Treatments

Forest fisheries biologists did not monitor riparian areas associated with weed treatments in 2018-20.

Other Riparian Habitat Conservation Area (RHCA) -Related Monitoring

Gold-Butterfly Project (Stevensville Ranger District)

The North Zone fisheries biologist and Forest hydrologist established a network of in-stream turbidity monitoring stations in three locations in Willow Creek in order to establish baseline turbidity levels prior to the implementation of the Gold-Butterfly project. The installed equipment recorded turbidity at each location every 20 seconds, continuously from March to November in both 2019 and 2020. The monitoring will be continued during implementation of the Gold-Butterfly project (currently slated to begin in 2021) to evaluate changes in turbidity as a result of potential effects of road management/construction and log hauling during the Gold-Butterfly project.

Sweathouse Creek Flow Monitoring (Stevensville Ranger District)

The North Zone fisheries biologist and Forest hydrologist conducted intensive stream flow monitoring from 2018-2020 on Sweathouse Creek, continuing a 10 year monitoring project intended to establish a robust stage-discharge relationship intended for use by both the Forest and the Blake-Highline Ditch users association in determining allowable water removal levels at various stream flows in order to maintain minimum-required instream flows for bull trout. A second flow monitoring site was installed in 2019 along with additional flow monitoring equipment (a transducer) in order to reduce variability in measurements.

2.7.4 Discussion

Summary of Prescribed Fire and Manual Fuel Reduction Effects

To summarize this section on prescribed fire and manual thinning effects, most of the acreage in prescribed fire burns at low severity with no long-term detrimental effects to the duff layer, which is why we typically see no evidence of significant soil erosion or sediment movement into streams. Prescribed fire usually burns RHCAs in a very spotty and low severity manner if they burn at all. In general, spring burns pose a lower risk to riparian areas than fall burns.

Spring burns usually have less fire encroachment and severity in RHCAs than fall burns because fuels are moister in spring, but that is not always the case. In a few instances, localized topography and fuel build-up has combined with dry conditions to create large patches of moderate severity burn in RHCAs during spring burns. Where that occurs, tree mortality is higher, and the duff layer is more compromised.

Manual thinning with 50-foot no treatment buffers around streams and wetlands has been effective in retaining streamside shade and preventing water temperature changes. Manual thinning and pile burning have not created ground disturbances that have resulted in sediment movement towards water bodies.

The Forest implements the mitigation measures (i.e. design elements) in the U.S. Fish and Wildlife Service Programmatic Biological Assessments for Prescribed Burning (U.S. Fish and Wildlife Service, 2001) and Timber Stand Improvement (i.e. manual thinning) (U.S. Fish and Wildlife Service, 1999) in all of its prescribed burn and manual thinning projects. Those mitigation measures/design elements have been effective in keeping effects to the aquatic ecosystem at insignificant levels.

Summary of Burned Area Recovery Activities

To summarize our key findings, BMPs have been properly applied during culvert replacement, road decommissioning, and road storage activities. The application of BMPs has been consistent with moving towards State water quality standards. The culvert replacement, road decommissioning, and road storage treatments have complied with the Forest Plan as amended by INFISH. Sediment contributions from the road decommissioning and storage treatments have been minimal. Few direct impacts on fish habitat have been observed. Where impacts have occurred, they have been temporary and localized to the immediate road crossing area where culverts have been removed and stream drainages recontoured. Sediment contributions during the culvert replacements have been consistent with the effects predictions made in the Burned Area Recovery FEIS. Water quality has been protected by mitigation to the extent possible given that short-term sediment inputs are unavoidable while replacing culverts.

Summary of Riparian Rehabilitation Projects

Overall, these projects have restored three portions of the West Fork RHCA which were chronically suffering from the negative effects of illegal firewood cutting in the riparian area and its associated creation and expansion of user-created roads in the RHCA.

Summary of Grazing Fence Monitoring

In summary, riparian exclosure fences have proven themselves to be an effective tool for protecting important riparian resources within grazing allotments. Fenced riparian areas have responded positively and quickly to the absence of livestock grazing. The most negative aspects of riparian exclosure fences are the annual maintenance workload, the lack of visual “naturalness” on the landscape (most of the fences are made out of conventional steel post and barbed wire), and a generally low potential for disrupting big game movement.

2.7.5 Evaluation of Results for Adaptive Management Finding

Table 2.7- 3: Summary of findings for Plan Monitoring AQT-03

PROGRESS TOWARD PLAN INTENT [1]	CHANGE WARRANTED?	WHERE IS CHANGE WARRANTED?
(E) Yes. The monitoring results described in the "Results and Discussion" section suggest that in most instances, management activities are maintaining the status of riparian areas and are achieving Forest Plan/INFISH standards and guidelines.	No	None

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

2.8 MON-VEG-01 – Silvicultural prescriptions

2.8.1 Monitoring item summary

- *Monitoring question:* Are forest stands moving towards un-even aged management ?"

Table 2.8-1 lists forest and grassland plan goals and objectives, monitoring indicators, data sources and partners, the frequency of data collection and reporting, and any quantitative targets or thresholds related to this monitoring item. Table 2.8-2 lists the most recent and next dates for data collection and reporting for this monitoring item.

Table 2.8- 1: Forest plan components, monitoring indicators, data collection intervals, and data sources for MON-VEG-01.

Plan components	Indicators	Data collection interval	Data Source / Partner
Goals: Seek out opportunities for biologically appropriate and cost-efficient un-even aged management. (p. II-3). **Objectives:** Maintain vegetative diversity on land where timber production is a goal of management (p.II-5) S**tandards**: Item 8 on page II-23 of the Forest Plan.	Acres of uneven management	Annual	FACTs

The Forest Service Manual (FSM) Chapter 2470, section 2478, requires a silvicultural prescription be prepared and signed by a certified silviculturist on all vegetation management projects. Vegetation management projects include timber harvest, prescribed burning, mechanical noncommercial thinning

and/or slashing, or reforestation projects. The Forest Plan and FSM requires monitoring of treatments through pre-action activities, during implementation, and post-action activities. Monitoring is designed to evaluate whether:

1. The silvicultural prescription was completed and/or approved by a Certified Silviculturist and updated as needed
2. The prescription was followed through all phases of implementation, and
3. The prescription met the desired conditions as defined in the NEPA document.

Table 2.8- 2: Monitoring collection and reporting dates for MON-VEG-01.

Milestone	Year
Data last collected or compiled in:	2020
Next scheduled data collection and compilation:	2021
Last monitoring evaluation report covering this monitoring item:	N/A
Next scheduled monitoring evaluation report covering this monitoring item:	2023

2.8.2 Methods

Projects involving any treatment to vegetation requires several items to be completed by a certified silviculturist to ensure that the direction in Forest Service Manual 2470 is met. These items include having a certified silviculturist 1) complete a diagnosis for stands proposed for action; 2) develop desired stand conditions and 3) complete or review the final silvicultural prescriptions for all areas included in a harvest project; 4) prepare and discuss marking guides with the marking crew and/or presale forester; 5) review timber marking in the field during sale preparation; and 6) review of treatment units post-harvest for next activities including non-commercial thinning/slashing and prescribed burning.

The following projects were evaluated in the field between 2015-2020. The projects evaluated are a mixture of commercial treatments, non-commercial thinning, reforestation, and prescribed fire. Not all treatment units were reviewed for the projects listed.

The following projects were monitored by the Forest silviculturist: Three Saddle Burn Units; Westside; Piquett Creek; Gold Butterfly; Como FHP; various reforestation sites and finally stand improvement units across the Forest. Additionally, the Interdisciplinary team reviewed Three Saddle Burn units and Westside.

2.8.3 Results

Three Saddle Burn Units 2, 4, 6. These units were reviewed on site after prescribed burning and before they were planted. The remaining overstory was approximately 20 BA ft^2/ac. Before the units were burned, the understory had been slashed and bucked into 4-6-foot pieces. Activity fuel had been dragged back from overstory trees. The upper third of the units are near the ridge and the organic layer is very minimal and moderately rocky. The review of the burn prescription along with the burn plan were discussed. Walk-thru examinations indicated portions of the burn units burned in a mosaic of severity. The hotter areas made up only a small percentage of the burn unit and were within the range of the burn prescription overall.

Westside units 2a, 2b, 2c, 3b, 3c, 3e, 4a, 5, 6, 7d, 7e, 9a, 9c, 10. These units were reviewed pre-harvest, during implementation and post-harvest. No problems were identified.

Piquett Creek units 1, 2, 3, 5, 6, 9, 14, 15, 16, 17, 18, 19, 20, 21, 25, 26, 27. These units were reviewed pre-harvest. Treatment of the units has not started. One quarter of the all the units treated were an uneven-aged harvest.

Gold Butterfly all treatment units. All treatment units were visited during marking. Implementation of the units has not started. No problems were identified. One quarter of the treatment units identified were an un-even aged harvest.

Como FHP all treatment units. All the units were visited in Como FHP post-harvest to review prescriptions needs for prescribed burning and stand improvement activities such as slashing. One quarter of the all the units treated were an uneven-aged harvest

Reforestation Sites. Various reforestation units were visited before and after planting. Units visited after planting during 3rd and 5th year stocking surveys indicated no units needed to be replanted.

Stand Improvement. Several non-commercial units across the Forest were reviewed pre-treatment, during implementation and post-treatment. No problems were identified.

Table 2.8- 3: Synopsis of Monitoring for Silvicultural Prescriptions

Project	Three Saddle Burn Units	Westside	Piquett Creek	Gold Butterfly	Como FHP	Stand Improvement & Reforestation
Silvicultural prescription was completed and updated	Y	Y	Y	Y	Y	Y
Prescription was followed through all phases of implementation	Y	Y	Y	Y	Y	Y
Prescription met the desired conditions	Y	Y	Y	Y	Y	Y

1/ NA = Not applicable or Not monitored; Y = fully met requirement; N = did not meet requirement; P = partially met requirement

2.8.4 Discussion

The monitoring item is being conducted through review of various vegetation treatments. Monitoring indicates silvicultural prescriptions are being met or modified and are moving towards Forest Plan goals and objectives and environmental analysis providing for vegetative diversity and un-even aged management.

2.8.5 Evaluation of Results for Adaptive Management Finding

Table 2.8- 4: Summary of findings for Plan Monitoring Item VEG-01

PLAN IMPLEMENTATION STATUS[1]	CHANGE WARRANTED?	WHERE IS CHANGE WARRANTED?
(C) Uncertain, based on in inappropriate indicators to inform on the status of the plan components being monitored.	Yes	Monitoring Plan: Change monitoring question to better reflect Forest Plan components. The goals and objectives of the Forest Plan is asking to seek out un-even aged management opportunities. Suggested change to monitoring question: "Are forest stands moving towards un-even aged management" would be more appropriate. Suggested change to indicators: Acres of uneven aged management

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

2.9 MON-VEG-02 – Forest conditions

2.9.1 Monitoring item summary

- *Monitoring question: Are treatments trending toward a more resilient forest?*

Table 2.9-1 lists forest and grassland plan goals and objectives, monitoring indicators, data sources and partners, the frequency of data collection and reporting, and any quantitative targets or thresholds related to this monitoring item. Table 2.9-2 lists the most recent and next dates for data collection and reporting for this monitoring item.

Table 2.9- 1: Forest plan components, monitoring indicators, data collection intervals, and data sources for MON-VEG-02.

Plan components	Indicators	Data collection interval	Data Source / Partner
Goals: Provide sawtimber and other wood products to help sustain a local economy. (pg.II-3). **Objectives:** Maintain vegetative diversity on land where timber production is a goal of management (p.II-5) **Standards**: Item 8 on page II-23 of the Forest Plan.	• Acres artificial/natural regeneration from prior regeneration harvests, • Acres intermediate harvest to reduce forest density, • Acres mechanical fuels treatments not related to timber harvest, • Acres of artificial/natural regeneration following wildfire, • Acres of prescribed burning, • Acres regeneration and removal harvests, • Acres stand improvement activities, • Acres treated to decrease conifer encroachments or improve native grassland/shrubland communities, • Acres treated to restore forest pattern, • MMBF offered and MMBF sold	Biennial	R1 Restoration and Resiliency Reports PTSAR Reports FIA

Table 2.9- 2: Monitoring collection and reporting dates for MON-VEG-02.

Milestone	Year
Data last collected or compiled in:	2020
Next scheduled data collection and compilation:	2021
Last monitoring evaluation report covering this monitoring item:	
Next scheduled monitoring evaluation report covering this monitoring item:	2023

2.9.2 Methods

The following reports are created from the Northern Region database tools or current Forest Service databases of record. They are used to support monitoring questions and biennial evaluations of Forest Plans.

Restoration and Resiliency Report

The Restoration and Resiliency Report documents the treatments the US Forest Service are accomplishing 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). This report is updated annually. https://www.fs.usda.gov/detail/r1/landmanagement/resourcemanagement/northernregionrestorationandresiliencyreport . The information from this report is pulled from data entered in the FACTs database.

Forest Service Activity Tracking System (FACTS) database

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.

R1 Reforestation Timeframe Report

The Reforestation Timeframe report displays the time from harvest until satisfactory stocking and certification based on data reported in the FACTS (Forest Service Activity Tracking System) database. Regeneration harvests since 1976 are included. The report provides the basis for assuring restocking when planning regeneration harvest, as required by NFMA. 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.

TIM Database – Periodic Timber Sale Accomplishment Reports (PTSAR)

The PTSAR report tracks forest product volume in various categories, including the regular program funded with appropriations, the Salvage Sale Fund, personal use permits and small commercial sales. In addition, PTSAR documents progress at Gates 4 (advertisement), Gate 5 (bid opening) and Gate 6 (award) including identification of status such as ongoing, delays, no-bids and re-offered volume. Fiscal year timber sale volume targets are also shown so that progress can be monitored. https://www.fs.fed.us/forestmanagement/products/ptsar/index.shtml

TIM Database - Cut & Sold Report

Cut and Sold reports show total volumes and values of all convertible forest products sold and harvested from the National Forest System lands and National Grasslands agency-wide, and by organizational unit. In addition, these reports show the amounts and values of species and products sold and harvested, including all other forest products that cannot be converted into volume measure (non-convertible). These non-convertible forest products include, for example, Christmas trees, mushrooms, and boughs. https://www.fs.fed.us/forestmanagement/products/cut-sold/index.shtml

2.9.3 Results

Restoration of forest resiliency (resilience of what, to what, for what, for how long?**)** in an uncertain future climate will require an adaptive management approach to restoration and resiliency treatments at various spatial and temporal scales. The species identified in this document are the ones most likely to provide the base for future resilient forest and grassland conditions.

Tree species or types to focus restoration on the Bitterroot NF are:

- Western larch (LAOC) (WL)
- Ponderosa Pine (PIPO) (PP)
- Aspen (POTR5)
- Whitebark Pine (PIAL) (WBP)
- Subalpine larch (LALY)
- Spruce and/or subalpine fir types that define Lynx winter habitat (PIEN/ABLA)

The restoration to a more resilient vegetation condition responds to desired conditions for vegetation in Forest Plans. Making progress in achieving this will include composition, size, density, and will

provide more natural patterns of diversity and resiliency to stress and disturbances. Tools engaged to influence this are:

- regeneration accomplished through planting,
- regeneration harvest,
- seeding or natural regeneration of forest or non-forest communities,
- prescribed fire or natural ignition wildfire,
- intermediate harvests using timber sales and or precommercial treatments such as precommercial thinning or other mechanical vegetation treatments in stands where intolerant species are retained,
- invasive species weed treatments and native species re-establishment to restore altered grasslands or shrublands,
- certain unplanned events**.**

Forest densities and structure to focus on will be densities that will restore the forest to be more resilient to historical and projected disturbance processes in various size classes including wildlife habitats of concern. Pattern of the forest to focus on will be ranges of patch sizes that develop a pattern informed by historical disturbance and influenced by projected disturbance by a changing climate. Diversity in the pattern of size classes and arrangement on the landscape that will help create a more resilient landscape should be a focus.

Table 2.9-3 tracks 6 years of activities from 2015-2020 which helps us to see if treatments are tending toward the resilient forests as described in the Forest Plan.

Table 2.9- 3: Year & Treatment Acres (Resilient Species Acres and Total Treatment Acres) derived from Restoration & Resiliency Report. Resilient species are western larch, ponderosa pine, aspen, subalpine larch, and Engleman Spruce.

Indicators	Resilient Species Acres (2015)	Total Acres (2015)	Resilient Species Acres (2016)	Total Acres (2016)	Resilient Species Acres (2017)	Total Acres (2017)	Resilient Species Acres (2018)	Total Acres (2018)	Resilient Species Acres (2019)	Total Acres (2019)	Resilient Species Acres (2020)	Total Acres (2020)
Restoration of Species Composition due to Wild Fire	449	3122	1220	3074	628	1149	747	1740	794	1861	223	1580
Restoration of Species Composition through Reforestation after Harvest	0	0	0	0	84	84	0	27	0	43	417	417
Regeneration Harvest		320		0		718		1276		103		120
Restoration of Density (Thinning)	822	859	315	344	1022	1022	12	378	573	573	430	450
Intermediate Harvest	851	1102		0	120	120	197	480	845	845	341	749
Restoration using Fuel Treatments	360	1162	2731	3129	496	1648	0	2082	323	1473	183	2163
Restoration thru Prescribed Fire	0	170	0	1	0	975	0	0	1020	2629	0	5
Grassland/ Shrubland Restored	-	7010	-	15073	-	14728	-	9385	-	6908	-	1647

Indicators	Resilient Species Acres (2015)	Total Acres (2015)	Resilient Species Acres (2016)	Total Acres (2016)	Resilient Species Acres (2017)	Total Acres (2017)	Resilient Species Acres (2018)	Total Acres (2018)	Resilient Species Acres (2019)	Total Acres (2019)	Resilient Species Acres (2020)	Total Acres (2020)
thru Burning or Noxious Weed Treatment												
Restoration treatment to restore Patch Size and Pattern	-	5563	-	2043	-	563	-	740	-	63	-	75

Table 2.9- 4: Amount of Timber Offered and Sold by Fiscal Year (PTSAR Reports)

Fiscal Year	Timber Offered (MMBF)	Timber Sold (MMBF)	Total Volume (MMBF) [1]	Forest Plan ASQ (MMBF)[2]
2015	6.646	6.646	9.216	33.4
2016	3.860	3.86	3.860	33.4
2017	5.045	5.045	7.520	33.4
2018	9.822	9.822	12.670	33.4
2019	7.317	6.490	10.373	33.4
2020	9.959	4.708	9.599	33.4

[1] Total volume including Personal use and Commercial, [2] Forest Plan pages II-14.

2.9.4 Discussion

The restoration/resiliency accomplishment process for vegetation management addresses implementation monitoring for vegetation activities as documented in FACTS. Acres treated to increase or sustain the existing geographic acreage of species that have been in decline due to altered disturbance regimes is being maintained on the Forest in this small snap shot of time from 2015-2020. Restoration of forest resiliency is being met thru a variety of tools such as planting, harvesting, prescribed burning, and wildfire as displayed in Table 2.9-3 and have different spatial and temporal scales which provide varying degrees of resiliency to disturbance and stressors. At least half of all acres being treated since 2015 have contributed to forests being more resilient. The tracking of indicators currently is more robust than that of the Forest Plan of 1987.

The Bitterroot Forest Plan recommends that we evaluate the accuracy of the Forest Plan Timber Yield Tables which projects the amount of timber that can be harvested based on growth of stands. In 1993 the Forest developed two methods to do this. The first method was to develop Empirical Yield tables utilizing volume data from all timber stands which had exams and plotting stand age over volume. The second method utilized Normal Yield tables for site quality and stocking.

These two methods predicted yields from 11.5 MBF to 35 MBF per acre. The Forest Plan Yield tables predicted harvest of approximately 12.5 MBF per acre on the average. With an ASQ of 33.4 .MMBF

When comparing the two methods used in determining yields in conjunction with current yields derived from stand exams it is obvious that previous yield tables over predicted what current stands are able to grow. On the average most stands can produce yields around 5-20 MBF per acre based on the habitat types of the Bitterroot.

One purpose of the yield tables is to assure that timber is not being cut faster than it is growing. Harvest levels on the Forest have been significantly lower than what is projected in the Forest Plan, averaging 6-12 MBF, which is about 5MBF per acre being harvested over the last 5 years. **The rate of current harvest coincides with what stands can produce.**

When the Forest Plan was created there was a commitment to a rigorous growth and yield approach to management of the forest. Currently, the Forest is implementing non-traditional harvest schedules and silvicultural prescriptions in addition to integrated ecosystem management which do not coincide with growth and yield.

