United States Department of Agriculture

Biennial
2024 Monitoring Evaluation Report

White River National Forest

Trappers Lake (2020) Photo by Cary Green, UDSA Forest Service

Forest Service **White River National Forest** **August 2025**

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Summary of Findings and Results

Table 1 consists of the 2024 Monitoring Report summary of the findings and results. This table briefly describes for each monitoring item if the monitoring results demonstrate intended progress toward plan targets, whether changes are warranted, and where changes may be needed in the Forest Plan, management activities and/or monitoring program.

Table 1. Summary of findings.

Monitoring Item	Year Updated	Do monitoring results demonstrate intended progress or trend toward Plan targets?	Based on the evaluation of monitoring results, may changes be warranted?	If a change may be warranted, where may the change be needed?[2]
1.1: Watershed Condition Framework Is the unit improving condition in priority watersheds?	2024	Trend is watershed conditions maintained or improving.	No	N/A
1.2: Watershed Condition Class Is the unit maintaining or improving watershed condition class in non-priority watersheds?	2024	Uncertain (B) Watershed condition class slow to change over time. Data points every 6 years may not show trend. Fire impacted watersheds show recovery	No	N/A
1.3: National Best Management Practices Program Are Best Management Practices (BMPs) implemented, and are they effective at protecting water quality?	2024	Trend is increased progress in effectiveness of BMPs in protecting water quality, but not at the 100% target effectiveness.	No	N/A
2.1: Air Quality What are the conditions and trends for visibility in Class I and selected Class II areas on the unit?	2024	Trend is improved air quality in select Class I and II areas on the WRNF.	No	N/A

Monitoring Item	Year Updated	Do monitoring results demonstrate intended progress or trend toward Plan targets?	Based on the evaluation of monitoring results, may changes be warranted?	If a change may be warranted, where may the change be needed?[2]
2.2: Forest and Grassland Health What are the status and trends of insects and disease in and around the plan area?	2024	Insects and diseases are at endemic levels in all forest cover types. Sub-alpine fir mortality and spruce budworm are largest insect/disease contributors on forest. Douglas-fir beetle mortality continues to be visible along valley floors across the entire forest.	No	N/A
2.3: Ecosystem Health How are major vegetation types on the planning unit changing over time?	2025	All vegetative cover types are stable with normal flux of mortality in the older structural stages.	No	N/A
3.1: Macro-invertebrates Is Forest management contributing to conditions that maintain or improve biological stream health trends for biotic macroinvertebrate communities?	2024	Uncertain (B) No statistical significant difference in impairment is apparent. The random sampling methods may not capture local impacts or trends	Yes	Utilize not only random sampling but also a stratified sampling method of historic problematic areas. Also move from current indices to Colorado MMI
3.2: Red Squirrel What do red squirrel populations tell us about the extent and condition of mid to late successional forested ecosystems on the planning unit?	2024	Population trend is positive except in lower elevation coniferous forest.	No	N/A
3.3: Pika What is the status of American pika populations as an indicator for alpine ecosystem integrity?	N/A	(C) Methods and results not available to answer question. Data not available for this reporting period.	N/A	N/A

Monitoring Item	Year Updated	Do monitoring results demonstrate intended progress or trend toward Plan targets?	Based on the evaluation of monitoring results, may changes be warranted?	If a change may be warranted, where may the change be needed?[2]
3.4 Avian Species What are the status and trends of select avian species on the White River National Forest?	2024	Population trends are positive for 4 of 8 species. Stable for other 3 species, and declining for one species (Stellar's jay)	No	N/A
4.1: Cutthroat Trout What is the status and trend of cutthroat trout across the planning area?	N/A	(C) Methods and results not available to answer question. Data not available for this reporting period. Analysis was not completed in 2025 due to staffing shortages and deferred resignations.	N/A	N/A
4.2 Amphibians What is the status and trend of boreal toads and northern leopard frogs being across the planning area?	N/A	(C) Methods and results not available to answer question. Data not available for this reporting period. Analysis was not completed in 2025 due to staffing shortages and deferred resignations.	N/A	N/A
4.3 Lynx Habitat What is the status and trend of early successional conifer and late seral spruce-fir forests to promote recovery of Canada lynx?	N/A	(C) Methods and results not available to answer question. Data not available for this reporting period No data or analysis was collected in 2025 due to staffing shortages and deferred resignations.	N/A	N/A
5.1: Visitor Satisfaction and use. What are the status and trends of visitor satisfaction for recreational visits on the planning unit?	N/A	(C) Methods and results not available to answer question. Next data period for this analysis will be collected in 2027. Data not available for this period. Analysis was not completed in 2025	N/A	N/A

Monitoring Item	Year Updated	Do monitoring results demonstrate intended progress or trend toward Plan targets?	Based on the evaluation of monitoring results, may changes be warranted?	If a change may be warranted, where may the change be needed?[2]
		due to staffing shortages and deferred resignations.		
5.2: Special Uses Administration What are the number and type of Special Use Permits administered to standard?	2025	Trend is stable for special use permits administered to standard.	No	N/A
5.3: Sustaining Recreation Infrastructure How is the Forest trending towards implementing a sustainable program for recreation related infrastructure?	2024	Trend is stable towards implementing a sustainable program for recreation related infrastructure.	No	N/A
6.1: Snowpack and Precipitation What is the status and trends of snowpack and precipitation in the planning area?	2025	Snow Water Equivalent Uncertain (B) Precipitation slight downward trend Temperature slight warming trend	No	N/A
7.1: Economic Contributions from Specific Programs What are the contributions from the range, timber, recreation, and minerals program from the National Forest or Grassland?	2024	(C) Methods and results not available to answer question. Data not available for this reporting period as it relies heavily on NVUM data. Other economic data variables are shown in tables where available.	Yes	Change economic analysis interval to coincide with MVUM, every 5 years.

Monitoring Item	Year Updated	Do monitoring results demonstrate intended progress or trend toward Plan targets?	Based on the evaluation of monitoring results, may changes be warranted?	If a change may be warranted, where may the change be needed?[2]
7.2. Heritage Program Stewardship To what extent have management activities on the Forest complied with Section 110 of the National Historic Preservation Act and provided quality heritage recreational experiences?	2024	Uncertain (B) unable to determine a trend at this time with the current data points.	No	N/A
7.3 – Travel Management Implementation What are the status and trends of roads and trails in the WRNF?	2024	Trend is stable for roads and trails.	No	N/A
7.4 - Wilderness What are the status and trends of the Wilderness Stewardship Performance elements?	N/A	(C) Methods and results not available to answer question. Data not available for this reporting period. Analysis was not completed in 2025 due to staffing shortages and deferred resignations.	N/A	N/A
7.5 - Management Activity Bare Ground Recovery Are project level design criteria and mitigation measures addressing ground disturbing management activities meeting the direction to "…maintain or improve levels of soil organic matter on all lands" through bare ground rehabilitation projects?	2024	Trend is stable for project level design criteria that address ground disturbing management activities.	No	N/A

Monitoring Item	Year Updated	Do monitoring results demonstrate intended progress or trend toward Plan targets?	Based on the evaluation of monitoring results, may changes be warranted?	If a change may be warranted, where may the change be needed?[2]
8.1 - Soil Productivity Monitoring What are the status and trends of soil productivity?	2024	Trend of soil productivity is stable with implementation of BMPs and design criteria.	No	N/A

[1]Interval of data collection is beyond this reporting cycle (A); or more time/data are needed to understand status or progress of the plan component (B); or methods/results are inadequate to answer monitoring question (C).
[2] see body of the report for more details regarding any specific recommendations/opportunities for change.

Introduction

Purpose

The purpose of the biennial monitoring evaluation report is to help the responsible official determine whether a change is needed in Forest Plan direction, such as plan components or other plan content that guide management of resources in the plan area. The biennial monitoring evaluation report represents one part of the Forest Service's overall monitoring program for this National Forest unit. The biennial monitoring evaluation report is not a decision document—it evaluates monitoring questions and indicators presented in the Plan Monitoring Program chapter of the Forest Plan, in relation to management actions carried out in the plan area. The White River National Forest Land and Resource Management Plan – 2002 Revision (Forest Plan) was updated in 2016 following the 2012 Planning Rule in order to replace "Chapter 4 Monitoring and Evaluation" with "White River Forest Plan: Updated Monitoring Plan (Monitoring Plan)."

Monitoring and evaluation are continuous learning tools that form the backbone of adaptive management. For this reason, our goal is to produce an evaluation report every two years. This is the third written report of this evaluation since the Monitoring Plan was adopted on May 6, 2016. This report indicates whether a change to the Forest Plan, management activities, monitoring program or Forest assessment may be needed based on the new information. This 2024 biennial monitoring evaluation report for the White River National Forest (WRNF) is available at https://www.fs.usda.gov/r02/whiteriver/planning/forest-plan/white-river-national-forest-plan

Objectives

There are several objectives for this report, including:

- Assess the current condition (i.e., status) and trend of selected Forest resources.
- Document implementation of the Monitoring Plan 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 towards achieving the selected desired conditions, objectives, and goals described in the Forest Plan.
- Assess the status of previous recommended options for change based on previous monitoring and evaluation reports.
- Document any scheduled monitoring actions that have not been completed and the reasons and rationale why it has not.
- Present any new information not outlined in the current plan monitoring program that is relevant to the evaluation of the selected monitoring questions.

How to Use this Report

This report is a tool and a resource for the Forest Service to assess the condition of Forest resources in relation to Forest Plan direction and management actions. It is also a tool and a resource for the public to learn more about how the Forest Service is managing Forest resources.

The biennial monitoring evaluation report is designed to help the public, Tribal entities, stakeholders, and federal, state, local governments anticipate key steps in the overall monitoring program. The biennial monitoring evaluation report is also intended to help people better understand reported results in relation to past monitoring reports, future monitoring reports, and the broader-scale monitoring strategy that is issued at the Forest Service regional level.

The White River National Forest will make this report available for public review and feedback. The Forest is also interested in how members of the public feel that the Forest Supervisor should incorporate this information into decision making. The forest will accept public comments on the 2024 monitoring plan. Please send comments to SM.FS.COMMENTS.R2.WHITERIVER@usda.gov Individuals and organizations are strongly encouraged to submit feedback.

The goal is to receive constructive feedback on how the Forest can utilize limited Forest Plan monitoring resources and take advantage of existing datasets and monitoring information. The monitoring program welcomes public participation per the Forest Service Handbook (FSH 1909.12_42.14) “to obtain public feedback on what the monitoring information suggests about the effectiveness of the land management plan.”

About the Forest Plan Monitoring Program

Roles and Responsibilities

The Forest Plan Monitoring Program requires a coordinated effort of many people. It includes people who collect the data, people who analyze the data and report results, people outside the Forest Service who provide feedback and assistance, and agency decision makers who apply the results. A list of contributors to this report is found in Appendix B: List of contributors.

How the Forest Plan Monitoring Program Works

Monitoring and evaluation requirements are 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).

Monitoring of the Forest Plan has occurred since it was adopted in 2002. For a copy of previous monitoring reports and for information about the monitoring program go to https://www.fs.usda.gov/r02/whiteriver/planning/forest-plan/white-river-national-forest-plan

This 2024 biennial monitoring evaluation report uses a new framework that is in line with the 2012 Planning Rule and follows the amendment to the Forest Plan made in 2016. Monitoring questions and indicators were selected to inform the management of resources on the plan area and not every plan component was determined necessary to track [36 CFR 219.12(a)(2)]. See the Plan Monitoring Program at https://www.fs.usda.gov/sites/nfs/files/r02/whiteriver/publication/WRNF%20Updated%20Monitoring%20Plan%202016.pdf for discussion on how the monitoring questions were selected to be consistent with the 2012 planning regulations 36 CFR 219.12. Providing timely, accurate monitoring information to the responsible official and the public is a key requirement of the plan monitoring program. This 2024 biennial monitoring evaluation report is the vehicle for disseminating this information.

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

- Implementation monitoring - Are we implementing the Forest Plan properly? Are we meeting our management targets and project guidelines?
- Effectiveness monitoring - Are we achieving our Forest Plan management goals and desired outcomes? If not, how, and why?
- Validation monitoring - Do our hypotheses testing indicate we may need to change the Forest Plan? To what extent? In what direction?

Implementation monitoring is important for tracking progress and accomplishments; however, it is effectiveness and validation monitoring that drive and support the adaptive management process. Effectiveness monitoring evaluates condition and 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 accurate?).

Monitoring Evaluation

Monitoring Activities

The following sections present the most current information (data and evaluations) for all monitoring questions contained within the WRNF Monitoring Plan. The monitoring plan contains 23 questions. Twenty questions were updated during the current evaluation period 2024 with the most recent available data and have had their associated discussions updated in the next section of this report.

This section and all its subsections describe the details of how monitoring data were collected, reported, and evaluated for the Monitoring Plan to support the recommendation options. This section displays the summary of data results compiled for each monitoring item. The organization of this section follows the organization of the monitoring program contained within the Forest Plan.

Questions in the 2016 Monitoring Plan Strategy have reporting intervals ranging from one to five years. This report includes questions scheduled for reporting after the adoption of the updated monitoring plan through 2024. Results for questions that have reporting intervals longer than two years are not included in this report, except for those that depend on periodic reports. This information

will be updated in the next biennial report. As described in the 2016 Monitoring Plan Strategy, 23 questions are spread over the eight required monitoring categories:

i. Watershed conditions
ii. Ecological conditions
iii. Focal species
iv. Ecological conditions for at-risk species
v. Visitor use, visitor satisfaction, and recreation plan objectives
vi. Climate change measures and other stressors
vii. Forest Plan desired conditions and objectives
viii. Management and productivity of land (soils)

Each monitoring item includes 1) a summary of the monitoring question and its indicators; 2) an evaluation of the monitoring results, discussion, and findings; and 3) an adaptive management finding on whether recommendation options could be considered for future changes or not.

I. The status of select watershed conditions

Monitoring Item 1.1: Watershed Condition Framework

Monitoring Question and Background

- Is the unit improving condition in priority watersheds?

Forest Plan Ref./ Driver	Indicators	Data Sources/ Protocols/ Partners	Frequency of data a) collection b) reporting	Targets or thresholds
Goal 1, Objective 1a: "Improve and protect watershed conditions to provide the water quality and quantity necessary to support ecological functions and intended beneficial uses."	Completion of the number and percentage of essential projects identified in Watershed Restoration Action Plan(s).	USFS Watershed Condition Framework (WCF). Watershed Condition Assessment Tracking (WCATT) database	a) Every 6 years for WCF and annually for WCATT; b) Every 6 years for WCF and annually for WCATT;	Condition class of select watersheds is maintained or improved over the life of the Forest Plan

Monitoring Results

The US Forest Service's "Watershed Condition Framework" (WCF) is used to assess the overall watershed condition of all sub-watersheds on the Forest, prioritize restoration efforts, and track progress toward improving watershed condition on National Forest System (NFS) lands (USDA Forest Service, 2011a). Within the WCF framework, several priority watersheds are designated that require the preparation of a Watershed Restoration Action Plan (WRAP). These are programmatic documents that identify essential projects needed to improve conditions in priority watersheds. Completion of WRAPs and essential projects are used to evaluate progress toward meeting Forest Plan goals and

objectives related to maintaining and improving watershed conditions. Figure 1 shows the location of priority watersheds on the WRNF, and Table 2 summarizes WRAPs and essential projects. In Figure1, green represents watersheds in best condition (Condition Class 1 – Functioning Properly) and yellow represent watersheds in moderate condition (Condition Class 2 – Functioning at Risk). The WRNF has no watersheds in the lowest condition class (shown in red – Impaired Function). Blue stars indicate WRNF priority watersheds.

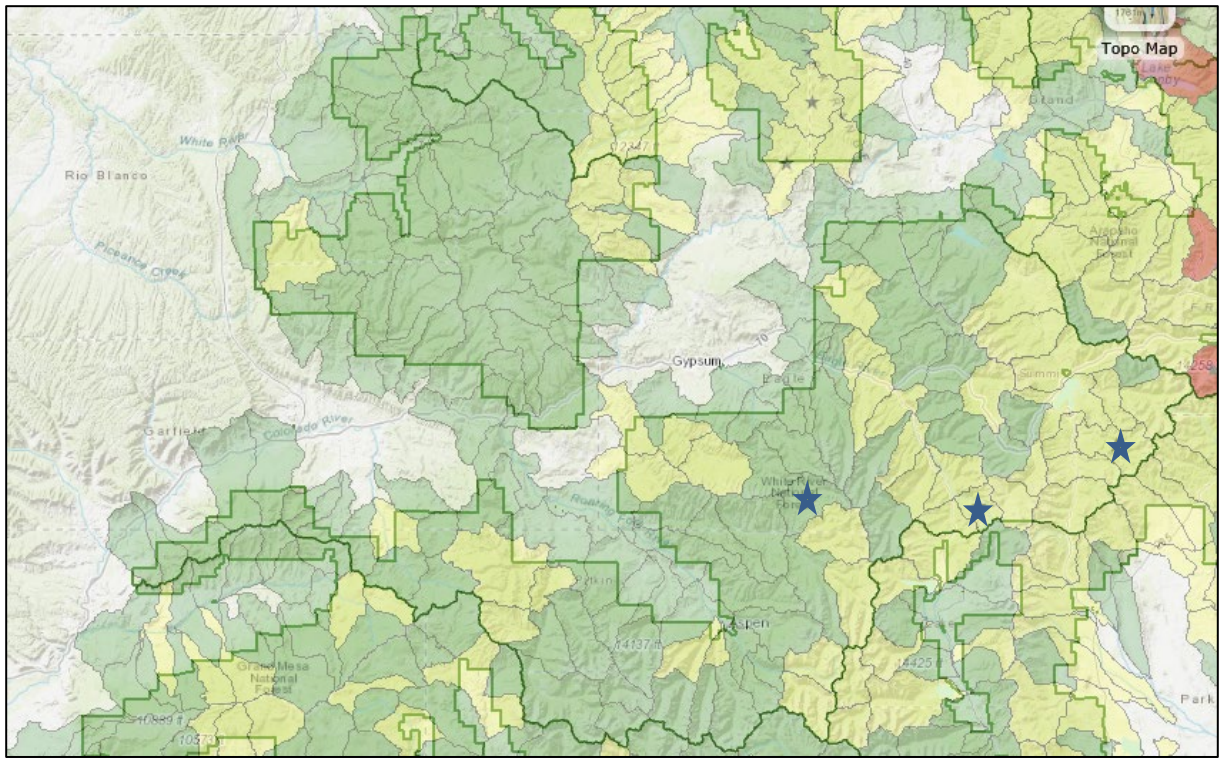


Figure 1. WRNF watershed condition classification and priority watersheds.

Green represents watersheds in best condition (Condition Class 1) and yellow represent watersheds in moderate condition (Condition Class 2). The WRNF has no watersheds in the lowest condition class (shown in red). Blue stars indicate WRNF priority watersheds.

Table 2. Summary of Watershed Restoration Action Plan implementation.

Sub-basin (HUC-8)	Sub-watershed (HUC-12)	WRAP Approval Date	Number of Essential Projects	Number of Essential Projects Completed	Estimated Completion Date of All Essential Projects
Roaring Fork	Lime Creek	24 Oct 2011	5	4	30 Sept 2025
Eagle	East Fork Eagle	01 Sept 2012	4	2	31 Oct 2028
Blue	Swan River	31 Aug 2012	3	2	31 Oct 2025
Eagle	Turkey Creek	Still in Draft	7	3	31 Oct 2028

Monitoring Discussion and Findings

The Forest has identified four priority watersheds for restoration with associated Watershed Restoration Action Plans (WRAPs) and restoration efforts are underway. Table 2 shows that significant

progress has been made on the approved WRAPs; most of the remaining projects are either very large, expensive and time consuming or are the responsibility of partner agencies, such as cutthroat trout reintroduction by Colorado Parks and Wildlife.

The USFS activities in the Lime Creek are near completion, but one project remains that will be accomplished by Colorado Parks and Wildlife in 2024-25. Progress continues in the Swan River; funding was recently received to continue the remaining projects in 2023 and beyond. Funding for Turkey Creek projects continue as funding is received. The wearyman road restoration project should be completed in 2026. Efforts in the Upper Eagle River at Camp Hale have been re-initiated with funding from the Collaborative Aquatic Landscape Restoration Program. Several issues are still outstanding. Prior to implementation asbestos cleanup by the U.S. Army Corps of Engineers is needed, while discussions continue with the State Historic Preservation Office on how to best restore aquatic conditions at Camp Hale while honoring the historical significance of the World War II military base. The recent declaration of the Camp Hale – Continental Divide National Monument (CHCDNM) should not affect the restoration. Planning this restoration project is ongoing and still in the initial stages (pre-NEPA).

The Forest intentionally prioritized large-scale and expensive restoration in watersheds that include Camp Hale and the historic dredge boat mining in the Swan River. This was done to bring attention to these large projects, knowing that completion would take a decade or more. While progress is slow in these watersheds, the conditions are being improved with each essential project completed, consistent with the goal of improving watershed conditions.

Adaptive Management Considerations

The monitoring shows that progress is being made to improve conditions in priority watersheds consistent with Forest Plan goals and objectives. Since the WCF is only updated every six years, it is not a particularly sensitive baseline of comparison; however, priority watersheds with associated essential projects can be designated at any time and tracked under this monitoring question. As such, no adaptive changes to the Forest Plan, WCF program or this monitoring question are anticipated at this time.

Monitoring Item 1.2: Watershed Condition Class

Monitoring Question and Background

- Is the unit maintaining or improving watershed condition class in non-priority watersheds?

Forest Plan Ref./ Driver	Indicators	Data Sources / Protocols / Partners	Frequency of data a) collection b) reporting	Targets, thresholds
Goal 1, Objective 1a. Strategy 1a.3 Over the life of the plan, monitor watershed condition in all watersheds. Evaluate degraded watersheds for improvement potential. Where restoration work has been applied, assess trends towards positive watershed condition."	Percentage of sub-watersheds maintained or improved.	Watershed condition framework	a) As conditions change, e.g. wildfire, floods, insect and disease outbreaks, large-scale restoration, etc. b) 6 years	Condition class of all watersheds is maintained or improved over the life of the Forest Plan

The WCF uses a suite of 12 indicators that reflect the condition of the underlying ecological, hydrological, and geomorphic functions and processes that affect watershed condition. These indicators include the physical aquatic metrics of water quality, water quantity and aquatic habitat; aquatic biological metrics of aquatic biota and riparian/wetland vegetation; terrestrial physical metrics related to the condition of roads, trails and soils; and terrestrial biological metrics for fire regime, forest and rangeland vegetation, invasive species and forest health. Each indicator has sub indicators which are assigned a numeric rating, all of which are summed and averaged to give a condition class rating for each watershed.

For this biennial report (2024), no changes in watershed condition class from the 2020-2022 biennial report.

Monitoring Results

Class 1watersheds – those Functioning Properly - have an ecological structure, function, and composition that are comparable to natural wildland conditions. Class 2 watersheds are "Functioning at Risk", and Class 3 watersheds have highly Impaired Function. Figure 2, which summarizes the condition of all sub-watersheds on the Forest, shows the proportion of watersheds in Class 1 and Class 2 condition classes. There are no watersheds on the WRNF in the lowest condition class.

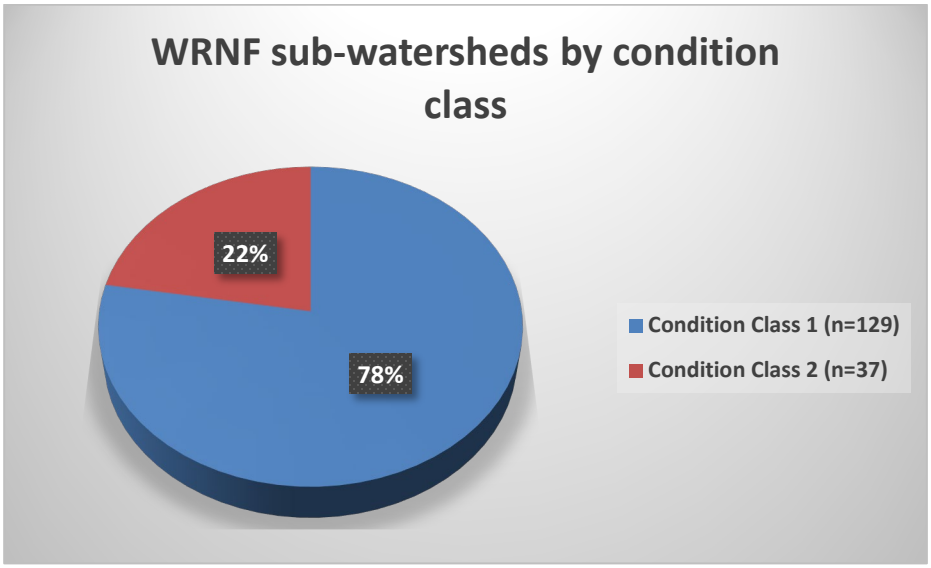


Figure 2. Proportion of WRNF HUC-12 (sub-watersheds) by condition class.

Monitoring Discussion and Findings

Watersheds in the highest Condition Class account for 78 percent of the total on the White River National Forest. Of the 22 percent of watersheds in Condition Class 2, most are impacted by roads, urbanization and/or invasive species. These current figures serve as a baseline for future biennial reporting.

Since the last monitoring period (2018), wildfires occurred in Glenwood Canyon, Sylvan Lake Area, Ptarmigan area near Silverthorne, and near the Lake Christine Wildlife Area in Basalt, potentially affecting aquatic resources in the Colorado and Fryingpan rivers. Thunderstorms caused several post-fire debris flows that delivered significant amounts of sediment to the Colorado River, affecting Interstate 70 and closing the highway in Glenwood Canyon. The five affected sub-watersheds were

Grizzly Creek, No Name Creek, Glenwood Canyon, Blue Creek-Roaring Fork River, and Mill Creek-Cattle Creek, all of which had at least 10 percent of the watershed burn. Only two watersheds had burn acreages and intensities that caused a change in ratings for Element 7.1 - Soil Productivity or Element 9.1 - Loss of Forest Cover. In both cases, the Element ratings dropped from Good to Fair, but neither caused the overall watershed rating to change. Glenwood Canyon remained in Condition Class 1 and Mill Creek-Cattle Creek remained in Condition Class 2.

Since these were natural events and vegetation and soil conditions will slowly recover, and the river will digest and redistribute the sediment deposits, conditions are expected to recover on their own. Recovery efforts should be accelerated by the sediment removal work in the Colorado River to protect Interstate 70 and by the planned soil amendment work to promote soil and vegetation recovery.

