

National Park Service

U.S. Department of the Interior

Fire and Aviation Management



Appalachian/Piedmont/Coastal Fire Management Zone: Fire Ecology Annual Report, 2022





***Lilium superbum* (Turk's-cap lily) growing in the Hyatt Cove Wildfire (Fall 2021) at Blue Ridge Parkway. Numerous flowering individuals were observed within the footprint of the wildfire during July 2022.**

On the Cover: March 2022 Savanna burn unit at Moore's Creek National Battlefield. This botanically diverse site has been burned annually since 2016.

Appalachian/Piedmont/Coastal Fire Management Zone: Fire Ecology Annual Report, 2022

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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 2022 field season was a distinct year of change for the APC Zone fire ecology staff, with long time fire ecologist Rob Klein and lead monitor Wylie Paxton (both active from 2003 to spring of 2022) moving on to new positions. This left a crew of one (Matt Wood) and presented a host of potential challenges for the completing the summer monitoring schedule. Matt was able to move from the assistant into the lead monitor position and fortunately Aerin Land from EVER detailed into the fire ecologist role for most of the summer, providing much needed assistance. Despite the small crew, a total of 46 plots were monitored at 7 different parks (**Table 1**), in addition to other field-based fire ecology support requested by park managers. There are four additional parks in our monitoring network that have plots but had no monitoring scheduled for 2022. A summary table of the APC Zone fire effects plot network can be found in Appendix B (**Table B-1**).

Monitoring highlights from the year included continued use of rapid-assessment monitoring with Survey123 at Moores Creek, Congaree, Big South Fork, Blue Ridge Parkway, and Kings Mountain. This approach complements existing long-term FMH monitoring and burn-severity mapping to create a three-pronged monitoring design that yields important programmatic data as well as project-level assessments. Information from this approach is featured in each park's section of this report. Another major highlight of the year was our continued collaborative monitoring with the Southeast Coast (SECN) Inventory and Monitoring Network at Moores Creek NB and joint monitoring of FMH plots at Big South Fork with the MS River Zone fire effects crew (**Figure 1**).



Figure 1. APC Zone Team collaborating with MS River Fire Effect and SE Regional Fire Ecologist at BISO.
Back Row from left: Rob Klein (SE Region), Aerin Land (APC Zone), Matt Wood (APC Zone)
Front Row from Left: Chandler Shepherd (BISO LEO), Alicia Schlarb (MS River), Fred Smith (MS River)

Implementation of fuels-management projects was average for 2022. A total of 22 projects were completed within our monitoring network for a total of 2493 acres treated (**Appendix C, Table C-1**). Members of our team participated directly in implementation and/or monitoring of 75% of these projects, playing key roles in most of the prescribed burns (**Appendix A, Tables A-1 thru 3**). Additional accomplishments of the fire ecology program included: support for Fire Management Plan updates, leading field trips, fire and fuels project mapping (GIS), and maintenance and support for RAWs.

Table 1. APC Zone Fire Effects Plot Workload (2022) and Total Plots Installed

Park	Monitoring Unit	Plot Type (FMH Forest/Brush/Grass plot, photo point, Rapid Assessment, CBI, etc.)	Years Data Collected (start-end)	Annual Total (2022)	Total Plots
Big South Fork (BISO)	Little Bluestem	FMH Forest Plot	2004-2022	3	4
	White Oak	FMH Forest Plot	2005-2022	1	13
	Rapid Assessment	Survey123	2022-2022	3	3
Blue Ridge Parkway (BLRI)	Rapid Assessment	Survey123	2022-2022	5	5
	CBI	CBI	2022-2022	4	4
Congaree (CONG)	Loblolly Pine	FMH Forest Plot	2005-2022	4	5
	Rapid Assessment	Survey123	2021-2022	1	12
Cumberland Gap (CUGA)	Scarlet Oak	FMH Forest plot	2004-2022	6	16
Great Smoky Mountains (GRSM)	Scarlet Oak	FMH Forest Plot	2008-2022	2	15
Kings Mountain (KIMO)	Blackjack Oak	FMH Forest Plot	2007-2022	2	8
	Chestnut Oak	FMH Forest Plot	1999-2022	3	21
	Rapid Assessment	Survey123	2021-2022	2	5
Moore's Creek (MOCR)	Photo Points	Photo Points	2010-2022	5	5
	LFEM	FIREMON	2022-2022	5	5
Total				46	121

B. Monitoring Results and Recommendations

The recurring theme for this year centers around burn unit scheduling and prioritization. Below are a few brief bullet points summarizing the observations common to many of our upland southeastern NPS sites with active burn program.

- There is a clear need to refocus. In the early to mid 2000s many of our southeastern parks were ramping up their burn programs, adding numerous new burn units. However, with turnover in operational staff and fluctuations in funding and staffing, the number of previously treated burn units appears to have exceeded our ability to effectively manage on a reasonable rotation.
- Re-evaluating the list of units for each park and selecting a manageable set across the zone to prioritize for consistent treatment is important moving forward. Many parks have 2-3 burn units with multiple burn treatments that represent the best examples of the core target vegetation, however several of these same units are 5-10+ years from their last treatment or have only recently been retreated after a long hiatus.
- In some cases, oak and yellow pine regeneration has been able to establish in the interim between burns, however where the interval extends out to 10-15 years, the density and size of competing mesic hardwood resprouts has become a real management challenge. This is especially true in a few areas where initial burns created large canopy gaps. The scale of resprouting that occurs in these 10-15 year intervals in some ways resets progress that was made over the prior 2-4 burn treatments.
- Prioritizing a core achievable set of burn units for each park then adding to them as time and capacity permit should allow us to maintain past success while still striving to improve and expand into the future.

The individual park level reports in the appendices will cover some specific examples of these observations. Additionally, the 2022 Management Objectives and Monitoring Results tables for each park with an applicable dataset can be found in these same appendices. Note that due to limited new data as well as turnover in fire effects staffing there are no updates to these tables from last year.

C. Research, Planning, and Communication

- Given the staffing limitation for 2022 there are no research activities or partnerships to report.
- Monitoring plans for all APC Zone parks remain in draft form with some additional progress made on the GRSM plan, however, given the draft format, plans are currently not posted for sharing.
- Planning efforts from fire effects staff for 2022 primarily focused on providing content review and GIS support for a few FMP updates and participation in annual park FMP update meetings
- Key communications for 2022 included meeting with the MOCR Superintendent to discuss current and past fire effects and identify monitoring needs moving forward, and attending a meeting at CHCH to review the FMP updates, conduct a site visit to the upcoming burn area, and discuss exotic plant control and cedar removal within critical limestone glade vegetation.

D. Future Direction

The priority focus for 2023 will center on rebuilding the fire effects crew through hiring efforts and rebuilding capacity to perform monitoring across the zone. Given the currently approved funding, the hope is to hire both a crew lead and assistant as well as one permanent crewmember and one seasonal crewmember. Field training, park familiarization, and collaboration with neighboring fire effects staff and the regional ecologist will be key goals for the year. Additionally, with office space becoming limited due to additional new hires, there is an opportunity to possibly relocate the fire effects crew to an alternate location within the zone, which will present an additional set of logistical issues to work through in the upcoming year. Essentially, 2023 will be a key year of transition and growth for both fire effects/ecology as well as the larger APC Zone program with new senior management staff and additions to fuels staffing.

