



United States Department of Agriculture



Biennial Monitoring Evaluation Report for the Coconino National Forest

Fiscal Years 2018-2020



Forest Service

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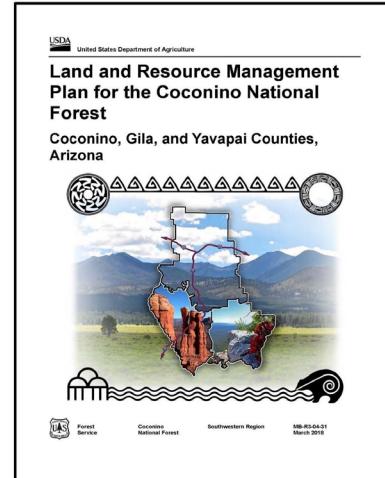
About Our Plan Monitoring Program

Purpose

The purpose of this Biennial Monitoring Evaluation Report is to inform the public, partners, stakeholders, other government agencies, and tribes of the completed and ongoing monitoring of forest plan implementation activities in the Coconino National Forest. The monitoring results presented in this report help the forest supervisor determine whether a change is needed in forest plan direction, plan components, or other plan content that guide management of resources in the Coconino National Forest. The Biennial Monitoring Evaluation Report represents one part of the Forest Service's overall monitoring program for this national forest. It is not a decision document. It evaluates monitoring questions and indicators presented in Chapter 5, Monitoring Strategy, of the revised Coconino Forest Plan (2018), and reports on the results of monitoring of management actions carried out in the forest.

Our monitoring plan addresses the following topics. the specific monitoring questions for these topics are in Table 1 below (Coconino NF plan monitoring questions (Revised Coconino Forest Plan, pp. 203-208)).

- ❖ Air quality
- ❖ Visibility in Class I Areas
- ❖ Grasslands
- ❖ Reducing uncharacteristic fire in fire-adapted ecosystems
- ❖ Improving stream riparian areas and wetlands
- ❖ Restoring riparian function to springs
- ❖ Water rights, surface water
- ❖ Incidence/abundance of aquatic invasive species and invasive plants
- ❖ Extent of insect and pathogen outbreaks
- ❖ Water quality, priority watersheds
- ❖ Long-term soil productivity
- ❖ Threatened, endangered, or proposed species
- ❖ Focal species (songbirds)
- ❖ Habitat diversity (late seral, early seral (aspen))
- ❖ Suitability for timber production, adequate regeneration, maximum size of even-aged management
- ❖ Recreation opportunities, scenic integrity
- ❖ Changes causing issues and requiring plan amendments
- ❖ Progress toward meeting plan objectives



Objectives

- Monitor how the forest plan is applied with project activities.
- Evaluate monitoring data for indicators of trends of or effects on forest resources, and how well plan implementation is moving forest resources toward desired conditions.
- Document and report the results of completed forest plan implementation, monitoring, and evaluation (this monitoring evaluation report).
- Document scheduled monitoring that has not been completed and the reasons and rationale why.
- Present recommended change opportunities to the responsible official.
- Through a management review of the monitoring evaluation report by the Forest Supervisor, determine if any changes are needed in monitoring indicators or methods, management actions, or forest plan management direction.

Table 1. Coconino NF Plan Monitoring Questions (Revised Coconino Forest Plan, pp. 203-208)

Question Number	Question	Metric and Data Source	Monitoring Frequency	Data Precision and Reliability ¹
1	What is the contribution of forest management to air quality in the three smoke management units that overlap the Coconino NF (Colorado River airshed, Little Colorado River airshed, Verde River airshed) when there are exceedances of State of Arizona's air quality standards? Scale: Greater than forestwide	Metric: Various, depending on pollutant. Source: Data from any Arizona Department of Environmental Quality (ADEQ) air quality monitoring station in the three smoke management units that overlap the forest. Evaluation: Forest activities that relate to air quality on day of exceedance.	Information is collected by ADEQ daily.	A
2	What is the contribution of forest management to visibility within the Sycamore Wilderness and Mazatzal Wilderness Class I Areas when there are exceedances of the Regional Haze Implementation Plan? Scale: Greater than forestwide	Metric: Various, depending on pollutant. Source: Data from IMPROVE ² program (Environmental Protection Agency air quality monitoring stations at Ike's Backbone and Sycamore Canyon). Evaluation: forest activities that relate to visibility on day of exceedance.	Weekly	A
3	How much have management activities contributed to maintaining or making progress toward DCs related to vegetation structure for the Semi-desert Grassland, Pinyon Juniper with Grass, Great Basin Grassland, and Montane/Subalpine Grassland ERUs?	Metric: Acres of vegetation treated in each ERU. Source: Database of record such as FACTS ³ database (Forest Activity Tracking System).	Annually	A
4	Are downed logs and snags falling within the ranges established in desired conditions for Ponderosa Pine and Mixed Conifer with Frequent Fire ERUs?	Metric: Frequency of snags and downed logs. Source: Field data and database of record such as FACTS.	3 to 5 years	A
5	Are tree densities within forested areas falling within the basal area ranges established in the desired conditions for Ponderosa Pine and Mixed Conifer with Frequent Fire ERUs?	Metric: Basal area. Source: Field data and database of record such as FACTS.	3 to 5 years	A

Question Number	Question	Metric and Data Source	Monitoring Frequency	Data Precision and Reliability ¹
6	How much have management activities contributed to reducing the risk of uncharacteristic fire?	Metric: acres mechanically treated, acres of prescribed fire, acres of wildfire for resource objectives. Source: Database of record such as FACTS.	Annually	A
7	How much have management activities contributed to returning fire to fire-adapted ecosystems?	Metric: acres of prescribed fire and acres of wildfire managed for resource objectives that maintain or move towards desired conditions in the forest plan. Source: Database of record such as FACTS.	Annually	A
8	How much have management activities improved functional-at-risk or nonfunctional stream riparian areas and wetlands?	Metric: acres/miles of functional-at-risk or nonfunctional stream riparian areas improved and number and acres of functional-at-risk or nonfunctional wetlands improved. Source: Database of record such as WIT ⁴ database (Watershed Improvement Tracking).	Annually	A, B
9	How much have management activities contributed to the restoration of riparian function to springs not in proper functioning condition?	Metric: number of springs improved or restored. Source: Database of record such as WIT.	Annually	A
10	How many water rights have been procured or how many water rights filings have been done?	Metric: number of water rights procured or filings completed Source: USDA Forest Service Water Rights and Uses (WRU) database and Arizona Department of Water Resources	Annually	A
11	What are surface water trends for Oak Creek, Wet Beaver Creek, and Fossil Creek?	Metric: annual mean discharge and peak streamflow Source: U.S. Geological Survey Gaging Stations	Annually	A
12	How much have management activities contributed to reducing the incidence or abundance of aquatic	Metric: miles of streams and acres of lakes, ponds, or wetlands with non-native species	Annually	A, B

Question Number	Question	Metric and Data Source	Monitoring Frequency	Data Precision and Reliability ¹
	invasive species?	removal or are affected by a fish barrier or other structure. Number of new populations of aquatic invasive species. Source: surveys and reports, including from partner agencies and organizations (such as Fossil Creek native fish annual monitoring report); information from State and Federal agencies on new populations of aquatic invasive species.		
13	How much have management activities contributed toward reducing the incidence or abundance of invasive plants?	Metric: Acres of invasive plants treated. Source: Database of record such as FACTS.	Annually	A
14	To what extent are undesirable outbreaks of insects and pathogens occurring on the forest? (1982 Planning Rule (sec. 219.12(k)(5)(iv))	Metric: acres of damage or mortality. Source: Forest Health and Condition Report, Southwestern Region.	Annually	A, B
15	How much have implemented projects and soil best management practices contributed to protecting soil, reducing accelerated erosion, reducing soil compaction, and maintaining soil and nutrient cycling thus maintaining long term soil productivity?	Metric: Acres of implemented projects that maintain or trend toward satisfactory soil condition. Acres and number of projects where BMP implementation was effective at protecting soil productivity. Source: Field data from a sample of implemented projects on the forest (soil condition and soil productivity), including implemented BMPs.	Every 3 to 5 yrs for soil condition assessments. Annually for BMP implementation.	B
16	Have management activities contributed to impairment of warm water or cold water streams based on aquatic macroinvertebrate metrics? Aquatic macroinvertebrates are an ecological indicator of water quality.	Metric: Streams added to or removed from ADEQ's impaired or non-attaining list. Source: ADEQ 305(b) reports.	Every 3 years.	A
17	Have management activities contributed to the delisting and improvement of impaired waters, or	Metric: number of streams or lakes removed or added to ADEQ's impaired or non-attaining	Every 3 years	A

Question Number	Question	Metric and Data Source	Monitoring Frequency	Data Precision and Reliability ¹
	waters non-attaining Arizona water quality standards?	list. Source: ADEQ 305(b) reports.		
18	How much have management activities contributed to maintaining or moving towards desired conditions of functioning properly for priority 6th code watersheds identified in the watershed condition assessment?	Metric: Acres of watershed maintenance or restoration activities and acres of vegetation treatments within priority 6th code watersheds. Name and number of 6th code watersheds that have moved to an improved class. Source: In forestwide WCATT (Watershed Condition Assessment Tracking Tool) and database of record such as FACTS.	Every 3 to 5 years	A
19	A. How much have management activities improved habitat for aquatic and riparian-dependent threatened, endangered, or proposed species (related to question 8)? B. How much have management activities contributed to reducing the incidence or abundance of aquatic invasive species in habitat for threatened, endangered or proposed species (related to question 10)?	A. Metric: acres/miles of functional-at-risk or nonfunctional stream riparian areas improved and number and acres of functional-at-risk or nonfunctional wetlands improved as related to threatened, endangered, and proposed species habitat. A. Source: Database of record such as WIT database. B. Metric: miles of streams and acres of lakes, ponds, or wetlands with non-native species removal or are affected by a fish barrier or other structure. B. Source: project files for structures completed. B. Metric: Number of new populations of aquatic invasive species. B. Source: surveys and reports, including from partner agencies and organizations (such as Fossil Creek native fish annual monitoring report); information from State and Federal agencies on new populations of aquatic	Annually	B

Question Number	Question	Metric and Data Source	Monitoring Frequency	Data Precision and Reliability ¹
		invasive species.		
20	What is the status of the three songbirds identified as focal species (Grace's warbler, black-throated gray warbler, and juniper titmouse)?-	Metric: Trends in occupancy (proportion of grid cells occupied across the forest) and density (birds per square kilometer) for each species. To monitor local populations and infer changes from restoration treatments, changes in cells/routes that had restoration treatments could be compared to untreated cells. Source: Bird Conservatory of the Rockies (BCOR) Integrated Monitoring in Bird Conservation Regions (IMBCR) data; state bird monitoring and long-standing bird monitoring data sets such as the Christmas Bird Count and Breeding Bird Surveys.	3 to 5 years	A
21	A. How much have management activities contributed to returning fire to Ponderosa Pine, Mixed Conifer with Frequent Fire, and Mixed Conifer with Infrequent Fire ERUs? B. Are plan components guiding fuels reduction and forest restoration activities maintaining the suite of late-seral ecological conditions within mixed conifer and pine-oak habitats that contribute to stable or increasing MSO populations?	A. Metric: Acres mechanically treated, acres of prescribed fire, acres of wildfire for resource objectives. A. Source: Field data and database of record such as FACTS. B. Metric: Acres of change in late seral mixed conifer and pine-oak habitats. B. Source: Best available remote sensing data (satellite, land cover databases) to measure change in acres. Results from Monitoring Questions 4, 5, and 6.	5 to 10 years	A, B
22	How much have management activities contributed to maintaining or moving toward desired conditions for aspen? Aspen is an ecological indicator of habitat diversity, and early seral stages in the following ERUs: Mixed Conifer with Infrequent	Metric: Acres of aspen protected or maintained. Source: Database of record such as FACTS database.	Annually	A

Question Number	Question	Metric and Data Source	Monitoring Frequency	Data Precision and Reliability ¹
	Fire, Mixed Conifer with Frequent Fire, Spruce-Fir, and in localized areas in Ponderosa Pine.			
23	Have areas classified as unsuited for timber production become suitable? (sec. 219.12(k)(5)(ii))	Metric: Acres of suitable timber. Method: Reapply timber suitability criteria and process. Source: TimCo (Timber code) Forest Service database	Every 10 years	A
24	Are forests and woodlands adequately restocked within 5 years of final harvest treatment when openings are created for the purpose of regeneration? (sec. 219.12(k)(5)(i))	Metric: Percentage of area adequately restocked. Source: Review annual reforestation needs report, stocking certifications, silvicultural prescriptions, and FACTS database.	1 to 5 years	A, B
25	Should maximum size limits of 40 acres for even-aged management harvest areas be continued? (sec. 219.12(k)(5)(iii)), 219.27 (d)(2)	Metric: Percentage of harvest units that exceed 40 acres for even-aged management. Source: FACTS database.	1 to 5 years	A, B
26	How many new recreation opportunities have been added to the system?	Metric: Number of new facilities. Number of miles and type of new trails provided. Source: INFRA ⁵ database	Every 5 years	A
27	How many recreation sites or locations have been improved, relocated, or decommissioned in response to known resource damage?	Metric: Number of facilities or dispersed sites. Source: INFRA database, PALS (Planning, Appeals, Litigation System) Forest Service database	Every 5 years	A
28	How much have management activities contributed to progress toward scenic integrity desired conditions in areas identified as needing rehabilitation?	Metric: Percentage of acres that have been thinned <u>and</u> burned and that improved (by at least one level) areas identified as needing rehabilitation. Source: FACTS database, Scenery Management – Scenic Integrity Objectives Rehabilitation Map (map14) included with the plan, and other areas identified by scenery resource specialists as needing rehabilitation.	Annually	A, B

Question Number	Question	Metric and Data Source	Monitoring Frequency	Data Precision and Reliability ¹
29	Have there been changes that have resulted in unforeseen issues requiring plan amendments? (sec. 219.12(k))	Metric: Number, type, and content of plan amendments. Source: database of record for number, type, and content of plan amendments.	Annually	B
30	How do actual accomplishments compare with plan objectives? (sec. 219.12(k)(1))	Metric: Various, as described in plan objectives. Source: database of record for the various accomplishments, such as: FACTS, INFRA, PALS, and WIT databases.	Annually	B

¹ Data Precision and Reliability: An indication of how rigorous the information used to evaluate the monitoring question is with respect to repeatability, reliability, accuracy, and precision. Two categories of precision and reliability are appropriate at the plan scale, and because of varying methods and data sources used to evaluate the monitoring question, both classes may be indicated. Classes of precision and reliability, however, are not meant to identify which methods and data sources may be most appropriate to answer the monitoring question.

