National Park Service
U.S. Department of the Interior

Division of Fire and Aviation Management

National Park Service
Glacier National Park, Inter Mountain Region
Fire Ecology Annual Report
Calendar Year 2025

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GLAC Fire Effects staff collecting 10-year post-fire data from the 2015 Reynolds Creek Fire (NPS photo)

The National Park Service (NPS) Division of Fire and Aviation Management relies on science and long-term monitoring to inform an adaptive management approach for assessing and improving fire management programs and activities at park units. Adaptive management, along with policies, standards, and responsibilities for monitoring are described in Chapter 8 of Reference Manual 18. The NPS Fire Ecology Program is responsible for the collection, analysis, and interpretation of fire effects monitoring data for park managers to use for program evaluation and decision making. This annual report is intended to partially fulfill reporting requirements for the Fire Ecology Program and does not constitute a complete analysis of any NPS fire management program or activity. Additional interpretation and reporting can be found in previous annual reports at NPS DataStore or by contacting the author(s) of this report.

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A. Summary

The Glacier National Park Fire Ecology and Fire Effects program had another safe and productive summer field season, balancing plot work, fire assignments, fuel moisture sampling, and wildland fire risk assessments. Saville Feist joined GLAC as a Fire Effects Monitor for her first season and Sam Menicke worked as a Fire Effects Monitor for his third season. Scott Lang, Assistant Lead Fire Effects Monitor, has been with the program since 2003 and Mike McClellan, Lead Fire Effects Monitor, has been with the program since 2001. Daniel Boughter has been the Fire Ecologist since March 2024.

Fire Ecology staff collected data in 6 Long-Term Fire Vegetation Monitoring (LTFVM) plots in the Reynolds Creek fire (Table 1). All data has been entered in FFI. Fifty-nine Wildland Fire Structural Assessments were completed. Photo points and 12 Brown's transects were collected at hazardous fuel reduction sites, and 11 photo points were repeated for our culturally scarred tree plots. Fire Ecology staff also collected, processed, and reported results from biweekly fuel moisture samples collected throughout the park.

The fire weather component of GLAC's Fire Management Program is managed by Fire Ecology staff. The Fire Ecology team performed annual maintenance and repair on the park's three Remote Automated Weather Stations (RAWS) and cooperated with the Blackfeet Tribe in managing the BIA-owned Saint Mary RAWS located within the park in the Saint Mary developed area on the park's east side.

West Glacier, on the park's west side, finished the water year with a total of 27.32" precipitation, which is 87% of the 30-year average of 31.35". Saint Mary, on the park's east side, finished the year with 22.11" precipitation, equating to 84% of the 30-year average of 26.26". July, along with August, are normally the driest months of the year on both the east and west sides of the continental divide. Continuing the trend of the two previous summers in which either July or August were abnormally wet, West Glacier received 3.42" in July, 274% of average, and Saint Mary received 5.37", 508% of average. This was, by far, the wettest month of the year in Saint Mary. Starting in early August, drier conditions prevailed across the park for the next several months. In 2021, 2022, and 2023 dry conditions also persisted throughout the fall. September was especially dry with West Glacier receiving .39" (20% of average), and Saint Mary .20" (11% of average).

Dry conditions in May and June sustained the highest ERC indices of the season for West Glacier and Fielding (Figure 1). This is also when the park's abundant live vegetation is in full green-up, which tends to reduce fire danger. ERCs dropped to below average throughout July and early August due to the park receiving abundant moisture. West Glacier and Fielding, however, had short ERC spikes that bumped into the 90th percentile before dropping to lower levels. Overall, the season was one of average to below average fire danger.

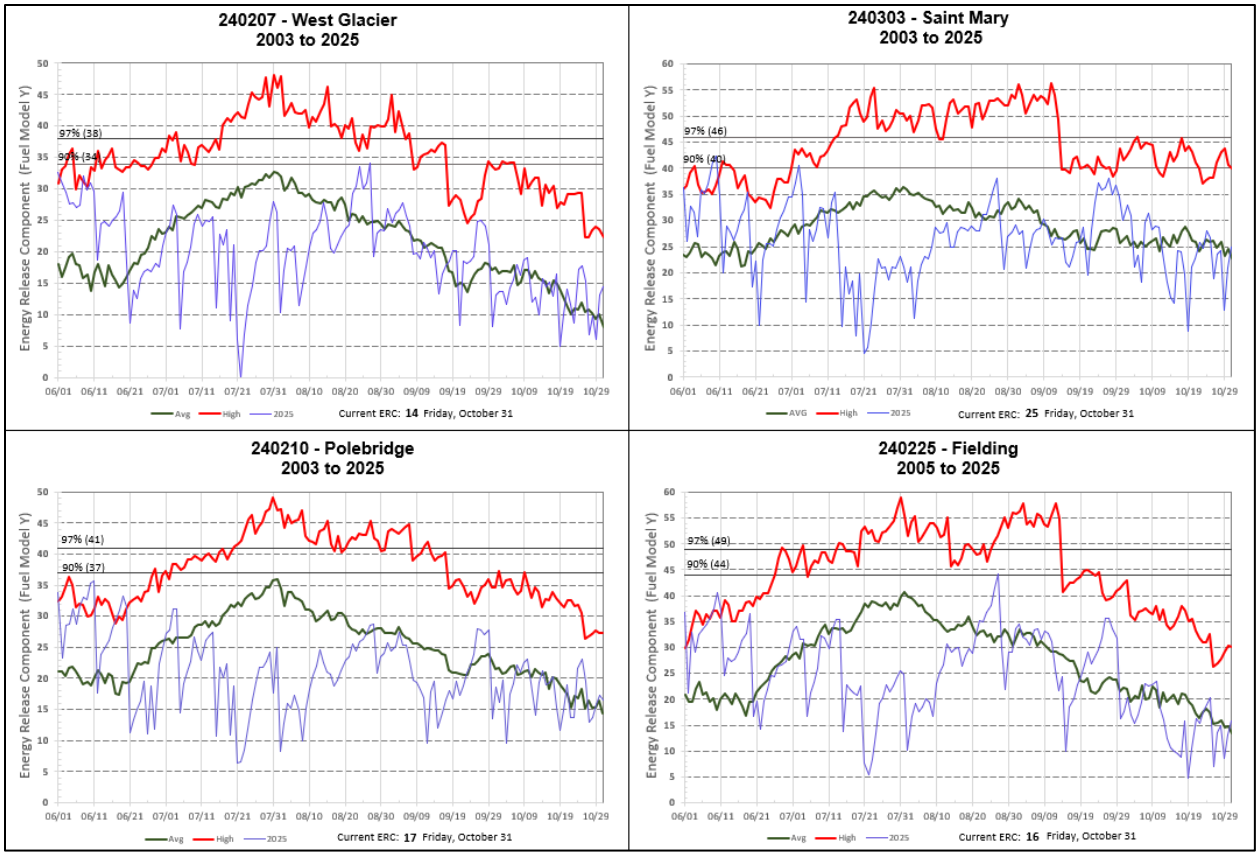


Figure 1. ERC charts comparing 2025 (blue) to average (green) and high (red).

GLAC had only two wildland fire incidents in 2025, making for a very quiet fire season. Both incidents were limited to single tree lightning strikes with little ground fire located during aerial detection flights. GLAC fire personnel, including the Fire Ecologist and two Fire Effects Monitors responded to assess the lightning strike in Logging Creek. The second fire was in an inaccessible area of the park on Stanton Mountain and was monitored by fire lookouts and aerial surveillance.

Fire Ecology staff were instrumental in completing pile burning activities in 2025. Over 200 piles were burned in the Apgar, Grist Rd., and Kelly Camp (see Section C) fuel reduction projects. The large piles at Camas and Logan pit were also successfully burned in 2025.

The Fire Ecologist served a 21-day assignment in BICY in late May through mid-June, gaining valuable experience with both wildland and prescribed fire. Seasonal Fire Effects Monitors Sam Menicke and Saville Feist joined other IMR fire personnel for a two-week assignment on the West Fork Fire, located on the Custer Gallatin National Forest in southwest Montana.

Fire Effects staff are always instrumental in the success of the park's training program. Mike McClellan assisted with the instruction and field certification for the NPS Chainsaw Safety, Maintenance, and Operation (CSMO) course for park personnel. Scott Lang and Mike also

helped implement several pack tests for many park staff. Fire Ecology and Fire Effects staff also participated in several SAR trainings and incidents throughout the year.

Table 1. Fire Effects Plot Workload (2025)

Park	Monitoring Unit	Plot Type (FMH Forest/Brush/Grass plot, photo point, Rapid Assessment, CBI, etc.)	Years Data Collected (start-end)	Annual Total (2025)	Total Plots
GLAC	North Fork Grasslands	FMH Grass	1996-2022		**22**
GLAC	North Fork Grasslands	FMH Forest	1997-2024		**13**
GLAC	North Fork Grasslands	FMH Brush	2016-2016		**3**
GLAC	North Fork Grasslands	FIREMON TD	2016-2017		**78**
GLAC	North Fork Grasslands	Non-native Grassland Daubenmire	2002-2019		**24**
GLAC	North Fork Ponderosa	FMH Forest	1997-2024		**18**
GLAC	North Fork Ponderosa	FIREMON TD	2016-2017		**49**
GLAC	North Fork Ponderosa (Units 2 and 3A)	Photo Points	2016-2022		**7**
GLAC	Long Term Monitoring - Parkwide Wildfires	Long Term Fire Vegetation Monitoring	1988-2025	**6**	**60**
GLAC	Post Fire Composition – Parkwide Wildfires	PFC	2009-2012		**380**
GLAC	CBI Burn Severity – Parkwide Wildfires	CBI	1999-2007		**334**
GLAC	Fuel Reduction – North Fork Grasslands	Modified Tree Belt	2012-2014		**3**
GLAC	Fuel Reduction – West Lakes Barn	Photo Points	2014-2016		**3**
GLAC	Fuel Reduction – Parkwide	Photo Points/Browns Transects	2004-2025	**12**	**110**
GLAC	North Fork Culturally Scared Trees	Photo Points	2017-2025	**11**	**11**
GLAC	Howe Ridge Post-fire Tree Regeneration	Howe Ridge Tree Regeneration protocol	2022-2022		**20**
GLAC/ BIHO/ GRKO	GLAC/BIHO/GRKO Parkwide	Structural Assessments	2014-2025	**59**	**1209**
Total				**88**	**2,357**

B. Monitoring Results and Recommendations

To date, GLAC has not had success determining if previous prescribed fire objectives were met due to the inconsistency of treatments (i.e. not all plots in a unit were burned in each prescribed fire) and the small sample sizes (see also Section C). Future monitoring efforts will be designed to ensure valid results are attainable. To this end, GLACs Fire Monitoring Plan will be updated in 2026 and will guide future monitoring efforts. In addition, burn plan objectives and data collection strategies are being developed for prescribed fires that will be implemented in Big Prairie and Ponderosa units.

C. Research, Planning, and Communication

The GLAC Fire Ecologist compiled "The History of Prescribed Fire and Fire Effects Monitoring in Glacier National Park" (Appendix C). The objective of this project was to understand what and where prescribed fire treatments have been implemented, where data collection plots were located, the different types of data collection plots, and what data has been collected. This information will be valuable to anyone interested in the history of prescribed fire in GLAC. The report will also inform revisions to the GLAC Fire Monitoring Plan to ensure future data collection efforts are designed to be statistically valid and produce results that will help fire managers make relevant fire management decisions.

Fire Ecology staff initiated the compliance process for fuel reduction projects at Kelly Camp (GLAC-25-003) and in culturally scarred tree (CST, GLAC-25-006) stands in the North Fork, and for enhancing prairie health and reducing tree encroachment in Big Prairie using both prescribed fire and manual tree removal. Kelly Camp and the CST work were both approved. The Big Prairie project is currently with the GLAC Interdisciplinary Team and, once approved, will be implemented in FY 2026. The Kelly Camp project, including pile burning, was completed.

D. Future Direction

In 2026, Fire Ecology staff will collect FMH plot data and repeat photos in the 2016 North Fork Pine prescribed fire and will collect long-term fire vegetation monitoring (LTVFM) plot data from the 2006 Red Eagle fire.

Post-treatment Brown's transect data will be collected for the Apgar and Grist Road fuel reduction projects and repeat photos will be taken to monitor the Kelly Camp fuel reduction project. Burn pile scars will be rehabilitated in the three fuel reduction projects. Fuels reduction work will also occur in the culturally scarred tree units in the Big Prairie area and repeat monitoring photos will be taken.

Fire Ecology staff will also collect pre-burn vegetation data in Big Prairie and assist with prescribed fire treatments. Fire Ecology staff will also collect pre-burn vegetation data in Ponderosa burn units and assist with prescribed fire treatments. Pre-treatment data will be collected for both projects to monitor progress towards meeting burn plan objectives.

Fire Ecology and Monitoring staff will continue structural assessments and will implement fuel reduction around backcountry structures in collaboration with GLAC Wilderness Rangers. Data

will be collected in the Howe Ridge tree regeneration plots to monitor regeneration in the fire scar.

Fire Ecology and Monitoring staff will work with GLAC and IMR GIS staff to create an authoritative Fire Effects GIS dataset. The dataset will be used to update the dip site list, the Duty Officer map, and the Local Unit Resource Guide.

The GLAC Fire Monitoring Plan will be updated to tier off the 2025 Fire Management Plan and to incorporate lessons learned.

Other planned activities include fuel moisture monitoring, on-going RAWS maintenance activities, and collaborating with Resource Management staff to monitor and map invasive plants in Big Prairie.

E. References, Links, and Additional Reading

Glacier National Park Fire Management Plan (2025) Accessible at: ParkPlanning - Glacier National Park Fire Management Plan.

The History of Prescribed Fire and Fire Effects Monitoring in Glacier National Park (2025) can be found in Appendix C of this document.

Link to most recent IRMA Data Store records for GLAC FFI data: NPS DataStore - Dashboard.

Appendix A. Staffing and Accomplishments

Table A-1. Fire Ecology Staffing 2025

Ecologist and Monitors	Position	Appointment Length	Training and Development
Daniel Boughter	Fire Ecologist	PFT – 26 pay periods	READ training ArcGIS Pro training R for Data Science self-paced training Technical SAR monthly refreshers Wildland Fire Refresher S-290 Intermediate Fire Behavior on-line component
Mike McClellan	Lead Fire Effects Monitor	STF – 24 pay periods	Wildland Fire Refresher First Aid/ CPR Training Assisted with the park's CSMO chainsaw class
Scott Lang	Assist Lead Fire Effects Monitor	STF- 25 Pay Periods	Wildland Fire Refresher ArcPro GIS Training Assisted with the park's CSMO chainsaw class
Sam Menicke	Fire Effects Monitor	9.5 Pay Periods	Wildland Fire Refresher ArcPro GIS Training FAL3 – Taskbook work First Aid/ CPR Training
Saville Feist	Fire Effects Monitor	8.5 Pay Periods	Operational Leadership Training ArcPro GIS Training Defensive Driving, Credit Card, No Fear, and other required training FAL3 – Taskbook work First Aid/ CPR Training S-290 Intermediate Fire Behavior on-line component

Table A-2. Fire Ecologist 2025 Accomplishments/Focus Areas

Category	Percent Time	Accomplishments and/or areas of activities
Planning	15%	Completed GLAC compliance process for Kelly Camp Fuel Reduction (GLAC-25-003), and Culturally Scarred Tree (GLAC-25-006) ; initiated compliance for Big Prairie Tree Encroachment (GLAC-25-018) project; GLAC FMP review
Presentations	1%	Hosted Fire Information Booth at Family Forestry Expo 2025
Meetings/task groups	10%	Meetings: weekly GLAC Fire Staff, weekly GLAC SRM Division, IMR Fire Planning Office Hours, FFI+R Working Group, quarterly Fuels calls, Fire Ecology group calls, IMR Fire & Aviation calls
Wildfire assignments	10%	Twenty-one-day FFT2 severity and Rx assignment to BICY late May-mid-June, responded to Logging Creek (GLAC) wildland fire
Prescribed fire/fuels treatment projects	10%	GRKO ditch burning; GLAC pile burning at Apgar and Grist Road: Kelly Camp Fuels Reduction and pile burning
Research	4%	GLAC fire history and effects research
Field work/data collection	10%	Estimated amount of time spent in the field collecting data; include time spent preparing for field work and travel time to plot locations
Data management	7%	Conducting quality control activities
Data analysis	15%	Authored “The History of Prescribed Fire and Fire Effects Monitoring in Glacier National Park”, data analysis
Supervision/ admin tasks	4%	Hiring, supervision, payroll, travel authorization/vouchers, purchasing, etc.
Training	10%	IMR Fuels Management Workshop, S-290 Intermediate Fire Behavior on-line component, Annual Fire Refresher, GLAC Supervisor’s Workshop, EPAP webinar, ArcGIS Pro training, R for Data Science self-paced training, technical SAR monthly refreshers, NPS Drone (UAS) Use for Resource Staff, Wildfire Risk/Fuels Reduction Projects and the SCC, monthly GLAC Supervisor’s Coffee Chat
Miscellaneous	4%	Selma Staff Ride, assisting other park divisions with road clearing activities

Table A-3. Fire Effects Crew 2025 Accomplishments/Focus Areas

Category	**Percent Time**	**Notes**
Data collection	31%	Wildland Fire Structural Assessments, Long-Term Fire Vegetation Monitoring plot data collection (Red Eagle), Cultural Scarred tree plot photos, Fuels photo points, bi-weekly fuel moisture sampling
Wildfire assignments	10%	Logging Creek fire response; one 20-person crew roll in SW Montana for two Fx crew members; provided coverage all through season for fire response in GLAC due to lack of suppression resources in Park
Prescribed fire/fuels treatment projects	14%	Fx crew worked on Apgar and Grist Rd. Fuel Reduction Projects. Assisted with burning 200 +/- piles from fuel reduction units, burned large material disposal piles at Camas and Logan Pit
Travel out-of-park for plot or project work	N/A	N/A
Data entry/management	4%	Completed data entry/error checking from 2025 field season, GIS data clean up
Data analysis	2%	Some analysis/GIS work of GLAC monitoring
Administrative activities	18%	Lang/McClellan supervised two seasonal monitors including hiring, training, managing time, providing career development, mentoring, evaluating, and counseling)
Training	13%	Crew attended annual fire refresher training. Various new/returning employee trainings, including travel card, defensible driving, blood-borne pathogens, trailer safety, etc.
Miscellaneous	8%	Maintenance and repair of the park's three NFDRS RAWS stations and data entry for two COOP stations, monitored St Mary RAWS (BIA owned) for issues, assisted other park divisions in clearing roads and trails, office maintenance work, assisted with Search and Rescue missions in Park, McClellan and Lang assisted Interpretation Division with fire education products, Fire Ecology education to university groups.

Appendix B. Fire/Fuels Treatments and Associated Monitoring

Hazardous fuels reduction work was implemented in the Apgar, Grist Road, and Kelly Camp projects in 2025 (table B-1). Work conducted for each unit consisted of thinning, hand piling, and pile burning treatments. Pre-treatment Brown's transects were installed and read; post-treatment reads are scheduled in 2026 for both project areas.