E. References, Links, and Additional Reading

Links to the most recent IRMA Data Store records for primary individual APC Zone Park FFI databases are listed below:

Big South Fork National River and Recreation Area (BISO)

<https://irma.nps.gov/DataStore/Reference/Profile/2298464>

Congaree National Park (CONG)

<https://irma.nps.gov/DataStore/Reference/Profile/2298456>

Cumberland Gap National Historical Park (CUGA)

<https://irma.nps.gov/DataStore/Reference/Profile/2298465>

Great Smoky Mountains National Park (GRSM)

<https://irma.nps.gov/DataStore/Reference/Profile/2298466>

Great Smoky Mountains National Park CBI Database

<https://irma.nps.gov/DataStore/Reference/Profile/2298457>

King Mountain National Military Park (KIMO)

<https://irma.nps.gov/DataStore/Reference/Profile/2298458>

Appendix A. Staffing and Accomplishments

Table A-1. Fire Ecology Staffing 2022

Ecologist and Monitors	Starting Date	Ending Date	# of Pay Periods	READ Qualified (Yes or No)	Training and Development
Rob Klein (Fire Ecologist)	1/1/22	04/09/22	7	Yes	APC RX burns; FMP updates for several Zone parks; Presentations for the NPS Climate/Fire Working Group and NPS Fire Ecology Training
Wylie Paxton (Lead Monitor)	1/1/22	03/26/22	6	Yes	APC Zone RX burns; Detail with SECN I&M; SBR FLN Workshop
Matt Wood (Assistant Lead) (Lead Monitor)	01/01/22 07/31/22	07/30/22 12/31/22	15 11	No	FEMO on APC RX burns; Assisted SECN I&M crew at MOCR; SBR FLN Workshop; Assisted with field trip for Purdue Disturbance Ecology Class; InFORM, Treatment Inspector, and NFPORS Training; WIMS and RAWS maintenance for GRSM and CAHA.
Aerin Land (Fire Ecologist – Detail)	05/22/22	09/10/22	8	No	Assisted SECN I&M crew at MOCR; SBR FLN Workshop

Table A-2. Fire Ecologist 2022 Accomplishments/Focus Areas

Category	Percent Time	Accomplishments and/or areas of activities
Planning	30%	Meetings; writing, reviewing, and presenting FMP updates for multiple APC Zone Parks ; GRSM Cades Cove IDT and Vegetation Management Plan ; Fire Management Review w/ MOCR Superintendent
Supervision/Admin	15%	Supervision, Employee exit clearance, Performance evaluations, Training, IDPs, travel, payroll, crew support, hiring, purchasing etc.
Data Collection	15%	Field monitoring at GRSM, MOCR, CONG, KIMO, BLRI, BISO; collaborative work at MOCR with SECN I&M Program; Wildfire mapping at CHAT
Data Management and Analysis	5%	Routine data management tasks; 2021 Annual report data analysis;
Fire Operations	5%	FEMO for CONG RX; Zone Duty officer during several fire events; staging with GFD resources during fire break; assist with planning, prep, and implementation of Red Bluff Road @ CONG; travelled to BISO for burn that got scrapped.
Research	<1%	
Presentations	8%	Monitoring Design presentations for NPS Fire Ecology Training; NPS Fire Effects Monitoring presentation for the NPS Climate/Fire Working Group; 3 university class field trips @ GRSM.
Reports	10%	Annual reports; FEMO reports
Misc	5%	Meetings – Southern Blue Ridge Fire Learning Network and Tennessee Interagency Fire Management Meeting; Jury Duty

Table A-3. Fire Effects Crew 2021 Accomplishments/Focus Areas

Category	Percent Time	Notes
Data Collection	35%	FMH, Mechanical, Survey123
Wildfire assignments	2%	Lead and Assistant- FFT2/READ on BISO and GRSM WF
Prescribed fire projects	10%	Lead and Assistant- FEMO/FFT1 on Rx burns : MOCR, GRSM, KIMO, CONG, USFS-Pisgah
Non-fire fuels projects	5%	Various technical support (GIS)
Travel out-of-park for plot or project work	10%	Lead/Assistant travel to MOCR, BISO, CONG, BLRI, KIMO, CUGA, and CHCH
Data entry/management	20%	Data mostly digital collection, WIMS data, InFORM and Treatment Inspector, Various GIS data
Data analysis	0%	
Admin	10%	Time/Travel/Budgeting/Purchasing
Training	3%	Provide field training for MS River Fire Effects @ BISO, FMH field training for USFS-Cherokee, SBR FLN Workshop, National Fire Ecology Workshop
Miscellaneous	5%	Assist SECN I&M crew, RAWS Maintenance, GIS Support

Appendix B. History of Fire Effects Monitoring Plots

Table B-1. Summary table of the APC Zone fire effects plot network

Park	Monitoring Unit	Plot Type (FMH Forest/Brush/Grass plot, photo point, Rapid Assessment, CBI, etc.)	Years Data Collected (start-end)	Total Plots
Big South Fork (BISO)	Little Bluestem	FMH Forest Plot	2004-2022	4
	Shortleaf Pine	FMH Forest Plot	2005-2017	2
	White Oak	FMH Forest Plot	2005-2022	13
	LFEM	FIREMON	2012-2014	21
	CBI	CBI	2009-2009	9
	Fuels Trans	Fuels Transect	2009-2016	4
	Rapid Assessment	Survey123	2022-2022	3
Blue Ridge Parkway (BLRI)	Chestnut Oak	FMH Forest plot	2010-2010	2
	LFEM	FIREMON	2015-2016	7
	Fuels Transect	Fuel Transect	2013-2013	6
	Rapid Assessment	Survey123	2022-2022	5
	CBI	CBI	2022-2022	4
Cape Hatteras (CAHA)	LFEM	FIREMON	2012-2018	17
	Photo Points	Photo Point	2012-2018	33
	Photo Points (Non-Permanent)	Photo Point	2012-2018	10
Chickamauga & Chattanooga (CHCH)	LFEM – Post Oak Woodland	FIREMON	2019-2019	3
	LFEM - Glade	FIREMON	2019-2019	6
Cowpens (COWP)	Southern Red Oak	FMH Forest plot	2007-2018	2
Cumberland Gap (CUGA)	Scarlet Oak	FMH Forest plot	2004-2022	16
	Virginia Pine	FMH Forest plot	2004-2005	1
	LFEM	FIREMON	2016-2016	10

Fort Raleigh (FORA)	Photo Point	Photo Point	2018-2021	3
	Rapid Assessment	Survey123	2021-2021	3
Great Smoky Mountains (GRSM)	Black Oak	FMH Forest Plot	1997-2020	8
	Scarlet Oak	FMH Forest Plot	2001-2022	15
	Yellow Pine	FMH Forest Plot	1997-2020	40
	LFEM	FIREMON	2017-2021	49
	Mech Trt	Photo Points	2018-2021	18
	CBI	CBI	2002-2018	128
	Fuels Trans	Fuel Transect	1998-2020	18
	Rapid Assessment	Survey123	2020-2021	23
Kings Mountain (KIMO)	Blackjack Oak	FMH Forest Plot	2000-2022	8
	Chestnut Oak	FMH Forest Plot	1999-2022	21
	LFEM	FIREMON	2013-2017	20
	Fuels Trans	Fuel Transect	2010-2010	3
	Rapid Assessment	Survey123	2021-2022	3
Moore's Creek (MOCR)	Photo Points	Photo Points	2010-2022	5
	Rapid Assessment	Survey123	2021-2021	5
Total				548

Appendix C. Fire/Fuels Treatments and Associated Monitoring

Table C-1. Summary of 2022 Fuels Treatments and Associated Monitoring

Park	Fire/Treatment Name	Monitoring Conducted	Acres
Big South Fork (BISO)	Darrow Ridge Rx	Yes (FMH and Survey123)	759
	Newtie King Rx	Yes (FMH)	135
Blue Ridge Parkway (BLRI)	Lost Bear Rx	Mapping Only	181
Cape Hatteras (CAHA)	South Nags Head Mech Trt	Mapping Only	31
	Ocracoke Mech Trt	Mapping Only	12
Congaree (CONG)	Harry Hampton VC Rx	Yes (FEMO, FMH, & Survey123)	172
	Dawson's Cabin/Red Bluff Rx	Yes (FEMO, FMH, & Survey123)	456
	Harry Hampton NE Bndry MT	Mapping Only	4
Fort Raleigh (FORA)	Heritage Point Mech Trt	Mapping Only	7
Great Smoky Mountains (GRSM)	Cable House Rx	Yes (FEMO)	97
	Sparks Rx	Yes (FEMO)	150
	Cades Cove Mech Trt	Mapping Only	51
Kings Mountain (KIMO)	WTP Rx	Yes (FEMO & Qualitative)	79
	Long Branch Rx	Yes (FEMO & Qualitative)	90
	Partner Rx	Yes (FEMO, Survey123, & Qualitative)	137
	Mechanical/Herbicide (Powerline, Midway, Main Park Dr, Mineshaft)	Mapping Only	29
Moore's Creek (MOCR)	Savannah Rx	Yes (Photopoints and LFEM)	9
	Southwest Rx	Yes (Photopoints, LFEM, and Qualitative)	77
Wright Brothers (WRBR)	West WUI Mech Trt	Mapping Only	17
	22	19	2493

Appendix D. Big South Fork National River and Recreation Area (BISO):

2022 Fire Effects Monitoring Annual Report

Activity Summary

During 2022, the APC Zone Fire Ecology team continued to provide fire ecology and fire effects monitoring services to BISO, although fire planning and operations services are now provided by the Mississippi River Fire Management Zone. BISO completed 2 prescribed burns in 2022 for 894 combined acres at Newtie King and Darrow Ridge.

