USDA

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Biennial Monitoring Evaluation Report Deschutes National Forest

Fiscal Years 2016 through 2022

Forest Service

Deschutes National Forest

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Why monitoring matters

There is no single correct approach to managing a forest or grassland. Each decision maker must weigh the ecological complexity of these ecosystems, the changing environmental conditions, the many different viewpoints of the public, and uncertainty about long-term consequences.

Data from monitoring can therefore be extremely useful. A robust, transparent, and meaningful monitoring program can provide information on specific resources, management impacts, and overall trends in condition – in other words, feedback on whether a national forest is meeting management objectives or not.

Each national forest or grassland has a land management plan that balances tradeoffs among recreation, timber, water, wilderness, wildlife habitat, and other uses. The plan describes a set of desired conditions – a science-based vision for what forest or grassland conditions should be once the goals of the plan are met. The forest or grassland plan also includes a monitoring program, organized around a set of monitoring questions and indicators that are designed to track progress toward achieving the desired conditions in the plan.

Monitoring of certain resources is required by law, regulation, or directive (see box below for the required nine monitoring topics). Other monitoring occurs depending on specific needs of the national forest or grassland. Every 2 years, each forest or grassland compiles and evaluates the monitoring results and drafts a report. Decision makers, such as forest and grassland supervisors, use these biennial monitoring evaluation reports to update their knowledge and assess progress toward the desired conditions in the forest plan. The public use these reports to understand what's happening on the land that they depend upon and enjoy.

The Northwest Forest Plan and monitoring

In 1994, the Northwest Forest Plan amended the planning documents of nineteen national forests and seven Bureau of Land Management districts. It includes extensive standards and guidelines that comprise a comprehensive ecosystem management strategy.

Monitoring efforts to verify whether land management plans were achieving the desired results have been a successful key element of the Northwest Forest Plan. In 2018, a comprehensive report including both monitoring data and research (Synthesis of Science to Inform Land Management Within the Northwest Forest Plan Area), provided an up-to-date review of scientific literature about the national forests and grasslands within the Northwest Forest Plan area. The most up to date monitoring reports from the six modules are available on the Regional Ecosystem Office Website.

Monitoring helps us to evaluate the

If the report reveals that a forest is not moving toward or maintaining the desired condition, then there is a need to change management in some way; this is adaptive management. Monitoring data allows us to learn and adjust our strategies based on what was learned. Monitoring also helps a forest to be accountable and transparent to interested and affected parties.

Because monitoring can be expensive, time-consuming, and labor-intensive, forests rely on the help of partners and work collaboratively with them to accomplish monitoring objectives. Forests also rely on existing data sources such as national and regional inventory, monitoring, and research programs; federal, state, or local government agencies; scientists, partners, and members of the public; and information from Tribal communities.

Reports like this one, are critical to adaptive management because they tell a forest and the public whether the land management plan is working. This report does not include any decisions but documents results.

Forest Service monitoring programs include questions and indicators that address nine topics identified in the 2012 Planning Rule (36 Code of Federal Regulations 219.12).

1. Status of select watershed conditions.
2. Status of select ecological conditions including key characteristics of terrestrial and aquatic ecosystems.
3. Status of focal species to assess the ecological conditions.
4. Status of a select set of the ecological conditions to contribute to the recovery of federally listed threatened and endangered species, conserve proposed and candidate species, and maintain a viable population of each species of conservation concern.
5. Status of visitor use, visitor satisfaction, and progress toward meeting recreation objectives.
6. Measurable changes on the plan area related to climate change and other stressors that might be affecting the plan area.
7. Progress toward meeting the desired conditions and objectives in the plan, including for providing multiple use opportunities.
8. Effects of each management system to determine that they do not substantially and permanently impair the productivity of the land.
9. Status of social, economic, and cultural sustainability.

Summary of this report

This 2022 biennial monitoring evaluation report for the Deschutes National Forest documents monitoring activities that occurred during fiscal years 2016 through 2022. Resource specialists addressed 8 monitoring topics by using 12 indicators to determine if current activities and monitoring described in the 2016 Deschutes National Forest Transition Monitoring Plan are moving the Forest toward or maintaining the desired conditions or objectives. Using data collected from fiscal years 2016 through 2022, specialists identified where more data is needed and recommended changes to our forest plan, monitoring plan, or management activities.

The detailed resource reports that were used to build this monitoring report are available in the project record upon request. For a complete listing of monitoring elements, including method of data collection, monitoring frequency, and reporting interval for each, see the 2016 Deschutes National Forest Transition Monitoring Plan. This report and previous monitoring reports are available on the Forest's website about monitoring.

Of the 12 indicators examined, we are meeting both plan objectives and progress towards our desired conditions in 9 indicators. To move the Deschutes National Forest closer to the desired condition for sensitive species we need to improve pumice moonwort habitat. To meet the desired condition for social and economic status the Deschutes National Forest needs to complete the 3 plus 1 strategy to complete the National Environmental Policy Act process for future timber projects which will lead to reaching timber volume targets. The Forest also needs to restore units with elevated detrimental soil conditions to meet the desired condition for soil productivity and to complete soil monitoring on the Sisters Ranger District.

Table 1 summarizes the results of evaluating the monitoring questions covered in this report. The table shows whether the monitoring is meeting the forest plan direction and, if not, whether changes to the forest plan, management activities, or plan monitoring program should be considered.

Table 1. Best Management Practice monitoring results for fiscal years 2017 through 2022

Category	Yes	Uncertain	No
Forest plan direction met	9	0	3
Change to forest plan recommended	0	0	12
Change to management activities recommended	3	0	9
Change to plan monitoring program recommended	0	0	12

In the following pages of this report, you will read about why it is important to evaluate the monitoring results from the five big themes mentioned above. You will also learn details about the key results of our monitoring efforts, and the changes recommended to our forest supervisor. Lastly, a summary table (Table 8) is provided at the end of the report that rolls up the progress and recommendations for each of the 12 indicators.

Forest Supervisor's certification

This report documents the results of monitoring activities that occurred during fiscal years 2016 through 2022 on the Deschutes National Forest. Monitoring on some topics is long-term and evaluation of those data will occur later in time.

I have evaluated the monitoring and evaluation results presented in this report. I have found that there are no recommended changes to the 1990 Deschutes Land and Resource Management Plan, as amended, at this time. I therefore consider the 1990 Deschutes Land and Resource Management Plan sufficient to continue to guide land and resource management of the Deschutes National Forest for the near future.

HOLLY JEWKES
Forest Supervisor, Deschutes National Forest

Status of select watershed conditions

Watersheds are an important part of the environment in the Pacific Northwest, shaping and supporting diverse cultures and ecosystems. Glaciers and snowy mountaintops at the Cascade crest, streams, rivers, waterfalls, and lakes provide clean water, recreational opportunities, and spiritual values for many on the Deschutes National Forest.

The 2012 National Core Best Management Practices Technical Guide was developed to improve agency performance and accountability in managing water quality consistent with the Clean Water Act and State water quality programs. Each national forest and grassland complete an assigned number of national Best Management Practice monitoring evaluations annually in a variety of land management categories. Identified deficiencies in either Best Management Practices implementation or effectiveness that require either adaptive management, or corrective actions are used to adjust land and resource management practices or implement measures to improve water quality protection. The target for this indicator is that Best Management Practices are fully implemented and effective.