Adaptive Management Considerations

Monitoring shows a snapshot of conditions from when the Watershed Condition Framework assessment was completed in 2010. Since overall rating changes are slow to occur, progress toward Forest Plan goals and objectives cannot be demonstrated in this biennial report. The exception is the impact from wildfire discussed previously.

Since the WCF is only updated every six years, it is not a particularly sensitive baseline of comparison to show progress toward watershed improvement goals. Ground disturbing activities and restoration work are simultaneously occurring in many watersheds across the Forest in any given year, yet the net effects of these activities are not large enough to cause a change in condition class. It can be argued that too much resolution is being requested from this national dataset. As such, to be an effective monitoring question, analysis in subsequent years may require that project level data be evaluated in affected watersheds with a determination of whether overall condition was decreased, maintained, or improved. WCF metrics may need to be updated annually to keep track of numeric or categorical changes in each watershed. As such, no adaptive changes to the Forest Plan are anticipated at this time, but elements of the WCF program and this monitoring question may need to be modified to provide meaningful results for subsequent biennial reports.

Monitoring Item 1.3: National Watershed Best Management Practices Program

Monitoring Question and Background

- Are Best Management Practices (BMPs) implemented, and are they effective at protecting water quality?

The purpose of Best Management Practices (BMPs) is to avoid, minimize, or mitigate adverse effects to soil, water, and riparian resources that may result from land management activities in or adjacent to aquatic ecosystems.

Forest Plan Ref./ Driver	Indicators	Data Sources / Protocols / Partners	Frequency of data a) collection b) reporting	Targets, thresholds
Goal 1, Objective 1a: "Improve and protect watershed conditions to provide the water quality and quantity necessary to support ecological functions and intended beneficial uses."	Monitoring protocol rating system categories	National Best Management Practices for Water Quality Management on National Forest System Lands (2012)	a) Annually b) 2 years	All prescribed BMPs in the National Core Technical Guide are fully implemented and effective for each evaluation

Monitoring Results

Since 2015, the WRNF has monitored the implementation and effectiveness of BMPs with nationally consistent protocols. The National BMP Program consists of four main components: 1) a set of National Core BMPs, 2) a set of standardized monitoring protocols to evaluate implementation and effectiveness of those BMPs, 3) a data management and reporting structure, and 4) corresponding national direction.

Monitoring protocols are available for forest management activities related to aquatic restoration, chemical uses, facilities management, fire, minerals and mining, rangeland management, developed and dispersed recreation, roads management, vegetation management, and water uses. Each year the forest completes at least ten formal monitoring evaluations, five of which are assigned by the Regional Office, the other five are selected by the forest. Both implementation monitoring (if BMPs were implemented) and effectiveness monitoring (if BMPs were effective at protecting aquatic resources) can be evaluated for each activity. Table 3 summarizes the monitoring activities evaluated over the reporting period.

Table 3. Forest management activities monitored on WRNF in fiscal years 2023-2024.

Activity by BMP Monitoring Code	Description	Number of Evaluations
AqEco_A	Active Construction of Aquatic Ecosystem Improvements	2
Chem_A	Chemical Use Near Waterbodies	2
Fire_A	Use of Prescribed Fire	2
Range_A	Grazing Management	1
Rec_C	Completed Construction or Re-routing of Motorized or Nonmotorized Trails	1
Rec_H	Completed Ski Area Construction or Reconstruction	3
Road_A	Active Road or Waterbody Crossing Reconstruction	2
Road_B	Completed Road or Waterbody Crossing Construction or Reconstruction	2
Veg_A	Ground-Based Skidding and Harvesting	1
Veg_C	Mechanical Site Treatments	1
WatUses_B	Operation and Maintenance of Spring-Source Facilities	3
WatUses_D	Active Construction of Diversion and Conveyances	1
	TOTAL	**21**

The results from applying the monitoring protocols are summarized below in Figure 3 for implementation monitoring and in Figure 4 for effectiveness monitoring. Figure 3 shows the extent to which required BMPs were implemented across the range of projects. Figure 4 shows how effective required BMPs were at protecting aquatic resources from a variety of land management activities.

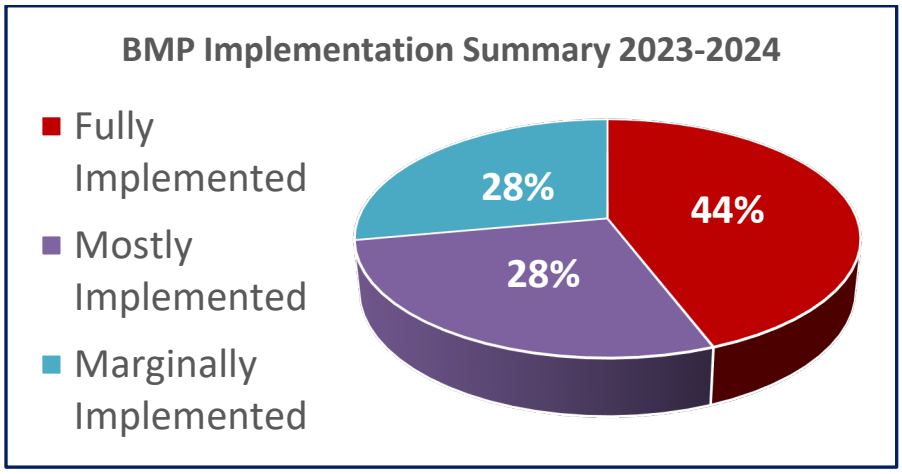


Figure 3. Results from BMP implementation monitoring sites for fiscal years 2023-2024.

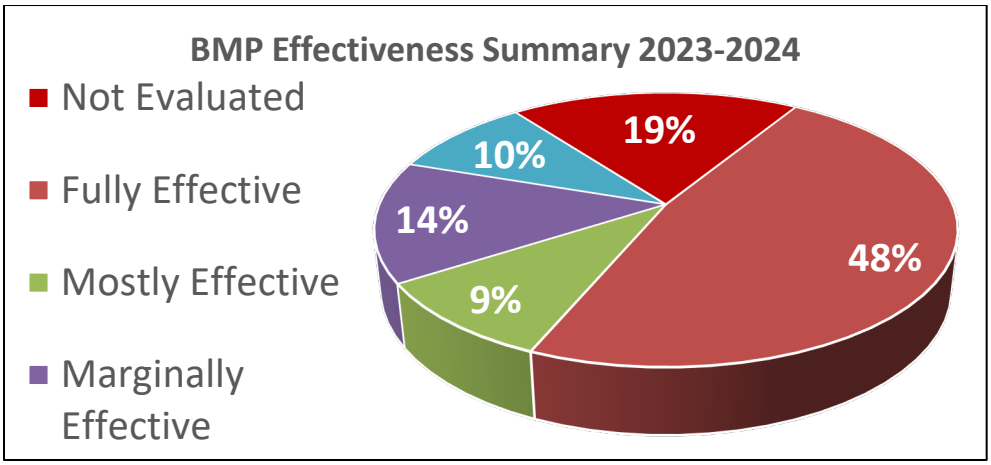


Figure 4. Results from BMP effectiveness monitoring sites for fiscal years 2023-2024.

Monitoring Discussion and Findings

The results shown in Figures 3 and 4 suggest that the implementation and effectiveness of accepted BMPs have protected aquatic resources to a degree but are falling short of complete compliance. Implementation monitoring displays room for improvement, especially in the mostly and marginally implemented categories with only 28%, respectively. Effectiveness of the prescribed BMPs show that 48% of those applied were fully or mostly effective. While this is encouraging, the intent is for the practices to be 100% effective at protecting aquatic resources. More analysis is required to determine if the shortcoming is due to the efficacy of the BMP itself, or if the BMP was not precisely implemented.

Adaptive Management Considerations

The monitoring shows that progress is being made to improve and protect watershed conditions consistent with Forest Plan goals and objectives, although there is room for improvement. The data collection methodology and monitoring question appear to be sufficiently scaled to reach meaningful conclusions about if, and how well, management actions are mitigated to protect aquatic resources. As

such, no adaptive changes to the Forest Plan, BMP program or this monitoring question are anticipated at this time.

II. The status of select ecological conditions

Monitoring Item 2.1: Air Quality

Monitoring Question and Background

- What are the conditions and trends for visibility in Class I and selected Class II areas on the unit?

Forest Plan Ref./ Driver	Indicators	Data Sources / Protocols / Partners	Frequency of data a) collection b) reporting	Targets, thresholds
Physical, Air Resources, Standard 1. "Meet state and federal air quality standards and comply with local, state, and federal air quality regulations and requirements either through original project design or through mitigation for such activities…."	Haze and visibility at Ajax IMPROVE monitoring site	IMPROVE / Federal Land Manager Environmental Database	a) Weekly b) 2 years	Maintain or improve visibility in Class I areas

Monitoring Results

Interagency Monitoring of Protected Visual Environments (IMPROVE)

Atmospheric visibility monitoring has been conducted on the WRNF at Ajax Ski Area in Aspen, CO since 2001 as part of the Interagency Monitoring of Protected Visual Environments program (IMPROVE). The IMPROVE program monitors pollutants and generates metrics to identify sources and causes of regional haze in Class 1 Areas in the U.S. The IMPROVE station on WRNF is called WHRI1 and located at the top of Aspen Mountain ski area. This station is intended to represent the air quality in the Wilderness areas of WRNF as well. Visibility is calculated using the "deciview" or "dv" index, which measures the degree to which light is absorbed or scattered by air pollution. A deciview value of 1 reflects a measure of change in visibility that is perceptible to the human eye. A low deciview reflects high visibility, while a high deciview number reflects low visibility. Long term haze trends at WHRI1 are visible below in Figure 5.

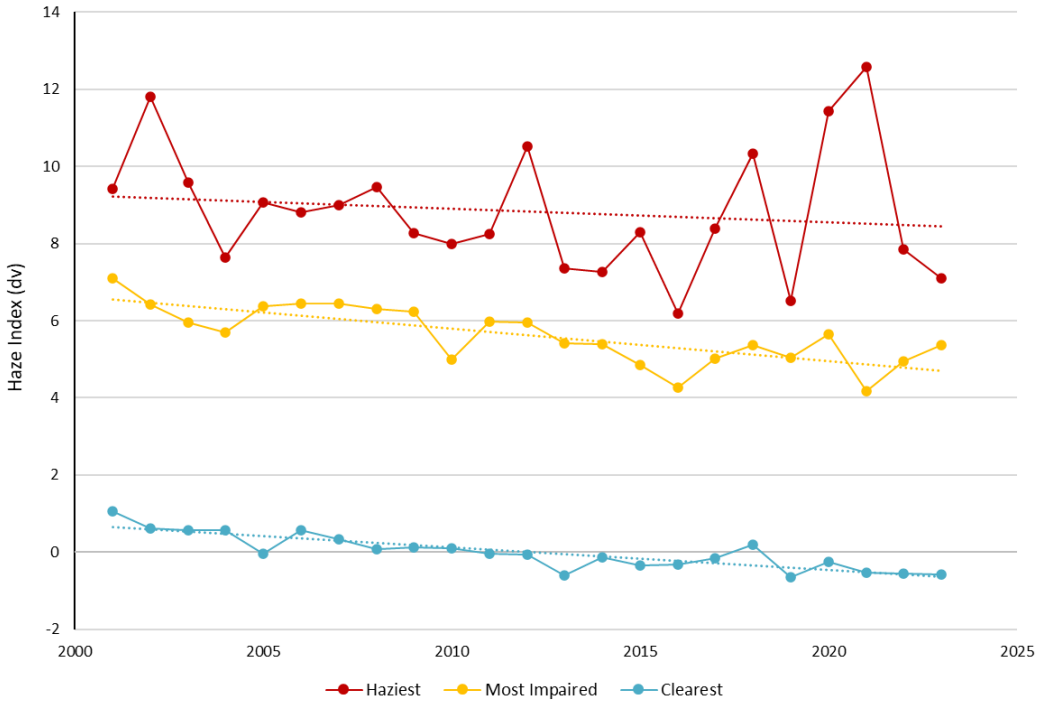


Figure 5. Deciview values and trends at WHRI1 since 2001 based on the clearest days, haziest days and days with the most impaired air quality.

(Annual data representing the clearest days are the average of the clearest 20 percent of samples collected in a year. Similarly, data for the haziest days are the average of the haziest 20 percent of samples over the year).

Since 2001, haze decreased and anthropogenic sources of haze like sulfate have improved based on the WHRI1 IMPROVE data (Figures 5 and 6). However, after the lowest haze and concentration year on record in 2021, atmospheric impairment increased annually from both anthropogenic and natural sources (Figure 6). (Data from 2024 is still preliminary and not finalized). The next several years of IMPROVE data will inform if this air quality degradation is a longer-term trend.

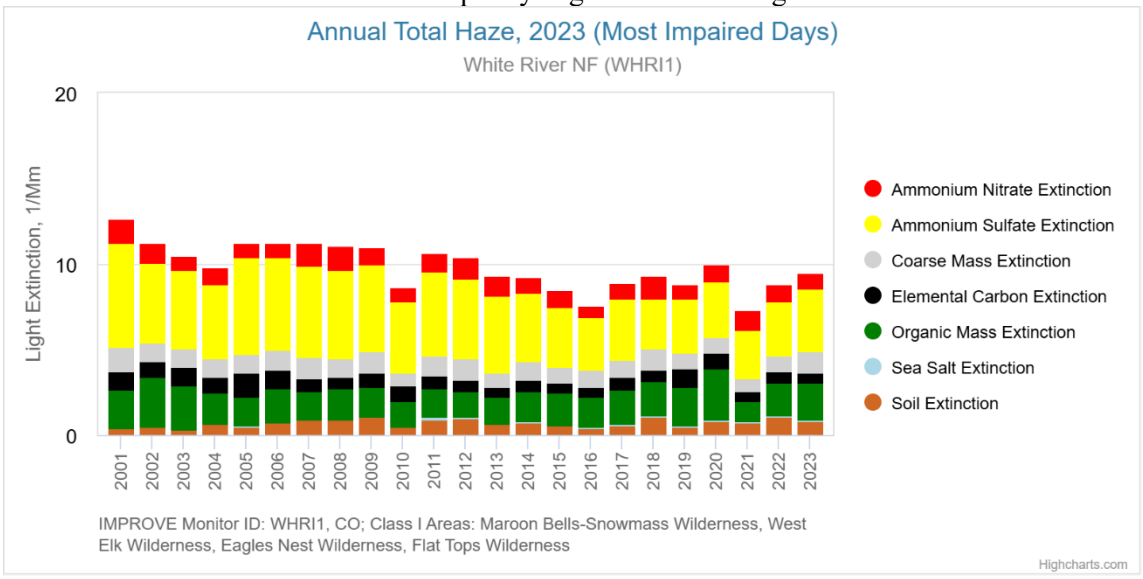


Figure 6. Haze composition during most impaired air quality days at WHRI1 from 2001 – 2023.

National Atmospheric Deposition Program (NADP) National Trends Network (NTN)
Wet deposition of atmospheric constituents is measured in WRNF through NADP. Weekly precipitation samples are collected, and precipitation quantity is measured at Four Mile Park CO08 near the base of Sunlight ski area outside Glenwood Springs.
The primary chemical compounds measured in the precipitation samples are Hydrogen, Potassium, Magnesium, Calcium, Sodium, Ammonium, Chlorine, Nitrate and Sulfate (Figure 7).

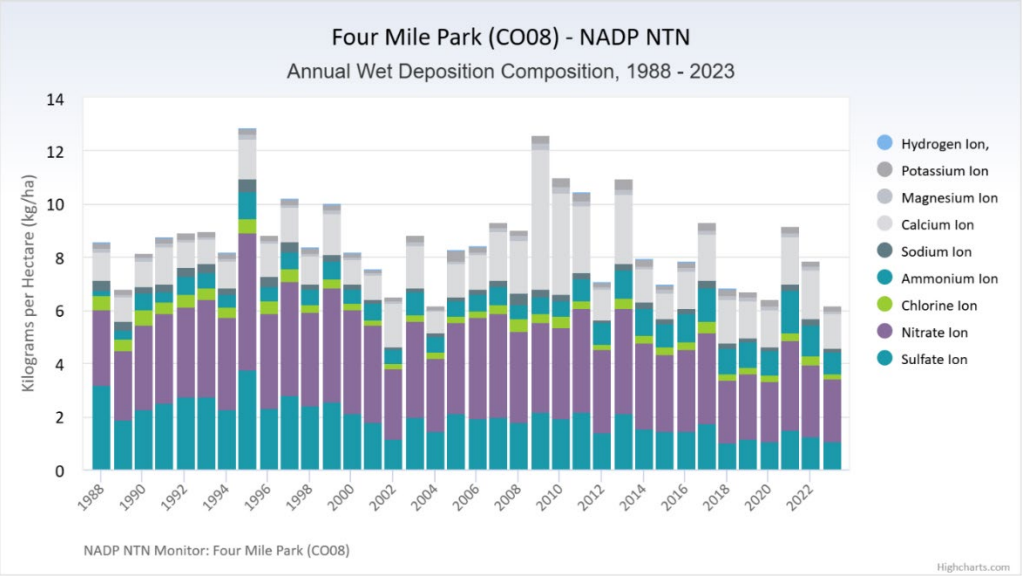


Figure 7. Long-term annual wet deposition chemical composition at CO08.

While most chemical compounds associated with anthropogenic inputs like Chlorine, Nitrate and sulfate show decreasing concentration trends at CO08 since the site began measuring in 1988 (Figures 8, 9 and 10) a few chemical constituents like Ammonium, show increasing deposition trends (Figure 11).

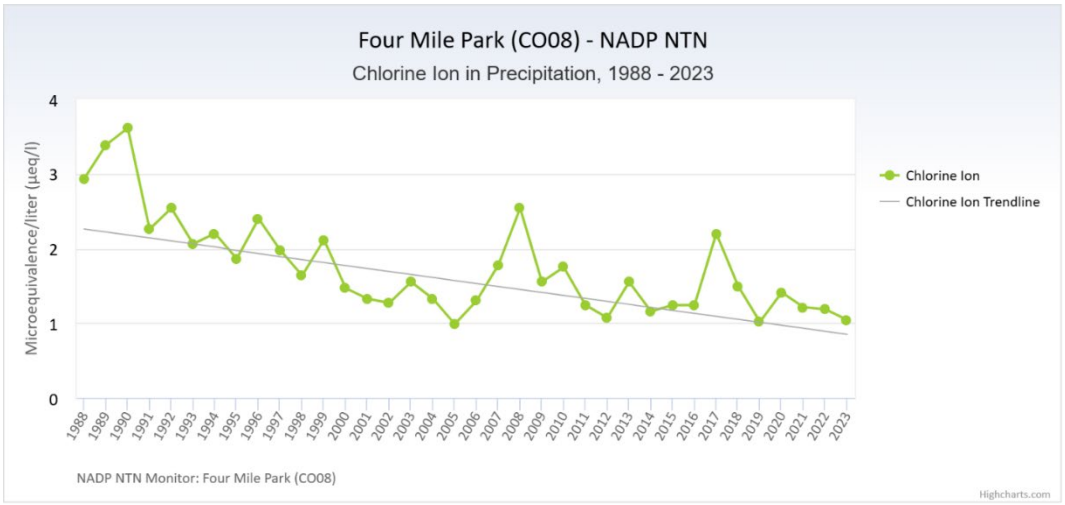


Figure 8. Long term decreasing Chlorine depositional trends at CO08 NADP site

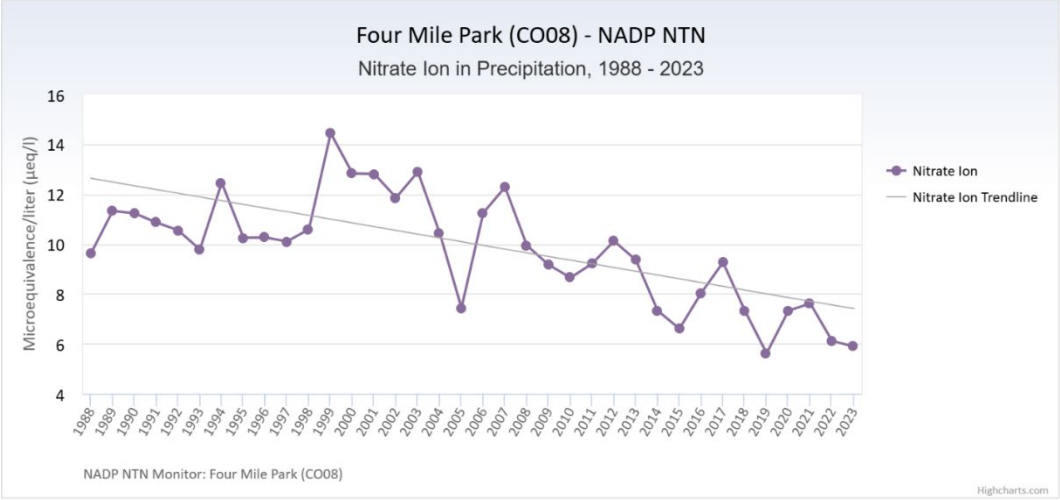


Figure 9. Long term decreasing Nitrate depositional trends at CO08 NADP site

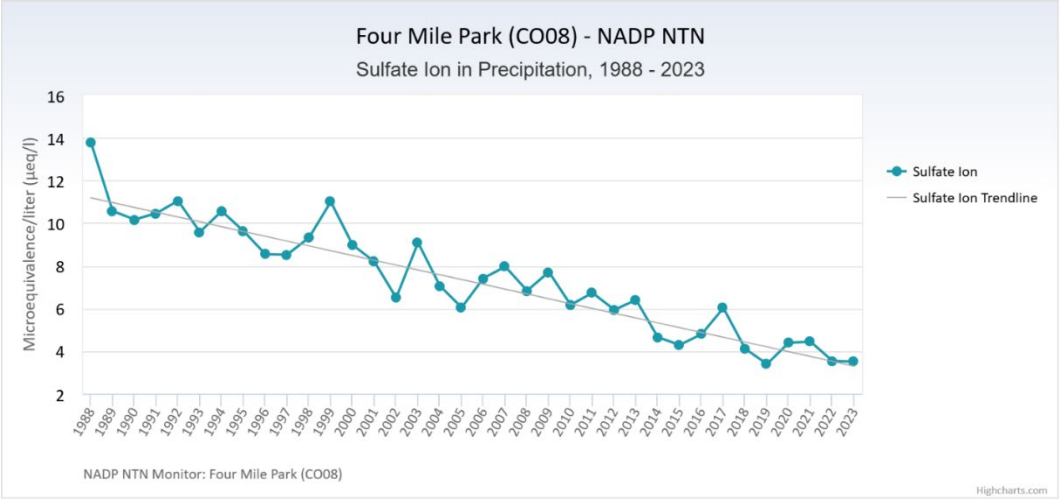


Figure 10. Long term decreasing Sulfate depositional trends at CO08 NADP site

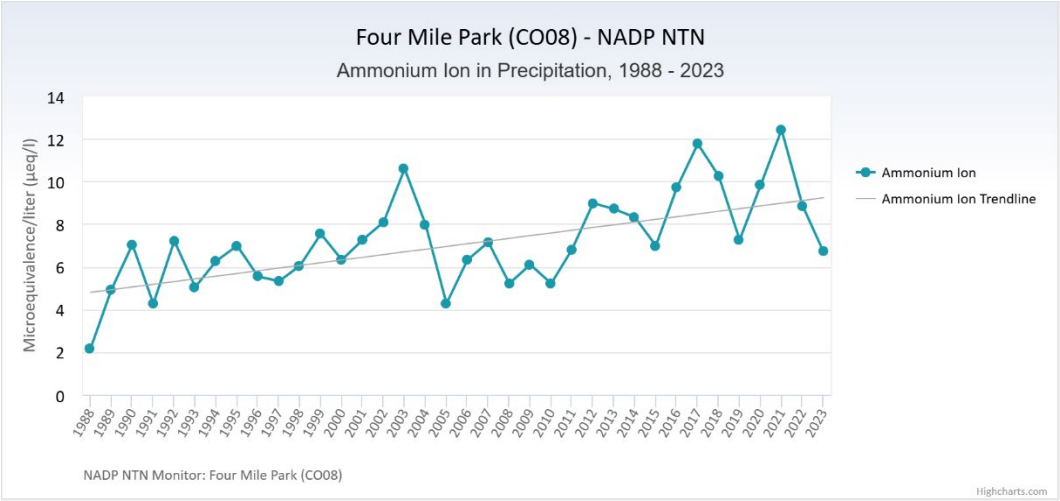


Figure 11. Long term increasing Ammonium depositional trends at CO08 NADP site

High Mountain Lakes Sampling

White River National Forest has 15 lakes in five Wilderness areas that get sampled three times every summer and analyzed for chemical components associated with atmospheric deposition, summer precipitation and other surrounding environmental inputs like geology (Figure 12 and Table 4). This long term wilderness lake sampling data is part of a larger compilation that informs long term trends in atmospheric conditions and precipitation inputs to high elevation headwaters throughout Wilderness areas in the Western United States. Some lakes in WRNF have samples dating to 1982 but most data for assessing trends on WRNF began around 1991. The primary analytes are pH, alkalinity, sodium, nitrate, sulfate, chloride, calcium, magnesium, potassium and ammonium.