2.9.5 Evaluation of Results for Adaptive Management Finding

Table 2.9- 5: Summary of findings for Plan Monitoring Item [1]

PLAN IMPLEMENTATION STATUS[1]	CHANGE WARRANTED?	WHERE IS CHANGE WARRANTED?
(A) uncertain	Yes	The monitoring question should be changed to better reflect what the Forest Plan components are being monitored. The goal and objectives of the Forest Plan is largely based on implementation. The monitoring question needs to be changed to "Are treatments trending toward a more resilient forest" would be more appropriate.

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

2.10 MON-VEG-03 – Forest disturbance

2.10.1 Monitoring item summary

- *Monitoring question: What is the status and change of vegetation disturbance?*

Table 2.10-1 lists forest and grassland plan goals and objectives, monitoring indicators, data sources and partners, the frequency of data collection and reporting, and any quantitative targets or thresholds related to this monitoring item. Table 2.10-2 lists the most recent and next dates for data collection and reporting for this monitoring item.

Table 2.10- 1: Forest plan components, monitoring indicators, data collection intervals, and data sources for MON-VEG-03.

Plan components	Indicators	Data collection interval	Data Source / Partner
Goals: Maintain forest stands so that pest-caused losses are reduced to acceptable levels. (pg. II-4). **Objectives:** Convert high-risk or insect and disease infested stands to young, healthy stands. (pg. II 6). **Standards:** Insect and Disease 1, 2, 3, 4, 5, 6, on pages II-28 of the Forest Plan.	• Acres of bark beetle hazard, • Acres of burned areas, • Acres of defoliators hazard, • Root disease hazard • Project monitoring of management activities	Biennial	R1 Insect and Disease Report, FIRESTATS Field reviews

Table 2.10- 2: Monitoring collection and reporting dates for MON-VEG-03.

Milestone	Year
Data last collected or compiled in:	Collected up to 2015, compiled in 2021
Next scheduled data collection and compilation:	Collected up to 2020, compiled in 2023
Last monitoring evaluation report covering this monitoring item:	n/a
Next scheduled monitoring evaluation report covering this monitoring item:	2023

2.10.2 Methods

Mountain Pine Beetle activity has historically caused widespread mortality of lodgepole pine throughout the western U.S. Mountain pine beetle activity has caused extensive pine mortality throughout the Northern Region over the last decade (Egan 2014). MPB-caused mortality in whitebark pine continues to be a great concern on the Bitterroot since the distribution of this species is limited across the Forest. The results are based on FIA data collected from 2006-2015 The analysis dataset is called the R1 Hybrid 2015. There were no reports for defoliators.

Project monitoring of the effectiveness of prescribed treatments for insects and disease are discussed in results for years 2016-2020. Acres burned is derived from the Forest Fire History layer in GIS.

R1 Broad-Scale Monitoring Strategy Analysis of FIA data Forest Inventory and Analysis (FIA) data were used to derive the estimates in all of the BSMS tables. Using FIA data allows for regional monitoring based on an unbiased, representative inventory of R1lands, which is remeasured over time.

This inventory design is appropriate for making estimates of a variety of attributes across large landscapes such as National Forests, geographic area or landscapes, and ecological section. The FIA sampling frame uniformly covers all lands, regardless of management emphasis. Therefore, wilderness areas, roadless areas, and actively managed lands all have the same probability of being sampled. More detail on the statistical foundation of using FIA data on National Forests is found in: *Application of Forest Inventory and Analysis (FIA) Data to Estimate the Amount of Old Growth Forest and Snag Density in the Northern Region of the National Forest System*.

An “FIA Analysis Dataset” is a set of FIA plots available for analysis using R1 analysis tools such as the R1 FIA Summary Database Estimator Form. An Analysis Dataset contains the most recent available measurement of each plot across the Region.in 2015.

A new analysis dataset is created each time a new set of FIA inventory data are brought into FSVeg and made available to the Region. This dataset contains the most recent available data for each inventory point location across the Region.

2.10.3 Results

Fire Disturbance

Fire disturbance across the Forest burned 149,739 acres between the years 2015-2020 with a variety of severity. These fires can contribute to bark beetle losses, however monitoring of these areas does not indicate considerable bark beetle mortality.

Hazard Ratings for Insects and Disease

Forest insects require three things to cause significant impact to resource values: susceptible hosts; insect populations; and favorable weather conditions. Hazard rating systems measure the susceptibility of forested areas to a particular insect by evaluating the degree to which sampled tree and stand-level characteristics are conducive to successful insect colonization and reproduction. High and moderate hazard forested areas are more likely to experience significant mortality if challenged by insect populations when weather conditions are favorable. The following are summary ratings used in the tables below:

- VL or 0 = Very Low (little to no host species but forested)
- L or 1 = Low Hazard
- M or 2 = Moderate Hazard
- H or 3 = High Hazard

Table 2.10- 3:Hazard Ratings for Insect and Disease. For each pathogen, a total of 255 Primary Sampling Units (PSUs) were sampled. A total of 993 subplots were sampled with forested potential vegetation type (PVT).

Pathogen	Hazard Rating	Estimate Acres	90% CI - Lower Bound	90% CI - Upper Bound	Total # of Subplots Meeting Hazard Criteria
Combined Beetle	VL	693,805	636,318	765,684	449
Combined Beetle	L	380,125	329,529	432,626	246
Combined Beetle	M	332,223	276,208	380,072	215
Combined Beetle	H	128,253	93,906	160,085	83
Combined Beetle	MH	460,476	396,092	511,970	298
Mountain Pine Beetle and Lodge Pole Pine	VL	984,307	925,661	1,059,538	637
Mountain Pine Beetle and Lodge Pole Pine	L	316,771	260,189	362,964	205
Mountain Pine Beetle and Lodge Pole Pine	M	207,060	162,601	249,188	134
Mountain Pine Beetle and Lodge Pole Pine	H	26,269	10,572	42,626	17
Mountain Pine Beetle and Lodge Pole Pine	MH	233,329	184,251	278,295	151
Mountain Pine Beetle and Whitebark Pine and Lodgepole	VL	1,335,072	1,288,502	1,379,462	864
Mountain Pine Beetle and Whitebark Pine and Lodgepole	L	139,070	105,475	175,874	90
Mountain Pine Beetle and Whitebark Pine and Lodgepole	M	37,085	19,717	54,364	24

Pathogen	Hazard Rating	Estimate Acres	90% CI - Lower Bound	90% CI - Upper Bound	Total # of Subplots Meeting Hazard Criteria
Mountain Pine Beetle and Whitebark Pine and Lodgepole	H	23,178	10,449	39,419	15
Mountain Pine Beetle and Whitebark Pine and Lodgepole	MH	60,264	36,964	85,405	39
Douglas-fir Bark Beetle	VL	839,056	776,686	918,142	543
Douglas-fir Bark Beetle	L	327,587	275,441	375,515	212
Douglas-fir Bark Beetle	M	278,140	227,767	322,164	180
Douglas-fir Bark Beetle	H	89,623	62,941	116,753	58
Douglas-fir Bark Beetle	MH	367,763	308,968	416,699	238
Spruce Beetle	VL	971,945	906,650	1,044,163	629
Spruce Beetle	L	242,600	199,289	289,834	157
Spruce Beetle	M	101,985	70,813	132,373	66
Spruce Beetle	H	217,876	168,110	261,754	141
Spruce Beetle	MH	319,861	259,269	371,464	207
Root Disease	VL	1,174,369	1,111,539	1,235,718	760
Root Disease	L	299,773	245,244	356,519	194
Root Disease	MH	60,264	36,105	85,574	39

PSU-Primary sampling unit; PVT-Potential Vegetation Type

2.10.4 Discussion

Silvicultural prescriptions utilize integrated pest management strategies and treatments that reduce long-term losses due to insects and diseases. In most cases, increasing tree vigor and reducing susceptibility to attack by insects and diseases is part of the criteria used to select which trees will stay and which will be removed. Examples of this include the control of mistletoe by selectively removing mistletoe-infected trees or thinning to reduce the susceptibility of forest stands to bark beetles. Mitigation measures are also routinely included in project implementation to prevent the spread of undesirable insects and diseases. In stands where ponderosa, lodgepole and whitebarkpine grows the primary concern is bark beetles (mainly pine engravers and mountain pine beetle) and annosum root disease in ponderosa pine. In Douglas-fir stands, Douglas-fir beetle, mistletoe, and root disease are the primary concerns.

Populations of bark beetles remain high in some areas but are not directly tied to management activities occurring on the Forest. They are the result of prolonged dry weather, decades of fire suppression, recent large fires, and existing vegetation conditions.

Project monitoring in several projects between 2016-2020 found relatively few insect and disease problems resulting from management activities. Ongoing activities that have the potential to cause insect or disease activities on the Forest include prescribed burning, precommercial thinning and slashing. However, mitigation measures applied to these projects have been effective in preventing any noticeable spread of damaging insects or disease. Incidental tree mortality was found on some projects but was well within the acceptable limits given project objectives. Mitigation measures include large landing piles to provide suitable habitat for pine engravers, limiting non-commercial thinning to July 1-Setemeber 30th in ponderosa lodgepole, and white bark pine pine, reducing stand densities, improves tree vigor and also provides open stand conditions which are less desirable for mountain pine beetle, applying an application of sporax on ponderosa pine stumps greater than 14" to reduce annosum root rot disease and finally removing mistletoe infected trees that are source for new infections in Douglas-fir.

The status based on the data set from FIA indicate the Foresr is within the low to moderate hazard (Table 2.10-3), but high and moderate hazard areas are more likely to experience significant mortality if challenged by insect populations when weather conditions are favorable.

2.10.5 Evaluation of Results for Adaptive Management Finding

Table 2.10- 4: Summary of findings for Plan Monitoring Item VEG-03

PLAN IMPLEMENTATION STATUS[1]	CHANGE WARRANTED?	WHERE IS CHANGE WARRANTED?
(B) Uncertain – need additional FIA data to see the change in hazard ratings over time.	uncertain	The Forest Plan components are being monitored.

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

2.11 MON-INV-01 – Invasive plants

2.11.1 Monitoring item summary

- *Monitoring question: What is the change in terrestrial invasive plant species area?*

Table 2.11-1 lists forest and grassland plan goals and objectives, monitoring indicators, data sources and partners, the frequency of data collection and reporting, and any quantitative targets or thresholds related to this monitoring item. Table 2.11-2 lists the most recent and next dates for data collection and reporting for this monitoring item.

Table 2.11- 1: Forest plan components, monitoring indicators, data collection intervals, and data sources for MON-INV-01.

Plan components	Indicators	Data collection interval	Data Source / Partner
See Below	• Net infested areas • Acres treated	Biennial	• Field inventories, • local monitoring efforts • Forest Employee identification of sites • TESP-IS • FACTS • List of projects, partners, contracts

Referenced Plan Components:

Goals: Control noxious weeds to protect resource values and minimize adverse effects on adjacent land. (p. II-3).

Objectives: Complete evaluation of risk of spread and implement control strategies, emphasize use of biological control for knapweed and leafy spurge. (p. II-6).

Standards: Primary means of preventing, containing, or controlling will be through vegetative management practices such as biological control, herbicides may be used to provide short term protection on specific sites after analysis. (p. II-29).

Table 2.11- 2: Monitoring collection and reporting dates for MON-INV-01.

Milestone	Year
Data last collected or compiled in:	2018
Next scheduled data collection and compilation:	2021
Last monitoring evaluation report covering this monitoring item:	2019
Next scheduled monitoring evaluation report covering this monitoring item:	2023

2.11.2 Methods

Terrestrial invasive species data are provided at two scales for this evaluation: landscape and site specific.

Landscape scale – Infested Area

At the landscape scale two measurements are evaluated:

- infested acres
- treatment acres

Infested Acres

Acres mapped of Montana and Idaho State listed species use protocols from the *National Forest System Invasive Species Management Record Keeping Business Rules and National Standards (v01.10.2014) t*o identify Infested Area. Infested Area is derived by the recorded percent infested of a

Total Area. Total Area varies and is determined on a site-by-site basis. See Figure I1-1 for definitions. Data was extracted from the TESP-IS database. Infested area provides a record of which species have been detected (of the areas surveyed) during a given time period. It does not provide an indication of which species is occupying the most or least acres, because it is not known what acres have been reduced or increased as re-measurements are not routinely conducted to record change. Infested acres also do not provide a trend of increasing or decreasing acres for the same reason.

Information is collected by forest personnel in the Botany and Range Programs, Wilderness Rangers, spray contractors, and Montana Conservation Corp members. It is not a systematic survey of all lands on the Bitterroot, but rather reflects opportunity, high priority areas, and project areas.

Treated Acres

Treated acres data were extracted from the Forest Activities (FACTS) using a standard report (Invasive Performance Reports – Performance Treats). The following FACTS activity codes were queried for terrestrial invasive species treatments. Acres reported are those completed acres (those acres where gridding, monitoring and spray treatment was completed by the agency unit). Biocontrol releases get credit for 5 acres per release and must be at least a quarter of a mile apart.

Figure I 1-1. Invasive Species Database (TESP-IS) – Definitions

Infested Area: An area of land or water, in acres, containing a single invasive species delineated by the actual perimeter of the infestation as defined by the outer edge of the canopy cover of plants or the visible population, home range or stream reach of other taxa excluding adjacent areas not infested and outside the perimeter of the population.

Total Area: An area, in acres, occupied by an invasive species delineated by a polygon that may represent a general area where the population is found or may represent the spatial extent of the infestation population. Total Area is calculated from the area of the spatial feature. Total Area may contain significant areas that are not within the perimeter of the target invasive species infestation in which case "% Infested" would be less than 100%.

Percent Infested: Percent (%) Infested is the proportion of the Total Area that is infested with the target invasive species. The default will be 100% Infested. In other words the application will assume that the spatial feature that represents the infestation is 100% infested. If the spatial feature represents a large area that contains significant area that is not within the perimeter of the target invasive species infestation, enter a percent that approximates the proportion that is actually infested based on the definition of "Infested Area". A "0" may be used to document an infestation that currently contains no detectable individuals. A value of 0 for percent infested is allowed only for re-measured infestations, indicating that treatment has eradicated an infestation or under natural conditions an infestation has been eliminated.

Figure 16 Invasive Species Database Definitions

Table 2.11- 3: FACTS Activity Codes

Activity Code	Activity Description
2510	Invasive - Pesticide Application
2520	Invasive - Treatment Activity Monitoring (can only be used with CWKV funding)
2530	Invasive - Mechanical/Physical
2540	Invasive - Cultural/Fire
2550	Invasive - Biocontrol, Classic

Site-specific scales

At the site-specific scale, two measures are evaluated:

- Status of terrestrial invasive species program projects
- Number of terrestrial invasive detections along monumented transects were taken at the following three locations.

Selway Trails Monitoring – Number of invasive/non-invasive plants in transect. Locate transects about 5 feet off the centerline of trail on the uphill side of the trail within the herbicide treatment zone. Record your sample "hits" from the uphill side of the tape immediately adjacent to the foot interval on the tape. If the sample point on the tape shows bare ground, rock or litter, then record the hit on that feature and also record the nearest plant within a 1-foot hemi-radius of the foot interval on the tape. If your tape interval sample point or hemi-radius sample encounters a plant that you cannot identify as invasive, native or exotic non-invasive, then mark "U" and go on to the next 10' interval sample point. Record a minimum of forty (more is better) sample points, not including "unknowns (U)" for each transect. Estimate the 10' intervals if you don't have a tape. Invasives include: spotted knapweed, sulfur cinquefoil, St Johnswort, common mullein and cheatgrass. Non-invasives include forbs, graminoids, shrubs and trees.

Frank Church River of No Return Invasives Monitoring – Number of invasive/non-invasive plants in transect sites are located in rush skeletonweed infestations that have been treated annually since 2007. Monitoring indicates the number of invasive/non-invasive plants in a 200' transect with samples taken every two feet. Record hits on Forbs, Grass, Shrubs and weed species. Invasives include spotted knapweed, rush skeletonweed and common mullein. Non-invasives were added to the monitoring in 2015. They include forbs, graminoids and shrubs.

Terrestrial Invasives Program Projects – number and status of projects involving spray treatments, biocontrol programs, monitoring and other efforts to reduce invasive species on the Forest.

2.11.3 Results

Landscape scale infestations

Infested Acres

As of 2019 there are 76 Montana and Idaho State listed species, 26 of these species have been detected on the Bitterroot NF and 50 species have not. Five of those detections have been eradicated and are no

longer included in these acreages. A total of 147,306 acres have been detected for the 26 detected species from the period of 1980 to 2020. This includes acreages of overlapping species so many acres are counted multiple times. (Note these are not occupied acres, see landscape methods section above). Cheat grass, spotted knapweed, oxeye daisy, and sulfur cinquefoil have the highest acres of detection. (Table 2.11-4).

Five other terrestrial invasive species - lesser burdock, bull thistle, tall tumble mustard, common dandelion, and common mullein - (not on the MT or ID state list) were also tracked during this same period. Infested Area for these 5 species is 2,264 acres.

Table 2.11- 4: Noxious Weed Infestation Information***

Montana Priority***	Idaho list****	Scientific Name	Common Name	FY 2017 Inventory Acres	FY 2020 Inventory Acres
Not listed	Contain	*Aegilpos cylindrica*	Jointed Goatgrass	0	0
Not listed	Control	*Anchusa arvensis*	Small Bugloss **	.07	0
Not listed	EDRR	*Azolla pinnata*	Feathered Mosquito Fern	0	0
2B	Contain	*Berteroa incana*	Hoary alyssum	57	66
3	Not listed	*Bromus tectorum**	Cheatgrass*	26,135	26,135
Not listed	Contain	*Bryonia alba*	White Bryony	0	0
2A	Contain	*Butomus umbellatus*	Flowering rush	0	0
2B	Contain	*Cardaria draba*	White top	0	0
Not listed	Contain	*Carduus acanthoides*	Plumeless Thistle	0	0
Not listed	Control	*Carduus nutans*	Musk Thistle	321	321
Not listed	EDRR	*Centaurea calcitrapa L*	Purple Starthistle		0
Not listed	Control	*Centaurea debeauxii*	Meadow Knapweed	0	0
2B	Contain	*Centaurea diffusa*	Diffuse knapweed **	0	0
Not listed	EDRR	*Centaurea iberica*	Iberian Starthistle		0
2B	Control	*Centaurea repens*	Russian knapweed	0	0
1A	Contain	*Centaurea solstitialis*	Yellow starthistle **	0	0
2B	Contain	*Centaurea stoebe**	Spotted knapweed*	89,542	92,890
Not listed	EDRR	*Centaurea triumfetti*	Squarrose Knapweed	0	0

Montana Priority***	Idaho list****	Scientific Name	Common Name	FY 2017 Inventory Acres	FY 2020 Inventory Acres
1B	Contain	*Chondrilla juncea*	Rush skeletonweed	148	172
2B	Contain	*Chrysanthemum leucanthemum*	Oxeye daisy	5,663	6,352
2B	Contain	*Cirsium arvense*	Canada thistle	1,298	1,369
Not listed	EDRR	*Cobomba caroliniana*	Fanwort	0	0
Not listed	Contain	*Conium maculatum*	Poison Hemlock	17	17
2B	Contain	*Convolvulus arvensis*	Field bindweed	0	0
Not listed	Control	*Crupina vulgaris*	Common Crupina	0	0
2B	Contain	*Cynoglossum officinale*	Houndstongue	2,718	2,833
1B	Control	*Cytisus scoparius*	Scotch broom **	.01	0
1B	Control	*Echium vulgare*	Blueweed (Vipers Bugloss)	17	17
3	EDRR	*Egeria densa*	Brazilian waterweed	0	0
Not listed	EDRR	*Eichhornia crassipes*	Water Hyacinth		0
3	Not listed	*Elaeagnus angustifolia*	Russian olive	0	0
2B	Contain	*Euphorbia esula*	Leafy spurge	125	127
Not listed	EDRR	*Heracleum mantegazzianum*	Giant Hogweed	0	0
2A	Control	*Hieracium aurantiacum*	Orange hawkweed	27	77
2A	Control	*Hieracium caespitosum*	Meadow/yellow hawkweed	34	34
Not listed	EDRR	*Hieracium glomeratum*	Yellow Devil Hawkweed	0	0
Not listed	EDRR	*Hieracium piloselloides*	Tall Hawkweed	0	0
Not listed	EDRR	*Hydrcharis morsus-ranae*	Common/European Frogbit	0	0
3	EDRR	*Hydrilla verticillata*	Hydrilla	0	0
Not listed	Control	*Hyoscyamus niger*	Black Henbane	1	1