Water Quality

Monitoring questions

- What Best Management Practices have been implemented and are they effective at managing water quality consistent with the Clean Water Act?

Key results

This report includes the results of Best Management Practice monitoring for fiscal years 2017, 2018, 2019, 2021, and 2022; monitoring did not occur in 2020 due to the Covid-19 pandemic. Table 2 shows that at the 35 monitored sites, 24 sites showed that Best Management Practices were fully or mostly implemented, and 25 sites showed that Best Management Practices were fully or mostly effective. The lowest rate of Best Management Practice implementation and effectiveness was reported for recreation because monitoring sites were at areas of ongoing recreation use and not associated with implementation of a project (for example, pack and riding stock use area, dispersed recreation area).

Table 2. Best Management Practice monitoring results for fiscal years 2017 through 2022

Resource categories	Number of sites monitored	Best Management Practice implementation	Best Management Practice effectiveness
Aquatic ecosystems	4	Fully - 2, not implemented - 1, no BMPs - 1	Fully - 2, mostly - 2
Chemical use	2	Fully - 1, marginally - 1	Fully - 2
Facilities	4	Fully - 3, no BMPs - 1	Fully - 3, no assessed - 1
Fire	5	Fully - 3, marginally - 1, not assessed - 1	Fully - 2, marginally - 2, not assessed - 1
Recreation	4	Fully - 1, no BMPs - 3	Fully - 1, not effective - 3

Resource categories	Number of sites monitored	Best Management Practice implementation	Best Management Practice effectiveness
Roads	6	Fully - 4, mostly - 1, not assessed - 1	Fully - 4, not assessed - 2
Vegetation	7	Fully - 2, mostly - 5	Fully - 7
Water uses	3	Fully - 2, no BMPs - 1	Mostly - 2, not effective - 1

Recommended changes

Based on these results, we are considering the following possible changes to management activities:

- Repair road closures that have been breached.
- Develop a formal operation and maintenance plan for dispersed recreation sites.
- Revise operation and maintenance plans for diversions and conveyances to include measures to address locations for disposal of materials including sediment, vegetation, debris, and trash.
- Include recommendations for refueling distances, use of spill kits and screens, emergency response plans for spills, no use of foam in aquatic management zones, Minimum Impact Suppression Tactic techniques, and decommissioning of hand line within aquatic management zones.
- Include spill response plan in resort operation and maintenance plans.
- Develop better practicable solutions for implementors to know where the aquatic management zone boundaries are when lighting prescribed fires.

Figure 1. Mulch and slash placement to address sedimentation along Paulina Creek

Status of select ecological conditions

The Deschutes National Forest supports a diversity of species and habitats. Some wildlife depend on forested areas while others need aquatic environments with good water quality. Consequently, we work to maintain a variety of terrestrial and aquatic habitats. Maintaining these habitats is monitored in several ways including the fuels conditions in forests and the stream temperatures in select watersheds.

Threats to ecosystem health include dense stands of trees because of wildfire suppression, high intensity fire uncharacteristic in specific plant association groups, and the spread of invasive species, insects, and disease. We use prescribed fire, defined as planned wildland fire ignited under specific conditions and according to policy, as well as silvicultural treatments[1] to maintain or improve fuels conditions. Prescribed fire treatments help us to maintain or restore fire-mediated[2] and fire-dependent[3] forest community types such as lodgepole and ponderosa pine forests. Fuels conditions are also often focused on the wildland urban interface where there is greater risk for loss of valuable infrastructure.

Figure 2. Installation of a stream temperature logger

Data such as stream temperatures and fuels conditions help the forest to monitor conditions on the ground and plan in response to potential changes.

Stream Temperature

The Deschutes National Forest maintains numerous instream temperature loggers to monitor water temperatures of forest streams. Long-term water temperature monitoring locations seek to assess forest management activities' effects on water temperature at a broad scale. Temporary, project-based temperature loggers are deployed to monitor and more closely identify localized effects of various projects on National Forest System lands.

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[1] Treatments that are applied to change, accelerate change, or maintain the condition of trees and stands. For example, by applying selective herbicides after planting, a desired tree species can be given a head start in growth that allows it to out compete other vegetation.

[2] Fire-mediated refers to a community in which fire occurs at greater frequency and possibly greater intensity than in other locations, and in which fire is expected to drive community composition and structure.

[3] Plants and vegetation communities that have evolved adaptations such as a reliance on fire as a disturbance agent, or a strengthening or enhancement by it.

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Page-Dumroese, D.S., A.M. Abbott, and T.M. Rice. 2009. Forest soil disturbance monitoring protocol (FSDMP). U.S. Deptartment of Agriculture, Forest Service. General Technical Report WO-82a.

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Monitoring item	Progress toward land management plan desired conditions and objectives	Recommended action
Recreation	Yes. Most visitors are satisfied with their visit (93 percent). This has not changed between 2008 and 2018.	No recommended changes.
Climate change impacts	Yes. Climate change vulnerabilities have been identified.	The assessment provides adaptation strategies that the Forest will consider incorporating into future management decisions and actions.
Social and economic status	No. The Forest exceeded target in 2017 and 2018 but not for the other years between 2016 and 2022.	The Region has implemented the 3 plus 1 active management strategy to accomplish 3 years of NEPA projects completed and 1 year of timber projects. To accomplish this, the annual target has been lowered for fiscal years 2022 through 2024; it will likely be raised again in 2025.
Energy resources: geothermal exploration	Yes. The Forest reviews and approves leases each year. In 2019, leases in special management areas were relinquished and closed. In 2020 that land was added to Newberry National Volcanic Monument.	No recommended changes.
Wilderness management	Yes. The Forest has implemented a limited entry permit system and monitored aspects of wilderness character.	No recommended changes.
Wild and scenic rivers	Yes. All wild and scenic rivers have had comprehensive management plans completed.	No recommended changes.
Soil productivity	No. About 60 percent of post-harvest or activity units were found to exceed the 20 percent detrimental soil disturbance threshold which is an increase from the 30 percent that exceed it prior to implementation.	Implement soil monitoring on the Sisters Ranger District. Restore units with prior entries and elevated detrimental soil condition to meet Deschutes Forest Plan standard and guideline SL-3, to leave at least 80 percent of an activity area with acceptable soil productivity.

Summary Table

Deschutes National Forest plan monitoring questions and evaluation addressed in this report. Possible types of change recommended include changes to the land management plan, changes in management activities or the monitoring program, and recommendations for a new assessment. See the 2012 Deschutes National Forest Monitoring Plan for questions not addressed in this report: 2016 Deschutes National Forest Transition Monitoring Plan.

Table 8. Monitoring item summary table

Monitoring item	Progress toward land management plan desired conditions and objectives	Recommended action
Water quality	Yes. Most Best Management Practices were fully implemented though not all.	Repair road closures that have been breached. Develop a formal operation and maintenance plan for dispersed recreation sites. Revise operation and maintenance plans for diversions and conveyances to include measures to address locations for disposal of materials including sediment, vegetation, debris, and trash. Include recommendations for actions within aquatic management zones. Include spill response plan in resort operation and maintenance plans. Develop better practicable solutions for implementors to know where the aquatic management zone boundaries are when lighting prescribed fires.
Stream temperature	Yes. Temperatures remain stable.	No recommended changes.
Fuels conditions	Yes. More acres have been moved to the desirable condition class. A total 160,662 acres have been treated since fiscal year 2016.	Increase the pace and scale of hazardous fuels reduction and maintenance.
Sensitive species: pumice moonwort	No. Populations have decreased except in powerline corridor locations.	Remove lodgepole pine particularly in sites where there are known concerns. Remove seedlings and saplings from sites such as the pumice flats. Compare precipitation records with long-term monitoring sites to determine if an association can be found between above ground emergence and precipitation levels. Continue population monitoring.
Management indicator species: deer and elk	Yes. Progress has been made toward reducing road densities however several areas still exceed Forest Plan standards.	Continue to address road density through road closure and decommissioning on a project-level basis.