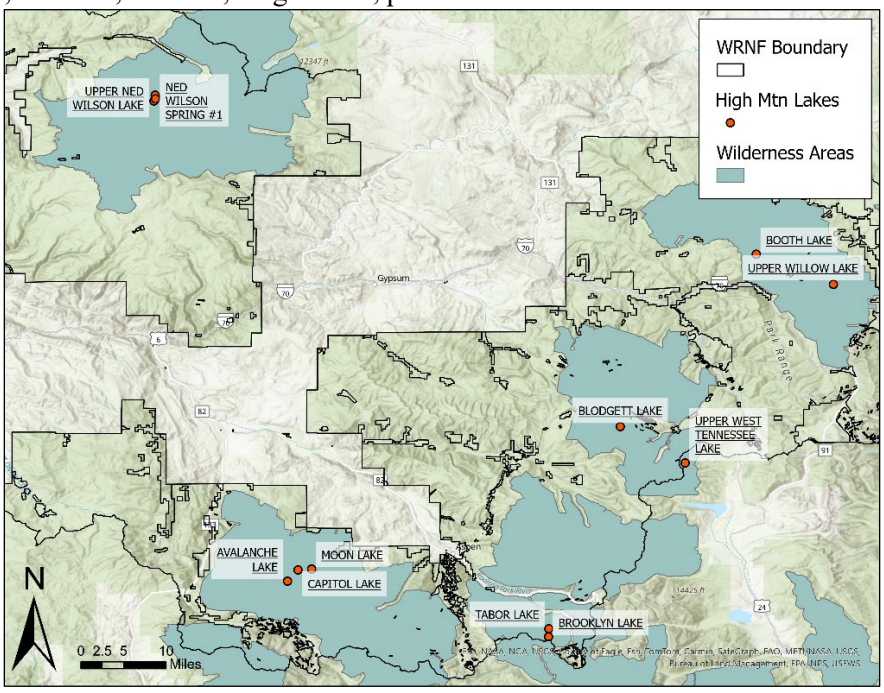


Figure 12. Starting in the early 1980s, high mountain lakes within Wilderness areas of WRNF are sampled 3X each summer and analyzed for chemical components (lakes in Flat Tops Wilderness in NW corner are close together so not all appear in the map)

Table 4. Grouped WRNF Wilderness regions and associated high mountain lakes sampled every summer

Maroon Bells-Snowmass and Collegiate Peaks Wilderness	Flat Tops Wilderness	Holy Cross and Eagles Nest Wilderness
Avalanche Lake	Ned Wilson Spring	Blodgett Lake
Capitol Lake	Ned Wilson Lake	Upper West Tennesee Pass Lake
Moon Lake	Upper Ned Wilson Lake	Upper Turquoise Lake
Brooklyn Lake	Lower Pack Trail Pothole	Upper Willow Lake
Tabor Lake	Upper Packtrail Pothole	Booth Lake

The lakes that are adjacent or in the same mountain range and exhibit similar precipitation trends have grouped Wilderness areas for higher sample size and more representative data. For WRNF, the three wilderness regions characterized are Maroon Bells-Snowmass and Collegiate Peaks Wilderness (southern WRNF), Holy Cross and Eagles Nest Wilderness (eastern WRNF) and the Flat Tops Wilderness (northwestern WRNF). To assess trends for these Wilderness groups, the analyte values are averaged on an annual basis for each lake and then averaged again with the nearby lakes or lakes

within the same wilderness regions. Data from 2012-2016 were compromised due to a new lab conducting analysis, however, the long term trends remain apparent.

For simplicity, this report highlights alkalinity and sulfate signatures from these lakes which represent larger environmental and climatic trends. The alkalinity of the water samples represents an overall chemical capacity to neutralize acidity. If water has a higher alkalinity, it is more resistant to acidification and able to retain a stable pH. The sulfate detected in these lakes is from geologic inputs and represents corelated long term climatic trends.

The Maroon Bells-Snowmass and Collegiate Peaks Wilderness shows similar trends as the Holy Cross and Eagles Nest Wilderness (Figures 13 and 14). The long term increases in alkalinity are correlated with increasing ion concentrations such as calcium, potassium, and sodium (along with the other analytes that are measured in the samples). In general, increases in these chemical components represent increasing chemical concentrations due to less dilution within the lakes that is believed to be caused by less summer precipitation and warmer temperatures which increase evaporation. The adjacent geologic environment is more readily available to weathering into the lakes due to lowering water tables, higher temperatures and exposure of previously frozen alpine permafrost. These trends are indicated in other research that focuses on acid rock drainage, climatic impacts to weathering changes and general high elevation climatic trends.

The Flat Tops Wilderness shows slight alkalinity increases over time but also shows a clear long term decrease of sulfate concentrations (Figure 15). The Flat Tops lake data needs additional analysis to better understand the implications of the chemistry and its interactions with the surrounding environment and climate.

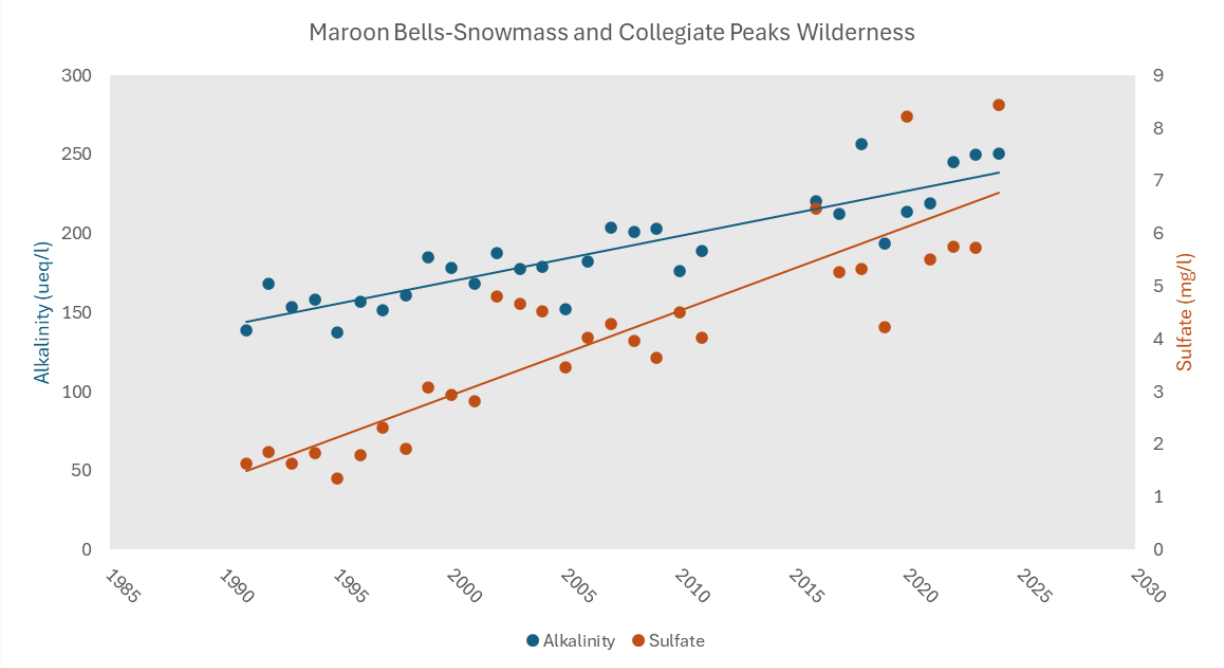


Figure 13. Annually averaged alkalinity and sulfate measurements and trends from the high mountain lakes in the Maroon Bells-Snowmass and Collegiate Peaks Wilderness, 1990 - 2024

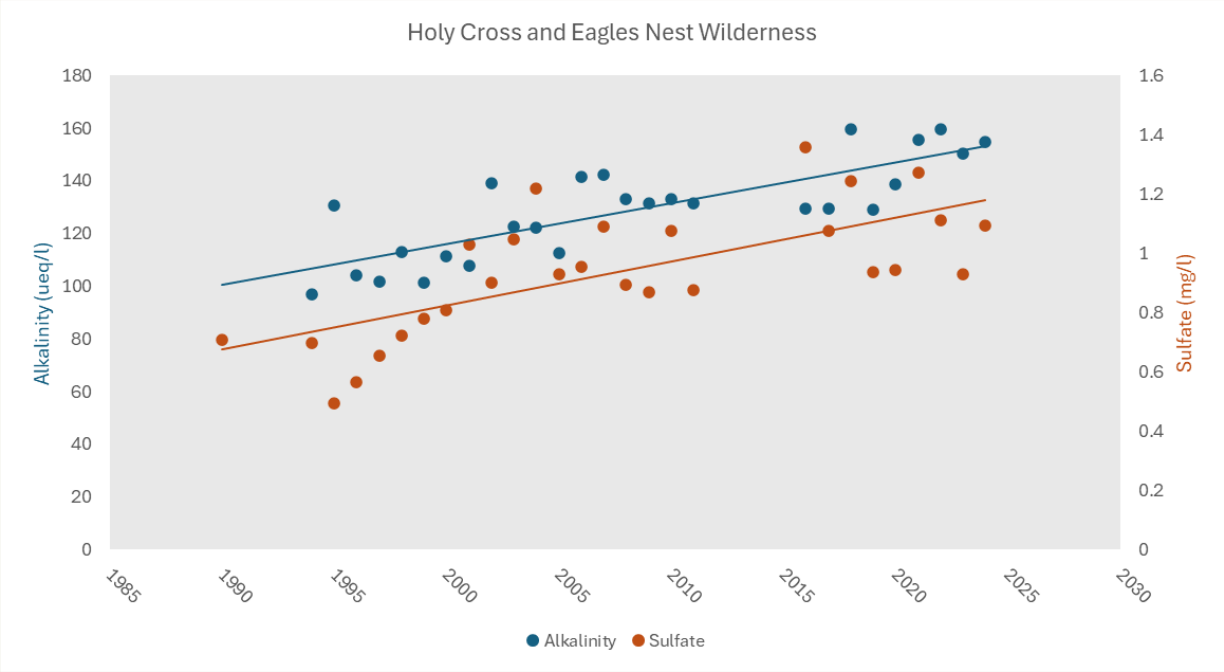


Figure 14. Annually averaged alkalinity and sulfate measurements and trends from the high mountain lakes in the Holy Cross and Eagles Nest Wilderness, 1990 – 2024

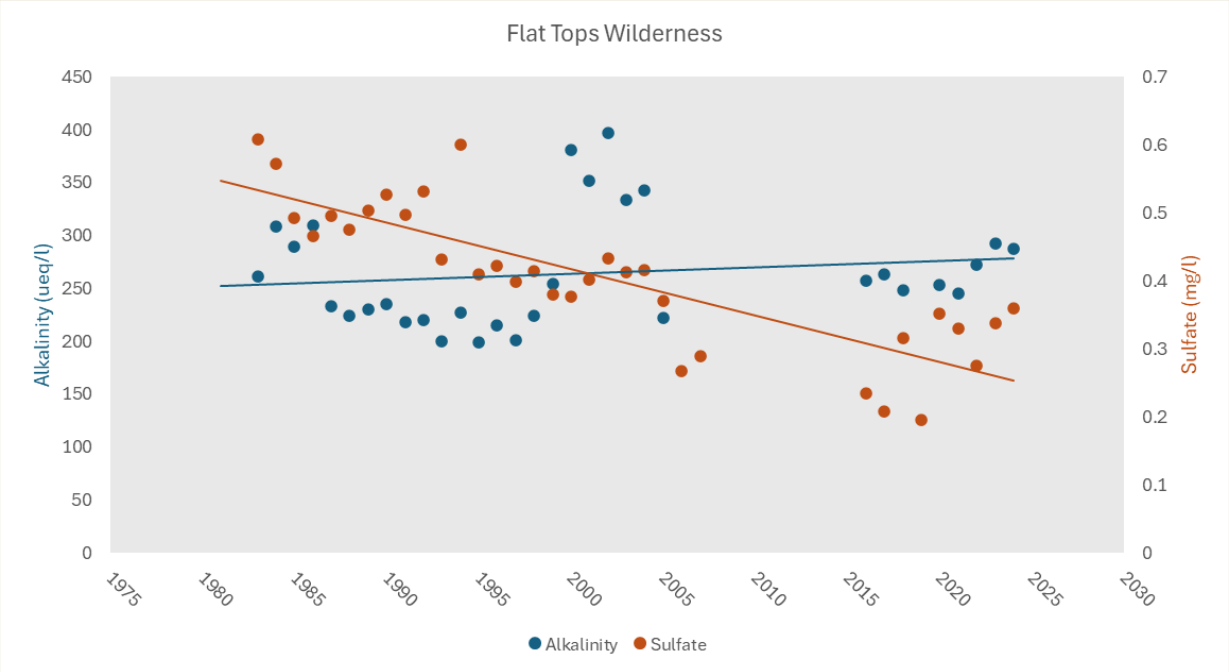


Figure 15. Annually averaged alkalinity and sulfate measurements and trends from the high mountain lakes in the Flat Tops Wilderness, 1980 – 2024

Monitoring Discussion and Findings

IMPROVE monitoring results show the haziest, most impaired and clearest days indicate a decreasing trend in haze and atmospheric contamination over time. Large drought and fire years show strong increases of haziest days of the year, but the long term trend shows decreasing haze and increasing air quality. This long-term data set serves as the monitoring baseline going forward. It should be noted

that while some forest management activities can affect visibility, these measured values are influenced by activities beyond and outside the control of the WRNF.
The NADP data show similarities with IMPROVE data where long term trends suggest decreasing depositional pollutants and chemical components. Ammonium shows long term increases, but most other chemical compounds, especially those associated with anthropogenic inputs have decreased since monitoring began in 1988. Like the IMPROVE data, the NADP measurements show relationships to activities and inputs that primarily occur outside WRNF control.
High mountain lake monitoring clearly shows increasing trends in chemical concentrations for most of our Wilderness area lake water. This is believed to be directly related to the long term trend of warmer temperatures and changes in precipitation quantities and regimes over the last 40-50 years. The lake monitoring data from the Flat Tops Wilderness area shows different trends which may be more influenced by local geology and the area also experiences different weather and precipitation patterns. This will be considered and assessed more thoroughly for the next WRNF biannual monitoring report.

Adaptive Management Considerations

These measurement collection methods and monitoring data provide the means to reach meaningful conclusions about trends in air quality and various climatic influence and environmental effects. While the influences of the trends may be outside WRNF jurisdiction, the data inform land managers and stakeholders of the current and past conditions of our environment and offer a baseline to understand if and how certain resources may become more susceptible as conditions change.
The monitoring shows that visibility in Class 1 areas is being maintained or improved, consistent with Forest Plan goals and objectives. Long term depositional trends appear to show improvement in air quality as well.
While the atmospheric and air quality data do not suggest changes in WRNF management, the lake sampling data coupled with weather station data, show high elevation systems in the Rocky Mountains are experiencing long term decreases in precipitation and increases in temperature. White River National Forest should continue to consider the implications for various land use, management and watershed health to ensure the continued function of these ecosystems. No adaptive changes to the Forest Plan, IMPROVE, NADP or high mountain lakes sampling program are anticipated.

Monitoring Item 2.2: Forest and Rangelands Health

Monitoring Question and Background

- What are the status and trends of insects and disease in and around the plan area?

Forest Plan Ref./ Driver	Indicators	Data Sources / Protocols / Partners	Freq. of a) data collection b) reporting	Targets, thresholds
Goal 1, Objective 1d "Increase the amount of forest and rangelands restored to or maintained in a healthy condition with reduced risk and damage from fires, insects, disease, and invasive species."	Type of Outbreak, acres and location in Canada lynx habitat (lynx analysis unit = LAU)	Maps and GIS shapefiles at http://www.fs.usda.gov/detail/r2/forest-grasslandhealth/ R2 Insect/Disease Aerial Detection Flight Data Colorado State Forest Service	a) annually b) every four years	The SRLA's Veg standard S1, LAU has no more than 30 percent of its lynx habitat in a currently unsuitable condition

Monitoring Results

Insect and disease outbreaks are monitored annually by the Region 2 Forest Health Monitoring program through aerial surveys. Insects, disease and wildfire are agents which contribute to forest and ecosystem health. These agents tend to ebb and flow over time, and are dependent upon structural and weather patterns. Table 5 shows the status and trends of disturbance agents from 2016-2024. Insect and disease are broadly tracked through annual aerial surveys.

Subalpine fir mortality has trended downward since 2016. Western balsam bark beetle and Armillaria root disease are the two primary agents responsible for this mortality and will continue to be present within cover types that include spruce and subalpine fir.

Western Spruce budworm activity has increased from 2022 to 2024 in spruce-fir vegetation cover types. This agent attacks the foliation of mainly younger trees. While generally affecting tree vigor, spruce budworm causes tree mortality where heavy infestation occurs. It can also affect cone production on infested trees.

Aspen defoliation is present and trending downward slightly between 2022 and 2024 according to aerial surveys. Defoliation agents such as tent caterpillar, lepidopterous caterpillar, aspen blotch miner, two tier moth, aspen leafminer, marssonina leaf blight, aspen leaf rust and large aspen tortrix are likely responsible for aspen defoliation observed across the Forest. See GSC-25-02 Technical report for aspen defoliation on Hardscrabble Mountain.

Douglas-Fir beetle trended downward between 2016 and 2020, then increased and stabilized to affect roughly the same amount of acreage on the forest. In 2024, Douglas-fir infestations are still active in clustered pockets in Pitkin, Eagle and Rio Blanco counties. Douglas-fir cover type is somewhat limited to elevations in the 7500-8500 foot range and on steeper valley slopes. Douglas-fir beetle has affected a larger percentage of this cover type across the Forest in relation to the availability of the cover type.

Spruce bark beetle mortality is low, considered normal and populations are endemic. 2022 and 2024 flight surveys showed an increase in new beetle activity in the Sawatch Range between Aspen and Leadville. There is an abundant spruce-fir cover type to carry an outbreak if biotic and abiotic conditions align.

Mountain pine beetle effects are barely noticeable from 2022-2024. Available habitat not affected by the 2004-2013 outbreak is present in Eagle, Pitkin and Garfield Counties.

Wildfire activity decreased from 2023-2024 as weather patterns normalized and an active monsoonal summer rain pattern was present.

Table 5. Major damage agents detected in aerial surveys on WRNF 2016-2024.

Agent	2016 Acres Affected	2017 Acres Affected	2020 Acres Affected	2021 Acres Affected	2022 Acres Affected	2024 Acres Affected
Subalpine fir mortality Western Balsam bark beetle	37,000	20,000	3,500	6,800	9,600	6,800
Western spruce budworm	22,000	13,000	220	30	4,500	9,000
Aspen discoloration and defoliation	7,400	10,200	370	200	1,400	1,200

Agent	2016 Acres Affected	2017 Acres Affected	2020 Acres Affected	2021 Acres Affected	2022 Acres Affected	2024 Acres Affected
Douglas-fir beetle	3,800	2,300	820	1,600	1,600	770
Spruce beetle	230	160	160	110	210	340
Mountain pine beetle	-	10	-	10	20	30
Western pine beetle	100	-	-	-	-	-
Total	70,530	45,670	5,070	8,750	17,320	18,140
Wildfire	-	20,709	34,499	-	3,887	25

2020 only 63% of the Forest was flown with detection surveys, data limited
Wildfires: 2020 sum of wildfires from 2018-2020
Wildfires: 2022 sum of wildfires from 2021-2022
Wildfires: 2024 sum of wildfires from 2023-2024

Monitoring Discussion and Findings

Insect and disease trends across the Forest for the most part is stable and endemic. Douglas-fir beetle impacts are visible throughout the lower valley watersheds on the WRNF. Subalpine fir continues to be affected by western balsam bark beetle but is decreasing. Western spruce budworm has affected the most acres in spruce-fir cover type across the forest. Aspen defoliation has slightly declined, but still present and considered at normal levels. Insects and disease are a normal function of Forest ecology and shape the structural composition of the Forest. Wildfire occurrences and spread were low due to average weather and precipitation across the forest.

There are not currently any damaging agents increasing to outbreak levels in any one forest vegetation component. Current rates of insect and disease impact are less than 30 percent on lynx analysis units (LAU) across the Forest. It has been determined that no changes to the Forest Plan or monitoring program are warranted at this time based on the current monitoring data.

Adaptive Management Considerations

Damaging agents fluctuate in their scope and intensity over time and will always be present on the forested landscape. Some agents have concentrated effects on tree mortality while other agents have a broader effect across the landscape. Forest managers consult with Gunnison Service Center Forest health biologists when considering forest management actions and their probability of success to suppress damaging agents. The overall goal is to have a diverse forest structure with a variety of tree species and age classes distributed across the Forest to minimize the effects of any one damaging agent reaching outbreak levels. Silvicultural treatments using prescribed fire, timber harvest, mastication and other treatment methods can be implemented to meet desired future conditions for an identified landscape and within standards/guidelines of the 2002 Forest Plan. If any LAU has no more than 30 percent of its lynx habitat in a currently unsuitable condition, then vegetation management projects should not move additional acres into a stand initiation stage.

Monitoring Item 2.3: Ecosystem Health

Monitoring Question and Background

- How are major vegetation types on the planning unit changing over time?

Forest Plan Ref./ Driver	Indicators	Data Sources / Protocols / Partners	Freq. of a) data collection b) reporting	Targets, thresholds
Goal 1, Objective 1d "Increase the amount of forest and rangelands restored to or maintained in a healthy condition with reduced risk and damage from fires, insects, disease, and invasive species."	Cover type, ecological site conditions, age class, size class, and structural stages of forest, shrubland, and grassland vegetation.	USFS FSVeg Corporate Database USFS FACTS activities database Forest Health monitoring	a) annually b) every four years	The SRLA's Veg standard S1, LAU has no more than 30 percent of its lynx habitat in a currently unsuitable condition.

Monitoring Results

Forest structure, function, and composition

Monitoring data on vegetation structure, function, and composition is provided by the USFS FSVeg database program. FSVeg compiles the current state of vegetation structure base on stand exam inputs and detection change monitoring. Stand exams occur infrequently across the Forest. Detection changes in vegetation cover occur when noticeable vegetation changes occur on the landscape, most notable wildfires and insect/disease outbreaks. FSVeg will also track land management actions which may convert forest structure, such as prescribed fire and timber harvest treatments.

Figure 16 shows the FSVeg estimates for acres by forested cover type on the WRNF. Other forest cover types do exist and cumulatively have less than 10,000 acres of forested area combined. These small forest cover types include blue spruce, bristlecone pine, limber pine, ponderosa pine and cottonwood. The major forested cover types on the WRNF are Engelmann spruce – subalpine fir (Spruce-Fir), Aspen, Lodgepole pine, Douglas-fir and pinyon-juniper, grass/forbs and mountain shrubs.

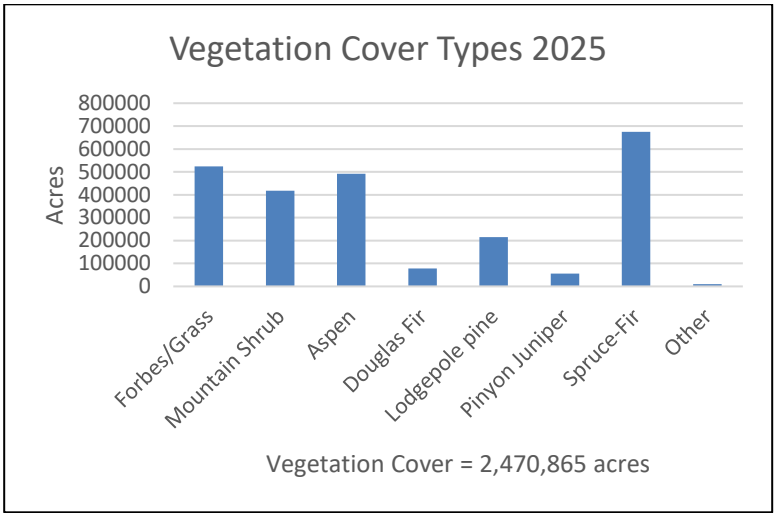


Figure 16. Vegetation Cover Types (2025)

FSVeg data are estimates and a snapshot of forest conditions across at the point in time when the data was extracted from the database. Forested acres are mostly stable from 2018-2025 as shown in Figure 17. There is a slight decline in lodgepole pine acres, likely because these are now classified as another

forest type (such as spruce/fir) due to loss of lodgepole basal area. Spruce-fir did see a slight increase in forested acres over this same time period. Forbs/Grasses declined and mountain shrub increased from 2018-2025, most likely due to vegetative recovery within areas burned by wildfire between 2018 and 2020.

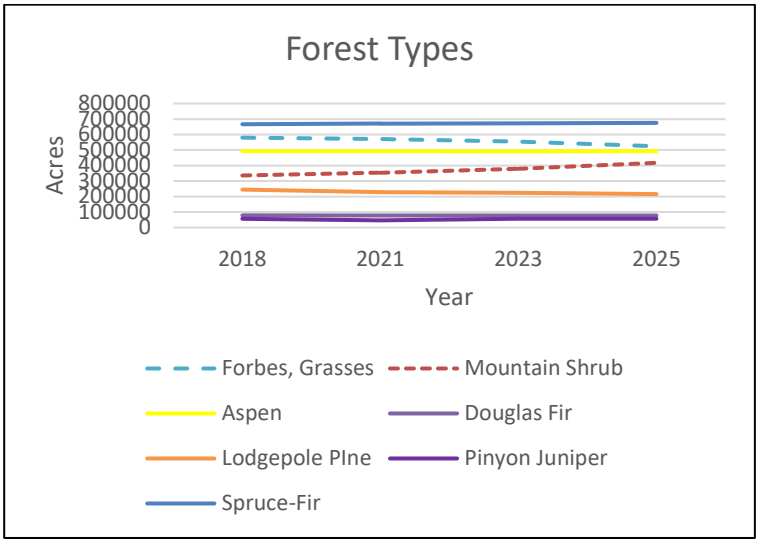


Figure 17. Forest Type changes 2018-2025

Forested ecosystems can be broken out into structural stage vegetative components which provides a snapshot of forest development across a landscape. Structural stages are used to assess current and desired future conditions of forested habitat at both the Forest planning level and project planning level. Table 6 shows the structural stage definitions.

Table 6. Forested Structural Stage Definitions

Structural Stage	General	Description
2T	Seedling/Sapling	Small trees, generally less than 6.0 feet in height
3A	Young forest, open canopy	Small/medium size trees, Crown cover percent <40
3B	Young forest, moderately closed canopy	Small/medium sized trees, Crown cover percent between 40 and <70
3C	Young forest, closed canopy	Small/medium sized trees, Crown cover percent >= 70
4A	Mature forest, open canopy	Large size trees, Crown cover percent <40
4B	Mature forest, moderately closed canopy	Large sized trees, Crown cover percent between 40 and <70
4C	Mature forest, closed canopy	Large sized trees, Crown cover percent >= 70

Engelmann Spruce-Subalpine fir (Spruce-fir)

Spruce-fir has the largest presence of forested cover type on the WRNF at approximately 675,324 acres (2025) and is relatively evenly split between young forest (3A-3C) 50% and mature forest (4A-4C) 49.6% composition. Seedling (2T) structural stage is generally only tracked through forest management treatments due to the uneven aged, tree size and species composition development of this forest type.