Montana Priority***	Idaho list****	Scientific Name	Common Name	FY 2017 Inventory Acres	FY 2020 Inventory Acres
2B	Not listed	*Hypericum perforatum*	St. Johnswort	1,766	2,139
Not listed	EDRR	*Impatiens glandulifera*	Policeman's Helmet	0	0
2A	Contain	*Iris pseudacorus*	Yellowflag iris	0	0
1A	Control	*Isatis tinctoria*	Dyer's woad	0	0
2A	Contain	*Lepidium latifolium*	Perennial pepperweed	0	0
2B	Contain	*Linaria dalmatica*	Dalmatian toadflax	108	108
2B	Contain	*Linaria vulgaris*	Yellow toadflax	17	17
1B	Contain	*Lythrum spp.*	Purple loosestrife	0	0
Not listed	Contain	*Milium vernale*	Milium	0	0
3	Control	*Myriophyllum aquaticum*	Parrotfeather Milfoil	0	0
Not listed	EDRR	*Myriophyllum heterophyllum*	Variable-Leaf-Milfoil	0	0
2A	Control	*Myriophyllum spicatum*	Eurasian watermilfoil	0	0
Not listed	Control	*Nardus stricta*	Matgrass	0	0
Not listed	EDRR	*Nymphoides pelata*	Yellow Floating Heart	0	0
Not listed	Contain	*Onopordum acanthium*	Scotch Thistle	0	0
1A	Control	*Phragmites australis*	Common Reed (Phragmites)	0	0
Not listed	Control	*Polygonum bohemicum*	Bohemian Knotweed	0	0
1B	Control	*Polygonum cuspidatum*	Knotweed complex **	.003	0
Not listed	Control	*Polygonum sachalinense*	Giant Knotweed	0	0
2B	Contain	*Potamogeton crispus*	Curlyleaf pondweed	0	0
2B	Not listed	*Potentilla recta*	Sulfur cinquefoil	13,292	13,408
2A	Not listed	*Ranunculus acris*	Tall buttercup	591	681
2A	Not listed	*Rhamnus cathartica L.*	Common Buckthorn	0	0

Montana Priority***	Idaho list****	Scientific Name	Common Name	FY 2017 Inventory Acres	FY 2020 Inventory Acres
Not listed	Control	*Salvia aethiopis*	Mediterranean Sage	0	0
Not listed	EDRR	*Salvinia molesta*	Giant Salvinia	0	0
2A	Contain	*Senecio jacobaea*	Tansy ragwort	0	0
Not listed	Control	*Solanum rostratum*	Buffalobur	0	0
Not listed	Control	*Sonchus arvensis*	Perennial Sowthistle	0	0
Not listed	Control	*Sorghum halepense*	Johnsongrass	0	0
1A	Not listed	*Taeniatherum caput-medusae*	Medusahead	0	0
2B	Contain	*Tamarix spp.*	Saltcedar	0	0
2B	Not listed	*Tanacetum vulgare*	Common tansy	541	542
Not listed	EDRR	*Trapa natans*	Water Chestnut	0	0
Not listed	Contain	*Tribulus terrestris*	Puncturevine	0	0
2A	Not listed	*Ventenata dubia*	Ventenata	0	.4
Not listed	EDRR	*Zygophyllum fabago*	Syrian Beancaper	0	0

*Estimated acres as these species are found profusely throughout the Forest and have not been a priority for inventory. The accuracy of Inventoried acres has improved in 2017 with spotted knapweed going down and cheatgrass going up.
**Found on the Forest in the past but currently considered eradicated
***The State of Montana list noxious weed species as Priority 1A, 1B, 2A, 2B and 3. Priority 1A weeds are not present in Montana. Management criteria will require eradication if detected, along with education and prevention. Priority 1B weeds have limited presence in Montana. Management criteria will require eradication or containment and education. Priority 2A weeds are common in isolated areas of Montana. Management criteria will require eradication or containment where less abundant. Management shall be prioritized by local weed districts. Priority 2B weeds are abundant in Montana and widespread in many counties. Management criteria will require eradication or containment where less abundant. Management shall be prioritized by local weed districts. Priority 3 weeds are not Montana listed noxious weeds. These regulated plants have the potential to have significant negative impacts. The plant may not be intentionally spread or sold other than as a contaminant in agricultural products. The state recommends research, education and prevention to minimize the spread of the regulated plant.
****In Idaho there are three categories of weeds. They are early detection rapid response (EDRR), control, and containment.
*****This table is not a systematic survey of all lands on the Bitterroot but rather reflects opportunity, high priority areas and project areas.

Acres Treated

Table 2.11- 5: Terrestrial Invasive Treatment Activities (acres completed)

Treatment Activity	2017	2018	2019	2020	Grand Total
2510 Invasive - Pesticide Application	4,145.8	9,115	9,201.4	6,251.8	28,714
2530 Invasive Mechanical/Physical			6.9	97.9	104.8
2550 Invasive Biocontrol, Classic				65	65
Grand Total	**4,145.8**	**9,115**	**9,208.3**	**6,414.7**	**28,883.8**

The tables below show results of monitoring completed on the Forest in terms of reduced invasive species numbers and increased non-invasive numbers over time.

Site-specific scale infestations

The tables below show results of monitoring completed on the Forest displaying number of detections of non-invasives and invasive species over time.

Table 2.11- 6: Selway Trails Monitoring – Number of invasive/non-invasive plants in transect showing change over time.

Year	Bad Luck Creek Trail #93	Bad Luck Ridge Trail #52	Beaver Jack Trail #37	Indian Ridge Trail #10	Nick Wynn Trail #35	Scimitar Trail #36	Selway River Trail #4	Spot Mountain Trail #3	White Cap Trail #24
2011 Invasives	25	43	12	39	21	17	22	21	43
2011 Non-invasives	35	25	33	21	31	52	26	25	20
2012 Invasives	0	11	0	13	5	0	0	3	5
2012 Non-invasives	50	36	34	42	41	62	38	30	37
2013 Invasives	4	24	0	13	10	0	0	4	14
2013 Non-invasives	54	40	36	46	47	69	37	32	31
2017 Invasives	5	21	1	24	5	0	0	2	7
2017 Non-Invasives	70	45	49	35	59	70	47	40	50

Table 2.11- 7: Frank Church River of No Return Invasives Monitoring – Number of invasive/non-invasive plants in transect showing change over time.

Year	Fawn Ridge #1	Fawn Ridge #2	Fawn Ridge #6	Elk Horn #2	Elk Horn #3	Prospect Ridge #3	Prospect Ridge #4	Prospect Ridge #5
2007 Invasives	15	0	0	0	1	2	2	0
2008 Invasives	4	0	0	0	0	0	0	0
2009 Invasives	0	0	0	0	0	0	1	0
2010 Invasives	1	0	0	1	0	0	0	0
2011 Invasives	0	0	10	2	9	1	0	1
2012 Invasives								
2013 Invasives	3	3				1	0	0
2014 Invasives				0	1			
2015 Invasives	3	0	9					
2015 Non-invasives	39	99	63					
2016 Invasives						0	0	1
2016 Non-Invasives						87	120	94
2017 Invasives	2	2	21	1	3			
2017 Non-Invasives	120	132	98	129	117			
2018 Invasives						0	1	1
2018 Non-Invasives						143	170	157
2020 Invasives				0	1			
2020 Non-Invasives				112	118			

Terrestrial Invasives Program Projects

Table 2.11-8 shows all the projects on the Forest involved in monitoring, gridding and treating with herbicide and bio control as well as monitoring and education efforts in the fight against invasives.

Table 2.11- 8: Projects on the Bitterroot Forest involving spray treatments, biocontrol programs, monitoring and other efforts to reduce invasive species on the Forest.

Project	Description
1) Backcountry contract	Ongoing 5 year 2016-2021 Forest wide backcountry treatment and gridding contract for treatment, mapping, and monitoring of new invaders and expanding established invaders on trails and remote areas including the Frank Church River of No Return & Selway Bitterroot Wilderness, west side canyon trails, and at-risk grassland sites.
2) Participating Agreement between Ravalli County and Bitterroot Forest	The Forest continually contributes funds to the existing agreement(s) that implement an integrated invasives strategy including: cooperative treatment of high priority invasive plants such as leafy spurge, Dalmatian toadflax, hawkweeds, common bugloss and rush skeletonweed across Forest/private land boundaries; biological control release and monitoring with the Victor and Darby schools science departments; mapping of new invaders; and improving and delivering invasive weed education to groups in the county. The agreements included regular appropriations and special funding.
3)Returned receipts stewardship	Funds received from returned receipts for stewardship work for the Meadow Vapor Timber Sale which were put into a new participating agreement with Ravalli County in 2019.
4) Participating Agreement with Montana Conservation Corps	On-going 2015-2020 agreement for mapping and treatment work in remote areas and trails on the Bitterroot Forest. The program also promotes education and training for the participants about invasive plants.
5) General Invasive Plant Education and Training	a) Wilderness Rangers inspect and enforce weed-free feed/hay requirements in the backcountry throughout the field and hunting seasons. In addition, they inform users about best practices to prevent the increase and spread of invasive weeds. b) Invasive plant awareness and prevention is a major theme in the conservation education program. The Forest continued to develop working relationships with groups like the Bitterroot Garden Club, county schools, and Backcountry Horsemen and ATV clubs. c) Forest and County specialists trained permanent and seasonal employees on each ranger district in the identification of new invaders and in the basic weed prevention measures outlined in the Region One supplement to the Forest Service Manual 2080 (R1 2000-2001-1). d) On the ground rush skeletonweed identification with Frank Church Selway Foundation
6) Roadside and ATV treatment	Ongoing multi-year contract 2016-2021 in which numerous weed-vector roads were treated throughout the Forest and selected low relief grassland terrain compatible with ATV treatment for a wide variety of invasive plant species.
7) BAER program	In 2018, funds were provided for treatment and monitoring for the Reynolds Lake Fire.
8) NRIS Database	On-going entry of newly found weed sites in the NRIS database. This database serves the purpose of allowing the quick generation of maps by species and location of invasive weeds. The database allows the program manager to target work objectives and timing for maximum effect and efficiency.

2.11.4 Discussion

At the landscape scale an increase of infested acres was detected from 2017 to 2020. This increase can be attributed to newly detected infestations and improved mapping. *Ventenata dubia* was the only new invader detected in 2019 that was not detected in 2017 (Table 2.11-4). Herbicide treatments and biocontrol are helping to reduce the percent cover of existing infestation areas, but current mapping does not have a way to show this (not reported here). Although overall detections of infested areas have increased, it is difficult to infer that there is also an increased area of infested acres because re-measurements are not systematically conducted for treated or untreated areas. Generally, the infested area does not change, just the percent cover of the infested area.

For the Selway and Frank Church trail monitoring (Tables 2.11-6 and 2.11-7), a general increase in non-invasive plants have been detected.

2.11.5 Evaluation of Results for Adaptive Management Finding

Table 2.11- 9: Summary of findings for Plan Monitoring Item 1

PLAN IMPLEMENTATION STATUS[1]	CHANGE WARRANTED?	WHERE IS CHANGE WARRANTED?
Yes – The national database of record (TESP-IS) does not require percent cover as a means to show a reduction with treated acres; therefore, it is not the method used to track changes in area. See Table I1-1 above for an explanation of infested acres and total area.	Yes.	Monitoring Plan: Recommend adding indicators tracking effectiveness of treatments. A standardized control code from the National TESP-IS Protocol will be used to approximate the most accurate control level. This information is submitted with the Annual Accomplishment Reporting; however, efficacy ratings are only for that fiscal year.

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

2.12 MON-WTR-01 – Watershed conditions

2.12.1 Monitoring item summary

- *Monitoring question: Is management improving or maintaining watershed conditions that support desired riparian and stream characteristics?*

Table 2.12-1 lists forest and grassland plan goals and objectives, monitoring indicators, data sources and partners, the frequency of data collection and reporting, and any quantitative targets or thresholds related to this monitoring item. Table 2.12-2 lists the most recent and next dates for data collection and reporting for this monitoring item.

Table 2.12- 1: Forest plan components, monitoring indicators, data collection intervals, and data sources for MON-WTR-01.

Plan components	Indicators	Data collection interval	Data Source / Partner
See Below	1) Miles of impaired streams removed from 303d list 2) Number of watersheds moved from one Watershed Condition Framework (WCF) Class to a higher functioning Class, e.g. Class 2 to Class 1. 3) Watershed conditions/improvement projects (acres, miles) designed to meet TMDL direction (crossings, road segments parallel to streams, contributing area) and effectiveness. 4) Best Management Practices (BMP) reviews conducted on forest and findings.	Annually	The Data Source is listed by Indicator in the discussion below.

Referenced Plan Components:

Forest-Wide Management Goal 11: Maintain soil productivity, water quality, and quantity. (p. II-3).

Forest-Wide Management Objective i Water (p. II-6)**:**

- Manage sufficient instream flows to support quality fish habitat
- Manage municipal watersheds to assure…high quality water.
- Manage riparian areas to prevent adverse effects on channel stability and fish habitat.

Standards: See pages II 23-26 of the Forest Plan:

- h (1) Utilize equivalent road area or similar to evaluate cumulative effects.
- h (2) Allow for hydrologic recovery.
- h (3) Evaluate site specific water quality effects at project level.
- h (4) Maintain instream flows for fish habitat, recreation, channel maintenance, and aesthetics.
- h (6) Include soil and water conservation practices (Best Management Practices) in project design and implementation
- h (8) Plan and conduct land management activities so that accelerated erosion will not affect water quality and soil productivity.
- h (10) Actively reduce sediment from forest roads.

Table 2.12- 2: Monitoring collection and reporting dates for MON-WTR-01.

Milestone	Year
Data last collected or compiled in:	2018-2019
Next scheduled data collection and compilation:	Field Seasons 2020-2021
Last monitoring evaluation report covering this monitoring item:	Bitterroot National Forest Monitoring Report 2018
Next scheduled monitoring evaluation report covering this monitoring item:	2022

2.12.2 Methods

The following section includes information on monitoring methods, results and findings for each monitoring indicator.

Data source: The data source for this report include the Natural Resource Management Watershed Improvement Tracking (WIT) Database, Department of Environmental Quality Total Maximum Daily Loads (TMDL) and restoration plans (http://deq.mt.gov/Water/SurfaceWater/tmdl/finalreports), Watershed Condition Class Framework https://apps.fs.usda.gov/wcatt/, DEQ Clean Water Act Information Center http://deq.mt.gov/Water/Resources/cwaic and Bitterroot National Forest records.

2.12.3 Results

Indicator 1: 303(d) streams (miles of streams removed from 303d list).

The Clean Water Act gives authority to individual States to develop, review, and enforce water quality standards under Section 303. This section also requires the States to identify existing water bodies that are not moving towards water quality standards and develop plans to make progress. These plans are commonly called TMDLs. Several streams in the Bitterroot River basin are listed on the Montana 303d List, the master list of impaired streams for the state. Impaired uses include aquatic life and cold water fish, usually caused by stream or habitat alterations, temperature, flow alteration, siltation, suspended solids, and/or nutrients. Writing a TMDL for a pollutant causes it to be "delisted" from Category 5 (because a TMDL has been prepared) and moved to Category 4a where pollutants are listed as causes for impairments. Of the impaired streams in the Bitterroot River Basin, Montana Department of Environmental Quality (MT DEQ) has completed TMDLs for pollutants and/or restoration plans for some areas in the Bitterroot with proposed additional TMDLs to be completed in 2021. TMDL reports can be found on the MT DEQ website at the following web address: Montana DEQ > Water > SurfaceWater > TMDL (mt.gov). The TMDL reports are under the TMDL Documents tab.

During the last two years, there has been no change in the status of the 52 Listed streams in the Bitterroot River basin. However, in 2019 the Montana Department of Environmental Quality began a Focus watershed program with the Bitterroot River basin the first Focus watershed. The Focus watershed will bring momentum to the combined efforts of the Forest Service and collaborators to develop water quality improvement projects in the Bitterroot basin. The Bitterroot Focus Watershed maintains a wikipage with relevant background and objectives, project accomplishments, and will eventually contain trend information on water quality for the streams in the Bitterroot Watershed. The wiki page is at the following web address: Montana Water Quality Planning Projects / Bitterroot Focus Watershed (pbworks.com).

The project planning process on the Bitterroot National Forest evaluates watershed improvement needs on a project by project basis. Watershed improvement activities designed to improve water

quality and improve watershed condition class are included in planning efforts and implemented as funding and workload permits. Consultation with Montana DEQ occurs during project planning to ensure that activities move towards the intent and recommendations of watershed restoration goals identified by DEQ. During 2018- 2019 reporting period, projects were not designed with the single purpose of addressing a TMDL or 303d listed impairment of a particular stream; however, numerous projects were implemented where the stated goals and objectives did include, at least in part, the goal to improve water quality and move towards the intent of a TMDL. Implementation projects designed to improve watershed condition and water quality are detailed in Table 2.12-3 below.

Indicator 2: Watershed Condition Class (WCF) number of watersheds moved from one Class to a higher functioning Class (e.g. Class 3 to Class 2, or Class 2 to Class 1).

The watershed condition goal as outlined in the Bitterroot Forest Plan is to protect National Forest System watersheds by implementing practices and projects designed to maintain or improve watershed condition. The Watershed Condition Framework (WCF), a national framework established in 2011, is one tool through which these efforts are being coordinated. 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 Bitterroot National Forest contains all or part of 87 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 Watershed Condition Framework (arcgis.com) identifies the ranking for each watershed on the Bitterroot National Forest. Approximately 65% of the watersheds on the Bitterroot National Forest classify as ‘Functioning Properly’ and 35% classify as ‘Functioning at Risk’. Priority watersheds are selected (and identified on that map) that focus improvement activities to move the watershed to a higher functioning Class or condition.

Priority watersheds are improved through the implementation of projects designed to reduce road density, improve infiltration, restore stream crossings, and improve vegetative cover, ultimately reducing erosion from road surfaces and contributions to area streams. The previous Monitoring and Evaluation Report (2018) details the progress made in two priority watersheds, 1) East Fork Bitterroot River, Bertie Lord and 2) Upper Sleeping Child. Both these watersheds moved from a classification of functioning at risk to functioning properly prior to 2018. The remaining Priority Watershed, Upper Rye Creek, remains a priority for ongoing restoration actions on the forest. As of 2019 not all the essential projects in Upper Rye Creek were completed and the Watershed Status was not yet reclassified but this may change with the upcoming review of the Watershed Classification Framework and watershed status in 2021. Table 2.12-3 displays the hydrologic unit information for Upper Rye Creek.

Table 2.12-4 included under Indicator 3 details projects completed during 2018 and 2019 in Upper Rye Creek and other watersheds designed to improve watershed function by improving water and habitat quality. As with Indicator 1, which is related to implementing TMDLs and delisting streams, watershed improvement projects implemented during the reporting period address all three indicators related to improving water quality and watershed condition. Consequently, the implementation projects are summarized together in Table 2.12-4.

Table 2.12- 3: WFC Priority Watersheds Status

Watershed Name	Upper Rye Creek
Hydrologic Unit Code	170102050801
Year Need Identified	2014
Project(s) Decision that authorized improvement activities	Darby Lumber Lands Watershed Improvement and Travel Management Project Phase I (2015) (DLL) and Phase II (analysis ongoing, 2020)
Completion Date	Estimated 9/30/2019
Acres	18,257
Ownership	94% National Forest
Initial Watershed Condition Class	Class 2-Functioning at Risk
Current Watershed Condition Class	Improvements partially complete (estimated completion date 9/30/2019)
Community Partners	Bitterroot Water Forum, Ravalli County Off-road Users, others associated with Phase II not yet identified
Resource Concerns	Species habitat, fish habitat, water quality

Indicator 3: Watershed improvement projects designed to move towards TMDL direction.

Sediment TMDL have prescribed reductions in sediment from forest roads. Much of the watershed restoration on the Bitterroot National Forest is aimed at sediment reduction. Many of the streams in the Bitterroot Basin contribute water and sediment either directly to streams with a sediment TMDL or are contributors or water and sediment to downstream TMDL reaches. As a result, essentially all improvement projects benefit streams with a sediment TMDL whether the immediate stream is listed or flow downstream into a listed water. Table 2.12-4 below compiles watershed improvement projects by stream and watershed. Most of the project activities have all included a focus on reducing sediment from roads.

While the Bitterroot National Forest does not have a formalized project monitoring protocol, some of these projects did receive site visits to qualitatively assess effectiveness of project implementation. While the site visits prove most valuable for providing a feedback loop for restoration technique effectiveness such as revegetation success, how well an instream structure worked at high flows, etc. these visits also provide some assessment for how well the project is reducing sediment to affected streams or waterways. Table 2.12-4 also notes if the project received a post-project site review during the reporting period and how that assessment judges the impact to water quality.