Table B-1. Summary of 2025 Fire/Fuels Treatments and Associated Monitoring

Park	Fire/Treatment Name	Monitoring Conducted	Acres
Glacier NP (GLAC)	Apgar	Pre-treatment Brown's transects; piles burned fall 2025 and post-treatment reads scheduled for 2026	17.14
	Grist Road	Pre-treatment Brown's transects; piles burned fall 2025 and post-treatment reads scheduled for 2026	1.74
	Kelly Camp	Pre-treatment photos, post-treatment photos scheduled for 2026	0.80
Total	**3**	**3**	**19.68**

Appendix C. The History of Prescribed Fire and Fire Effects Monitoring in Glacier National Park

The following unpublished report summarizes the history of prescribed fire treatments and data collection efforts in GLAC.

National Park Service
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Division of Fire and Aviation Management

National Park Service
Glacier National Park

The History of Prescribed Fire and Fire Effects Monitoring in Glacier National Park

Daniel Boughter



Prescribed fire in a North Fork ponderosa pine forest, May 2019 (NPS photo).

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Prescribed Fire in Glacier National Park

This report summarizes National Park Service (NPS) prescribed fire projects and fire ecology data collection activities that have occurred in Glacier National Park (GNP). Most of these projects are in the Big Prairie area north of Polebridge and in ponderosa pine (*Pinus ponderosa*) stands along the Inside North Fork Road south of Polebridge. Cultural burning practices, while not discussed here, were also known to occur for thousands of years prior to the establishment of GNP (Reeves and Peacock, 2001).

The purpose of this report is to provide an overview of prescribed fire treatments, to document related data collection and monitoring efforts, and to provide some context to the GNP prescribed fire program. Information in this report was collected from various hard copy reports found in the GNP Archives, the GNP Fire Cache, and digital files in *X:\Fire Management\ Fire_Program\ Prescribed_Fire\ Burn_Plans*, *X:\Fire Management\ Fire_Monitoring_and_Ecology* and other locations on GNP servers. The hard copy burn plans can be found in the GNP Archives and GNP Fire Cache. Additional information came from the GNP FEAT/FireMon Integrated (FFI) database, and observations provided by GNP Fire Management Officer Jeremy Harker and GNP Fire Effects Leads Mike McClellan and Scott Lang.

1978 Leafy Spurge Burn

The 1978 Leafy Spurge Burn is the earliest known prescribed burn proposed in GNP. The project area is a leafy spurge infestation in Big Prairie just south of the current Big Prairie units 6 and 7, and just northwest of unit 12. Twenty-four research plots were established in the project area in May 1977 to test various treatment combinations (mowing, burning, fire) for controlling the spread of leafy spurge (*Euphorbia esula*). The objective of the project was to test whether fire could be used to control leafy spurge, a state-listed noxious plant in Montana. Records found in the GNP archives indicate the project was effective in killing above-ground leafy spurge but was ineffective at killing the roots.

1979 Burn Plan

A burn plan (Appendix A) written in 1979 listed three burn areas; Burn Area #1 was the same Big Prairie leafy spurge project area burned in 1978; Burn Area #2 was between Sullivan Meadow and Anaconda Creek along the Inside North Fork Road (also referred to as Management Burn #3[1]) and Burn Area #3 was immediately Northeast of the Inside North Fork Road and Bowman Road junction (also referred to as Management Burn #4).

Burn Area #1 Leafy Spurge

This is the same area burned in 1978. Fire was not ignited in this unit in 1979, and the area is currently excluded from all burn plans. Fire has been shown to be ineffective at controlling leafy spurge, and can, in many cases, increase leafy spurge infestation size by increasing disturbance and decreasing native species cover, allowing for more area to be infested. While the following two burn areas continue to be discussed and plans made for burning, the Spurge Burn was never repeated. No information has been found regarding why this burn was dropped, but presumably it was dropped due to the difficulty of controlling leafy spurge with fire treatment. Currently, the GNP Vegetation Program continues to treat this infestation using a containment strategy with targeted herbicide treatment.

[1] At the time, NPS required a unique "serial number" to be assigned to all fires in the proposal stage. It is believed that the 1978 leafy spurge burn would have been Management Burn #1 and the proposed 1979 leafy spurge burn would have been Management Burn #2, although no reference to such designations for either fire has yet been found.

Burn Area #2 Sullivan Meadow

The Sullivan Meadow project area was a 5-acre stand of ponderosa pine between Sullivan Meadow and Anaconda Creek. The project objectives were to: (1) test feasibility of using fire to stimulate ponderosa pine regeneration, (2) diversify ground cover, (3) reduce crown fire potential, and (4) create a fire interpretation and demonstration area. No data collection plots are discussed in the burn plan. This project evolves into the 1983 Ponderosa Research Burn discussed below.

Burn Area #3 Bowman Burn

The proposed 1979 Bowman Burn project area was 5-7 acres just north and east of the junction of the Inside North Fork Road and the Bowman Lake Road (figure 1). Project objectives were to: (1) test the feasibility of reducing crown fire potential by burning down and standing fuels, (2) perpetuate stand diversity by thinning lodgepole, and (3) create a fire interpretation and demonstration area. No data collection plots are discussed in the burn plan. This burn, while still being discussed as a viable project into the early 1980's, was never ignited

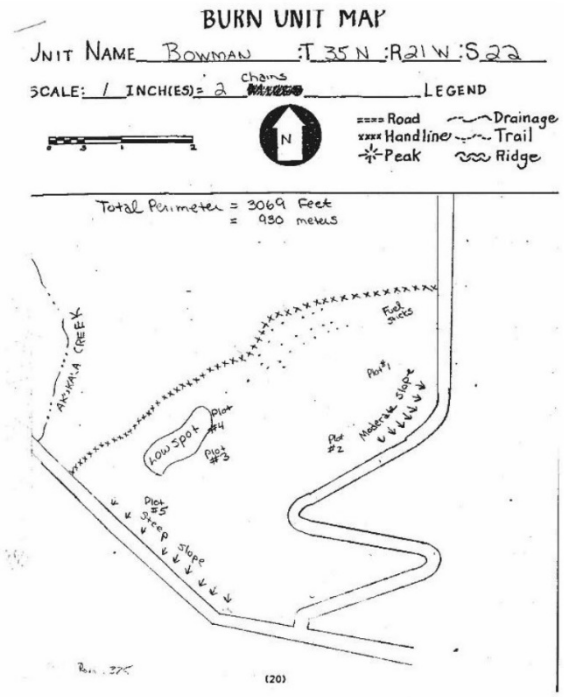


Figure 1. 1979 Bowman Burn project area map.

1983 Ponderosa Research Burn

This project was a collaborative effort between the Forest Service, Missoula Fire Science Laboratory, and NPS (Kilgore 1986). This burn was originally proposed in 1979 and was implemented in 1983 near

Sullivan Meadow, about 0.3 miles southeast of the Logging Ranger Station, in a ponderosa and lodgepole pine stand of approximately 80 acres north of the Inside North Fork Road (figure 2). The burn plan objectives were to:

1. Reduce downed woody fuels by 50 to 80 percent.
2. Kill nearly 60 percent of the understory conifers (Douglas-fir, lodgepole pine, and spruce less than 6 inches DBH[2]):
3. Prevent more than 50 percent crown scorch of the mature ponderosa pine;
4. Prevent mortality in more than 10 percent of the mature ponderosa pine;
5. Expose 15 to 35 percent of the mineral soil, and allow establishment of ponderosa pine seedlings;
6. Rejuvenate the successional cycle of native shrubs, forbs, and grasses; and,
7. Prevent escape or trespass fires.

Data collection

One-tenth (1/10) acre circular plots were established to monitor fire effects on trees, and subplots within those were established to monitor fire effects on shrubs and herbaceous vegetation (Kilgore, 1986). Percent cover, down woody fuels, impacts on mature ponderosa pine, depth of duff around ponderosa pines, fuel moisture, and other parameters were compared pre- and post-fire. The burn was implemented over two days in late August 1983.

Results

Burn objectives were at least partially met. One year after the burn, downed woody fuels were reduced by 30%, lower than the objective of 50 to 80%. This was partially explained by the fire-killed trees adding to the fuel load, which was initially reduced by 40% immediately post-fire. The burn "successfully killed 60 percent of the sapling Douglas-fir and spruce with little damage to overstory ponderosa pine" (Kilgore 1986). Less than 50% crown scorch was identified and only 2 of 32 ponderosa pine trees in the study area appeared likely to die two years after the fire. Little mineral soil was exposed except in a dense stand of lodgepole pine, where an increase in lodgepole pine seedlings of more than 300% was observed the following year. There was little data on the successional cycle of forbs and shrubs in the timeframe of the study. There were no problems holding the fire within the study area. Overall, the burn was considered successful "in allowing Glacier National Park resource managers to initiate an understory burning program—with some knowledge of impacts related to management objectives" (Kilgore 1986).

[2] Diameter at breast height

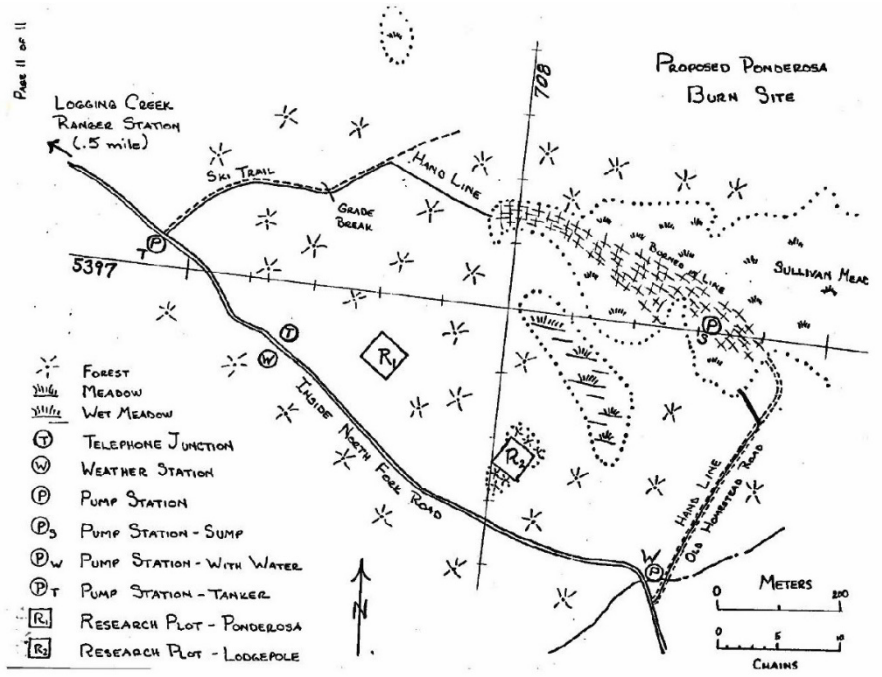


Figure 2. Project area map from the 1987 Ponderosa Burn plan.

Round Prairie

Round Prairie is in the North Fork District of GNP approximately 7 miles north of Polebridge Ranger Station on the west side of the Inside North Fork Road (figure 2). The project area covers approximately 60 acres and is bounded to the west by the North Fork Flathead River, to the east by the Inside North Fork Road, to the south by the Round Prairie/North Fork River Access Road, and to the north by a fire line from the Inside North Fork Road to the river. The vegetation in the project area consists of three general vegetation communities: (1) short-grass prairie dominated by rough fescue (*Festuca campestrus*), Idaho fescue (*Festuca idahoensis*), and Richardson's needlegrass (*Achnatherum richardsonii*); (2) sagebrush (*Artemisia tridentata*) prairie; and (3) small lodgepole pine (*Pimus contorta*) stands and scattered individuals. Except for along the riverbanks, the site is surrounded by lodgepole pine stands and spruce/fir forest (*Picea engelmannii, P. glauca*[3], *Pseudotsuga menziesii*) (Kurth and Benson 1995).

[3] The two species of spruce in GNP readily hybridize- pure *Picea engelmanii* are most common at higher elevations while pure *P. glauca* are most likely encountered in the valley bottoms; hybrids displaying a mix of characteristics are generally found in the montane zones (Lesica 2002). Hereafter, *P. engelmanii* x *glauca*, the hybrid species likely encountered in these project areas, will be referred to as Engelman spruce.

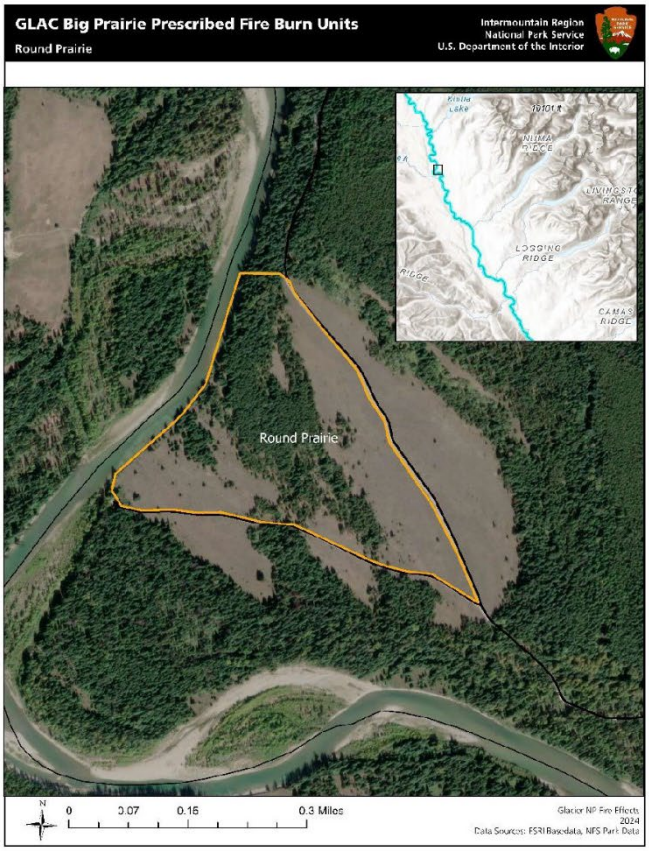


Figure 3. Round Prairie location map.

A burn plan written in 1987 states the treatment objective is to reintroduce fire on the North Fork prairies. No quantitative objectives were identified in the plan, nor was the 1987 burn plan implemented. The first entry prescribed fire this unit was implemented in October 1992. Kurth and Benson (1995) provide an excellent summary of the 1992 burn.

In addition to reintroducing fire to the North Fork prairies, ecological objectives for the Round Prairie burn were:

- Reduce tree encroachment into the prairies by reducing the number of trees less than 2.5 cm DBH by 70 to 100 percent and trees 2.5 cm to 7.5 cm DBH by 30 to 70 percent.
- Reduce fuel loadings in the forest inclusions by 30 to 70 percent.
- Reduce sagebrush cover by 50 to 90 percent.
- Encourage proliferation of native grassland species by increasing percent cover of species by 10 – 30 percent the first growing season following the fire.

Data collection

Three 20 by 50 meters ECODATA plots were installed in each of the three vegetation community types and data was collected using modified ECODATA protocols. Vegetation cover, tree size, and fuel loading data was collected in each plot. Transects to measure tree encroachment were established along the edge of the prairie. "Species, status (alive, dead, fallen), DBH, height, and location were recorded for each tree in the transect" (Kurth and Benson 1995). Percent crown scorch was measured after the fire and used to estimate tree mortality.

In conjunction with a burn plan written in 2016, three FMH plots were installed in Round Prairie (BARTR1D02). Pre-treatment FMH protocols *cover – points*, *cover -species composition*, and *density – belts* FMH data and pre-treatment photos were collected in 2016.

Results

Burn objectives were at least partially met, an exception being the reduction of sagebrush by 50 to 90 percent. "High fuel moistures in the forest inclusions and a lack of wind led to little burning in the forests and virtually no fire in the sagebrush" (Kurth and Benson, 1985). As for lodgepole pine encroachment, "lower rates of mortality (3 percent observed and 80 percent predicted) in Round Prairie are expected due to the burning conditions" (Kurth and Benson, 1995). No fuel loading or species composition data were reported. Interestingly, a site visit notes document from April 4, 2016, indicates that "the previous (fire) entry (1992) should be considered a "non-treatment" due to its minimal success." The document also notes that this area was on the prescribed fire plan "since 2005".

Burn plans for Round Prairie were also written in 1999 and 2016; neither were implemented. Objectives for these burn plans were:

- Reduce lodgepole pine tree encroachment into the prairies by killing:
    - 70 to 100% of trees <2.5 cm DBH,
    - 30 to 70% of trees 2.5 to 7.5 cm DBH, and
    - 10 to 40% of trees >7.5 cm DBH.
- Reduce sagebrush cover by 50 to 90%.
- Maintain original herbaceous species composition in the grassland, with <5% loss being acceptable.

The 2016 burn was not implemented because, after the burn plan was modified to allow for spring burning, the site was inaccessible due to snow.

Big Prairie

Introduction

Big Prairie burn units are located north of Polebridge along the Inside North Fork Road (Appendix B). Existing vegetation within the treatment areas is predominantly short prairie grassland consisting of grasses and forbs including rough fescue, Idaho fescue, Richardson's needlegrass, timber oatgrass (*Danthonia intermedia*), pinegrass (*Calamagrostis rubescens*), yellow penstemon (*Penstemon confertus*), yarrow (*Achellia millefolium*), strawberry (*Fragaria virginiana*), prairie smoke (*Geum trifolium*), and rosy pussytoes (*Antennaria rosea*). Scattered clumps and dense thickets of lodgepole pine regeneration are found in all burn blocks. Lodgepole pine within the southern burn blocks is regeneration from the 1988 Red Bench Fire. Forested clumps and thickets are more common in the northern burn blocks. These

forested clumps are composed of lodgepole pine, Douglas-fir, Engelmann spruce, and quaking aspen (*Populus tremuloides*). An occasional ponderosa pine (*Pinus ponderosa*) may also be encountered. Black cottonwood (*Populus trichocarpa*) and willow (*Salix* spp.) are common along the river and other low-lying areas within the burn blocks. Prairie grassland extends outside the individual burn blocks. Some areas contain leafy spurge (*Euphorbia esula*) and other invasive, non-native species including spotted knapweed (*Centaurea stoebe*) and common toadflax (*Linaria vulgaris*). The area between units 6/7 and 12, discussed previously, contain leafy spurge and are now excluded from burning. The GNP Vegetation Program has been actively working on containing the population and has reduced area infested from approximately 100 acres historically to a current estimated size of 20 acres (D. LaFleur pers. comm.). Otherwise, vegetation surrounding the burn blocks is mixed conifer forest or riparian woodland consisting of lodgepole pine, Douglas-fir, Englemann spruce, ponderosa pine, quaking aspen, black cottonwood, willow, snowberry (*Symphoricarpos albus*), serviceberry (*Amelanchier alnifolia*), bearberry (*Arctostaphylos uva-ursi*), huckleberry (*Vaccinium membranaceum*), and many other forbs and grasses. "The Big Prairie project area encompasses approximately 5000 acres. Within that 5000 acres, approximately 1000 acres have historically been designated as prescribed fire burn units from which primary target areas for ignition may be selected each year" (2005 burn plan).

"In an effort to restore fire to its natural role, Glacier Park managers prepared a Prescribed Fire Plan in 1993 which calls for conducting prescribed burns at periodic intervals in Big Prairie" (GNP Fire Management Program Update Big Prairie Burn Units January 25, 2000). The first burn plan for the area was written and implemented in 1992. Three additional burn units (Dry Fork 10, Johnnie 11, Aerie 12) were added later. Units 10, 11, and 12 were burned in the 1988 Red Bench Wildfire and 74 acres in Unit 12 were burned in a 2019 prescribed fire.