In late June, APC Fire Ecology staff were joined by the Southeast Region Fire Ecologist, Mississippi River Zone Fire Ecology staff, and BISO LE staff to monitor a total of four long-term monitoring plots at Newtie King and Darrow Ridge and collect Survey 123 data to ground truth extended burn severity imagery. This was a great opportunity for training and collaboration between subject matter experts from across the southeast region.

The focus for our program in the coming year will be to provide operational and monitoring support for any prescribed burns or non-fire fuels-management projects at BISO. The other priority will be to complete the summer monitoring for any plots that burn during the 2023 burn season.

Review of 2022 Projects

Newtie King Rx

This year marked the sixth burn treatment for the 135 acre Newtie King burn unit. This area is a mix of open native grass fields and little bluestem woodlands bordered by mature oak forest. Given a couple past instances of 5-6 year gaps between burns, the primary little bluestem monitoring area has become overgrown in shortleaf and Virginia pine along with a mix of hardwood seedlings and poles. This has converted the structure from former field and open woodland to encroached fields and closed woodland/forest. The recent burn was successful in top-killing most of the hardwood seedlings, however these will continue to resprout and expand with infrequent burning. Moreover, the pines that have become established have grown into fairly dense stands that are now shading the diverse herbaceous understory, likely causing it to diminish over time under these conditions.



Figures D-1 and D-2. Plot photos from SCSC 2 (Top) and SCSC 3 (Bottom) in the Newtie King burn unit showing shortleaf pine-little bluestem woodland structure and top-kill of understory tree seedlings from the recent burn. Notice the amount of resprouting woody stems in the understory which was formerly dominated by diverse herbaceous cover.

Key Observations:

- This burn unit would likely benefit from burning on a more frequent and consistent basis (1-2 year rotation) to help manage the woody encroachment within the fields and maintain the woodland areas in a more open structure
- Given the density of small trees that have grown up across the unit due to longer intervals between burns some form of broadcast mechanical treatment would likely be beneficial in reclaiming the fields and re-opening the woodland areas (this should be coordinated with the fire effects crew to avoid loss of rebar marking monitoring plot boundaries)
- Shortleaf pine and post oak both appear to be favored by burning within the woodland areas

Darrow Ridge Rx

Darrow Ridge is a 759 acre forested burn unit located on the southwest side of the park near Jamestown, TN. This area has burned five times since 2001, beginning with a wildfire in 2001 followed by prescribed burn treatments in 2006, 2010, 2015, and most recently in 2022. The area consists of dry oak forests formerly mixed with shortleaf pine killed by southern pine beetle in the early 2000s with dry-mesic oak forest in the shallow drainages, a small area of post oak-little bluestem woodland, and narrow strips of sandstone outcrop with stunted Virginia pine woodlands along the edge of the bluff at the northern extent of the unit. A new area with younger mature forest was also added this year on the northwest end of the unit.

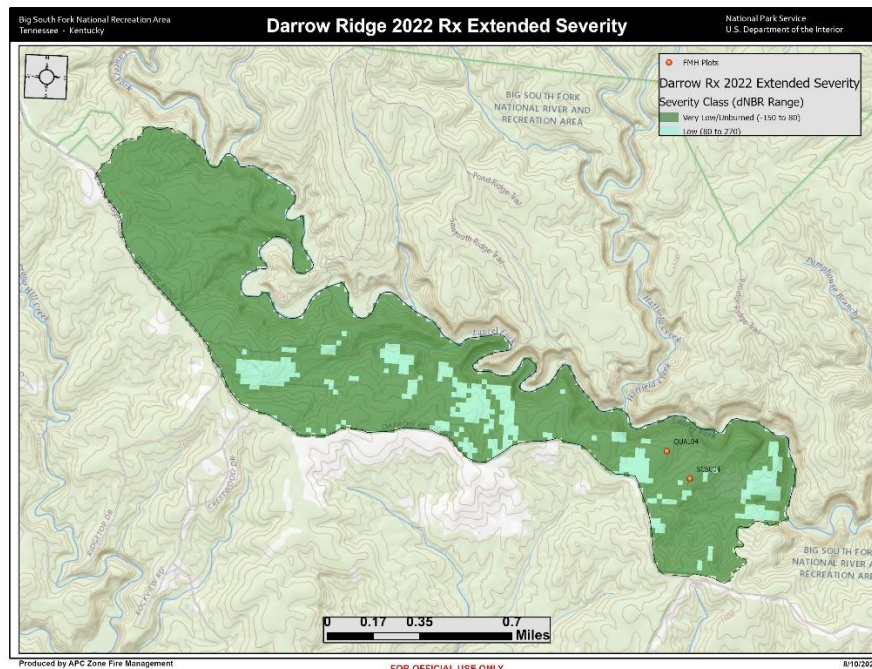


Figure D-3. Extended burn severity map of the 2022 Darrow Ridge Rx. Note that most of the burn was very low severity (green) with patches of low (aqua blue) occurring in former canopy gaps. Also note the northwest quarter of the unit which encompasses the new acreage is all very low severity.

Overall, the burn was low to very low severity with high litter consumption and most of the impacts limited to the understory where many of the hardwood resprouts were top-killed while the overstory and midstory remained intact. However, given the seven year interval between burns, hardwoods resprouts were well established across the unit especially in the former canopy gaps created from previous burns and southern pine beetle (see the aqua blue area in **Figure D-3**) and they will continue to persist in dominating the understory cover without more frequent burns. There is some yellow pine regeneration occurring in the largest western canopy gap within the burn that has survived the last 2-3 burns and is competing well with the surrounding mixed hardwoods, but again these areas need to burn more frequently to continue favoring pine and oak species and control the encroaching mesic hardwoods species, especially tulip-poplar. The new addition, like most of the burn, appeared to have primarily thinned the understory leaving the overstory mostly unaffected.