Table 2.12- 4: Improvement Projects Implemented during 2018-2019 addressing Forest Plan Water Standards and Streams Listed by the MT DEQ for Sedimentation level

Affected Listed Streams	Hydrology Units (HUC's) Affected	Project, Decision Date and Improvement Activities Implemented	Activity	Implementation Monitoring (y/n)	Water Quality Trend by Qualitative Assessment
Rye Creek North Rye	170102050702-Upper Sleeping Child	Darby Lumber Lands Watershed Improvement and	Road storage and decommissioning	y	improving

Affected Listed Streams	Hydrology Units (HUC's) Affected	Project, Decision Date and Improvement Activities Implemented	Activity	Implementation Monitoring (y/n)	Water Quality Trend by Qualitative Assessment
	170102050701-Divide Creek 170102050801-Upper Rye Creek 170102050802-Lower Rye Creek	Travel Management Project Phase I (2015) (DLL) – Road Storage and Decommission			
Rye Creek	170102050801-Upper Rye Creek	Burned Area Recovery (BAR) (2001)-Road Storage	Road storage	y	neutral
Rye Creek	170102050802-Lower Rye Creek	Motorized Trail Drainage	Crossing installation	n	Unknown
Multiple Streams	Forest-wide	Trail Maintenance and Re-construction along streams	Drainage improvement on trails	n	Unknown
Multiple Streams	Forest-wide	Road Maintenance to reduce erosion and road related sediment to streams	Drainage improvement, culvert cleaning, and grading on roads	(often covered in BMP Audits, but not specifically here)	
Bugle Creek	170102050404 - Meadow Creek	Bugle Creek Exclosure Removal	Streambank stabilized or protected	n	Improving based on past assessments
Meadow Creek	170102050404 - Meadow Creek	Meadow Creek Exclosure Removal	Streambank Stabilized or protected	n	
East Fork Bitterroot River and Bush Creek	1701020500402 -Martin Creek	BushFR726 Culvert Replacement	Culvert Replacement for aquatic habitat connectivity	n	improving
Lick Creek	170102050401 - Moose Creek	OHV trail Lick Creek Crossing	Installing crossing for OHV trail to reduce erosion	n	Improving based on past assessments

Beyond projects implemented during 2018 and 2019, several implementation projects completed prior to the reporting period received technique effectiveness monitoring site visits. Technique effectiveness monitoring typically includes a site visit to qualitatively evaluate how well best practices techniques appeared to work including effectiveness of revegetation efforts, if sediment traps were installed, is there evidence that worked to capture sediment or is there evidence of sediment delivery past traps.

Technique effectiveness monitoring provides invaluable site visit information and a feedback loop to improve future projects; however, some of the utility is limited at a programmatic level because the monitoring lacks a consistent set of questions, clearly defined protocols, and does not have a formalized method for providing feedback to future projects. Table 2.12-5 summarizes monitoring assessments for watershed improvement projects completed prior to 2018 where site visit technique effectiveness monitoring may continue. There were numerous other site visits as well, but the sites detailed in Table 2.12-5 provide an overview.

Table 2.12- 5: Technique Effectiveness Monitoring for Watershed Improvement Projects Completed prior to 2018

Watershed	Project Name	Project Type	Monitoring Year	Implement Year	Description	Sediment Trend
170102050506-Laird Creek-East Fork Bitterroot River	Bear Creek Channel Stabilization	Culvert Replacement and Channel Work FSR#370	2018	2004	Instream channel work and new culvert to accommodate post fire flows is working	Reduced
170102050702-Upper Sleeping Child	NFSR 62646 Burned Area Recovery Project	Road Storage and Spring/Wetl and Protection	2018	2001	Road partially decompacted and less erosion. Spring not accommodated in road storage and ponding caused small road failure. Cattle exclusion not successful in protecting spring and wetland. Culvert installed to drain road but still issue with livestock degrading spring and water quality.	Stable
170102050501-Tolan Creek	Bunch Gulch	Wetland Rehab	2018	2012	Bunch Gulch allotment cattle removal has allowed channel and wetland area to stabilize and revegetate	Reduced
170102050702-Upper Sleeping Child, 170102050701-Divide Creek, 170102050801-Upper Rye Creek, 170102050802-Lower Rye Creek	Darby Lumber Lands Road Decom	Road Decom and Stabilization	2018	2015	Decommissioned roads improved sedimentation but slow revegetation	Reduced
170102050502-Camp Creek	Indian Tree (trib to W Fk Camp Creek)	Channel realignment	2018	2018	Handwork to correct channel diversion resulting from increased post fire flows.	Reduced

Watershed	Project Name	Project Type	Monitoring Year	Implement Year	Description	Sediment Trend
1701020500402-Martin Creek	Martin Creek Road Stabilizaiton	Treatments to reduce erosion on stored roads	2018	2013-2015	Evaluating reveg on decommissioned roads and skid trails	Reduced Erosion but mixed revegetation success
170102050506-Laird Creek-East Fork Bitterroot River	FSR#321 Sula Peak Road	Allotment and road monitoring	2018	2015	Road continues as sediment source	Not improving
170102051503-Threemile Creek	Arrastra Creek-three mile road decom	Vegetation monitoring of road decom	2018	2014	Native plants not competing well with invasives	Not improving

2.12.4 Discussion

Indicators 1-3

The Forest continues to implement projects forest-wide designed to improve watershed conditions. In previous reporting periods, the 3 WCF priority watersheds received the bulk of the improvement activities; however major planned implementation work in these priority watersheds is completed or on hold awaiting funding. The Forest Plan Water Standards address water quality through project level measures including requiring BMPs and the Standards do emphasize reducing sediment from Forest Roads. During this reporting period, water quality improvement projects such as road work and various seeding projects followed the Forest's priorities for timber harvest and fuels treatment projects. Including water quality protection efforts such as mitigation measures with Forest Management actions responds to the Forest Plan direction to maintain water quality by preventing adverse impacts from management. The efforts to improve and restore watershed function and improve water quality of streams not currently fully supporting their beneficial uses as identified by Montana DEQ's water quality standard requires more than just mitigating project impacts. The Bitterroot National Forest along with numerous partners had made great efforts toward these kinds of larger-scale restoration and watershed improvement efforts. However, for this reporting period, the completion of work in priority watersheds and scaled down opportunistic implementation result in water quality and watershed condition trends more incremental and harder to assess without more targeted monitoring. Previous reports and long-term observational monitoring show that the last two decades of implementation of watershed improvement projects such as road decommissioning, road drainage improvements, stream bank stabilization, and revegetation efforts do lead to water quality improvements both in the short-term and water quality continues to improve over a longer-term, decadal time period. Though this reporting period had fewer implementation projects accomplishments, the trend in Forest-wide water quality is likely steady or showing incremental improvement resulting from the cumulative impacts of focused restoration projects.

The Montana Department of Environmental Quality's Bitterroot Headwaters TMDL Implementation Evaluation (2021) evaluates the progress of the Bitterroot National Forest's progress toward TMDLs and found the record of implementing restoration projects to improve water quality is successful and the planned activities are on schedule for the TMDL implementation plan. Technique effectiveness monitoring for projects such as those summarized in Table 2.12-4, show that it can take years for a watershed restoration projects to fully recover and during that time water quality continues accrue benefits.

Future watershed improvement projects will continue to focus on reducing sediment from the open road system, stream bank stabilization opportunities, and dispersed recreation restoration needs. It is expected that the planning process will identify future restoration/improvement opportunities.

Indicator 4: Best Management Practices- BMP reviews conducted on Forest and findings.

BMP reviews, in the context of Monitoring Item WTR-01, serve as a check on the efficacy of project and activity implementation; these reviews are used to assess whether projects and activities are avoiding or mitigating soil and water resource impacts. These reviews, in effect, validate the value of soil and water resource projects discussed under the previous three indicators in maintaining or improving watershed conditions.

2018-2019 BMP Reviews

Data source: National Core BMP Database

A total of 2 BMP reviews were conducted during the 2018-2019 review cycle. All BMP reviews were completed using the Forest Service's National Core BMP protocols. In 2012, the Forest Service rolled out its National Core BMP framework, which provided the protocols for those 2018/2019 reviews discussed below. This initiative was an effort to standardize BMP evaluation processes across the National Forest System. In doing so, the intent was to better understand management activity shortcomings, improve accountability, and systematically evaluate trends in BMP implementation and effectiveness at varying scales (for example, between forests, between regions, etc.) within the agency. Per national direction, the Bitterroot N.F. has been conducting BMP reviews using the nationwide BMP protocols since 2014. During the 2016/2017 review cycle, reviewed projects included recreation sites (trails and campgrounds), road storage, maintenance, and decommissioning, and streambank stabilization (Table 2.12-6).

Table 2.12- 6: Number and type of National Core BMP review types conducted during the 2016-2017 review cycle.

Category	Number
Operation and Maintenance of Non-Corridor and Non-Recreation Facilities (Fac-B)	1
Motorized Vehicle Use Area (Rec E)	1
TOTAL	**2**

National Core BMP reviews consist of Implementation and Effectiveness monitoring. Implementation monitoring evaluates the degree to which planned soil and water conservation measures for a given activity or project have been carried out. Effectiveness monitoring, in turn, evaluates whether implemented soil and water conservation practices successfully avoided resource impacts. With respect to those reviews conducted during the 2018-2019 audit cycle, the two different audits yielded very different results.

Operation and Maintenance of Non-Corridor and Non-Recreation Facilities Category:

Implementation and Effectiveness ratings for Lost Trail Powder Mountain Ski Area in the Camp Creek watershed evaluated how well the Lost Trail Ski Area ski lifts and ski lift support buildings including the outhouses met the Special Use Permit requirements to protect water quality. The BMP audit found that the facility met all mitigation criteria and there were no water quality issues related to the water and waste systems of the buildings or erosion resulting in water quality concerns from the ski lifts and

lift corridors. The BMP Audit determined that both the Implementation and Effectiveness measures were “Effective” at protecting water quality.

Motorized Vehicle Use Area Category

Implementation and Effectiveness ratings for OHV Loop 1 in the Lower Rye Creek and Upper Sleeping Child watersheds found significant water quality concerns along this 25-mile loop trail. The review found that stream crossings and drainage features were not properly constructed, and no mitigation measures were implemented. The trail is now actively delivering sediment into waterways at drainage features and stream crossings. In addition, the revegetation of the trail surfaces did not prove successful and the exposed native surface trail easily erodes, contributing sediment to ditches and crossings. Several locations were noted during review within the campgrounds where bank erosion was resulting in sediment being delivered to adjacent waterbodies. As a result of the implementation failures and lack of mitigation, both the implementation and effectiveness monitoring received a rating of ‘Not Effective’.

2000-2019 BMP Reviews:

The Bitterroot NF has a lengthy and robust record of BMP reviews and project monitoring. Bitterroot Forest Plan Monitoring and Evaluation Reports were reviewed for all years available between 2000 and 2019. All findings discussed below have been documented in these past reports, which are available on the Bitterroot N.F. website (https://www.fs.usda.gov/detail/bitterroot/landmanagement/planning/?cid=fseprd490792).

The few audits completed during this reporting period is an anomaly with the Forest averaging about 14 audits during a two-year period. The following Table 2.12-7 is a brief summary of reviews and was included in the Monitoring and Evaluation Report completed in 2018. The intent of this exercise was to look at BMP reviews conducted on forest across a number of years and see whether common themes emerge in terms of issues that may need to be addressed and whether those deficiencies have been rectified as a result of identification through the BMP review process.

Table 2.12- 7: Summary BMP Audit Results (2000-2019)

Activity	# of BMP audits/ monitored	Audit Summary	Discussion
Vegetation/Fuels Projects	34 timber /fuels projects	BMP reviews have found only minor departures in BMP application and with minor exception have been deemed effective in protecting soil and water quality. New road construction associated with the Horselick Timber Sale identified multiple erosion and sediment delivery concerns. This was rectified through coordination between BNF watershed, timber, and engineering personnel.	BMPs and mitigations associated with timber sale and prescribed burning implementation, included associated temporary roads, are effectively mitigating or avoiding sediment delivery to waterbodies on forest and are minimizing short-term impacts to soil productivity.
Road decommissioning and storage	55 roads	Monitoring generally noted positive results from project implementation. The most common concerns identified during monitoring were 1) excess weed proliferation and 2) poor initial vegetation reestablishment, particularly on harsh sites such as steep south aspects. Stream channel adjustments have been commonly observed at crossing locations, but for the most part channel adjustments were relatively minor and generally stable within 1-3 years post implementation.	Road decommissioning and storage activities have been successfully implemented, though in some instances are taking longer to recover than desired. These activities are designed to restore natural hillslope hydrology and minimize erosion and sediment delivery potential.
Road upgrade/maintenance	18 road upgrades	BMP upgrades were generally deemed effective at preventing erosion and mitigating sediment contributions to adjacent waterbodies.	On existing roads, road-related BMP upgrades have been implemented successfully and are perceived to be minimizing sediment input to waterbodies. Monitoring during project implementation has resulted in adjustments to best practices that were deemed successful at mitigating sediment conveyance to streams.
Stream channel/riparian condition	15 reviews	As a whole, the monitoring record suggests that pebble counts have had limited success at discerning upland management effects on stream habitat.	Efforts to link in-stream particle size distributions with upstream and upland management activities have had limited past success. Though grazing has a limited footprint on forest, monitoring has clearly demonstrated the positive resource effects associated with changes in activity in one allotment.

The table above shows that the Bitterroot National Forest has a strong track record for successfully implementing BMPs and correcting issues observed during the BMP audit process. The Bitterroot is particularly successful in implementing BMPs for road-related activities such as routine maintenance or implementing drainage upgrades. Motorized use trail construction shares many parallels with road construction. The experience in engineering and lessons from past road projects exists on the Forest to address the erosion concerns discovered during the BMP audit of the OHV trail. Audit results highlight the need to have engineering designs for motorized trails. The gaps that occurred during the construction of the OHV trail highlight the importance of inter- and multi-disciplinary BMP audits where staff from different backgrounds can share insights from past work and learn together how to improve future work.

2.12.5 Evaluation of Results for Adaptive Management Finding

Findings

The intent of Monitoring Element WTR-01 is to evaluate whether the Bitterroot National Forest is improving or maintaining watershed conditions as directed in the Forest Plan. Improved watershed conditions are accomplished either through time to allow natural recovery or the implementation of watershed improvement projects designed to more quickly improve hydrologic function (discussed in Indicator 3, watershed improvement projects). Improvement in watershed conditions resulting from implemented projects is evaluated under the following indicators: Indicator 1-improvement of impaired streams and Indicator 2-movement of streams to a higher functioning condition and Indicator 3-Watershed Improvement Projects to move towards the intent of a TMDL. Changes in these metrics may not occur every monitoring cycle depending upon funding, the level of needed improvements, and other forest priorities. Nonetheless, progress towards changes in Indicators are documented qualitatively in this report both in the short-term (2018-2019 monitoring period) and long-term in previous reports. Indicator 4 documents the application of Best Management Practices and their effectiveness. Findings of these reviews, with some exception, validate the value of the work being done within the other three indicators to maintain or improve watershed conditions.

The writing of this report highlighted a few areas where monitoring could be improved to better understand how projects are moving towards Forest Plan direction and better evaluate long-term trends in water quality. The first would be to create a different over-arching question for monitoring to align with the Region's Broader Scale Monitoring questions and create specific metrics for Indicators that would allow a more robust evaluation of the efficacy of Forest actions toward improving water quality and watershed condition. In addition, the Forest's years of project specific monitoring and repeat technique effectiveness monitoring is a valuable feedback loop into the Watershed Program and has and will greatly improve outcomes on the ground with future projects. However, the lack of a consistent monitoring protocol and the extra step of linking monitoring sites to georeferenced points make more quantitative and conclusions from repeat visits regarding recovery or project changes difficult.

Table 2.12- 8: Summary of findings for Plan Monitoring Item WTR-01

PLAN IMPLEMENTATION STATUS[1]	CHANGE WARRANTED?	WHERE IS CHANGE WARRANTED?
(E) Yes - though rigorous monitoring for water quality has not been completed on Forest in the last two years, the Bitterroot maintains a suite of restoration actions and implementation of BMPs along roads and other management actions that research shows to be highly effective at improving and protecting water quality. The Montana DEQ (2021) in their Headwater TMDL report, concluded that there is successful implementation progress and improving water quality trends in the headwater streams of the Bitterroot through reduction of sedimentation. Therefore, the Bitterroot Forest is making progress toward improving watershed conditions.	Yes	Monitoring Plan: The Report showed that watershed conditions and water quality are being maintained or improved. The next report will modify the question, "is management improving or maintaining watershed conditions that support desired riparian and stream characteristics" to ensure that the question and Forest monitoring incorporates specific metrics consistent with the Regional Broadscale Monitoring and Evaluation strategy that is currently in the development phase. The indicator "miles of impaired streams removed from the 303d list" would be changed to focus on the change in status of the pollutant, "streams no longer impaired by (name impairment)". If these activities are to continue to be used as indicators for Forest Plan Monitoring Item MON-WTR-01, then the forest may want to establish specific metrics for evaluation of project efficacy in the context of watershed integrity. Establish a formal post-implementation monitoring protocol that evaluates technique effectiveness and links data (if possible) to changes in water quality or watershed condition.

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

2.13 MON-SOILS-01 – Soil productivity

2.13.1 Monitoring item summary

- *Monitoring question: Are management activities impairing soil productivity?*

Table 2.13-1 lists forest and grassland plan goals and objectives, monitoring indicators, data sources and partners, the frequency of data collection and reporting, and any quantitative targets or thresholds

related to this monitoring item. Table 2.13-2 lists the most recent and next dates for data collection and reporting for this monitoring item.

Table 2.13- 1: Forest plan components, monitoring indicators, data collection intervals, and data sources for MON-SOILS-01.

Plan components	Indicators	Data collection interval	Data Source / Partner
See Below	Detrimental soil disturbance (DSD) Field inventories and surveys Environmental analysis	Biennial	Forest Supervisor's Office Records

Referenced Plan Components:

Goals: Maintain soil productivity. (p. II-3, 24, and 25). The Bitterroot NF has adopted the Region 1 Supplement 2500-99-1 which provides soil standards to better move towards FP requirements.

Objectives: Design management activities to maintain soil productivity. (p. II-6).

Monitor to determine the effects of management activities on soil productivity. The effects monitored include: soil compaction, rutting, displacement, severely burned soil, surface erosion, and soil mass movement as described in the Region 1 Supplement 2500-99-1 (R1 Soil Quality Standards SQS). *(In November, 1999, Region 1 issued a new Soil Management Handbook. The new direction provided information regarding monitoring of soil impacts and also how detrimental soil disturbance should and should not be measured. This handbook direction replaced the Forest Plan variability threshold of 20% detrimental disturbance. The Forest Plan was not officially amended to include the more stringent manual direction. However, the Bitterroot NF has adopted the manual standards and has adhered to them since 1999.*)

Standards:

- Plan and conduct land management activities so that reductions of soil productivity potential caused by detrimental compaction, displacement, puddling, and severe burning are minimized (p II-25 #7).
- Plan and conduct land management activities so that soil loss, accelerated surface erosion and mass wasting, caused by these activities, will not result in an unacceptable reduction in soil productivity and water quality (p II-25 #8).
- Design or modify all management practices as necessary to protect land productivity and maintain land stability (p II-25 #9).
- Forest Service Manual (2550, Amendment No 2500-90-2) and Handbook (2509.18 WO Amendment 2509.18-91-1 and Region 1 Supplement 2509.18-2005-1).

Table 2.13- 2: Monitoring collection and reporting dates for MON-SOILS-01.

Milestone	Year
Data last collected or compiled in:	2019
Next scheduled data collection and compilation:	Field Seasons 2020-2022
Last monitoring evaluation report covering this monitoring item:	2017-2018 Bitterroot National Forest Monitoring Report
Next scheduled monitoring evaluation report covering this monitoring item:	2023

2.13.2 Methods

Forest Plan direction indicates that soil monitoring and site inspection should be completed pre and post implementation after activity on susceptible soils. Pre-implementation monitoring is completed on all activity units where commercial timber harvest is proposed. Post project implementation monitoring should occur on 25% of projects' units implemented annually (Chapter IV-8 line 31). Soil monitoring has historically been completed by the Forest Soil Scientist. Collection methods and protocols have varied from 1988 to present. Methods have involved walk through observations to full transect evaluation of soil conditions in activity areas following a Forest Service protocol, originally developed by Steve Howes, the Region 6 soil scientist. The most recent soil monitoring protocol used since 2009 was developed by the Rocky Mountain Research Station for consistency. The following references below outline the protocol:

- The Region 1 Approach to Soils NEPA Analysis Regarding Detrimental Soil Disturbance In Forested Areas – A Technical Guide, March 2009
- Forest Soil Disturbance Monitoring Protocol, Volume 1 Rapid Assessment. USDA Forest Service. Gen. Tech. Report WO-82A. September 2009
- Soil –Disturbance Field Guide. USDA Forest Service. National Technology & Development Program. 0819 1815-SDTDC. August 2009.