Effects of management systems on productivity of the land

The long-term sustainability of forest ecosystems depends on the productivity and hydrologic functioning of soils. Ground-disturbing management activities directly affect soil properties, which may adversely change the natural capability of soils and their potential responses to use and management. A detrimental soil condition often occurs where heavy equipment or logs displace surface organics or reduce soil porosity through compaction. Detrimental disturbances reduce the soil's ability to supply nutrients, moisture, and air that support soil microorganisms and vegetation growth. The biological productivity of soils is tied to the amount of surface organic matter and coarse woody debris retained or removed from affected sites. Since forest soils are a non-renewable resource as measured by human lifespans, maintenance or enhancement of soil productivity must be an integral part of National Forest management.

The Forest Plan includes the goal to maintain or enhance soil productivity (USDA FS 1990, page 4-2). Land disturbing activities are designed to: (1) Preserve the litter, duff, and topsoil layers; (2) Maintain and replace organic matter; (3) Protect soil biology; (4) Maintain soil porosity, structure, and aeration. Management activities that change any of these elements are considered critical. This includes the removal of topsoil during tree planting, compacting soil with logging machinery, or changing the nutrient status by harming soil organisms or removing large woody debris. Monitoring and remedial measures have maintained long-term soil productivity (USDA FS 1990, page 4-7). The following results reflect data collected from fiscal years 2018 through 2022.

Soil Productivity

Monitoring questions

- Are management activities being implemented so that they do not substantially and permanently impair the productive capacity of the land?

Key results

Soils were monitored on the Bend-Fort Rock and Crescent ranger districts in 52 pre-National Environmental Policy Act and 33 post-harvest or activity units using the Forest Soils Disturbance Monitoring Protocol (Page-Dumroese et al. 2009). No monitoring occurred on the Sisters Ranger District during this time period. Of monitored units, 29 percent of pre-National Environmental Policy Act and 60 percent of post-harvest/activity units were found to exceed the 20 percent detrimental soil disturbance threshold.

Recommended changes

Based on these results, the following possible changes are being considered:

- Implementing soil monitoring on the Sisters Ranger District.
- Restore units with prior entries and elevated detrimental soil condition to meet Deschutes Forest Plan standard and guideline SL-3, to leave at least 80 percent of an activity area with acceptable soil productivity.

Wild and Scenic Rivers

Monitoring questions

- Have river management plans been completed?
- Are we protecting the outstandingly remarkable values of the Congressionally designated rivers?

Key results

All wild and scenic river management plans for designated wild and scenic rivers on the Deschutes National Forest have now been completed.

Table 7. Wild and scenic river management plan completion

Wild and scenic river	Designation	Status of river management plan
Big Marsh Creek	Recreation River	Completed in 2001
Crescent Creek	Recreation River	Completed in 2019
Little Deschutes River	Recreation River	Completed in 2001
Metolius River	Recreation and Scenic River	Completed in 1996
Upper Deschutes River	Recreation and Scenic River	Completed in 1996
Whychus Creek	Wild and Scenic River	Completed in 2010

From 2016 through 2022, projects for special uses, with some restoration, recreation, reforestation, and thinning projects have been proposed that overlap with designated wild and scenic rivers on the forest. All environmental analyses found that the proposed actions would follow the applicable wild and scenic river plan and that that there would not be a change to the river's outstandingly remarkable values because of project activities.

Recommended changes

Based on these results, no changes are being considered at this time. The Forest will continue to assess projects' consistency with wild and scenic management plans and to protect outstandingly remarkable values.

The Three Sisters Wilderness contained a greater number of social trails. A total of 513 social trail spurs and 1,240 social trail segments were mapped in the Three Sisters Wilderness. These social trails and social trail spurs were mostly between 12 and 24 inches in width, and very little human waste was observed along the trails when they were mapped.

This data provides a baseline. Mapping social trails should continue to compare changes over time, especially before and after the limited entry permit system as implemented.

Recommended changes

Based on these results, no changes are being considered. The Forest will continue to implement both the self-issued and limited entry permit systems as well as continue to track changes and trends in use.

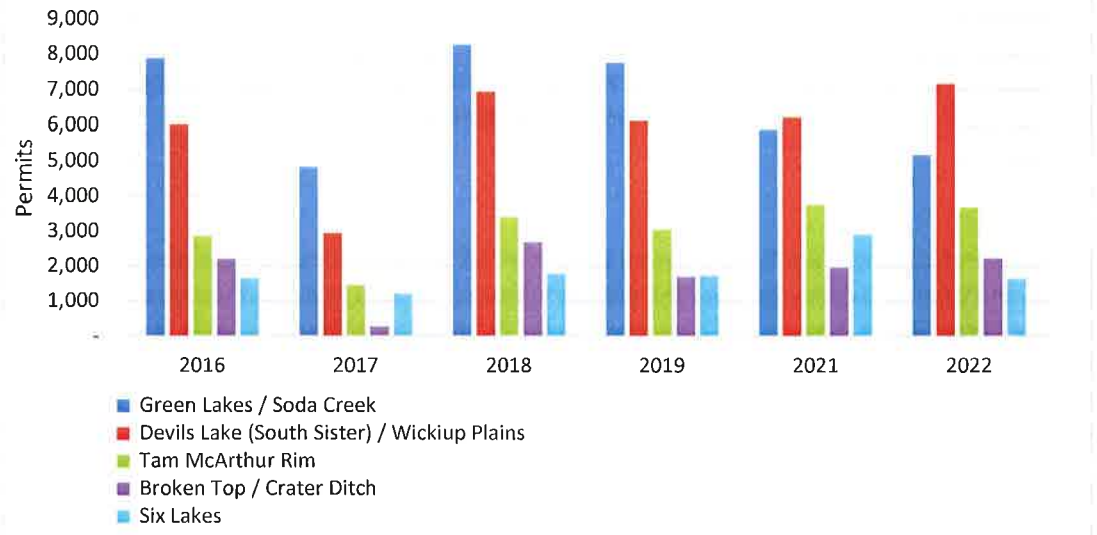

Figure 9. Top 5 trailheads for wilderness area visitation on the Deschutes National Forest, fiscal years 2016 through 2022

Solitude Monitoring

Solitude monitoring was conducted in the Three Sisters, Mount Jefferson, and Mount Washington wilderness areas in 2019 and 2022 in accordance with national protocols. Encounter rates varied considerably in different locations.

The fewest groups, on average, encountered in an 8-hour day on weekdays ranged from 1.1 (Pine Ridge, Mount Jefferson) to 13.4 (Obsidian, Three Sisters). The largest average number of groups per 8-hour day on weekdays ranged from 14.3 (Pacific Crest Trail South, Mount Washington) to 50.5 (Green Lakes, Three Sisters). On weekend days/holidays, the fewest groups, on average, encountered in an 8-hour day ranged from 4.1 (Pine Ridge, Mount Jefferson) to 21.0 (Blow/Doris, Three Sisters). The largest average number of groups per 8-hour day ranged from 29.4 (Benson/Tenas, Mount Washington) to 114.6 (Green Lakes, Three Sisters). This notable variation aligns with the popularity of easily accessed destinations with alpine lakes and views and proximity to larger populations areas.