The Big Prairie burn units had burn plans written for each implementation and were not all burned in the same year. This section therefore examines each burn unit individually and describes burn plans for each unit(s) through time.

Data collection plots and protocols

Various data collection plots were established in Round Prairie, Big Prairie, Lone Pine Prairie, and Ponderosa burn units to track progress towards burn plan objectives (table 1).

Table 1. Summary of Big Prairie burn units.

Burn Unit	Initial Burn	Re-entry burn(s)	Data Collection Plots (year established) – *FMH protocol*
Bericlaus 1	1992 Rx	1998 Rx, 2014 Rx	ECODATA plots (1992); FMH tree density plots (2017) *Trees – metric* protocol; FMH 30-meter veg transects (2020) *Cover – points*, *Cover – species composition* protocols
Bericlaus 2	1993 Rx	1998 Rx, 2014 Rx	ECODATA plots (1992); FMH tree density plots (2017) *Trees – metric* protocol; FMH 30-meter veg transects (2022) *Cover – points*, *Cover – species composition* protocols
Bericlaus 3	n/a	n/a	This unit was established in 1992 as a "control" plot. One ECODATA plot was located in this unit.

"Indian Tree" 4	1996 Rx	2005 Rx 2014 Rx	FMH plots (1996) with *cover – points*, *cover - species composition*, *density- belts*, *density – quadrats*, and *trees – individuals* protocols, plot photos
Miller Cabin 5	1993 Rx	2014 Rx	ECODATA plots (1992); FMH tree density plots (2016) *Trees – metric* protocol; FMH 30 meter veg transects (2020) *Cover – points*, *Cover – species composition* protocols
Aspen Corner 6	1996 Rx	2002 Rx (partial), 2014 Rx	FMH plots (1996) with *cover – points*, *cover - species composition*, *density- belts*, *density – quadrats*, and *trees – individuals* protocols, plot photos
Cedar Tree 7	1996 Rx	2013 Rx	FMH plots (1996) with *cover – points*, *cover - species composition*, *density- belts*, *density – quadrats*, and *trees – individuals* protocols, plot photos
Ladder 8	1996 Rx	Dover Peak (2011) 2013 Rx	FMH plots (1996) with *cover – points*, *cover - species composition*, *density- belts*, *density – quadrats*, and *trees – individuals* protocols, plot photos
Dry Fork 10	1988 Red Bench Wildfire	No Rx burn to date	None
Johnnie 11	1988 Red Bench Wildfire	No Rx burn to date	FMH 30 meter veg transects (2022) *Cover – points*, *Cover – species composition* protocols, plot photos
Airie 12	1988 Red Bench Wildfire	2019 Rx	FMH 30 meter veg transects (2022) *Cover – points*, *Cover – species composition* protocols, plot photos

In 1992, ECODATA plots were installed in units 1, 2, and 5. See Kurth and Benson (1995) for a description of the ECODATA protocols.

Starting in 1996, Fire Monitoring Handbook (FMH, USDI 2003) plots were installed in units 4, 6, 7, and 8. FMH plots are 20 meters by 50 meters and each corner is labeled Q1-Q4. Plots are divided into 4 quadrants Q1 through Q4 and are arranged as shown in Figure 1. below. Six photos are taken from (1) Q4 towards Q1 with a range pole at the 15 meter mark, (2) from 30 P towards Q4 with a range pole at the 15 meter mark, (3) from Q1 towards Q4 with a range pole at the 25 meter mark, (4) from Q2 towards Q3 with a range pole at the 25 meter mark, (5) from Q3 towards Q2 with a range pole at the 25 meter mark, and (6) a landscape photo taken from the mid-point perpendicular to the line running from Q3 to Q4 towards the plot (Appendix C). A vegetation point-intercept line runs 30 meters along the line between Q4 and 30P. Plant species information is taken every 0.3 meters along the transect, starting at 0.3 meters (*Cover – points* FMH protocol). The transect is also surveyed for additional plant species occurring within 5 meters of the transect line and any additional species seen that were not captured along the point-intercept line are recorded in the notes section (*cover – species composition* FMH protocol). Pole-sized trees (2.5 to 15 cm DBH) are mapped within each quadrant, and DBH and height is recorded (*trees – individuals* FMH protocol). Overstory trees (>15 cm DBH) are tagged with a permanent tree tag and its location is recorded using (x, y) coordinates. During each subsequent data collection visit, DBH is re-measured, tree status is recorded (live vs. dead), and any damage to the tree is noted (also *trees –*

individuals FMH protocol). Tree seedlings (<2.5 cm DBH) are recorded and tallied based on height class and quadrant location (*density – quadrats* FMH protocol). Only seedlings occurring in the first 10 by 25 meters quadrat (starting at Q1) were recorded from 1996 through 2007. After 2007, seedlings occurring in all four quadrants of the 20 by 50 meters plots were recorded. The FMH protocols *Post Burn Severity* and *Trees – individuals* and plot photos are collected after each fire entry. The GNP FMH database also lists *density – belts* as a protocol in these plots, however, no data is entered in the database for this protocol. This protocol was originally included to track any sagebrush encroachment into the grasslands. Because no sagebrush was noted in any of the established plots, the *density – belts* protocol was dropped sometime after 2016.

FMH tree density plots were installed in unit 5 (2016) and in units 1, 2, and 4 (2017) to determine if tree mortality objectives were being met. Additional FMH vegetation transects (*cover – points* and *cover – species composition* FMH protocols and plot photos) were established in units 1 (1), 2 (2), 5 (3), 11 (3), and 12 (3) in 2022.

It should be noted that FFI protocols collect data on tree size classes that are different than the tree size classes used in many, if not all, GNP burn plans. The FFI protocols define seedlings as being <2.5 cm DBH, which does match the size class in these burn plans. FFI defines 'pole-size' trees as 2.5-15 cm DBH, and 'overstory' trees as any tree with a DBH greater than 15 cm. Many of these burn plans use 7.5 cm DBH as a cutoff between tree size classes. Objectives related to seedlings can be readily analyzed; however, trees greater than 2.5 cm DBH will first need to be divided into size classes (2.5-7.5 cm DBH and >7.5 cm DBH) before being analyzed with respect to the burn plan objectives.

All data is recorded on paper data sheets and manually entered in the GNP FFI database. Any data analysis up to the date of this report that is found will be discussed. There appears to be much data still waiting to be analyzed, and that will be analyzed, upon completion of this report.

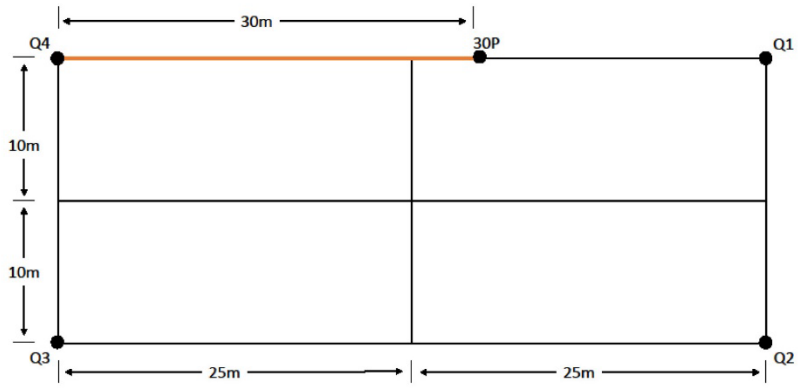


Figure 4. FMH plot diagram.

1992 Big Prairie Unit 1 Prescribed Burn

Objectives:

- Reintroduce fire to the North Fork prairies.
- Reduce tree encroachment into the prairies by reducing the number of trees < 2.5 cm DBH by 70-100% and trees 2.5-7.5 cm DBH by 30-70%.
- Sustain less than 10% mortality of ponderosa pine greater than 5 cm DBH.
- Reduce fuel loadings in the lodgepole pine, fir, and spruce inclusions by 30-70%

Data collection

The burn plan indicates that "monitoring plots installed, and fuel loading calculations completed to compile data base" and "all monitoring will be done in accordance with the Park Fire Monitoring Plan and the ECODATA methods."

Results

This burn was implemented on September 22, 1992. Kurth and Benson (1995) noted "9 percent of lodgepole pine trees were observed dead following the fire and 100 percent are predicted to be dead." Results from fuel loading, ponderosa pine mortality, and grassland species composition were not reported.

An unpublished post-burn report indicates that there were four plots with five fuel transects each in the burn area. Two of these were in grassland habitat, one was "established in a lodgepole pine inclusion and another in an open ponderosa pine stand", making analysis difficult. In general, fuel loading decrease immediately post-burn, then increased 1-year post-burn and 3-years post-burn. Tree mortality objectives were difficult to interpret with respect to the objectives. Data in the unpublished report only included mortality from the >7.5 cm DBH size class. No data was reported for the seedling size class (>2.5 cm DBH) nor the 2.5 to 7.5 cm size class. The number of trees greater than 7.5 cm DBH did decline post-fire, but these results can't be compared to objectives since no objectives for trees greater than 7.5 cm DBH were included in the burn plan. Ponderosa mortality was also difficult to analyze. The post-burn report notes a 6.5% mortality rate for ponderosa pine, but it is unclear how this percentage was calculated. Data in table 5 of the report indicates a decline of 10.87% three years post-fire in ponderosa greater than 7.5 cm DBH.

The post-burn report also analyzed an objective not included in the original burn plan which was to increase the percent cover of native plants by 20-50% (the unknown author of the post-burn report was not able to find the original burn plan and therefore used burn objectives from the 1993 Big Prairie burn unit 2 plan). Regardless, that objective was not met. An increase in pinegrass and Kentucky bluegrass was noted in the plots.

Recommendations

The post-burn report states "managers may want to reevaluate the goal of increasing native grassland species; specifically, identifying what species and in what areas this increase should occur. Do native grassland species need to increase the prairies? Or are we only concerned about increasing the extent of native grassland species by reducing forest inclusions and encroaching lodgepole pine?"

1993 Big Prairie Unit 2 Prescribed Burn

Objectives

- Reintroduce fire to the North Fork prairies.
- Reduce lodgepole pine dominance by reducing the number of trees by 70-100%.
- Reduce fuel loadings by 30-70%.
- Increase cover of native grassland species by 20-50%.
- Reduce fuel loadings in the lodgepole pine inclusions by 30-70%

Data collection

The 1993 burn plan indicates that "monitoring plots installed, and fuel loading calculations completed to compile data base" and "all monitoring will be done in accordance with the Park Fire Monitoring Plan and the ECODATA methods."

Results

This burn was implemented on October 1, 1993. The unpublished post-burn report written in 1995 states "because the unit burned only two years ago and first year post-burn data was not gathered, due to the chaotic nature of the 1994 fire season, it is difficult to capture any short- or long-term trends. However, we can observe that this burn has yet to accomplish any of its fire effects goals other than reintroducing fire to the ecosystem." While 1-hour and 10-hour fuels were significantly reduced, overall fuel loading was not reduced by 30-70%. Lodgepole mortality did not reach the 70% goal, but the report noted overall mortality may increase in subsequent years due to the death of fire-injured trees. Additionally, native species cover did not increase by 20-50%. The report noted that grass species cover did increase, the increase was likely driven by increases in pinegrass and Kentucky bluegrass.

Recommendations

Recommendations in the post-burn report largely follow those discussed above in the 1992 burn unit. In addition to the native species cover comments already mentioned, recommendations include burning under lower fuel moistures and relative humidities to increase fuel consumption and tree mortality to better meet burn objectives.

1993 Big Prairie Unit 5 Prescribed Burn

A burn plan for this ignition has not been located, but a post-burn report indicates that one was written. Objectives for the burn were:

- Reintroduce fire to the North Fork prairies.
- Reduce lodgepole pine dominance by reducing the number of trees by 70-100%.
- Reduce fuel loadings by 30-70%.
- Increase cover of native grassland species by 20-50%.
- Sustain less than 10% mortality of ponderosa pine with a DBH greater than 5 cm.
- Reduce fuel loadings in the lodgepole pine, fir, and spruce inclusions by 30-70%

Data collection

It is assumed that, like in units 1 and 2, "monitoring plots installed and fuel loading calculations completed to compile data base" and "all monitoring will be done in accordance with the Park Fire Monitoring Plan and the ECODATA methods."

Results

This burn was implemented on October 4, 1993. An unpublished post-burn report written in 1995 for unit 5 states, identical to the reported results from burn unit 2, "because the unit burned only two years ago and first year post-burn data was not gathered, due to the chaotic nature of the 1994 fire season, it is difficult to capture any short- or long-term trends. However, we can observe that this burn has yet to accomplish any of its fire effects goals other than reintroducing fire to the ecosystem." The reduction in fuels did not reach 30%, and lodgepole mortality was only 40%. It was speculated that lodgepole mortality may increase in future years due to mortality of fire-injured lodgepole. Native grassland species did not increase by 20-50%. Two years post-burn, grasses and forbs were found to decrease in grassland plots. Grass and forb cover increased in the forest inclusions, but those increases were driven by pine grass and fireweed, which are considered non-grassland species.

Recommendations

Recommendations in the unit 5 post-burn report largely follow those discussed above in burn units 1 and 2. The post-burn report states that future burn plans look at "burning under lower fuel moistures and relative humidities to increase fuel consumption and tree mortality", and "reevaluate the goal of increasing native grassland species; specifically, identifying what species and in what areas this increase should occur."

1996 Big Prairie Units 4, 6, 7, and 8 Prescribed Burn

Objectives (same for all units)

- Reintroduce fire to the North Fork prairies which have greatly exceeded their mean fire interval.
- Reduce lodgepole pine tree encroachment into the prairies by killing 70-100% of trees < 2.5 cm, 30-70% of trees 2.5-7.5 cm DBH, and 10-40% of trees > 7.5 cm DBH.
- Maintain original herbaceous species composition (i.e., limit exotic plant introduction) in the grassland, with a < 5% loss being acceptable.

Data collection

Four FMH plots were established in unit 4 (FESC01-04), two in unit 6 (FESC12, 13), four in unit 7 (FESC08-11), and three in unit 8 (FESC05-07) and were read to determine vegetation composition; seedling, pole-sized, and overstory tree composition; and fuel loadings. Data from monitoring plots were to be collected at a minimum at 1-, 3-, and 5-years post-burn. Approximately 2 weeks following the burn, burn severity, tree scorch height, tree mortality, and plot photos were be documented in the fire effects plots. Pre- and post-burn data was also to be compared to determine if objectives were met. No analysis of the data has been located.

Results

Unit 7 was ignited on October 3 and 4, 1996. "Burn objectives were met over approximately 50% of the unit." In the northern part of the unit, average scorch height was 4.1 meters (13.5 feet) and mortality in lodgepole pine was estimated to be 80-90%. It was noted in all the post-burn reports from 1996 that "past experience has shown that even slightly yellowed needles on the lodgepole pine immediately after the burn indicate the level at which mortality will occur." It is assumed that this means that even slightly yellowed needles immediately post-burn usually indicates the tree will die. In the southwest corner of the

unit, however, the burn did not meet objectives and only burned lightly in a very patchy pattern. There was little tree scorch and little lodgepole mortality in this area.

Unit 8 was ignited on October 4, 1996. "At this time it appears that burn objectives were met." An estimate of 60-80% lodgepole pine mortality was achieved in this unit, and that "those on the fringes of the prairie appear to be especially scorched." Scorch height averaged 2.0 meters (6.6 feet).

Unit 6 was ignited on October 6, 1996. Neither plot in this unit had any overstory trees, so scorch height was not recorded. It was estimated that lodgepole pine mortality was 70-80%. Final mortality and herbaceous species composition were to be determined in the following years. The eastern flank of the unit was not lined or held, which resulted in more encroaching trees killed. Some torching occurred in the wetter forest on the eastern flank, but it did not carry very far outside the burn unit. This method was recommended for all future burns.

Unit 4 was ignited on October 10, 1996. "All portions of the unit seemed to burn well enough to meet management objectives except in the northeast corner where burning was patchy and inconsistent." The east line did not hold during the high winds and an additional 5 acres east of the project area that also burned. No suppression actions were taken and the four monitoring plots in unit 4 had an average scorch height of 5.5 meters (18 feet) and an estimated 50-80% mortality in the lodgepole. The report also noted the RH was 55% at the time of ignition. An RH of over 50% is considered too high for this fuel type, but high winds (3-5 mph average with 12-19 mph gusts) helped make the behavior "more than satisfactory." Final mortality and herbaceous species composition in all plots was to be determined in the following years.

1997 Big Prairie Units 1, 2, and 7 Burn Plan

Objectives

The objectives differ slightly between the three plans, but in general were:

- Reapply fire to the units.
- Reduce tree encroachment into the prairies by reducing the number of trees < 2.5 cm DBH by 70-100%, the trees 2.5-7.5 cm DBH by 30-70%, and the trees > 7.5 cm DBH by 10-40%.
- Sustain <10% mortality of ponderosa pine > 10cm DBH.

Monitoring

The burn plan states that "all monitoring will be done in accordance with the Park Fire Monitoring Plan" and "NPS fire monitoring plots are not present in Unit 1; plots are found in other Big Prairie burn units." Ecodata plots were installed in units 1 and 2 and data collection likely would have followed the ECODATA protocols described in Kurth and Benson (1995). FMH plots were installed in unit 7 in 1996.

Results

This plan was not implemented, most likely due to lack of funding, lack of personnel, the lack of a burn window, or some combination of those factors.

1998 Big Prairie Units 1 and 2 Prescribed Burn

Objectives (same for both units)

- Reapply fire to the unit. Unit 1 and 2 were burned in 1992 and 1993, respectively.
- Reduce tree encroachment into the prairies by reducing the number of trees < 2.5 cm DBH by 70-100%, the trees 2.5-7.5 cm DBH by 30-70%, and the trees > 7.5 cm DBH by10-40%.
- Sustain <10% mortality of ponderosa pine > 10cm DBH.

The Burn Boss report from September 1998 states "the 1993 unit 2 burn was on the cool side and did not completely meet the objectives in regards to overstory and pole sized Lodgepole pine mortality in one 2-3 acre "forested" area. This area really did not burn at all in 1993. My main objective was to achieve as much mortality as we could in this area and to take out the seedlings throughout the area."

Monitoring

The burn plan states that "all monitoring will be done in accordance with the Park Fire Monitoring Plan" and "NPS fire monitoring plots are not present in Unit 1; plots are found in other Big Prairie burn units." Ecodata plots were installed in units 1 and 2 and data collection likely would have followed the ECODATA protocols described in Kurth and Benson (1995). The Burn Boss report states that "photos were retaken at the old Ecodata plot locations" and were "the only record our progress in these two units."

Results

This prescribed fire was ignited on September 30, 1998. "I did put all the heat possible on the ground, but we still had 20-30% of the area unburned." The Burn Boss felt that there was 10-40% scorch and expected to get "another 10-30% mortality in the next 2-3 years." Lodgepole seedling mortality was high, with only those in unburned patches surviving. The repeat photography indicated "a great reduction in stems per acre, but an increase in 100- and 1000-hour" fuels.

Recommendations

The burn boss report recommends that "these Big Prairie units should be burned earlier in September whenever the grasses cure and the 1000-hour fuels are at their driest. The burning window is so narrow at the end of September that it is hard to complete ignition in time. It would be beneficial to burn before any fall rains occur; they are difficult to recover from at this time of year."