- Class A: Methods that are generally well-accepted for modeling or quantitative measurement. Results have a high degree of repeatability, reliability, accuracy, and precision.
- Class B: Methods or measurements that are based on project records, personal communications, ocular estimates, pace transects, informal visitor surveys, and similar types of assessments. The degree of repeatability, reliability, accuracy, and precision are not as high as Class A methods, but they still provide valuable information.

² The Interagency Monitoring of Protected Visual Environments (IMPROVE) monitoring program was established in 1985 to aid the creation of Federal and State implementation plans for the protection of visibility in Class I areas (156 national parks and wilderness areas) as stipulated in the 1977 amendments to the Clean Air Act.

³ FACTS refers to the Forest Activity Tracking System database that is part of the Natural Resource Manager's (NRM) system of database tools for managing agency data across the Forest Service. It is an activity tracking application for all levels of the Forest Service. The application allows tracking and monitoring of National Environmental Policy Act (NEPA) decisions as well as the ability to create and manage Knutson-Vandenberg (KV) trust fund plans at the timber sale level.

⁴ WIT refers to the Watershed Improvement Tracking database that is part of the NRM system of database tools for managing agency data across the Forest Service. WIT manages data, observations and planning details about sites that need to be (or have been) restored or improved with the intent of benefiting watershed and aquatic ecosystem health and function. The application is a watershed restoration activity tracker that addresses site conditions, administrative plans and actions, and outcomes.

⁵ INFRA refers to the Infrastructure database that is part of the NRM system of database tools for managing agency data across the Forest Service.

Summary

Monitoring was completed from 2018-2020 to address the following topics in the Coconino's Monitoring Plan, covering 18 of the 30 monitoring questions. The results and recommendations from this monitoring are described in this 2021 Biennial Monitoring Evaluation Report for the Coconino National Forest.

- Air quality (Monitoring Question 1)
- Visibility in Class I Areas (Monitoring Question 2)
- Grasslands (Monitoring Question 3)
- Reducing uncharacteristic fire in fire-adapted ecosystems (Monitoring Questions 6 and 7)
- Improving stream riparian areas and wetlands (Monitoring Question 8)
- Restoring riparian function to springs (Monitoring Question 9)
- Water rights, surface water (Monitoring Questions 10 and 11)
- Incidence/abundance of aquatic invasive species and invasive plants (Monitoring Questions 12 and 13)
- Extent of insect and pathogen outbreaks (Monitoring Question 14)
- Protecting soil productivity (Monitoring Question 15b)
- Aquatic and riparian-dependent threatened, endangered, or proposed species (Monitoring Question 19)
- Habitat diversity (early seral (aspen)) (Monitoring Question 22)
- Scenic integrity (Monitoring Question 28)
- Changes causing issues and requiring plan amendments (Monitoring Question 29)
- Progress toward meeting plan objectives (Monitoring Question 30)

Monitoring for the following topics will be reported in the 2023 Biennial Monitoring Evaluation Report for the Coconino, as their monitoring frequency is greater than this initial report covers.

- Downed logs, snags, tree densities in Frequent Fire ERUs (Monitoring Questions 4 & 5)
- Long-term soil productivity (Monitoring Question 15a)
- Water quality, priority watersheds (Monitoring Questions 16, 17, and 18)
- Focal species (Monitoring Question 20)
- Habitat diversity (late seral) (Monitoring Question 21)
- Suitability for timber production, adequate regeneration, maximum size of even-aged management (Monitoring Questions 23, 24, and 25)
- Recreation opportunities (Monitoring Questions 26 and 27)

Monitoring results show that, in general, project activities implemented per the revised forest plan have moved forest resources toward desired conditions for those resources. As of this reporting, there are no resource areas monitored for which a Forest Plan amendment needs to be considered to change the existing management direction or the monitoring strategy.

A different type of forest plan amendment that is recommended is to incorporate the new management direction for the Fossil Creek Designated Wild and Scenic River Special Area, as well as the boundary adjustments to that special area and the Designated Fossil Springs Botanical Area. This is an amendment analyzed and approved in the Fossil Creek Comprehensive River Management Plan (CRMP) Final Environmental Impact Statement and Record of Decision. This recommendation is described in more detail in the Amendments and Objectives section.

There were seven (7) resource areas for which management activities may need to be increased or concentrated to better meet forest plan objectives, namely grasslands, riparian areas, wetlands, springs, maple habitat, stream habitat, and scenic resources. Forest plan objectives, to what extent they were met in the first three years of the current 10-year planning period, and recommendations to fully meet them for these resources are listed in the Amendments and Objectives section.

Table 2 summarizes the results of evaluating the monitoring questions covered in this report. It displays if the monitoring metrics gathered are in accord with forest plan direction and if changes to plan direction, management activities, or the plan monitoring program should be considered.

Table 2. Number of Evaluated Monitoring Questions Resulting in Adaptive Management Recommendations

	Yes	Unsure	No
Forest Plan direction met	18	0	0
Change to Forest Plan warranted	0	0	18
Change to management activities recommended	0	7	11
Change to Plan monitoring program warranted	0	0	18

Table 3 summarizes the findings of this report for each of the plan monitoring questions evaluated in the resource sections.

Table 3. Summary of Findings by Plan Monitoring Question

Monitoring Question (covered in this biennial report)	Progress toward Desired Conditions Using Plan Direction?	Type of Change Recommended	Recommendation
1. What is the contribution of forest management to air quality in the three smoke management units that overlap the Coconino NF (Colorado River airshed, Little Colorado River airshed, Verde River airshed) when there are exceedances of State of Arizona's air quality standards? Scale: Greater than forestwide	Yes. No notices of exceedance were sent to the forest during the 2018, 2019, or 2020 fiscal years. None of the forest management activities, including prescribed burns and unplanned ignitions, resulted in concerns for the air quality in the three local airsheds monitored.	None	Continue to coordinate with the Arizona Department of Environmental Quality (ADEQ) in the monitoring of the Colorado River, Little Colorado River, and Verde River airsheds.
2. What is the contribution of forest management to visibility within the Sycamore Wilderness and Mazatzal Wilderness Class I Areas when there are exceedances of the Regional Haze Implementation Plan? Scale: Greater than forestwide	Yes. None of the forest management activities, including prescribed burns and unplanned ignitions, resulted in concerns for visibility in the Sycamore Wilderness and Mazatzal Wilderness Class I Areas monitored.	None	Continue to coordinate with the Environmental Protection Agency in the IMPROVE monitoring program stations at Ike's Backbone and Sycamore Canyon.
3. How much have management activities contributed to maintaining or making progress toward DCs related to vegetation structure for the Semi-desert Grassland, Pinyon Juniper with Grass, Great Basin Grassland, and Montane/Subalpine Grassland ERUs?	Yes. Mechanical and prescribed fire treatments implemented, as well as the wildfire occurring, in these grassland ERUs have maintained or made progress toward desired conditions.	Increase management activities.	Restore or improve at least 3,388 acres of Semi-desert Grasslands, at least 8,651 acres of Great Basin Grasslands, and at least 5,131 acres of Montane/Subalpine Grasslands in FYs 2021 to 2028.
6. How much have management activities contributed to reducing the risk of uncharacteristic fire?	Yes. The mechanical and prescribed fire treatments implemented, as well as wildfires managed to meet resource objectives, in all forest ERUs during these three fiscal years have reduced the risk of uncharacteristic fire by: <ul style="list-style-type: none"> • Reducing fuel loads and tree densities on over 106,000 acres of the forest. • Using prescribed fire after mechanical treatments. • Managing wildfires for resource objectives and restoring fire return intervals. 	Improve contracting.	Improve contracting and communication with sale area maps that display up-to-date utility and road information and with more consistent sale administration.

Monitoring Question (covered in this biennial report)	Progress toward Desired Conditions Using Plan Direction?	Type of Change Recommended	Recommendation
7. How much have management activities contributed to returning fire to fire-adapted ecosystems?	<p>Yes. The mechanical and prescribed fire treatments implemented, as well as wildfires managed to meet resource objectives, in all forest ERUs during these three fiscal years have helped return fire to these fire-adapted ecosystems by:</p> <ul style="list-style-type: none"> • Increasing fire treatments to achieve and/or maintain composition, structure, and function of fire-adapted ERUs. • Using prescribed fire after mechanical treatments. • Managing wildfires for resource objectives and restoring fire return intervals 	Improve contracting.	Improve contracting and communication with sale area maps that display up-to-date utility and road information and with more consistent sale administration.
8. How much have management activities improved functional-at-risk or nonfunctional stream riparian areas and wetlands?	<p>Yes. Implemented management activities have improved functional-at-risk or nonfunctional stream riparian areas and wetlands by:</p> <ul style="list-style-type: none"> • Stabilizing active headcuts. • Improving soil water infiltration and storage. • Stabilizing gullies. • Improving vegetation along streambanks and around springs. • Increasing the wetted area with stabilization treatments. • Reducing invasive plants. 	Increase management activities.	Restore at least 119 acres of nonfunctioning and functioning-at-risk riparian areas, and at least three (3) more forest wetlands, in FYs 2021 to 2028.
9. How much have management activities contributed to the restoration of riparian function to springs not in proper functioning condition?	<p>Yes. Implemented management activities have contributed to the restoration of riparian function to springs not in proper functioning condition by:</p> <ul style="list-style-type: none"> • Improving vegetation around springs. • Fencing to protect springs, their sources, and their cultural values from degradation. • Reducing invasive plants. 	Increase management activities.	Restore the riparian function of 22 springs in FYs 2021 to 2028.

Monitoring Question (covered in this biennial report)	Progress toward Desired Conditions Using Plan Direction?	Type of Change Recommended	Recommendation
10. How many water rights have been procured or how many water rights filings have been done?	Yes. No new water rights were procured, but water rights validations continued, with approximately 42 Statements of Continuing Uses validated and submitted to the Arizona Department of Water Resources. The forest worked proactively with the AZ Department of Water Resources to ensure that FS water rights are kept in FS ownership and are not forfeited.	None	
11. What are surface water trends for Oak Creek, Wet Beaver Creek, and Fossil Creek?	Yes. Annual discharges measured ranged from the lowest since 2006 to the highest since 2005 for Oak and Wet Beaver Creeks, and from the lowest to the highest since 2010 for Fossil Creek.	None	
12. How much have management activities contributed to reducing the incidence or abundance of aquatic invasive species?	Yes. The number of new populations of invasive species remained low. Invasive populations were identified, inventoried, and treatments were designed and implemented to stop their spread and eliminate them.	None	
13. How much have management activities contributed toward reducing the incidence or abundance of invasive plants?	Yes. Identified populations of invasive plants were reduced by: <ul style="list-style-type: none"> Using hand, mechanical, and chemical treatments. Designing prescribed fire treatments to protect listed species habitat and reducing the threat of uncharacteristic wildfire. 	None	
14. To what extent are undesirable outbreaks of insects and pathogens occurring on the forest? (1982 Planning Rule (sec. 219.12(k)(5)(iv))	Yes. Acres of damage or mortality from insects and disease varied but remained in the tens of thousands of acres during FYs 2018 to 2020.	Increase management activities	Address the thousands of acres with damage or mortality from insect and disease outbreaks. During project planning each year, address those forest stands affected by these outbreaks.
15. (b) How much have soil best management practices contributed to protecting soil, reducing accelerated erosion, reducing soil compaction, and maintaining soil and nutrient cycling?	Yes. In riparian areas treated, protective vegetative ground cover is increasing, and soil productivity and function is improving. Compaction and erosion is reduced.	Increase BMP monitoring	Commit to continued annual BMP monitoring beginning in FYs 2021 and 2022.

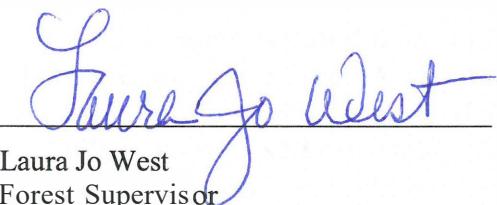
Monitoring Question (covered in this biennial report)	Progress toward Desired Conditions Using Plan Direction?	Type of Change Recommended	Recommendation
<p>19. A. How much have management activities improved habitat for aquatic and riparian-dependent threatened, endangered, or proposed species (related to question 8)?</p> <p>B. How much have management activities contributed to reducing the incidence or abundance of aquatic invasive species in habitat for threatened, endangered or proposed species (related to question 10)?</p>	<p>Yes. Management activities implemented have improved habitat for aquatic and riparian-dependent threatened, endangered, or proposed species by:</p> <ul style="list-style-type: none"> • Maintaining or improving native riparian vegetation. • Reducing riparian fragmentation, the threat of excessive sedimentation, soil compaction, water quality concerns, and vegetation damage from dispersed recreation. • Reducing the threat of uncharacteristic wildfire. In riparian and spring areas treated, protective vegetative ground cover is increasing, and soil productivity and function is improving. Compaction and erosion is reduced. <p>The number of new populations of invasive species remained low. Invasive populations were identified, inventoried, and treatments were designed and implemented to stop their spread and eliminate them.</p>	Increase management activities	Restore another 40.6 miles of stream habitat in FYs 2021 to 2028.
<p>22. How much have management activities contributed to maintaining or moving toward desired conditions for aspen? Aspen is an ecological indicator of habitat diversity, and early seral stages in the following ERUs: Mixed Conifer with Infrequent Fire, Mixed Conifer with Frequent Fire, Spruce-Fir, and in localized areas in Ponderosa Pine.</p>	<p>Yes. The management activities implemented to restore, protect, and maintain aspen have contributed to habitat diversity and early seral stages in forest ERUs. Aspen was regenerated and protected with planting and fencing, released with conifer weeding and maintenance treatments, and treated for oystershell scale.</p> <p>Aspen restoration on the Flagstaff Ranger District is making great progress and on target to meet forest plan objectives.</p>	Increase management activities	Consider restoration activities that promote regeneration, remove competing vegetation, or remove disturbances that could negatively impact maple habitat in FYs 2021 to 2028. Continue the great progress being made to restore aspen on the forest.