This data provides a baseline. Solitude monitoring will continue to be monitored as the limited entry permit system continues to be implemented.

Social Trail Mapping

Social trails were identified and mapped in the Three Sisters and Mount Jefferson Wilderness areas in 2017 by Forest Service staff and volunteers using standard protocols adopted by the Forest Service.

The Mount Jefferson Wilderness contains 420 social trail spurs and 737 social trails totaling 225,025 feet. Social trail segments average 305 feet in total length. On average, the social trails and social trail spurs were between 12 and 24 inches in width. Human waste was rarely observed while mapping social trails or social trail spurs in the Mount Jefferson Wilderness.

Wilderness Management

Monitoring questions

- Is the wilderness character being preserved and protected?
- Are the physical, biological, managerial, and social settings of each Wilderness Resource Spectrum maintained consistent with the standards for wilderness management?

Key results

Permit System

Since 1991, the Forest has implemented a self-issue permit system for all wilderness areas. Data was recorded to track use at wilderness entry points (trailheads) over the summer seasons. In 2021, a limited entry permit system was implemented in the Three Sisters, Mount Jefferson, and Mount Washington Wilderness areas at specific trailheads in place of self-issues permits. More data will be available in the coming years to determine the effectiveness of the limited entry permit system on preserving wilderness character. Permits were not available or collected during the 2020 season due to the COVID-19 pandemic.

The total number of permits issued from 2016 through 2022 was consistent; however, visitation to the top 5 most visited trailheads decreased during these years.

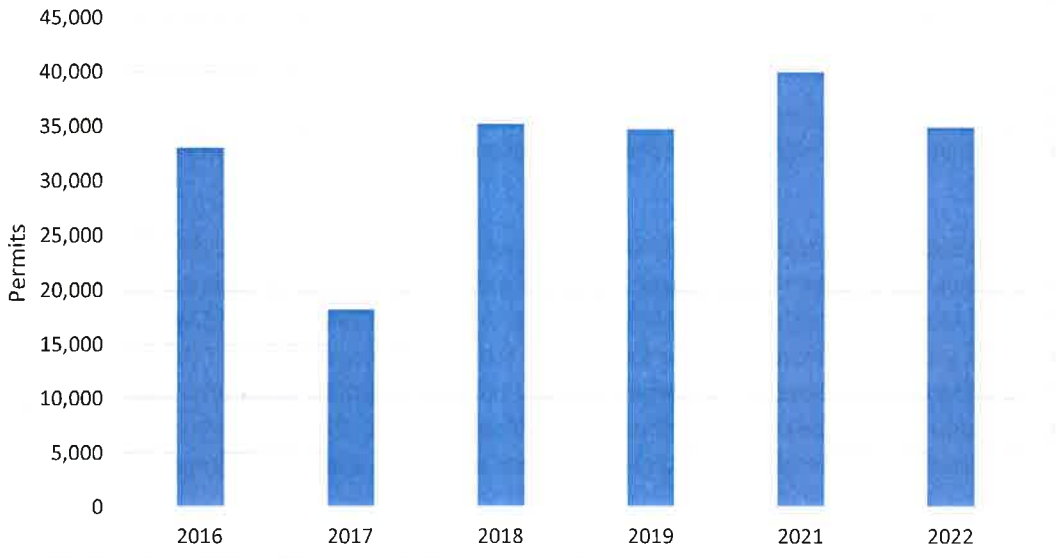

Figure 8. Total number of wilderness permits on the Deschutes National Forest, fiscal years 2016 through 2022

2022 – Cement samples were lowered in to test the resiliency of the cement under temperature and pressure. Samples lowered in July were collected in October. More samples were lowered in October and have not been retrieved.

Trends in Exploration and Development

Geothermal provides a sustainable alternate energy source. The 1970 Mining and Minerals Policy Act directs the Forest Service "to foster and encourage mineral development on National Forest System lands in an ecologically sound manner." There was a decrease in leases between the years 2016 through 2020 but the leases and proposals have increased again since 2020. More proposals are expected as additional funding is being offered again.

The 2022 Infrastructure Investment and Jobs Act (also known as the Bipartisan Infrastructure Bill) provides $84 million over the next 3 years to the Department of Energy for Enhanced Geothermal Systems research and development. Enhanced Geothermal Systems are used to extract geothermal heat from reservoirs that otherwise would not be feasible for energy production due to their low-permeability and/or low-porosity. Newberry Volcano is a proven deep hot-dry geothermal resource. Enhanced Geothermal Systems technologies are improving every year to make geothermal production at Newberry Volcano economical.

Recommended changes

Based on these results, no changes are being considered. The Forest will continue to review and approve leases and proposals for geothermal energy exploration.

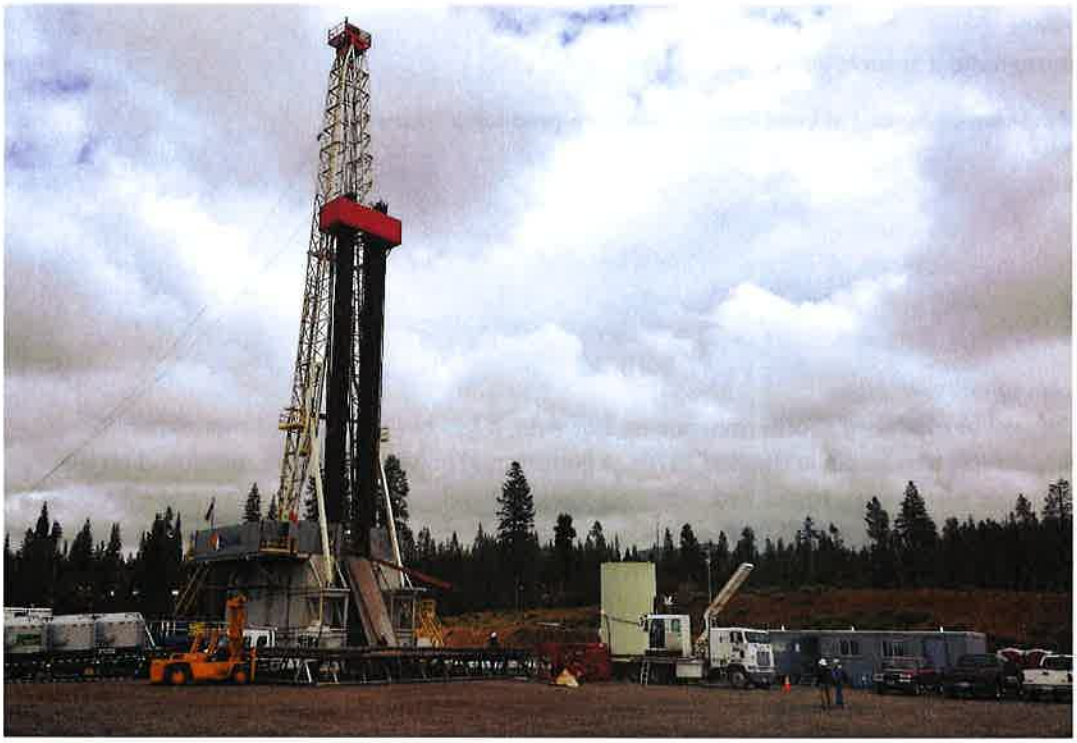

Figure 7. Geothermal exploratory well

Energy Resources – Geothermal Exploration

Monitoring questions

- Have leases been issued by the Bureau of Land Management and do they contain stipulations consistent with Forest Service decisions?
- Have geothermal exploration and development occurred?
- What are the trends in exploration and development?