Pre-implementation soil monitoring determines baseline, existing soil conditions used during the National Environmental Policy Act (NEPA) planning process to guide project design and proposed actions. Soil resource protections include Soil and Water Conservation Practices (SWCPs), Montana Best Management Practices (BMPs), and in some cases design features and mitigations prescribed to protect and maintain soil resources within the R1 SQS 15% DSD trigger. If levels of soil disturbance exceed SQS 15% DSD trigger, rehabilitation projects may be derived based on these pre-implementation surveys.

Post-implementation soil monitoring of vegetation management activities on the Bitterroot NF dates back to 1989 when soil disturbance triggers were initiated as a means to move towards Forest Plan standards and the National Forest Management Act (1976). The major vegetation management activities monitored have included the following types of timber extraction and fuels treatment activities paired with season of logging:

- Summer skidding with dozer piling;
- Summer skidding with feller buncher, (whole tree yarding with no dozer piling);
- Summer forwarder;
- Winter skidding;
- Summer skyline yarding;
- Helicopter;

- Mastication; and
- Prescribed fire.

In addition to determining if management activities are maintaining soil quality, the post-implementation monitoring provides information regarding practices that may need to be avoided on specific soil or land types. The monitoring has also led to the development of mitigation or design features that are prescribed to limit detrimental soil disturbance.

2.13.3 Results

Long-term Soil Monitoring Data

Soil disturbance monitoring between 1989 and 2017 provide an average DSD measured for each year across multiple timber treatment units and projects for the different types of vegetation extraction and treatment methods.

During the period of 2013-2017 post-project DSD are lower when compared to previous years.. The data shows that that vegetation activities typically result in disturbance of less than 10% for the last five years well under the Forest Plan Standards. Long-term soils monitoring data indicated that summer ground-based skidding of logs has the highest detrimental effects to soils on the forest. The two methods of vegetation management that have had effects greater than 15% DSD include:

- Summer skidding with dozer piling; and
- Summer skidding with feller buncher (whole tree yarding with no dozer piling).

Feedback from the post-harvest Soil Disturbance Monitoring led to the Bitterroot National Forest implementing a suite of design criteria to limit disturbance including the elimination of the highest disturbance creating practice, summer skidding with dozer piling.

Summer skidding with feller buncher operations also incurred high DSD, particularly operations prior to the year 2000. This harvest operation involves the use of a tracked harvester with an articulating cab that cuts and piles whole trees in bundles. The bundles are then “grabbed” by the grapple on a rubber tired skidder and the entire bundle is skidded to the landing site. Operations since 2000 have had less soil disturbance and have not exceeded R1 soil quality standards (15% DSD) since 2005 due to the development of design features, sale administration, and operator awareness of soil disturbance. The greatest concern for soil disturbance remains on existing and future summer ground-based skidding projects including slopes that near the 40% threshold for ground-based skidding. Units with a high percentage of slopes close to 40% often have the highest DSD following operations due to displacement of topsoil from the torque required by the machine on the steeper slopes.

Soils monitoring of other vegetation management activities involving summer skyline, helicopter, summer forwarder, winter skidding, mastication, and prescribed fire has indicated these activities cause low to moderate disturbance that is well below the 15% standard for DSD. Use of design features has also been important for implementation of these activities and move towards the 15% soil standard.

Current Project Level Soil Monitoring Data

Pre-Implementation Monitoring

Two projects in the final stages of the planning phase were evaluated for existing soil disturbance, Piquett Fuels and Mud Creek. Both projects are Conditional Based NEPA projects where harvest units are not defined before the final decision is signed making it difficult to follow the standardized

Regional Soil Disturbance protocols; however, some DSD surveys were conducted within both project areas as a part of the analysis and found disturbed areas to be low. The Conditional NEPA requires DSD surveys to be completed in areas classified as a high risk for longer-term impacts to soil productivity after Unit boundaries are established prior to the start of management actions. Piquett Fuels established harvest units in 2020, but Mud Creek has not yet been signed as a Decision. Both the Piquett Fuels and Mud Creek project areas are within locations where legacy harvest impacts from the 1950's into the 1990's remain. All high-risk Commercial Harvest units in the Piquett Fuels project area were surveyed during field season 2020. Except for one Unit, the amounts of pre-existing DSD were well within the R1 Soil Quality Standard of 15% DSD. Most of the existing DSD identified during the surveys was found on main skid trails used in past ground-based skidding operations or in areas where past treatment of activity fuels following harvest left the forest floor with limited cover and organic matter in the form of large and small wood debris. Additional mitigation criteria were developed for the one Unit where high disturbance was discovered to promote soil recovery following the harvest.

Post-Implementation Monitoring

Post-implementation monitoring (summer 2019) was completed on 5 treatment units in a project called Westside Fuels. The data has not been processed and the project record no longer contains files that explain harvest methods for each unit. However, all units monitored were within the R1 Soil Quality Standard of 15% DSD. Typically, the forest has been able to monitor approximately 10% of units implemented but has been unable to move towards the FP goals and objectives of post-implementation monitoring due to limited budget and staffing.

2.13.4 Discussion

The strong improvement trend for post-harvest DSD documented led to the recommendation to implement fewer post-harvest evaluations of impacts to soil productivity. The Forest created a Soil Risk Assessment Framework to evaluate where areas are most likely to have higher pre-existing disturbance and lower resilience to post-harvest impacts to soil productivity. The new framework is fully detailed in the project files for an ongoing harvest and fuels reduction project called Piquet Fuels. The Soil Risk Framework bases risk on a matrix. The matrix consists of two primary factors – a soil resiliency index and levels of existing soil disturbance that could complicate recovery of proposed forestry treatments. The soil resiliency index is developed from water deficit data and classified into high and low categories. High resiliency is associated with low water deficit since these areas have greater potential soil water for growth. Low resiliency has higher levels of solar exposure and thus higher summer water deficit such as low elevation south facing slopes. The threshold was based on field data, observed recovery and aerial photo interpretation of reforestation canopy. The second matrix factor spans three levels of soil condition: no sign of soil disturbance, potential soil disturbance from past management, and verified soil disturbance from past management.

For each soil risk category (SRC), a general narrative description was developed to understand and contextualize the risk posed to soil resources should a management activity be proposed at a given location with the project area. Soil surveys will occur in the higher risk soils. Table 2.13-3 below contains the Soil Risk Categories and the actions required for each soil category.

Table 2.13- 3: Soil Risk Category Decision Matrix

Soil resilience (inverse of climatic water deficit)	Water deficit range	No known past activities	Past activities	Past activities with known DSD
High	371-500	A	C	E
Low	500-589	B	D	F

Table 2.13-4. Narrative Description of Soil Risk Categories

Soil Risk Category (SRC)	Narrative Description
A	There are no documented past management activities within these areas and relative soil resilience within this area is considered high (i.e. better than the rest of the project area). **Actions:** Proposed project activities are subject to the standard range of design features contained in Appendix B.
B	No known past activities have occurred within these areas, but soil resilience following disturbance will be more limited than in SRC A. Management activities have potential to have more prolonged impacts than in SRC A. **Actions:** Careful selection of management activities may be required to ensure long-term soil productivity and additional design features beyond those contained in Appendix B may be warranted.
C	Past management activities have been documented in these areas, but there are currently no documented instances of persisting short- or long-term soil productivity compromise from past project implementation. Relative soil resilience is considered high. **Actions:** Inventory of persisting detrimental soil disturbance will be required within these project areas. Proposed project activities are subject to the standard range of design features contained in Appendix B. Should persisting DSD from past management activities be found during field reconnaissance, proposed project activities may need to be modified to avoid adverse soil resource effects.
D	Past management activities have been documented in these areas, but there are currently no documented instances of persisting short- or long-term soil productivity compromise from past project implementation, but likelihood of persistence is higher than under SRC C. Relative soil resilience is limited. **Actions:** Careful selection of management activities may be required to ensure long-term soil productivity and additional design features may be warranted. Should persisting DSD from past management activities be found during field reconnaissance, proposed project activities may need to be modified to avoid adverse soil resource effects.
E	Past management activities in these areas has created persisting long-term detrimental soil disturbance. More information is needed to discern the extent to which natural site potential versus differences in past harvest practices may have influenced persisting concerns in these areas. **Actions:** Careful selection of management activities may be required to ensure long-term soil productivity and additional design features may be warranted. Proposed project activities may need to be modified to avoid adverse soil resource effects.
F	Past management activities in these areas has created persisting long-term detrimental soil disturbance. Management activities may have more prolonged impacts than in SRCs A, C, and E. **Actions:** Careful selection of management activities is required to ensure long-term soil productivity and additional design features may be warranted. Avoidance of commercial harvest or prescribed burning in these areas should be considered as well as exploration of potential restoration opportunities. If project activities are deemed necessary and/or appropriate, additional design features may be necessary.

The use of the Soil Risk Framework has the potential to transform, or at least streamline, both the planning and field data collection efforts of the Forest's soil scientists and technicians. During the next reporting period, efforts will be made to validate the framework's assumptions for soil productivity resilience following disturbance where past harvest has occurred.

2.13.5 Evaluation of Results for Adaptive Management Finding

Table 2.13- 5: Summary of findings for Plan Monitoring Item SOILS-01

PLAN IMPLEMENTATION STATUS[1]	CHANGE WARRANTED?	WHERE IS CHANGE WARRANTED?
(E)Yes. Based on historical DSD averages, vegetation management operations on the Bitterroot NF continue to move towards the R1 SQS and FP standard for soil productivity over the last 10 years. At this time, the consistent compliance shown by the past 8 years of monitoring supports that current project design and implementation adheres to the Bitterroot Forest Plan soil standards.	No.	None.

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

2.14 MON-REC-01 – Recreation opportunity spectrum

2.14.1 Monitoring item summary

- *Monitoring question: What actions have been taken to change ground conditions to attain ROS objectives? What actions have impacted ROS objectives?*

Table 2.14-1 lists forest and grassland plan goals and objectives, monitoring indicators, data sources and partners, the frequency of data collection and reporting, and any quantitative targets or thresholds related to this monitoring item. Table 2.14-2 lists the most recent and next dates for data collection and reporting for this monitoring item.

Table 2.14- 1: Forest plan components, monitoring indicators, data collection intervals, and data sources for MON-REC-01.

Plan components	Indicators	Data collection interval	Data Source / Partner
See below	• Miles of trail maintained. • Miles of road maintained. • Number of campgrounds maintained. • Number of ski areas permitted. • Number of developed recreation sites maintained. • User survey responses. • Number of guide permits issues and service days. • Challenge cost share agreements and partnership agreements. • Number of recreation user events. • Number of cabin, lookout, and campsite reservations issued	Biennial	• Special Use Data System (SUDS Database) • National Visitor Use Monitoring Surveys (NVUM) • Trailhead and Recreation Site Registration (where available) • Natural Resource Management (NRM) • National Recreation Reservation System (NRRS) • Motorized Vehicle Use Map (MVUM) • Over Snow Vehicle Use Map (OSVUM) • Recreation Opportunity Spectrum (ROS) • Forest Transportation Atlas (INFRA Database) • LIEMARS Database

Referenced Plan Components:

Goals: Provide a broad spectrum of recreation opportunities. (p. II-4). Provide for mix of dispersed recreation. Evaluate need for developed recreation, reconstruct trails as needed, rec. residences. (p. II-2).

Standards: Review travel plan annually, build trailheads to provide access to trail systems, information and education used to meet visitor needs. (p. II-18).

Table 2.14- 2: Monitoring collection and reporting dates for MON-REC-01.

Milestone	Year
Data last collected or compiled in:	2018
Next scheduled data collection and compilation:	2021
Last monitoring evaluation report covering this monitoring item:	N/A
Next scheduled monitoring evaluation report covering this monitoring item:	2023

2.14.2 Methods

The following indicators were used for this evaluation.

- Miles of road maintained.
- User survey responses
- Miles of new trail added to forest trail system.
- Occupancy rates of expanded amenity developed recreation sites.
- Changes to recreation site PAOT per ROS class.
- Visitation estimates.
- MVUM/OSVUM violations.
- Number of dispersed campsite management actions

Other indicators currently listed in the monitoring plan for this monitoring item were not used because they were not needed to inform the evaluation and those indicators selected for this evaluation were the most informative)

Data monitoring and collection is completed by the forest recreation and trails staff through field visits, real property surveys, annual recreation site inspections, and law enforcement records in the LEIMARS database. Recreation site, trails, and special use data is entered into the Natural Resource Manager (NRM) database. Data for occupancy of reservation sites can be obtained at www.recreation.gov. Data from the National Visitor Use Monitoring (NVUM) surveys can be obtained at http://www.fs.fed.us/recreation/programs/nvum.

The indicators used were modified for this reporting to improve the relevancy of data in relation to showing how the goals and standards are being met, especially as the 2012 Planning Rule wording modifications needed to provide correlation to Recreation Opportunity Spectrum objectives. A majority of indicators identified in the monitoring plan are difficult to track changes to ROS objectives or support goals and standards and were omitted or modified. See Table 2.14-1 for the indicators that were used for this monitoring report and those that are identified in the Monitoring Plan (some of which were omitted or modified).

2.14.3 Results

Table 2.14- 3: National Visitor Use Monitoring (NVUM) Results as reported by the 2007, 2012 & 2017 Visitor Use Reports for the Bitterroot National Forest.

Visitor Use Monitoring Results	2007 Data	2012 Data	2017 Data	Data Source
Visitation Estimates (Site Visit)	735,000	400,000	539,000	NVUM Survey Data
Perceptions of Crowding* at Day Use Developed Sites	4.9	4.6	4.2	NVUM Survey Data
Perceptions of Crowding* at Overnight Use Developed Sites	4.5	4.8	4.9	NVUM Survey Data
Perceptions of Crowding* at Undeveloped Areas	4.8	3.9	5	NVUM Survey Data
Perceptions of Crowding* at Designated Wilderness	3.9	3.4	4.4	NVUM Survey Data

*Perceptions of crowding on a scale of 1-10 where 1= “hardly anyone” and 10= “overcrowded”

Visitation estimates were determined by sites visits, or the entry of one person onto a National Forest site or area to participate in recreation activities for an unspecified period of time. Crowding data was

reported on a scale of 1 to 10 where 1 denotes hardly anyone was there, and a 10 indicates the area was perceived as overcrowded. The averages for each site type are reported in the chart above.

Table 2.14- 4: Occupancy Rates of Expanded Amenity Sites

Occupancy Rates	2019 Data	2020 Data	Data Source
Developed Campgrounds	21.5%	30.8%	NRRS Occupancy Reports
Group Campgrounds	16.1%	25.25%	NRRS Occupancy Report
Recreation Rentals	63.9%	80.9%	NRRS Occupancy Report
Total Occupancy Rate of all Facilities	26.8%	36%	NRRS Occupancy Report

These figures only reflect occupancy of sites that are available for reservation and does not reflect all other sites that are first-come, first-served.

Table 2.14- 5: Facility PAOT Totals (Persons at One Time)

Facility Type	2018 Data	2020 Data	Data Source
Developed Campgrounds	1581	1576	NRM- Recreation Sites
Group Campgrounds	400	400	NRM- Recreation Sites
Recreation Rentals	75	75	NRM- Recreation Sites
Day Use Areas	697	725	NRM- Recreation Sites
Trailheads	1698	1698	NRM- Recreation Sites
Total PAOT of all Facilities	4,451	4,473	NRM- Recreation Sites

Table 2.14- 6: Total Number of Reservations by Year*

Reservations	2016 Data	2017 Data	2019 Data	2020 Data
Number of nights cabin, lookout, and campsites are reserved	1721	2072	2132	2885

*Data provided by NRRS. 2018 data is unavailable for the purpose of this assessment.

Table 2.14- 7: Recreation Opportunity and Infrastructure Statistics by Fiscal Year

Indicators	2019 Data	2020 Data	Data Source
Miles of road maintained	753	806	NRM – INFRA
Miles of Trail	1,769	1,794	NRM – INFRA Trails
Miles of new trail added to forest trail system	25	2.5	NRM – INFRA Trails
Number of issued special use permits	86	79	SUDS
MVUM/OSVUM violations	35	50	LEIMARS database
Number of management actions to address resource impacts from dispersed camping	1	0	Small NEPA Project Files

2.14.4 Discussion

The Bitterroot National Forest provides for a wide range of outdoor recreation opportunities in a variety of settings, ranging from developed recreation sites, primitive dispersed camping opportunities, motorized and non-motorized trails, educational/interpretive sites, day use, water access, cabin and lookout rentals, organization camp, downhill ski area, outfitter and guide permits, and general forest recreation.

In 2020, the COVID-19 pandemic had significant implications for recreational activity on the forest. Visitors were eager to enjoy recreation on forest lands as the spring brought nice weather early in the season. Most facilities were opened to the public near the same scheduled time as years past; however, there was a much larger demand on our facilities prior to typical opening dates which continued through the end of recreation season. It was observed by forest staff that developed recreation sites and undeveloped camping had a significant increase in visitation than the previous year. This has also been a phenomenon reported region- and nation-wide on public lands. However, an increase in recreational activity in previous years has also been identified and specifically documented for the Lake Como Recreation Area.

Visitation estimates are gathered through National Visitor Use Monitoring (NVUM) data; however, the last monitoring data was collected in 2017; therefore, the most recent data to be analyzed for visitation estimates and perceptions of crowding. Although NVUM visitation estimates show an overall decline from the 2007 results, occupancy data 2017 to 2020 indicates there is an increasing trend in the number of nights reservation sites are reserved. A draft Master Plan was compiled to accommodate continued increasing year-round use at the Lake Como Recreation Area also supports an increasing trend in visitation over time. An increase in visitation creates a higher demand for recreation opportunities and more impact to the natural resources. The plan contains a number of specific management actions to alleviate these impacts.

In addition to visitation estimates, perceptions of crowding were also gathered using NVUM data and used as an indicator that may show change in the social setting under each Recreation Opportunity Spectrum class. On a scale of 1-10 (Table 2.14-3), results show that visitors to the forest in a variety of different settings generally feel 3.4-5 on the crowding scale. The majority ROS classes generally classify the social setting provides for a low to moderate contact with other parties, specifically primitive, Semi-Primitive Non-Motorized (SPNM) and Semi-Primitive Motorized (SPM) classes. According to Table 2.14-3, Undeveloped Areas had the highest rating at a 5 for crowding.

To monitor changes to the physical setting under each ROS class, changes to PAOT and occupancy rates were used as indicators (Tables 2.14-4 and 2.14-5). Occupancy rates were used to show utilization of existing campgrounds, group sites and recreation rentals that are reservable under the NRRS system; however, only a percentage of sites are on the reservation system but show an overall representation of utilization based on facility type.

Several factors also caused changes to PAOT capacity in 2019 and 2020. Recently, 8 vehicle parking spots were added to the Lake Como Boat Launch parking area in 2020 adding 28 PAOT for the facility and additional development is planned for the near future as funding becomes available. However, in 2019, spring runoff caused high river flows resulting in flooding throughout sections of Rombo Campground. Flooding waters flowed through the campground caused erosion to the shoreline and campsite #6 which resulted in a closure of the campsite and a reduction in PAOT. Funding has been granted in FY2021 for survey and design for a project that will provide the necessary improvements needed for restoration. On the other hand, there is still an overall increase in PAOT in sites within the Roaded Natural ROS class.

Another indicator to help identify actions taken to change ground conditions to attain ROS objectives and to help identify actions that have impacted ROS objectives are the number of violation notices issued for travel management violations. Travel management violations may negatively impact the ROS setting, particularly in primitive and semi-primitive settings. The number of violation notices issued is a way to monitor the issues and identify areas where resource damage may be occurring. Management actions may be taken to help prevent further violations, mitigate resource damage and help ensure the ROS conditions can be attained. The number of violation notices also provides insight into the effectiveness of education and enforcement and also the need for additional education and enforcement efforts.

The Bitterroot NF strives to provide a broad spectrum of recreation opportunities and provide for a mix of dispersed recreation. An indicator of change in ROS is the number of management actions implemented to address resource impacts from dispersed recreation. These actions may change the ROS of the area based on changes in development scale of the site, visitation, size of the site, and/or in the access to the site. In 2019, management actions were implemented in a large, high use areas used for dispersed camping at the junction of State Highway 38 and FS Road 75. The Forest recognized the recreational value of the site but also needed to address resource concerns within the riparian area, such as loss of green trees, dumping of refuse, driving off road, etc. Actions included hardening the access roads and spur parking areas, restricting any further encroachment into the riparian area by setting barrier rocks, rehabilitating illegal motorized trails and hill climbs, and installing an information board with posters pertaining to forest rules and regulations.