1999 Big Prairie Units 7 and 8 Burn Plans

Objectives

- Reintroduce fire to the North Fork prairies which have greatly exceeded their mean fire interval.
- Reduce lodgepole pine tree encroachment into the prairies by killing 70-100% of trees < 2.5 cm-7.5 cm DBH, and 10-40% of trees 7.5 cm DBH.
- Maintain original herbaceous species composition (i.e., limit exotic plant introduction) in the grassland, with <5% loss being acceptable.

Monitoring

Four FMH plots were established in unit 7 and three in unit 8. Plots were to be read to determine vegetation composition, seedling tree, pole-sized tree, and overstory tree composition, and fuel loadings. Data from the fire effects plots were to be collected at a minimum at 1-, 3-, and 5-years post-burn. Approximately 2 weeks following the burn, burn severity, tree scorch, and mortality was also to be

documented for trees in the fire effects plots. Pre- and post-burn data was to be compared to determine if objectives have been met. "All monitoring will be done in accordance with the Glacier National Park Fire Monitoring Plan (1997)."

Results

This plan was not implemented, most likely due to lack of funding, lack of personnel, the lack of a burn window, or some combination of those factors.

2000 Big Prairie Burn Plan

There was a burn plan written by Resource Management staff in 2000 but due to a prescribed fire moratorium the burn was never initiated.

Objectives

- Reduce lodgepole pine:
  - Seedlings (< 1" DBH) by 70-100%,
  - Poles (1"- 6" DBH) by 30-70%, and
  - Overstory trees (>6" DBH) by 10-40%, within 5 years postburn.
- Maintain the original flora with no more than a 5% increase in relative cover of non-native plants within five years postburn.

This burn was never initiated. In addition to other factors discussed later in the "Stand-Replacing Management Ignited Prescribed Fire Project Proposal" section of this document, there was a DOI-wide prescribed fire moratorium at this time following the aftermath of the Cerro Grande Fire, an escaped prescribed fire that was initiated at Bandelier National Monument in New Mexico. The Cerro Grande Incident also spurred the review and update of the 1995 Federal Wildfire Management Policy, which was published in January 2001.

2002 Big Prairie Prescribed Burn

This burn plan is the first to use primary and secondary "target areas". Primary target areas are defined as "specific burn units within the project area that will be directly ignited", and secondary target areas are defined as "all areas outside the primary target area but within the project area". "Unplanned spots or slopovers from primary target areas into secondary areas will not necessarily be suppressed in order to allow for a more natural burn mosaic and to minimize resource damage associated with intensive holding/ fire suppression activities". Target area 1 includes burn units 6 and 7, target area 2 includes burn units 1,2,3 and 5, and target area 3 corresponds to burn unit 8 (figure 5).

Objectives

- Reduce lodgepole pine tree encroachment into the prairies by killing 70-100% of trees <2.5 cm DBH, 30-70% of trees 2.5-7.5 cm DBH, and 10-40% of trees >7.5 cm DBH after three entries.
- Maintain original herbaceous species composition in the grassland, with a <5% loss being acceptable after three entries.
- Reduce sagebrush component by 50% post burn.

- After three or fewer entries, monitor units and conduct prescribed fires or allow fire use fires to treat the area on a schedule commensurate with the mean fire return interval of approximately 25 years.
- Reduce 1- and 10-hour and dead and down fuel loading by at least 60% immediately post burn. (Note: a temporary increase in 10- and 100- hour fuels is expected after initial treatments.)
- Monitor all plots one-, three-, and five-years post burn and on a 5-year schedule every year thereafter.
- Ensure there are no losses of fire-sensitive cultural resources.
- Maintain overall coniferous 'footprint' in and adjacent to the meadows at a level equal to, or somewhat smaller than, the 1945 aerial photo series.

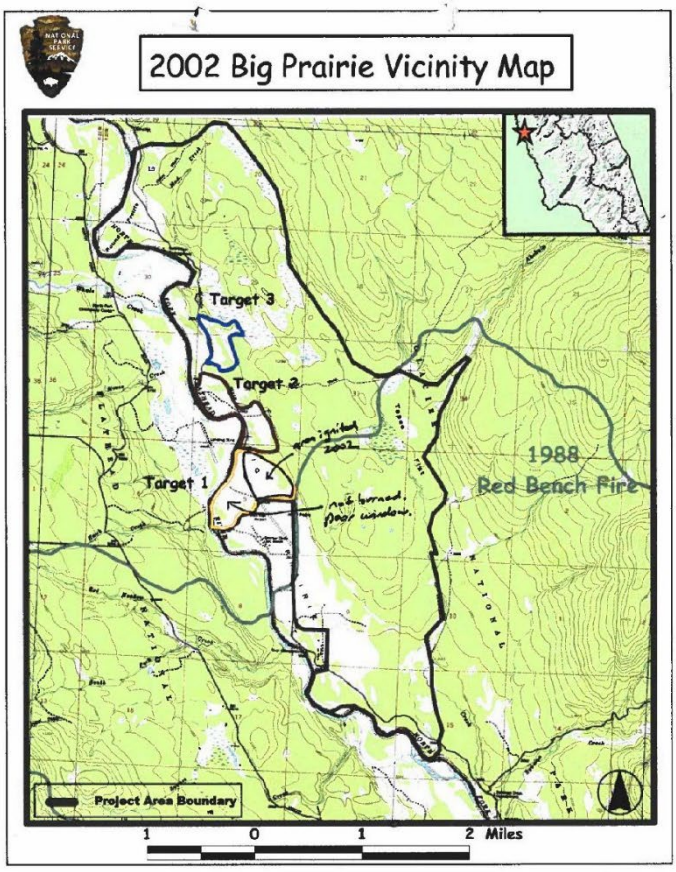


Figure 5. 2002 Big Prairie Burn Plan project area.

Results

Target area 1 was ignited on September 19 (blacklining) and September 21 (prescribed fire), 2002. A burn narrative from 9/21/2002 indicated approximately 60 acres in Unit 6 were burned. No Prescribed Fire Monitoring Report has been found describing initial fire effects. The 2002 Big Prairie Vicinity Map has hand-written notes indicating that burn unit 6 was ignited in 2002 and that burn unit 7 was "not burned, poor window" (figure 5). There is no 2002 data collection event in FFI for unit 6 (FESC12, FESC13) and no indication that a burn occurred. It is possible the prescribed fire did not burn over the two FMH plots in Unit 6. A Prescribed Fire Monitor Report from 2014 indicates that unit 4 was burned in 2002, but there is no information showing a burn in unit 4 in the 2002 project folder, nor is there a record in FFI of a 2004 burn. There is, however, a 2005 burn (Burn02/Post02) recorded in FFI in unit 4 (FESC01, FESC02, FESC03, FESC04).

2005 Big Prairie Prescribed Burn

The burn plan from 2005 identifies three target areas, which are generally the target areas in the 2002 burn plans, but they are re-prioritized in 2005 (figure 6). Target area 1 (2005) was target area 2 in 2002, but the perimeter was expanded to the east and to the north. Target area 1 includes Big Prairie units 1, 2, and 4. Target area 2 (2005) was target area 1 in 2002 but includes only the west side of the Inside North Fork Road in 2005. Target area 2 includes Big Prairie unit 6. Target area 3 is largely the same in both plans and is basically Big Prairie unit 8.

Objectives

- Reduce lodgepole pine tree encroachment into the prairies by killing 70-100% of trees <2.5 cm DBH, 30-70% of trees 2.5-7.5 cm DBH, and 10-40% of trees >7.5 cm DBH after three entries.
- Maintain original herbaceous species composition in the grassland, with a <5% loss being acceptable after three entries.
- Reduce sagebrush component by 50% post burn.
- After three or fewer entries, monitor units and conduct prescribed fires or allow fire use fires to treat the area on a schedule commensurate with the mean fire return interval of approximately 25 years.
- Reduce 1- and 10-hour and dead and down fuel loading by at least 60% immediately post burn. (Note: a temporary increase in 10- and 100- hour fuels is expected after initial treatments.)
- Monitor all plots one-, three-, and five-years post burn and on a 5-year schedule every year thereafter.
- Ensure there is no loss of fire sensitive cultural resources.
- Maintain the overall coniferous "footprint" in and adjacent to the meadows to a level equal to or somewhat smaller than, the 1945 aerial photo series.

Results

Target area 1 was ignited on September 28, 2005. Only a portion of target area 1 (unit 4) was burned, and all four FMH plots in the unit were successfully burned in the second-entry prescribed fire. The 2005 FEMO Initial Report states, "it was acknowledged prior to ignition that it would be difficult to meet the reduction objectives in trees greater than 2.5 cm DBH" and that "this unit was chosen, however, due to the high density of lodgepole seedings in areas where the canopy had been successfully treated in 1996."

"Big Prairie 2005 Burn Unit is considered successful as far as meeting goals and objectives for fuel reduction Continuing postburn assessments will monitor tree mortality over the next 5 years and evaluate if long-term objectives were met."

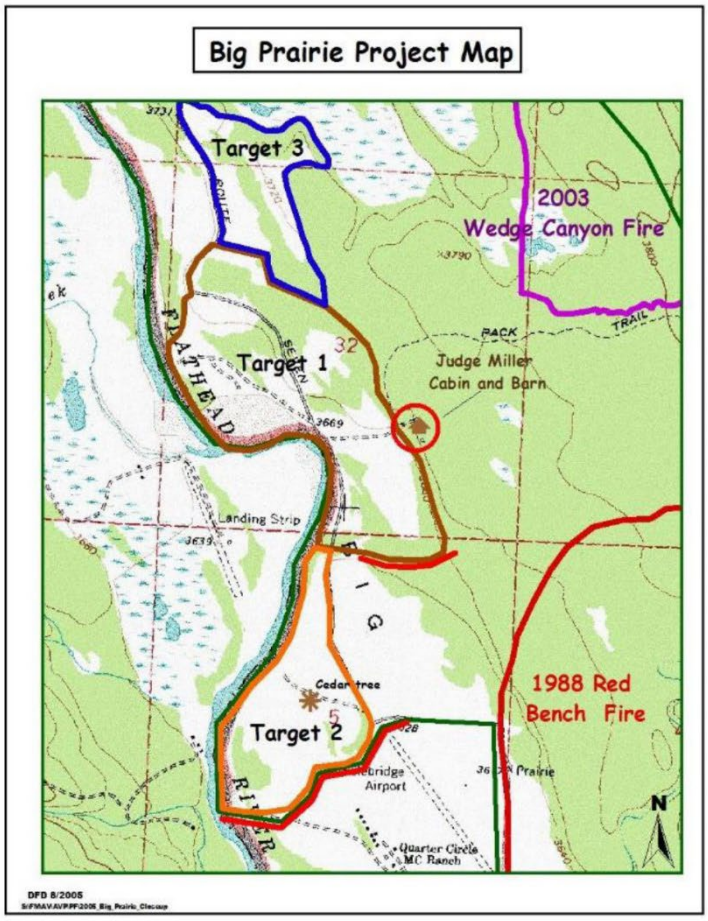


Figure 6. 2005 Big Prairie Burn Plan project area map.

2008 and 2012 Big Prairie Burn Plans[4]

[4] Sometime after 2008, burn plans it became increasingly common for burn plans and monitoring reports to be written digitally and be found on the GNP network. Prior to this change, most burn plans and monitoring reports are found in physical project folders, most of which are currently in the GNP Fire

Burn plans were drafted in 2008 and 2012.

Objectives (2008)

- Reduce lodgepole pine tree encroachment into the prairies by killing 70-100% of trees <2.5 cm DBH, 30-70% of trees 2.5-7.5 cm DBH, and 10-40% of trees > 7.5 cm DBH after three entries.
- Maintain a 95% or greater cover of native herbaceous species.
- After three or fewer entries, monitor units and conduct prescribed fires or allow fire use fires to treat the area on a schedule commensurate with the mean fire return interval of approximately 25 years.
- Reduce 1- and 10- hour dead and down fuel loading by at least 60% immediately post burn. (Note: a temporary increase in 100- and 1000-hour fuels is expected after initial treatments).
- Monitor all plots one-, two-, five-, and ten-years post burn and on a 10-year schedule thereafter.

Results

Neither plan was implemented, most likely due to lack of funding, lack of personnel, the lack of a burn window, or some combination of those factors.

2011 Big Prairie (Dover Peak) Wildfire

The 6.5-acre Dover Peak Wildfire burned one plot (FESC05) in burn unit 8 on May 23, 2011. This event is recorded as a second-entry fire in plot FESC5 FFI data. This fire was accidently started by out-of-bounds campers.

2013 Big Prairie Units 7 and 8 Burn

While no burn plan has been found, it is believed this event used the plan written in 2012. A Fire Monitor Report was found. This burn was implemented on April 24, 2013.

Objectives (from 2012 burn plan)

- Reduce lodgepole pine by the following percentages:
  - 70-100% in the less than 2-inch[5] diameter (at breast height) size class (one-year post-burn).
  - 30-70% in the 3- to 6-inch diameter size class (one-year post-burn).
  - 10-40% in the 6- to 9-inch diameter size class (two-years post burn)
- Monitor invasive species trends in the burned areas.

Results

This burn was ignited on April 24, 2013. This was recorded in FFI as a second-entry fire in units 7 (FESC08, FESC09, FESC10, FESC11) and 8 (FESC05, FESC06, FESC07). The Prescribed Fire Monitor Report (4/24/2014) states that approximately 140 acres were burned in units 7 and 8. "Burn Objectives:

Cache file cabinet. Burn plans written prior to this change should be scanned and saved to the GNP network. This task is a low-priority item on the upcoming Fire Ecology work plan.

[5] It is not clear why DBH measurements switched from metric units, which is how data is collected in FMH protocols. This switch further complicates data analysis.

Initial observations and thoughts are that objectives were met on the seedlings, poles, and overstory in the open grassy areas with very little to no mortality in the shaded areas and within the forested section of these units. This was not important in Unit 7, but we would have liked to see more mortality on the forest edges in Unit 8. Two to three weeks will be needed to make a better initial evaluation on the overall mortality." The two-week follow-up report from 5/6/2013 states that "mortality is readily apparent on the seedlings, especially those less than 1' tall in what was the thicker grass. It presently appears that most of the poles were limbed, rather than killed, but we will have a much better idea on their mortality by Fall of 2013. On some of the overstory trees where we had witnessed very hot pitch burning at the base, they are showing no signs of yellowing needles, but again, it is too early to assess."

Recommendations

The monitoring report recommends that future burns be hotter "to better achieve objectives in the more forested areas of Unit 8. Attempt to burn at an ERC of 25 or higher to better meet objectives in the more forested areas of the units."

2014 Big Prairie Units 1, 2, 4, 5, and 6 Burn

While 2014 no burn plan has been found, it is believed this event used the plan written in 2012. The Prescribed Fire Monitor report from 5/2/2014 indicates units 1,2, 4, 5, and 6 were burned. The monitoring report indicates unit 6 was burned in 2002. It is assumed the fire did not burn either of the FFI plots in unit 6 as there is no record of a 2002 burn in either plot in FFI. There is no data entry for any plot indicating a burn occurred in 2014; however, there is monitoring data entries in FFI that indicate the burn took place (Re02Year01, Re02Year02, etc.).

There is no third-entry fire (Burn03) recorded in FFI for Big Prairie burn units 4 (FESC01, FESC03, FESC04); however, there are Post03 (2014), Re03Year01 (2015), Re03Year02 (2016), Re03Year03 (2017), and Re03Year05 (2019) data recorded in FFI. Unit 4 plot FESC02 was apparently not burned in 2014. The subtitle of the monitoring report indicates that units 1 and 2 were also burned, but no narrative description of the burn was included in the report. As stated previously, as of 2013, there are still no FMH plots in unit 1, 2, or 5.

Objectives (from 2012 burn plan)

- Reduce lodgepole pine by the following percentages:
    - 70-100% in the less than 2-inch diameter (at breast height) size class (one-year post-burn).
    - 30-70% in the 3- to 6-inch diameter size class (one-year post-burn).
    - 10-40% in the 6- to 9-inch diameter size class (two years post burn)
- Monitor invasive species trends in the burned areas.

Results

The 5/2/2014 Prescribed Fire Monitoring Report indicates that approximately 240 acres were burned in units 5 and 6 between April 30 and May 1, 2014. "Initial observations and thoughts are that objectives were met on the seedlings, poles, and overstory. One of the best initial results since the inception of RX program in Big Prairie. Non-natives are always a worry and it will take a few years to monitor that issue."

There is no description of burning conditions or results in either unit 1 or 2.

The monitoring report states "one issue to be monitored over the next few years is if the slash plots tend to generate non-natives (due) to the heat at the soil surface." It has since been noticed anecdotally that common toadflax is found in areas where dead and downed fuels had accumulated and were burned (e. g. under recently fallen trees that burned during the prescribed fire).

Recommendations

The Prescribed Fire Monitoring Report (5/2/2014) suggested that "the spring prescription include "4-5 days of dry weather just prior to burning, ERCs of 25 and above, temps 65+ (70 is better), RH's < 25%, little to no cloud cover – this seems to be very important on flat ground, and do not start ignition until those elements are met. Black lining can be done under a cooler prescription whenever good solid black line is produced. Black lining without cut lines (in the spring when the logs are damp) produces good results that are very favorable with wilderness values. In the past, we built some very large windrows of cut logs that were very artificial looking. The overall burn exceedingly met the mortality objectives, I do not think at this time, that the slashing is necessary if the unit is burned with an optimum prescription. More monitoring is needed, but initial results very good. One issue to be monitored over the next few years is if the slash plots tend to generate non-natives to the heat at the soil surface. That will take 2-3 years to follow up with."

Starting in 2016, FMH tree density plots were installed in Big Prairie burn units 1, 2, and 5 to determine if tree mortality objectives in the 2014 were met. These plots were randomly located and were not permanently marked.

2019 Big Prairie Unit 12 Burn

Approximately 74 acres in Unit 12 were burned in 2019. No burn plan has been located, so it is assumed that the 2012 burn plan was used for this ignition. The objectives found in the monitoring report are the same as in the 2012 burn plan. The objectives were:

Reduce lodgepole pine by the following percentages:

  - 70-100% in the less than 2-inch diameter (at breast height) size class (one-year post-burn).
  - 30-70% in the 3- to 6-inch diameter size class (one-year post-burn).
  - 10-40% in the 6- to 9-inch diameter size class (two years post burn)
- Monitor invasive species trends in the burned areas.

Results

This burn was ignited on 4/25/2019. Prescribed Fire Monitoring Report indicates the fire was driven mostly by north/northwest winds that slowed ignition and cut short accomplishments "due to complex ignition and holding operations near Park inholdings and facilities." The report contains photos of the burn results and captions that indicate good overall results in area that did burn. The photos show "good girdling of trees due to cured out grasses under canopies", a "mosaic burn pattern due to heavy and light grass", "moderate understory consumption due to dry fuel", "some backing fire early on until winds changed out of the North-Northeast", and "good consumption of 1000 hour fuels in some locations due to low fuel moisture."

Recommendations

It was recommended to burn the unit with more heat in the future to "better achieve objectives in the forested areas of unit 12." An ERC of 23 or higher was recommended for the next fire entry. It was also noted that some fuel load had been reduced to some extent by elk grazing which may have led to less fire intensity is some areas.