Key results

BLM Leases

Several leases and agreements have been authorized through the Bureau of Land Management during fiscal years 2016 through 2022. Non-producing leases are not currently producing energy and are exploratory only. They may be converted to producing leases at any time but that is not anticipated by the Forest Service to happen soon. In 2019, all geothermal leases in the special management area were relinquished and closed. In 2020, all special management areas were converted to become part of Newberry National Volcanic Monument.

The leases include sites that contain exploration infrastructure. Active exploratory infrastructure on the Forest currently includes:

- Three 5-acre pads with 1.5-million-gallon sumps
- Two deep exploration wells (>10,000 feet each)
- Two water wells
- Twelve thermogradient seismic wells (<10,000 feet each)

Table 6. Acreages of authorized Bureau of Land Management non-producing leases

Year	Acres
2016	30,033
2018	15,837
2020	14,086
2022	18,281

Geothermal Exploration and Production

Newberry Volcano has never produced geothermal power; however, it has been the site of exploration for several decades. Early exploration began in the late 1970s. A geothermal power facility was proposed on the west flank in the 1990s but was never constructed. The west flank of Newberry does not have known or discovered hydrothermal resource. The west flank only has a "Hot-Dry" resource (no water, low-permeability and low-porosity) that requires advanced Enhanced Geothermal Systems technology to access the stored heat energy. EGS technology is only beginning to advance enough to tap into the deep heat of Newberry Volcano.

2016-2020 – No exploration work proposed or conducted during this time frame.
Very little federal Department of Energy grant funds were available.

2021 – Conducted flow test of well, no water flowed for test.
High pressure carbon dioxide was released during the test. Some gas samples were taken.

Progress toward meeting desired conditions and objectives

The Deschutes National Forest is managed to support a variety of ecological conditions. This helps provide stable and sustainable habitat, recreational opportunities, and timber products. To achieve this the Forest manages land for multiple uses and sustained yield oftentimes balancing trade-offs between different management actions. Monitoring allows managers to assess whether the decisions related to such trade-offs are meeting the Forest Plan goals and objectives.

Stands of trees are managed to achieve many resource management objectives including, but not limited to the production of usable wood fiber for a variety of uses, the maintenance and enhancement of visual quality, recreation opportunities, wildlife habitat, and livestock grazing opportunities. (USDA FS 1990, pages 4-4 to 4-5)

Social and Economic Status

Monitoring questions

- What are the annual timber targets? What are the trends?

Key results

It was determined that with the 5-year period from 2016 through 2022, the Forest did not meet target in fiscal years 2016, 2019, 2020, 2021, and 2022. This is partly attributed to lack of staffing capacity on the Forest to complete the National Environmental Policy Act analysis required prior to timber sales. Various resource areas were understaffed during this time. During that 5-year period the forest exceeded target in 2017 and 2018.

Table 5. Annual timber targets, sales, and harvest

Fiscal year	Timber target	Timber sold	Timber harvested
2016	96,000	92,161	73,269
2017	73,000	101,002	80,364
2018	86,400	87,996	109,404
2019	86,400	64,935	70,830
2020	86,400	79,122	71,504
2021	86,400	78,203	25,669
2022	50,000	41,323	75,331

Recommended changes

Based on these results, the Region has implemented the 3 plus 1 active management strategy to accomplish 3 years of National Environmental Policy Act projects completed and 1 year of timber projects. To accomplish this, the annual target has been lowered for the years 2022 through 2024; it will likely be raised again in 2025.

- Changes in food availability, competition, predator-prey dynamics, and availability of key habitat features, such as nesting or resting structures and ephemeral water sources will affect wildlife populations.
- Summer recreation (hiking, camping, and bicycling) will benefit from a longer period of suitable weather without snow, especially during the spring and autumn shoulder seasons.
- Snow-based recreation (downhill skiing, cross-country skiing, and snowmobiling) will be negatively affected by a warmer climate because of less and more transient snow. Ski areas and other facilities at lower elevations will be especially vulnerable.
- Higher temperature and increased frequency and extent of disturbances will alter forest structure and growth, thus affecting both timber supply and carbon sequestration as well as livestock forage.
- The ability of forests to sequester carbon will likely decrease if a warmer climate increases physiological stress in trees and increases the frequency and extent of disturbances.
- A warmer climate may also affect the physiology and behavior of some insect pollinators, possibly creating a phenological mismatch in timing of flowering and pollinator emergence.

Recommended changes

The Forest is not considering any changes to Forest Plan components. However, the assessment provides adaptation strategies that the Forest will consider incorporating into future management decisions and actions. Adaptation options are identified for water use, roads, fisheries, vegetation management, range management, riparian areas, wildlife habitat, and recreation (USDA FS 2019).

Climate change and other stressors

In the last decade, the United States has experienced new records for extreme temperature, drought, storms, and fire. These events affect millions of Americans and pose a growing threat to the resilience of communities, as well as the services that flow from the nation's forests and grasslands. The Forest Service is working to mitigate the effects of climate change using the best available science and information.

In 2010, the Agency provided specific direction to the National Forest System in the form of the National Roadmap for Responding to Climate Change (USDA FS 2010) and the Performance Scorecard for Implementing the Forest Service Climate Change Strategy. The goal of the agency's climate change strategy is to "ensure our national forests and private working lands are conserved, restored, and made more resilient to climate change, while enhancing our water resources" (USDA FS 2010).

The 2019 report, Climate Change Vulnerability and Adaptation in South-Central Oregon, built on previous efforts in ecosystem-based management and ecological restoration in the Pacific Northwest to address climate change and put these efforts in a broader regional context in south-central Oregon.

The South-Central Oregon Adaptation Partnership was developed to identify climate change issues relevant for resource management on federal lands in south-central Oregon (Deschutes National Forest, Fremont-Winema National Forest, Ochoco National Forest, Crooked River National Grassland, Crater Lake National Park). This science-management partnership assessed the vulnerability of natural resources to climate change and developed adaptation options that minimize negative impacts of climate change and facilitate transition of diverse ecosystems to a warmer climate. The vulnerability assessment focused on water resources and infrastructure, fisheries and aquatic organisms, vegetation, wildlife, recreation, and ecosystem services.

Climate Change Impacts

Monitoring questions

- What are the plan area vulnerabilities?

Key results

The South-Central Oregon area vulnerabilities include the following:

- Decreased snowpack and declining summer stream flows will alter the timing and availability of the water supply.
- Decreased summer stream flows and warmer water temperatures will reduce habitat quality for cold-water fish species, especially at lower elevations.
- Higher air temperature, through its influence on soil moisture, is expected to cause gradual changes in the abundance and distribution of tree and shrub species, with more drought-tolerant species being more competitive.

Visitor use, satisfaction, and progress on recreation objectives

Recreation activities provide enjoyment for millions of national forest visitors. Recreation improves physical and mental health and helps people connect with the outdoors. Participation in recreational activities is how most people experience national forests and grasslands.