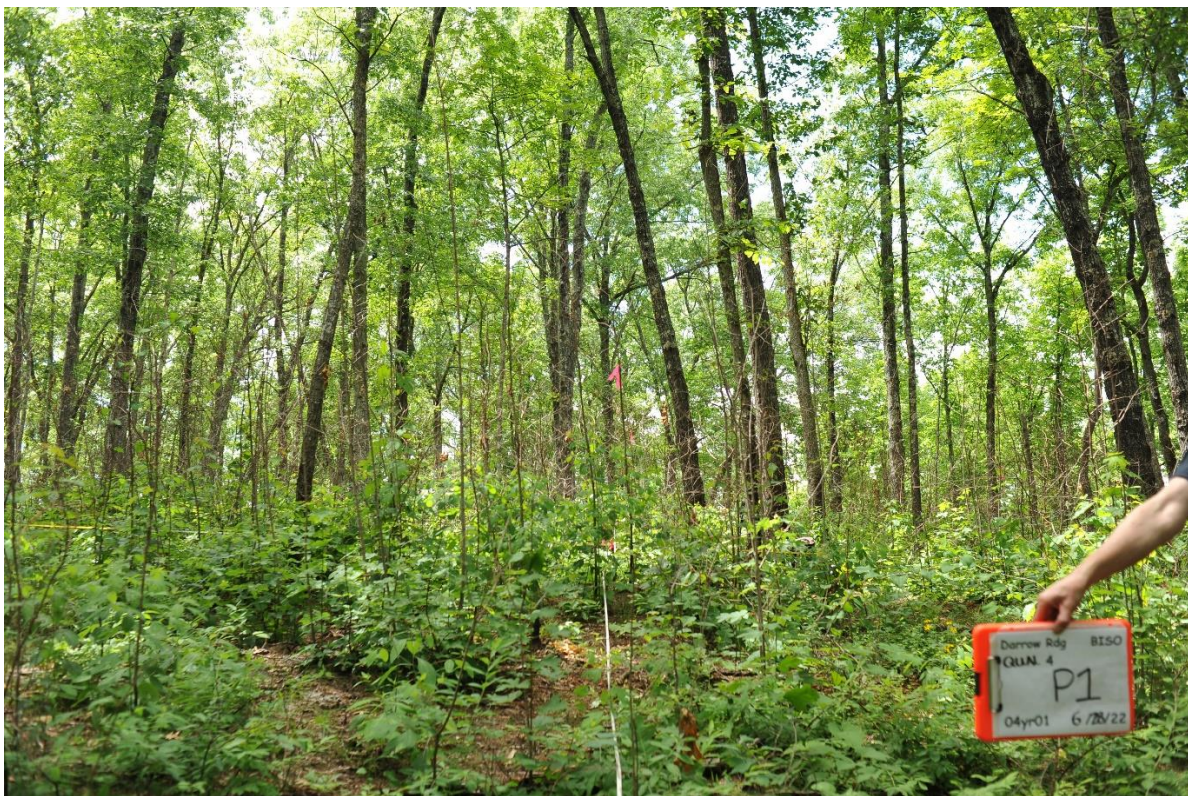


Figure D-4. Photo showing typical understory effects in the forest areas of the unit. Note the extensive mortality in the understory hardwood seedling strata.



Figure D-5. Photo showing shortleaf pine regeneration observed in the large canopy gap on the west end of the unit. Note the dense hardwood resprouts that were top-killed by the recent burn.

Key Observation:

- The Darrow Ridge unit contains some of the most fire dependent vegetation within the park and it has received the most burn treatments since the prescribed fire program was implemented.
- The 2022 burn entry was an excellent retreatment of the unit with widespread top-kill of understory hardwood resprouts and low overstory impacts.
- Like Newtie King, Darrow would likely benefit from more frequent burning (2-4 years) to help control hardwood resprout, especially in the canopy gaps created during previous burns.
- The new addition appeared to be a good first entry treatment with overall low severity effects and good overstory retention.

Long-Term Monitoring Results

Long-term monitoring plots were burned at both Darrow Ridge and Newtie King in 2022, however, not enough data were collected to warrant updates to the monitoring results table. For reference, the long-term monitoring results table from last year's annual report is provided below (**Table 5**). The accompanying text from the 2020 report provided a good overview of the data trends from the BISO prescribed burn program, and that overview is worth repeating. That text is included below:

An important take away from all of these long-term results is that *prescribed-fire restoration takes time and a commitment to frequent burning*. Until all of the plots have been burned multiple times, and the data can be collected and analyzed, we must rely on these trends to determine if the program is heading in the right direction. Findings up to this point indicate that most of the trends for the objective-related variables are favorable, *with the exception of fuel loading and perhaps pole-sized tree reduction*. These data point to valuable lessons that we have learned, and that have been discussed in detail in previous annual reports. To sum:

1. Total-fuel-load changes during prescribed fire restoration do not appear to be uni-directional, and total fuel loads may actually *increase* as mature trees are killed by fire and other events
2. Large canopy gaps created during initial burning can lead to rapid growth of resprouting red maple and other undesirable species, greatly complicating restoration efforts.

Table D-1. Management Objectives and Monitoring Results

All results shown are 80% confidence intervals of the mean. Fuel reduction objectives/results are mean percent reduction from pre-burn to immediate post-burn. An underlined number of plots indicates that the minimum sample size has been attained for that variable.

Vegetation Type	Management Objective Restoration Phase- (After 4 burns)	Monitoring Results (80% confidence intervals)	Progress Towards Meeting Objectives	Year Last Analysis Completed
Dry Oak Forest (FQUAL1) 14 plots - 11 have burned once 7 have burned twice (3 Fuel Transects have also burned twice) 5 have burned three times 3 remain unburned	>50% Reduction in total fuel loading	Total fuel load change After one burn (n= <u>10</u>): -52% ($\pm 3\%$) After 2 burns (n=8): -43% ($\pm 7\%$) After 3 burns (n=3): 46% ($\pm 27\%$)	More data needed. Objective may need to be reevaluated.	2018
	>70% Reduction in pole-sized tree density ($\leq 15\text{cm dbh}$)	Pole reduction After one burn (n= <u>10</u>): 62% ($\pm 11\%$) After 2 burns (n=4): 93% ($\pm 10\%$) After 3 burns (n=2): 69% ($\pm 27\%$)	Trend is very positive. More burns and data needed.	2018
	20-40% Reduction in overstory tree density ($>15\text{cm dbh}$)	Overstory reduction After one burn (n= <u>11</u>): 5% ($\pm 3\%$) After 2 burns (n=5): 36% ($\pm 17\%$) After 3 burns (n=3): 28% ($\pm 40\%$)	Trend is very positive. More burns and data needed.	2018
	>200 tall ($>1\text{m}$) Oak seedlings /ac	Oak Seedlings: Preburn (n=11): 199/acre (± 162) After 1 burn (n=11): 537/acre (± 276) After 2 burns (n=5): 1020 (± 545) After 3 burns (n=3): 1161 (± 334)	Trend is very positive. More burns and data needed.	2018
	>30% Cover by native herbs	Preburn: 10.5% (± 6.9) After 1 burn: 10.2% (± 4.7) After 2 burns: 27.6% (± 16.6) After 3 burns: 37.5% (± 10.4)	Trend is very positive. More burns and data needed.	2021

Vegetation Type	Management Objective Restoration Phase- (After 4 burns)	Monitoring Results (80% confidence intervals)	Progress Towards Meeting Objectives	Year Last Analysis Completed
Little Bluestem Sandstone Glade (FSCSC1) 3 plots- <i>2 have burned five times</i> <i>1 has burned three times</i>	>70% Reduction in pole-sized tree density	<u>Pole reduction:</u> After 1 burn ($n=3$) = 14% ($\pm 16\%$) After 2 burns ($n=3$) = 29% ($\pm 23\%$) After 3 burns ($n=3$) = 34% ($\pm 23\%$) After 4 burns ($n=2$) = 35% ($\pm 20\%$)	Insufficient data, but the trend is very positive. <i>Objective may need to be revised.</i>	2018
	>100% Cover by native herbs	Preburn cover: 98% (± 26) After 1 burn ($n= 3$): 123% (± 28) After 2 burns ($n= 3$): 133% (± 30) After 3 burns ($n= 3$): 102% (± 32) After 4 burns ($n= 2$): 138% (± 71)	Insufficient data.	2019

Appendix E. Blue Ridge Parkway (BLRI): 2022 Fire Effects Monitoring Annual Report

Activity Summary

Portions of BLRI were burned during the USFS Big Lost Bear prescribed fire on 4-13-2022 and the Barnett Branch wildfire on 4-27-2022, although no long-term monitoring plots are present in either burned area. The APC Zone Lead Fire Effects Monitor created Initial and Extended Severity Maps for these fires as well as an extended severity map for the fall 2021 Hyatt Cove Wildfire and the team visited both wildfire areas collecting a combination of qualitative, Survey 123 rapid assessment, and CBI data. Due to limited staffing and time constraints the Lost Bear Rx Burn was not visited this season.

The focus for our program in the coming year will be to provide operational and monitoring support for any prescribed burns or non-fire fuels-management projects at BLRI, as needed.