Lone Pine Prairie

Lone pine prairie is located along the Inside North Fork Road approximately 3.0 miles south of Polebridge (figure 7). Ten FMH plots (GFESC14-23) were established in 2020 using the *cover – points* and *cover- species composition* protocols. This area did burn in the 1988 Red Bench fire; however, a burn plan was never written nor has prescribed fire been applied to the unit. A pilot study conducted in 2020 (Appendix D) indicated that "time since last fire, proportion of dead biomass, and diameter of bunches all suggest the need for (prescribed fire) treatment to reduce fuel load and dead component of rough fescue".

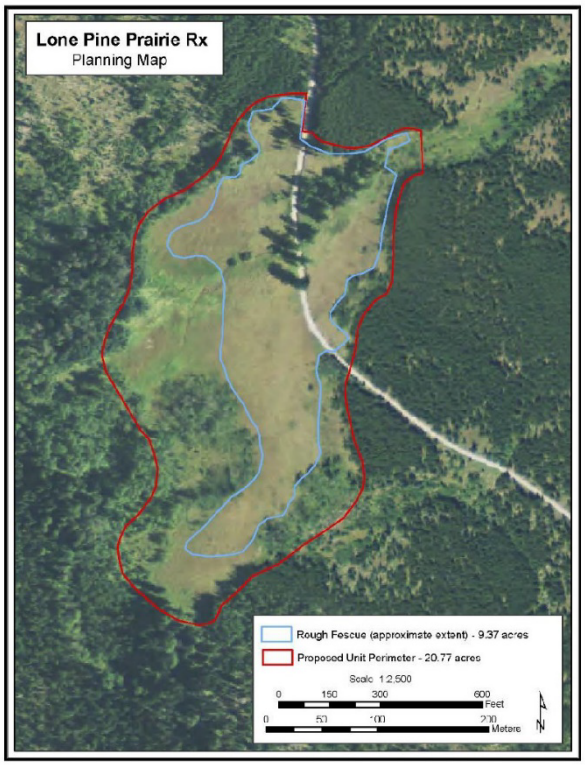


Figure 7. Lone Pine Prairie Prescribed Fire Planning Map.

Stand-Replacing Management Ignited Prescribed Fire Project Proposal

In the mid-1990's, it was becoming apparent that prescribed natural fire (a.k.a. fire-use or resource benefit fires) would not be sufficient to meet ecological objectives of the fire management program due to the lack of natural starts from adjacent lands entering the park and the concern that such fires would exceed their prescription, escape park boundaries, and cause negative impacts to human health and safety and potentially cause property damage. In addition, the small, low intensity prescribed fires being implemented by the park were seen as insufficient in reestablishing fire's ecological role in the park's fire-adapted ecosystems. This led park staff to the bold idea of proposing a stand-replacing management ignited fire in GNP. This was one of the most ambitious projects ever proposed by GNP, then or now. The project goal was to "restore fire to its natural role in the park to the maximum extent possible to enable natural processes to function essentially unimpaired by human influence." This project would develop a foundation for integrating fire into landscape-scale land management by increasing knowledge and expertise in the use of stand-replacing prescribed fire to restore ecological processes in fire-adapted ecosystems. Other project benefits would include the development of scientifically sound messaging regarding the role of fire in the ecosystem, and the ability to field test the latest computer modeling of fire growth and behavior. This project was being developed with partners from Parks Canada, Alberta Land

and Forest Service, Waterton Lakes National Park, National Interagency Fire Center, NPS Rocky Mountain Regional Office, Yellowstone NP, US Forest Service (Region One, Flathead NF, Lolo NF, Kootenai NF, and Aerial Fire Depot), US Fish and Wildlife Service, Intermountain Fire Science Laboratory, Montana Air Quality Division, Montana Department of State Lands, and University of Montana.

The proposed project area was in the North Fork area of GNP, where "the natural fire cycle his close to being exceeded" and "fire suppression has resulted in unnatural fuel load distributions." (Taken from a document titled "Background Information for Considering Stand Replacement Management Ignited Prescribed Fire and Alternatives in Glacier National Park." No date is listed on the document, but it refers to the 1994 fire season; therefore, the document was authored sometime after 1994.) The document continues: "fifty years of fire suppression where historical fire intervals are short as well as recent beetle infestations enhance the probability that forests in the North Fork may experience more extensive stand-replacing fires in the future." It was thought that the limited prescribe fire, mostly small, low intensity underburns the park had been implementing, along with the lack of significant "prescribed natural fires" were not enough to get the fire return interval back in line with natural, pre-suppression era conditions. The project proposed to "explore the desirability and feasibility of alternatives, including stand-replacement MIPFs (management ignited prescribed fire), to reinstate fire and fire effects in order to maintain dynamic natural ecosystems in Glacier National Park."

This ambitious project never caught fire, figuratively or literally. Between 1996 and 2000, many large fires, both naturally caused and escaped prescribed fires, burned thousands of acres in the western U.S. Lightning-ignited fires include the Superstition Fire in AZ (1996, 24,000 acres), the Siskiyou Complex in Oregon and California (1996, 40,000 acres), the Sadler Fire in Nevada (1999, over 200,000 acres), and the Big Bar Complex in California (1999, 140,000). Escaped prescribed fires during this time include the 2,000-acre Lowden Ranch escaped prescribed fire in 1999 that destroyed 23 homes near Redding, CA, and the 48,000-acre Cerro Grande (2000) escaped prescribed fire near Los Alamos, NM that destroyed 400 homes and caused significant damage to Los Alamos National Laboratory, causing an estimated $1 billion in damages. These situations created a much more risk-adverse group of fire managers. There simply was no appetite any longer for such an ambitious plan as was proposed in GNP.

Between the mid-1990's when this project was being developed and today, several large, stand-replacing fires have occurred in the North Fork area. These include Anaconda (1999), Moose (2001), and the Wedge Canyon (2003) fires, which collectively burned approximately 63,500 acres in the North Fork of GNP.

North Fork Ponderosa

Introduction

The North Fork Ponderosa Pine burn units are located along the Inside North Fork Road (Glacier Route 7) between Logging Creek to the northeast and Dutch Creek to the southeast (Appendix D). These units occur in mixed conifer forest consisting of a predominantly ponderosa pine and western larch (*Larix occindentalis*) overstory with interspersed Douglas-fir and Engelmann spruce. Ground cover is mostly native grasses (pinegrass) with a variety of herbaceous forbs and low shrubs including bearberry, huckleberry, snowberry, and serviceberry. The predominate surface fuels are a mix of grass and shrub and includes needle cast from the overstory ponderosa and lodgepole pine.

Ponderosa pine is an important, albeit small, component of North Fork vegetation communities. The ponderosa community in GNP is unique in that it is on the northeastern edge of its range, competing with other species (Douglas-fir and Engelmann spruce) which are probably better adapted to the local growing conditions, and as a fire-dependent species growing in an area with less fire than in other parts if its range. Ponderosa is also an important cultural resource. There are several large, culturally scarred trees (CST) in the North Fork area, most of which are ponderosa pine.

Prescribed fire projects in the North Fork ponderosa are focused making these stands more resilient to wildfires by reducing overall fuel loading and reducing the number of shade-tolerant tree species (Douglas-fir and Engelmann spruce) that may act as ladder fuels while exposing mineral soil to encourage ponderosa seed germination.

In addition to prescribed fire, fuel reduction work has also been implemented around CSTs in the North Fork area. A 2006 report documented 34 culturally scarred tree sites with 74 individual trees. The CSTs in this report are 200- to 500-year-old ponderosa and western larch and the sites were thought to have had a historic fire return interval of 26-32 years (Barrett 1983). These relatively frequent fires presumably reduced understory vegetation in the stands. As the park policy once was to suppress all fires, fuel load increased in these stands over time. Then, in 1988, the Red Bench fire burned through the North Fork area, causing mortality in 22 of 34 known stands of CSTs. A project was initiated in 2016 to reduce fuel loading around known CSTs to decrease the potential for high intensity and long duration fire behavior.

North Fork Ponderosa Pine burn units 2 (Picnic), 4A, 4B, and 7 (Dutch) and associated FMH plots were established in 1997. Lobo units 3A and 3B and associated FMH plots were established in 2001. FHM plots were established in these units to monitor progress towards burn objectives.

Many of the units and FMH plots were burned either during the 1999 Anaconda (4B, and 7) and/or the 2001 Moose Wildfires (Lobo 3A and 3B). Conifer regeneration in these fire perimeters led to a dense understory of lodgepole pine and western larch with intermittent Douglas-fir and Engelmann spruce. In areas without prolific regeneration, the understory is scattered Douglas-fir, larch, some spruce, and an occasional ponderosa pine.

A prescribed fire was implemented in Units 4A, 4B in 1998, and a prescribed fire was implemented in Unit 2 in 1999. The 1999 Anaconda Wildfire burned units 4A, 4B, and 7 (Dutch). The 2001 Moose fire burned units 2 (Picnic) and Lobo 3A. A prescribed fire was implemented in Lobo 3A and Picnic 2 in 2016. A prescribed fire was also implemented in Units 4A and 4B in 2019.

Individual burn plans were written for burn unit 2 in 1999, and for 4A and 4B in 1998. In 2016, a burn plan covering all units was written and used for the prescribed fire in units 2 and 3A. The 2016 burn plan was also used for the 2019 prescribed fire in units 4A and 4B.

The burn plans list different acreages for these units between years. The variation is due to varying planned acreages and/or different final burn perimeters between years.

Data Collection Plots

CST project work

This project is monitored by repeat photography. Photo plots were established to provide the best view of the work and marked with a rebar stake driven in to ground level. Repeat visits use GPS and metal detectors to find the plot center. A photo board labeled with site, view number, azimuth, pre- or post-treatment, and date is included in the photo (figure 8).



Figure 8. Pre- (left) and post-treatment photos showing fuel reduction on a CST treatment site.

Ponderosa burn units

FMH plots were established in each unit to track progress towards burn plan objectives (table 2). Plot design and data collection protocols mirror those described in the *Big Prairie: Data Collection* section of this document. In 2017, FMH tree density plots were installed in units 2 (Picnic) and 3A (Lobo).

Table 2. North Fork Ponderosa burn units.

Burn Unit	Initial Burn	Re-entry burn(s)	Data Collection Plots (year established) - *FMH protocol*
2 (Picnic)	1999 Rx	2001 Moose Wildfire, 2016 Rx	PIPO06, PIPO07 (1997) *Cover – points*, *Cover – species composition*, *Density – quadrats*, *Trees – individuals*; plot photos
**Lobo 3A	2001 Moose Wildfire	2016 Rx	PIPO15 (2001) *Cover – points*, *Cover – species composition*, *Density – quadrats*, *Trees – individuals*; plot photos
Lobo 3B	2001 Moose Wildfire	None	PIPO16, PIPO17, PIPO18 (2001) *Cover – points*, *Cover – species composition*, *Density – quadrats*, *Trees – individuals*, plot photos
4A	1998 Rx	*1999 Anaconda Wildfire, 2019 Rx	PIPO01, PIPO02, and PIPO04 (1997), PIPO14 (1998) *Cover – points*, *Cover – species composition*, *Density – quadrats*, *Trees – individuals*, plot photos

4B	1998 Rx	1999 Anaconda Wildfire, 2019 Rx	PIPO03, PIPO05 (1997) *Cover – points*, *Cover – species composition*, *Density – quadrats*, *Trees – individuals*, plot photos
7 (Dutch)	1999 Anaconda Wildfire	None	PIPO08, PIPO09, PIPO10, PIPO11, PIPO12, PIPO13 (1997) *Cover – points*, *Cover – species composition*, *Density – quadrats*, *Trees - individuals*, plot photos

*The "Plot Monitoring Event Log – Edited Anaconda Burn Plots.xls" found on the X:\drive indicates the 1999 Anaconda Fire did not burn plots in unit 4A; however, the "FINAL NF_pine_2016_rx_plan.docx" indicates plots in unit 4A were burned in the 1999 Anaconda Fire.
**FFI data does not differentiate between Lobo 3A and 3B; however, they are noted as being different "burn blocks" in the 2016 burn plan.

Ponderosa Unit 2 (Picnic)

Location

Ponderosa Pine Unit 2 (Picnic) is located approximately 1.5 miles southeast of the Logging Ranger Station along the Inside North Fork Road. This unit abuts the Inside North Fork Road and is on the NNE side of the road. Unit 2 was mapped at 16.7 acres in 1996.

Summary

Ponderosa Unit 2 (Picnic) was established in 1996 and two FMH plots (PIPO 06, PIPO 07) were installed. Pre-burn data was collected in 1997. A prescribed burn was implemented in 1999. Although the unit is within the 2001 Moose fire boundary, neither of the monitoring plots were burned. Table 3 outlines fire activity and data collection events from 1997 to present.

Table 3. Ponderosa Pine Unit 2 (Picnic) FMH Monitoring Plot Data Collection Summary

Plot Number	1997	1999	2000	2001	2004	2009	2015	2016	2017	2018	2021
PIPO 06	*00 Pre 8/11/97	Rx Fire 9/17/99, 01 Post 9/21/99	01 Yr01 8/1/00	01 Yr02 8/1/01	01 Yr05 6/29/04	01 Yr10 7/6/09	01 Yr16 7/29/15	Rx Fire 4/21/16, 02 Post 5/25/16	02 Yr01 7/13/17, Tree density plots read	02 Yr02 8/30/18	02 Yr05 7/15/21
PIPO 07	00 Pre 8/12/97	Rx Fire 9/17/99, 01 Post 9/26/99	01 Yr01 8/1/00	01 Yr02 8/1/01	01 Yr05 6/29/04	01 Yr10 7/6/09	01 Yr16 8/20/15	Rx Fire 4/21/16, 02 Post 5/25/16	02 Yr01 7/13/17, Tree density plots read	02 Yr02 8/9/18	02 Yr05 7/19/21

*00 Pre indicates pre-fire data collection; 01 Post indicates post-fire data collection from first entry (01) fire; 01 Yr01 indicates first entry fire 1-year post-fire data collection; 02 Yr01 indicates second entry fire 1-year post-fire data collection, etc.

1999 Ponderosa Unit 2 (Picnic) Burn Plan

Objectives

- Reintroduce fire into the ponderosa pine vegetation type.
- Reduce ladder fuels buy reducing the number of trees < 2.5 cm DBH by 70-100%, the number of trees 2.5-7.5 cm DBH by 30-70%, and the number of trees > 7.5 cm DBH by 10-40% within 1-year postfire.
- Sustain < 20% mortality of ponderosa pine > 7.5 cm DBH within 5 years postfire.

- Minimize management impact in terms of ground disturbing activity.

Results

The first-entry prescribed fire was ignited in this unit on September 17, 1999. The Fire Monitoring Report written on September 17, 1999, states that "fire intensity was greatest on the north and east flanks where the concentration of 1000 hr fuel was greatest. The intensity decreased to low-moderate as ignition proceeded south and west." A Burn Boss Narrative report indicates that "the unit was burned on the "hot" end of the prescription", there was "low to moderate" fire behavior with "torching occurring in any area with jackpots", and that "immediate postburn reads show favorable results. Continued monitoring will be necessary to assess full success of the burn."

2016 Ponderosa Unit 2 (Picnic) Burn Plan

Objectives

- Reduce understory conifer encroaching on overstory ponderosa pine, provide seed bed for natural regeneration of ponderosa pine, and maintain fire in the fire-dependent ponderosa pine ecosystem.
- Greater than 50% mortality of young post-fire conifer (lodgepole pine, western larch, Douglas fir, Engelman spruce) (less than 4" diameter at root collar)
- 30-80% mortality of 4-to-10-inch DBH conifer understory
- 25-50% reduction of litter and duff
- 25-50% mineral soil exposed
- Less than 10% mortality of ponderosa pine in all size classes

Results

This prescribed fire was ignited on April 21, 2016. A Prescribed Fire Monitor Report does not describe the initial results from the prescribed fire. Rather, it is a collection of weather observations during the fire operation. Plots PIPO06 and PIPO07, along with Plot 15 (Unit 3A Lobo), were burned during this fire.

Ponderosa Lobo Units 3A and 3B

Location

Lobo Unit 3A is located along the Inside North Fork Road approximately 2 miles southeast of the Logging Ranger Station and was mapped at 36.8 acres in 1996. Lobo Unit 3B is located along the Inside North Fork Road approximately 2.5 miles southeast of the Logging Ranger Station and was mapped as 20.9 acres in 1996. The two units are not connected spatially.

Summary

The four FMH plots in these units were established prior to, and burned during, the 2001 Moose Wildfire. The 2001 Moose Wildfire is considered the first-entry burn for this unit. In 2016, the Lobo unit was divided into Lobo 3A (PIPO 15) and Lobo 3B (PIPO 16, PIPO 17, and PIPO 18). A second-entry prescribed fire was ignited in PIPO 15 on April 21, 2016. The same prescribed fire also burned plots PIPO06 and PIPO07 (Unit 2 Picnic); however, no other plots in Unit 3A Lobo were burned. The Picnic and Lobo 3A/B map in appendix C shows plots PIPO16, PIPO17, and PIPO18 are located outside of both Lobo 3A and 3B. These plots were installed in what was originally unit 3, but the unit boundaries had

changed over time. Table 4 outlines fire activity and data collection events from in Lobo units 3A and 3B from 2001 to present.

Table 4. Ponderosa Pine Unit 3A and 3B FMH Monitoring Plot Data Collection Summary

Plot Number	2001	2002	2003	2006	2011	2016	2017	2018	2021
PIPO 15 (3A)	00 Pre 6/27/01, Moose Fire 9/2/01, 01 Post 9/26/01	01 Yr01 7/22/02	01 Yr02 7/15/03	01 Yr05 7/12/06	01 Yr10 7/20/11	Rx Fire 4/21/16, 02 Post 5/25/16	02 Yr01 7/18/17	02 Yr02 9/5/18	02 Yr05 7/16/21
PIPO 16 (3B)	00 Pre 8/6/01, Moose Fire 8/31/01, 01 Post 9/26/01	01 Yr01 7/18/02	01 Yr02 7/15/03	01 Yr05 7/11/06	01 Yr10 7/21/11	01 Yr15 7/17/16	n/a	n/a	01 Yr20 8/11/21
PIPO 17 (3B)	00 Pre 8/8/01, Moose Fire 8/31/01, 01 Post 9/25/01	01 Yr01 7/18/02	01 Yr02 7/14/03	01 Yr05 7/11/06	01 Yr10 7/25/11	01 Yr15 7/21/16	n/a	n/a	01 Yr20 8/10/21
PIPO 18 (3B)	00 Pre 8/8/01, Moose Fire 8/31/01, 01 Post 9/25/01	01 Yr01 7/22/02	01 Yr02 7/14/03	01 Yr05 7/11/06	01 Yr10 7/21/11	01 Yr15 7/19/16	n/a	n/a	01 Yr20 8/6/21

2016 Ponderosa Unit 3A and 3B Burn Plan

Objectives

- Reduce understory conifer encroaching on overstory ponderosa pine, provide seed bed for natural regeneration of ponderosa pine, and maintain fire in the fire-dependent ponderosa pine ecosystem.
- Greater than 50% mortality of young post-fire conifer (lodgepole pine, western larch, Douglas fir, Engelman spruce) (less than 4" diameter at root collar[6])
- 30-80% mortality of 4-10 inch (diameter at breast height) conifer understory
- 25-50% reduction of litter and duff
- 25-50% mineral soil exposed
- Less than 10% mortality of ponderosa pine in all size classes

Results

The prescribed fire monitor report does not describe the initial results from the prescribed fire. Rather, it is a collection of weather observations during the fire operation. FMH plots in unit 3B offer an opportunity to analyze long-term effects of wildfire.