The Forest Plan identifies several management areas related to recreation. Each one has its own goals and objectives, but overall the aim is to provide a range of recreation opportunities in a variety of settings. The goal of Management Area 11 - Intensive Recreation is to provide a wide variety of outdoor recreation opportunities within a forest environment where localized settings may be modified to accommodate large numbers of visitors. The goal for Management Area 12 - Dispersed Recreation is to provide a range of quality recreation opportunities is an undeveloped forest environment. The objective for this area is to be managed to provide limited social contact. Management Area 13 - Winter Recreation has the goal to provide winter recreation opportunities within a forest environment that can be modified for visitor use and satisfaction.

The National Visitor Use Monitoring program provides reliable information about recreation visitors to national forest system managed lands at the national, regional, and forest level.

Recreation

Monitoring questions

- What is the trend in visitor use and satisfaction?

Key results

Total estimated site visits to the Deschutes National Forest grew between 2008 (2,274,000 visitors) and 2018 (3,206,000 visitors), with a dip in visitation in 2013 (1,937,000 visitors). Most visitors have been satisfied with their time on the Deschutes National Forest between 2008 (93.3 percent very or somewhat satisfied) and 2018 (93.2 percent very or somewhat satisfied).

To review more National Visitor Use Monitoring results visit the Forest Service's website.

Recommended changes

Based on these results, the Forest is not considering any changes but will continue to review monitoring results.

Recommended changes

Based on these results, we are considering the following possible management activity changes:

- Continue to address road density through road closure and decommissioning on a project-level basis.

- When considering future proposals for road closure and decommissioning, include the concept of distance banding. Travel routes are buffered with an area of disturbance, which encompasses all potential locations that an animal may encounter and be influenced by people. The spaces that remain outside of this buffer, that also contain other suitable characteristics of a species habitat, are considered areas that wildlife can be expected to use with less disruption of human contact. These areas are referred to as 'core' or 'refuge' habitat. The disturbance buffers need to be considered cumulatively, and in some cases may overlap, creating an absence of core habitat. The distance buffer can depend on numerous factors, such as habitat type, terrain, type of recreational use, time of year, frequency of use, wildlife species being considered and individual animal tolerance levels. Depending on these factors, and the saturation of the landscape with disturbance potential, trail and road systems can become barriers and create 'dead zones' within otherwise suitable habitat.