Review of 2022 Projects

Big Lost Bear Rx

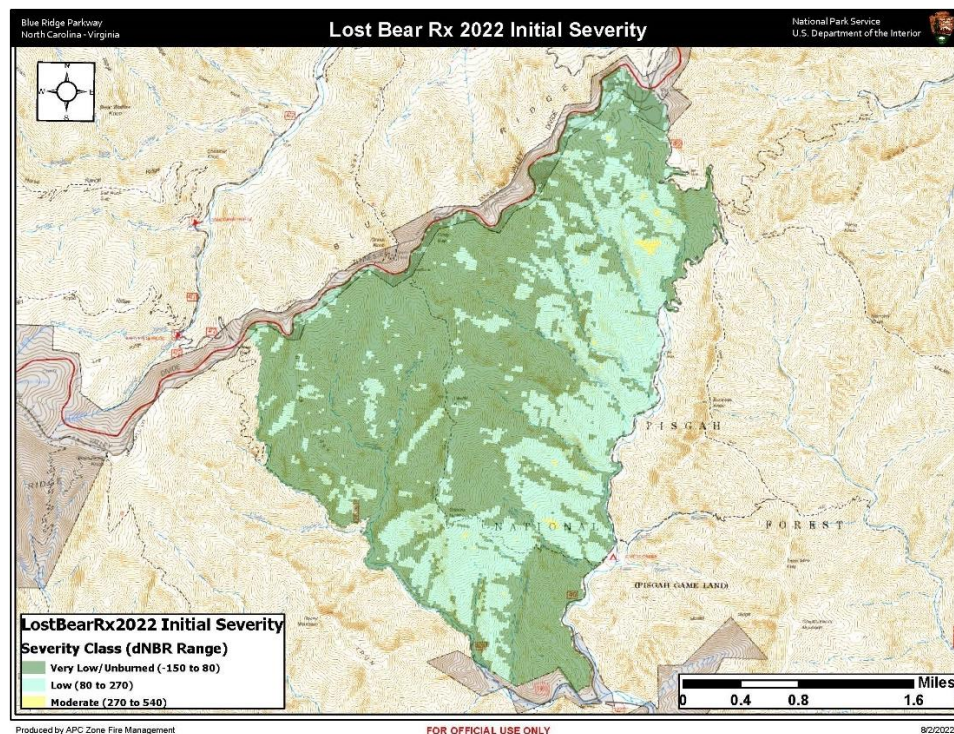


Figure E-1. Map of Lost Bear prescribed fire showing Initial Burn Severity. Overall burn severity appears to be very low to low particularly along the relatively small portion within the park boundary. Very little impact to overstory trees is expected and creation of new snags along the parkway is anticipated to be low. No on-ground monitoring was completed in 2022.

The Big Lost Bear Rx was a roughly 4600 acre USFS (Pisgah NF) burn unit adjacent to the Blue Ridge Parkway that encompassed a 180 acre strip of parkway property. Due to limited staff and time restrictions, this area was not visited in 2022 but an initial burn severity map was created indicating very low to low severity along the parkway portion of the burn (**Figure E-1**). Hopefully 2023 will see a return to normal staffing levels for the crew allowing the ability to devote more time to monitoring the effects of USFS burns along the parkway.

Barnett Branch WF

The Barnett Branch Wildfire was a 337 acre fire that burned from adjacent Pisgah NF land onto a roughly 30 acre strip of parkway property at the Cradle of Forestry Overlook containing high elevation red oak forest with a tall mountain laurel shrub layer. A brief site visit was made in August to assess the effects along the parkway with the aid of an extended burn severity map (**Figure E-2**). The observed severity matched the burn severity map with very low effects primarily impacting to the understory and tall shrub layers (**Figure E-3**). Litter appeared to mostly be consumed with light charring of 100-hr and 1000-hr fuels and very little impact to the overstory oaks and midstory red maple.

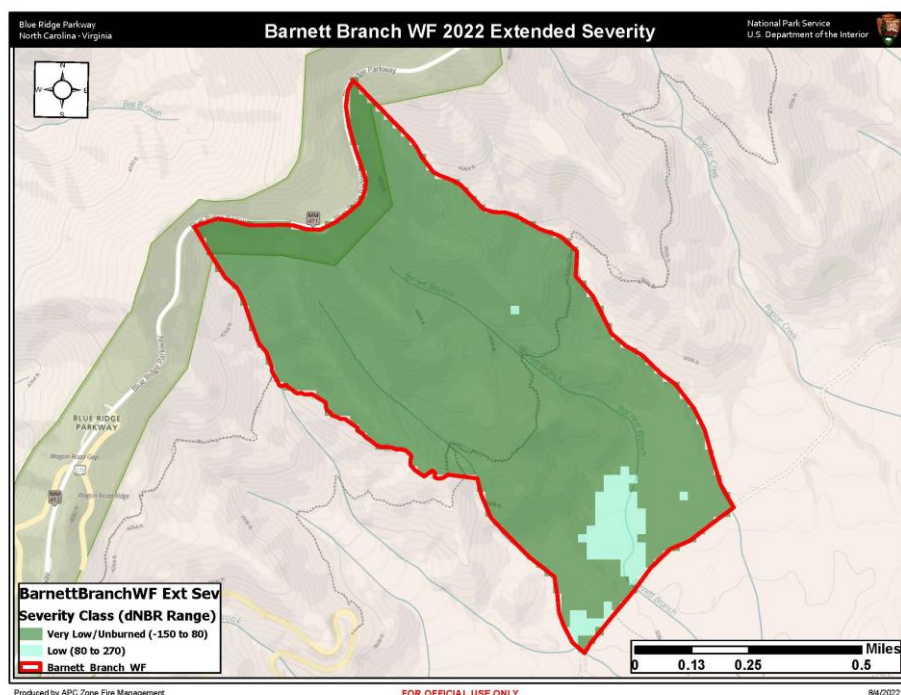


Figure E-2. Map of Barnett Branch Wildfire showing Extended Burn Severity. Ground truthing of the severity map indicated overall severity along the parkway was indeed very low with impacts primarily limited to the understory and dense ericaceous shrub layer.

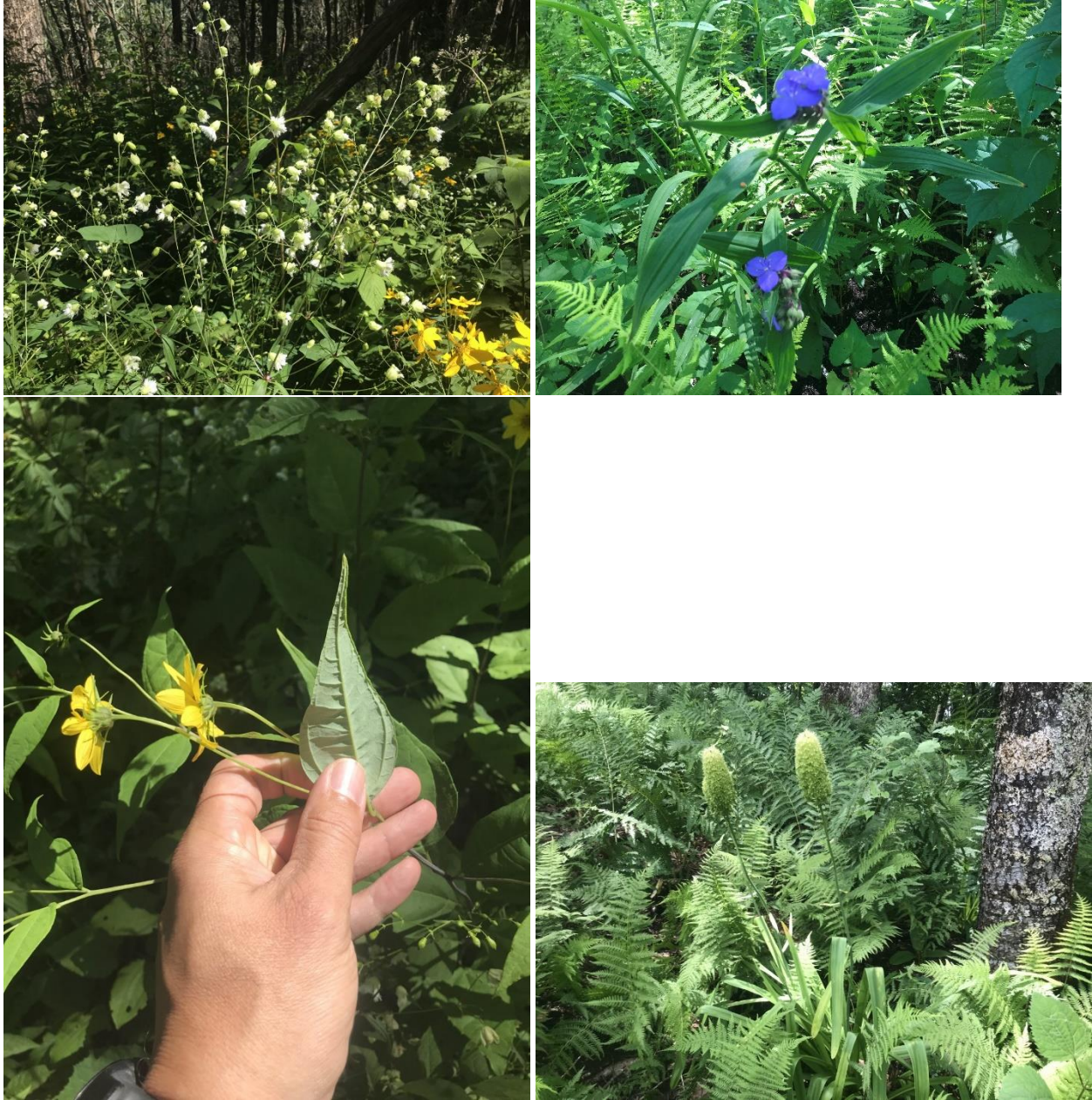


Figure E-3. Photo showing typical understory effects within the parkway boundary. Note the thinning of the tall mountain laurel shrubs while the surrounding midstory and overstory remain intact.