Monitoring Question (covered in this biennial report)	Progress toward Desired Conditions Using Plan Direction?	Type of Change Recommended	Recommendation
28. How much have management activities contributed to progress toward scenic integrity desired conditions in areas identified as needing rehabilitation?	Yes. Site-specific vegetation and fire treatments in areas identified for rehabilitation were designed and implemented to maintain or move toward the desired SIOs. The standards and guidelines for scenic resources and design features and BMPs for visuals and scenery were followed per forest plan direction, and visual inspections were required to assess compliance with Forest Plan desired conditions.	None	Treat approximately 8,608 acres of identified rehabilitation areas to improve the SIO by at least one level in FYs 2021 to 2028.
29. Have there been changes that have resulted in unforeseen issues requiring plan amendments? (sec. 219.12(k))	Yes. No amendments were needed to the Forest Plan. Two administrative changes were made: to transition to focal species and respond to appeal resolutions.	None	
30. How do actual accomplishments compare with plan objectives? (sec. 219.12(k)(1))	Yes. Progress made on meeting plan objectives. See Recommendations in Plan Amendments, Objectives section.	Increase management activities	Seven (7) recommendations made to fully meet plan objectives in the first 10-year planning period. See by monitoring question in this table and in Plan Amendments, Objectives section.

Forest Supervisor's Certification

This report documents the results of monitoring activities from Fiscal Year (FY) 2018 through FY 2020 on the Coconino National Forest. The monitoring frequency for some of the forest plan monitoring questions is longer than the three years included in this report. Evaluation of monitoring data for those topics will be included in later editions of this biennial report.

I have evaluated the monitoring and evaluation results presented in this report and endorse them. I have found that there are no recommended changes to the management direction or monitoring strategy in the 2018 Revised Coconino Forest Plan at this time. There are, however, some recommendations as a result of these findings that management activities increase for some of the resources identified in the plan monitoring questions. I therefore consider the Coconino Forest Plan sufficient to continue to guide land and resource management of the Coconino National Forest for the foreseeable future, and plan a deeper examination of any recommended changes with forest leadership and resource specialists. This Biennial Monitoring Evaluation Report is posted on the forest website and available for public review here: <https://www.fs.usda.gov/land/coconino/landmanagement>.



Laura Jo West
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Coconino National Forest

fur 12, ZOZJ

Date

Air Quality and Visibility

The first two monitoring questions in the Coconino Forest Plan require monitoring for air quality and visibility.

1. What is the contribution of forest management to air quality in the three smoke management units that overlap the Coconino NF (Colorado River airshed, Little Colorado River airshed, Verde River airshed) when there are exceedances of State of Arizona's air quality standards?
2. What is the contribution of forest management to visibility within the Sycamore Wilderness and Mazatzal Wilderness Class I Areas when there are exceedances of the Regional Haze Implementation Plan?



Air Quality

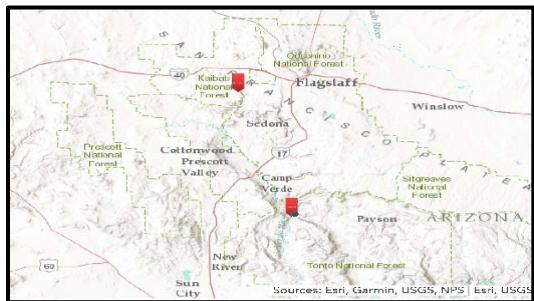
There are three smoke management units that overlap the Coconino National Forest, the Colorado River, Little Colorado River, and Verde River airsheds. Air quality data are collected daily by Arizona Department of Environmental Quality (ADEQ) air quality monitoring stations in these airsheds and determine if there are any exceedances of State of Arizona's air quality standards for any pollutant measured. Forest managers receive notice of any exceedance and evaluate if it is related to any forest management activities being implemented on the forest.

Results: No notices of exceedance were sent to the Coconino National Forest during the 2018, 2019, or 2020 fiscal years. This reflects that none of the forest management activities, including prescribed burns and unplanned ignitions, resulted in concerns for the air quality in the three local airsheds monitored.

Visibility

The Interagency Monitoring of Protected Visual Environments (IMPROVE) monitoring program was established in 1985 to aid the creation of Federal and State implementation plans for the protection of visibility in Class I areas (156 national parks and wilderness areas) as stipulated in the 1977 amendments to the Clean Air Act. The Environmental Protection Agency's air quality monitoring stations at Ike's Backbone and Sycamore Canyon are part of the IMPROVE monitoring program. These stations collect data within the Sycamore Wilderness and Mazatzal Wilderness Class I Areas and determine when there are exceedances of the Regional Haze Implementation Plan ([The Regional Haze Plan | ADEQ Arizona Department of Environmental Quality \(azdeq.gov\)](https://www.azdeq.gov/air-quality/air-quality/air-quality-improvement/improve)).

The Regional Haze Program relies upon the haze index to track two different trends: visibility on the haziest days annually and on the clearest days annually. The haziest days are also compared to a national visibility goal of no manmade impairment by 2064:

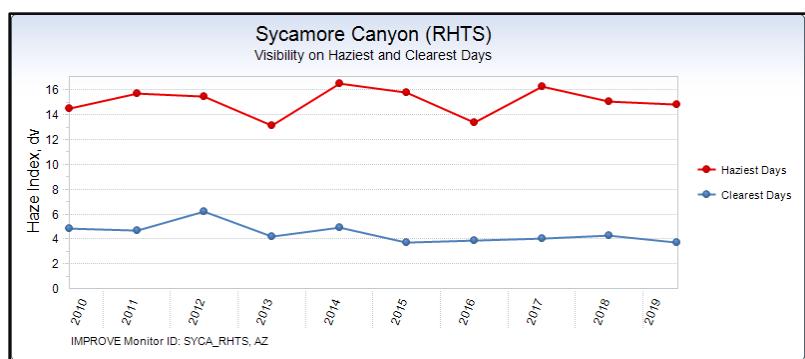


Location of the Sycamore Canyon and Ike's Backbone IMPROVE Monitors

The prevention of any future, and the remedying of any existing impairment of visibility in mandatory class I Federal areas which impairment results from manmade air pollution. (Section 169A) ([Arizona Regional Haze State Implementation Plan Under Section 308 of Federal Regional Haze Rule \(azdeq.gov\)](http://azdeq.gov), Chapter I, p. 4).

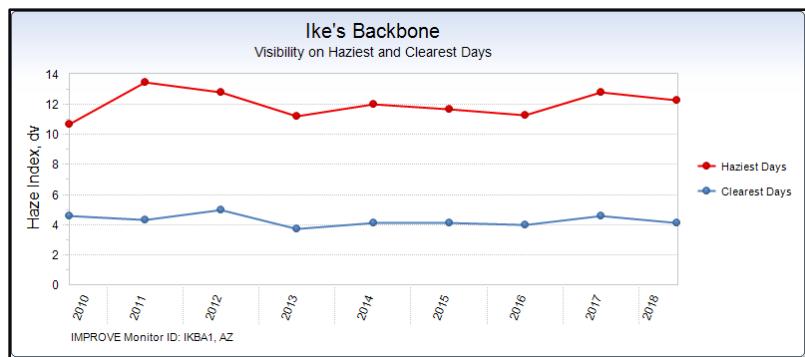
Sections 169A and 169B of the Clean Air Act were promulgated by Congress in the 1990 Clean Air Act Amendments with the intent of preventing any future, and remedying any existing, impairment of visibility caused by manmade sources in 156 mandatory Class I areas. Through this requirement, Congress set the goal of achieving natural visibility conditions in the Class I areas by 2064. In the interim, States are required to make reasonable progress towards the achievement of this national goal (*ibid.*, Appendix D, p. 3).

Results: The following graphs show the trends in visibility over the last ten years, from 2010 through 2019, as measured by the Sycamore Canyon and Ike's Backbone IMPROVE monitors. The haze index has a unit of measure called a deciview and a one unit change in deciview may be noticeable under certain conditions. Higher deciview values correspond to hazier scenes.



The annual average haze index value collected by the Sycamore Canyon IMPROVE monitor on the haziest days from 2010 to 2019 ranged from a minimum of approximately 13.1 in 2013 to a maximum of approximately 16.3 in 2014. This same value collected on the clearest days at the

Sycamore Canyon IMPROVE monitor ranged from a maximum of 6.1 in 2012 to a minimum of 3.9 in 2019.



The annual average haze index value collected by the Ike's Backbone IMPROVE monitor on the haziest days from 2010 to 2019 ranged from a minimum of 10.7 in 2010 to a maximum of 13.5 in 2011. This same value collected on the clearest days at the Ike's Backbone IMPROVE monitor ranged from a maximum of 5.0 in 2012 to a minimum of 3.7 in 2013.

The trend for visibility for the last ten years of collection has been slightly upward on the haziest days, 0.03 dv/yr for Sycamore Canyon and 0.04 dv/yr for Ike's Backbone, neither considered a significant trend. The trend for visibility has been significantly downward on the clearest days, -0.1 dv/yr for both Sycamore Canyon and Ike's Backbone monitors.

Forest managers receive notice of any exceedance and evaluate if it is related to any forest management activities being implemented on the forest. No notices of exceedance were sent to the Coconino National Forest during the 2018, 2019, or 2020 fiscal years. This reflects that none of the forest management activities, including prescribed burns and unplanned ignitions, resulted in concerns for visibility in the Sycamore Wilderness and Mazatzal Wilderness Class I Areas monitored.

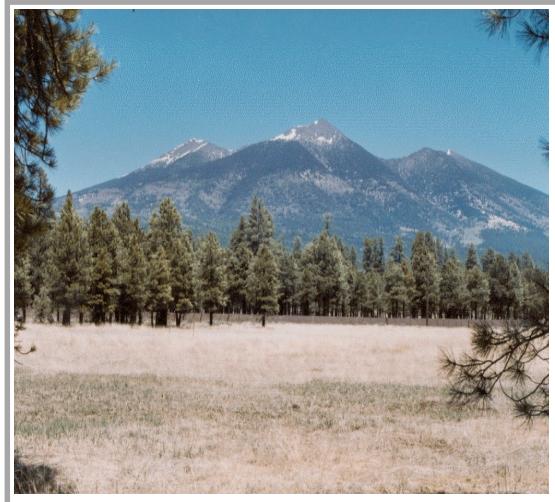
Recommendations

Based on these results, we are not considering any changes to the direction for Air Quality or Visibility in the revised Coconino Forest plan. The forest will continue to coordinate with the Arizona Department of Environmental Quality (ADEQ) in the monitoring of the Colorado River, Little Colorado River, and Verde River airsheds, and continue to coordinate with the Environmental Protection Agency in the IMPROVE monitoring program stations at Ike's Backbone and Sycamore Canyon.

Grasslands

The purpose of Monitoring Question 3 is to determine the status and trend of the grassland ecological restoration units (ERUs) found on the Coconino National Forest: Semi-desert Grassland, Pinyon Juniper with Grass, Great Basin Grassland, and Montane/Subalpine Grassland.

- How much have management activities contributed to maintaining or making progress toward DCs related to vegetation structure for the Semi-desert Grassland, Pinyon Juniper with Grass, Great Basin Grassland, and Montane/Subalpine Grassland ERUs?



Management activities in these grasslands are designed to maintain or make progress toward the desired conditions (DCs) related to vegetation structure for these grasslands, and are reported in the Forest Activity Tracking System (FACTS) database.

Monitoring Results

The acres of treatments implemented in these grasslands from FY 2018 through FY2020 are listed in Table 5 by fiscal year. The mechanical treatments implemented in these three fiscal years include group selection harvest, precommercial and commercial thinning, and chipping of fuels. The fire treatments implemented include prescribed broadcast burning, burning of piled material, and jackpot burning, as well as wildfire (natural ignition). The treatments to reduce invasives include pesticide application, mechanical/physical removal, and biocontrol methods.

Table 5. Acres of Management Activities in Grassland ERUs

Grassland ERU Treatments	FY2018	FY2019	FY2020	3-year Total for ERU
Semi-desert Grassland				
Mechanical	0	0	0	0
Rx Fire	0	0	0	0
Wildfire (Natural Ignition)	0	0	0	0
Invasives	0	108	4	112

Grassland ERU Treatments	FY2018	FY2019	FY2020	3-year Total for ERU
Pinyon Juniper with Grass				
Mechanical	421	0	341	762
Rx Fire	293	414	0	707
Wildfire (Natural Ignition)	918	2,643	0	3,561
Invasives	0	97	56	153
Great Basin Grassland				
Mechanical	59	0	489	548
Rx Fire	650	470	0	1,120
Wildfire (Natural Ignition)	420	0	0	420
Invasives	30	4	27	61
Montane/Subalpine Grassland				
Mechanical	103	386	44	533
Rx Fire	618	397	134	1,149
Wildfire (Natural Ignition)	54	0	0	54
Invasives	306	104	323	733
Total for FY	3,872	4,623	1,418	9,913

*All acres are approximate and based on the most recent FACTS and GIS data available.

Coconino Leadership Team (CLT) Monitoring

In addition to the treatments in grasslands reported in the FACTS database, one of the projects monitored by the Coconino Leadership Team in FY2020 was the Apache Maid Allotment Project on the Red Rock Ranger District. The Apache Maid non-structural range improvement proposal identified 32,700 acres of treatments to maintain desired conditions in semi-desert grassland and pinyon juniper to control pinyon pine and juniper that are encroaching into grassland areas and help restore desert grasslands and savannahs.

The leadership team visited the Apache Maid project area to determine the effectiveness of recent treatments and make recommendations applicable to similar future projects on the Coconino National Forest. Much was learned about different methods to move toward desired conditions for grasslands. Lessons learned include that areas with juniper encroachment may take longer to return to grassland, that juniper removal by fire aids in that return, that hotter and faster fire improves grass production, and that continued and expanded treatments are needed to reach grassland restoration objectives.