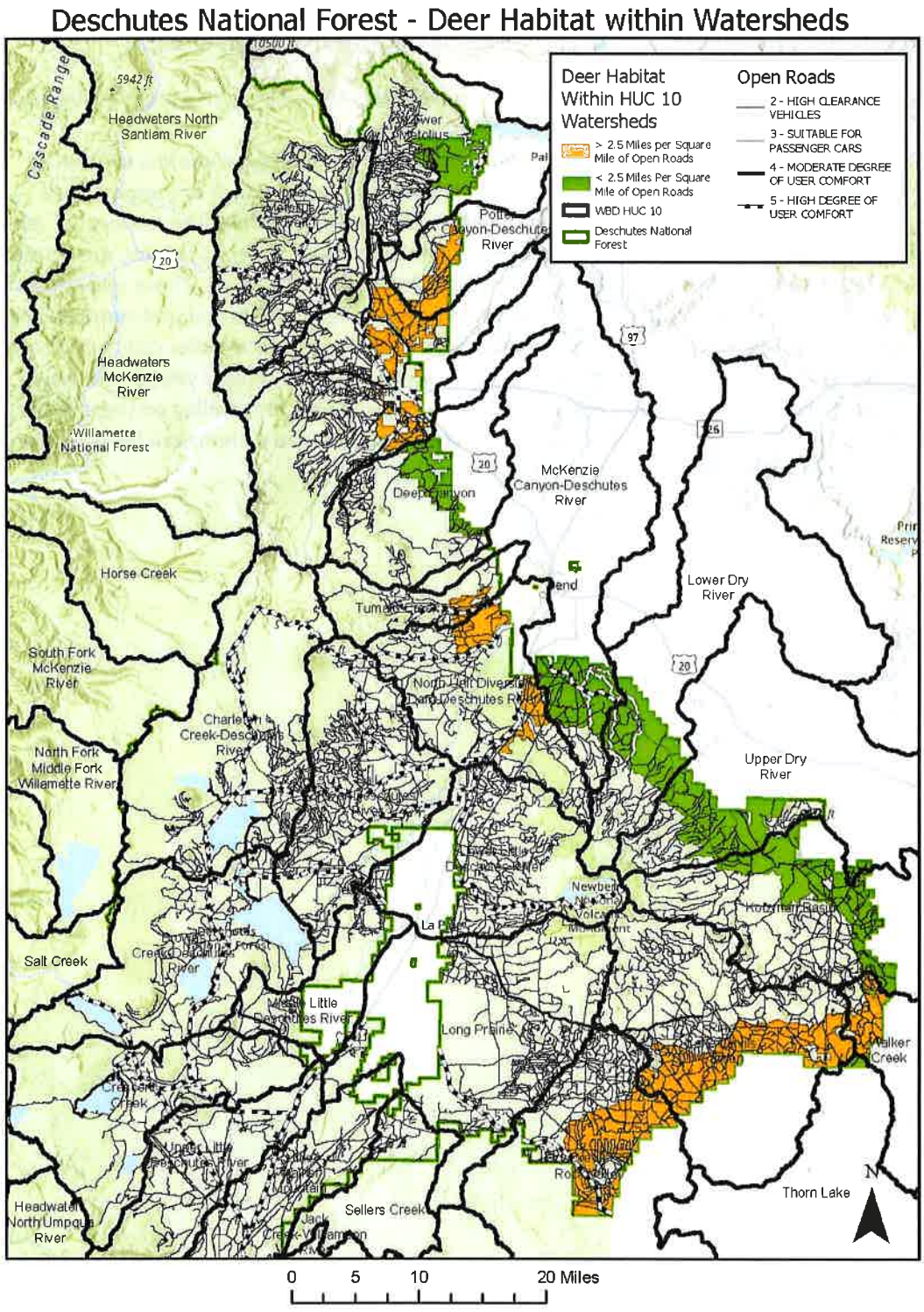

Figure 6. Deer habitat grouped by open road density

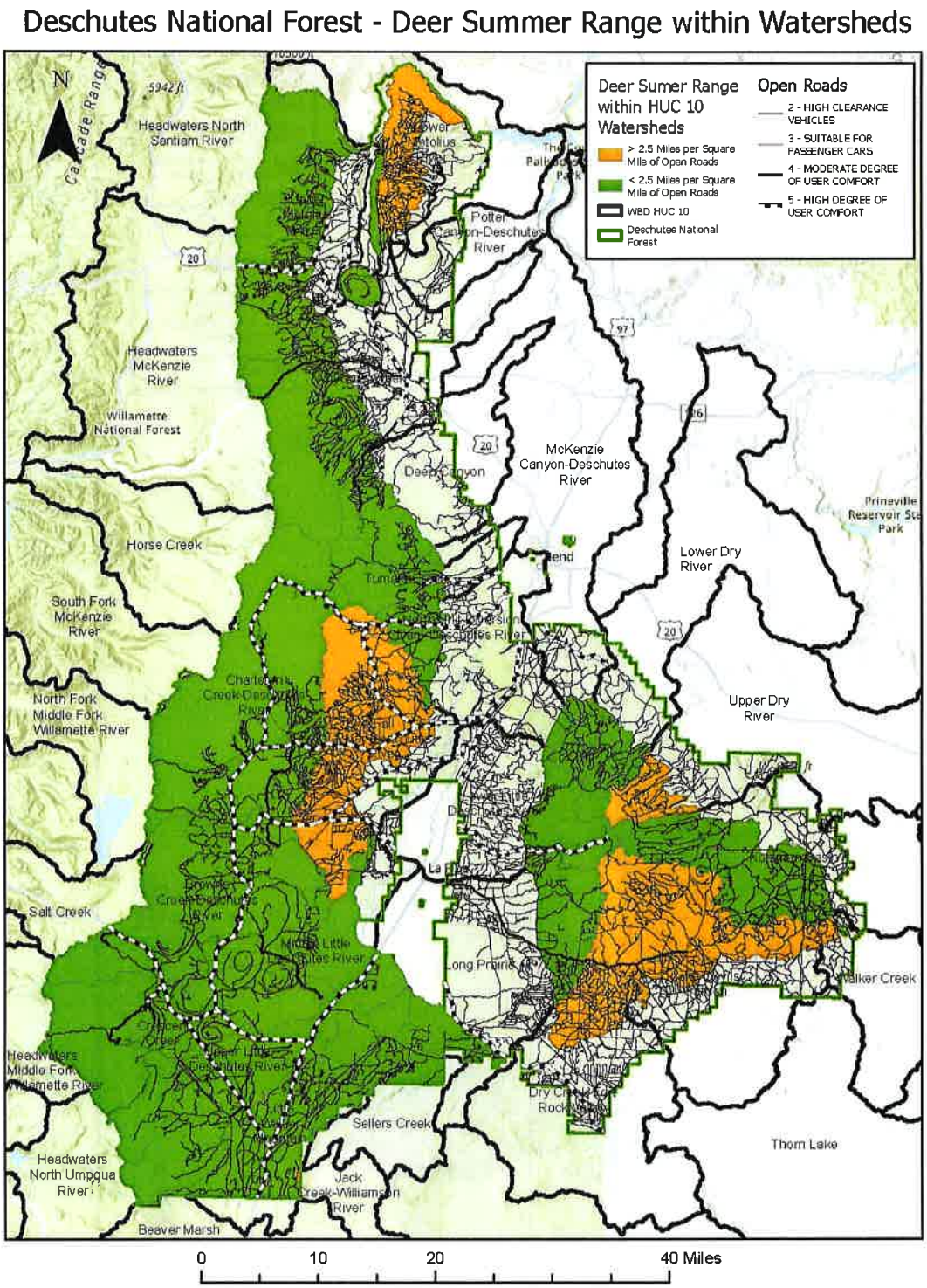

Figure 5. Deer summer range grouped by open road density

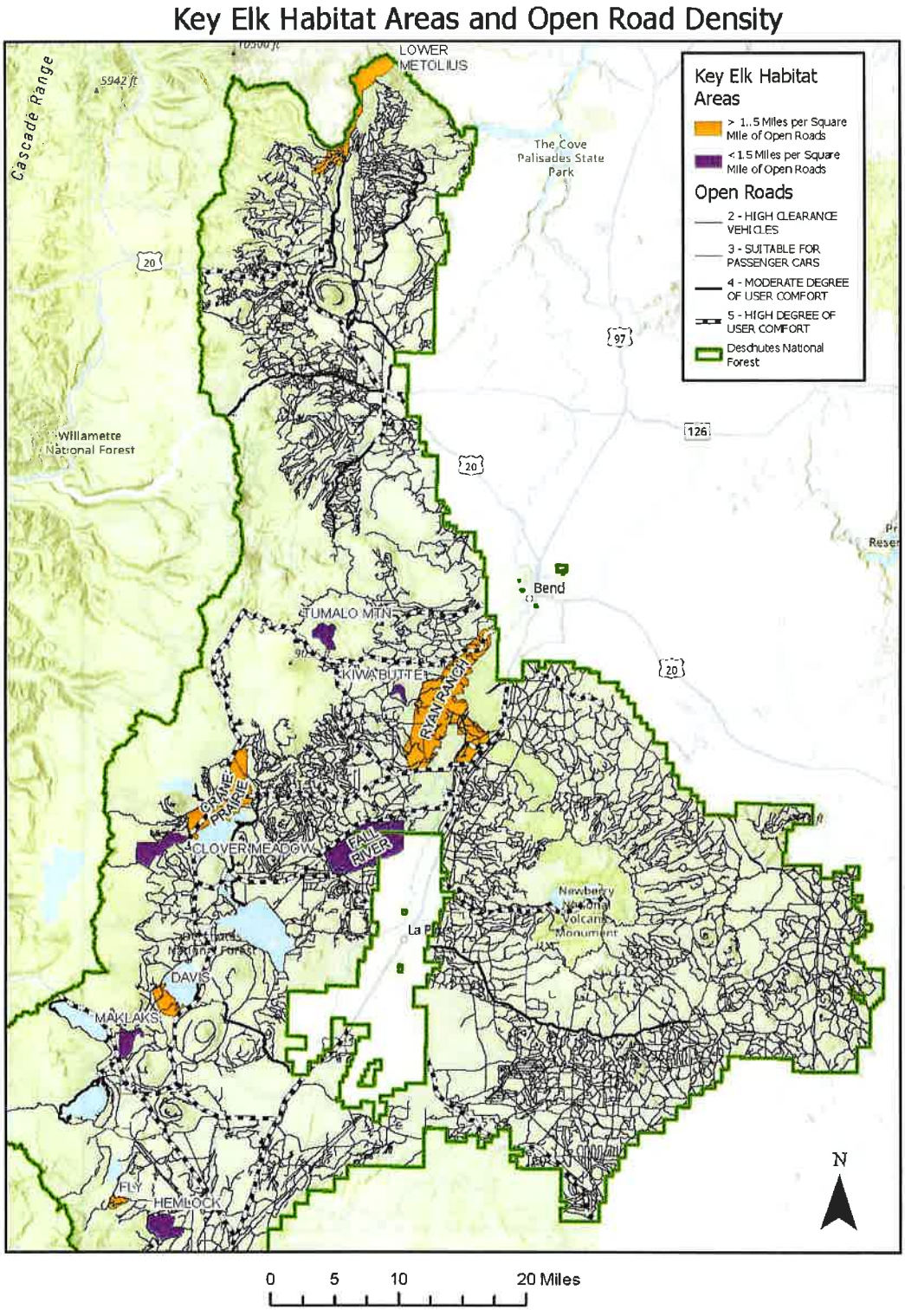

Figure 4. Key elk habitat areas grouped by open road density

Management Indicator Species: Deer and Elk

Monitoring questions

- What are road densities and trail mileages in key elk areas?
- What are road densities in summer range and Management Area – 7 Deer Habitat?

Key results

Five of the 11 Key Elk Areas on the Deschutes National Forest currently exceed the target open road density of 1.5 miles per square mile. The Clover Meadow, Fall River, Hemlock, Kiwa Butte, Maklaks, and Tumalo Mountain Key Elk Areas meet the target open road density; Crane Prairie Reservoir, Davis Lake, Fly, Lower Metolius and Ryan Ranch Key Elk Areas exceed the target open road density.