Hyatt Cove Wildfire

This 118 acre wildfire occurred in November of 2021, burning from Cherokee Reservation land onto parkway land near the intersection with Balsam Mountain Road. The fire burned across a portion of the Mountains-to-Sea Trail through high elevation northern red oak forest and was held along the parkway. The site was visited in late July of 2022 to ground truth the burn severity map and collect some basic rapid assessment data. The forest was largely comprised of high elevation northern red oak forest with a tall deciduous shrub layer containing flame azalea, witch-hazel, and upland highbush blueberry and an understory layer often dominated by interrupted fern with occasional blooming Turk's Cap Lily and flypoison. Portions of the Mountains-to-Sea trail and the slopes above the parkway also contain northern red oak forest with an evergreen shrub layer. Numerous flowering plants were observed along the Mountain-to-Sea trail and sampling is included in the list below:

- *Amianthium muscitoxicum* (flypoison)
- *Lilium superbum* (turk's-cap lily)
- *Coreopsis major* (woodland coreopsis)
- *Silene stellata* (starry campion)
- *Tradescantia subaspera* (zigzag spiderwort)
- *Aureolaria laevigata* (entireleaf yellow false foxglove)
- *Lysimachia quadrifolia* (whorled yellow loosestrife)
- *Helianthus glaucophyllus* (whiteleaf sunflower)
- *Hypericum mitchellianum* (Blue Ridge St. Johnswort)



Figures E-4, 5, 6, & 7. Starry Campion (Top Left), Zigzag Spiderwort (Top Right), Whiteleaf Sunflower (Bottom Left), Flypoison (Bottom Right)

The observed burn severity was generally low across most of the fire with the highest area of severity occurring along the northeast spur at a bend in the parkway and it might have been influenced by a burnout operation. Overall the burn severity map (**Figure E-8**) generally matched field observations with most of the overstory and midstory surviving the fire with little to no damage and most of the effects limited to the understory and tall shrub layer.

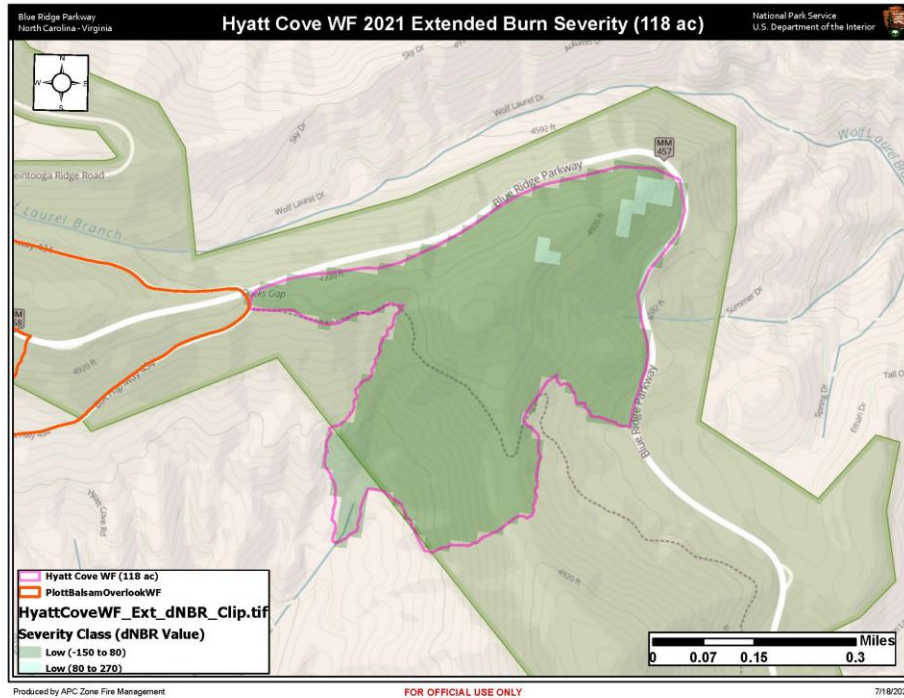


Figure E-8. Map of the Hyatt Cove Wildfire showing extended burn severity. Note the overall severity was very low (green) to low (aqua blue) across most of the burn.



Figure E-9. Photo of moderate severity in northwest corner of the wildfire. This was a small scale patch with high char and some overstory and midstory mortality which was apparently the result of a short uphill run from a burnout operation along the parkway.



E-10. Example of a low severity site where mortality was limited to the understory and part of the midstory. Fire probably flanked through this area after making the initial uphill run onto parkway property from the adjacent reservation land.



E-11. Photo showing typical very low severity effects observed across the majority of the burn where impacts were generally limited to the understory and tall shrub layer strata.

Appendix F. Chickamauga and Chattanooga National Military Park (CHCH):

2022 Fire Effects Monitoring Annual Report

Activity Summary

CHCH did not complete any prescribed burning in 2022, and hence no long-term monitoring was completed. The APC Fire Ecology program provided planning support for CHCH during 2022, assisting with the update of the Fire Management Plan and collaboration with park resource managers, regional fire staff, Cumberland-Piedmont I&M, and southeastern IPMT managers to review proposed burn areas and discuss options for exotic plant control and eastern redcedar thinning within critical glade areas.

The focus for our program in the coming year will be to provide operational and monitoring support for any prescribed burns or non-fire fuels-management projects at CHCH, as needed. The multi-year fuels treatment plan includes the 'Viniard-Alexander Central' prescribed burn project for FY23. This unit contains 9 long term monitoring plots, and these will be monitored in 2023 if the prescribed burn is completed. The goals and objectives for the Viniard-Alexander prescribed burn, along with a map of the 'Viniard-Alexander Central', are provided below for reference.

Goals and Short-Term Objectives for Glades and Oak/Pine Woodlands at CHCH:

1. *Glades*

Long-term goal: Maintain or expand current areal extent and species composition of herb-dominated glades by reducing woody stem density and limiting future woody encroachment.

1. Burn at least 90% of herb-dominated glade area
2. Consume at least 80% of fine fuels over the burned area
3. Top-kill >40% of small woody stems (less than 2.5" dbh) within the glade perimeter

2. *Oak/Pine Woodlands*

Long-term goal: Restore an oak/shortleaf pine/(loblolly pine?) woodland characterized by an open canopy and midstory, adequate oak and shortleaf pine regeneration, and >30% cover of native herbaceous species.