Four Forest Restoration Initiative (4FRI) Multi-party Monitoring Board (MPMB)

Pronghorn habitat connectivity modeling has been conducted to answer the question of how restoration treatments affect habitat connectivity for grassland species. The 4FRI MPMB and Forest Service partnered with Northern Arizona University in 2019 in using pronghorn collar data from 1995 to 2017 to model pre-treatment habitat quality and landscape migration permeability. Among other findings, the study identified certain constrictive “pinch points” or bottleneck areas that exhibit high pronghorn movement among high quality habitat areas and that

would be good candidates for treatments to reduce tree cover and improve near-ground visibility for pronghorn (Anderson and Dickson 2019). And that treatments in areas of high topographic diversity may have less benefit to pronghorn than similar treatments in flat areas. This can help the forest prioritize where to implement grassland treatments.

The mechanical and prescribed fire treatments implemented, as well as the wildfire occurring, in these grassland ERUs have maintained or made progress toward desired conditions by:

- Reducing the canopy cover of trees and shrubs to less than 10%.
- Increasing the regeneration of native grasses, forbs, and annuals.
- Increasing the diversity of vegetation that provides food and cover for invertebrates and wildlife.

Recommendations

Based on these results, we are not considering any changes to the direction for Grassland ERUs in the revised Coconino Forest Plan. The forest will continue to implement mechanical, fire, and invasives treatments to restore and improve grasslands, and consider ways to successfully treat more semi-desert grassland. Though restoration work is planned each year, seasonal and scheduled grazing, clearance from specialists, and workforce limitations can hinder implementation. Suppression activities for large wildfires can be and have been used to aid implementation of restoration treatments. For example, fire lines used in suppressing wildfires can be left in place to help with future prescribed burn treatments. Forest Service wildlife biologists will continue to work with the 4FRI MPMB and Northern Arizona University to design treatments in grassland ERUs that will benefit pronghorn and other grassland species.

Fire-adapted Ecosystems

Monitoring Questions 6 and 7 address reducing the amount of uncharacteristic fire in fire-adapted ecosystems, and returning fire to fire-adapted ecosystems.

6. How much have management activities contributed to reducing the risk of uncharacteristic fire?
7. How much have management activities contributed to returning fire to fire-adapted ecosystems?



The acres of prescribed fire and acres of wildfire managed for resource objectives that are implemented to maintain or move towards desired conditions in these ecosystems are reported in the Forest Activity Tracking System (FACTS) database.

Monitoring Results

The following table summarizes the mechanical, prescribed fire, and wildfire treatments that were completed in fiscal years (FYs) 2018, 2019, and 2020. The different types of these treatments are reported in the FACTS database as listed. Both “Wildfire – Natural Ignition” and “Planned Treatment Burned in Wildfire” reported in the FACTS database represent acres of wildfire that moved the vegetation toward desired conditions.

Table 6. Acres of Mechanical and Fire Treatments Completed in FYs 2018, 2019, and 2020*

Treatment	FY 2018	FY 2019	FY 2020	3-year Total
Mechanical Treatments				
Group Selection Cut (UA/RH/FH)/Commercial Thin	4,245	3,243	3,492	10,980
Precommercial Thin/Tree Encroachment Control	930	1,753	1,506	4,189
Thinning for Hazardous Fuels Reduction	44	0	0	44
Tree Release and Weed	5	0	0	5
Total Acres Mechanically Treated	5,224	4,996	4,998	15,218
Prescribed Fire				
Broadcast Burning	29,373	16,543	20,105	66,021
Jackpot Burning	0	0	995	995
Burning of Piled Material	1,764	2,479	0	4,243
Total Acres Prescribed Fire	31,137	19,022	21,100	71,259

Treatment	FY 2018	FY 2019	FY 2020	3-year Total
Wildfire (Natural Ignition) for Resource Objectives	16,603	3,176	0	19,779
Total Acres of Fire	47,740	22,198	21,100	91,038
Total Acres of Treatments	52,964	27,194	26,098	106,256

*All acres are approximate and based on the most recent FACTS and GIS data available.

CLT Monitoring

Some of these treatments reported in the FACTS database include projects monitored by the Coconino Leadership Team (CLT) in FY2019. The CLT monitored implementation of the Windmill Timber Sale on the Mogollon Rim Ranger District. The Windmill Timber Sale area includes treatments approved by both the older Bald Mesa Project and the 2013 Clints Well Forest Restoration Project, which includes approximately 16,810 acres around the community of Clints Well. The purpose and need for these treatments is to reduce the risk of unnatural, high-severity wildfire and move the project area toward historic and desired conditions, with thinning planned on almost 12,900 acres and prescribed burning on over 16,440 acres.

The leadership team visited different sections of the Windmill Timber Sale Area to determine the effectiveness of treatments thus far and make recommendations for the remainder of needed treatments and future vegetation treatment projects on the Coconino National Forest. The team determined that the treatments conducted so far have had varying levels of success, with some moving the landscape toward desired conditions faster than others. Both surface and ladder fuels were decreased significantly, thereby reducing the risk of an unnatural, high-severity wildfire. However, some areas still contained more slash than desired; this slash needs to be removed to realize desired conditions. Contracting and communication need to be improved, with better sale area maps with up-to-date utility and road information, and more consistent sale administration.

4FRI MPMB

Member organizations of the 4FRI Multi-party Monitoring Board (MPMB) are engaged in the following monitoring of effects from vegetation and fire treatments in the fire-adapted ecosystems of the Coconino National Forest:

Rapid plots: The 4FRI MPMB has collected plot-based pre-treatment data since 2015 across 27 project areas on the Coconino National Forest. This monitoring includes plots to establish the pre-treatment diameter distributions of trees, number of trees per acre, ground cover types, and existing regeneration. As expected in the project areas surveyed and reported in an initial 2019 report, ponderosa pine makes up the largest proportion of all tree density. The distributions of living trees show that 40 percent of trees are less than 16 inches in diameter. Grass and forbs are the predominant vegetative understory. Plots will be re-surveyed following mechanical thinning and burning treatments to help understand the effects of treatments on overstory and understory structure and composition. The first post-treatment surveys with corresponding pre-treatment survey data were completed in 2020 in the Chimney Springs project area on the Flagstaff Ranger District. Preliminary results from these surveys will be available in late 2021 or early 2022 and will be reported in the 2023 Biennial Monitoring Evaluation Report.

The mechanical and prescribed fire treatments implemented, as well as wildfires managed to meet resource objectives, in all forest ERUs during these three fiscal years have moved ecosystems toward their desired conditions. They have both contributed to reducing the risk of uncharacteristic fire and helped return fire to these fire-adapted ecosystems by:

- Increasing fire treatments to achieve and/or maintain composition, structure, and function of fire-adapted ERUs.
- Reducing fuel loads and tree densities on over 106,000 acres of the forest.
- Emphasizing treatments in the wildland-urban interface (WUI).
- Using prescribed fire after mechanical treatments.
- Managing wildfires for resource objectives and restoring fire return intervals.
- Reducing invasive plants (see Invasives, Insects, and Disease section).
- Meeting forest plan objectives for Grassland, Pinyon Juniper, Aspen and Maple, Ponderosa Pine, and Mixed Conifer ERUs (see the Plan Amendments/Objectives section).

Recommendations

Based on the results of monitoring the mechanical, prescribed fire, and wildfire treatments completed in FYs 2018, 2019, and 2020, we are not considering any changes to the management direction for the fire-adapted Ecological Restoration Units (ERUs) in the revised Coconino Forest Plan.

The Coconino National Forest will continue to move more of the landscape toward a more open condition, reducing the risk of uncharacteristic wildfire and promoting resilient ecosystems. In addition, the forest will work on improving the contracting process for harvesting operations and communication during sale administration. Turnover in Timber Sale Administrator staff positions, the needed hiring process, and related budget constraints resulted in a delay in refilling these district positions and affected communication between timber and other resource areas. In response, districts will be planning more frequent Program of Work meetings, as well as continuing plan-in-hand meetings, with sale administrators and all resource specialists.

Watershed and Soil Resources

Monitoring Questions 8, 9, 10, and 11 address improving stream riparian areas and wetlands, restoring riparian function to springs, water rights, and surface water.

8. How much have management activities improved functional-at-risk or nonfunctional stream riparian areas and wetlands?
9. How much have management activities contributed to the restoration of riparian function to springs not in proper functioning condition?
10. How many water rights have been procured or how many water rights filings have been done?
11. What are surface water trends for Oak Creek, Wet Beaver Creek, and Fossil Creek?



The Watershed Improvement Tracking (WIT) database is used to collect and report acres and miles of improvement for Monitoring Question #s 8 and 9. WIT manages data, observations and planning details about sites that need to be (or have been) restored or improved with the intent of benefiting watershed and aquatic ecosystem health and function. It tracks watershed restoration activity that addresses site conditions, administrative plans and actions, and outcomes. Water rights activities for Monitoring Question #10 are tracked by the Forest Service Water Rights and Uses (WRU) database and the Arizona Department of Water Resources. Surface water trends are monitored with U.S. Geological Survey gauging stations for Oak Creek, Wet Beaver Creek, and Fossil Creek.

Monitoring Question #15 looks at the maintenance of long-term soil productivity, looking at the effects on soils from implemented projects. Soil condition assessments are conducted every three to five years, and will be reported in the 2023 Biennial Monitoring Evaluation Report. The effectiveness of soil Best Management Practices (BMPs) is to be monitored annually for implemented projects and is reported in this 2021 Biennial Monitoring Evaluation Report. Region 3 uses the national BMP database to record BMP effectiveness monitoring that takes place.

15. How much have implemented projects and soil best management practices contributed to protecting soil, reducing accelerated erosion, reducing soil compaction, and maintaining soil

and nutrient cycling thus maintaining long term soil productivity?

Approximately 28 percent of the stream system riparian areas on the Coconino National Forest are in functional-at-risk condition, and approximately five percent are in nonfunctional condition. Wetland riparian conditions range from fair to good on the 78 wetlands identified on the forest. There are at least 300 springs on the Coconino National Forest, in varied condition depending on the degree of modification and degree of protection (revised Coconino Forest Plan Final Environmental Impact Statement, Volume I, pages 90-99). And it is estimated that approximately 21 percent of the soils across forest ERUs is in an impaired condition (revised Coconino Forest Plan Final Environmental Impact Statement, Volume I, Table 11, page 113).

The revised forest plan requires implementation of BMPs to prevent soil erosion and adverse effects to water quality; avoiding wetlands, springs, seasonally wet meadows, and montane meadows; and avoiding soils that are unstable and highly erodible where connected to streamcourses (revised Coconino Forest Plan, FW-RdsFac-G-5, page 99). BMPs are specified in project planning documents.

Monitoring Results

In fiscal year (FY) 2018:

- 34 acres of stream and wetland habitat were restored in Houston Draw. A series of active headcuts were stabilized with the help of the Arizona Elk Society using loose rock structures. This improved not only channel function and stability, but also increased the wetted area by improving soil water infiltration and storage.
- Two springs were improved in FY 2018, Deer Run Spring and T-Six Spring. Supplemental energy dissipation was installed in the runout channel in Deer Run Spring on the Red Rock Ranger District. In early 2018, Grand Canyon Trust restored the T-Six Spring site by filling in the trench and building an 8-foot elk fence around the ciénega habitat. This restoration buried the anthropogenic hillslope source and resulted in the spring emerging directly into the ciénega below.
- No new water rights were procured. Water rights validations continued, with approximately 28 Statements of Continuing Uses validated and submitted to the Arizona Department of Water Resources.
- The average annual discharge in Oak Creek in 2018 was 31 cfs (cubic feet per second). This was the lowest annual discharge rate since 2006. Average annual discharge in Wet Beaver Creek was 7.05 cfs. This was lower than previous years and was the lowest discharge rate since 2006. Average annual discharge in Fossil Creek was 42.1 cfs, the lowest discharge on record and lower than the 2017 average annual discharge of 61.1 cfs.
- Best Management Practices (BMP) implementation and effectiveness were monitored:

- in developed recreation sites at Clear Creek in March,
- for ground-based skidding and harvesting in the Chimney Springs Project in April,
- for motorized/non-motorized trail operations and maintenance on the Barbershop Trail 91 in April,
- for the active construction of aquatic ecosystem improvements in the Long Valley Headcut Stabilization Project in July,
- on ski run operation and maintenance at Arizona Snowbowl, Aspen Meadows, in August, and
- in developed recreation sites at Forked Pine Campground and Picnic Area in September.

In FY 2019:

- Approximately 47 acres of riparian habitat were improved as part of the annual Arizona Elk Society project. Most of this work was in Long Valley and Houston Draw, where loose rock structures and other gully stabilization treatments were implemented to address channel incision and de-watering of adjacent slope wetlands. These treatments effectively increased the wetted area adjacent to the stream channel.
- Barbershop Spring on the Mogollon Rim RD was improved with assistance from the Grand Canyon Trust. Volunteers assisted with erosion stabilization and headcutting by installing loose rock structures to prevent soil erosion within the spring runout channel. The area has experienced very heavy browsing by ungulates (mainly elk), leading to inadequate vegetative cover. These stabilization measures will increase the wetted area, improve vegetation establishment, and increase the robustness of the wetland vegetation.
- No additional water rights were procured. Fourteen (14) Statements of Continuing Uses were filed with the Arizona Department of Water Resources, including for the 68 Tank, Willow Valley Tank, Antelope Draw Tank, Clearcut Tank, Steer Tank, Upper Long Valley Tank, Brusky Knoll Tank, Fire Line Tank, Driveway Tank, Gonzales Tank, Linn Tank, Joe's Tank, and Jim's Tank.
- The mean annual discharge in Oak Creek was 111.9 cfs, nearly three times that of the previous year. This value represents the second highest mean annual discharge rate since 2005. The mean annual discharge in Wet Beaver Creek was 52.2, more than seven times that of the previous year. This value also represents the highest mean annual discharge rate since 2005. The mean annual discharge in Fossil Creek was 64.1 cfs, approximately 50 percent more than that of the previous year. This value represents the highest mean annual discharge rate since the stream gauge was installed in 2010.