In Deer Summer Range (outside of Management Area 7 Deer Habitat), six of 26 hydrologic unit code (HUC) 10 watersheds exceed the Deschutes Forest Plan target open road density of 2.5 miles per square mile. The watersheds that exceed the road density target are Dry Creek-Fort Rock Valley (between the Newberry National Volcanic Monument and Fort Rock), Fall River-Deschutes River (west of Sunriver and La Pine), Lower Metolius River, Pine Lake-Devils Garden (north of Fort Rock), Upper Dry River (southwest of Millican), and Walker Creek (northeast of Fort Rock).

In Management Area 7 Deer Habitat, seven of 14 hydrologic unit code (HUC) 10 watersheds exceed the Deschutes Forest Plan open road density guideline of 2.5 miles per square mile. The watersheds that exceed the road density target are Dry Creek-Fort Rock Valley (between the Newberry National Volcanic Monument and Fort Rock), North Unit Diversion Dam-Deschutes River (south of Bend), Pine Lake-Devils Garden (north of Fort Rock), Potter Canyon-Deschutes River (north of Sisters), Tumalo Creek (west of Bend), Walker Creek (northeast of Fort Rock), and Whychus Creek (south of Sisters).

While not every area meets the Forest Plan standards and guidelines, the Forest has made progress to lower open road densities. Recent projects such as Surveyors, Kew, and Lex vegetation management projects have all include road closure and decommissioning which will contribute to lowering road densities in deer and elk habitat. The Forest acknowledges the challenges of maintaining closures, especially on flat, open landscapes. Staff will continue to implement various methods of closing roads and to monitor the effectiveness of these methods.

Recommended changes

Based on these results, we are considering the following possible management activity changes:

- Remove lodgepole pine through stewardship projects, commercial timber sales, or fuel reduction projects, particularly in sites where there are known concerns.
- Remove seedlings and saplings from sites such as the pumice flats.
- Compare precipitation records with long-term monitoring sites to determine if an association can be found between above ground emergence and precipitation levels.
- Continue monitoring populations of pumice moonwort.

Status of focal species

The Deschutes National Forest encompasses a diverse landscape from high alpine peaks to riparian areas and dry sagebrush steppe. Some of these biological areas contain species federally listed as endangered or threatened. Several species of plants and animals that are federally listed plants are known to exist and/or to have critical habitat within the Deschutes National Forest.

The Forest also provides habitat for a wide variety of more common terrestrial and aquatic fauna. Some of the species we focus on are management indicator species—species whose population changes are believed to indicate the effects of management activities. We monitor these species to track their population numbers, and as indication of biodiversity. For example, we work to maintain deer and elk habitat which can indicate the health of other species and ecological conditions.

Sensitive Species: Pumice Moonwort

Monitoring questions

- What are the population trends especially in monitoring sites?
- What is the status of habitat condition and threats for the species on the Deschutes National Forest?

Key results

Many Bend-Fort Rock Ranger District and Crescent Ranger District pumice moonwort populations have decreased from numbers in the hundreds to only single- or double-digit numbers except for powerline corridor populations which have been steadily increasing. Population surveys underscore the importance of the power line populations in the context of other nearby populations since they comprise as much as 17 percent of the known pumice moonwort population for the Deschutes National Forest. Powerline corridors are kept open by periodic mowing and management of vegetation to minimize risk of fire or damage to infrastructure. This also maintains pumice moonwort habitat.

Figure 3. Pumice moonwort

Pumice moonwort have declined in other sites likely because of disappearing frost pockets as well as encroaching lodgepole pine or other seedlings and shrubs. The implications of these observations suggest that active management may be necessary to maintain open habitat with frost pockets for pumice moonwort.

Table 4. Acreage treated during fiscal years 2016 through 2022[5]

Area	Overstory	Understory	Underburning	Total acres
Wildland urban interface	10,534	39,953	16,386	66,873
Other parts of the Forest	22,876	49,824	21,090	93,790
Total acres	33,410	89,777	37,476	160,663

Treatments that have been accomplished result from successful collaboration and partnerships both internal and external to the agency. During fiscal years 2017-2022, the Forest experienced high turnover in personnel and often had to respond to shifting priorities. That in addition to an outdated Forest Plan that does not align with the best available science related to the role of fire on the landscape, have limited the Forest's ability to treat more acres. The Forest is working to actively address these challenges with the goal of maintaining and improving fuel conditions. The number of acres treated each year also depends on the presence of favorable conditions, such as temperature, fuel moisture levels, and wind direction, during times of the year when this type of work can be accomplished.

Recommended changes

Based on these results, we are considering the following possible changes:

- Increasing the pace and sale of hazardous fuels treatments and maintenance. This is one of the primary objectives of the Wildfire Crises Strategy being prioritized in the agency.

[5] Treatment acreage from USFS Enterprise Data Warehouse Forest Service Activity Tracking System (FACTS). U.S. Department of Agriculture. Accessed 4 March 2023 at https://data.fs.usda.gov/geodata/edw/datasets.php?xmlKeyword=FACTS

Fuels Conditions

Monitoring questions

- Are forest fuels conditions functioning properly as determined by departure from desired forest fuels conditions?
- How many acres of the different plant association groups are at desired fuel levels and where are they located?
- What are the barriers to maintaining or improving conditions?

Key results

The Deschutes National Forest seeks to manage fuel conditions across the landscape, to reduce natural resource and infrastructure vulnerability to undesirable outcomes from uncharacteristically large-scale fire, climate change, disease, and pathogens. Using an established reference condition for each plant association group allows for monitoring to determine how much of the landscape is within or close to the desired condition. The desired condition has forest characteristics that would be at lower risk for large-scale wildfire.

The reference conditions are called conditions classes. Condition class I is the closest to the desired conditions, condition class II is moderately meeting the desired condition, and condition class III is the farthest from the desired condition. Table 3 shows the percent of each plant association group that is in each condition class on the Forest.

Table 3. Percent of plant association groups within each condition class[4]

Condition class	Ponderosa pine, mixed conifer dry	Meadow, shrub, hardwood	Lodgepole pine dry, mixed conifer wet	Lodgepole pine wet, alpine dry	Mountain hemlock, whitebark pine, alpine, juniper woodland
Condition class I (closest to desired condition)	29%	21%	51%	55%	75%
Condition class II (moderately within the desired condition)	70%	75%	48%	39%	16%
Condition class III (farthest from the desired condition)	1%	4%	1%	6%	9%

Since 2016, approximately 160,662 acres have been treated to move plant association groups toward the desired condition (condition class I). Treatments may have been overstory, understory, underburning, or a combination of two or three of these. Table 4 shows the number of acres treated and the types of treatment in both wildland urban interface and in other parts of the Forest during fiscal years 2016 through 2022.

[4] Condition class based on LANDFIRE Vegetation Condition Class, U.S. Department of Agriculture and U.S. Department of the Interior. Accessed 2 March 2023 at https://www.landfire.gov/vcc.php

Monitoring questions

- Are watersheds functioning properly with the focus on stream temperature to support desired fish habitat, including downstream habitat?

Key results

Overall, temperatures remain stable in most of the monitored systems (Deschutes River above Crane Prairie, Tumalo Creek, and Whychus Creek). Warming air temperatures and reduced water flows due to drought conditions Region-wide are expected to impact stream temperatures in the future, though. The spring-fed nature of most streams in the monitoring area attenuate temperature swings that likely would have occurred on more run-off dependent systems.

Recommended changes

Based on these results, we are not considering any changes. Stream temperature monitoring will continue.