Ponderosa Pine Unit 4A

Location

Ponderosa Pine Unit 4A is located approximately one mile west of Anaconda Creek on the north/northeast side Inside North Fork Road and was mapped as 14.1 acres in 1996. Ponderosa Pine Unit 4A is directly adjacent to Unit 4B (described below). They are separated by the Inside North Fork Road.

Summary

[6] It is unclear why this parameter was used in the objectives. FMH protocols typically call for DBH measurements, not root collar diameters.

Four FMH plots were established in this unit in 1997. A first-entry prescribed fire was conducted in September 1998, and a second-entry prescribed fire was conducted in May 2019. All plots burned in both fires. This unit is within the 1999 Anaconda fire perimeter; however, none of the FMH plots burned during the fire. Table 5 outlines fire activity and data collection events in unit 4A from 1997 to present.

Table 5. Ponderosa Pine Unit 4A FMH Monitoring Plot Data Collection Summary

Plot Number	1997	1998	1999	2000	2003	2004	2009	2015	2019	2020	2021	2024
PIPO 01	*00 Pre 7/2/97	Rx Fire 9/15/98; 01 Post 9/28/98	01 Yr01 7/13/99	01 Yr02 7/31/00	01 Yr05 7/16/03	01 Yr06 7/6/04	01 Yr11 7/9/09	01 Yr17 8/4/15	Rx Fire 5/14/19, 02 Post 5/28/19	02 Yr01 7/9/20	02 Yr02 7/13/21	02 Yr05 7/16/24
PIPO 02	00 Pre 7/3/97	Rx Fire 9/15/98, 01 Post 9/28/98	01 Yr01 7/13/99	01 Yr02 7/30/00	01 Yr05 7/16/03	01 Yr06 6/30/04	01 Yr11 7/2/09	01 Yr17 8/3/15	Rx Fire 5/14/19, 02 Post 5/29/19	02 Yr01 7/7/20	02 Yr02 7/13/21	02 Yr05 7/17/24
PIPO 04	00 Pre 8/4/97	Rx Fire 9/15/98, 01 Post 9/28/98	01 Yr01 7/19/99	01 Yr02 7/31/00	01 Yr05 7/18/03	01 Yr06 7/6/04	01 Yr11 7/9/09	01 Yr17 8/4/15	Rx Fire 5/14/19, 02 Post 5/29/19	02 Yr01 7/8/20	02 Yr02 7/14/21	02 Yr05 7/16/24
PIPO 14	n/a	00 Pre 7/28/98, Rx Fire 9/15/98, 01 Post 9/28/98	01 Yr01 7/13/99	01 Yr02 8/2//00	01 Yr05 7/20/03	01 Yr06 7/6/04	01 Yr11 7/7/09	01 Yr17 8/5/15	Rx Fire 5/14/19, 02 Post 5/29/19	02 Yr01 7/9/20	02 Yr02 7/9/21	02 Yr05 7/17/24

*Plot reads are scheduled for 2024.

1998 Ponderosa Pine 4A Burn Plan Objectives[7]

- Reintroduce fire into the Ponderosa Pine vegetation type.
- Reduce ladder fuels buy reducing the number of trees < 2.5 cm DBH by 70-100%, the number of trees 2.5-7.5 cm DBH by 30-70%, and the number of trees > 7.5 cm DBH by 10-40% within 1 year postfire.
- Sustain < 20% mortality of Ponderosa Pine > 7.5 cm DBH within 5 years postfire.
- Minimize management impact in terms of ground disturbing activity.
- Initial Reports for each unit also mention limiting the introduction of noxious species as an objective.

Results

1998 Initial Report 4A

A first-entry prescribed fire was ignited in this unit on September 15, 1998. "Preliminary observations suggest that burn objectives were met." "Ponderosa Burn Unit 4A is considered successful as far as meeting and exceeding goals and objectives for fuel reduction. Continuing postburn assessments will monitor tree mortality over the next 5 years and evaluate if long-term objectives were met."

[7] The PIPO 4A objectives page from the 1998 burn plan is missing from the document found in the Fire Cache, but it is assumed they are identical to objectives from 4B.

1998 Burn Boss Report Unit 4A

"The burn came off very well; no injuries, good communication between holders and igniters, fire effects that appear to meet objectives, and excellent training."

2019 Ponderosa Pine 4A Burn Plan Objectives

Objectives

- Reduce understory conifer encroaching on overstory ponderosa pine, provide seed bed for natural regeneration of ponderosa pine, and maintain fire in the fire-dependent ponderosa pine ecosystem.
- Greater than 50% mortality of young post-fire conifer (lodgepole pine, western larch, Douglas fir, Engelman spruce) (less than 4" diameter at root collar)
- 30-80% mortality of 4 to10-inch (diameter at breast height) conifer understory
- 25-50% reduction of litter and duff
- 25-50% mineral soil exposed
- Less than 10% mortality of ponderosa pine in all size classes

Results

A second-entry prescribed fire was ignited on May 14, 2019, in unit 4A, and on May 15, 2019, in unit 4B using the 2016 burn plan. A total of 25.5 acres were burned in this project. The post-burn report indicated "objectives were more closely met in the first burn, unit 4A. The second day's burn (4B) was hindered by rain, higher RH and fuel moistures."

Recommendations

"Although burn conditions during the second day were less ideal, bringing fire back into the ecosystem was still beneficial overall, since jackpot fuels and thick duff near ponderosa pine tree bases were reduced, which could help protect the stands in a Wildfire. Getting started earlier in the morning on the first day might have provided enough time to burn both units before it rained."

Ponderosa Pine Unit 4B

Location

Ponderosa Pine Unit 4B is located approximately one mile west of Anaconda Creek on the south side Inside North Fork Road (Glacier Route 7) and was mapped at 11.1 acres in 1996. Ponderosa Pine Unit 4B is directly adjacent to Unit 4A; the two units are separated by the Inside North Fork Road.

Summary

Two FMH monitoring plots (PIPO 03, PIPO 05) were installed in 1997. A first-entry prescribed fire was conducted in September 1998. Ponderosa Pine Unit 4B was burned in the 1999 Anaconda Wildfire, and a third-entry prescribed fire was conducted in May 2019 (the adjacent unit 4A is also within the 1999 Anaconda fire perimeter, but none of the plots burned during the fire). Table 6 outlines fire activity and data collection events from 1997 to present.

Table 6. Ponderosa Pine Unit 4B FMH Monitoring Plot Data Collection Summary

Plot Number	1997	1998	1999	2000	2001	2004	2009	2015	2019	2020	2021	2024
PIPO 03	00 Pre 7/24/97	Rx Fire 9/17/98, 01 Post 9/28/98	01 Yr01 7/12/99, Anaconda Wildfire 9/24/99, 02 Post 9/28/99	02 Yr01 7/29/00	02 Yr02 7/31/01	02 Yr05 6/28/04	02 Yr10 7/8/09	02 Yr16 8/14/15	Rx Fire 5/15/19, 03 Post 5/28/19	03 Yr01 7/8/20	03 Yr02 7/12/21	03 Yr05 7/15/24
PIPO 05	00 Pre 8/5/97	Rx Fire 9/17/98, 01 Post 9/28/98	01 Yr01 7/12/99, Anaconda Wildfire 9/24/99, 02 Post 9/28/99	02 Yr01 7/30/00	02 Yr02 7/31/01	02 Yr05 6/28/04	02 Yr10 7/8/09	02 Yr16 7/30/15	Rx Fire 5/15/19, 03 Post 5/28/19	03 Yr01 7/9/20	03 Yr02 7/8/21	03 Yr05 7/15/24

1998 Ponderosa Pine Unit 4B Burn Plan Objectives

- Reintroduce fire into the Ponderosa Pine vegetation type.
- Reduce ladder fuels buy reducing the number of trees < 2.5 cm DBH by 70-100%, the number of trees 2.5-7.5 cm DBH by 30-70%, and the number of trees > 7.5 cm DBH by 10-40% within 1-year postfire.
- Sustain < 20% mortality of Ponderosa Pine > 7.5 cm DBH within 5 years postfire.
- Minimize management impact in terms of ground disturbing activity.
- Initial Reports for units 4A and 4B also mention limiting the introduction of noxious species as an objective.

1998 Initial Report 4B

A first-entry prescribed fire was ignited in Unit 4B on September 17, 1998. "Preliminary observations suggest that some of the burn objectives may not have been met." "While preliminary observations suggest that the burn objectives may not have been met, the Douglas fir and Engelmann spruce may have been stressed enough to achieve the desired mortality." "A walk through by the Burn Boss and Ignition Specialist two weeks postburn revealed that mortality due to scorch will most likely occur to a significant percentage of the poles." "No live overstory Ponderosa trees had burned and fallen at this time, nor did any appear to be sufficiently scorched to cause any immediate mortality."

2019 Ponderosa Pine Unit 4B Burn Plan Objectives

Objectives

- Reduce understory conifer encroaching on overstory ponderosa pine, provide seed bed for natural regeneration of ponderosa pine, and maintain fire in the fire-dependent ponderosa pine ecosystem.
- Greater than 50% mortality of young post-fire conifer (lodgepole pine, western larch, Douglas fir, Engelman spruce) (less than 4" diameter at root collar)
- 30-80% mortality of 4 to 10-inch (diameter at breast height) conifer understory
- 25-50% reduction of litter and duff
- 25-50% mineral soil exposed

- Less than 10% mortality of ponderosa pine in all size classes

A second-entry prescribed fire was ignited on May 14, 2019, in unit 4A, and on May 15, 2019, in unit 4B using the 2016 burn plan. A total of 25.5 acres were burned this project. The post-burn report indicated "objectives were more closely met in the first burn, unit 4A. The second day's burn (4B) was hindered by rain, higher RH and fuel moistures."

Recommendations

"Although burn conditions during the second day were less ideal, bringing fire back into the ecosystem was still beneficial overall, since jackpot fuels and thick duff near ponderosa pine tree bases were reduced, which could help protect the stands in a Wildfire. Getting started earlier in the morning on the first day might have provided enough time to burn both units before it rained."

Ponderosa Unit 7 (Dutch) Burn Unit

Location

Ponderosa Pine Unit 7 (Dutch) is located approximately two miles east of Anaconda Creek on the north side Inside North Fork Road (Glacier Route 7) and was mapped at 45.3 acres in 1996.

Summary

Ponderosa Pine Unit 7 was established and six FMH plots were installed in 1997. The 1999 Anaconda Wildfire burned all plots and post-burn data was collected in 1999. Table 7 outlines fire activity and data collection events from 1997 to present.

Table 7. Ponderosa Pine Unit 7 (Dutch) FMH Monitoring Plot Data Collection Summary

Plot Number	1997	1999	2000	2001	2004	2009	2015	2019
PIPO 08	00 Pre 8/13/97	Anaconda Wildfire 9/24/99, 01 Post 9/29/99	01 Yr01 7/18/00	01 Yr02 7/24/01	01 Yr05 7/7/04	01 Yr10 7/20/09	01 Yr16 8/20/15	01 Yr20 7/24/19
PIPO 09	00 Pre 8/19/97	Anaconda Wildfire 9/24/99, 01 Post 9/30/99	01 Yr01 7/20/00	01 Yr02 8/27/01	01 Yr05 7/7/04	01 Yr10 7/21/09	01 Yr16 8/5/15	01 Yr20 7/16/19
PIPO 10	00 Pre 8/20/97	Anaconda Wildfire 9/24/99, 01 Post 9/29/99	01 Yr01 7/28/00	01 Yr02 7/26/01	01 Yr05 7/7/04	01 Yr10 7/20/09	01 Yr16 8/5/15	01 Yr20 7/16/19
PIPO 11	00 Pre 8/21/97	Anaconda Wildfire 9/24/99, 01 Post 9/29/99	01 Yr01 7/20/00	01 Yr02 7/30/01	01 Yr05 7/7/04	01 Yr10 7/21/09	01 Yr16 8/13/15	01 Yr20 7/17/19
PIPO 12	00 Pre 8/22/97	Anaconda Wildfire 9/24/99, 01 Post 9/29/99	01 Yr01 7/20/00	01 Yr02 7/30/01	01 Yr05 7/7/04	01 Yr10 7/14/09	01 Yr16 8/20/15	01 Yr20 7/22/19
PIPO 13	00 Pre 8/25/97	Anaconda Wildfire 9/24/99, 01 Post 9/29/99	01 Yr01 7/29/00	01 Yr02 7/30/01	01 Yr05 7/7/04	01 Yr10 7/14/09	01 Yr16 8/20/15	01 Yr20 7/24/19

1999 Ponderosa Unit 7 (Dutch) Burn Plan

Objectives

- Minimize management impact in terms of ground disturbing activites.
- Reintroduce fire to the Ponderosa Pine vegetation type.
- Reduce ladder fuels buy reducing the number of trees < 2.5 cm DBH by 70-100%, the number of trees 2.5-7.5 cm DBH by 30-70%, and the number of trees > 7.5 cm DBH by 10-40% within 1 year postfire.
- Sustain < 20% mortality of Ponderosa Pine > 7.5 cm DBH within 5 years postfire.

Results

This prescribed burn was not initiated; however, all monitoring plots were burned in September 1999 during the Anaconda Wildfire. This unit, like unit 3B, offers another opportunity to analyze long-term effects of wildfire.

Summary

This document, along with the GNP Fire Monitoring Plan, should be able to provide future fire effects personnel, future fire management staff, and anyone interested in prescribed fire in GNP a general history of the Park's implementation of the prescribed fire program. While all attempts were made to fill in gaps by conducting research at the GNP archives, fire management offices, the basement of Quarters 14, and the GNP digital network, additional relevant information may turn up in the future. It is the author's hope that any such information be added and/or that incomplete information be updated.

Literature Cited

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Appendix A. Summer 1979 Prescribed Burn Program Memo

OPTIONAL FORM NO. 10
JULY 1973 EDITION
GSA FPMR (41 CFR) 101-11.6

UNITED STATES GOVERNMENT

Memorandum

TO :Chief Ranger through W.L. District Ranger **DATE:** 22 February, 1979

FROM :W.L. Resource Management Ranger

SUBJECT: Summer 1979 prescribed burn program

With the summer season approaching, it is timely to propose areas for experimental prescribed burning as noted in the Fire Management Action Plan presently under review. I suggest we consider three small areas, which would be burned independently and with separate objectives. The proposed areas are delineated on the accompanying maps..

The following considerations are taken into account:
a) compatibility with long range goals of reducing fuel loading and reducing crown fire potential on a large scale in the lower elevation closed forest types;
b) testing local predictability models and prescriptions;
c) evaluating ecological impact, including suppression of exotic species or unnaturally abundant native species, perpetuation of native species and natural processes;
d) providing accessible demonstration areas for interpretation and demonstration purposes.

Burn area #1: 10 to 15 ha area of Big Prairie, including the largest stand of leafy spurge. The area is east of the landing strip, between the landing strip and the road.

Prior to burning, the impact of the 1978 prescribed burn on native grasses, exotic grasses, and leafy spurge will be evaluated. If the 1978 burn did not successfully suppress spurge, and/or stimulate native species, the decision to burn in 1979 will be reviewed. Objectives for burning here would be to suppress leafy spurge and exotic grasses and to stimulate native grasses.

Burn area #2: 3 ha of Ponderosa pine between Sullivan Meadow and Anaconda Creek next to the Inside Road. Part of this stand contains an essentially open understory, while the margins contain frequently dense understory of 50+ year-old Lodgepole pine. There is little or no Ponderosa pine reproduction.

Objectives for burning here would be to test the feasibility of using fire to stimulate Ponderosa pine reproduction, diversify the ground cover on the stand margin, reduce crown fire potential by burning forest floor and standing fuels, and provide an easily

5010-110

Buy U.S. Savings Bonds Regularly on the Payroll Savings Plan

accessible interpretation and demonstration area.

I suggest using a prescription which will kill about 90% of standing lodgepole pine up to 10 cm diameter, reduce 10-hour fuels and larger by about 60% and reduce smaller fuels by about 90%.

Burn area #3: 3 ha of mixed Ponderosa pine, Western larch, and Douglas fir, just north of the Bowman Creek Campground near Polebridge Ranger Station. This quite diverse stand has developed a very dense 50-year-old Lodgepole pine understory with attendant standing and ground fuels with quite high crown fire potential.

Objectives for burning would be to test the feasibility of using prescribed fire to reduce crown fire potential by burning down and standing fuels, perpetuate stand diversity by thinning the Lodgepole pine understory, and provide a strategically located fire management interpretation and demonstration area.

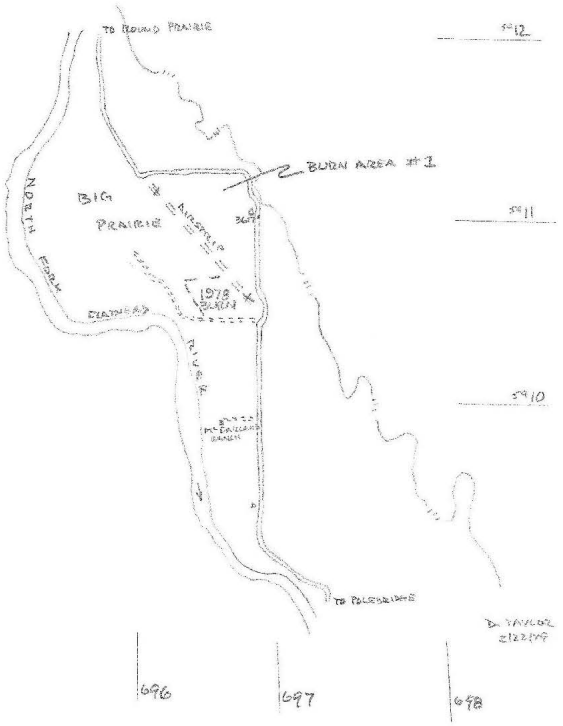
I suggest using a prescription similar to the one for Burn area #2.

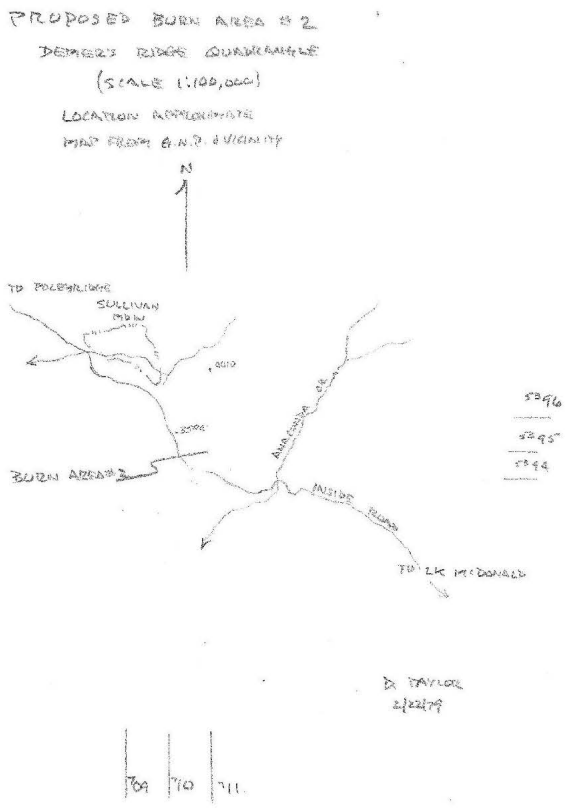
Burn area #3 can be burned if, for some reason area #2 can't be burned on schedule or if #2 is burned successfully and manpower and time are still available during the burning season.