In FY 2020:

- No additional water rights were procured. However, the watershed program worked proactively with Arizona Department of Water Resources to ensure that Forest Service

water rights are kept in Forest Service ownership and are not forfeited.

- The mean annual discharge in Oak Creek was 102.4 cfs, slightly lower than the previous year. This value represents the fifth highest mean annual discharge rate since 2005. The mean annual discharge in Wet Beaver Creek was 32.7 cfs, about 37 percent lower than the previous year and the sixth highest discharge rate since 2005. The mean annual discharge in Fossil Creek was 64.0 cfs, almost the same as the previous year and the second highest mean annual discharge rate since the gage was installed in 2010.

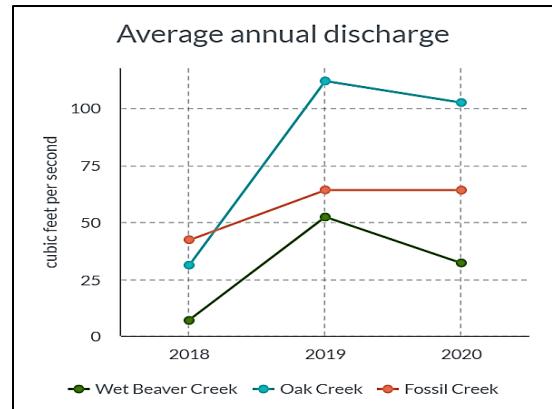


Table 7. Acres and Numbers of Watershed Resource Activities Completed in FYs 2018, 2019, and 2020

Watershed Resource Activity	FY 2018	FY 2019	FY 2020	3-year Total
Acres of functional-at-risk or nonfunctional stream riparian areas and wetlands improved (Q 8).*	34 acres	47 acres	-	81 acres
Number of springs improved or restored (Q 9).	2 springs	1 spring	-	3 springs
Number of water rights procured or filings completed (Q 10).	None	None	None	None
Annual mean discharge and peak streamflow (Q 11).	Oak Creek: 31 cfs Wet Beaver Crk: 7.05 cfs Fossil Creek: 42.1 cfs	Oak Creek: 111.9 cfs Wet Beaver Crk: 52.2 cfs Fossil Creek: 64.1 cfs	Oak Creek: 102.4 cfs Wet Beaver Crk: 32.7 cfs Fossil Creek: 64.1 cfs	N/A
Number of projects where BMP implementation was effective at protecting soil productivity (Q 15) ("Field data from a sample of implemented projects on the forest (soil condition and soil productivity), including implemented BMPs.")	6	-	-	6

*All acres are approximate and based on the most recent FACTS and GIS data available.

4FRI MPMB

Member organizations of the 4FRI MPMB are engaged in the following monitoring of watershed resources in the Coconino National Forest:

Springs: The 4FRI MPMB has worked with the Grand Canyon Trust and the Forest Service since 2018 to monitor the site-level effects from spring restoration on aquatic and emergent vegetation, using pre- and post-restoration vegetation transects at select sites. These partners are also working together to refine and improve spring monitoring protocols.

In 2018 the 4FRI MPMB and Forest Service partnered with the Springs Stewardship Institute at the Museum of Northern Arizona to develop a landscape-scale monitoring protocol that will detect ecosystem changes at springs resulting from upland thinning and burning treatments (Schenk et al. 2019).

In 2019 the MPMB and Forest Service funded a five-year agreement with the Springs Stewardship Institute to implement the monitoring protocol at 56 springs across the Kaibab and Coconino National Forests. The Springs Stewardship Institute hosts the database of completed spring condition surveys which supports restoration of selected springs and monitoring of those springs. Also in 2019, the 4FRI MPMB and Forest Service entered into an agreement with Northern Arizona University to place instruments and continuously monitor flows at four springs on the Kaibab and Coconino National Forests. Preliminary results of this study, expected early in FY 2022, will shed light on the links between restoration treatments, climactic events, and spring flows. The Coconino National Forest will report on those and future results in the 2023 Biennial Monitoring Evaluation Report.

The restoration and improvement treatments implemented in stream riparian areas, wetlands, and at springs during these three fiscal years have moved these resources toward their desired conditions. These management activities, conducted with the appropriate BMPs, as well as dispersed recreation management, have improved functional-at-risk or nonfunctional stream riparian areas and wetlands, and contributed to the restoration of riparian function to springs not in proper functioning condition by:

- Stabilizing active headcuts using loose rock structures.
- Improving soil water infiltration and storage.
- Addressing channel incision with gully stabilization treatments.
- Improving vegetation establishment and robustness along streambanks and around springs.
- Increasing the wetted area with stabilization treatments.
- Fencing to protect springs, their sources, and their cultural values from degradation.
- Reducing invasive plants (see Invasives, Insects, and Disease section).
- Making progress in meeting forest plan objectives for Riparian Forest Types, Wetlands, Springs, and Soil (see the Plan Amendments/Objectives section).

In riparian and spring areas treated, protective vegetative ground cover is increasing, and soil productivity and function is improving. Compaction and erosion is reduced.

Recommendations

Based on the ongoing restoration work and monitoring results for these three fiscal years, we are not considering any changes to the direction for Watershed and Soil Resources in the revised Coconino Forest Plan. Budget constraints resulted in a delay in refilling the forest and district hydrologist positions and a lack of BMP monitoring in FYs 2019 and 2020. The Coconino NF has since filled these positions and the forest is committed to continuing BMP monitoring in FY 2021 and FY 2022.

Invasives, Insects, and Disease

Monitoring Questions 12, 13, and 14 address the incidence and abundance of aquatic invasive species and invasive plants, and the extent of insect and pathogen outbreaks.

Monitoring Question 19B looks at how much management activities have contributed to reducing the incidence or abundance of aquatic invasive species in habitat for threatened, endangered or proposed species. One of its metrics is similar to that for Monitoring Question 12; its other metric is the number of new populations of aquatic invasives.



12. How much have management activities contributed to reducing the incidence or abundance of aquatic invasive species?
13. How much have management activities contributed toward reducing the incidence or abundance of invasive plants?
14. To what extent are undesirable outbreaks of insects and pathogens occurring on the forest? (1982 Planning Rule (sec. 219.12(k)(5)(iv))
19. B. How much have management activities contributed to reducing the incidence or abundance of aquatic invasive species in habitat for threatened, endangered or proposed species (related to question 10)?

Monitoring Results

In fiscal year (FY) 2018:

- Green sunfish were removed in 3.2 miles of Spring Creek, greenies were removed in 4.7 miles of Red Tank Draw, and greenies were removed from stock tanks in 10.7 miles of West Clear Creek.
- Bark beetles damaged approximately 33,780 acres of ponderosa pine forest; pinyon ips beetles and cedar bark beetles damaged about 2,990 acres of pinyon-juniper forest; Douglas-fir beetles, Douglas-fir tussock moths, and fir engravers damaged approximately 1,225 acres of mixed conifer forest; and spruce beetles and western spruce budworms damaged about 625 acres of spruce-fir forest. Total acres of damage or mortality from these undesirable outbreaks was 38,620 acres across ecological restoration units (ERUs).

In FY 2019:

- Green sunfish were removed in 3.2 miles of Spring Creek, bullhead were removed in 2.5 miles of Rarick Canyon, greenies were removed in 47 miles of Red Tank Draw, greenies and smallmouth were removed in 3 miles of Walker Creek, and greenies were removed from stock tanks in 10.7 miles of West Clear Creek.
- A new population of green sunfish were found in two miles of General Springs and a new population of New Zealand (NZ) mud snail were found in one mile of Oak Creek.
- Bark beetles damaged approximately 15,120 acres of ponderosa pine forest; pinyon ips beetles and cedar bark beetles damaged about 2,395 acres of pinyon-juniper forest; Douglas-fir beetles, Douglas-fir tussock moths, and fir engravers damaged approximately 1,670 acres of mixed conifer forest; and spruce beetles and western spruce budworms damaged about 625 acres of spruce-fir forest. Total acres of damage or mortality from these undesirable outbreaks was 38,620 acres across ecological restoration units (ERUs).

In FY 2020:

- Bullhead were removed in 2.5 miles of Rarick Canyon, greenies were removed from 4.7 miles of Red Tank Draw, and greenies and smallmouths were removed from three miles of Walker Creek.
- Bark beetles damaged approximately 32,730 acres of ponderosa pine forest; pinyon ips beetles, cedar bark beetles, and pinyon needle scale damaged about 2,100 acres of pinyon-juniper forest; Douglas-fir beetles, Douglas-fir tussock moths, and fir engravers damaged approximately 1,750 acres of mixed conifer forest; and spruce beetles, western spruce budworms, and spruce aphids damaged about 135 acres of spruce-fir forest.

Table 8. Amount of Invasives Treatments and Insect and Disease Damage in FYs 2018, 2019, and 2020

Treatments/Damage*	FY 2018	FY 2019	FY 2020	3-year Total
Miles of streams and acres of lakes, ponds, or wetlands with non-native species removal or are affected by a fish barrier or other structure (Qs 12, 19B).	18.6 miles	24.1 miles	10.2 miles	52.9 miles
Acres of invasive plants treated (Q 13).	866	4,358	1,280	6,504
Acres of damage or mortality from insects and disease (Q 14).	38,620	19,810	36.715	95,145
Number of new populations of invasive species (Q 19B).	3 new populations	7 new populations	4 new populations	14 new populations

*All miles and acres are approximate and based on the most recent FACTS and GIS data available.

4FRI MPMB

A partnership comprising The Nature Conservancy, AmeriCorps, the Monitoring Board, and the Forest Service has added to the Forest Service's capacity to conduct post-treatment monitoring of invasive species. To date, The Nature Conservancy and AZ AmeriCorps team members have identified and mapped locations of invasive plant populations following thinning in one project area on the Coconino National Forest. This information is expected to be shared with the forest early in FY 2022 and will then be used to target invaded areas for treatment with herbicides. The Coconino National Forest will report on these and any other results from this monitoring in the 2023 Biennial Monitoring Evaluation Report.

The management activities implemented in streams, lakes, ponds, or wetlands have contributed to reducing the incidence or abundance of aquatic invasive species. Treating identified populations of invasive plants have moved forest ERUs toward their desired conditions. These management activities, as well as continued monitoring of non-native fish and plant populations, have maintained, restored, and improved habitat by:

- Using hand, mechanical, and chemical treatments to control or remove non-native and invasive species.
- Removing non-native fish to improve the survival and success of reintroduced populations of native fish.
- Reducing predation and competition from aquatic invasive species, and threats to the sustainability of listed species such as the Chiricahua leopard frog.
- Designing prescribed fire treatments to protect listed species habitat and reducing the threat of uncharacteristic wildfire.

Acres of damage or mortality from insects and disease varied but remained in the tens of thousands of acres during FYs 2018 to 2020. The number of new populations of invasive species remained low. These invasive populations were identified, inventoried, and treatments were designed and implemented to stop their spread and eliminate them.

Recommendations

Based on these results, we are not considering any changes to the direction for Invasives, Insects, & Disease in the revised Coconino Forest Plan. However, it is clear that we need to address the thousands of acres with damage or mortality from insect and disease outbreaks. During project planning each year, address those forest stands affected by these outbreaks. This increased susceptibility to insect and disease should be addressed with additional mechanical thinning and fire treatments to return stands to healthier reference conditions. Treatments that reduce stand density will reduce the occurrence of insect and disease outbreaks by lessening tree competition for water and nutrients, making trees less vulnerable to these stressors, and increasing forest health and resilience to climate change.

Threatened, Endangered, and Proposed Species; Habitat Diversity

Monitoring Question 19A addresses the status and trend of ecological conditions needed for aquatic and riparian-dependent threatened, endangered, and proposed species.

Monitoring Question 22 looks at how management activities have helped maintain or moved toward desired conditions for aspen, an ecological indicator of habitat diversity and early seral stages.



19. A. How much have management activities improved habitat for aquatic and riparian-dependent threatened, endangered, or proposed species (related to question 8)?
22. How much have management activities contributed to maintaining or moving toward desired conditions for aspen? Aspen is an ecological indicator of habitat diversity, and early seral stages in the following ERUs: Mixed Conifer with Infrequent Fire, Mixed Conifer with Frequent Fire, Spruce-Fir, and in localized areas in Ponderosa Pine.

Monitoring Question 9, addressing the restoration of riparian function to springs, is included in this section as well as in the previous Watershed and Soils Resources section.

Monitoring Results

In fiscal year (FY) 2018:

- Meadow restoration was completed in two miles of Houston Draw and in two miles of Buck Springs Canyon.
- Spinedace stocking was completed in four miles of Barbershop Canyon and in two miles of Kehl Canyon.
- 424 acres of aspen were protected with exclosure fencing or maintained with conifer weeding and other release treatments.
- Two springs were improved in FY 2018, Deer Run Spring and T-Six Spring. Supplemental energy dissipation was installed in the runout channel in Deer Run Spring on the Red Rock Ranger District. In early 2018, Grand Canyon Trust restored the T-Six

Spring site by filling in the trench and building an 8-foot elk fence around the ciénega habitat. This restoration buried the anthropogenic hillslope source and resulted in the spring emerging directly into the ciénega below.

In FY 2019:

- Meadow restoration was completed in two miles of Houston Draw and in two miles of Buck Springs Canyon.
- Bank stabilization was completed in 3.2 miles of Spring Creek.
- Spinedace stocking was completed in four miles of Barbershop Canyon, in three miles of Miller Canyon, and in two miles of Kehl Canyon.
- 305 acres of aspen were protected with exclosure fencing or maintained with conifer weeding, oystershell scale treatments, and other release treatments.
- Barbershop Spring on the Mogollon Rim RD was improved with assistance from the Grand Canyon Trust. Volunteers assisted with erosion stabilization and headcutting by installing loose rock structures to prevent soil erosion within the spring runout channel. The area has experienced very heavy browsing by ungulates (mainly elk), leading to inadequate vegetative cover. These stabilization measures will increase the wetted area, improve vegetation establishment, and increase the robustness of the wetland vegetation.

In FY 2020:

- Spinedace stocking was completed in 3.2 miles of Spring Creek.
- 293 acres of aspen were protected with exclosure fencing or maintained with conifer weeding, other release treatments, and aspen planting.