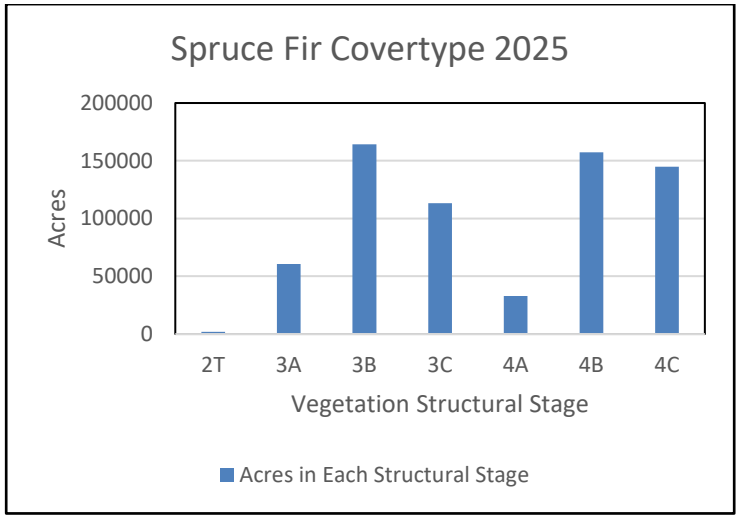


Figure 18. Existing Spruce-fir Vegetation Structural Stages (2025)

Spruce-fir forests are dynamic and long lived. Changes to this cover type are often small-scale with creation of gaps and highly variable stand structures. Large scale insect and disease outbreaks will often times modify the structural stages of spruce-fir within stages 3A-4C. Wildfire will generally move spruce-fir into another cover type, especially if lodgepole pine and aspen are present. Figure xx shows the structural stage changes from 2018-2025 in the Spruce-fir cover type for each structural stage. There are acreage gains in the 3A, 3B, 4A and 4B structural stages and losses in the 3C and 4C structural stages. Movements in these structural stage changes are most likely due to insects/disease and wildfire disturbance.

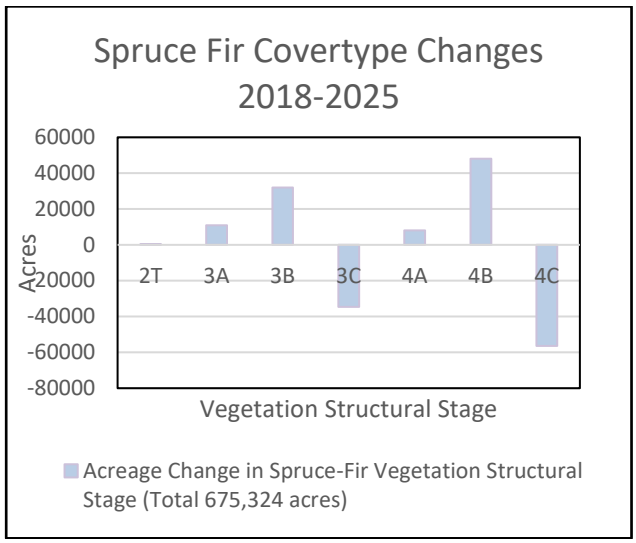


Figure 19. Spruce-fir Vegetation Structural Stage Changes.

Aspen

Aspen is the second largest forested cover type on the WRNF at approximately 492,297 acres. Figure 20 shows that the majority of aspen is in young (75%) and mature (22%) structural stages.

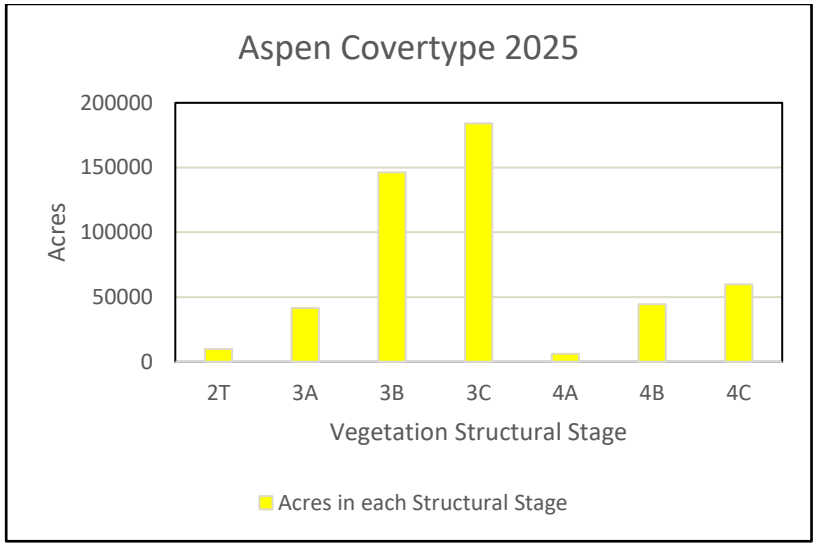


Figure 20. Existing Aspen Vegetation Structural Stages

Aspen is generally a short-lived species and generally establishes itself after a disturbance event. There are stable stands of aspen present on the Forest in the young and mature structural stages. Figure 21 shows the change in structural stages from 2018-2025. This data shows a loss of aspen in the 3B, 3C and 4C structural stages with gains in the 2T, 3A, 4A and 4B structural stages.

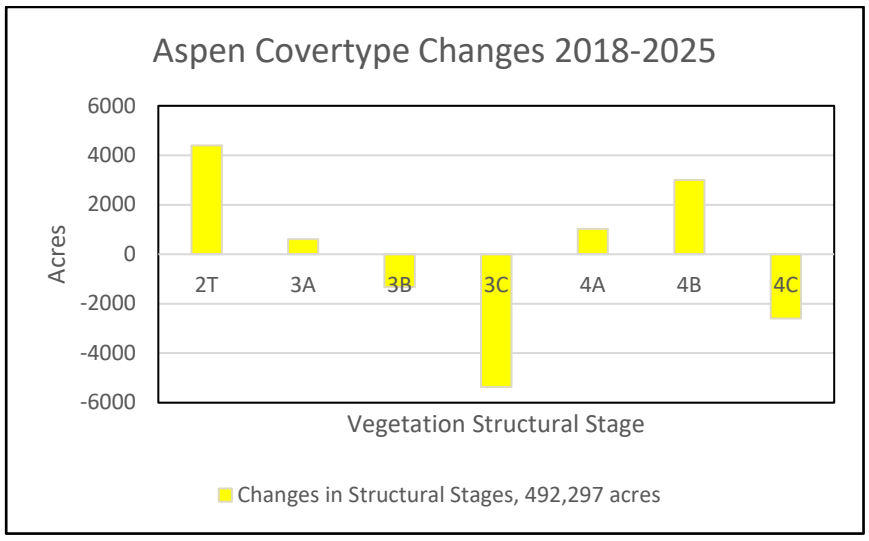


Figure 21. Aspen Vegetation Structural Stage Changes.

Changes in structural changes can be due to conversion of forest cover types, wildfire, timber harvesting, insects/disease and development of forest structure over the 2018-2025 time period. All of these changes are normal and represent a minor portion of the total aspen on the Forest.

Lodgepole Pine

Lodgepole pine is the third largest forested cover type on the WRNF at approximately 215,923 acres. Figure 22 shows that the majority of lodgepole pine is in young (65%) and mature (31%) structural stages.

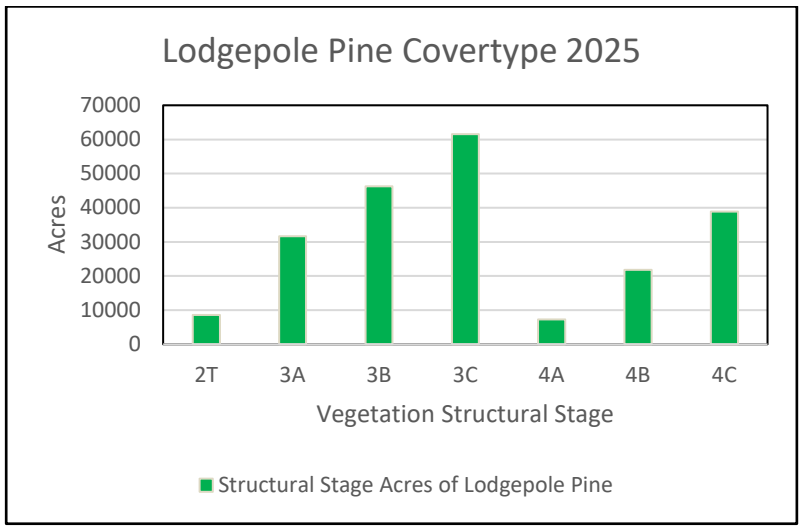


Figure 22. Lodgepole pine Structural Stages.

Lodgepole pine is a short to moderate lived species and relies on wildfire to naturally regenerate itself. Figure 23 shows the change in structural stages from 2018-2025. This data show a loss of lodgepole pine in the 3C and 4C structural stages with gains in the 2T, 3A, 3B, 4A and 4B structural stages.

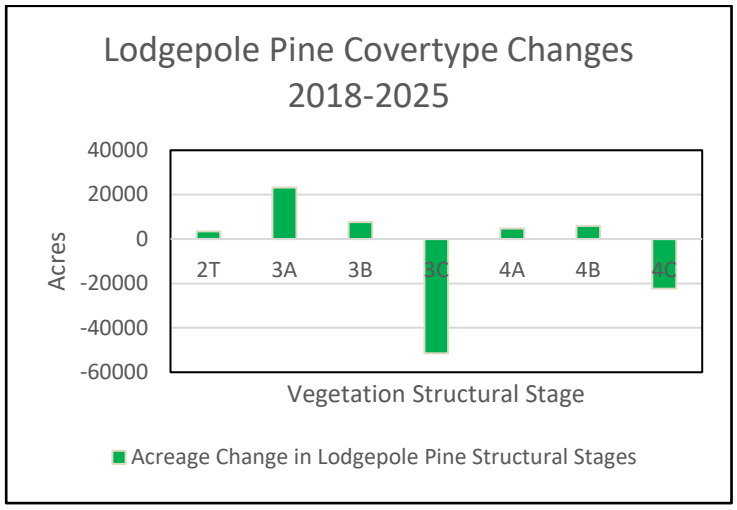


Figure 23. Lodgepole pine Vegetation Structural Stage Changes.

Changes in structural changes can be due to timber harvesting, insects/disease, wildfire and development of forest structure over the 2018-2025 time period. Structural stages 3C and 4C combined lost approximately 27,000 acres or 13% of the total lodgepole pine on the Forest. The majority of the loss was most likely due to wildfire with a minor amount of timber harvest during this time period. Mountain pine beetle had no effect on the loss of young and mature structural stage lodgepole pine. Increase in structural stage 3A, 3B acreage is most likely the result of areas hit hard

with the mountain pine beetle outbreak (2004-2013) recovering with recruitment of seedling/sapling into a younger forest cohort.

Douglas-fir

Douglas-fir is the fourth largest forested cover type on the WRNF at approximately 78,694 acres. Figure 24 shows Douglas-fir forest is in young (40%) and mature (60%) structural stages. Very little recruitment is occurring in the seedling structural stage.

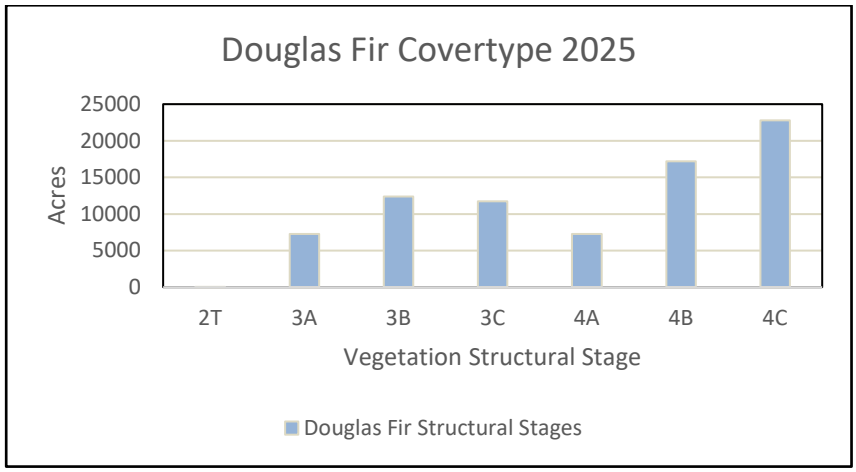


Figure 24. Douglas-fir Structural Stages.

Changes in structural changes in Douglas-fir is mainly due to Douglas-fir beetle related mortality (insects/disease). Wildfire and development of forest structure has had little effect over the 2018-2025 time period. Structural stages 2T, 3A, 3B and 4A showed an increase in their respective structural stages. Loss of acreage occurred in structural sages 3C, 4B and 4C. The combined loss was approximately 926 acres or approximately 1% of the cover type. This loss is most likely due to Douglas-fir beetle which has been consistently affecting Douglas-fir stands on the Forest.

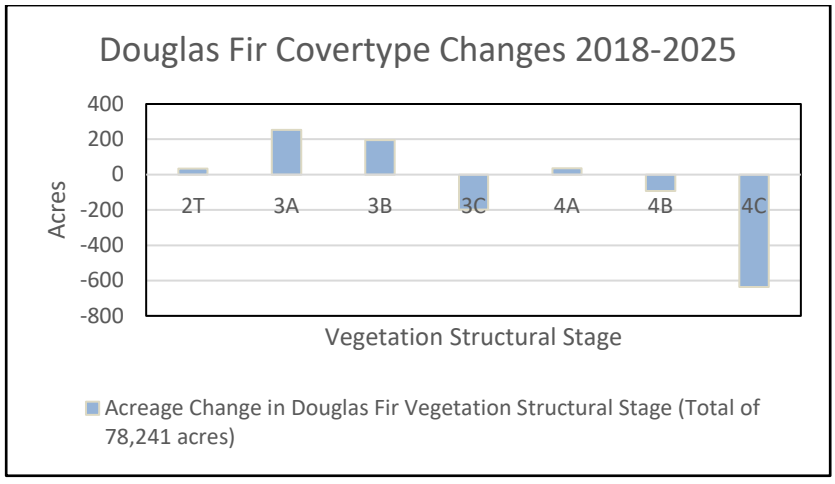


Figure 25. Douglas-fir Vegetation Structural Stage Changes.

Pinyon-Juniper

Pinyon-Juniper is the fifth largest forested cover type on the WRNF at approximately 56,000 acres. Figure 26 shows that all Pinyon-Juniper forest is predominantly in young (90%) forest structural stages, with a minor amount in mature forest (10%).

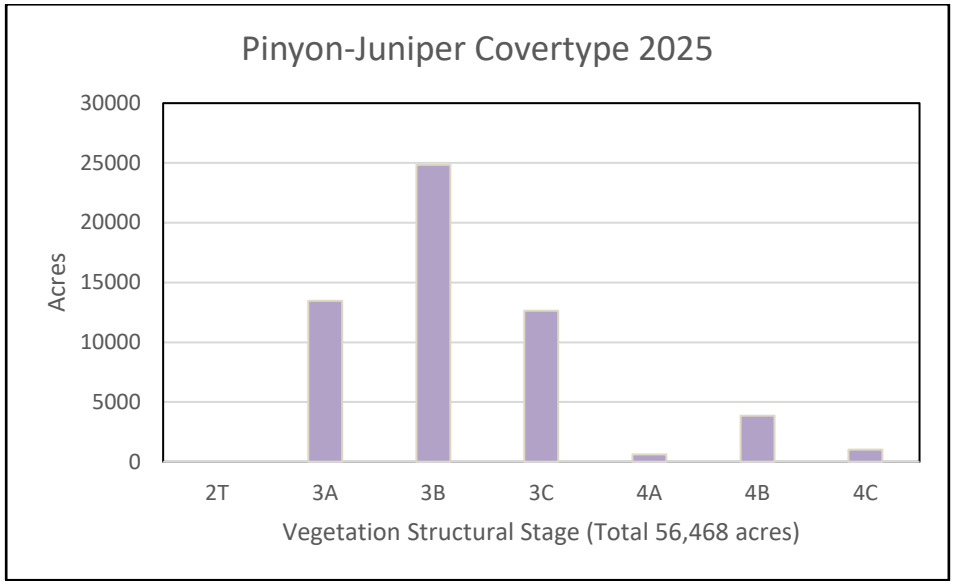


Figure 26. Pinyon-Juniper Structural Stages.

Pinyon-Juniper forests are stable. Very little change is occurring across the structural stage components of this forest cover type. From 2018-2025, data indicates less than 85 acres of pinyon-juniper habitat has declined. Insects, disease and natural disturbance has not impacted pinyon juniper habitats since 2018.

Monitoring Discussion and Findings

Spruce-fir, aspen and lodgepole pine forests are generally stable across the Forest with the majority of forest types in the younger to mature forest structure. Lodgepole pine experienced about a 13% decline in younger to mature forest structure, most likely due to wildfire events and to a minor degree timber harvest which occurred during the 2018-2024 timeframe. Lodgepole pine is slowly starting to recover from the 2004-2013 mountain pine beetle outbreak as stands of seedling/saplings begin to move into younger structural stage forest. Similarly, spruce-fir shows some decline in mid-late structural stages and recruitment in the younger structural stages, most likely due to wildfire as insects/disease in spruce fir is at endemic levels. Douglas-fir forests continue to be affected by Douglas-fir beetle. Almost all of the Douglas-fir cover type occurs on steep slopes and is not managed through timber harvest or fuels treatments. Pinyon-juniper forests are stable. Natural processes will continue to occur affecting the mature structural stage components of this forest type. Overall, all vegetation across the Forest is regenerating at acceptable levels. This is a normal progression of forest successional ecology. It has been determined that no changes to the Forest Plan or monitoring program is warranted at this time based on the current monitoring data.

Adaptive Management Considerations

Forest ecosystems on the WRNF are dynamic. Changes to forest structure generally occur slowly over time (10-50 years), except when disturbance events affect large portions of the landscape in short timeframes (1-10 years). The overall goal is to have a diverse forest structure with a variety of tree

species and age classes distributed across the Forest. Having a diverse forest structure across the landscape benefits all resources across the Forest. Silvicultural treatments using prescribed fire, timber harvest, mastication and other treatment methods can be implemented to achieve forest structure desired future conditions for an identified landscape and within standards/guidelines of the 2002 Forest Plan. If any LAU has no more than 30 percent of its lynx habitat in a currently unsuitable condition, then vegetation management projects should not move additional acres into a stand initiation stage.

III. The status of focal species

Monitoring Item 3.1: Macro-invertebrates

Monitoring Question and Background

- Is forest management contributing to conditions that maintain or improve biological stream health trends for freshwater riparian macroinvertebrate communities?

Based on several long-term data sets that have indicated static or changing levels of stream health over time, this quantitative monitoring approach gives the Forest a rigorous multi-variate dataset and successfully evaluates biological stream health over time.

Forest Plan Ref./ Driver	Indicators	Data Sources / Protocols / Partners	Freq. of a) data collection b) reporting	Targets, thresholds
Goal 1, Objective 1b "Provide ecological conditions to sustain viable populations of native and desired nonnative species and to achieve objectives for Management Indicator Species (MIS) and focal species.	Aquatic macroinvertebrate richness	USFS Macro-invertebrate surveys	a) Annually b) Biannually	Presence/Absence of indicator species; CDPHE aquatic life standards

Monitoring Results

The WRNF has been sampling benthic macroinvertebrates (aquatic insects) to assess and monitor aquatic ecosystem integrity since 2003. A view of a trend at the scale of the Forest was obtained by aggregating site-level trends from sites scattered across the Forest. Metrics speak to taxa diversity, and a community's degree of tolerance for stressors including dissolved oxygen levels and heavy metals, nutrients, and fine sediment. The measure of aquatic macroinvertebrate richness equates to sustainable ecological health and can be measured by the presence or absence of indicator species.

Because of the number of metrics, the number of factors that can affect aquatic communities, and the natural variability in data collected from the field over the years, determinations were based on a plurality of evidence. If a site had one or two metrics that declined, for example, while the other metrics showed little or no change or improved, that site was considered stable, i.e. no trend one way or the other in habitat quality. If a site had three or more metrics that increased or decreased (about one-third of the metrics examined), that would be evidence to suggest that that site had either

improved or deteriorated in terms of habitat quality. The fundamental assumption of this monitoring approach is that sites that "improved" or "deteriorated" are reflecting degrees of disturbance in the watershed upstream of the sampled location. A site that appears to have deteriorated in instream habitat quality thus gets a closer examination to try to determine the validity of the statistical assessment or the nature of the disturbance.

The Forest collects an average of 50 aquatic macroinvertebrate samples per year from across the Forest. Since 2003, 1,497 samples have been collected. Some samples are collected for inventory/survey purposes, others target specific streams or sites of particular interest. At the beginning of the Multiple Indicator Species (MIS) monitoring program, 60 sites across the Forest were randomly selected for Forest Plan-scale monitoring. The random selection of these sites was vitally important to allow the generalization of information collected from these sites to the Forest as a whole. These sites are now monitored under the Focal Species monitoring program. The Forest samples about 14 of these 60 sites each year, with the aim of repeating sampling at each site roughly every 5 years at least. By 2024, 312 samples had been obtained from these 60 sites since 2003. The following discussion of site/stream status and trend relied only upon data collected from these (originally) randomly selected sites.

Forest Fisheries personnel collect the samples and a contractor processes them, returning spreadsheets of counts and summary metrics.
Streams on the Forest are considered by the Colorado Department of Public Health and the Environment (CDPHE) as Class I – suitable for Cold Water Aquatic Life that are:

(1) Capable of sustaining a wide variety of cold water biota, including sensitive species, or
(2) Could sustain such biota but for correctable water quality conditions. Waters shall be considered capable of sustaining such biota where physical habitat, water flows or levels, and water quality conditions result in no substantial impairment of the abundance and diversity of species.

(Colorado Water Quality Control Act, 25-8-102(2), 31.13 State Use Classifications (1); CDPHE, 2020).

Streams on the Forest are within the Mountains Biotype.

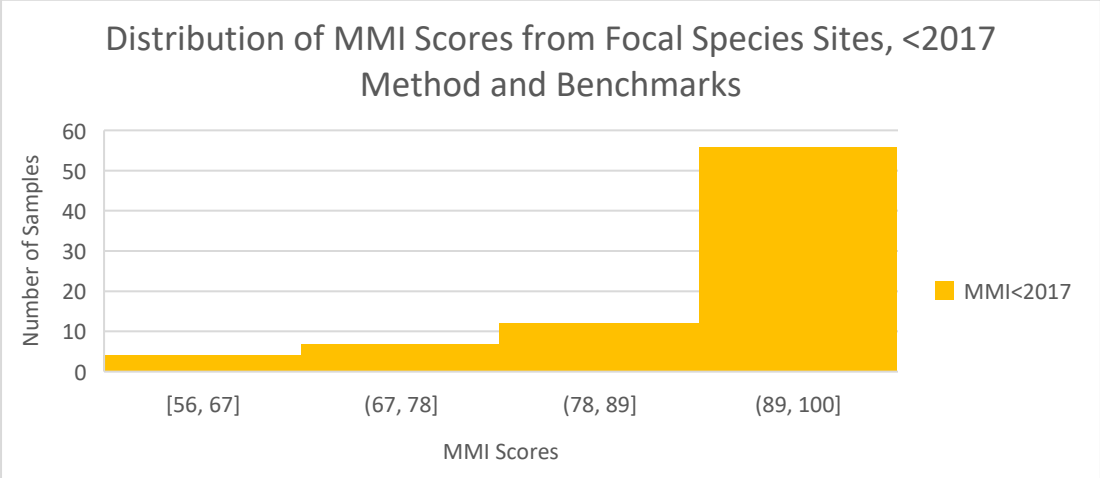
Analysis Methods
Trends over time were assessed with linear or multiple regression using log-transformed values (lm in R, alpha = 0.1; R Core Team, 2024). Models were re-leveled ("relevel" in R) to the smallest slope terms. Slope terms with p-values less than 0.1 were considered statistically significant.

Monitoring Discussion and Findings

Colorado's quantitative assessment of biological conditions relies upon the Colorado Multi-Metric Index (MMI). MMI scores range from 0 to 100; the higher the number the better.
Prior to 2017, MMIs were calculated differently and evaluated against a different set of benchmarks (CDPHE, 2010). Figure 27 illustrates the distribution of MMI scores from Focal Species sites prior to 2017 (n = 79). MMI scores above 50 were considered "attaining" aquatic life standards. No MMI scores from Focal Species sites were below 50 and the majority were between 89 and 100, the highest possible score.

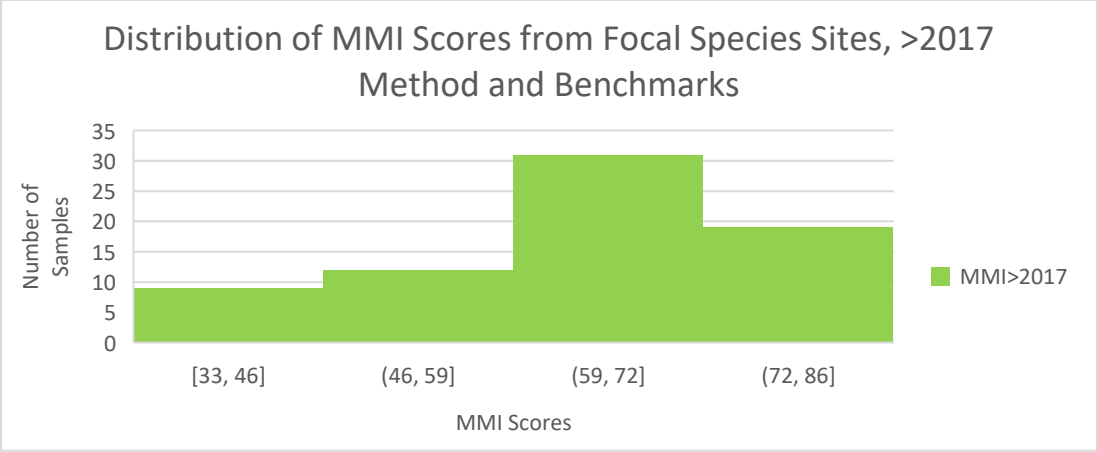
At the scale of the Forest, there was no statistically significant trend in MMI scores over time between 2003 and 2017.

Figure 27. Distribution of MMI scores from Focal Species sites prior to 2017.



The calculation of MMI scores and the relevant benchmarks were re-calibrated in 2017 (CDPHE, 2017; version 4), and have remained the same through the end of 2025 (CDPHE, 2020). Because of this recalibration, MMI scores from prior to 2017 are not comparable to those after. No Focal Species sites had MMIs calculated between 2017 and 2019. In the relevant Mountains Biotype, sites with MMI scores exceeding 48 "Attain" the aquatic life threshold. Figure 28 illustrates the distribution of MMI scores from Focal Species sites across the Forest from 2020 to 2024 (n = 71). Note that the distribution of MMI scores is much more centered following recalibration of the metric and benchmarks, and that most of the samples on the Forest are better than average. At the scale of the Forest, there was no statistically significant trend in MMI scores over time between 2020 and 2024.