Lastly, the year 2020 also provided several opportunities for increased funding starting in FY2021. In October, the Great American Outdoors Act was passed, granting funding for recreation facility and trail deferred maintenance. The forest was awarded $700k in deferred maintenance projects that will be implemented in FY2021. In December, the Bitterroot National Forest's proposal to increase fees at 14 campgrounds and three cabin rentals was approved by the regional Resource Advisory Committee (RAC). The BNF has not raised its fees in nearly 20 years and currently has more than $700,000 in deferred maintenance needs at campgrounds and cabin rentals where fees will increase the summer of 2021. As authorized by the Federal Lands Recreation Enhancement Act (FLREA), 95% of all fees collected on the Bitterroot National Forest at recreation sites, campgrounds, and cabin rentals stay on the Forest and are used to operate, maintain, and improve local sites.

Additionally, the approved fee proposal will also allow for the implementation of new fees at two campgrounds and one rental cabin. The proposal would enable the historic Lost Horse Guard Station, built in 1935 and listed on the National Register of Historic Places, to be available for public rental, adding to the Forest's popular recreation rental program. Work is planned in 2021 to restore the facility to a rentable condition and will become available in the near future.

2.14.5 Evaluation of Results for Adaptive Management Finding

Findings

Despite the increase in recreation use in 2020 triggered by the pandemic, there is an overall increase in recreation activity each year, as shown by occupancy rates, number of nights reserved for rental facilities and staff observations. The only exception was a decrease in special permits issued in 2020 for recreation events which was a result of national and local direction to limit group sizes. However, new funding opportunities will contribute greatly to decreasing deferred maintenance, improving infrastructure and providing increased customer service to the visiting public which alleviate the associated impacts caused by a higher visitation and recreation demand. This will also ensure that the forest will continue to provide a broad spectrum of recreation opportunities. In combination with

implementation of the Lake Como Master Plan, these factors will contribute to maintaining ROS objectives.

Although funding is a limited factor in providing new recreation facilities, the forest was able to expand on existing recreational opportunities in 2019 and 2020. Twenty-seven miles of new system trail (Table 2.14-7) provided new opportunities for winter recreation and mountain biking. Eight additional parking spots added to the Lake Como Boat Launch parking area also added 28 PAOT (Table 2.14-5) to day use facilities. Additionally, fee changes and planned projects will continue to increase PAOT capacity and add new miles of system trails starting in FY2021 and support the Forest's ability to continue providing high levels of services to visitors at popular recreation sites. Lastly, the forest continues to issue a variety of special use permits on the forest for recreational activities and provide road maintenance to access recreation areas throughout the forest.

An assessment of indicators also determined that changes to the ground have not impacted ROS objectives. Crowding results indicate that the social settings are well within each established ROS class on the forest; however, Undeveloped Areas had the highest rating (Table 2.14-3) which should be closely monitored in the future for potential increase that may trigger a need for management actions to attain SPNM and SPM ROS class objectives. Roaded Natural and Rural ROS classes provide for a moderate to high frequency of contact which crowding results would indicate that there is a room for expansion in the social setting before an impact to ROS objectives may occur.

Occupancy rates show that the reservation campsites in campgrounds and group campground facilities are underutilized with a high of 30%; however, data also indicates that there is an increase in use for all facility types. Except for Lake Como Recreation Area, at this time there is not an immediate need for these types of facilities in certain areas but steadily increasing visitation could trigger the need for new facilities in the longer-term. Recreation rentals had high occupancy rates in both 2019 and 2020 which demonstrate their popularity and need to continue offering these unique experiences. The newly approved fee proposal will add Lost Horse Guard Station as a rental to be added in 2022.

The number of travel management violation notices issued was greater in 2020 than in 2019. There are several factors that this could be attributed to: increase in use and outdoor recreation activities on the Bitterroot NF in 2020 due to the pandemic, perhaps a level of unawareness of the travel restrictions from recreationists that may have been new to the area and unfamiliar with the forest's travel management, and an increase in patrols due to the increase in people recreating on the Forest. Any management action taken in areas where travel management violations were repeatedly issued more than likely helped reaffirm the intended ROS class for the area.

The management action taken in the Skalkaho-Rye undeveloped camping area in 2019 did not change the ROS for the area.

Table 2.14- 8: Summary of findings for Plan Monitoring Item REC-01

PLAN IMPLEMENTATION STATUS[1]	CHANGE WARRANTED?	WHERE IS CHANGE WARRANTED?
Yes, based on 1) expansion of rec opportunities, 2) changes to ground not impacting ROS objectives, 3) increase in use in facility all facility types 4) recreation rentals with high occupancy rates.	Yes	Monitoring Program: Modify indicators to only use those evaluated for this report and drop the remaining currently listed Management Activities: Though progress is being made, some improvements are recommended. 1) improving infrastructure and providing increased customer service to the visiting public which alleviate the associated impacts caused by a higher visitation and recreation demand, 2) implementation of the Lake Como Master Plan, 3) continue to closely monitor undeveloped areas for potential increase that may trigger a need for management actions to attain SPNM and SPM ROS class objectives

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

2.15 MON-REC-02 – Access management

2.15.1 Monitoring item summary

- *Monitoring question: Are management activities effective in reducing resources concerns related to off-road vehicle use, other trail use or recreation site use?*

Table 2.15-1 lists forest and grassland plan goals and objectives, monitoring indicators, data sources and partners, the frequency of data collection and reporting, and any quantitative targets or thresholds related to this monitoring item. Table 2.15-2 lists the most recent and next dates for data collection and reporting for this monitoring item.

Table 2.15- 1: Forest plan components, monitoring indicators, data collection intervals, and data sources for MON-REC-02.

Plan components	Indicators	Data collection interval	Data Source / Partner
See Below	• Number citations NVUM/OSVUM, and Resource violations • Number of closure orders due to resource concerns • Number of developed recreation facilities	Biennial	• LEIMARS (LEO database) • Forest Closure Order records - Pinyon • Condition Site Surveys • INFRA, TRACS • Forest Records-- MVUM/OSVUM tracking spreadsheet • Forest Records—Project NEPA documents

Referenced Plan Components:

Goals: Provide a safe trail system that protects soil and water resources. (p. II-2).

Objectives: Evaluate the need for increasing or decreasing developed recreation facilities. Restore or reconstruct trails. (p. II-4 and 5).

Standards: Review travel plan annually. Off-road vehicles use will be controlled to prevent soil degradation. Priority for trail reconstruction and relocation will be based upon safety, resource damage and type of use. (p. II-18).

Table 2.15- 2: Monitoring collection and reporting dates for MON-REC-02.

Milestone	Year
Data last collected or compiled in:	2018
Next scheduled data collection and compilation:	2021
Last monitoring evaluation report covering this monitoring item:	N/A
Next scheduled monitoring evaluation report covering this monitoring item:	2023

2.15.2 Methods

The following indicators were used for this evaluation:

- Number of developed recreation facilities maintained to standard.
- Miles of trail maintained to standard.
- Number of dispersed campsite management actions
- Number citations NVUM/OSVUM, and Resource violations
- Number of closure orders issued for resource protection.

Other indicators currently listed in the monitoring plan for this monitoring item were not used because they were not needed to inform the evaluation and those indicators selected for this evaluation were the most informative.

Data monitoring and collection is completed by the forest recreation and trails staff through field visits, condition surveys, MVUM/OSVUM tracking, and law enforcement records. When warranted, MVUM/OSVUM citations and resource violations are issued and are recorded in the LEIMARS database.

The indicators used were modified for this reporting to improve the relevancy of data in relation to showing how the goals and standards are being met, especially as the 2012 Planning Rule wording was modified. Most of the previous indicators were determined difficult to track changes/trends or support goals and standards and were omitted or modified.

2.15.3 Results

Table 2.15- 3: Management activities associated with monitoring resource concerns by Fiscal Year

Indicators	2019 Data	2020 Data	Data Source
Number MVUM/OSVUM citations and resource violations	35	50	LEIMARS database
Number of closure orders due to resource concerns	12	12	Forest closure order records—Pinyon
Miles of trail maintained	45.2%	37.7%	NRM—TRACS
Number of facilities maintained to standard	104	104	NRM- Recreation Sites
Number of management actions to address resource impacts from dispersed camping	1	0	Project Files

2.15.4 Discussion

The above monitoring indicators were selected to help understand if management activities are effective in reducing resource concerns related to off-road vehicle use or other trail use. Bitterroot National Forest employees monitor areas for resource damage and document any resource damage by completing incident reports, condition surveys, or other internal tracking documents, however these are not included in this report. Mitigation actions are taken in areas where resource damage is occurring, such as rehabilitating user-created roads, signing, monitoring, and enforcement actions (data not included in this report).

In 2020, the COVID-19 pandemic had significant implications for recreational activity on the forest. Visitors were eager to enjoy recreation on forest lands as the spring brought nice weather early in the season which created a much higher demand on our roads, trails and recreation facilities that continued through early November, beyond the end of a typical recreation season. It was observed by forest staff that developed recreation sites and undeveloped camping had a significant increase in visitation than the previous year. This has also been a phenomenon reported region- and nation-wide on public lands. However, an increase in recreational activity in previous years has also been identified and specifically documented for the Lake Como Recreation Area. Although 2020 brought challenges to typical facility operation, the forest was able to maintain all developed recreation facilities to standard and accomplish a significant amount of trail maintenance. Accomplishments included maintenance on 37-40% of all forest system trails which is significantly higher than the regional average of ~20%.

In a typical year, education efforts and working with partners are one of the key components of this monitoring item. The Forest Off-Highway Vehicle Ranger implements an education program in partnership with the Ravalli County Off-Road User Association (RCORUA) and reaches over 400 7th graders in the Bitterroot Valley annually. RCORUA is also heavily involved with trail maintenance and restoration of user-created impacts. The OHV Ranger also conducts regular patrols forest-wide and visits with the public about ethical use of forest land. However, the 2020 field season proved to be challenging as forest recreation staff had to adapt field operations to COVID-19 protocol. This limited the amount of exposure of forest staff to the public made it challenging to provide adequate field presence, make public contacts and provide educational school programs; however, RCORUA's efforts compensated for activities where forest staff were unable or limited.

For the protection of recreation site infrastructure and natural resources, 12 special orders on the Bitterroot National Forest have been issued over time. Orders include motorized vehicle prohibitions and occupancy and use to protect the Lake Como Recreation Area, Bass Creek Recreation Area, Lost Trail Ski Resort, winter recreation opportunities, trails, and wilderness areas. In a typical year, field staff provide support to law enforcement officers on the forest as Forest Protection Officers (FPO). FPOs can write warning notices, incident reports and violations. Although there was an increase in visitation to the forest and COVID-19 held challenges for forest recreation field staff, it was noted that there was an increase in MVUM and resource damage violations and incidents from 2019 to 2020. The number of violation notices provides insight into the effectiveness of education and enforcement, the need for additional education and enforcement efforts, and a way to monitor the issues and identify areas where resource damage may be occurring.

In 2019, documentation of law enforcement activities resulted in identification and implementation of management actions at the junction of State Highway 38 and FS Road 75 in the Skalkaho undeveloped camping area. The area is a large, high use area used for dispersed camping the Forest recognized the recreational value of the site but also needed to address resource concerns within the riparian area, such as loss of green trees, dumping of refuse, driving off road, etc. Actions included hardening the access roads and spur parking areas, restricting any further encroachment into the riparian area by setting barrier rocks, rehabilitating illegal motorized trails and hill climbs, and installing an information board with posters pertaining to forest rules and regulations.

2.15.5 Evaluation of Results for Adaptive Management Finding

Findings

Although the COVID-19 pandemic created challenges, management actions were implemented to reduce resource concerns related to off-road vehicle use and trail use. Public contacts and education have been an effective tool in combination of involvement from our partners, such as the RCORUA. Forest staff were still able to provide public contacts in the field and an increase in reported violations indicates that field presence is effective.

Additionally, the forest continues to identify, implement, and explore opportunities to improve, rehabilitate, and/or prevent resource damage from recreation activities during NEPA analysis of all proposed projects. Projects to manage resource impacts from dispersed recreation such as the Skalkaho restoration project and the Gold Butterfly are great examples that show this method is effective in reducing off-road vehicle use and trail resource concerns.

Table 2.15- 4: Summary of findings for Plan Monitoring Item REC-02

PLAN IMPLEMENTATION STATUS[1]	CHANGE WARRANTED?	WHERE IS CHANGE WARRANTED?
Uncertain due to need to have more time to assess "the effectiveness of education and enforcement, the need for additional education and enforcement efforts, and a way to monitor the issues and identify areas where resource damage may be occurring.	Yes.	Monitoring Plan: 1) Modify indicators as identified in the methods section.

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

2.16 MON-RDLS-01 – Inventoried roadless areas

2.16.1 Monitoring item summary

- *Monitoring question: What is the change in the roadless base? What activities have occurred in roadless areas to change their roadless character?*

Table 2.16-1 lists forest and grassland plan goals and objectives, monitoring indicators, data sources and partners, the frequency of data collection and reporting, and any quantitative targets or thresholds related to this monitoring item. Table 2.16-2 lists the most recent and next dates for data collection and reporting for this monitoring item.

Table 2.16- 1: Forest plan components, monitoring indicators, data collection intervals, and data sources for MON-RDLS-01.

Plan components	Indicators	Data collection interval	Data Source / Partner
See Below	• Activities in Inventoried Roadless Areas as provided for in 36 CFR 294.12 and 294.13 • Acres of Wilderness • Acres of proposed wilderness • Acres of Inventoried Roadless Areas • Acres of Inventoried Roadless Areas substantially altered (36 CFR 294.13(b) (4)). • Acres of Inventoried Roadless Area not substantially altered. • Miles of National Forest System Road (NFSR) within Inventoried Roadless Areas • Miles of Unauthorized (non-system) road within Inventoried Roadless Areas	Biennial	Natural Resource Information System (NRIS) Natural Resource Management (NRM) Forest Service Activity Tracking System (FACTS) Enterprise Data Center (EDC) Forest GIS Layer Forest Transportation Atlas (INFRA Database)

Referenced Plan Components

Goals: Emphasize motorized and nonmotorized semiprimitive recreation activities. (p. II-37).

Standards: 1) Manage for recreation activities associated with roadless areas… 2) Travel plan will identify areas...open for use and types of vehicles permitted. 3) ROS is semiprimitive motorized and nonmotorized. 4) Facilities and trails will be compatible with semiprimitive setting. 5) … (several) roads will be managed to provide recreation access. 6) Pending resolution by Congress… will be administered according to goals and standards established for MA (management area) 6. (p. III-37).

Table 2.16- 2: Monitoring collection and reporting dates for MON-RDLS-01.

Milestone	Year
Data last collected or compiled in:	2018
Next scheduled data collection and compilation:	2021
Last monitoring evaluation report covering this monitoring item:	N/A
Next scheduled monitoring evaluation report covering this monitoring item:	2023

2.16.2 Methods

The following indicators were used in the evaluation of this monitoring item:

- Acres of roadless base removed
- Miles of Unauthorized (non-system) road within Inventoried Roadless Areas

Identified in Monitoring Plan

The indicators used were modified for this reporting to improve the relevancy of data in relation to showing how the goals and standards are being met, especially as the 2012 Planning Rule wording was modified. The indicators identified in the monitoring plan do not help in answering the monitoring question.

Data monitoring and collection is completed by the forest recreation and trails staff though database searches, field visits, forest NEPA projects and MVUM/OSVUM tracking.

2.16.3 Results

Findings

Table 2.16- 3: Inventoried Roadless Area Data

Indicators	2019 Data	2020 Data	Data Source
Acres of roadless base removed	0	0	NRM
Miles of Unauthorized (non-system) trail within Inventoried Roadless Areas	0	0	NRM

2.16.4 Discussion

In combination with inventoried roadless, wilderness study areas, recommended wilderness and designated wilderness, the Bitterroot National Forest contains a total of 1.05 million acres of roadless base forest-wide. These areas account for 65% of forest land and provide ample opportunities for hiking, hunting, fishing, camping, motorized trail use and snowmobiling recreation activities in a primitive to semi-primitive motorized setting. The forest continues to identify new recreation opportunities within the roadless base that is consistent with maintaining roadless character as well as identifying, implementing and exploring opportunities to improve, rehabilitate, and/or prevent resource damage from recreation activities during NEPA analysis of all proposed projects (i.e. Skalkaho restoration project, Gold Butterfly).

The Roaring Lion Timber Salvage sale was the only project implemented within the roadless base and was the result of the Roaring Lion Fire that occurred in 2016. The fire caused dead and dying trees which impacted access to three trails and trailheads and presented hazards to forest visitors. The purpose of this project was to mitigate hazard trees in these roadless recreation areas and reduce long-term fuel loading to the wildland urban interface. The impacts of this project have no effect to roadless character as the project is relatively small and did not include building temporary or permanent roads. The activities were more of a benefit to the roadless base as it provided a remedy to open recreational access, protect recreation infrastructure, and mitigate hazards to the public.

Lastly, no new miles of unauthorized road have been recorded; however, this does not indicate whether or not some may exist. Starting in 2021, the forest will be performing wilderness character monitoring in roadless areas which will provide an opportunity to gather unauthorized road and trail data to be used for monitoring at a later date.

2.16.5 Evaluation of Results for Adaptive Management Finding

Findings

No change occurred to the roadless base in 2019 and 2020. The Roaring Lion Salvage project is the only project that occurred within the roadless base during this monitoring period and had no effect to

the roadless character. The forest continues to explore all proposed NEPA projects for recreation and restoration opportunities that are aligned with maintaining and enhancing the primitive to semi-primitive motorized ROS settings and roadless character.

Table 2.16- 4: Summary of findings for Plan Monitoring Item RDLS-01

PLAN IMPLEMENTATION STATUS[1]	CHANGE WARRANTED?	WHERE IS CHANGE WARRANTED?
Yes - Based on no new roads or change in roadless base.	Yes	Monitoring Plan: Modify indicators to those identified in the methods section and remove the remainder.

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

2.17 MON-RNG-01 – Livestock management

2.17.1 Monitoring item summary

- *Monitoring question: Are livestock managed for the carrying capacity of the land?*

Table 2.17-1 lists forest and grassland plan goals and objectives, monitoring indicators, data sources and partners, the frequency of data collection and reporting, and any quantitative targets or thresholds related to this monitoring item. Table 2.17-2 lists the most recent and next dates for data collection and reporting for this monitoring item.

Table 2.17- 1: Forest plan components, monitoring indicators, data collection intervals, and data sources for MON-RNG-01.

Plan components	Indicators	Data collection interval	Data Source / Partner
See Below	• Riparian condition, as it relates to livestock use, • Annually authorized AUMs	Biennial	• As directed in environmental documents or operating plans. • Allotment inventories collected by Range and other Forest Specialists associated with monitoring range condition. • Information stored in allotment management folders and NRM

Referenced Plan Components

Goals: Manage to provide livestock forage where environmental quality can be protected and mgt. is efficient. Objective p. II-6: Provide forage for current actual use about 10,000 aum/year. (p. II-3).

Standards: Allotments may be closed if permittee stops cattle operation, if transitory range is eliminated, not cost effective, or environmental quality can't be protected. (p. II-29).

Table 2.17- 2: Monitoring collection and reporting dates for MON-RNG-01.

Milestone	Year
Data last collected or compiled in:	2017
Next scheduled data collection and compilation:	2021
Last monitoring evaluation report covering this monitoring item:	2018
Next scheduled monitoring evaluation report covering this monitoring item:	2023

2.17.2 Methods

Forest rangeland specialists inspected actively grazed allotments during the 2016-20 grazing seasons. The Forest uses these inspections to determine range readiness, permit compliance, and utilization levels, as well as to collect data for the Allotment Management Plan (AMP) revision process. In addition, range specialists inspect allotments to determine if they are in compliance with Forest Plan standards. These standards vary by management area, but generally require that forage use by livestock not exceed 50% on elk summer range or 35% on elk winter range. Rangeland monitoring work continues to focus strongly on grazing impacts to riparian condition. Specialists also employ supplemental stream bank alteration standards prescribed for some drainages to address fisheries concerns. See RHCA conditions within Grazing Allotments in 2.7 MON-AQT-03 Riparian areas of this report for more details.