Table 9. Activities for Habitat Improvement by Fiscal Year

Management Activity*	FY2018	FY2019	FY2020	3-year Total
Miles of functional at-risk or nonfunctional stream riparian areas improved with threatened, endangered, and proposed species habitat (Q 19A)	10 miles	16.2 miles	3.2 miles	29.4 miles
Acres of aspen protected or maintained (Q 22)	424	305	293	N/A
Acres of aspen protected by exclosure fencing	286	273	261	N/A
Acres of aspen planted	-	-	2	2
Acres of oystershell scale treatments	-	2	-	2
Acres of aspen release (conifer weeding, maintenance treatments)	138	47	30	215
Number of springs improved or restored (Q 9)	2 springs	1 spring	-	3 springs

*All miles and acres are approximate and based on the most recent FACTS and GIS data available.

CLT Monitoring

One of the projects/programs monitored by the Coconino Leadership Team in FY2019 was the Aspen Restoration Program on the Flagstaff Ranger District. The Aspen Restoration Program is key to implementing the Coconino Forest Plan's objective to restore at least 1,000 acres of aspen every 10 years. The program consists of restoration activities that promote regeneration, remove competing vegetation, or remove disturbances that could negatively affect aspen. It includes:

1. Monitoring aspen regeneration on 600 to 800 acres of the Schultz Fire area.
2. 1,765 acres slated for aspen restoration in the Hochdorffer Task Order under the Hart Prairie EA (cutting conifers to release overstory aspen and create a suitable understory environment for aspen regeneration).
3. 2.4 acres of aspen planting inside exclosure fences along Highway 180, with funding provided by a National Forest Foundation (NFF) grant, in coordination with and Friends of Northern Arizona Forests (FoNAF), and trees grown at the Northern Arizona University (NAU) greenhouse from local root cuttings.
4. Jackstraw treatments (the process of falling trees on top of each other and leaving them unlimbed and unbuckled so as to maximize a physical barrier and protect aspen from browsing by large ungulates).
5. A Memorandum of Understanding (MOU) with the Arizona Game and Fish Department (AZGFD) to increase hunting pressure and reduce the elk population on the district in areas where large-scale disturbances or forest management treatments are likely to induce aspen regeneration. The Forest Service and AZGFD agreed that herbivory by elk (and other ungulates) can adversely affect aspen growth and survival, and the Forest Service agreed to "aggressively pursue opportunities to regenerate aspen at a landscape scale."
6. An aspen exclosure program in partnership with FoNAF, a volunteer group dedicated to helping protect and enhance northern Arizona forests. FoNAF has constructed and/or maintained over 70 eight-foot ungulate exclosure fences to protect 300 acres of aspen from browsing. Forest Service personnel capture detailed data on every exclosure.
7. A partnership with Forest Health and Protection (FHP) and NAU to explore different mechanical treatment options for controlling oystershell scale infestations and enhancing aspen vigor and growth.
8. A propagation study to test whether certain genotypes possess natural resistance to browsing by FoNAF and an American Conservation Experience (ACE) crew, with subsequent monitoring.
9. Monitoring plots to evaluate the distribution and abundance of aspen regeneration and preliminary browsing impacts, and monitored through a partnership between the Coconino National Forest, Forest Health and Protection (FHP), and NAU.

The Coconino Leadership Team visited aspen treatments on the Flagstaff Ranger District, including fenced and unfenced areas of aspen regeneration, planted aspen inside exclosure

fencing, different cutting treatments (hand-thinning, precommercial thinning, coppice/clearfell) being applied to control oystershell scale infestations, and a jackstrawing treatment to protect aspen regeneration from browsing. The team discussed how effective these treatments have been, their inherent trade-offs, and recommendations for ongoing treatments. Lessons learned from implemented treatments speak to:

- the abundance of aspen regeneration in the Schultz Fire area where vegetative competition is lacking and hunting pressure on elk has been increased, as well as in fenced stands eliminating browsing pressure;
- maintaining high levels of hunting/predator pressure on deer and elk, especially when new pulses of aspen regeneration occur;
- the need for continued study of treatments to reduce the effects from oystershell scale;
- successful aspen planting being more intensive than traditional conifer planting;
- determining if hotter burns produce larger pulses of aspen regeneration;
- the importance of partnerships in research and restoration projects.

The team determined that the treatments conducted so far have been very successful in restoring and maintaining aspen on the forest and moving stands of aspen toward desired conditions. Planned and modified treatment will continue as recommended by the Coconino Leadership Team.

Other Wildlife and Plant Monitoring

In addition to that required by the revised Coconino Forest Plan for these three fiscal years (required annually), wildlife and plant monitoring completed in FYs 2018 to 2020 included:

In fiscal year (FY) 2018:

- Mexican spotted owl (Bird Conservancy of the Rockies and wildlife crews: 45 Protected Activity Centers (PACs) on the Flagstaff Ranger District (RD), 48 PACs on the Mogollon Rim RD, and 3 PACs on the Red Rock RD)
- Southwestern willow flycatcher (4 surveys on the Red Rock RD)
- Western yellow-billed cuckoo (5 surveys on the Red Rock RD)
- Narrow-headed garter snake (multiple surveys, captive breeding program on the Red Rock RD)
- Northern Mexican garter snake (with Arizona Game and Fish Department (AZGFD))
- Chiricahua leopard frog (critical habitat photo monitoring on the Red Rock RD)
- Bald eagle (winter bald eagle survey routes forest-wide)
- Federally listed and sensitive fish surveys (4 creeks)
- Arizona toad (1st year surveys on the Red Rock and Mogollon Rim RDs)
- Northern goshawk (28 Post-fledging Family Areas (PFAs) on the Flagstaff RD)
- Northern leopard frog (86 springs, lakes, and stock tanks on the Flagstaff RD)
- Peregrine falcons (10 eyries on the Flagstaff RD)

- Sensitive agave (1 population on the Red Rock RD)
- NABat Acoustical Monitoring (5 cells on the Red Rock and Mogollon Rim RDs)
- Four-nerve daisy (habitat on the Red Rock RD)

In FY 2019:

- Mexican spotted owl (Bird Conservancy of the Rockies and wildlife crews: 51 PACs on the Flagstaff RD, 6 PACs on the Mogollon Rim RD, and 3 PACs on the Red Rock RD)
- Southwestern willow flycatcher (Friends of the Verde River surveys on the Red Rock RD)
- Western yellow-billed cuckoo (5 surveys with AZGFD, FWS on the Red Rock RD)
- Narrow-headed garter snake (multiple surveys, captive breeding program on the Red Rock RD)
- Northern Mexican garter snake (with AZGFD on the Red Rock RD)
- Fossil springsnail (known populations on the Red Rock RD)
- Bald eagle (winter bald eagle routes, banding forest-wide)
- Federally-listed and sensitive fish surveys (7 creeks)
- Arizona toad (2nd year surveys on the Red Rock and Mogollon Rim RDs)
- Northern goshawk (24 PFAs on the Flagstaff RD)
- Northern leopard frog (156 springs, lakes, and stock tanks on the Flagstaff RD)
- Peregrine falcons (11 eyries on the Flagstaff RD)
- Sensitive agave (Verde Valley on the Red Rock RD)
- Common black-hawk (Fossil Creek nest surveys on the Red Rock RD)
- NABat Acoustical Monitoring (3 cells on the Red Rock RD, 1 cell on the Flagstaff RD, 2 cells on the Mogollon Rim RD)

In FY 2020:

- Mexican spotted owl (Bird Conservancy of the Rockies and wildlife crews: 41 PACs on the Flagstaff RD and 5 PACs on the Mogollon Rim RD)
- Southwestern willow flycatcher (Friends of the Verde River surveys on the Red Rock RD)
- Narrow-headed garter snake (multiple surveys, captive breeding program on the Red Rock RD)
- Chiricahua leopard frog (critical habitat photo monitoring on the Red Rock RD)
- Bald eagle (winter bald eagle routes forest-wide)
- Eagle nest site on the Mogollon Rim RD, 4 visits
- Federally-listed and sensitive fish surveys (3 creeks and stock tanks)
- Arizona toad (3rd year surveys on the Red Rock RD)
- Northern goshawk (24 PFAs on the Flagstaff RD; 37,000 acres on the Mogollon Rim RD)
- Northern leopard frog (50 springs, lakes, and stock tanks on the Flagstaff RD)

- Peregrine falcons (12 eyries on the Flagstaff RD)
- Sensitive agave (2 populations on the Red Rock RD)
- Common black-hawk (3 Fossil Creek nest surveys on the Red Rock RD)
- NABat Acoustical Monitoring (4 cells on the Red Rock RD, 2 cells on the Flagstaff RD, and 1 cell on the Mogollon Rim RD)
- Colonial nesting waterbirds (one site, the Cragin Reservoir, on the Mogollon Rim RD)
- Riparian herpetofauna VES (96 sites on the Mogollon Rim RD)

The management activities implemented in functional at-risk or nonfunctional stream riparian areas, the acres of aspen protected or maintained, and the springs improved or restored have moved these forest resources toward their desired conditions. They have improved habitat for aquatic and riparian-dependent threatened, endangered, or proposed species, and contributed to habitat diversity and early seral stages in forest ERUs by:

- Maintaining or improving native riparian vegetation along streambanks and around springs.
- Reducing riparian fragmentation, the threat of excessive sedimentation, soil compaction, water quality concerns, and vegetation damage from dispersed recreation.
- Reducing the threat of uncharacteristic wildfire.
- Reducing invasive plants (see Invasives, Insects, and Disease section).
- Protecting springs, their sources, and their cultural values from degradation.
- Protecting aspen with fencing, planting aspen, releasing aspen with conifer weeding and maintenance treatments, and treating for oystershell scale.
- Making progress in meeting forest plan objectives for Riparian Forest Types, Wetlands, Springs, and Aspen and Maple (see the Plan Amendments/Objectives section).

In riparian and spring areas treated, protective vegetative ground cover is increasing, and soil productivity and function is improving. Compaction and erosion is reduced. Aspen restoration on the Flagstaff Ranger District is making great progress and on target to meet forest plan objectives.

Recommendations

Based on these results, we are not considering any changes to the management direction for aquatic and riparian-dependent threatened, endangered, and proposed species habitat, including springs and aspen stands, in the revised Coconino Forest Plan. The forest is making great progress on the wildlife, fish, and plant objectives in the Forest Plan, meeting or exceeding all but one of them in this first three years of this 10-year planning period.

Scenic Integrity

Monitoring Question 28 looks at the progress toward scenic integrity desired conditions in areas identified as needing rehabilitation.

Monitoring looks at the acres of fire and vegetation treatments in the Scenic Integrity Objectives rehabilitation areas, as well as the percentage of acres in them that have been thinned and burned and that improved by at least one level.



28. How much have management activities contributed to progress toward scenic integrity desired conditions in areas identified as needing rehabilitation?

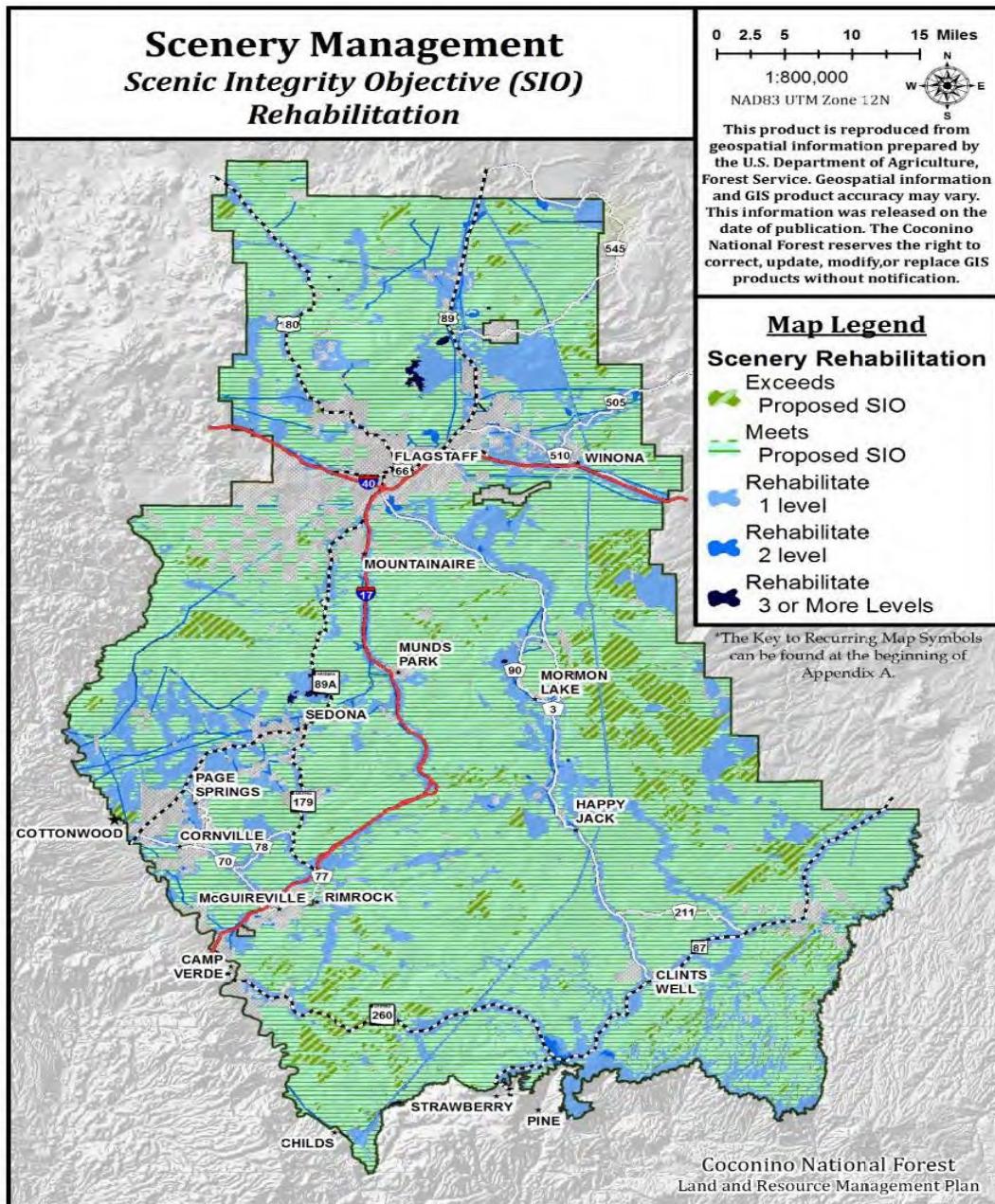
The Coconino NF is divided into four levels of desired scenic integrity: very high, high, moderate, and low. These levels set objectives for the amount of variation from the desired landscape character that is permissible within the scenic integrity level.