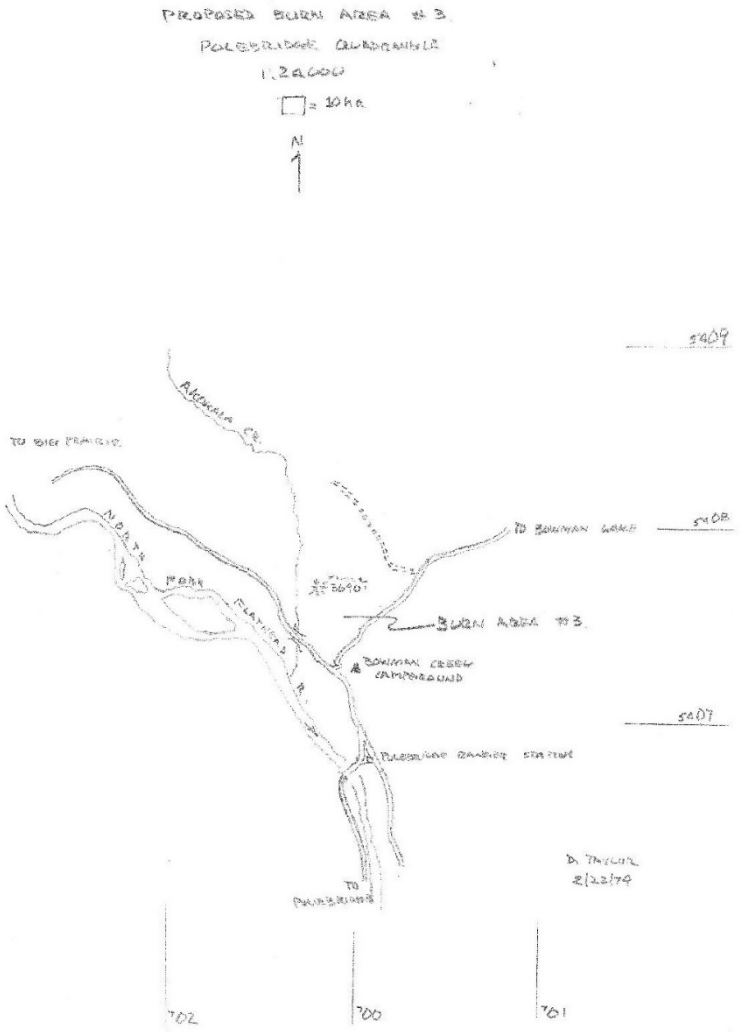
I suggest we begin collaborating with the Fire Management Officer in final selection of areas and prescriptions, with a view toward burning shortly after mid-season.

I also suggest we request research support from the Research Division, with particular reference toward evaluating the short term and long range ecological impact of these burns.

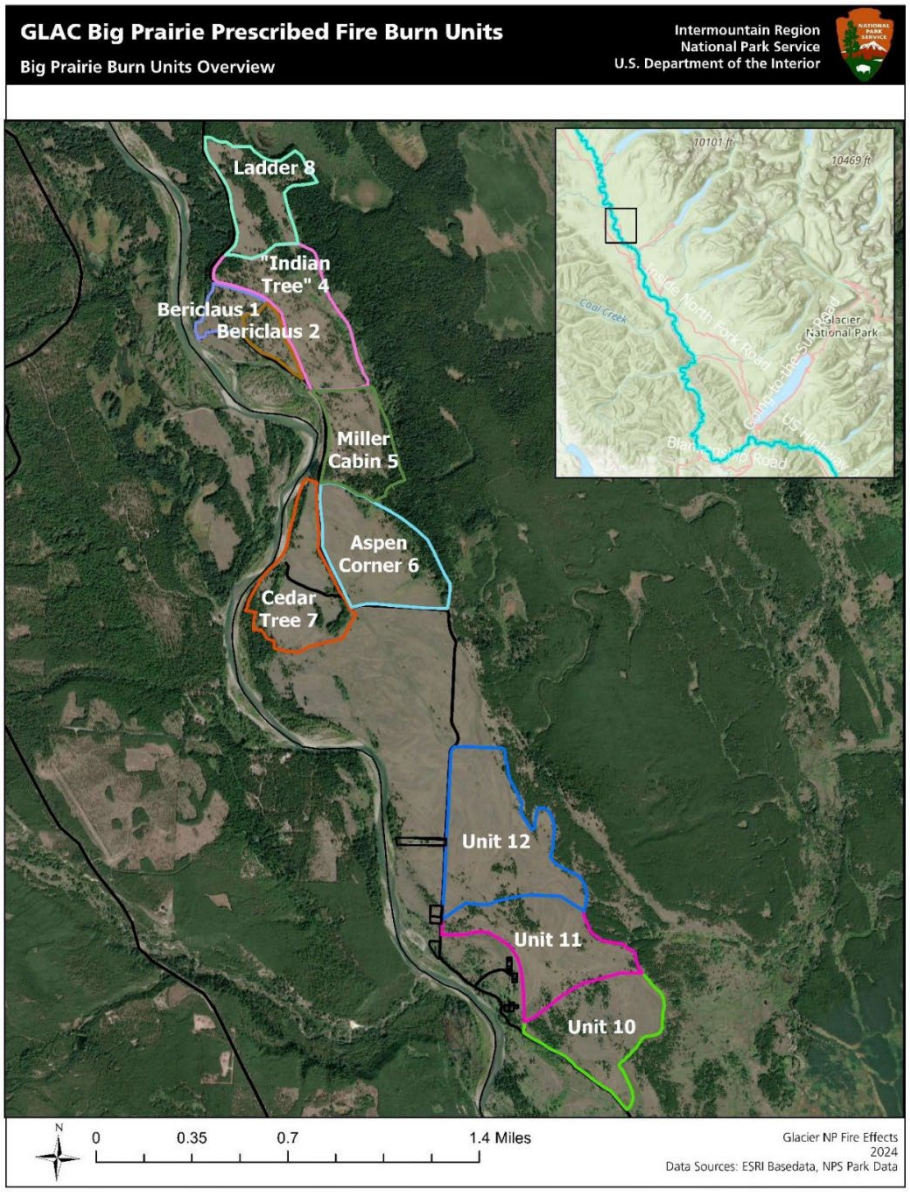
PROPOSED BURN AREA # 2
POLEBRIDGE QUADRANGLE
1:24,000
□ = 10 ha

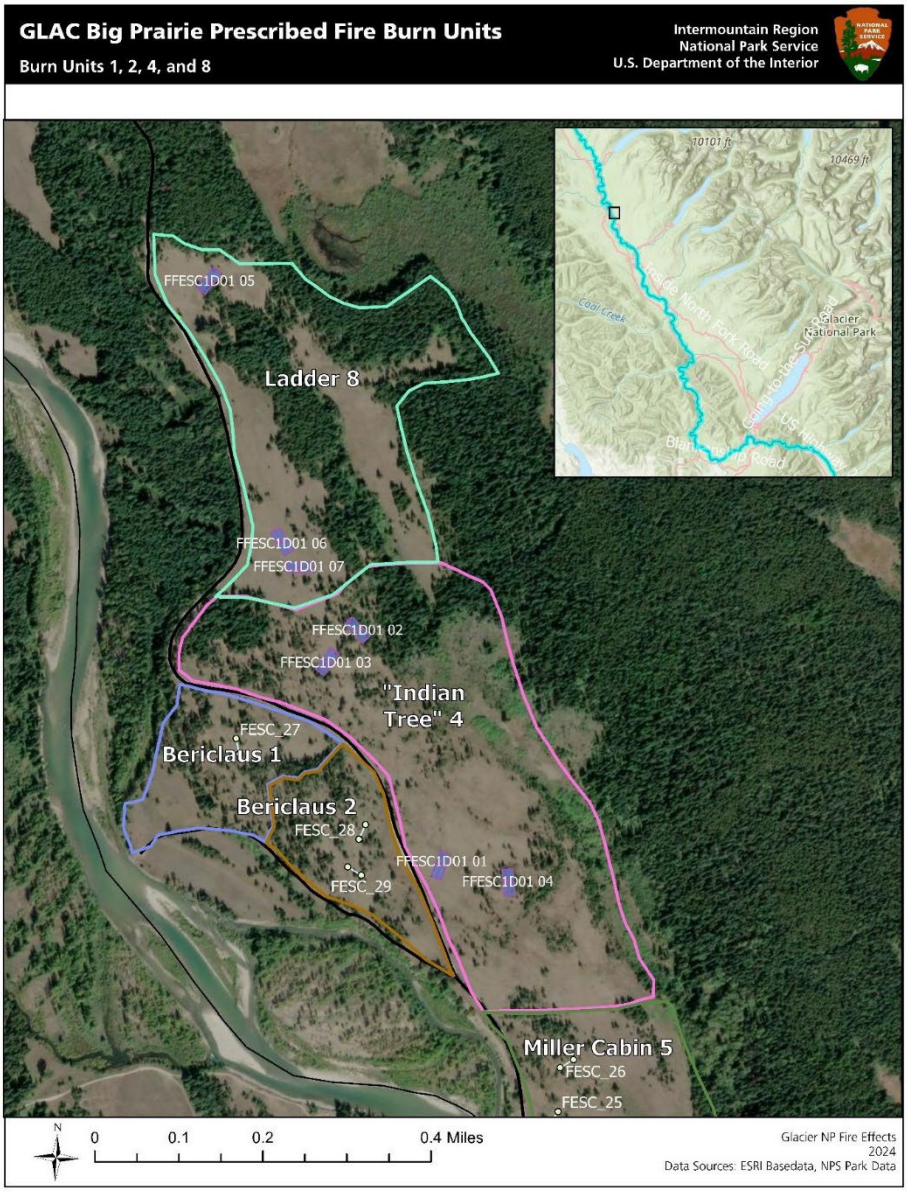


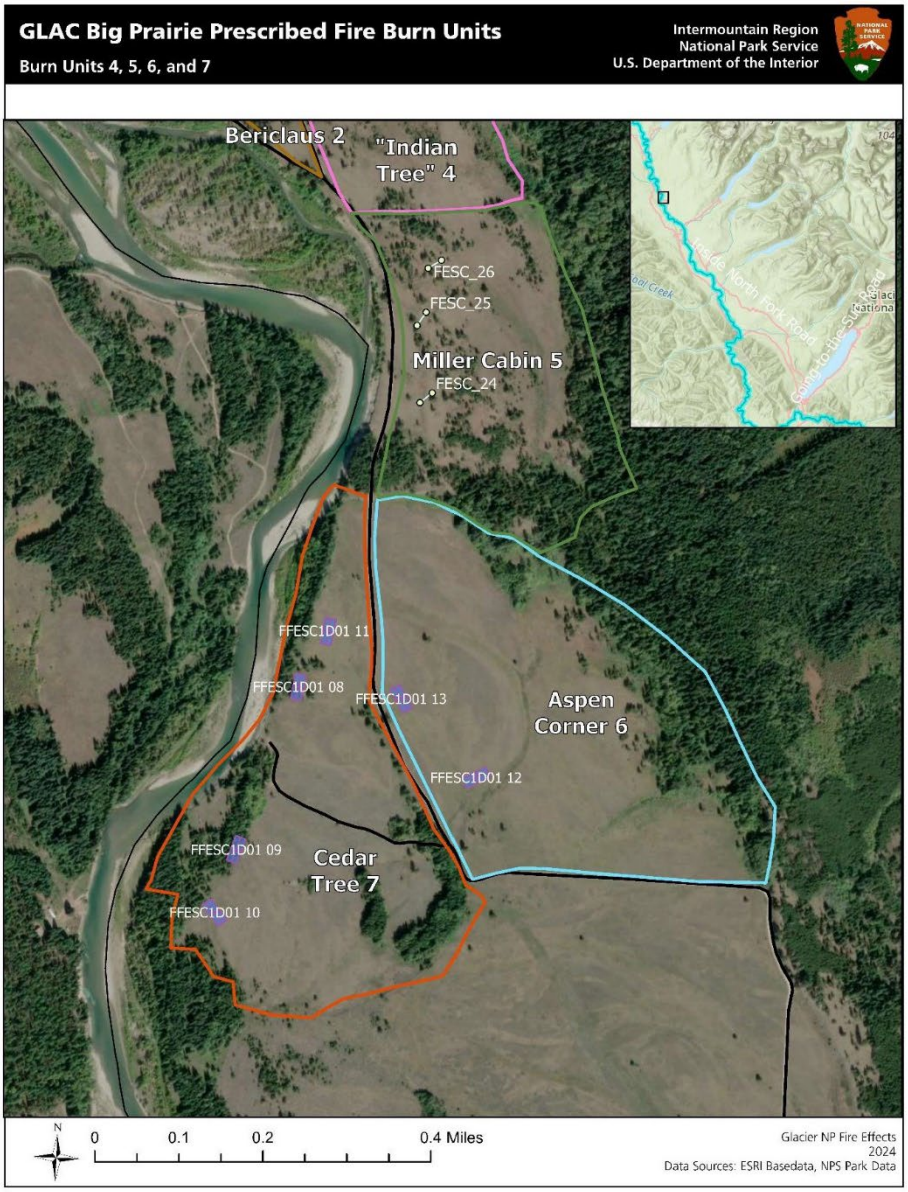

PROPOSED BURN AREA # 2
DEMERS RIDGE QUADRANGLE
(SCALE 1:100,000)
LOCATION APPROXIMATE
MAP FROM B.N.D. & VICINITY
N
TO POLEBRIDGE
SULLIVAN MTN
BURN AREA #2
INSIDE ROAD
TO LK MCDONALD
D TAYLOR
2/22/79

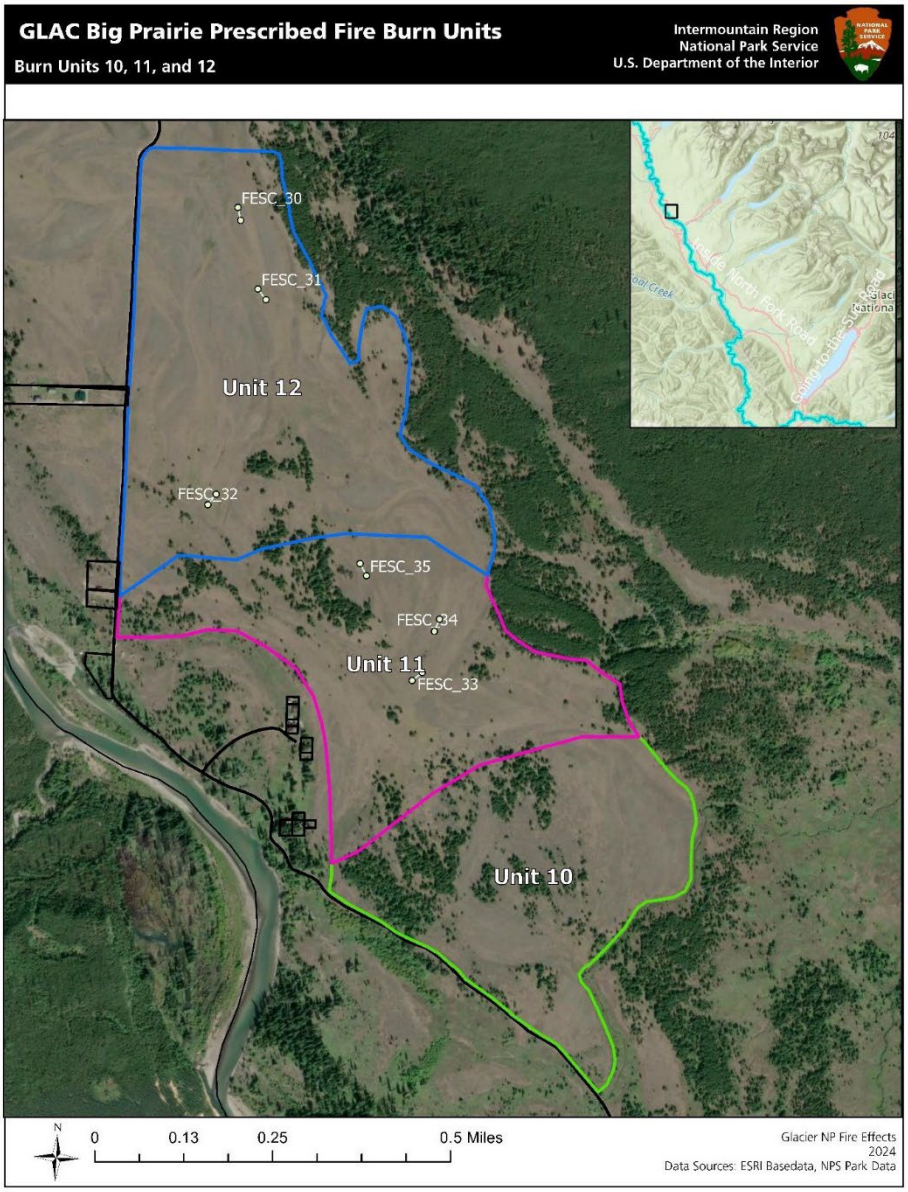

PROPOSED BURN AREA # 3
1:24000
□ = 10 ha
N
5409
TO BOWMAN LAKE
5408
BURN AREA #3
BOWMAN CREEK CAMPGROUND
5407
D. TAYLOR
2/22/79
702
700
701

Appendix B. Big Prairie Burn Unit Maps




GLAC Big Prairie Prescribed Fire Burn Units
Burn Units 1, 2, 4, and 8
Intermountain Region
National Park Service
U.S. Department of the Interior
FFESC1D01 05
Ladder 8
FFESC1D01 06
FFESC1D01 07
FFESC1D01 02
FFESC1D01 03
"Indian Tree" 4
FESC_27
Bericlaus 1
Bericlaus 2
FESC_28
FESC_29
FFESC1D01 01
FFESC1D01 04
Miller Cabin 5
FESC_26
FESC_25
10101 ft
10469 ft
Glacier National Park
Coal Creek
North Fork Road
Camas to the Sea
US Highway
Blankenship Road
N
0
0.1
0.2
0.4 Miles
Glacier NP Fire Effects
2024
Data Sources: ESRI Basedata, NPS Park Data


GLAC Big Prairie Prescribed Fire Burn Units
Burn Units 4, 5, 6, and 7
Intermountain Region
National Park Service
U.S. Department of the Interior
Bericlaus 2
"Indian Tree" 4
FESC_26
FESC_25
Miller Cabin 5
FESC_24
FFESC1D01 11
FFESC1D01 08
FFESC1D01 13
Aspen Corner 6
FFESC1D01 12
FFESC1D01 09
Cedar Tree 7
FFESC1D01 10
N
0
0.1
0.2
0.4 Miles
Glacier NP Fire Effects 2024
Data Sources: ESRI Basedata, NPS Park Data


GLAC Big Prairie Prescribed Fire Burn Units
Burn Units 10, 11, and 12
Intermountain Region
National Park Service
U.S. Department of the Interior
FESC_30
FESC_31
Unit 12
FESC_32
FESC_35
FESC_34
Unit 11
FESC_33
Unit 10
0
0.13
0.25
0.5 Miles
N
Glacier NP Fire Effects
2024
Data Sources: ESRI Basedata, NPS Park Data

Appendix C. Example plot photo set



Q4 to Q1



30P to Q4



Q1 to Q4



Q2 to Q3



Q3 to Q2



Landscape

Appendix D. Lone Pine Prairie Pilot Study

Lone Pine Prairie Pilot Study



Background: The Study area is located in the North Fork area of Glacier National Park. The North Fork grasslands are characterized by native bunchgrass prairies interspersed between aspen stands and forested groves of lodgepole pine, ponderosa pine, douglas fir, spruce, and larch. Remnant culturally scarred ponderosa pine trees (CST) are present within some forested groves.