2.17.3 Results

Based on inspection observation's, there was little change in the carrying capacity which is the amount of forage that can sustain livestock and wildlife over a decade or more. Forage may increase or decrease annually, mostly due to precipitation and weather conditions but increasing shrub components quickly take over openings created by logging or fire reducing any short-term gains in grass forage. However grazing permittees are reducing their use of the grazing allotments by personal choice which is showing improvements in riparian and watershed conditions and reducing erosion.

Authorized Use

Cattle grazing is authorized on approximately 11 percent of the land area of the Bitterroot National Forest. Thirteen of the 20 grazing allotments hold active permits. In 2018, 6 permittees were authorized to graze 1127 Animal Unit Months (AUMs) on 6 allotments. In 2019, 6 permittees were authorized to graze 865 AUMs on 6 allotments. In 2020, 5 permittees were authorized to graze 1,190 AUMs on 6 allotments.

Table 2.17- 3: Authorized Use

Allotment	2018 Authorized AUM's	2019 Authorized AUM's	2020 Authorized AUM's
Ambrose Creek	0	0	0
Andrews-Waugh	0	0	0
Warm Springs	0	0	0
Bass Creek	132	132	132
Bertie Lord *	0	0	0
Bunch Gulch	0	0	0
Shirley Mountain	0	0	0
Camp Reimel	0	0	0
Coal Creek*	0	0	0
Gold Creek	0	0	0
Harlan Gulch	161	143	0
Little Sleeping Child*	0	0	0
Meadow Creek	0	0	0
Medicine Tree	265	265	265
North Sleeping Child	0	0	132
Piquett Creek *	0	0	0
Skalkaho	211	211	238
Sula Peak/ East Fork	0	93	402
Sweathouse/Gash	21	21	21
Trapper Peak	337	0	0

Transitory Forage Status

The Forest no longer includes transitory forage in the calculation of the carrying capacity of an allotment. The transitory forage produced by the opened canopy of a timber sale, or a burned timber habitat type is classified as secondary or supplemental rather than part of the primary permanent forage base. The amount of transitory forage does not change the allowable stocking rate of an allotment (the number of animals and the duration of grazing) in most cases. Natural plant succession eventually returns these areas to a forested cover type and phases out any flush of palatable forage plant growth.

New transitory feeding areas may change established livestock foraging patterns. The amount of grazing that occurs in these areas is dependent on the forage production and palatability, distance to water, natural barriers, elevation, steepness of slope, noxious weed invasion, and availability of other forage. Many of the sites that experienced fire and are accessible by permitted livestock are not producing palatable herbaceous forage species. For example, pinegrass (Calamagrostis rubescens), an unpalatable grass that livestock generally avoid, dominates many acres of Douglas-fir habitat types. As tree roots and boles weaken from fire effects, the resulting downfall increasingly prevents livestock movement through burned areas.

Table 2.17- 4: Allotment Compliance Results Summary

Allotment	2018	2019	2020
Ambrose Creek	Inactive	Inactive	Inactive
Andrews-Waugh	Rested	Rested	Rested
Warm Springs	Rested	Rested	Rested
Bass Creek	Grazed to standards	Grazed to standards	Grazed to standards
Bertie Lord *	Inactive	Inactive	Inactive
Bunch Gulch	Rested	Rested	Rested
Shirley Mountain	Rested	Rested	Rested
Camp Reimel	Rested	Rested	Rested
Coal Creek*	Inactive	Inactive	Inactive
Gold Creek	Inactive	Inactive	Inactive
Harlan Gulch	Grazed to standards	Grazed to standards	Rested
Little Sleeping Child*	Inactive	Inactive	Inactive
Meadow Creek	Rested	Rested	Rested
Medicine Tree	Grazed to standards	Grazed to standards	Grazed to standards
North Sleeping Child	Rested	Rested	Grazed to standards
Piquett Creek *	Inactive	Inactive	Inactive
Skalkaho	Grazed to standards	Grazed to standards	Grazed to standards
Sula Peak	Rested	Grazed to standards	Rested
East Fork	Rested	Rested	Rested
Sweathouse/Gash	Grazed to standards	Grazed to standards	Grazed to standards
Trapper Peak	Grazed to standards	Inactive	Inactive

**Reserve allotment in inactive status to be used when another allotment needs rest*

Allotment Management NEPA and Plan Revision Status:

Work was started on the North Sleeping Child Grazing Allotment Environmental Assessment, the final allotment without an EA, in 2012 but the Forest set it aside for other priorities.

2.17.4 Discussion

Livestock are being managed for the carrying capacity of the land. The allotments are being managed to meet the standards of the Environmental Assessments which were designed to manage the allotments for the land carrying capacity. Trends are static or improving with rest on many allotments.

2.17.5 Evaluation of Results for Adaptive Management Finding

Table 2.17- 5: Summary of findings for Plan Monitoring Item RNG-01

PLAN IMPLEMENTATION STATUS[1]	CHANGE WARRANTED?	WHERE IS CHANGE WARRANTED?
(E) Yes. Trends are static or improving with rest on many allotments. Active allotments are managed to standards set up in the Environmental Assessments and Allotment Management Plans with changes made to move towards long term goals.	No.	None.

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

2.18 MON-RDS-01 – Roads

2.18.1 Monitoring item summary

- *Monitoring question: Do roads meet construction standards?*

Table 2.18-1 lists forest and grassland plan goals and objectives, monitoring indicators, data sources and partners, the frequency of data collection and reporting, and any quantitative targets or thresholds related to this monitoring item. Table 2.18-2 lists the most recent and next dates for data collection and reporting for this monitoring item.

Table 2.18- 1: Forest plan components, monitoring indicators, data collection intervals, and data sources for MON-RDS-01.

Monitoring Question	Plan components	Indicators	Data collection interval	Data Source / Partner
MON-RDS-01 Do roads meet construction standards?	See Below	• Road related issues identified in Timber Sale Inspection Reports • Road maintenance needs compiled by Engineering Staff	Biennial	• Timber Sale Inspection reports • DNRC BMP Audits where applicable • Construction and Maintenance Contracts ER/COR Reports Timber Sale Inspection Report • Sediment source and road condition inventories conducted during project planning. • Road Analysis (USDA FS, 1999)

Referenced Plan Components

Goals: Design transportation system and road management programs that are responsive to public concerns and protect resource goals. (p. II-3).

Objectives: Minimize extent of road system needed for resource mgt. and need for capital investment funds, minimize effects on water quality and fish habitat during construction and maintenance. (p. II-7).

Standards: Roads will be maintained to design standards, roads will be closed to public use if adequate road maintenance funds are not available, all roads will be designed to facilitate…vegetative recovery… water bar spacing guide. (p. II-27 and 29-33).

Table 2.18- 2: Monitoring collection and reporting dates for MON-RDS-01.

Milestone	Year
Data last collected or compiled in:	2019
Next scheduled data collection and compilation:	2021
Last monitoring evaluation report covering this monitoring item:	2016-2017
Next scheduled monitoring evaluation report covering this monitoring item:	2023

2.18.2 Methods

Data collection methods included review of timber sale contract documents, road maintenance accomplishment reports, yearly accomplishment reports, roads analysis documents, NEPA decisions and deferred maintenance surveys. The forest watershed staff and transportation engineer collect data during project planning and implementation work associated with a variety of projects on the forest. These include force account road decommissioning work, force account road maintenance work, public works contracts and timber sale contracts. In response to feedback from the 2016-2017 Biennial Monitoring Report, the use of Watershed BMP audits as an Indicator is removed from the road section and only reported in the Watershed Condition section of the report. The change will avoid duplication of reporting and allow the roads section to be focused on whether the Forest Road program is moving towards Forest Plan Standards. The Watershed section will continue to use BMP audits as an Indicator to evaluate how well implemented BMPs protect water quality.

2.18.3 Results

Indicator 1: Road related issues identified in timber sale inspection reports

In 2018 and 2019 there was only one timber sale administered by Forest, the Meadow Vapor Timber sale. A review of timber sale inspection reports informs that there was no evidence of road work failing to move towards design standards.

Indicator 2: Road Maintenance needs

The Bitterroot National Forests completes road maintenance yearly even though the Washington Office no longer assigns a target associated with miles maintained. See following table for accomplishments for maintenance levels 2 and 3-5 in 2018 and 2019.

Table 2.18- 3: Road Maintenance Miles, Accomplished 2018 and 2019

Road Maintenance Category	Accomplishments 2018	Accomplishments 2019
High Clearance Improvement (ML 2)	0.50	4.50
High Clearance Maintenance (ML 2)	50.60	75.0
Passenger Car Improvement (ML 3-5)	1.90	3.80
Passenger Car Maintenance (ML 3-5)	202.60	156.1

The forest has about 1,500 miles of open road, yearlong and seasonally. The road maintenance is prioritized by resource need and level of use. In other words, maintenance cycles on roads across the forest varies. Those getting the most use, with the most resource impact get maintenance more often. Where private lands are accessed from forest roads, maintenance is normally done once a year.

Main access roads into the Bitterroot National Forest generally have portions of the road very close to streams. The majority of the Forest's road maintenance budget goes to those roads located near watercourses, low-elevation roads receiving a lot of yearlong traffic, roads with steeper grades, and roads in impaired watersheds (303(d)-listed streams). These sections generally are a high priority for improved aggregate surfacing and improved road drainage features including CMP installations, drainage dips, and road prism shaping. Most main access roads are generally maintained to design standards, there are however exceptions. In instances where roads traverse large areas of land, and mainly cross drainages, the amount of attention and maintenance work declines. The forest prioritizes the improvement and maintenance operations to help mitigate the impacts of roads on the surrounding resources.

No new roads were constructed in the 2018-2019 monitoring report timeframe. Road designs are developed in accordance with Forest Service Directives and the 1987 Bitterroot National Forest Plan.

2.18.4 Discussion

During the 2018-2019 monitoring period, there was no new road construction. The Meadow Vapor timber sale included reconstruction and maintenance of roads, and this work complied with design standards. Maintenance of existing forest roads to standard is based on prioritization, and although most main access roads are maintained to standard, there are exceptions. The road maintenance trend is flat at this time (see indicator 2), the forest is maintaining critical roads in watersheds to standard, but not all roads traversing large areas of forest land and roads with lower maintenance levels which are not arterial access roads are not receiving regular maintenance and consequently develop erosion and other issues that may impair water quality.

2.18.5 Evaluation of Results for Adaptive Management Finding

Table 2.18- 4: Summary of findings for Plan Monitoring Item RDS-01

PLAN IMPLEMENTATION STATUS[1]	CHANGE WARRANTED?	WHERE IS CHANGE WARRANTED?
(E) YES – design features are being followed and many forest roads are being maintained to standard.	No.	None.

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

2.19 MON-MIN-01 – Minerals

2.19.1 Monitoring item summary

- *Monitoring question: What effect are: forest management activities having on mineral activities / mineral activities having on forest management resources?*

Table 2.19-1 lists forest and grassland plan goals and objectives, monitoring indicators, data sources and partners, the frequency of data collection and reporting, and any quantitative targets or thresholds related to this monitoring item. Table 2.19-2 lists the most recent and next dates for data collection and reporting for this monitoring item.

Table 2.19- 1: Forest plan components, monitoring indicators, data collection intervals, and data sources for MON-MIN-01.

Plan components	Indicators	Data collection interval	Data Source / Partner
See Below	• Acres open and accessible for mineral development and leasing. • Number of reclamation plans approved and reclamation activities completed to standard.	Biennial	2 Years • Project level transportation minerals analysis and NEPA documentation. • Mineral Permits and Plan of Operations • Natural Resource Information System (NRIS) Natural Resource Management (NRM)

Referenced Plan Components:

Goals: Provide for the development of mineral and energy resources. (p. II-3).

Objectives: Provide reasonable access for the exploration and development of mineral resources. Review existing mineral withdrawals and need for continuance… (p. II-6).

Standards: Cases by case surface management restrictions will be developed…six items listed including: identify common variety mineral sites, use NEPA, consider outstanding and reserved mineral rights. (p. II-26).

Table 2.19- 2: Monitoring collection and reporting dates for MON-MIN-01.

Milestone	Year
Data last collected or compiled in:	2018
Next scheduled data collection and compilation:	2022
Last monitoring evaluation report covering this monitoring item:	2019
Next scheduled monitoring evaluation report covering this monitoring item:	2021

2.19.2 Methods

Land status was determined using GIS data. Number of active Plans of Operation were determined using Natural Resource Manager (NRM) data.

2.19.3 Results

Table 2.19- 3: Acres open and accessible for mineral development and leasing (2019 & 2020)

Mineral	Acres	% of Total USFS Acres
Open to Mineral Entry and Leasing	823,485	51.64%
Open to Leasing Only	7,674	0.48%
Open to Mineral Entry Only	687	0.04%

*There was no change in USFS acres, Withdrawals, or mineral ownership on the Bitterroot NF between FY2019 and FY2020.

In the last 7 years there has been one unapproved mine Plan of Operations (Plan) (Copper Queen) requiring a reclamation plan, and it has been in an idled phase, so little reclamation has been completed, and no mining has occurred. Copper Queen is a very small (less than ½ acre of surface disturbance), underground, recreational mining operation. There were no approved Plans in 2019 or 2020.

There has been very little hard rock mining activity on this Forest in recent years, and no oil and gas leasing activity.

2.19.4 Discussion

There is little minerals activity on the Bitterroot National Forest. The locatable and leasable minerals programs are reactionary to external demands and dependent on geology. Locatable minerals operations are not discretionary. The Forest Plan encourages mineral development in appropriate management units (lands open to mineral entry and leasing), but there is no Forest Plan goal for number of locatable mineral operations. There was no change in land status regarding lands open to mineral entry and leasing (Pedde 2021).

2.19.5 Evaluation of Results for Adaptive Management Finding

Table 2.19- 4: Summary of findings for Plan Monitoring Item MIN-01

PLAN IMPLEMENTATION STATUS[1]	CHANGE WARRANTED?	WHERE IS CHANGE WARRANTED?
(E) Yes, based on the minimal activity	No.	None.

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

2.19.6 Indicators Influenced by Climate Change

It is uncertain if climate change would influence the acres open and accessible for mineral development and leasing. Climate change would not affect the number of reclamation plans approved and reclamation activities completed to standard.

2.20 MON-ECON-01 – Timber Contracts

2.20.1 Monitoring item summary

- *Monitoring question: Are projects marketable and being purchased when offered?*

Table 2.20-1 lists forest and grassland plan goals and objectives, monitoring indicators, data sources and partners, the frequency of data collection and reporting, and any quantitative targets or thresholds related to this monitoring item. Table 2.20-2 lists the most recent and next dates for data collection and reporting for this monitoring item.

Table 2.20- 1: Forest plan components, monitoring indicators, data collection intervals, and data sources for MON-ECON-01.

Plan components	Indicators	Data collection interval	Data Source / Partner
See Below	# of contract or stewardship projects purchased	Biennial	• Project economic analysis • Economic reports in Environmental analysis

Referenced Plan Components:

Goals: Provide wood products to sustain a viable local economy. Provide an economically efficient sale program. (p. II-3). Strive for economically efficient management. (p. II-4).

Objectives: Offer affordable sales, Maintain advance sale prep at a level to provide flexibility in offering sales that are responsive to market conditions and economic efficiency. (p. II-6).

Standards: Timber sales will be designed as well as possible to be affordable to purchasers…An economic analysis will be completed… (p. II-21 and 23).

Table 2.20- 2: Monitoring collection and reporting dates for MON-ECON-01.

Milestone	Year
Data last collected or compiled in:	2016-2020
Next scheduled data collection and compilation:	2021
Last monitoring evaluation report covering this monitoring item:	2015-2016
Next scheduled monitoring evaluation report covering this monitoring item:	2023

2.20.2 Methods

Data was collected by the Forest Timber Management Assistant from timber contracting database.

2.20.3 Results

Table 2.20- 3: Timber Volume Offered and Sold 2016.

NEPA Document Project Name	NEPA Decision Date	Sale Name	Ranger District & Location	Total Volume (MBF)	Harvest Acres	Remarks
Personal Use Firewood		Personal Use Firewood	Forestwide	3,250		
Campground Hazard Tree removal	Aug-11	Sam Billings BD CG	West Fork	24		
Ravalli Electric Cooperative Right of Way		East/Westfork Powerline Clearing	East Fork/West Fork RD's	40		
3-Saddle EA	Apr-14	AddVol (BlowDown)	Stevensville	660		
Horselick EIS		Add Volume	Darby	177	1,039	
Observation & Roaring Lion Fires	N/A	Observation Deck Sale	Darby	275		
Total				**4,426**	**1,039**	

Table 2.20 -4. Timber Volume Offered and Sold 2017.

NEPA Document Project Name	NEPA Decision Date	Sale Name	Ranger District & Location	Total Volume (MBF)	Harvest Acres	Remarks
Westside Project (EA)	May-16	Westside TS	Darby	4,812	1,000	4th quarter offering
Ravalli Electric Cooperative Right of Way		ROW deck sale	Sula	75		
Campground CE	Aug-11	Warm Springs	Sula	11	15	
Roaring Lion Salvage CE	Dec-16	Roaring Lion Salvage	Darby	518	50	1st quarter offering
Personal Use Firewood		Personal Use Firewood	Forestwide	3,312		
Total				**8,728**	**1,065**	

Table 2.20-5. Timber Volume Offered and Sold 2018

NEPA Document Project Name	NEPA Decision Date	Sale Name	Ranger District & Location	Total Volume (MBF)	Harvest Acres	Remarks
Meadow Vapor (EA)	Aug-17	Meadow Vapor TS	Sula	7,458	1,340	Sold 8/3/18
Meadow Vapor (EA)	Aug-17	Springer Firewood TS	Sula	878	196	8/30 bid opening
Westside Project (EA)	May-16	Little Jumper TS	Darby	1,257	202	Sold 11/28/17
Rec Maintenance (CE)		Leadwood Salvage TS	Darby	17	4	8/30 bid opening
Personal Use Firewood		Personal Use Firewood	Forestwide	3,250		
Personal Use Post and Pole		Personal Use Post and Pole	Forestwide	150		
Total				**13,010**	**1,742**	

Table 2.20-6. Timber Volume Offered and Sold 2019

NEPA Document Project Name	NEPA Decision Date	Sale Name	Ranger District & Location	Total Volume (MBF)	Harvest Acres	Remarks
Darby Lumber Lands P2	Mar-19	Tabor TS	Darby	5,715	945	3rd quarter offering
Meadow Vapor	Aug-17	Teepee deck sale	Sula	177	0	MV Add'l Vol or Tmbr Subject to agreement
N/A		Meyer Fire Decks	Sula	500	25	MV Add'l Vol or Tmbr Subject to agreement
Personal Use Firewood		Personal Use Firewood	Forestwide	3,750		
Personal Use Post and Pole		Personal Use Post and Pole	Forestwide	250		
Total				**10,392**	**970**	

Table 2.20-7. Timber Volume Offered and Sold 2020

NEPA Document Project Name	NEPA Decision Date	Sale Name	Ranger District & Location	Total Volume (MBF)	Harvest Acres	Remarks
BuckHorn CE (GNA)	Apr-20	Buckhorn GNA	Darby-Sula	4,072	750	June 17th bid opening= No Bid, Re-offer opening 7/28. Sold 4th 1/4.
McCart LO Defensible Space Project CE	Sep-19	McCart Post and Pole	Darby-Sula	238	9	Awarded 3/12/20
3-Mile GNA CE	Jul-19	3-Mile GNA	Stevi	907	167	Sold 11/07/2019
Personal Use Firewood		Personal Use Firewood	Forestwide	615		
Personal Use Post and Pole		Personal Use Post and Pole	Forestwide		0	
COVID-19 Firewood/ Free-use		Credit	Forestwide	3,500	0	Credit due to free-use
Total				**9,332**	**926**	

2.20.4 Discussion

The Bitterroot National Forest offers marketable sales that are being purchased when put out for bid. Board-feet sold has increased since 2016 and remains fairly stable.

2.20.5 Evaluation of Results for Adaptive Management Finding

Table 2.20- 8: Summary of findings for Plan Monitoring Item ECON-01

PROGRESS TOWARD PLAN INTENT [1]	CHANGE WARRANTED?	WHERE IS CHANGE WARRANTED?
(E)Yes. Based on increase in board-feet sold from 2016-2020	No.	None.

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

2.21 MON-VIS-01 – Visual quality

2.21.1 Monitoring item summary

- *Monitoring question: Is visual quality being met after project implementation?*

Table 2.21- 1: Forest plan components, monitoring indicators, data collection intervals, and data sources for MON-VIS-01.