Table 54, Scenery Rehabilitation Acreage, in the forest plan's Final Environmental Impact Statement (FEIS, Vol. I, p. 305) shows the acreage exceeding and meeting desired conditions for scenery and those acres identified for rehabilitation.

Table 10. Acres and Percent of Forest Exceeding or Meeting SIOs or Needing Rehabilitation

Summary	Acres	Percent of Forest
Exceeds scenic integrity objective (desired condition)	188,109	6
Meets scenic integrity objective (desired condition)	1,322,194	72
Rehabilitate (1 level to meet scenic integrity objective)	352,810	19
Rehabilitate (2 levels to meet scenic integrity objective)	39,138	2
Rehabilitate (3 or more levels to meet scenic integrity objective)	4,065	<1

Map 14 in Appendix A (Maps) to the revised Coconino Forest Plan displays those areas identified as needing rehabilitation to meet proposed Scenic Integrity Objectives (SIOs). This map shows what areas on the forest already exceed or meet the proposed SIOs, as well as those areas that have been identified as needing one, two, or three or more levels of rehabilitation.



In areas identified for rehabilitation, existing visual impacts may be managed through site-specific projects, such as vegetation treatments, fuels reduction, prescribed fire, etc., to improve the scenic integrity in the long term. Any of the areas identified for rehabilitation, if improved by one scenic integrity objective, would meet the objective. Areas identified to be rehabilitated by two or more levels may not realize the overall desired scenic integrity for several planning cycles.

For vegetation treatments, guidelines for all scenic resources include reducing the visibility of management-created debris such as slash, slash piles, and stumps. These guidelines, along with the proposed SIOs, would manage for natural-appearing scenery and reduce negative effects from vegetation management activities on scenery viewed in concern level 1 and 2 travel corridors.

In regard to fire management, fire would play a more natural role on the landscape. By implementing the scenery management system, the effects of fire, burning in the natural disturbance regime of fire-adapted ecosystems, would be part of the desired condition of the landscape character. Typically, when fire burns with low intensity and severity or in a mosaic pattern, the valued landscape character attributes would be intact or mostly intact.

Monitoring Results

The following table reflects the acres of both fire and vegetation treatments completed in areas identified for SIO rehabilitation, as well as the percentage of acres in each SIO rehabilitation level that have been thinned and burned, in FYs 2018, 2019, and 2020.

Table 11. Acres of Treatments in Forest Plan SIO Rehabilitation Levels

SIO Rehabilitation Level ¹ /Management Activity*	FY2018	FY2019	FY2020	3-year Total
Rehabilitate 1 Level				
Prescribed Fire	3,623.2	3,279.1	4,089.3	10,991.6
Wildfire for Resource Objectives	408.7	49.3	-	458.0
Mechanical Treatments	1,620.9	665.8	635.5	2,922.2
% of Rehabilitation Level	1.6 %	1.1 %	1.3 %	4.1 %
Rehabilitate 2 Levels				
Prescribed Fire	305.8	222.6	80.9	609.3
Wildfire for Resource Objectives	80.7	278.9	-	359.6
Mechanical Treatments	895.9 ²	80.7	60.0	1,036.6
% of Rehabilitation Level	3.3 %	1.5 %	0.4 %	5.1 %
Rehabilitate 3 Levels				
Prescribed Fire	-	-	-	-
Wildfire for Resource Objectives	0.1	-	-	0.1
Mechanical Treatments	9.8	3.7	0.6	14.1
% of Rehabilitation Level	0.2 %	0.1 %	<0.1%	0.3 %
Total Acres by Year	6,945.1	4,580.1	4,866.3	16,391.5

*All acres are approximate and based on the most recent FACTS and GIS data available.

¹ SIO Rehabilitation Level = the number of levels of rehabilitation needed in an area to reach its desired SIO.

² 621 acres of these mechanical treatments in 2018 were for corridor maintenance of existing Arizona Public Services rights-of-way.

The projects in which these mechanical treatments were implemented include the Antelope Tank Grassland Restoration, I-17 Hazard Tree Removal, Archies PAC Hand-thin, Mayflower PAC Hand-thin, Yeager Canyon Grassland Restoration, Hart Prairie Meadow Restoration, Flagstaff Watershed Protection Project (FWPP) Force Account Thinning, and FWPP Helicopter Projects.

The fire treatments include those in the Victorine, Newman, Mountainaire, Bar M, East Clear Creek, Horseshoe, Brui, Airport, and Upper Beaver Creek (UBC) prescribed burn projects.

These site-specific vegetation and fire treatments in these areas identified for rehabilitation were designed and implemented to maintain or move toward the desired SIOs. The standards and guidelines for scenic resources and design features and BMPs for visuals and scenery were followed per forest plan direction, and visual inspections were required to assess compliance with Forest Plan desired conditions. This is documented in contract administration documents, sale contract provisions, plan-in-hand documents, resource reviews of task orders, silvicultural prescriptions, and quality control plans in project stewardship agreements. Design features include “feathering” of mechanical treatments, using directional marking, retaining particular trees for scenic value, keeping stump heights to six inches or lower, requiring treatment of or removal of slash from mechanical treatments, and creating irregularly-shaped regeneration openings of small size (less than one acre).

In areas identified for rehabilitation, existing visual impacts were managed through these site-specific vegetation and fire treatments. These management activities, though adding to scenery impacts in the short term during and immediately after treatment, meet the objective of improving the scenic integrity objective by at least one level over the long term. Evidence of fire and vegetation treatments was removed and the treatment area restored in a timely manner, except where evidence of fire was within the natural range of variability. For example, pile burning removed the piles of slash from mechanical treatments. Stands treated with prescribed burning or wildfire for resource objectives looked burned and blackened for the short term, but reduced ground and ladder fuels and prompted fresh new forb and grass growth in the next growing season. This not only reduced the risk of uncharacteristic fire, but improved the healthy open park-like appearance of the treated stands.

Recommendations

Based on these results, we are not considering any changes to the direction for Scenery Management in the revised Coconino Forest Plan. The forest will continue treatments in those parts of the forest identified as needing rehabilitation to meet the SIO, monitoring the use of scenery standards and guidelines and BMPs. The forest does not currently have a scenery management specialist or landscape architect. Retirements and turnover, the needed hiring process, and budget constraints in the last few years have delayed filling this type of position. This has limited the forest’s capacity to determine the results of annual scenery monitoring. The forest will continue to work to provide this particular expertise for the forest.

Plan Amendments, Objectives

Monitoring Questions 29 and 30 look at any unforeseen issues that require plan amendments, and the progress made toward meeting the objectives laid out in the revised Coconino Forest Plan.

29. Have there been changes that have resulted in unforeseen issues requiring plan amendments? (sec. 219.12(k))
30. How do actual accomplishments compare with plan objectives? (sec. 219.12(k)(1))

Plan Amendments

From FY 2018 through FY 2020, no amendments were needed to the revised Forest



Plan. Two (2) administrative changes were made: one to transition to focal species as required by the Planning Rule, and one to respond to appeal resolutions.

Plan Objectives

The revised Coconino Forest Plan includes the following objectives related to the monitoring questions addressed in this 2021 Biennial Monitoring Evaluation Report. The amount of these objectives fulfilled in FYs 2018, 2019, and 2020 is described as follows:

Objectives for Grassland ERUs

FW-TerrERU-Grass-O

- 1 Restore or improve at least 3,500 acres of Semi-desert Grasslands during each 10-year period over the life of the plan.
- 2 Restore or improve 10,800 to 12,400 acres of Great Basin Grasslands during each 10-year period over the life of the plan.
- 3 Restore or improve 7,600 to 11,400 acres of Montane/Subalpine Grasslands during each 10-year period over the life of the plan.

Approximately 112 acres of Semi-desert Grasslands were treated for invasives reduction; 2,149 acres of Great Basin Grasslands were treated mechanically, with fire, and for invasives reduction; and 2,469 acres of Montane/Subalpine Grasslands had mechanical, fire, and invasives

treatments. In these three years, the forest has only met about three percent (3%) of the objective for Semi-desert Grasslands, but has met a higher percent of the objectives for Great Basin and Montane/Subalpine Grasslands, almost 20 percent and more than 32 percent respectively, for the current 10-year period of the Forest Plan. In order to meet the objectives for these grasslands, at least 3,388 acres of Semi-desert Grasslands, at least 8,651 acres of Great Basin Grasslands, and at least 5,131 acres of Montane/Subalpine Grasslands need to be restored or improved in FYs 2021 to 2028.

Objectives for Pinyon Juniper ERUs

FW-TerrERU-PJ-O

- 1 Mechanically treat between 1,000 and 10,000 acres of Pinyon Juniper with Grass during each 10-year period over the life of the plan.
- 2 Use naturally ignited wildfires (lightning-caused fires that are managed for resource objectives) to treat at least 3,750 acres of Pinyon Juniper with Grass within the natural fire regime during each 10-year period over the life of the plan.
- 3 Use naturally ignited wildfires (lightning-caused fires that are managed for resource objectives) to treat at least 3,750 acres in Pinyon Juniper Evergreen Shrub within the natural fire regime during each 10-year period over the life of the plan.

Approximately 762 acres of the Pinyon Juniper with Grass ERU were treated mechanically in FYs 2018 to 2020, already providing more than 76 percent of the minimum acres for the 1st objective.

Approximately 2,772 acres of naturally-ignited wildfire were managed for resource objectives in the Pinyon Juniper with Grass ERU in FYs 2018 to 2020, meeting almost 74 percent of the objective for the current 10-year period of the Forest Plan.

Although there was no naturally-ignited wildfire reported in the Pinyon Juniper Evergreen Shrub ERU in FYs 2019 to 2020, approximately 3,372 acres of prescribed burning was conducted.

Objective for Aspen and Maple

FW-TerrERU-AspMpl-O

- 1 Restore at least 1,000 acres of aspen and maple during each 10-year period over the life of the plan. Restoration could include, but is not limited to, activities that promote regeneration, remove competing vegetation, or remove disturbances that could negatively impact aspen or maple.

From 293 to 424 acres of aspen were restored each FY (2018-2020) with planting, fencing, aspen release, and oystershell scale treatments. These treatments meet this objective for aspen and maple during these first three years of the current 10-year period of the revised Forest Plan.

Aspen restoration on the Flagstaff Ranger District is making great progress and on target to meet forest plan objectives. Though silviculture prescriptions specify that maples are not to be damaged or cut, there is no record of any specific maple restoration activities taking place during these three fiscal years.

Objectives for Ponderosa Pine

FW-TerrERU-PP-O

- 1 Use prescribed cutting to treat 50,000 to 260,500 acres of Ponderosa Pine during each 10-year period over the life of the plan.
- 2 Use prescribed fire to underburn 150,000 to 200,000 acres of Ponderosa Pine within the natural fire regime during each 10-year period over the life of the plan.
- 3 Use naturally ignited wildfires (lightning-caused fires that are managed for resource objectives) to treat at least 135,000 acres of Ponderosa Pine within the natural fire regime during each 10-year period over the life of the plan.

Approximately 12,341 acres of Ponderosa Pine were treated with some type of cutting in FYs 2018 through 2020; meeting almost 25 percent of the minimum acres for the current 10-year period of the Forest Plan.

Approximately 59,634 acres were treated with prescribed fire in these three FYs and 13,819 acres were treated with naturally ignited wildfires in FYs 2018 to 2020. In these three years, the forest has met almost 40 percent of the minimum acres for prescribed fire in the Ponderosa Pine ERU and more than 10 percent of the acres for naturally-ignited wildfire, for the current 10-year period of the Forest Plan. The forest is making good progress toward meeting the objective for prescribed fire in this type. Meeting the objective for managing naturally-ignited wildfires for resource objectives will be dependent upon the occurrence of lightning-caused fires in the Ponderosa Pine ERU.

Objectives for Mixed Conifer ERUs

FW-TerrERU-MC-MCFF-O

- 1 Use prescribed cutting to treat 2,900 to 15,000 acres of Mixed Conifer with Frequent Fire during each 10-year period over the life of the plan.
- 2 Use prescribed fire on at least 8,000 acres of Mixed Conifer with Frequent Fire within the natural fire regime during each 10-year period over the life of the plan.
- 3 Use naturally ignited wildfires (lightning-caused fires managed for resource objectives) to treat at least 7,500 acres of Mixed Conifer with Frequent Fire within the natural fire regime, during each 10-year period over the life of the plan.

No prescribed cutting took place in Mixed Conifer with Frequent Fire during FYs 2018 to 2020; approximately 995 acres of Mixed Conifer with Aspen were treated with some type of cutting. Combining these, the forest met a little more than 34 percent of the minimum acres of Mixed Conifer ERUs for the current 10-year period of the Forest Plan.

Approximately 59,634 acres were treated with prescribed fire in these three FYs and 13,819 acres were treated with naturally ignited wildfires in FYs 2018 to 2020. In these three years, the forest has met almost 40 percent of the minimum acres for prescribed fire in the Ponderosa Pine

ERU and more than 10 percent of the acres for naturally-ignited wildfire, for the current 10-year period of the Forest Plan. The forest is making good progress toward meeting the objective for prescribed fire in this type. Meeting the objective for managing naturally-ignited wildfires for resource objectives will be dependent upon the occurrence of lightning-caused fires in the Ponderosa Pine ERU.

Objectives for Riparian Forest Types

FW-Rip-RipType-O

- 1 Restore the function of 200 to 500 acres of nonfunctioning and functioning-at-risk riparian areas during each 10-year period over the life of the plan, with emphasis on priority 6th code watersheds, so that they are in or moving toward proper functioning condition.

Approximately 1 acre and 9 acres of Mixed Broadleaf Deciduous Riparian Forest and Montane Willow Riparian Forest, respectively, had prescribed cutting in FYs 2018 to FY2020.