Figure 28. Distribution of MMI scores from Focal Species sites following the 2017 recalibration.



Sites with MMI scores less than 40 indicate "Impairment". Sites with MMI scores between 40 and 48 are in the "gray" and auxiliary metrics such as Shannon's Diversity Index ("diversity") and the Hilsenhoff Biotic Index (HBI) can be used to determine "Impairment". Sites in the gray with diversity or HBI scores below thresholds (Shannon Diversity Index < 3.2, or HBI > 4.9; CDPHE, 2020) are considered "Impaired".

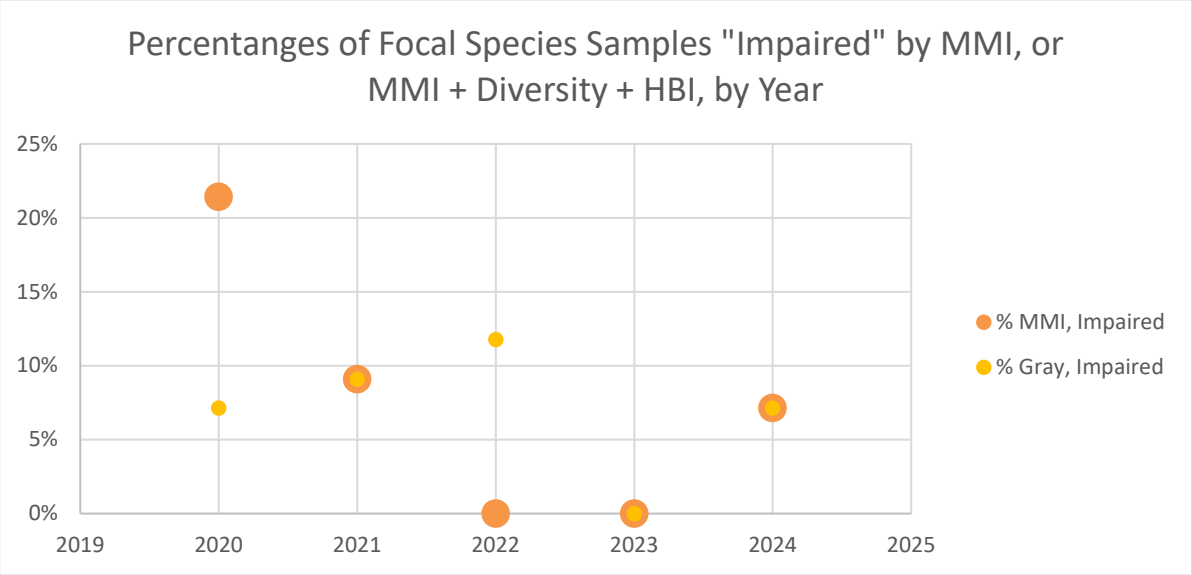
Since 2020, 71 Focal Species sites were sampled and MMIs calculated. Five (7%) of those MMI scores were below 40 or impaired on the basis of their MMI score. An additional 5 (7%) sites had MMI scores in the gray and diversity or HBI scores that failed to meet thresholds, and were therefore

impaired on the basis of these three metrics (Table 7). There were no statistically significant trends over time in the percentages of "impaired" sites (Figure 29).

Table 7. Percentages of impaired samples by year, 2020-2024.

Year	n_samples/sites	Impaired, MMI	% MMI, Impaired	Gray, Impaired	% Gray, Impaired
2020	14	3	21%	1	7%
2021	11	1	9%	1	9%
2022	17	0	0%	2	12%
2023	15	0	0%	0	0%
2024	14	1	7%	1	7%
Total/Average	71	5	7.0%	5	7.0%

Figure 29. Percentages of impaired samples by year, 2020-2024.



Shannon's Diversity Index and the Hilsenhoff Biotic Index

The MMI analysis was constrained by the limited availability of that metric. The following analyses considered the diversity and HBI metrics relative to benchmarks to exploit the larger and longer sample sizes available. Only data collected from Focal Species sample sites were considered. Between 2003 and 2024, analysis of 310 samples determined that an average of 25% of samples were "impaired" on the basis of their diversity or HBI scores (Table 8, Figure 30). There was no significant change over time in the percentage of samples that were found by this measure to be "impaired" between 2003 and 2024 (Figure 31).

Table 8. Samples "Impaired" per diversity or HBI, 2003-2024.

Year	n samples/sites	# Impaired, Div or HBI	% Impaired, Div or HBI
2003	8	2	25%
2004	9	2	22%
2005	16	5	31%
2006	13	1	8%

Year	n samples/sites	# Impaired, Div or HBI	% Impaired, Div or HBI
2007	17	3	18%
2008	12	3	25%
2009	13	2	15%
2010	17	6	35%
2011	12	3	25%
2012	10	2	20%
2013	8	1	13%
2014	23	6	26%
2015	23	6	26%
2016	18	6	33%
2017	19	3	16%
2018	14	4	29%
2019	7	2	29%
2020	14	6	43%
2021	11	5	45%
2022	17	4	24%
2023	15	2	13%
2024	14	4	29%
Total	310	78	-
Average	14.1	3.5	25%

Figure 30. Number of Focal Species samples collected by year and the number of samples that could be considered impaired per Colorado benchmarks for Shannon's Diversity Index and/or HBI, 2003 – 2024.

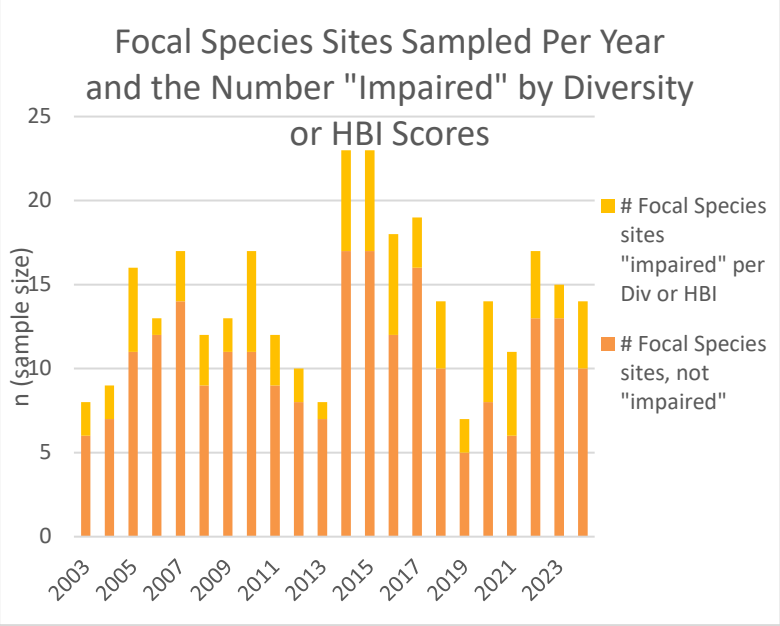
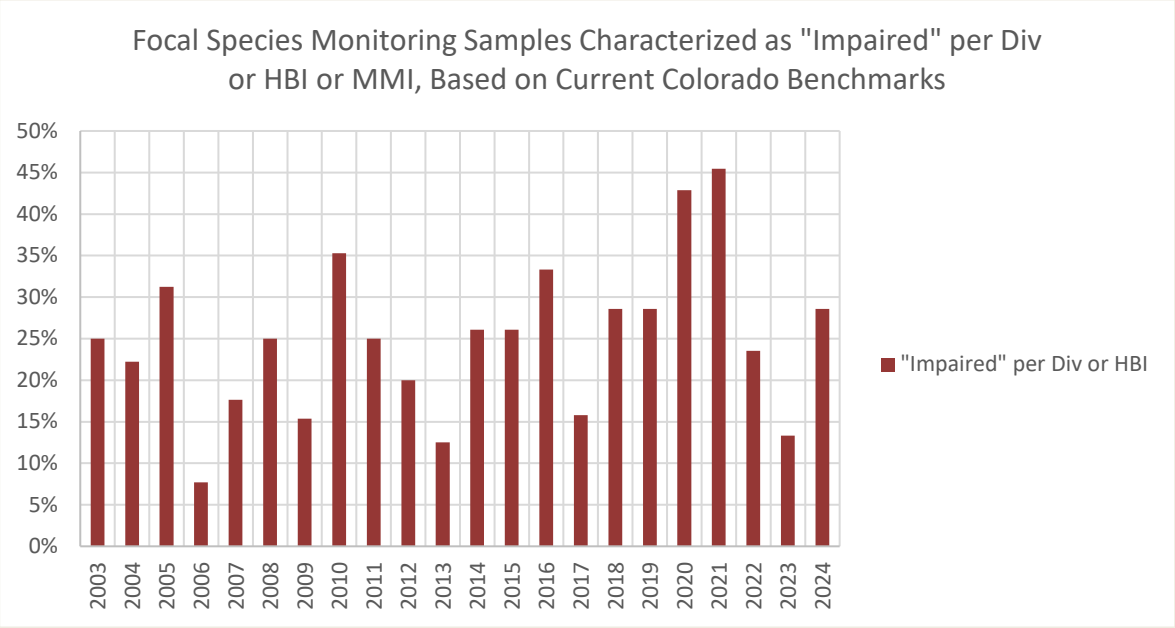


Figure 31. Percentage of samples from Focal Species sites reflecting impaired conditions per year, per Colorado benchmarks for Shannon's Diversity Index and/or HBI, 2003 – 2024.



Trends in Select Macroinvertebrate Metrics at the Forest-Scale

To examine change at the Forest scale, data were aggregated by year and trends over time were examined.

Metric: MMI Scores

Multi-Metric Index scores (MMI) are the quantitative standard for assessing attainment of aquatic life standards in Colorado. At the Forest scale, there were no statistically significant trends in MMI scores over time, either between 2003-2017 (n = 79), or from 2020-2024 (n = 71).

Metric: Shannon's Diversity Index

Shannon's Diversity Index accounts for the number of taxa at a site (richness) and their relative abundance (evenness). A site with very few taxa, or particular taxa that radically outnumber the others would thus be penalized by this measure. The higher the number, the better. At the Forest level, Shannon's Diversity Index has not changed from 2003 to 2024 (n = 311).

Metric: Number of EPT Taxa

Mayflies, stoneflies, and caddisflies (EPT, respectively) are taxa sensitive to environmental disturbance. As disturbance increases, the prevalence of these taxa tends to decrease. At the Forest level, the number of EPT taxa has not changed significantly over time (n = 312).

Metric: Percent Intolerant Taxa

The number of taxa intolerant of the effects of disturbance relative to the total number of taxa sampled at a given site is statistically (negatively) related to the prevalence of fine sediment and stream temperatures and is therefore an important indicator of disturbance within a watershed. As fine sediments and stream temperatures increase, the percentage of intolerant taxa in the community decreases. At the Forest level, the percentage of intolerant taxa has increased by 0.12% per year between 2003 and 2024 (n = 312).

Metric: Hilsenhoff Biotic Index

The Hilsenhoff Biotic Index (HBI) reflects organic nutrient pollution. As "excess" nutrients, relative to the expected, natural nutrient conditions at a site, increase, the HBI will *increase*, reflecting an increasing prevalence of organisms tolerant of high nutrient levels (thus, the smaller the number, the better). At the Forest level, HBIs have not changed between 2003 and 2024 (n = 311).

Metric: Percent Fines

The prevalence of fine sediment (particles less than 6 mm in diameter) in streams is an important aquatic habitat characteristic relevant to both macroinvertebrate and fish populations. Physical disturbance to the hydrologic network and streambanks in a watershed contributes to elevated fine sediment concentrations. At the Forest level, fine sediment concentrations in streams have not changed between 2003 to 2024 (n = 230).

Discussion

To render pre-2017 data comparable to post-2017, MMI scores will have to be recalculated using the raw data. This process is underway. This will provide us a longer period of record over which we can more succinctly evaluate status and trends over time.

In the meantime, although limited, the post-2017 MMI data is most useful. Eighty-six percent of sites (61 out of 71) have MMI scores that "attain" cold water aquatic life standards. Secondly, all of those 61 sites had MMIs greater than 50, the middle of the MMI range, and so therefore habitat quality at all of those sites is better than average for this metric across the Mountain region of Colorado. This measure thus confirms the generally high-quality instream habitat that the Forest provides. Sample sizes at this point make for weak analyses of trends over time.

The MMI analysis found that about 14% of sampled sites were impaired per Colorado standards for MMIs, or, diversity or HBI, in the case of sites in the "gray". Looking only at diversity and HBI, about 25% of samples were impaired. It may be that MMIs are under-reporting impairment or that diversity and HBI are over-reporting. In years where both measures were available, the same pattern was observed, where the two auxiliary metrics flagged on the order of twice as many samples as impaired. Based on considerable vetting, Colorado's regulatory regime is based on the MMI. But, since we have considerably more diversity and HBI data over a longer period of record, we consult those metrics as well.

If we assume that these auxiliary metrics over-report by almost double what MMI scores do, our background rate of impairment would change. However, our conclusion about the lack of change over time still holds, indicating that at the Forest scale, impaired conditions are not getting more or less common over time at this gross level. If a lack of change doesn't appear impressive on its face, consider the area and intensity of activity this Forest is subject to. We have facilitated those uses without measurably degrading instream conditions while doing so, which is after all our mission and duty.

It's important to remember that samples are collected from discrete sites, mere tens- or hundreds of feet in length, to represent generally miles of stream. There will be variation in condition between sites within particular streams, which is an entirely natural phenomenon and a consequence of sampling in general vs. a census. To try to capture a single characterization of a particular stream for example, many samples from different reaches could be averaged to get a better approximation, but that is beyond the scope of this report. The randomization of site selection is the means to overcome this site-specific variation as for every "poor" condition site randomly selected in an otherwise healthy stream, there will be other sites with better than average conditions and thus bias will balance out at the Forest scale. When measuring a complicated set of conditions at many sites over a large area and temporal scale, the conditions measured at every site at every time will not all be ideal, even in a high habitat quality system. We're also dealing with small sample sizes, so while 13% of samples from sites sampled in 2013 could be considered impaired, that was only 1 site out of the 8 Focal Species samples collected that year (Table 8).

Because observable, watershed- or stream scale evidence of disturbance at some of these "impaired" sites is absent, increases in the rate of impairment might reflect changes in the physical environment, temperatures, precipitation, stream discharge, and even landscape-scale nutrient cycling, more so than effects of Forest management. Forest management has not altered the conditions of the East Maroon

Creek watershed lately (in Wilderness), for example, and yet a site in that stream is showing up on the "impaired" list. Our more standard explanations of road development, grazing or timber harvest do not apply to these newly "impaired" watersheds because those things aren't occurring there. The specific environmental mechanism(s) driving impairment is/are thus often not clear. If we don't quantify effects, we'll have no chance of noticing their contributing factors.
There is some evidence to suggest that HBIs are increasing at many sites. This pattern is not explainable at this point, but it is a metric the Forest is paying attention to. The Forest generally does not quantify dissolved- or other nutrient levels, fluxes, or trends in Forest soils or streams and therefore we can only watch HBIs as a proxy of those direct measurements.

Forest Biologists as a rule operate in an environment of information scarcity. While the literature is vast, apples-to-apples comparisons are uncommon and un-testable, and empirical data are labor- and cost intensive and therefore also scarce. As-large-as-feasible sample sizes over as long a time frame as feasible are the way to make these analyses more useful and powerful. These data are not an example of diminishing returns, rather they get more valuable the more we add to them. In ~25 more years, we could have a 50-year record of instream conditions on the Forest. Those data will not exist if we don't collect them. Forest macroinvertebrate collection efforts therefore are extremely valuable in providing some little empirical evidence of conditions important to the human- and natural environment across millions of acres of public land across space and time.

Adaptive Management Considerations

The analysis of the randomly selected sites showing no substantive impacts suggests that no changes are needed in macroinvertebrate, bioassessment and monitoring. It should be noted however, that outside of the randomly selected sites there have been substantial changes in water quality that were first observed in macroinvertebrate monitoring (see discussion below in cutthroat trout section). Therefore, it is recommended that for future monitoring reports the macroinvertebrate, bioassement monitoring should analyze not only the random samples but also look at a stratified set of subsamples where we know there have been historic anthropogenic impacts. Furthermore if possible the Colorado MultiMetric Indices should be used to standardize the analysis.

Monitoring Item 3.2: Red Squirrel

Monitoring Question and Background

- What do red squirrel populations tell us about the extent and condition of mid- to late-successional forested ecosystems on the planning unit?

The 2012 Planning Rule requires Forests to monitor focal species that can indicate changes in key characteristics of ecological integrity (36 CFR 219.12). Red squirrels were selected as one of the focal species for forest structure and composition because they require mature conifer forests for pinecones and seeds, and in Colorado they are often found in stands with closed canopies (Scott et al. 1982).

Forest Plan Ref./ Driver	Indicators	Data Sources/ Protocols/ Partners	Freq. of a) data collection b) reporting	Targets, thresholds
Goal 1, Objective 1b	Extent, density and occupancy of red squirrels	Bird Conservancy of the Rockies (BCR)	Annually; reporting every 2 years	Declining trend in extent, density, or occupancy

Monitoring Results

The Bird Conservancy of the Rockies (BCR) has monitored red squirrels on the WRNF since 2011. BCR utilizes highly trained crews and a sophisticated spatially balanced sample frame to generate estimates of occupancy and density for numerous bird species and small mammals at multiple scales. Evaluating both density and occupancy is important for understanding population trends and distribution across the landscape, and potential changes in ecological conditions (BCR, 2021). Table 9 below shows the population trend based on both density and occupancy on the WRNF using data collect from 2011 – 2024.

Table 9. Red Squirrel Population Trend

Elevation Stratum	Years of Data Collection	Population Trend Based on Density	Population Trend Based on Occupancy	Overall Trend
Low Elevation	2011 - 2024	-1.7	0.52	Negative
Mid Elevation	2011 - 2024	1.93	1.23	Positive
High Elevation	2011 - 2024	2.03	4.82	Positive
Forest-wide	2011 - 2024	1.94	2.2	Positive

Population Trends

Overall population trends for the red squirrel are moving in a positive direction on the WRNF, based on both density of squirrels and occupancy rates in areas surveyed. The one exception to this is within the lower elevation stratum.

Monitoring Discussion and Findings

There is a negative population trend within the low elevation sampling stratum on the WRNF, based on density. Given the relatively small amount of active management in mature conifer stands across the WRNF, this negative trend is likely based on other factors. These could include mortality of mature lodgepole pine trees resulting from the mountain pine beetle infestation or climate conditions that are more likely to impact lower elevation conifer forests first.

Adaptive Management Considerations

With an overall positive population trend for the WRNF, there are no changes recommended to this monitoring program or Forest Plan direction at this time.

Monitoring Item 3.3: Pika

Monitoring Question and Background

- What is the status of American pika populations as an indicator for alpine ecosystem integrity?

Pikas are excellent focal species for assessing alpine ecosystem integrity and climate change because they can be abundant, are active during the day and easily detectable, and are sensitive to climate change (Beever et al, 2016).

Forest Plan Ref./ Driver	Indicators	Data Sources/ Protocols/ Partners	Freq. of a) data collection b) reporting	Targets, thresholds
Goal 1, Objective 1b	Extent, density and occupancy of American pika	Bird Conservancy of the Rockies (BCR) and WRNF-Rocky Mountain Wildlife Citizen Science Monitoring Project.	Annually; reporting every 2 years	Declining trend in extent, density, or occupancy

Monitoring Results

American Pika

No monitoring results are available. Staffing shortages and deferred resignations in 2025 has impacted the agency's ability to analyze this monitoring question. This monitoring question will be re-assessed in 2026.

Monitoring Discussion and Findings

Overall, early results indicate that pika are well distributed, and trends are fairly stable across the WRNF. Precise occupancy estimates and trends will be analyzed when a final report is provided by Rocky Mountain Wild. We expect that this will be discussed in the next WRNF monitoring report.

Adaptive Management Considerations

There are no adaptive management actions be considered at this time.

Monitoring Item 3.4: Avian Species

Monitoring Question and Background

- What are the status and trends of select avian species on the WRNF?

Birds are excellent focal species for evaluating ecological trends and conditions because they are generally conspicuous during the breeding season, and responsive to their environment at multiple scales (Hutto, 1998).

Forest Plan Ref./ Driver	Indicators	Data Sources/ Protocols/ Partners	Freq. of a) data collection b) reporting	Targets, Thresholds
Goal 1, Objective 1b	Species richness, density and occupancy of, and trends of bird communities	Bird Conservancy of the Rockies (BCR)	Annually; reporting every 2 years	Declining trend in extent, density, or occupancy

Monitoring Results

The WRNF uses a program that is implemented by Bird Conservancy of the Rockies called Integrated Monitoring in Bird Conservation Regions (IMBCR). It is a collaborative breeding bird monitoring program in which partners pool monitoring resources to create efficiencies in data collection and analysis. IMBCR is based on a spatially balanced sampling design which provides inference to avian populations at various scales, from local field offices to entire states or Bird Conservation Regions (BCR), facilitating conservation at local and national levels (Pavlacky et al. 2017). The nested design

also provides a consistent and flexible framework for understanding and comparing the status and annual changes of bird populations with local and regional context. Trained observers conduct point count surveys across public and private land from the Great Basin to the Great Plains.

Bird Conservancy of the Rockies has been monitoring across private and public land in Colorado since 2008. Starting in 2011, they began monitoring on the WRNF each year, and the Forest is divided into three substrata based on high, medium, and low elevation bands. This stratification allows biologists to adjust sampling intensity to target species of interest on the Forest. Because we monitor all other Forests and Grasslands within Colorado (and Region 2), biologists can make inferences about the status of bird populations within their management unit, and also compare to populations within other Forests or regions for context.

This status of general ecological conditions was assessed by evaluating the biodiversity of bird species on USFS lands. Birds are excellent indicators of biodiversity because a wide variety of species rely on a broad range of habitat types from wet to dry, low to high elevation, and early to late seral succession. A broad and stable array of bird species on a landscape indicates a broad array of favorable ecological conditions for that landscape.

Landscapes are diverse and dynamic due to natural and managed ecological conditions. At a given time in a dynamic system, some species will be favored by current conditions, with their populations increasing, but others will be adversely impacted, and their populations will be decreasing. As a forest ages, for example, early seral stage dependent bird species will be in decline while later seral stage species will be increasing dues to shifts in available habitat. A balance of upward, stable, and downward trending bird species likely indicates favorable ecological conditions across the landscape, so graphing species trends in a healthy and balanced ecosystem should produce a bell-shaped histogram with species trends centered around 1.0 (i.e., stable growth rates); compromised ecosystem health is suspected if the mean trend is <1.0 or the distribution is skewed <1.0 (Figure 32.) This approach was used to evaluate bird population trends as indicators of general ecological conditions.

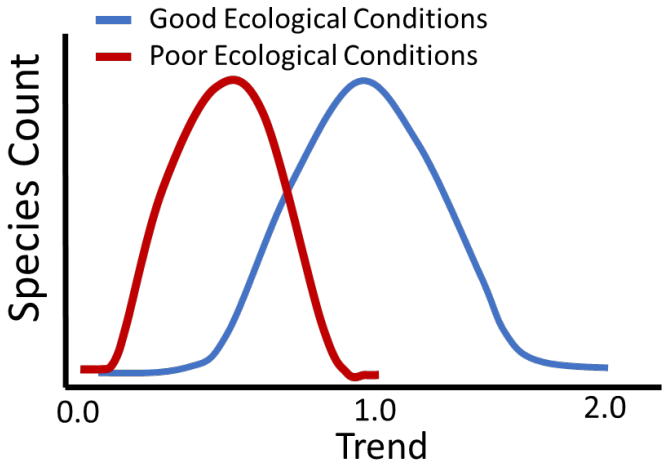


Figure 32. Representative example of bird population density trends as indicators of general ecological conditions. If most species populations are trending near and around 1.0 (i.e., stable), good ecological condition are inferred. If most species population trends are below 1.0, or the data skew below 1.0, it indicates species declines and poor ecological conditions.

Data were downloaded from the Rocky Mountain Avian Data Center.
https://apps.birdconservancy.org/rmadc/

on trends in bird species.

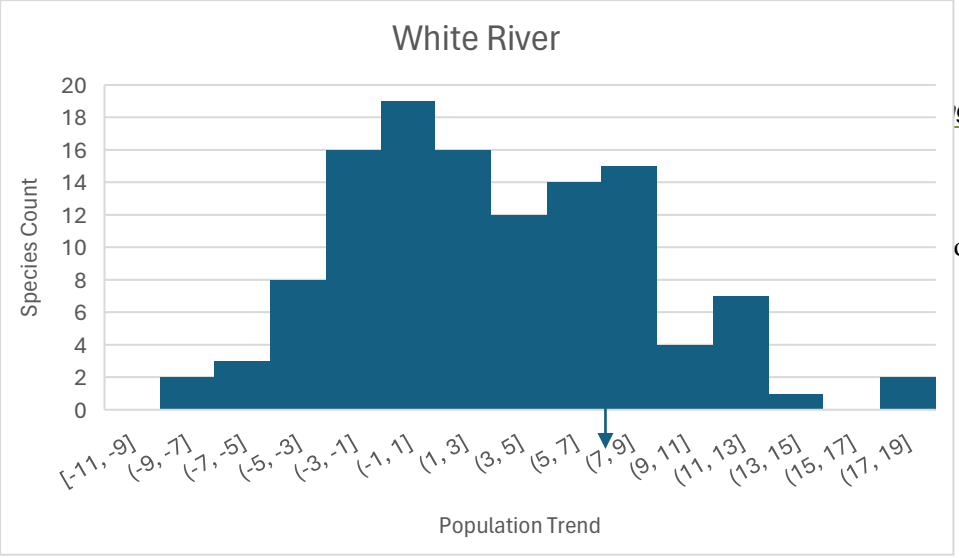


Figure 33. Overall trends of bird species on the WRNF. A balanced ecosystem is indicateddistributedistribution with a peak trend at 0 (arrow).