Lone Pine Prairie is a 15 acre (approximately) prairie within the northfork grasslands dominated by remarkably tall and wide rough fescue (*Festuca campestris*) bunches. The prairie is bordered by aspen groves, a spruce dominated intermittent stream bed, young lodgepole pine thickets, and ponderosa pine. The last fire to occur in Lone Pine Prairie was the Red Bench fire 32 years ago.

During a reconnaissance trip, the fire effects crew observed how much dead accumulation of plant material is present in the rough fescue clumps in Lone Pine Prairie. The accumulation of dead biomass and large size of bunches generated interest in a pilot study. The objectives of the pilot study were to determine baseline conditions of the prairie (percent cover of species, mean bunch size, and live and dead biomass). This information, and relevant literature, will be used to evaluate potential for prescribed fire treatment in Lone Pine Prairie.

Rough Fescue Fire ecology: Rough fescue is moderately resistant to mortality from fire, and well adapted to intermittent burning (Aiken, 1990; Thompson, 1990). Mortality appears to be related to fire severity, frequency, and timing of burn in relation to growing season. Under damp conditions, or with little fuel build up, rough fescue resprouts from top-killed plants. Under dry conditions with heavy accumulated fuels, burning frequently persists within the bunches after the initial flame front passes (Antos et al. 1983; Wright et al. 1982).

Antos and others (1983) studied burn response to high-severity wildfire in a rough fescue complex outside of Missoula, MT that had been fire free for at least 32 years. Results indicated that resprouting after wildfire decreased with increasing clump size. Generally, clumps less than 10cm resprouted completely, and clumps greater than 20cm were severely damaged. The study concluded that short and long fire cycles can be detrimental to rough fescue survival and recovery, but historical average fire cycles of 5-10 years in the area, were probably more favorable.

Pilot Study: During the summer of 2020, the fire effects crew installed 10 monitoring transects throughout lone pine prairie to collect information on percent cover of species, fuel load, and percent live and dead material of rough fescue clumps.

Results: Rough Fescue averaged 88.3% cover across lone pine prairie, followed by yarrow, sticky geranium, and sedge species (Figure 1). Fuel load including all species across the prairie averaged 3.49 tons/acre. 34.9% of the rough fescue biomass in the prairie is live, and 65.1% is dead accumulated rough fescue biomass. Bunches sampled ranged from 35cm in diameter to 67cm, with an average diameter of 46.3cm.

FIGURE 1: PERCENT COVER OF 10 MOST ABUNDANT SPECIES

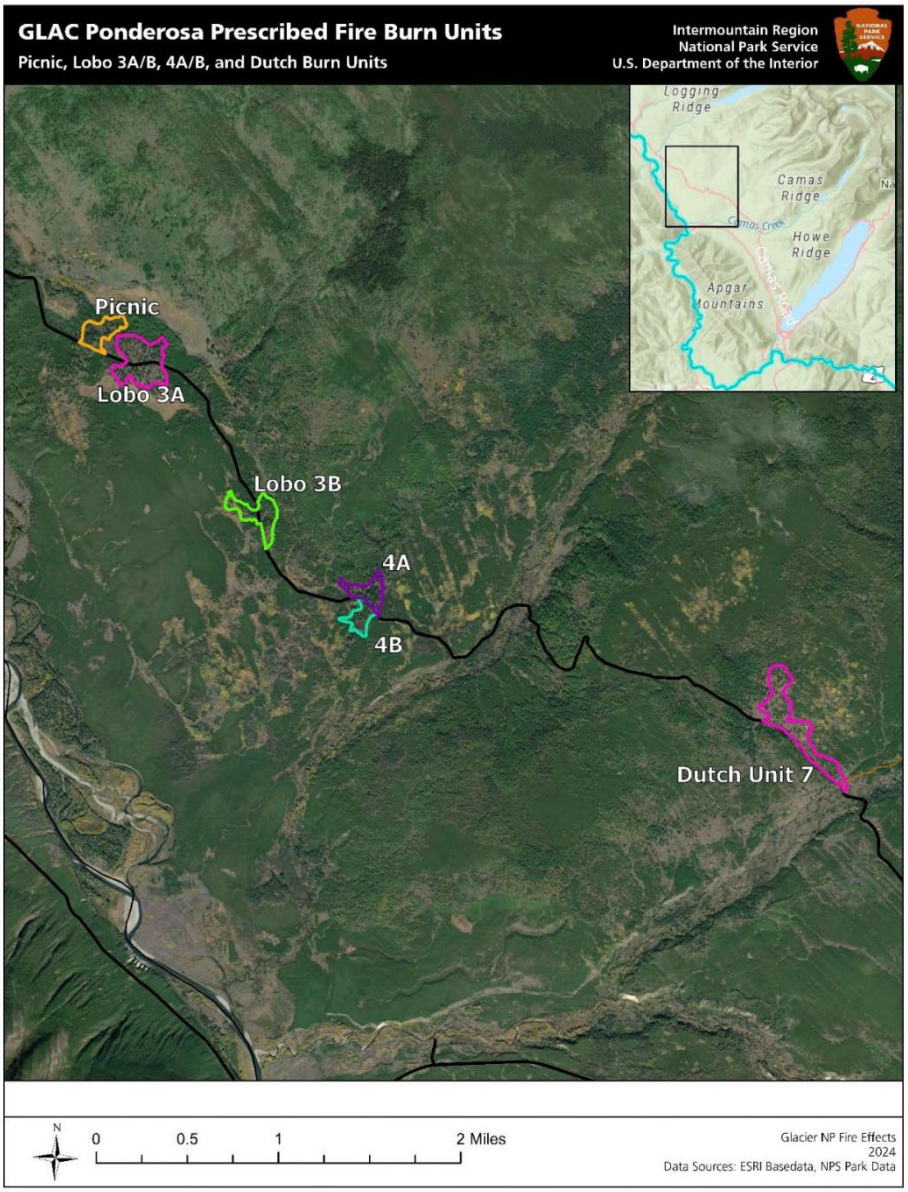


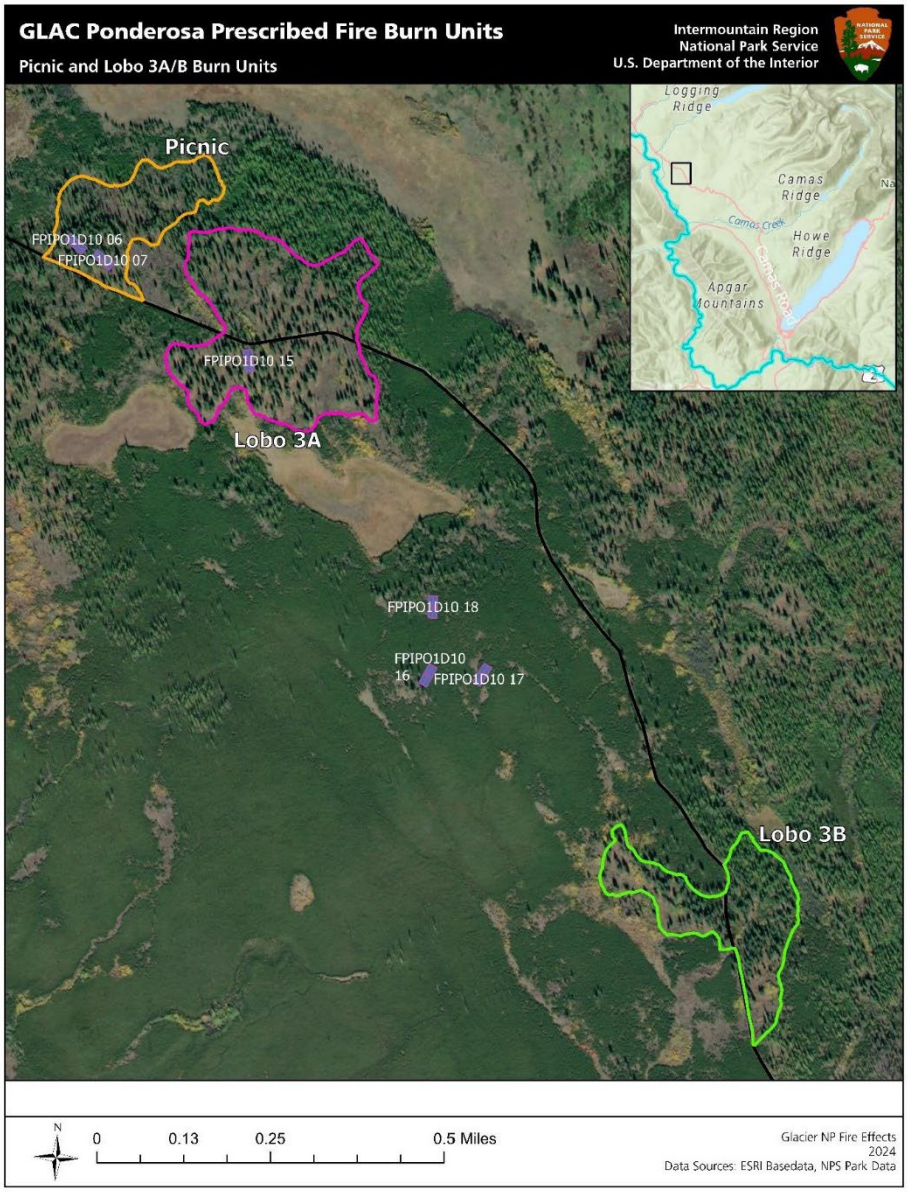


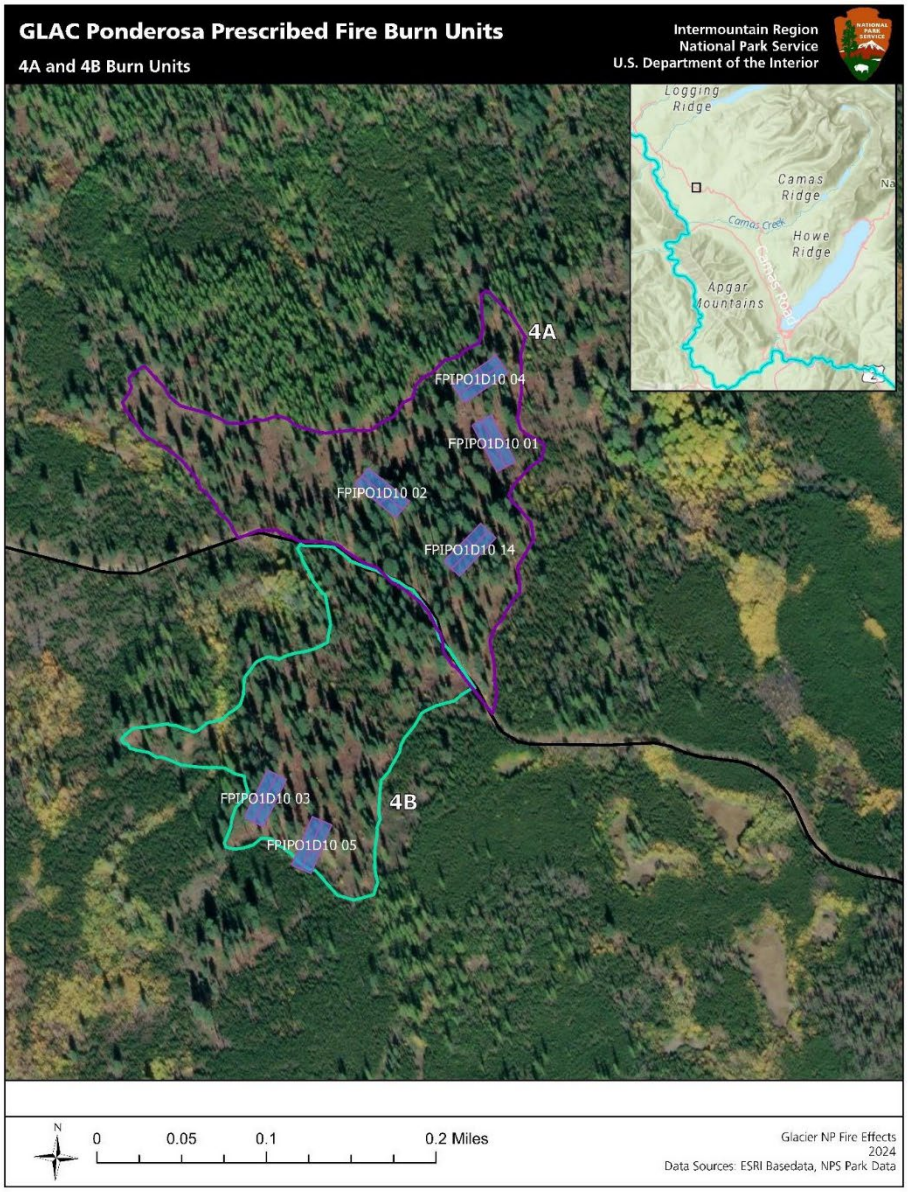
Discussion and Next Steps: Time since last fire, proportion of dead biomass, and diameter of bunches all suggest the need for treatment to reduce fuel load and dead component of rough fescue in Lone Pine Prairie. It will be important to time prescribed burn for favorable fire effects to rough fescue. Fire effects on smooth brome (*Bromus inermus*) patches on the edge of the prairie will be heavily researched and incorporated into planning. The secondary objectives of reducing ladder fuels around remnant ponderosa pine will also be considered. Mike McClellan will lead the effort to design and implement treatment and monitoring.

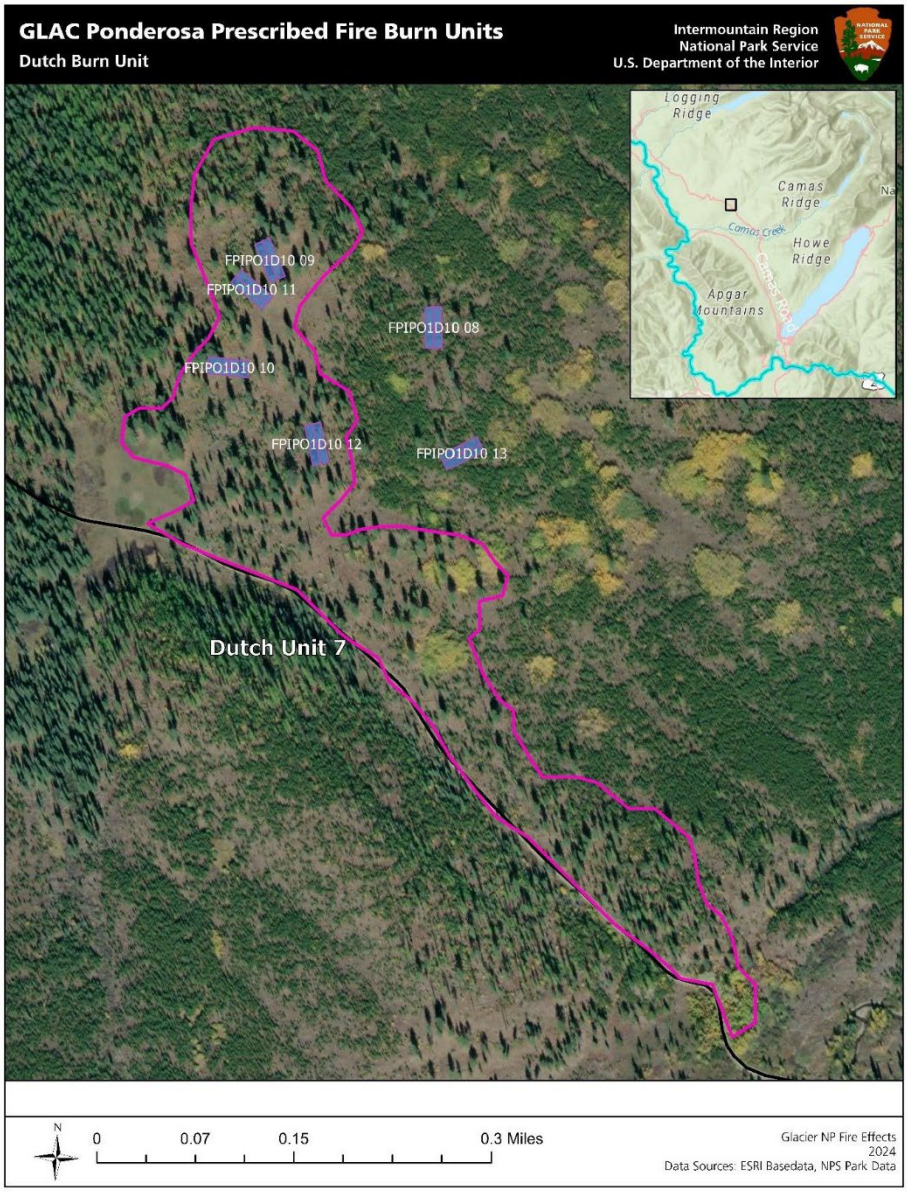
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Thompson, S. M. 1990. The initial response of several forage species to prescribed burning in s outheastern British Columbia. Vancouver, BC: University of British Columbia. 137 p. Thesis.
Wright, Henry A.; Bailey, Arthur W. 1982. Fire ecology: United States and southern Canada. New York: John Wiley & Sons. 501 p.

Appendix E. North Fork Ponderosa Burn Unit Maps




GLAC Ponderosa Prescribed Fire Burn Units
Picnic and Lobo 3A/B Burn Units
Intermountain Region
National Park Service
U.S. Department of the Interior
Logging Ridge
Camas Ridge
Camas Creek
Howe Ridge
Apgar Mountains
Picnic
FPIPO1D10 06
FPIPO1D10 07
FPIPO1D10 15
Lobo 3A
FPIPO1D10 18
FPIPO1D10 16
FPIPO1D10 17
Lobo 3B
N
0
0.13
0.25
0.5 Miles
Glacier NP Fire Effects 2024
Data Sources: ESRI Basedata, NPS Park Data


GLAC Ponderosa Prescribed Fire Burn Units
4A and 4B Burn Units
Intermountain Region
National Park Service
U.S. Department of the Interior
Logging Ridge
Camas Ridge
Camas Creek
Howe Ridge
Apgar Mountains
4A
FPIPO1D10 04
FPIPO1D10 01
FPIPO1D10 02
FPIPO1D10 14
4B
FPIPO1D10 03
FPIPO1D10 05
N
0
0.05
0.1
0.2 Miles
Glacier NP Fire Effects 2024
Data Sources: ESRI Basedata, NPS Park Data


GLAC Ponderosa Prescribed Fire Burn Units
Dutch Burn Unit
Intermountain Region
National Park Service
U.S. Department of the Interior
Logging Ridge
Camas Ridge
Camas Creek
Howe Ridge
Apgar Mountains
Camas Road
FPIPO1D10 09
FPIPO1D10 11
FPIPO1D10 08
FPIPO1D10 10
FPIPO1D10 12
FPIPO1D10 13
Dutch Unit 7
N
0
0.07
0.15
0.3 Miles
Glacier NP Fire Effects
2024
Data Sources: ESRI Basedata, NPS Park Data