1. Burn at least 70% of area currently dominated by oak, loblolly pine, or shortleaf pine
2. Consume at least 80% of fine fuels over the burned area
3. Top-kill >30% of small woody stems (less than 4" dbh) within oak and oak-pine forest

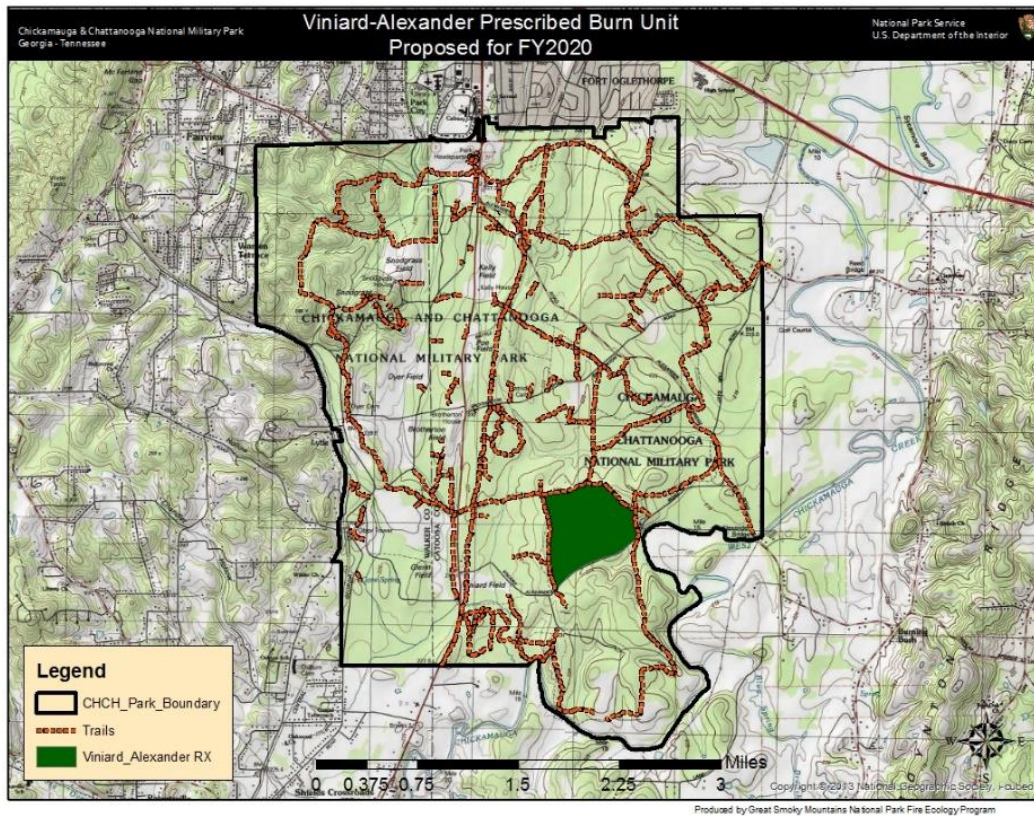


Figure F-1. Location of proposed 'Viniard-Alexander Central' prescribed burn unit.

Appendix G. Congaree National Park (CONG):

2022 Fire Effects Monitoring Annual Report

Activity Summary

During 2022, the APC Zone Fire Ecology team made a trip to provide operational, planning and monitoring support for the CONG fire program. CONG completed two prescribed burns in 2022 in the Dawson's Cabin/Red Bluff and Harry Hampton East burn units. The crew completed growing season monitoring of long-term plots in both burn units as well as some brief qualitative monitoring in the RCW unit. Additionally, the pilot mastication treatment monitoring project was determined to be no longer needed as the initial treatment was considered successful and the park requested that the plot rebar be removed to prevent damage to the machinery during future treatments.

The focus for our program in the coming year will be to provide operational and monitoring support for any prescribed burns or non-fire fuels-management projects at CONG. The other priority will be to complete the growing-season monitoring for any plots that burn during the 2023 burn season. The CONG multi-year fuels treatment plan for FY23 currently lists burns of Harry Hampton and RCW units, Red Bluff Road and Dawson's Cabin, and Griffins Creek.

Review of 2022 Projects

Dawson's Cabin/Red Bluff Rx

The Dawson's Cabin/Red Bluff unit was burned for the seventh time on 3/2/22 after a 3 year interval from the previous treatment. The 450 acre burn unit is a linear strip of land bordering Red Bluff Road to the north and South Cedar Creek/floodplain forest to the south. Additionally, the burn included a roughly 26 acre rectangle of private land near the northwest corner. The area is dominated by mature successional and plantation loblolly pine forest with occasional depressions containing both willow and water oak.

Overall fire behavior was excellent with enough intensity to top-kill greater than 80% of the resprouting hardwood seedlings, particularly sweetgum which dominates the understory cover. Fire coverage was continuous across the unit even burning into the floodplain along the southern edge of the unit. The overstory remained largely intact with some additional thinning of the already heavily reduced midstory. Litter was mostly consumed across the unit, with good consumption of 1-hr and 10-hr fuels and light char to partial consumption of 100-hr and 1000-hr fuels.



Figures G-1,2, and 3. Photos showing examples of observed fire behavior, (Top) fire on west side of unit near Red Bluff Rd, (Middle) fire backing along the bluff edge above the floodplain, (Bottom) fire lightly burning through the floodplain

The initial burn severity map for Dawson’s Cabin/Red Bluff (**Figure G-4**) showed very low to low severity across the burn which appeared to match on the ground observations with the low mortality in the pine overstory.

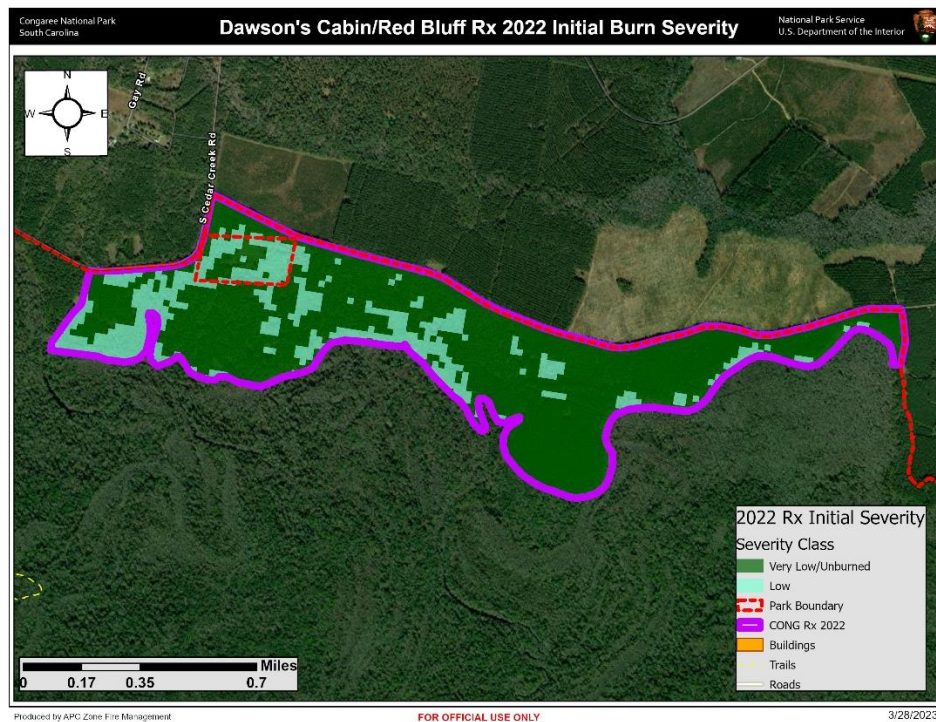


Figure G-4. Initial burn severity map of Dawson’s Cabin/Red Bluff Rx.



Figures G-5 and 6. (Left) Photo showing effects roughly 2 months post burn, note the understory sweetgum resprouts were all top-killed, (Right) Photo showing growing season post burn response where most of the woody stems are resprouting, note how the midstory has been thinned out from the previous 7 burns but the overstory basal area is still relatively high.

Key Observations:

- The 2022 burn of Dawson's Cabin/Red Bluff was an excellent re-treatment of the unit following a 3 year interval between burns. A two year rotation is still recommended given how quickly the vegetation responds and the overall high density of understory woody stems proportional to herbaceous cover
- Good progress has been made over the last seven burns in reducing the midstory and creating some scattered small gaps in the overstory, however, the overstory basal area remains high and there is still a predominance of woody stems in the understory
- Given the overstory density, combining mechanical treatments with continued consistent, frequent burning could help improve the overall structure as observed with previous combined treatments in the Harry Hampton East unit. Additionally, timing burns during the early growing season whenever possible may help increase herbaceous cover over time as observed in both the RCW and Harry Hampton Units.

Harry Hampton East Prescribed Burn

The Harry Hampton East unit (175 acres) was burned on 4/22/22. This burn was highly notable because it was the first time that this unit had been burned in consecutive years (it was last burned on 3/11/21). The original plan was to burn both Harry Hampton and RCW, but due to time constraints, the decision was made to not burn RCW.