WRNF - Significantly Declining Species:

The only species on the WRNF that showed a statistically significant decline was the Steller's jay (Table 10). Bird species showing significant declines (credible interval boundaries < 0.0), Density Trend=median density trend for the region; LCI95=lower credible interval; UCI95=upper credible interval; f=confidence in the direction of the reported trend, e.g., 0.83 suggests 83% confidence in the direction of an observed trend (but not its magnitude). A trend <0.0 indicates downward population trend, 0.0 indicates stable trend, and >0.0 indicates increasing trend.

Table 10. Stellar's Jay Trend

Species	Years	Density Trend	Density f	L95CI	U95CI
Steller's Jay	2011-2023	-5.15	0.98	-10.03	-0.05

WRNF - Significantly Increasing Species:

Bird species in the Table 11 show statistically significant increases (credible interval boundaries > 0.0), Density Trend=median density trend for the region; LCI95=lower credible interval; UCI95=upper credible interval; f=confidence in the direction of the reported trend, e.g., 0.83 suggests 83% confidence in the direction of an observed trend (but not its magnitude). A trend <0.0 indicates downward population trend, 0.0 indicates stable trend, and >0.0 indicates increasing trend.

Table 11. Significantly Increasing Bird Species

Species	Years	Density Trend	Density f	L95CI	U95CI
MacGillivray's Warbler	2011-2023	13	1.00	5.34	22.13
Western Tanager	2011-2023	8.22	1.00	3.66	13.04
Red-breasted Nuthatch	2011-2023	6.1	1.00	1.27	9.86
Red Crossbill	2011-2023	8.21	0.98	0.71	16.16

Monitoring Discussion and Findings

For avian species on the WRNF, four species showed a statistically significant positive population trend, and one showed a negative trend.

For the species that showed a positive trend, three are associated with mature conifer forests: the Western tanager, red-breasted nuthatch and red crossbill. MacGillivary's warbler is associated with dense, mountain shrub habitat.

Stellar's jay is the only species on the WRNF that showed a statistically significant density trend decline. Although this species is typically associated with coniferous forests, it is also often found near human altered habitats, including campgrounds and agricultural areas. Forest management activities are not commonly associated with threats to this species. The two adjacent National Forests (GMUG and MBRTB) did not show a decline for this species. At this time, it is not known what may be causing a decline for this species on the WRNF.

Overall the WRNF showed a positive ecological condition for song birds monitored by the IMBCR program (Figure 33 above). There was a predominance of species that have a population density that is trending at or above 1.0, which means populations are stable or increasing.

The WRNF will continue to work with its partners at Bird Conservancy of the Rockies to find the best species to analyze from the vast about of bird survey data that the organization continues to collect.

Adaptive Management Considerations

Avian density, occupancy and trend will continue to be evaluated from BCR data collection efforts as long as funding can be obtained. Unfortunately, 2025 is the last year that the Forest Service has sufficient funding to implement this monitoring program. The longer that this same monitoring technique is utilized, the more accurate trend data will be. If additional funding becomes available, the WRNF has the ability to have BCR increase the number of monitoring transects on the Forest. Since none of the selected species showed a negative population trend during this monitoring period, there are no changes to the monitoring program, Forest Plan direction, or management activities proposed at this time.

IV. The status of select ecological conditions for at-risk species

Monitoring Item 4.1: Colorado River Native Cutthroat Trout

Monitoring Question and Background

- What is the status and trend of cutthroat trout across the planning area?

Forest Plan Ref./ Driver	Indicators	Data Sources/ Protocols/ Partners	Freq. of a) data collection b) reporting	Targets, Thresholds
Goal 1, Objective 1c "Help ensure viability of species of concern for the White River National Forest"	Number of conservation populations in the planning area; Miles of occupied habitat; Presence/absence of aquatic nuisance species and/or non-native trout; Elevation, snow depth inches, and snow-water-equivalent (SWE)	USFS sensitive species monitoring data; Colorado Parks and Wildlife (CPW) cutthroat monitoring data; FWS Recovery Plan; CRCT Conservation Agreement	Annually; reporting every 2 years	Decline in any of the indicators

Monitoring Results
No monitoring results are available. Staffing shortages and deferred resignations in 2025 has impacted the agency's ability to analyze this monitoring question. This monitoring question will be re-assessed in 2026.

Monitoring Discussion and Findings
No discussion due to staffing shortages and expertise.

Adaptive Management Considerations
There are no changes recommended to the monitoring program or to Forest Plan direction at this time.

Monitoring Item 4.2: Amphibians
Monitoring Question and Background
What is the status and trend of boreal toads and northern leopard frogs across the planning area?

Forest Plan Ref./ Driver	Indicators	Data Sources/ Protocols	Freq. of data collection/	Last evaluation/ next evaluation	Desired conditions/ Thresholds/ Triggers
Goal 1, Objective 1c. "Help ensure viability of species of concern for the White River National Forest"	Number of active breeding populations in the panning area Presence/absence of chytrid fungus	CNHP survey data CPW survey data USFS survey data Future eDNA testing based on new research	Annually	This is the first evaluation for amphibian populations	Maintain existing populations of adult boreal toad Threshold - Loss of 50% of breeding populations

Monitoring Results
No monitoring results are available. Staffing shortages and deferred resignations in 2025 has impacted the agency's ability to analyze this monitoring question. This monitoring question will be re-assessed in 2026.

Monitoring Discussion and Findings
No discussion due to staffing shortages and expertise.

Adaptive Management Considerations
There are no changes recommended to the monitoring program or to Forest Plan direction at this time.

Monitoring Item 4.3: Lynx Habitat
Monitoring Question and Background
- What is the status and trend of early successional conifer and late seral spruce-fir forests to promote recovery of Canada lynx?

This monitoring item address regulatory requirements associated with the Southern Rockies Lynx Amendment (SRLA) (USDA Forest Service 2008). The SRLA contains several management standards intended to conserve habitat for lynx, a threatened species under the Endangered Species Act.

Forest Plan Ref./ Driver	Indicators	Data Sources/ Protocols	Freq. of data collection/	Last evaluation/ next evaluation	Desired conditions/ Thresholds/ Triggers
Goal 1, Objective 1c. **Southern Rockies Lynx Amendment**	Extent and condition of early successional and late seral spruce-fir forests; Habitat connectivity; and Dense horizontal cover	FS Veg Spatial Project impacts or mitigation Habitat improvements USFWS Future FWS Recovery plan WRNF lynx habitat map layer.	Annually	The lynx habitat on WRNF was re-mapped in 2017. In 2018 there were 3 large fires on WRNF– the change in habitat will be evaluated and mapped in 2019. New critical lynx habitat mapping in place in 2025.	3% lynx habitat treated (VegS1, S2, S5, S6) WUI exemption 1% precommercial thinning exception (VegS5) .5% pre-commercial thinning or multi-story management (VegS5, S6 Exception)

Monitoring Results
No monitoring results are available. Staffing shortages and deferred resignations in 2025 has impacted the agency's ability to analyze this monitoring question. This monitoring question will be re-assessed in 2026.

Monitoring Discussion and Findings
No discussion due to staffing shortages and expertise.

Adaptive Management Considerations
There are no changes recommended to the monitoring program or to Forest Plan direction at this time.

V. Visitor use, visitor satisfaction, and progress toward meeting recreation objectives

Monitoring item 5.1: Visitor satisfaction and use

Monitoring Question and Background
- What are the status and trends of visitor satisfaction for recreational visits on the planning unit?

This monitoring question address WRNF plan goals and objectives associated with recreation and visitor use.

Forest Plan Ref./ Driver	Indicators	Data Sources/ Protocols/ Partners	Freq. of a) data collection and b) reporting	Targets, Thresholds
Goal 2 "Multiple Benefits to People", Objective 2a "Improve the capability of the National Forests and grasslands to provide diverse, high quality recreation opportunities."	Visitor satisfaction; Number of visitors; Demand within the Forests niche	National Visitor Use Monitoring Program	a) 5 Years; b) 5 years	N/A

Monitoring Results

Data on visitation, visitor satisfaction and changes in recreation demand is collected through survey methods by the USFS National Visitor Use Monitoring (NVUM) Program every five years. The next NVUM data collection will occur in 2027, therefore, no data is available to assess trends in visitor satisfaction, number of visitors and demand.

Monitoring Discussion and Findings

National Visitor Use Monitoring data will be compiled in 2027 and findings presented in the 2028 Forest Plan Biennial Monitoring Report.

Adaptive Management Considerations

There are no changes recommended to the monitoring program or to Forest Plan direction at this time.

Monitoring item 5.2: Recreation Special Uses Administration

Monitoring Question and Background

- What are the number and type of Recreation Special Use Permits administered to standard?

Forest Plan Ref./ Driver	Indicators	Data Sources/ Protocols/ Partners	Freq. of a) data collection and b) reporting	Targets, Thresholds
Goal 2, Objective 2c "Improve the capability of National Forests and rangelands to sustain desired uses, values, products, and services."	Permits administered to standard, number of service days permitted, type of permit.	INFRA, Administering Recreation Special Use Permits to Standard Best Practices; SUDS	Annually	All permits administered to standard set by Region for permit type

Special use permits provide the public high-quality recreational opportunities on WRNF and support the local economy. Administering these permits to standard is key to maintaining these experiences.

The national target established to ensure delivery of a quality special uses program on behalf of the Forest Service is the number of permits administered to standard. At the end of each fiscal year, all active special use authorizations are evaluated within the Special Uses Data System (SUDS). Depending on the type of authorization, various measurement elements are considered when determining whether the permit has been administered to standard for that fiscal year. To be rated as

"administered to standard" for the current fiscal year, the special use authorization being evaluated must receive a "Yes" determination for all applicable measurement elements. Any "No" determinations, will result in a determination of "Not Administered to Standard". Measurement elements have been identified at a national level as critical for maintaining a quality special uses program, delivering quality experiences and opportunities to the public, providing adequate natural resource protections, and for ensuring Forest Service compliance with applicable law, regulation and policy.

ATS Measurement Element Relation to the WRNF Forest Plan Goal and Objective for Special Uses Administration:

Authorization Document Current- All special use permits must be current and up to date.

Rental Fees Documented- Land use fees are determined in accordance with applicable law, regulation, policy, and permit terms and conditions. 36 CFR 251.57 requires all special use permits to have an advance fee paid unless otherwise stated in law, regulation, or policy.

Bill Issued or Rent Fully Waived- 36 CFR 251.57 states: *"(a) Except as otherwise provided in this part or when specifically authorized by the Secretary of Agriculture, special use authorizations shall require the payment in advance of an annual rental fee as determined by the authorized officer."* Most fees are returned to the U.S. Treasury; however, in unique cases within recreation like outfitting and guiding, recreation events, and filming, the majority of the land use fees are returned to the Forest on which they were collected. Those fees are intended for continuation and enhancement of those specific programs and opportunities. The WRNF, its permit holders, and the public benefit greatly from the Forest's ability to reinvest those fees into those specific programs and by extension allow us to meet the Forest Plan objective of "Improv[ing] the capability of national forests and rangelands to sustain desired uses, values, products, and services."

Document Current and Adequate Insurance- FSM 2713 states that the Forest Service must require insurance for concessionaire uses and should require other holders to carry liability insurance depending on the likelihood and potential severity of injury.

Document Inspections and Take Actions for Non-Compliance- Inspection of special uses permits is an integral process for ensuring the holders' compliance with the terms and conditions of their special use permit and help the Forest maintain high quality public services on NFS lands.

Document Performance Evaluations and Take Action for Non-Compliance- Similar to inspections, it is necessary for the Forest Service to be familiar with the holders' operations and ensure compliance with the permit terms and conditions and operation and maintenance plan. Performance reviews also allow for verification of public satisfaction with the permit holders' operation.

Monitoring Discussion and Findings

In past years, Administered to Standard has been identified as an accomplishment target for Regions and Forests as part of the annual National Budget Direction. Below is a table (Table 12) identifying the specific program administered by WRNF from FY2023-FY2025 including the number of permits, diversity of uses authorized, regional target accomplishment, as well as number of permits administered to standard.

Table 12. WRNF administered to standard data for recreation special uses from fiscal year 2016- 2024.

Recreation	FY2016	FY2017	FY2020	FY2022	FY2024
Total Permits	375	418	359	384	373
Total Use Types Authorized	14	15	12	15	17
Total ATS for FY	333	324	228	284	221

White River National Forest- Meeting Forest Plan Goal and Objective for Recreation Special Uses Administration:

With the exception of number of service days authorized, the table above provides information on the indicators identified in the Forest Plan Monitoring Plan for Special Uses Administration- Permits Administered to Standard, and Types of Permits. Findings with respect to each of these indicators are listed below.

Number of Permits Administered to Standard- The number of permits administered to standard is dependent on the season the permit operates within, so this metric is not an accurate measure of the administrative work that is accomplished annually within the WRNF Recreation Special Uses program. The WRNF works diligently to ensure that all permits are in active status, bills are issued, collections are verified, operating plans are approved, and inspections are performed as needed.

Service Days Authorized- At this time, WRNF does not maintain a database for gathering or tracking the total amount of service days authorized. However, NVUM data shows that WRNF is the most highly visited forest in the country with an estimated 18.5 million forest visits. A good portion of these visits occur at the Forest's ski areas that are authorized under a special use permit, but those visitors leave the ski areas and enjoy the National Forest either on their own or participating in events or hiring an outfitter guide to enhance their forest experience. SUDS data shows that WRNF administers one of the largest outfitter and guide and recreation event programs in the Rocky Mountain Region. The WRNF has not only a great number of service days authorized for outfitting and guiding use but also supports a great number of visitor opportunities through its recreation event and ski area programs.

Types of Permits- With respect to recreation and lands uses, the WRNF demonstrates a wide variety of special use authorizations. They include outfitter guides, recreation events, recreation residences, resorts, concession, winter recreation area, shelters, and snow play to name a few. Furthermore, the forest has maintained that variety of uses for many years, indicating a willingness to continue providing those opportunities into the future.

Adaptive Management Considerations

There are no changes recommended to the monitoring program or to forest plan direction at this time.

Monitoring item 5.3: Sustaining Recreation Infrastructure

Monitoring Question and Background

- How is the Forest trending towards implementing a sustainable program for recreation related infrastructure?

Forest Plan Ref./ Driver	Indicators	Data Sources/ Protocols/ Partners	Freq. of a) data collection and b) reporting	Targets, Thresholds
Goal 2 Objective 2a	Site Condition	INFRA corporate database; Site Condition Surveys	Once every 5 years	Site conditions improving Deferred maintenance backlog reduced

Monitoring Results

Site Condition Surveys are completed a minimum of once every five years for all developed recreation sites, including trailheads. Table 13 shows the number and type of sites listed by their operational status (existing or disposed). Disposed means the site is no longer operational, features have been removed from the forest and the area may or may not be closed to recreational use. Current data will serve as a baseline to evaluate changes in the future.

Table 13. Recreation sites closed or opened since 2003, as of 2024.

Recreation Site Type	Currently closed	Currently Open
BOATING SITE		5
CAMPGROUND	9	55
CAMPING AREA		1
CLIMBING AREA		1
DAY USE AREA	2	4
DOCUMENTARY SITE		4
FISHING SITE	2	3
GROUP CAMPGROUND	1	5
GROUP PICNIC SITE		2
HORSE CAMP		2
HOTEL, LODGE, RESORT		23
INFO SITE/FEE STATION		2
INTERPRETIVE SITE		3
INTERPRETIVE VISITOR CENTER (MINOR)		2
LOOKOUT/CABIN		1
OBSERVATION SITE		3
PICNIC SITE	3	13
RECREATION RESIDENCE	1	15
SKI AREA ALPINE		11
SKI AREA NORDIC		2
TARGET RANGE		1
TRAILHEAD	2	162

Recreation Site Type	Currently closed	Currently Open
Grand Total	**20**	**320**

Monitoring Discussion and Findings

The White River National Forest manages developed recreation sites through a combination of concessionaires (private companies) and force-account (Forest Service employees), and through both fee and non-fee sites. Site condition surveys document and track a recreation site being "managed to standard," annual operations and maintenance, and help with future planning of replacements of developed recreation sites features and amenities. These are also useful to understanding the amount of deferred maintenance, where recreation fees may or may not provide enough funding to address deferred maintenance.

The findings disclosed in Table 13 provide a baseline for future evaluations. As such, it reflects that there a 6% permanent closure (disposed) (20 of 320) recreation sites on the WRNF since 2003. In this reporting period, one campground was opened that was previously closed. The permanent recreation site closures reduce the amount of overall developed recreation infrastructure and focus concessionaire and force-account capacity on supporting a sustainable recreation program.

Another tool to implementing a sustainable program for recreation related infrastructure is through Recreation Site Analysis (RSA). RSA looks at the totality of operating and maintaining sites and deferred maintenance but also broadens the goals to consider how recreation sites contribute to social stability, environmental integrity, and economic viability for the forest and its communities. This is a tool that provides future prioritization, including a range of options including expansion and/or reductions in services of recreation sites, closing sites, shifting operational responsibility to other stakeholders, etc.

Adaptive Management Considerations

The WRNF has performed 2 rounds of Recreation Site Analysis. The forest has implemented many of the management actions to reach a sustainable developed recreation program. The forest issued a new campground concession permit in 2024 authorizing 69 developed sites out for private concession management. This prospectus added 5 new sites into the offering to allow for sustainable management, 3 sites were made optional offerings. We do not foresee any changes to the monitoring program, forest plan direction or management activities proposed at this time.

VI: Status of climate change measures and other stressors

Monitoring Item 6.1: Snowpack and Precipitation

Monitoring Question and Background

- What are the status and trends of snowpack and precipitation in the planning area?

Forest Plan Ref./ Driver	Indicators	Data Sources/ Protocols/ Partners	Frequency of data a) collection b) reporting	Targets, Thresholds
Goal 1, Objective 1e "Work cooperatively with individuals, organizations, local, state, tribal, and other federal agencies to promote ecosystem health and sustainability across landscapes."	Snow accumulation and ablation, cumulative precipitation, average temperature	Natural Resource Conservation Service SNOTEL DRI/University of Idaho Google Earth Engine	a) Daily b) Annually	Snow accumulation and ablation trends, precipitation trends, and temperature trends

Monitoring Results

Snowpack

Snowpack monitoring on White River National Forest (WRNF) is conducted by the Natural Resources Conservation Service (NRCS) at SNOTEL (Snow Telemetry) monitoring sites and manual snow courses. Snow water equivalent (SWE) data from approximately 26 snow courses and 35 SNOTEL sites are used to measure available water in the mountain snowpack and project runoff forecasts across the Colorado River Headwaters Basin, the watershed that encompasses most WRNF (Figure 34). While not all SWE observation points are within WRNF boundaries, most are adjacent and in the same mountain ranges; the larger sample size offers a more representative estimate of SWE, precipitation and temperature within Colorado River Headwaters basin and WRNF.

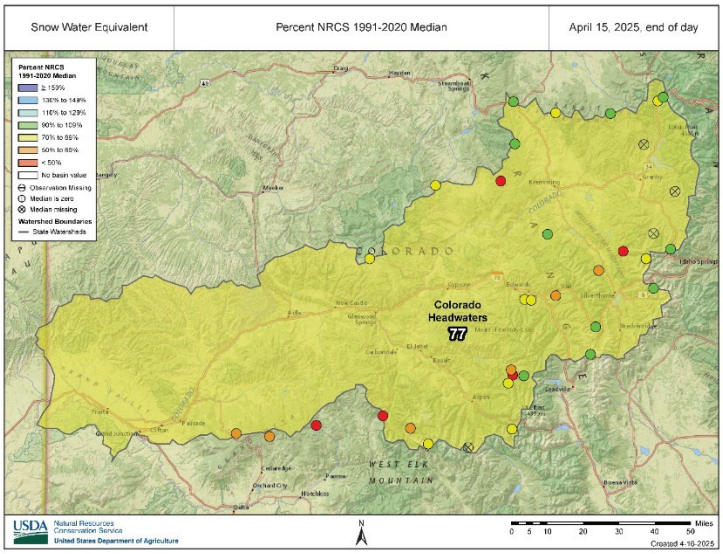


Figure 34. The Colorado Headwaters basin encompasses most of the White River National Forest. The points are associated SNOTEL stations used for snowpack, precipitation and temperature measurements in this report. On April 15, 2025, the SWE in the Colorado Headwaters basin was estimated to be 77% of the 1991-2020 median value at 12.7 inches.

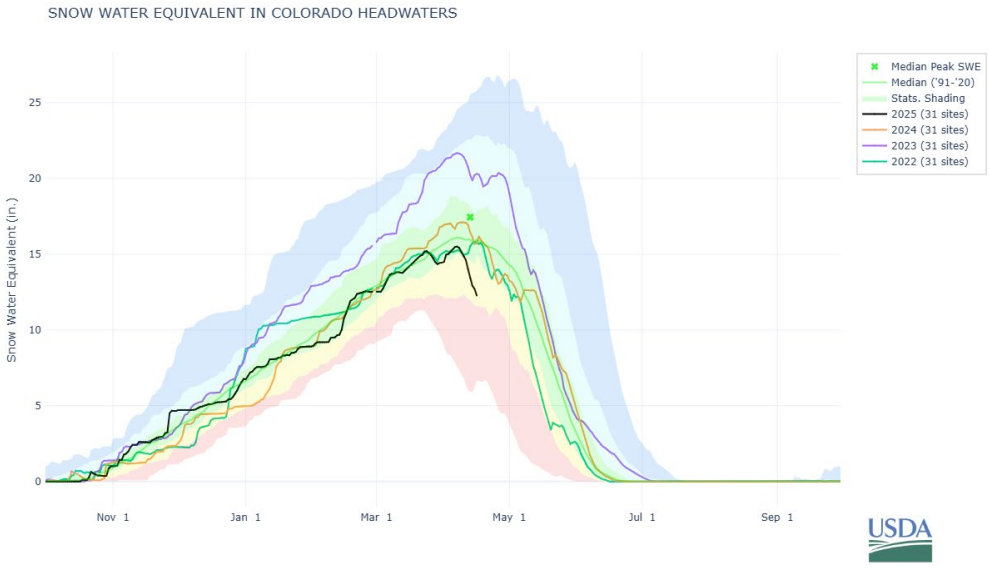


Figure 35. 2022 – 2025 water year SWE compared to percentiles and 1991-2020 median for Colorado Headwater Basin

Median peak SWE for the Colorado Headwater basin is approximately 17.4 inches of water on April 13th. Water year 2022 showed below median snow accumulation and a rapid melt-off which coincides with the drought index for 2022. Peak SWE for 2022 was approximately 15.8 inches of water on April 16th. The snowpack in the basin during 2023 was substantial and lasted longer than normal, providing melt water later into the spring and summer. Peak SWE in 2023 was approximately 21.7 inches of water on April 7th and significant late season

(March-April) precipitation events bolstered the snowpack. December, January and March experienced above-median snow accumulation in 2023 (Figure 36 and 37). Water year 2024 peak SWE measured approximately 17 inches of water on April 10th, while a series of late season storms prolonged the snowpack, temperatures remained high and melt-out occurred faster than 2023. While the 2022 – 2024 water year peak SWE was near or exceeded median values, it is worth noting the changes in the timing of peak SWE and melt-off in the discussion below (Figure 36).

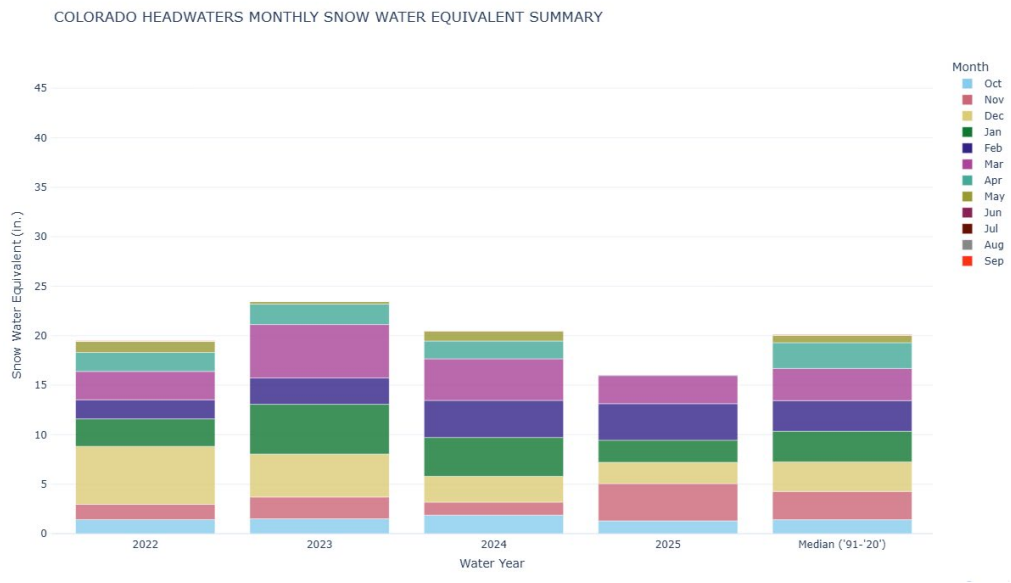


Figure 36. Monthly SWE totals and median monthly SWE totals for Colorado Headwaters basin from 2022 - 2025

Precipitation

Annual precipitation data was also collected by NRCS SNOTEL sites throughout the Upper Colorado River Basin (Figure 37). In the continental mountain region, most precipitation falls within the winter months as snow, but larger rain and seasonal monsoon events may relieve drought conditions later in the season as seen in later summer of 2022 and 2024 (Figure 37 and 38). Precipitation data and trends for the White River National Forest area were also calculated from gridded datasets using GRIDMET within the Climate Engine tool (Figure 39) and represented within the US Drought Monitor tool which shows land percentage by drought severity in the Upper Colorado River Basin.