Plan components	Indicators	Data collection interval	Data Source / Partner
Forest Plan Goals: Maintain high level of visual quality on landscapes seen from population centers, major travel routes, fishing streams (II-2). Forest Plan Standards: Discussion on recovery times, openings created by harvest should blend with existing openings, consider other resources when designing openings (II-19).	Preservation Retention Partial Retention Modification Maximum Modification Enhancement	2 years	Visual resource analysis or scenery specialist report Forest scene area analysis Visual management system (USDA Forest Service 1974) Scenery management system (USDA Forest Service 1975) Forest Service Manual 2380 USDA Agricultural Handbooks 462, 483, 559 and 608 available at http://fsweb.r1.fs.fed.us/rmlhw/scenery_mgmt/scenery.htm

Referenced Plan Components:

Forest Plan Goals: Maintain high level of visual quality on landscapes seen from population centers, major travel routes, fishing streams (II-2).

Forest Plan Standards: Discussion on recovery times, openings created by harvest should blend with existing openings, consider other resources when designing openings (II-19).

Table 2.21- 2: Monitoring collection and reporting dates for MON-VIS-01.

Milestone	Year
Data last collected or compiled in:	NA
Next scheduled data collection and compilation:	2023
Last monitoring evaluation report covering this monitoring item:	NA
Next scheduled monitoring evaluation report covering this monitoring item:	2023

The Bitterroot Forest does not have a landscape architect; this position is vacant at this time and therefore this monitoring item was not completed. We do expect to fill this position in the near future and therefore will keep this monitoring question at this time.

Table 2.21- 3: Summary of findings for Plan Monitoring Item MON-VIS-01

PROGRESS TOWARD PLAN INTENT [1]	CHANGE WARRANTED?	WHERE IS CHANGE WARRANTED?
(B) Uncertain, as this monitoring was not evaluated	No.	None.

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

2.22 MON-FIRE-01 – Wildland fire

2.22.1 Monitoring item summary

- *Monitoring question: What is the number of fires managed in approved areas?* Table 2.22-1 lists forest and grassland plan goals and objectives, monitoring indicators, data sources and partners, the frequency of data collection and reporting, and any quantitative targets or thresholds related to this monitoring item. Table 2.22-2 lists the most recent and next dates for data collection and reporting for this monitoring item.

Table 2.22- 1: Forest plan components, monitoring indicators, data collection intervals, and data sources for MON-FIRE-01.

Plan components	Indicators	Data collection interval	Data Source / Partner
See below.	Acres treated for resource objectives.	Biennial	FACTS, FTEM-IFTDSS, WFDSS

Referenced Plan Components:

Goals: Design fire management programs that are consistent with other resource goals (Appendices K and M) and eliminate backlog fuels. (p. II-4 and II-5).

Table 2.22- 2: Monitoring collection and reporting dates for MON-FIRE-01.

Milestone	Year
Data last collected or compiled in:	2020
Next scheduled data collection and compilation:	2023
Last monitoring evaluation report covering this monitoring item:	2015-2016
Next scheduled monitoring evaluation report covering this monitoring item:	2023

2.22.2 Methods

This item utilizes data collected in Forest Activity Tracking System (FACTS), Fuel Treatment Effectiveness Monitoring (FTEM) and the Wildfire Decision Support System (WFDSS) to summarize what occurred over the analysis period for the Bitterroot National Forest.

2.22.3 Results

Table 2.22- 3: Bitterroot NF – 2018-2020 Wildland Fire[1] (acres) greater than 10 acres, FACTS Activity Code 1117

Fire Name (Year)	Local Qualifier	Acres
Reynolds Lake (2018)	NF-High Severity	1068
12 Mile (2020)	NF-Mixed Severity	54
Lake Como (2020)	NF-Mixed Severity	22
Total		**1144**

2.22.4 Discussion

The results show only three fires managed to achieve resource objectives. The fire seasons of 2018 and 2019 were relatively slow on the Bitterroot National Forest. Natural ignitions in areas the forest typically considers managing fires for resource objectives did not occur. The 2020 fire season was complicated by the Covid 19 pandemic, and the forest followed national direction to not manage any fires for resource objectives. Natural ignitions in the 2020 season were also considerably lower than the forest typically experiences.

2.22.5 Evaluation of Results for Adaptive Management Finding

The current strategy is tracking the number of fires managed for resource objectives by the acre. However, there may be a need to assess how many fires were not managed to achieve resource objectives. There were multiple ignitions that occur upwind of values with no treatment or recent fire disturbance to act as the proverbial catcher's mitt, thus suppression actions were taken for valid reason/concerns. This trend is most likely to lead to increased future threats to values with this strategy.

Table 2.22- 4: Summary of findings for Plan Monitoring Item FIRE-01

PLAN IMPLEMENTATION STATUS[1]	CHANGE WARRANTED?	WHERE IS CHANGE WARRANTED?
(E)Yes, despite the limited occurrences within this monitoring period, when wildfires encounter treatments that are approx. 10 years or less in age, objectives are more easily accomplished.	Yes	Monitoring Plan: Modify the monitoring question to also include the associated acres. Change current: What is the number of fires managed in approved areas? Modify to: What is the number of fires ***and associated acres*** managed in approved areas?

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

2.23 MON-FIRE-02 and MON-FIRE-03 – Fuel treatments

2.23.1 Monitoring item summary

- *Monitoring question 1: Are fuel reduction treatments effective at reducing the potential of uncharacteristically intense fire and increasing capabilities to protect life and property when a wildfire occurs within an area with previous fuel treatments?*

- *Monitoring question 2: Are fuels treatments effective when a wildfire occurs in the area?*

Table 2.23-1 lists forest and grassland plan goals and objectives, monitoring indicators, data sources and partners, the frequency of data collection and reporting, and any quantitative targets or thresholds related to this monitoring item. Table 2.23-2 lists the most recent and next dates for data collection and reporting for this monitoring item.

Table 2.23- 1: Forest plan components, monitoring indicators, data collection intervals, and data sources for MON-FIRE-02 and MON-FIRE-03.

Plan components	Indicators	Data collection interval	Data Source / Partner
See below.	• Did the treatment contribute to the control of the fire? • Did the fire behavior change as a result of the treatment? • Prescribed Fire and Fuels Treatment Effectiveness (PFETM) • Completed when wildfire intersects with a hazardous Fuels Treatment area if: • Fuels Treatment is 10 years or less • Report to be submitted within 90 days of control date of the wildfire that occurs	Biennial	FACTS, FTEM-IFTDSS

Referenced Plan Components:

Goals: Design fire management programs that are consistent with other resource goals (Appendices K and M) and eliminate backlog fuels (p. II-4 and II-5).

Table 2.23- 2: Monitoring collection and reporting dates for MON-FIRE-02 and MON-FIRE-03.

Milestone	Year
Data last collected or compiled in:	2020
Next scheduled data collection and compilation:	2023
Last monitoring evaluation report covering this monitoring item:	2019
Next scheduled monitoring evaluation report covering this monitoring item:	2023

2.23.2 Methods

This item utilizes data collected in Forest Activity Tracking System (FACTS), Fuel Treatment Effectiveness Monitoring (FTEM) and the Wildfire Decision Support System (WFDSS) to summarize what occurred over the analysis period for the Bitterroot National Forest for the indicators above.

2.23.3 Results

In FY2018-2020, the Forest had 19 wildfires intersect previous treatments for 119 acres. 100% of these entries stated yes to 1) Did the treatment contribute to control and/or management of the fire and 2) Did the fire behavior change because of the treatment. 69% stated yes, the treatment was strategically located to facilitate control of the fire. 57% of the incidents recorded that they were able to do direct attack due to the past treatment. There were 3 instances that stated past treatments “arrested fire spread” allowing for containment.

Table 2.23- 3 Fuels Treatment Effectiveness Monitoring FY 2018

Treatment Name	Treatment Type	Year Treated	Treatment Acres Burned by Wildfire	Wildfire Name	Did the fire behavior change as a result of the Treatment?	Did the treatment contribute to control of the fire?	Was the treatment strategically located in order to facilitate control of the fire?	Were firefighters able to do direct attack?	Was the treatment used for burn out operations?	Was fire spread arrested in the treatment unit?	Was fire spread slowed as it moved through the treatment?	Energy Release component percentile
Three Saddle Stewardship	Thinning	2016	0.1	Ambrose	Y	Y	Y	Y	N	Y	Y	<90%
Saddle Complex Fire	Fire Use	2011	112	Reynolds Lake	Y	Y	Y	Y	N	Y	Y	<90%
Gold Pan Fire	Fire Use	2013	0.1	West Lazy	Y	Y	N	Y	N	Y	Y	<90%
Three Saddle Stewardship 23	Thinning	2016	0.1	Cinnabar	Y	Y	Y	Y	N	Y	Y	<90%

Table 2.23-4 Fuels Treatment Effectiveness Monitoring FY 2019

Treatment Name	Treatment Type	Year Treated	Treatment Acres Burned by Wildfire	Wildfire Name	Did the fire behavior change as a result of the Treatment?	Did the treatment contribute to control of the fire?	Was the treatment strategically located in order to facilitate control of the fire?	Were firefighters able to do direct attack?	Was the treatment used for burn out operations?	Was fire spread arrested in the treatment unit?	Was fire spread slowed as it moved through the treatment?	Energy Release component percentile
Trapper Stewardship 13	Machine Pile/Burn	2016	0.1	Little Trapper Creek	Y	Y	Y	Y	N	Y	Y	<90%

Treatment Name	Treatment Type	Year Treated	Treatment Acres Burned by Wildfire	Wildfire Name	Did the fire behavior change as a result of the Treatment?	Did the treatment contribute to control of the fire?	Was the treatment strategically located in order to facilitate control of the fire?	Were firefighters able to do direct attack?	Was the treatment used for burn out operations?	Was fire spread arrested in the treatment unit?	Was fire spread slowed as it moved through the treatment?	Energy Release component percentile
Elevator Mountain Fire	Fire Use	2014	0.1	North Star	Y	Y	N	Y	N	Y	Y	<90%
Ditch Fire	Fire Use	2012	0.9	Archer Point	Y	Y	N	Y	N	Y	Y	<97%
Gold Pan Fire	Fire Use	2013	0.1	Grass Gulch	Y	Y	N	Y	N	Y	Y	<90%
Gold Pan Fire	Fire Use	2013	0.1	Lunch Creek	Y	Y	N	Y	N	Y	Y	<90%

Table 2.23 -5 Fuels Treatment Effectiveness Monitoring FY 2020

Treatment Name	Treatment Type	Year Treated	Treatment Acres Burned by Wildfire	Wildfire Name	Did the fire behavior change as a result of the Treatment?	Did the treatment contribute to control of the fire?	Was the treatment strategically located in order to facilitate control of the fire?	Were firefighters able to do direct attack?	Was the treatment used for burn out operations?	Was fire spread arrested in the treatment unit?	Was fire spread slowed as it moved through the treatment?	Energy Release component percentile
Little Jumper Unit 7	Biomass Removal	2019	0.1	Gravel Pit	Y	Y	Y	Y	N	Y	Y	<90%
Little Jumper Unit 7	Biomass Removal	2019	0.1	Lost Horse Pile	Y	Y	Y	Y	N	Y	Y	<90%
TSMRS Legacy Stand	Machine Pile/ Burn	2005	0.1	Victor V	Y	Y	Y	Y	N	Y	Y	<90%

Treatment Name	Treatment Type	Year Treated	Treatment Acres Burned by Wildfire	Wildfire Name	Did the fire behavior change as a result of the Treatment?	Did the treatment contribute to control of the fire?	Was the treatment strategically located in order to facilitate control of the fire?	Were firefighters able to do direct attack?	Was the treatment used for burn out operations?	Was fire spread arrested in the treatment unit?	Was fire spread slowed as it moved through the treatment?	Energy Release component percentile
Trapper Stewardship Unit 13	Machine Pile	2005	0.3	Trapper	Y	Y	Y	Y	N	Y	Y	<90%
Three Saddle Stewardship Unit 18	Thinning	2016	0.1	Ambrose Saddle	Y	Y	Y	Y	N	Y	Y	<90%
Larry Bass Stewardship NEPA Unit 2A	Biomass Removal	2013	0.1	Larry	Y	Y	Y	Y	N	Y	Y	<90%

2.23.4 Discussion

The results show that where wildfires intersect a fuels treatment, fire spread is altered or arrested. The age of treatment or disturbance does show variability in the length of effectiveness of treatments. The Forest Service requirement to report of Fuels Treatment Effectiveness Monitoring (FTEM) started in 2012. These results show treatments that are designed to effectively change fire behavior/severity under moderate burning conditions (ERC < 90th percentile) are effective. The results above show a high degree of success when conditions are below the 97th percentile.

2.23.5 Evaluation of Results for Adaptive Management Finding

The monitoring results do show that our treatments are effective at slowing or arresting fire spread. The program is trending towards the desired outcome of increasing our ability to use fire as a tool to accomplish resource objectives both during and outside of our traditional prescribed fire seasons. Room still exists to increase the scale of treatments to the landscape level which is expected to have an impact when ERC percentiles are at or above the 90th.

Table 2.23- 6: Summary of findings for Plan Monitoring Item FIRE-02

PLAN IMPLEMENTATION STATUS[1]	CHANGE WARRANTED?	WHERE IS CHANGE WARRANTED?
(E) Yes. Based on fire spread being altered or arrested in majority of wildfire intersections with fuels treatments	Yes	Monitoring Plan: MON-FIRE-02 and MON-FIRE-03 are very similar monitoring questions and should be collapsed into one question (retain wording from MON-FIRE-02). An additional new monitoring question is needed to address the amount of ecological restoration and/or the protection of values (homes, timber, bridges, infrastructure, etc.) accomplished with prescribed fire. The indicator for this monitoring question will be acres of prescribed fire applied.

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

2.24 MON-SOC-01 – Adjacent landowners and communities and 2.25 MON-PROC-01 – Social values

2.24.1 Monitoring item summary

- *Monitoring question: How do Bitterroot National Forest activities affect adjacent landowners and communities?*

2.25.1 Monitoring item summary

- *Monitoring item: During project analysis and public outreach, emerging issues and social values are highlighted and addressed in project design, mitigation.*

Table 2.24-1 lists forest and grassland plan goals and objectives, monitoring indicators, data sources and partners, the frequency of data collection and reporting, and any quantitative targets or thresholds related to this monitoring item. Table 2.24-2 and Table 2.24-3 list the most recent and next dates for data collection and reporting for these monitoring items.

Table 2.24- 1: Forest plan components, monitoring indicators, data collection intervals, and data sources for MON-SOC-01 and MON-PROC-01.

Plan components	Indicators	Data collection interval	Data Source / Partner
Goals: Coordinate land management activities with management activities of adjacent landowners, tribes, and other agencies. p. II-3 Objectives: Pursue land adjustments that help resolve planning issues, obtain necessary rights of way…prevent further encroachment by posting the forest boundary. p. II-7 **Goals:** Involve interested and affected individuals, organizations and agencies to: 1) increase understanding of resource management activities and issues. 2) obtain public input for resource management decisions. 3) prevent resource and facility damage. 4) Reduce need for use restrictions, regulations, and law enforcement. 5) Promote a cooperative relationship between Forest managers and the public. (p. II-4).	• Public comment and involvement during project planning. • Public comment received • Collaborative group comments received • General public meetings • Project scoping comments • Official project comment period comments received • Project objections received • Project litigation claims received • Consultation responses from other Federal, State, local and tribal governments	• Biennial	Public comment and issues raised during project analysis Headwater Economics Tools: (http://headwaterseconomics.org/tools/economic-profile-system/about) – (data compiled and evaluated every two years by Regional Office at region by forest/grassland scales) By project, reported biannually Line officer and staff public comment records Public Information Office public contact records Meeting notes Project planning (NEPA) public response to scoping, comment, and objection periods Social Media Public newspaper articles and editorials

Table 2.24- 2: Monitoring collection and reporting dates for MON-SOC-01.

Milestone	Year
Data last collected or compiled in:	2019
Next scheduled data collection and compilation:	2023
Last monitoring evaluation report covering this monitoring item:	2019
Next scheduled monitoring evaluation report covering this monitoring item:	2023

Table 2.24- 3: Monitoring collection and reporting dates for MON-PROC-01.

Milestone	Year
Data last collected or compiled in:	2019
Next scheduled data collection and compilation:	Suggest dropping this monitoring item
Last monitoring evaluation report covering this monitoring item:	2019
Next scheduled monitoring evaluation report covering this monitoring item:	Suggest dropping this monitoring item

2.24.2 and 2.25.2 Methods

During the NEPA process, the Forest scopes proposed actions with the public, interested parties, and with our tribal partners for decisions that the law requires scoping.

2.24.3 and 2.25.3 Results

Public comments are posted on our public webpage for each project.
https://www.fs.usda.gov/projects/bitterroot/landmanagement/projects

2.24.4 and 2.25.4 Discussion

Comments and issues raised by the public and our partners are considered during project development.

2.24.5 and 2.25.5 Evaluation of Results for Adaptive Management Finding

Public and other stakeholder participation and comment during the various stages of the NEPA process gives the Forest insight to emerging issues and concerns. This helps the responsible official adjust project proposals or develop alternatives.

Currently, the Forest is trending toward the desired conditions of the associated plan components by engaging communities and incorporating social values in forest management.

Table 2.24- 4: Summary of findings for Plan Monitoring Items MON-SOC-01 and MON-PROC-01.

PLAN IMPLEMENTATION STATUS[1]	CHANGE WARRANTED?	WHERE IS CHANGE WARRANTED?
(E) Yes. For most Forest decisions, the public and our partners are informed and invited to comment. Issues solicited at project scoping and comment periods are helping the responsible official adjust projects, as necessary. Public involvement (including the objection process and litigation) has brought current issues with forest management to light, e.g. road and travel management. Responsible officials are trying to collaborate earlier on projects and adjust proposed activities based on what was learned from the previous project. The results indicate trending toward the desired conditions as most local stakeholders in the plan area do not disagree that forest management is in line with local values.	Yes.	Monitoring Plan: The MON-PROC-01 item should be dropped from future monitoring reports. For all projects required by law, the Bitterroot adequately scopes with the public and our partners and incorporates the feedback we receive into our project designs and mitigations. Public comments are posted to our webpage and decision documents describe how this input is incorporated.

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

References

Archer, E., W.C. Saunders, and J.V. Ojala. Stream Habitat Condition for Sites in the Bitterroot National Forest. PACFISH/INFISH Biological Opinion Effectiveness Monitoring Program. Fish & Aquatic Ecology Unit. Logan, Utah. 22 pages. http://fsweb.r4.fs.fed.us/unit/nr/pibo/index.shtml

Eby, L.A., O. Helmy, L.M. Holsinger, and M.K. Young. 2014. Evidence of Climate-Induced Range Contractions in Bull Trout, Salvelinus confluentus in a Rocky Mountain Watershed, U.S.A. PLoS ONE 9(6): e98812. Doi:10.1371/journal.pone.0098812.

Isaak, D., M. Young, D. Nagel, D. Horan, and M. Groce. 2015. The cold-water climate shield: Delineating refugia for preserving salmonid fishes through the 21st Century. Global Change Biology. 21:2540-2553.

Isaak, D., S. Wenger, E. Peterson, J. VerHoef, D. Nagel, C. Luce, S. Hostetler, J. Dunham, B. Roper, S. Wollrab, G. Chandler, D. Horan, S. Parkes-Payne. 2017. The NorWeST summer stream temperature model and scenarios for the western U.S.: A crowd-sourced database and new geospatial tools foster a

user community and predict broad climate warming of rivers and streams. Water Resources Research, 53: 9181-9205. https://doi.org/10.1002/2017WR020969
https://www.fs.fed.us/rm/boise/AWAE/projects/NorWeST.html

LeMoine, M.T., L.A. Eby, C.G. Clancy, L.G. Nyce, M.J. Jakober, and D.J. Isaak. 2020. Landscape resistance mediates native fish species distribution shifts and vulnerability to climate change in riverscapes. Global Change Biology 2020; 00:1-17.

Pederson, G.T., L.J. Graumlich, D.B. Fagre, T. Kipfer, and C.C. Muhlfeld. 2010. A century of climate and ecosystem change in Western Montana: what do temperature trends portend? Climate Change (2010) 98:133-154.

Stagliano, D. 2010. Freshwater Mussels in Montana: Comprehensive Results from 3 years of SWG Funded Surveys. Report prepared for Montana Department of Fish, Wildlife, and Parks. Montana Natural Heritage Program. Helena, Montana.

Stagliano, D. 2015. Re-evaluation and Trend Analysis of Western Pearlshell Mussel (SWG Tier 1) Populations across Watersheds of Western Montana. Report of State Wildlife Grant (SWG) FY2015 Activities to Montana Fish, Wildlife, and Parks. FWP Agreement #150027. Montana Natural Heritage Program. Helena, Montana. April, 2015.