Approximately 9 acres of Cottonwood Willow Riparian Forest and 244 acres of Montane Willow Riparian Forest were treated with prescribed fire in FYs 2018 to 2020. In addition, about 39 acres of Montane Willow Riparian Forest were treated with naturally-ignited wildfire for resource objectives. These 302 acres of prescribed treatments and wildfire to meet resource objectives were used to aid in restoring the function of riparian areas.

As the Watershed Improvement Tracking (WIT) database reports, and as displayed in the Watershed and Soils section above, 34 acres of functional-at-risk or nonfunctional stream riparian areas and wetlands were improved in FY2018, and 47 acres were improved in FY2019. These 81 acres in this first three years of the current 10-year period for the Forest Plan constitute more than 40 percent of the minimum acres to be met in this objective. In order to meet this objective fully during this period, at least 119 acres of nonfunctioning and functioning-at-risk riparian areas need to be restored in FYs 2021 to 2028.

Objectives for Scenic Resources

FW-Scenic-O

- 1 Rehabilitate¹² at least 25,000 acres that do not meet the desired SIO by at least one level within 10 years of plan approval.

¹² In the context of scenery management, rehabilitation is a short-term management action used to return a landscape to a desired level of scenic quality formerly found in the natural landscape. While the rehabilitation action may be completed in the short term, the scenic rehabilitation may only be achievable in the long term as a result of the short-term management action.

Approximately 14,371 acres (4.1%) of Rehabilitate 1 Level, 2,005 acres (5.1%) of Rehabilitate 2 Levels, and 14 acres (0.3%) of Rehabilitate 3 Levels identified for the forest received treatments in FYs 2018, 2019, and 2020. The total acres treated in these SIO Rehabilitation Levels during these three years was approximately 16,392 acres. This number of acres in the first three years of the current 10-year period for the Forest Plan constitute more than 65 percent of the acres to be

restored in this objective. In order to meet this objective fully during this period, approximately 8,608 acres of identified rehabilitation areas need to be treated to improve the SIO by at least one level in FYs 2021 to 2028.

Objectives for Wetlands

FW-Rip-Wtlnds-O

- 1 Restore 5 to 10 wetlands currently not in proper functioning condition so that they are in, or are trending toward, proper functioning condition during each 10-year period over the life of the plan.

Approximately 86 acres of Wetland or Cienega were treated with prescribed fire in FYs 2018 to 2020, about 10 acres with naturally-ignited wildfire for resource objectives, and approximately three acres with prescribed cutting. These 99 acres of prescribed treatments and wildfire to meet resource objectives were used to aid in restoring the function of these acres of wetland or cienega.

As the Watershed Improvement Tracking (WIT) database reports, and as displayed in the Watershed and Soils section above, 34 acres of functional-at-risk or nonfunctional stream riparian areas and wetlands were improved in FY2018, and 47 acres were improved in FY2019. The restoration activities in Long Meadow and Houston Draw effectively increased the wetted area adjacent to the stream channel in treated areas. This work in two forest wetlands in the first three years of the current 10-year period for the Forest Plan represents almost 40 percent of the minimum number to be restored to meet this plan objective. In order to meet this objective fully during this period, at least three more forest wetlands need to be restored in FYs 2021 to 2028.

Objectives for Springs

FW-Rip-Spr-O

- 1 Restore riparian function to at least 25 springs identified as not in proper functioning condition to provide water quantity and aquatic habitat for the recovery of plant and animal species during each 10-year period during the life of the plan.

Records show that three (3) springs identified as not in proper functioning condition were improved or restored in FYs 2018 to 2020 (this is displayed in the Watershed and Soils section above). These three spring restorations in the first three years of the current 10-year period for the Forest Plan constitute only 12 percent of the number of springs to be restored. In order to meet this objective fully during this period, at least 22 springs need to have their riparian function restored in FYs 2021 to 2028.

Objectives for Soil

FW-Soil-O

- 1 Maintain satisfactory soil conditions and/or improve impaired and unsatisfactory soil conditions on 100,000 to 350,000 acres during each 10-year period over the life of the plan. Maintenance and improvement would occur as a result of some management actions in other resources. For example, re-locating a road in a grassland could improve impaired soil conditions.

2021 Coconino NF Biennial Evaluation Monitoring Report

This objective will be addressed in the next Biennial Monitoring Evaluation Report published in 2023. Per Monitoring Question #15, the monitoring frequency for soil condition assessments is every three (3) to five (5) years.

Objectives for Wildlife, Fish, and Plants

FW-WFP-O

- 1 Implement at least 20 activities that contribute to the recovery for federally listed species during each 10-year period over the life of the plan. An example of an activity could be thinning a Mexican spotted owl protected activity center to reduce the risk of uncharacteristic fire and to improve habitat conditions for prey species.
- 2 Implement at least 10 activities to benefit sensitive species that contribute to positive trends to avoid the need for listing during each 10-year period over the life of the plan.
- 3 Restore or enhance at least 60,000 acres of terrestrial wildlife habitat during each 10-year period over the life of the plan.
- 4 Restore or enhance at least 70 miles of stream habitat during each 10-year period over the life of the plan.
- 5 Complete at least 30 products or activities that educate the public about wildlife, fish, and plant resources during each 10-year period over the life of the plan. Examples of products include educational signs and brochures, website pages, species checklists, presentations, and field trips.

- 1 Ten (10) activities contributing to the recovery of federally-listed species were implemented in FY 2018, eight (8) in FY 2019, and nine (9) in FY 2020, totaling 27 for these first three years of this 10-year planning period. This number already exceeds that needed to meet this objective for wildlife, fish, and plants.
- 2 Six (6) activities to benefit sensitive species that contribute to positive trends to avoid the need for listing were implemented in FY 2018, four (4) in FY 2019, and five (5) in FY 2020, totaling 15 in these first three years of this 10-year planning period. This number already exceeds that needed to meet this objective for wildlife, fish, and plants.
- 3 Approximately 49,790 acres of terrestrial wildlife habitat was restored or enhanced in FY 2018, about 73,420 acres in FY 2019, and approximately 29,050 acres in FY 2020. In these three years, over 152,260 acres were treated to improve wildlife habitat, far exceeding the number needed to meet this objective for wildlife, fish, and plants.
- 4 Approximately 29.4 miles and 81 acres of stream riparian areas were improved in FYs 2018, 2019, and 2020. The miles of stream habitat represent 42 percent of the number to be restored or enhanced in the first 10-year planning period to meet this plan objective. In order to meet this objective fully during this period, another 40.6 miles of stream habitat needs to be restored in FYs 2021 to 2028.
- 5 Twelve (12) activities that educate the public about wildlife, fish, and plant resources were

completed in FY 2018, ten (10) in FY 2019, and eight (8) in FY 2020, totaling 30 in these first three years of this 10-year planning period. This number already meets that needed to meet this objective for wildlife, fish, and plants.

Recommendations

Amendments

The Fossil Creek Wild and Scenic River Comprehensive River Management Plan (Fossil Creek CRMP) and Final Environmental Impact Statement (FEIS) were originally completed in December 2020. Before the Record of Decision for the CRMP was to be signed, the Backbone Fire burned into the river corridor in the summer of 2021. After a Burned Area Emergency Response (BAER) survey and report, a Supplemental Information Report (SIR) was completed. The SIR documented whether or not effects from the fire would result in new effects from implementation of the CRMP not already disclosed in the Fossil Creek FEIS. The SIR concluded that they would not. The Fossil Creek CRMP was updated to recognize and share information about the Backbone Fire and its effects on the Fossil Creek Wild and Scenic River corridor, and the Record of Decision was signed in October 2021.

The Fossil Creek CRMP and its decision analyzed and approved an amendment to the revised Coconino Forest Plan to:

1. Decrease the area of the Fossil Creek Designated Wild and Scenic River Special Area by four acres at T21N, R7E, E 1/2 Section 21 in order to comply with the requirements of Section 3(b) of the Wild and Scenic Rivers Act, which states, “boundaries shall include an average of not more than 320 acres of land per mile....”
2. Include the management direction provided in Chapter 3 of the Fossil Creek CRMP. This management direction would apply to the 2,892 acres within the Fossil Creek Designated Wild and Scenic River Special Area on the Coconino National Forest.
3. Recommend an 11.6-acre addition to the Designated Fossil Springs Botanical Area in order to better incorporate the diverse vegetation community in the vicinity of Fossil Springs.

Objectives

Based on our current progress toward meeting plan objectives, we are not considering any changes to the objectives currently in the revised Coconino Forest Plan. However, in order to fully meet plan objectives in the first 10-year planning period, we need to consider the following:

- In order to fully meet the objectives for grasslands, restore or improve at least 3,388 acres of Semi-desert Grasslands, at least 8,651 acres of Great Basin Grasslands, and at least 5,131 acres of Montane/Subalpine Grasslands in FYs 2021 to 2028.
- In order to fully meet the objective for Riparian Forest Types, restore at least 119 acres of

nonfunctioning and functioning-at-risk riparian areas in FYs 2021 to 2028.

- In order to fully meet the objective for Wetlands, at least three more forest wetlands need to be restored in FYs 2021 to 2028.
- In order to fully meet the objective for Springs, restore the riparian function of 22 springs in FYs 2021 to 2028.
- In order to fully meet the objectives for Aspen and Maple, consider restoration activities that promote regeneration, remove competing vegetation, or remove disturbances that could negatively impact maple habitat in FYs 2021 to 2028. Continue the great progress being made to restore aspen on the forest.
- In order to fully meet the Wildlife, Fish, and Plants objective for restoring stream habitat, restore another 40.6 miles of stream habitat in FYs 2021 to 2028.
- In order to fully meet the Scenic Resources objective fully during this period, approximately 8,608 acres of identified rehabilitation areas need to be treated to improve the SIO by at least one level in FYs 2021 to 2028.
- Does our current POW process allow us to anchor to these objectives and attain them? Ensure that the annual financial allocation for the discretionary Program of Work supports all objectives, using annual and outyear projections.

Monitoring with Partners

The Coconino National Forest recognizes the value of citizen science in engaging stakeholders and augmenting monitoring and existing data collection programs. With the help of tribes, other agencies, and our partners and stakeholders engaged with the forest, we are making great strides in sharing data and monitoring forest resources.

Monitoring by our partners is extensive and adds a great deal to our community of knowledge about ecosystem restoration. Current citizen science, partnerships, and other volunteer data collection and monitoring activities with reported results on the Coconino



National Forest are described in the previous resource sections. Partners working with the Coconino National Forest on monitoring and data collection include, but are not limited to:

- ❖ Tribes
 - Hopi and Kaibab Band of Paiute – Spring Restoration
 - San Carlos, Tonto, Yavapai, and White Mountain Apache – Emory oak
 - Arizona Tribes with Northern Arizona University (NAU) – Identification and mapping of traditional use plants
 - Yavapai Apache Nation – traditional use, cultural sites
- ❖ Four Forest Restoration Initiative (4FRI) Stakeholder Group Multi-party Monitoring Board, a group of partner organizations that acts as a hub for designing and coordinating monitoring for the large 4FRI projects. Members included the Arizona Game and Fish Department, Campbell Global, Center for Biological Diversity, Ecological Restoration Institute, Grand Canyon Trust, Greater Flagstaff Forests Partnership, Mottek Consulting, Salt River Project, The Nature Conservancy, U.S. Forest Service Rocky Mountain Research Station, and Trout Unlimited.
- ❖ Spring Stewardship Institute of the Museum of Northern Arizona – the health and condition of springs across the 4FRI footprint.

- ❖ The Conservation Economics Institute – the regional economic contributions of 4FRI-related projects.
- ❖ Grand Canyon Trust and Trout Unlimited – the condition of various streams and springs across 4FRI.
- ❖ Bird Conservancy of the Rockies (BCOR) – songbirds.
- ❖ Ecological Restoration Institute – rapid plot pre-treatment surveys
- ❖ Landscape Conservation Initiative/Center for Adaptable Western Landscapes – traditional use plants (with Arizona Tribes), pronghorn habitat quality and connectivity, rapid plot pre- and post-treatment surveys.
- ❖ The Nature Conservancy (TNC) – pre-treatment rapid plots, data
- ❖ Salt River Project – surface water flow
- ❖ U.S. Geological Survey (USGS)
- ❖ AZ Water Science Center – Unmanned Aircraft System (UAS) aerial surveys, canopy/forest pattern
- ❖ Broad Agency Announcement (BAA) – LiDAR collection
- ❖ Friends of the Forest
 - Reading air quality monitors
 - Water quality sampling
 - Bare soil monitoring
- ❖ Arizona Department of Environmental Quality (ADEQ)
 - Water quality
 - Aquatic macroinvertebrates surveys
- ❖ National Forest Foundation (NFF) – analysis of sediment reduction
- ❖ Oak Creek Watershed Council – recreational trail photo points, trail rehabilitation monitoring, analysis of trail BMPs
- ❖ Arizona Department of Game and Fish (AZGFD)
 - Riparian birds
 - Bald and golden eagle flights

- Fossil springsnail
- Native fish
- Ranid frogs program (lowland leopard frog)
- Northern Mexican garter snake
- ❖ Bureau of Reclamation – fish barrier inspections
- ❖ U.S. Fish and Wildlife Service (FWS)
 - Mexican spotted owl
 - Native fish
 - Western yellow-billed cuckoo, southwestern will flycatcher
 - Listed species
- ❖ Northern Arizona University (NAU)
 - Black hawk, western yellow-billed cuckoo, southwestern willow flycatcher surveys
 - Preliminary browsing impacts on aspen regeneration
- ❖ Bat Conservation International (BCI) – acoustic monitoring recording echolocations
- ❖ Friends of the Verde River (FOVR)
 - inventory and mapping of non-native plants
 - southwestern willow flycatcher
- ❖ Forest Health and Protection (FHP) – Preliminary browsing impacts on aspen regeneration
- ❖ Friends of Northern Arizona Forests (FoNAF)
 - aspen exclosures
 - aspen browsing resistance

Recommendations

Encourage continuation of existing partnerships and determine how best to leverage additional partnerships to accomplish monitoring objectives, using consistent and corporate data collection and management requirements.