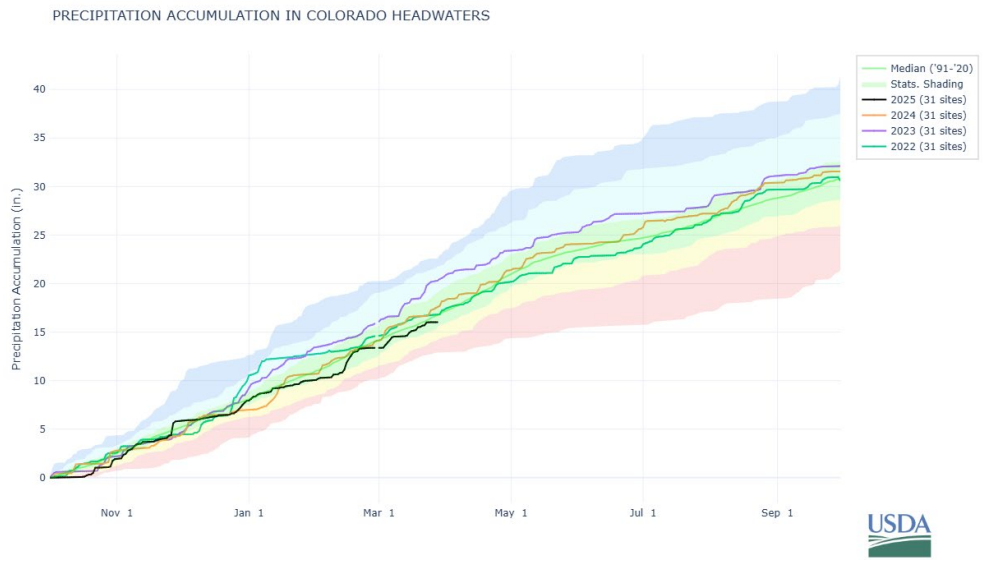


Figure 37. 2022 – 2025 water year precipitation accumulation compared to percentiles and 1991-2020 median for Colorado Headwater Basin

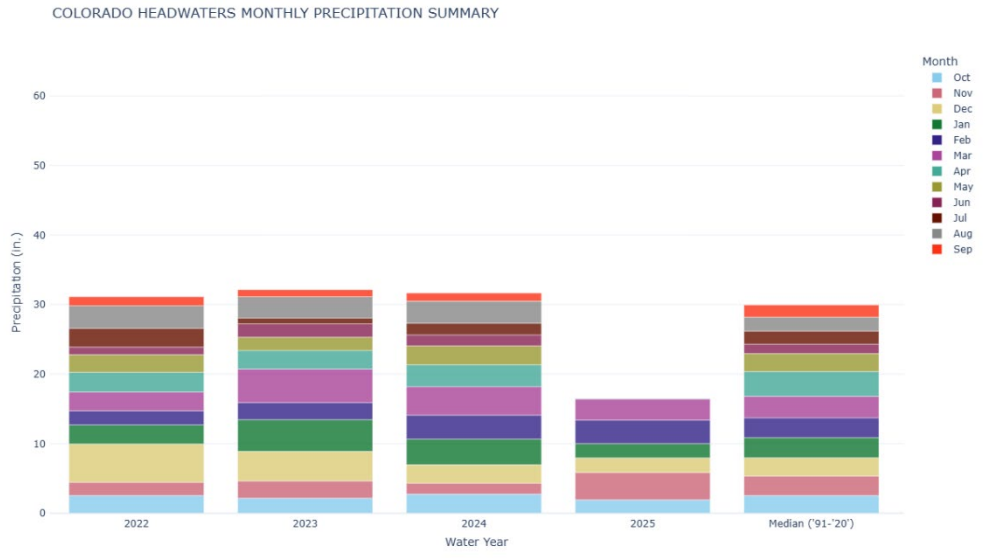


Figure 38. Monthly precipitation totals and median monthly precipitation totals for Colorado Headwaters basin from 2022 - 2025

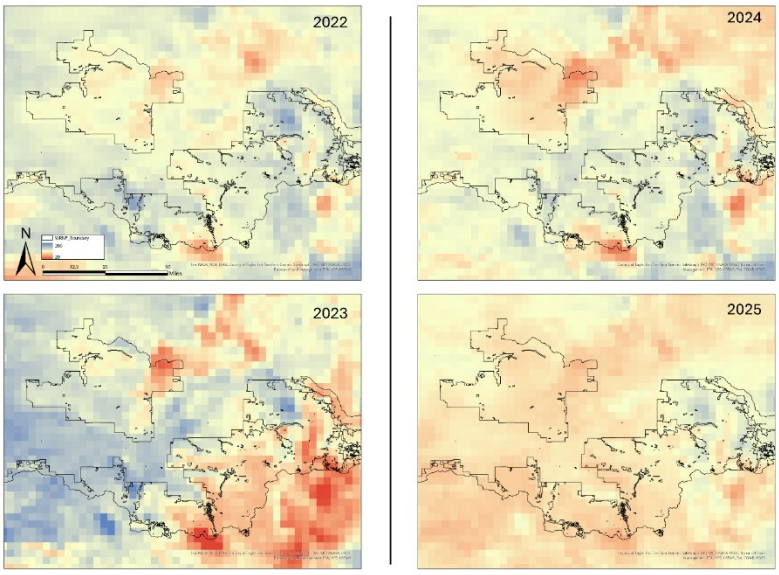


Figure 39. GridMET 4km water year precipitation in the White River region (2022 – present) as percentage of 1991-2020 average (dark red=20% and dark blue=200%)

Temperature

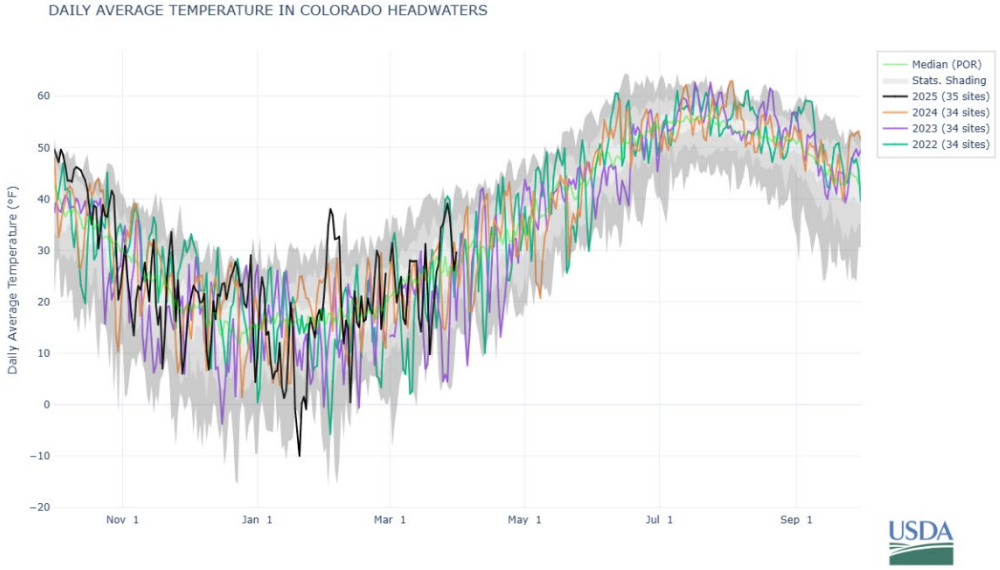


Figure 40. 2022-2025 average daily temperatures compared to period of record (1986-2025) percentiles and median of Colorado Headwater basin SNOTEL sites

From 1980 to 2024, the mean daily temperature in the Colorado headwaters basin was approximately 27 degrees Fahrenheit (GridMET data). Years 2021, 2022 and 2024 showed increased daily temperature averages compared to the 44-year average while 2023 had the lowest average daily temperature since 1980 (Figure 40). The lower temperatures coupled with the higher precipitation levels contributed to the drought relief during the 2023 water year. A running ten-year average shows a general increase in average daily temperatures in the region from 1980 to 2024 (Figure 41)

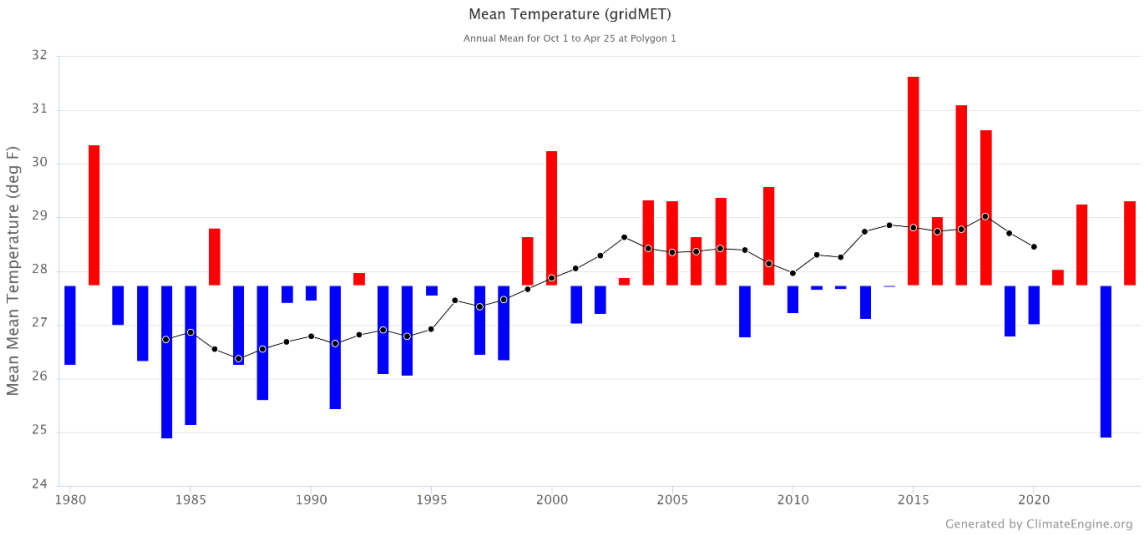


Figure 41. Annual mean daily temperature deviation from 1980-2024 average with running ten-year average (black line)

Monitoring Results, Discussion and Findings

Water year 2022 had the lowest cumulative precipitation and total SWE compared to 2023 and 2024. This was also evident in the drought monitor index, showing the majority of the Upper Colorado River Basin experiencing severe drought (Figure 42). Water year 2023 provided consistent above median precipitation and a long snow accumulation period which helped buffer the severe drought from 2021-2022. The GridMET data suggested that while some of the higher elevation regions in the Upper Colorado River Basin experienced less than average precipitation during 2023, lower elevations had significantly above average precipitation (Figure 39), combined with cooler temperatures, this appeared to sustain higher flow volumes and offer drought relief. To date, water year 2025 is warmer than average and as of April 15th, will have the earliest and fastest melt off in the past 5 years with comparable snow accumulation to 2021-2022. This snow accumulation and melt data suggests the Upper Colorado River Basin and WRNF are trending toward severe drought conditions in 2025.

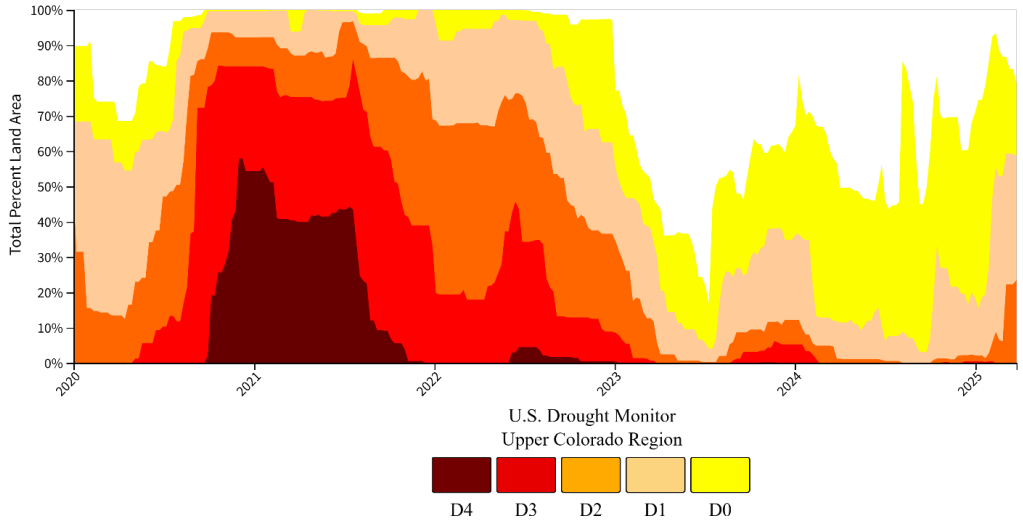


Figure 42. U.S. Drought monitor estimates in Upper Colorado River Basin from 2020 – present. (D0 = Abnormally Dry, D1 = Moderate Drought, D2 = Severe Drought, D3 = Extreme Drought and D4 = Exceptional Drought)

Compared to 20 years ago, peak SWE and complete melt-off (no snow-covered ground) occurs earlier seasonally, largely because of long-term increasing temperature trends. This means snowmelt leaves high elevation systems (> 9,000 feet) earlier and faster, changing flow magnitude and timing and stream temperature regimes. High elevation ecosystems which rely on seasonal temperatures and sustained flows will have lower summertime flow and warmer stream temperatures. In addition to changing snowmelt timing, warmer temperatures increase evapotranspiration and cause more precipitation to fall as rain. Changing flow regimes pose risk to infrastructure like bridges, culverts, roads and dams while increased evapotranspiration poses risk to water resources for irrigation, municipalities and watershed health. These observations continue to prove as long-term uncertainties for snow dominated systems. Figure 43 below, shows snow accumulation and snowmelt timing from 2022 -2024 compared to discharge timing in the Roaring Fork River at Glenwood Springs (a significant tributary to the Colorado headwater basin in WRNF). The later 2023 snow melt sustained higher flows into the summer months while the earlier snow melt of 2022 caused earlier low flow conditions. 2023 and 2024 had larger than median snowpack and peak flows, the falling limb of the hydrograph in 2023 is substantially less steep than 2024, which further illustrates the sustained flow volumes caused by slower melt rates. Given current snowpack conditions in the Upper Colorado River Basin, it is likely that river discharge will peak seasonally early with lower than median peak flow volumes. This will likely lead to low flow conditions earlier in the summer, exacerbated drought conditions later in the season and possibly an early and prolonged fire season.

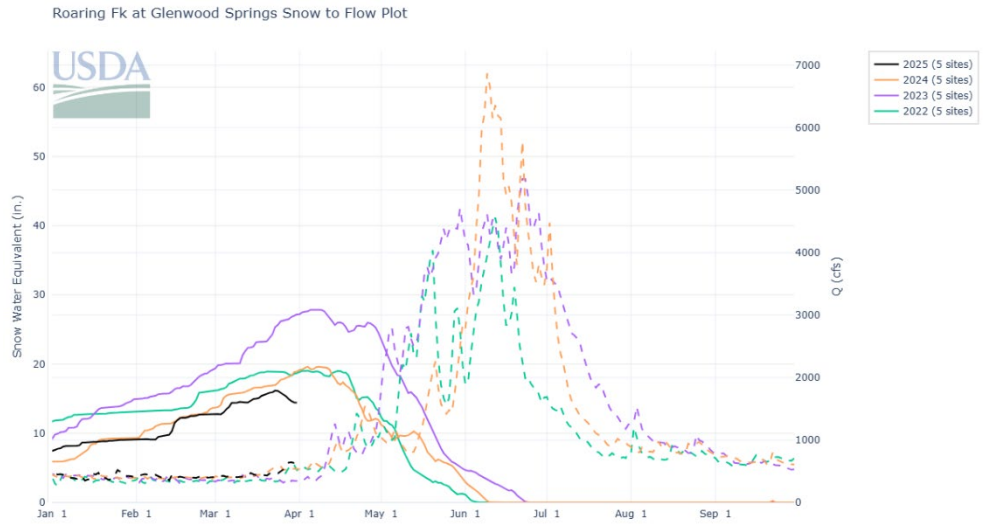


Figure 43. 2022 – 2025 water year SWE accumulation in the Roaring Fork watershed and corresponding discharge volumes of the Roaring Fork River

Adaptive Management Considerations
These precipitation and temperature datasets are collected continuously and reported over various spatial and time scales. Although forest management activities will typically not have a direct and measurable influence on regional precipitation and temperature measurements, the trends described can provide a context for evaluating other monitoring results and trends on the forest. The historical precipitation and temperature data show implications of future conditions for land and resource management within WRNF which directly influence water availability, drought, wildfire and recreation. Current fire and fuels programs typically incorporate these types of data into decisions for upcoming fire seasons and direct fuels treatment actions on the ground. No adaptive changes to the Forest Plan or this monitoring are anticipated.

VII. Progress toward meeting Forest Plan desired conditions and objectives

Monitoring Item 7.1: Economic Contributions from Specific Programs

Monitoring Question and Background

- What are the contributions from the range, timber, recreation, and minerals programs to the National Forest?

Forest Plan Ref./ Driver	Indicators	Data Sources/ Protocols/ Partners	Freq. of a) data collection and b) reporting	Targets, Thresholds
Goal 5, Objective 5a "Work cooperatively with individuals and organizations, local, state, tribal, and federal governments to promote ecological, economic, and social health and sustainability across landscapes."	**Indicator 1:** Range, timber, recreation, and minerals contributions to local employment and income	IMPLAN	a) Annually; b) 2 years (recommended 5 years to align with NVUM report)	Maintain economic contributions

National Forests and Grasslands provide multiple benefits to the American people and to local communities. They provide clean air and water, preserve cultural resources, and conserve lands for the enjoyment of present and future generations. They also support local economies through recreation, timber, energy, minerals, and livestock grazing. In addition, counties with National Forests or

grasslands receive funds to support schools, road maintenance, and stewardship projects. The Forest Service also invests in such things as the construction and maintenance of infrastructure, environmental restoration, and forest health, in addition to providing salaries to its employees and contractors.

The economic contributions from the WRNF have a wide geographic reach (Fig 58). For the purpose of this analysis, the "economic area of influence" includes the following 32 counties: Adams, Arapahoe, Boulder, Broomfield, Chaffee, Clear Creek, Delta, Denver, Douglas, Eagle, Fremont, Garfield, Gilpin, Grand, Gunnison, Jackson, Jefferson, Lake, Larimer, Mesa, Moffat, Montrose, Park, Pitkin, Rio Blanco, Routt, Saguache, Summit, Teller, and Weld Counties in Colorado; and Grand and Uintah Counties in Utah. The counties selected to form the WRNF's economic area of influence were chosen based on where Forest Service management decisions have a direct effect on economic activity. The map in Fig. 1 shows where Forest Service-related direct expenditures occur, including recreation and wildlife visitor spending, the location of grazing permit holders, the location of logging and restoration firms, mills processing Forest Service wood products, the counties receiving returns to states funds and payments in lieu of taxes, the location of Forest Service budget expenditures, and the salary spending by Forest Service employees.

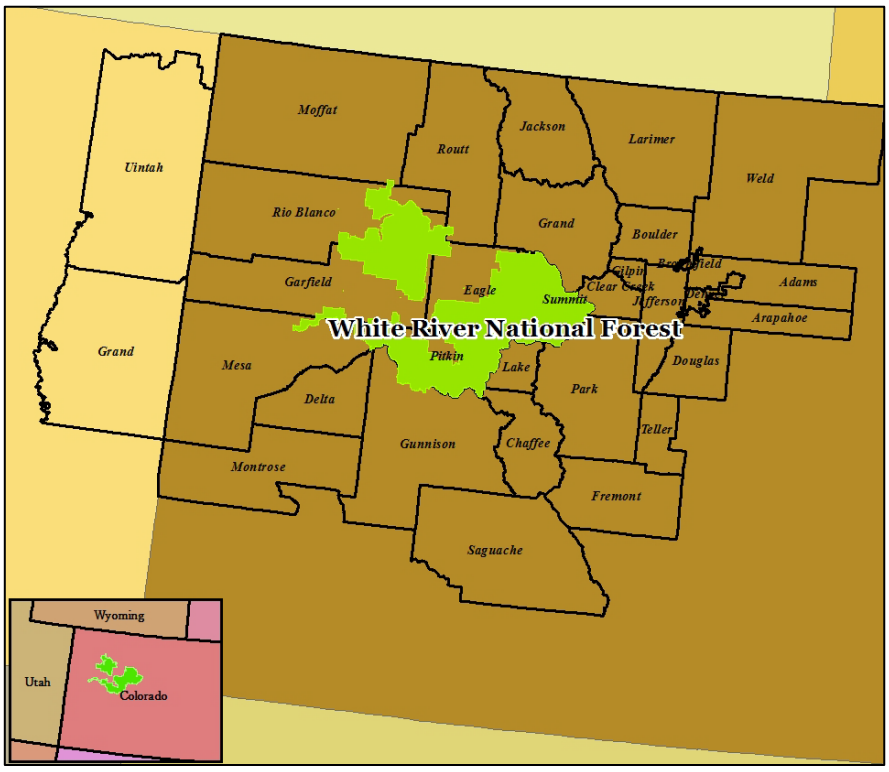


Figure 44. Counties in Colorado and Utah that comprise the "Economic Area of Influence" of the White River NF for the purposes of this analysis.

Monitoring Results, Discussion and Findings

Results for two-year periods will not capture economic contributions in their entirety due to the mismatch in reporting cycle of recreation visitation. The National Visitor Use Monitoring (NVUM) program, which supplies recreation visitation data, samples every National Forest on a five-year cycle. The WRNF was sampled in 2017 and again in 2022. Not until 2027 will "fresh" recreation data be available again. Given that the WRNF is one of the most highly visited Forests in the nation and that recreation spending plays an outsized role in supporting local jobs and labor income, biennial reporting of IMPLAN estimates will frequently miss a key component of the Forest's overall economic contributions. A robust economic activity report will be completed in 2028 using 2027 NVUM data to align with the same five-year timeframe as recreational visitors use data within the WRNF monitoring program. Biennial reports will include data points for other IMPLAN inputs as they are available.

Contributions to Local Jobs

Jobs supported by National Forests and Grasslands are often in small, rural communities and therefore make an important contribution to economic and social sustainability. Employment is the estimate of average annual full-time, part-time, temporary, and seasonal jobs. “Direct” job contributions come from economic activity immediately associated with a Forest Service program. “Secondary” job contributions are the ripples in the labor pool that are stimulated by the direct economic activity—for instance, hiring by firms that support the programs indirectly, or hiring that is enabled by workers spending their earnings on goods and services in the local area. Total job contributions are the sum of direct and secondary contributions. Local job contribution data will be assessed in 2027 in alignment with NVUM reporting.

Contributions to Labor Income

Labor income is the value of wages, salaries, and benefits for wage earners plus income to local business owners. This includes direct, secondary, and total labor income supported by WRNF programs. Labor income contribution data will be assessed in 2027 in alignment with NVUM reporting.

Economic Inputs from the White River

Management decisions by the Forest Service aren’t the sole or even major determinant of the "economic contributions". Final economic contribution values are heavily affected by actual use of natural resources from the Forest (i.e., demand) and other local, national, and global economic conditions (e.g., prices, trade patterns, population change, etc.) that are beyond the scope of Forest Service control. The sphere of influence is limited to the supply of certain material inputs through Forest planning and budget allocations.

A more appropriate data set for tracking the Forest Service’s influence on the economic sustainability of the region over time is the collective *program outputs* that serve as the raw data for the IMPLAN model. Number of visitors, barrels of oil, volume of Forest products, dollars spent on Forest Service salaries, etc. – these indicators are more directly under the control of the Forest Service and can be compared year by year to track our changing contributions to the local economy.

Program outputs that are used to estimate the tie between management actions and economic activity in communities in and around the White River National Forest are listed below. Where possible, data are presented for 2016, 2018, 2020, 2022 and 2024.

Recreation

Recreation visitation data is collected through NVUM every 5 years. The next cycle of data is planned for 2027. No recreation visitation data is available for 2024 monitoring.

Minerals and Energy

Mineral and energy outputs are tracked through DOI Office of Natural Resources Revenue. The primary minerals and energy resources produced by the WRNF are crude oil, natural gas, and natural gas liquids. These products are mostly produced on the Aspn-Sopris and Rifle Ranger Districts. Production of each of these three resources has fluctuate with local and national market supply needs. Data for this resource will be assessed in 2027 in conjunction with NVUM reporting.

Forest Products

Softwood sawtimber harvest volumes vary widely from year to year, with 2022 being an exceptionally high year for timber volume removed due to task orders within the long-term stewardship contract nearing termination and the contractor increasing capacity in order to meet termination timelines. There is no hardwood harvesting on the WRNF. The fuelwood volumes reported here are not included in the economic contribution values because the firewood is gathered for personal (not commercial) use. The material in the "All Other" category, consists mostly of biomass Forest products utilized by the bioenergy plant in Gypsum, Colorado. Biomass feedstock grew steadily from 2016-2023 due to annual awards of long-term stewardship task orders. The bioenergy plant in Gypsum, Colorado shut down in April or 2024. The bioenergy plant was the sole source of biomass utilization coming off the forest.

Table 14. Volume of Forest products harvested on the WRNF in alternating years between 2016 and 2024.

Type of Forest Product	2016	2018	2020	2022	2024
Softwood Sawtimber (Hundred Cubic Feet, CCF)	10,107	8,706	1,767	27,146	13,034
Softwood Pulp (CCF)	-	-	-	-	
Hardwood Sawtimber (CCF)	-	-	-	-	
Hardwood Pulp (CCF)	-	-	-	-	
Posts & Poles (CCF)	1,447	2,468	980	6	102
Fuelwood (CCF)	2,301	2,715	1,718	1,769	1,620
All Other (CCF)	5,095	15,398	22,178	23,270	13,034
TOTAL	**18,950**	**29,287**	**26,643**	**52,191**	**27,790**

Source: US Forest Service, Forest Products Cut and Sold Report (CUTS203f)

Livestock Grazing

Table 15. Livestock grazing values in "Animal Unit Months" (AUMs) for the WRNF in alternative years between 2016 and 2024.

Livestock	2016	2018	2020	2022	2024
Cattle and Horses (AUMs)	67,511	76,181	66,325	73,144	71,495
Sheep and Goats (AUMs)	27,833	31,608	27,813	29,667	30,208
Total AUMs	**95,344**	**107,789**	**94,138**	**102,811**	**101,703**

Source: US Forest Service Rangeland Management Report (RNGR310P)

Grazing on the WRNF has seen some minor fluctuations and the number of cattle and horses grazing on the Forest as measured in Animal Unit Months (a standard unit referring to the forage necessary to sustain a 1000-pound animal for one month) averages around 100,000 AUMs in the biennial reporting period.

Forest Service Expenditures

Table 16. Expenditures by the White River National Forest on Salary and Non-Salary in alternating years between 2016 and 2022. Reported in units of 1000s of USD.

Expenditure	2016	2018	2020	2022	2024
Forest Service – Salary ($1000s)	$12,608.97	$11,987.41	$12,113.86	$11,555.84	$19,817
Forest Service – Non-Salary ($1000s)	$9,990	$19,838	$32,369	$11,631	$3,181
Total	**$22,599**	**$31,826**	**$44,483**	**$23,187**	**$22,997**

Source: Administrative Officer, Courtney Murray.

Table 17. Number of Full Time Employees (FTEs) in service to the WRNF in alternating years between 2016 and 2022.

Workforce	2016	2018	2020	2022	2024
Permanent Full Time Employees (FTEs)	106	103	120	120	189
Other than Permanent FTEs	112	117	44	31	22
Total FTEs	**218**	**220**	**164**	**151**	**212**

Source: FMMI Regional Payroll Summary Report, "FTEs by HR Org Code"

Total expenditures by the WRNF have fluctuated over the last eight years with a sharp rise in 2018 and 2020, and a return to near 2016 levels in 2022. In 2024, salary expenditures increased with the relevant increase in hiring and permanent staff on the payroll. Also, in a change in accounting, most base salaries for the forest are being tracked at the regional level, and not the forest level. Non-salary spending in 2024 was the lowest since 2016. Lower budget allocations on the forest are usually made up with external partner contributions which are not accounted for in Table 17.

The number of Permanent Full Time Employees (FTEs) grew by 57% since 2022 due to an influx of BIL and IRA monies appropriated by congress, and, also due to conversion of seasonal employees to permanent status, “Other than Permanent” FTEs decreased by 41% since 2022, most likely to the conversion of temporary employees to permanent status. Other factors are the difficulty in recruiting employees due to lack of government housing, high cost of living and low unemployment in communities on the forest.

Payments to States and Counties

The Secure Rural Schools program provides critical funding for schools, roads, and other municipal services to more than 700 counties across the U.S. and Puerto Rico; however, 73 counties have elected not to receive Secure Rural Schools payments and instead to receive 1908 Act (amended) 25% payments, in which 25% of gross receipts generated on Forest Service lands during the fiscal year are distributed to counties. The White River contains both kinds of counties, and so disburses both types of payments annually. (See the Secure Rural Schools Payments page for more information on the two types of payments and the selection process).

No mineral royalty data for 2024 was available at the time of this report, but in previous years, all segments of Payments to States and Counties have increased over time.

Table 18. Payments to States and Counties by the WRNF since 2016.

	2016	2019[1]	2020	2022	2024
Payments to Counties: Total Secure Rural Schools Act (SRS) and 25% Fund Payments ($1000s)	$30	*N/A*	$1,997.07	$2,126.55	$2803.30
Minerals Royalties	$0	*N/A*	$15.51	$63.92	unknown
Payments in Lieu of Taxes (PILT)	$4,859	*N/A*	$5,249	$5,496	$6,183
Total Payments to States and Counties	**$4,889**	**$7,155**	**$7,262**	**$7,623**	**$8,986.30**

Sources: Secure Rural Schools Program; Office of Natural Resources Revenue; DOI Payment in Lieu of Taxes Website

Adaptive Management Considerations At this time, there are no adaptive management considerations to consider for economic contributions to WRNF.

Monitoring Item 7.2: Heritage Program

Monitoring Question and Background

- To what extent have management activities on the Forest complied with Section 110 of the National Historic Preservation Act and provided quality heritage recreational experiences?

Forest Plan Ref./ Driver	Indicators	Data Sources/ Protocols/ Partners	Freq. of a) data collection and b) reporting	Targets, Thresholds
Heritage Program Standard 1: Conduct all land management activities in such a manner as to comply with all applicable federal, state and local regulations. Many heritage resources values can be protected effectively through application of the provisions of these regulations:	**Indicator 1:** Number of heritage stewardship actions taken, including preservation, stabilization, research, interpretation, partnerships, volunteer opportunities, and other forms of public outreach.	National Resource Manager Database, Heritage Program reports	a) Annually; b) 10 years.	45 total points from Heritage Program Managed to Standard targets is the annual target for Forests.

[1] When this report was being compiled, data were not immediately available for 2018, so 2019 data were included instead. However, only the Total value for 2019 was readily available, not the line-by-line breakdown.

Monitoring Results

Table 19. Heritage Program Managed to Standard Target Accomplishments.

FY22-24 WRNF Heritage Program Managed to Standard Target Accomplishments				
Measures	**2022 Max Points**	**YTD Points**	**2024 Max Points**	**Description**
Heritage Program Planning	10 total		10 total	
Heritage Program Plan	10	0	2	Comprehensive Plan – all categories
Cultural Resource Overview	2	0	2	Synthesis of WRNF known cultural resources
Predictive Model	2	0	2	Site probability model
Monitoring Plan	1	1	1	Current
NAGPRA Protocol	1	0	1	Legacy plan – needs update
Looting & Vandalism Protocol	1	0	1	Legacy plan – needs update
Emergency Response Protocol	1	0	1	Legacy plan – needs update
Field Survey	10	0	10	1 pt per 20 acres up to 200 acres total
Legacy Evaluations/Nominations	10	10	10	0.5 pt per NRHP evaluation 10 pts per nom
Condition Assessment on PHAs	10	2	10	1 pt per current (5 yrs.) condition assessment
Stewardship Activities	10	0	10	2.5 pts per Stewardship project
Study/Public Use	10	10	10	2 pts per outreach project
Volunteers	10	10	10	0.025 pt per volunteer hours. 400 hrs+ = 10pts
Yearly Total Target	70		70	
Totals		33		

Monitoring Discussion and Findings

The Heritage Program Plan has stalled given the lack of Heritage Program Manager the entire 2024 fiscal year to work on the effort as well as other program objectives. No Section 110 field survey was completed due to only having 1 full time person in the Heritage Department.

Adaptive Management Considerations

There has been an emphasis on completing Section 106 compliance in the WRNF Heritage Department for years, Section 110 work has been on the back burner while forest project work comes first. Most of our Heritage Program Managed to Standard targets have been met by our partner's contributions - Aspen Historic Society, Breckenridge History, Vail Resorts (Keystone), and Walking Mountains Science Center.

Limited to one functioning GS-9 archeologist on the forest, little work was done except priority project work related to fuels, lands, recreation and timber projects. The White River has had 3rd party applicants rely exclusively on 3rd party contractors like Metcalf and Alpine archeology to conduct surveys and report writing on behalf of the forest.

Adaptive Management Considerations were limited due to lack of funding. But there are options such as using the Enterprise team for completing measures, as they have been working on a Predictive Model for the WRNF without a cost to us, or having volunteers assist us with PIT projects like survey work.

Item 7.3 - Travel Management Implementation

Monitoring Question and Background

- What are the status and trends of roads and trails on WRNF*?*

Forest Plan Ref./ Driver	Indicators	Data Sources, Protocols, Partners	Freq. of a) data collection and b) reporting	Desired Conditions, Targets, Thresholds
Goal 4, Objective 4a **2011 Travel Management Plan**	Miles of Roads Managed to Standard, Miles of Trails Managed to Standard, Miles of Routes (Roads/Trails) Decommissioned, Number of Kiosks and Information Panels installed	USFS Infrastructure (INFRA) database	a) Annually; b) 2 years.	14 miles of road decommissioned per year Number of miles of trails maintained to USFS standard

Monitoring Results

Since the signed record of decision of the 2011 Travel Management Plan (TMP), WRNF recreation staff has been implementing management actions in accordance with decisions related to motorized and non-motorized trails and recreation visitors for both summer and winter seasons. The 2011 TMP Record of Decision requires a substantial amount of planning and coordination every year between WRNF staff, public and private organizations, volunteer and partner organizations, as well as state and local government agencies. Every year the forest completes updates, produces and makes available to the public Motor Vehicle Use Maps (MVUM's) for both summer and winter seasons.

Roads

Forest Service classifies maintenance of National Forest System roads by five levels: 1, 2, 3, 4, and 5. Maintenance level 1 roads are closed to motor vehicle use. Maintenance level 2 roads are maintained for high-clearance vehicles. Maintenance level 3, 4, and 5 roads are maintained for passage by standard passenger cars during the normal season of use. The status and trend of roads within the WRNF is summarized in Table 18. These data were prepared from the natural resource manager (NRM) corporate database's road accomplishment reporting (RAR) module. The quantity of system road miles in the WRNF NRM report differs greatly from the quantity of system road miles shown in 2011 TMP (Table 19). This large difference in mileage is because the total mileage of system roads identified the 2011 TMP as "decommissioned", or "not needed" is not included in the TMP road mileage. WRNF Engineering staff have worked with the USFS enterprise team through an agreement and other resource specialists to make the proper corrections to our databases. Current figures will serve as a baseline for future biennial reporting until such time when all the database errors have been corrected.

The TMP identified 1,551 miles of system and non-system roads for decommissioning, and a target of 14 miles of road decommissioned each year. Figure 38 shows miles of road decommissioned each year versus the target. Figure 38 was populated with a variety of reports, ranging from force account to recreation staff cooperative agreement accomplishments, and contract reports. Since the March 2011 Record of Decision for the TMP, and through 2024, approximately 254 miles of road have been physically closed and decommissioned with heavy equipment. Another approximate 14 miles are anticipated to be completed in 2025. This totals approximately sixteen percent of the decommissioning identified in the TMP. A substantial portion, perhaps one-third or more, of the remaining identified road decommissioning mileage has become effectively closed to traffic and become stabilized through natural processes. This will remain a rough estimate until project level planning efforts are able to identify decommissioning treatments needed for specific roads.

Table 20. WRNF roads by maintenance level operated at or above plan objectives, 2024 report.

Objective Maintenance Level	Mileage Operated Above Objective	Mileage Operated Equal To Objective	Mileage Operated Below Objective	Total System Miles	% of Mileage Operated At Or Above Objective
5	0.0000	15.9010	1.5840	17.4850	90.9
4	0.0000	42.7930	39.0700	81.8630	52.3
3	0.3490	315.9642	75.9720	392.2852	80.6
2	28.4100	1,255.0863	23.3040	1,306.8003	98.2
1	55.1150	268.0860	0.0000	323.2010	100.0
C	12.7070	0.0000	0.0000	12.7070	100.0
D	9.0240	0.0000	0.0000	9.0240	100.0
Total:	**105.6050**	**1,897.8305**	**139.9300**	**2,143.3655**	**93.5**

Table 21. 2011 TMP data and 2015 Subpart A report.

Roads	Miles
Maintenance Level 5	14
Maintenance Level 4	48
Maintenance Level 3	325
Maintenance Level 2	1,029
Maintenance Level 1	4
Total System Roads	1,420

Figure 45. Miles of road decommissioned 2008-2017.

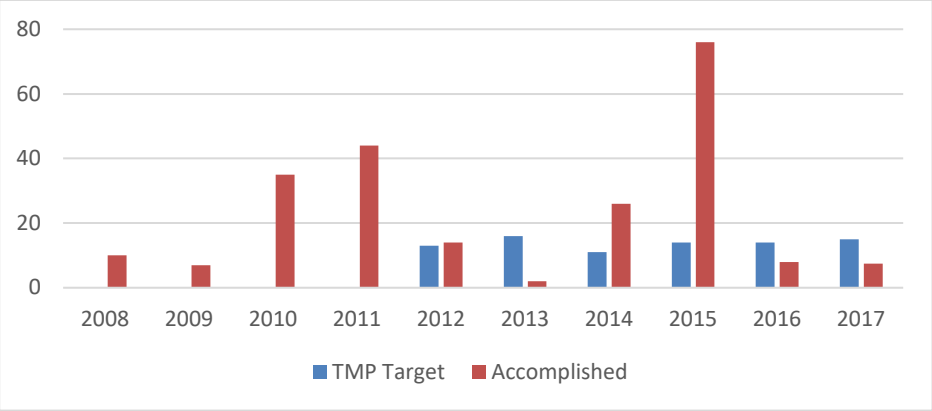
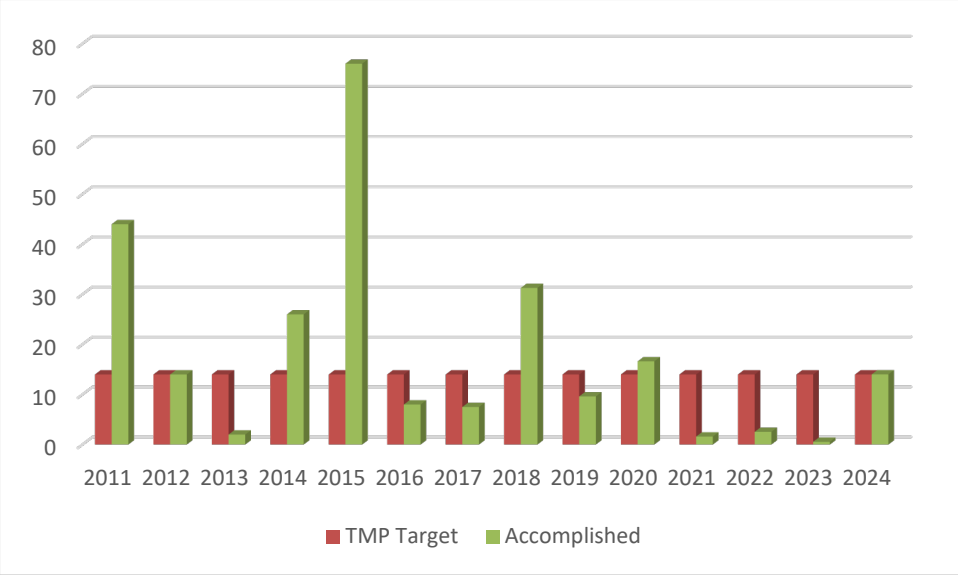


Figure 46. Miles of road decommissioned 2011-2024.



In summary, while there is significant variation in miles decommissioned each year based on available funding and priorities, the WRNF has been averaging above target (approximately 18.12 miles annually) since beginning implementation of the 2011 TMP Record of Decision.

Trails

The TMP Implementation Plan identified management actions related to Recreation and Trails under four separate emphasis areas: Education, Enforcement, Engineering, and Evaluation (addressed within Monitoring Discussion and Findings). All trails designated through the TMP are to be maintained to standard, routes not designated will be decommissioned. The WRNF made Travel Management Implementation a priority for 5 years and continues to earmark funding for education, informational and regulatory signing across the forest.

- Education - As part of the education and information component of the TMP, the WRNF sign program has been an integral part of getting travel and access information out to forest visitors. Over the years, various Forest Sign Programs have worked to provide consistent and high-quality signage across the forest and from 2006-2010 the forest installed kiosks at

approximately 80 locations. As part of the TMP decision, the forest identified additional locations for kiosks across the forest that would house TMP information for roads and trails. As part of that effort, the forest entered into an agreement in 2012 with Colorado Corrections Industry (CCI), in Buena Vista to construct kiosks. From 2011 thru 2024 the forest installed kiosks at approximately 213 locations across the forest. Currently, the forest has completed approximately 91% of the originally planned 233 kiosk locations. Planned kiosk and sign locations includes TMP "Portals", Ranger Districts, trailheads and campgrounds. WRNF recreation continues to work with the USFS Enterprise Team for the design and production of trailhead sign panels in accordance with our sign and kiosk plan.

- Enforcement - Enforcement has been underway from the beginning; however, information and education were the focus for the first 3 years. A key part of enforcement was the production and distribution of the MVUM's. MVUM's have been available and free to the public since 2012. On average the WRNF spends $16,000 + a year to print MVUM's.

- Engineering - The TMP identified 2,608 miles of system trails on WRNF. As of 2017, all system routes have been signed and continue to be maintained in accordance with USFS signing standards. Sign procurement on the WRNF has been supplemented $7,500 each year from "Stay the Trail Colorado" which is funded from Colorado Parks and Wildlife. The Forest currently has 3 "Good Management" OHV Crews that are also funded by CPW through the States OHV sticker fund. These OHV crews play a key role in providing public information, planning, management, and maintenance for motorized routes on WRNF.

Monitoring Discussion and Findings

On average, the WRNF is assigned and has met the following trails accomplishments/targets each year. "Trails maintained to standard" =478 miles; and "Trails Improved to Standard" = 12 miles. Non-system trails continue to be decommissioned or closed as recreation staff comes upon unauthorized trails.

WRNF continues to focus maintenance on existing system trails that are important for access and key to our community's sense of place. Trails have been a priority on the forest for decades as the forest is home to some of Colorado's premier destination resorts. Trails serve as a key component that offer's visitors high quality recreation opportunities in a world class setting. Visitation continues to increase as well as increased stewardship and volunteerism. Trail maintenance on WRNF is and has been predominately done with youth corps, partner, non-profit and volunteer organizations. WRNF recreation continues to work on validating and ground truthing trail data so we can provide the public with the most accurate and current data so visitors can interface this information with their phones or handheld devices.

Adaptive Management Considerations

There are no changes recommended to the monitoring program or to forest plan direction at this time.

Monitoring Item 7.4 - Wilderness

Monitoring Question and Background

- What are the status and trends of the Wilderness Stewardship Performance elements?

Forest Plan Ref./ Driver	Indicators	Data Sources/ Protocols/ Partners	Freq. of a) data collection and b) reporting	Targets, Thresholds
Goal 2, Objective 2b	Wilderness Stewardship Performance (WSP) Elements	*NRM- "WSP Accomplishment Report Summary" (12.7.2023)*	A) Annual B) Annual	Target: 5-point increase per selected element each year in every wilderness until all meet or are above "Standard Performance level = 60-69 points".

Wilderness Stewardship Performance (WSP) is a framework to track how well the USFS is meeting our primary responsibility under the Wilderness Act—which is to preserve wilderness character. This new performance allows the flexibility in the selection of individual elements for each wilderness area to reflect local wilderness stewardship priorities, while also correcting other long-acknowledged short-coming. It seeks to foster improved integration and communication between program areas, to accurately reflect the collaboration required to steward our wilderness resources. Wilderness Stewardship Performance will track the number of wildernesses meeting baseline performance for preserving wilderness character. For complete information on WSP: https://www.wilderness.net/NWPS/documents/FS/WSP-Guidebook_v2017.2.pdf

Ten elements are selected for each wilderness and will be reported upon annually. The WRNF convened several full interdisciplinary team (IDT) meetings to select six elements that matched local stewardship priorities for each wilderness. There are four mandatory elements: Agency Management Actions, Workforce Capacity, Education, and Wilderness Character Baseline. A wilderness scoring 60 points or higher equates to "Wilderness meeting baseline performance for preserving wilderness character". Scoring and deliverables is unique to each element.

Wilderness Character Monitoring (WCM): The framework for WCM is woven into the overall format of the new performance measure and is also included as a stand-alone required element.

Monitoring Results

No monitoring results are available. Staffing shortages and deferred resignations in 2025 has impacted the agency's ability to analyze this monitoring question. This monitoring question will be re-assessed in 2026.

Monitoring Discussion and Findings

No discussion due to staffing shortages and expertise.

Adaptive Management Considerations

There are no changes recommended to the monitoring program or to Forest Plan direction at this time.

Monitoring Item 7.5 - Status of Bare Ground Recovery

Monitoring Question and Background

- Are management projects designed to address ground disturbing management activities meeting the direction to "…maintain or improve levels of soil organic matter on all lands" through bare ground rehabilitation projects?

Forest Plan Ref./ Driver	Indicators	Data Sources/ Protocols/ Partners	Freq. of a) data collection and b) reporting	Targets, Thresholds
Goal 2; "Multiple Benefits to People", Objective 2c "Improve the capability of National Forests and rangelands to sustain desired uses, values, products, and services."	Field/ground-truthed soil organic matter transects coupled with a comparison of time-stamped, remotely-sensed data of bare ground rehabilitation areas prior to and following mitigation.	Soil Organic Matter transects Remote sensing products, i.e. Climate Engine	a) Annually; b) 2 years.	14 miles of road decommissioned per year

Monitoring Results, Discussion and Findings

Bare ground, vegetation percentage cover, and effective ground cover data has been collected for recent ground disturbing activities at all ski areas across the Forest. Ground disturbing activities include new terrain development, lift replacement, general maintenance, this data has been utilized to assess after implementation revegetation success to determine if projects are maintaining or improving levels of surface cover and soil organic matter. Results of revegetation success vary across resorts and resultant from different methods used including: initial revegetation planning, types and application rates of soil amendments used, type of surface erosion control devices used, timing of implementation, post-implementation follow up, and monitoring. Post construction ground disturbance transects have been collected from all resorts on the WRNF. Monitoring has shown a variability in success at meeting effective ground cover guidelines. Post-construction revegetation monitoring has found revegetation not meeting, meeting, and exceeding effective minimum ground cover guidelines at monitoring sites across ski areas on the WRNF.

Bare ground on timber projects have been observed to be on landings, multiple pass skid trails and temporary roads that have not been closed – these bare ground areas do not exceed 15% of the project areas, but efforts to rehabilitate the bare ground remain active. There was no quantitative analysis to determine total bare ground on WRNF, but it is known to exist in more actively managed project areas. Adherence to design criteria and best management practices should keep soil erosion and bare ground to minimal levels that fall within tolerances for acceptable loss.

Adaptive Management Considerations

Where ground disturbing activities at ski resorts are to occur, conduct soil fertility and organic matter content laboratory sampling as part of the revegetation planning process. Continue monitoring to track success of revegetation and methods used by either Forest Service staff or consultants.
There are no changes recommended to the timber monitoring program or to forest plan direction at this time.

VIII. Status of land productivity (soils)

Monitoring Item 8.1 - Soil Productivity Monitoring

Monitoring Question and Background

- What are the status and trends of soil productivity?

Forest Plan Ref./ Driver	Indicators	Data Sources/ Protocols/ Partners	Freq. of a) data collection and b) reporting	Target or Threshold
Goal 2; Objective 2c	Type, degree, and extent of soil disturbances to determine effects on soil productivity and hydrologic function.	National Forest Soil Disturbance Monitoring Protocol; Results from best management practices reviews in timber, recreation, roads, range, etc.	a) Annually; b) 2 years.	Extent of detrimental soil disturbance must be less than 15% of activity area

Monitoring Results, Discussion and Findings

Soil disturbance monitoring guidelines provide reliable monitoring methods that are repeatable and used to evaluate soil conditions across the forest. These methods should be regularly reviewed to ensure adaptive management considerations are met. These evaluations are used to identify detrimental compaction, displacement, puddling, erosion, effective ground cover, and overall soil quality as well as identifying and predicting soils that are susceptible to disturbances. Continued monitoring also identifies project sites with significant disturbance needing restoration to reestablish soil productivity. Finally, continued monitoring of sites where soil restoration has occurred, will improve continued decision making for future monitoring and restoration.

Timber

A variety of timber projects were implemented throughout the forest between the years 2023-2024 on WRNF. They include salvage, sales, ski area settlement, fuelwood, and fuel reduction. Some of these timber projects had little to no impact on the soil resource due to helicopter logging on ski resorts or winter/over the snow harvest operations.

Conventional timber treatments can leave some compaction, displacement, and removal of ground cover, and increased potential for erosion. However, the area of the designated landings, skid trails and travel routes for each of the timber sales do not reach greater than 15% of the activity area. These effects to soils are short-term because they are mitigated through restoration activities such as de-compaction, lopping and scattering, as well as slash and seeding. Other timber projects include salvage treatments from mountain beetle-killed trees and hand treatments which do not cause much ground disturbance nor effect to soil productivity. Overall, the timber harvest activities during the monitoring period did not substantially and permanently impair the productivity of the lands on WRNF.

Ski Resorts

WRNF has eleven ski areas that are developed and operated by the private sector to provide opportunities for intensively managed outdoor recreation activities during all seasons of the year. Construction activities to build facilities, summer use recreation, and winter recreation infrastructure has occurred at ski resorts on WRNF between the years of 2023-2024. Ground disturbance occurs in a

greater scale with ski area development through activities such as vegetation clearing, tree removal and grading which results in temporary and permanent impairment of the productivity of soils. Implementation of soil management requirements and project design criteria minimalizes erosion and loss of soil organic material from ski area projects. The footprint from past management activities on the ski areas does exist, as there is an array of unintentional bare ground still remaining. As new intentional bare ground is being created, mitigation of existing bare ground would occur through revegetation and rehabilitation. Soil productivity in the Management Area 8.25 (Ski areas) is maintained through following project design criteria and Forest Service Handbook direction.

Other Management Activities

Range developments and livestock grazing has continued to occur through the years of 2023-2024, however, no additional projects are currently proposed. Impacts from livestock grazing to soils has been minimal due to the spread out impacts that livestock have on the landscape, however, when there are impacts local to streams and waterbodies, there have been documented instances where soil erosion has occurred rapidly.

Oil and gas developments and its impacts on soil has not been monitored during the monitoring period.

Adaptive Management Considerations

There are no changes recommended to the monitoring program or to forest plan direction at this time.

Conclusion

Progressing trends

The following monitoring items and associated resources have been determined to be progressing and/or trending toward Forest Plan targets.

1.1: Watershed Condition Framework
1.3: National Best Management Practices Program
2.1: Air Quality
2.2: Forest and Grassland Health
2.3: Ecosystem Health
3.2: Red Squirrel
3.4: Avian Species
5.2: Special Uses Administration
5.3: Sustaining Recreation Infrastructure
7.3: Travel Management Implementation
7.5: Management Activity Bare Ground Recovery
8.1: Soil Productivity Monitoring

Uncertain trends

The following monitoring items and associated resources have uncertainties in progressing and/or trending toward Forest Plan targets.

1.2: Watershed Condition Class
Watershed Condition Framework (WCF) data are updated every six years and are a snapshot of the watershed condition at that time; they are not a particularly sensitive baseline comparison. WCF metrics may need to be updated annually to better track numeric or categorical changes in each watershed to better determine that non-priority watersheds are in a maintained or improving watershed condition class.

3.1: Macro-invertebrates
Using analysis of random samples suggests that management practices are maintaining stream health. The random sampling methods may not capture local impacts or trends.

6.1: Snowpack and Precipitation
Snow Water Equivalent: More time/data is needed to understand status or progress of the plan component.

7.2: Heritage Program Stewardship
This is second reporting period for heritage data. Although trend seems stable, it is hard to discern with only two monitoring periods to compare. Heritage staffing continues to be in short supply.

Not evaluated

The following monitoring items and associated resources were not evaluated during this monitoring period, and therefore a determination whether these resources are progressing and/or trending toward Forest Plan targets and/or thresholds have not been made.

3.3 Pika
4.1 Colorado River Cutthroat Trout
4.1 Amphibians
4.3 Lynx Habitat
5.1 Visitor Use Satisfaction
7.1 Economic Contributions from Specific Programs
7.4: Wilderness

Not determined

The following monitoring items and associated resources findings were not determined in this monitoring report.

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Partners
The Forest gratefully acknowledges the partnership and assistance of the following organizations:

Bird Conservancy of the Rockies
Colorado Division of Parks and Wildlife
USDA-Rocky Mountain Research Station
Colorado State Forest Service
Wilderness Workshop