This was the 10th prescribed burn of the Harry Hampton unit since 2002, and large sections of the unit had understory thinning and mastication during the summers of 2016-17. The unit lies on the park boundary and has interface with private structures and private forest along nearly the entire eastern perimeter. There is also a significant collection of park structures within the unit, including the Ranger Station, Learning Center, Maintenance Yard, and a developed campground.

The unit consists largely of successional loblolly pine forest, with smaller areas of mesic hardwoods and shortleaf pine/oak forest. There is a notable section of loblolly forest with a high understory cover of native warm-season grasses northeast of the powerline. This area apparently had less soil disturbance during historic times, and it serves as an important refugium and seed source for plants that were once much more widespread in the Congaree uplands.

Fuel types in the unit range from: (in order of abundance) **pine litter, pine litter w/light grass, pine/compact hardwood litter, and tall grass**. The unit was nearly in full green-up at the time of this burn, and resprouting sweetgum and wax myrtle had achieved heights of 3-6' since the 2021 burn.

Fire intensity was initially patchy in the pine litter fuels that cover much of the unit due to elevated humidity and advanced green-up, but it increased throughout the burn period with coverage generally exceeding 80% (**Figure G-7**). Additionally, the native grass area northeast of the powerline burned exceptionally well compared to rest of the unit with nearly complete top-kill of understory sweetgum resprouts (**Figure G-8**).



Figure G-7. Photo showing typical observed fire behavior in pine needle litter common throughout the Harry Hampton East burn unit. This burn entry was generally lower intensity and initially patchy, but overall coverage was high across the majority of the unit.



Figure G-8. Photo showing fire burning through the native grass area northeast of the powerline with moderate intensity resulting in good top-kill of woody resprouts

The initial burn severity map created for the Harry Hampton East burn (**Figure G-9**) showed very low severity which both burn day observations and post burn growing season monitoring confirmed, noting widespread top-kill of woody resprouts 4'-6' tall (**Figure G-10**).

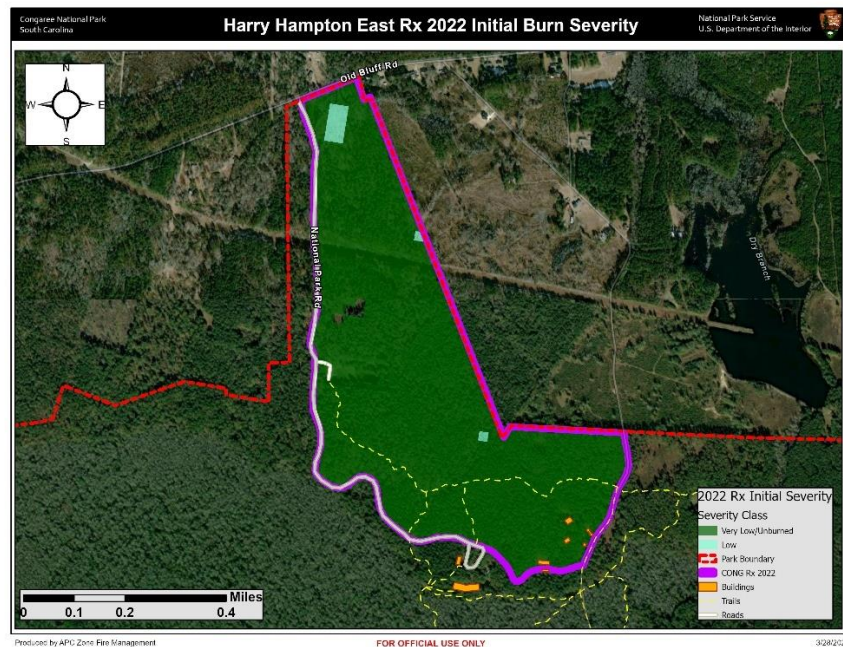


Figure G-9. Initial burn severity map of Harry Hampton East Rx.



Figure G-10. Photo showing typical post burn effects observed during the growing season. Note the brown leaves of top-killed sweetgum seedlings in the foreground and the small patch of taller live sweetgum stems in the background that survived the fire. Surviving patches like this were observed scattered across the unit.

Key Observations:

- Despite shading from advanced green-up and elevated humidity throughout the burn period, this was a successful burn with good coverage and reasonable top-kill of most of the woody resprouts
- Areas with greater concentrations of grass fuels carried fire extremely well despite the more marginal weather conditions
- Use of annual burning is worth serious consideration as often as it is possible not only for the Harry Hampton unit but especially for the RCW unit which contains even more grass fuels especially in the core longleaf pine area
- When using annual burning it might be worth considering alternating between dormant and growing season burn from one year to the next to help ensure ideal burning conditions for at least every other burn

RCW Prescribed Burn

Although no burn was conducted at the RCW unit this year, the area was briefly visited and one observation was made that is worth sharing. Along the northern edge of the core longleaf pine area at the south end of Garrick Road, a scattering of post oak seedlings and small pole size trees were observed thriving in the open woodland. These stems are clearly surviving repeated prescribed burns with moderate to high intensity flames given observations of past fire behavior in and around their location. This is both an interesting observation related to post oak's general fire tolerance as well as the fact that other small scale stands of mature post oak are starting to become evident just east of this general area following several years of burning. Post oak and shortleaf pine both continue to be species of at ecological interest around the uplands of Congaree as the burn program progresses over time.



Figure G-11. Photo of a stout post oak pole size tree (center foreground of image) growing along the northern edge of the core long leaf pine area in the RCW burn unit.

Long-Term Monitoring Results

There are no updates to the long-term monitoring results for this year's annual report. The results table from last year's report are provided for reference.

Table G-1. Objectives and long-term monitoring results for CONG

* There are numerous longleaf seedlings within the core longleaf area and some additional seedlings near the Bluff Campground.

Vegetation Type	Management Objective Restoration Phase- After ?? burns	Monitoring Results	Progress Towards Meeting Objectives	Year Last Analysis Completed
Longleaf/ Loblolly Pine Woodland (FPIPA1) 5 plots	>50% Reduction in total fuel loading	Fuel reduction - 7 burns: 10% (n=4 plots, 1 burn unit)	No. The objective needs to be changed	2019
	15-30% Reduction in overstory tree density	Overstory reduction - 10 burns: 16% (n=4 plots, 1 burn unit)	Yes	2019
	>200 tall (>1m) Longleaf pine seedlings /ac	Preburn density: data not clean After 8 burns: 4/acre (n=4 plots, 1 burn unit)	No*	2019
Loblolly Pine Forest (FPITA1) 5 plots	>50% Reduction in total fuel loading	Total fuel reduction - 5 burns: 20% (n=3 plots, 1 burn unit)	No. The objective needs to be changed	2019
	>70% Reduction in pole-sized tree density	Pole reduction – 8 burns: 87% (n=3 plots, 1 burn unit)	Yes	2019
	25-50% Reduction in overstory tree density	Overstory reduction – 8 burns: 28% (n=3 plots, 1 burn unit)	Yes	2019

Appendix H. Cumberland Gap National Historical Park (CUGA):

2022 Fire Effects Monitoring Annual Report

Activity Summary

During 2022, the APC Zone Fire Ecology team continued to provide fire ecology and fire effects monitoring services to CUGA, although fire planning and operations services are now provided by the Mississippi River Fire Management Zone. No prescribed burning or fuels management projects were completed in 2021, however plot maintenance was conducted for the Dark Ridge A, B, and C units as well as Tiprell. A brief review of the 2022 monitoring will follow this section.

The focus for our program in the coming year will be to provide operational and monitoring support for any prescribed burns or non-fire fuels-management projects at CUGA. The other priority will be to complete the summer monitoring for any plots that burn during the 2023 burn season. The primary focus for the upcoming year appears to be Dark Ridge and Sugar Run. The Dark Ridge units contain long-term monitoring plots.

Review of 2021 Projects

The primary observations from conducting plot maintenance in 2022 include:

- The Dark Ridge units (A,B, and C) are excellent project areas with a significant amount of past investment. These units are well overdue for a follow-up treatment especially given the density of hardwood resprouts in the understory. This area along with Harlan should receive priority consideration for future burn planning for both the short and long term.
- Chinese silver grass (*Miscanthus sinensis*) continues to be a problem exotic plant invading the Dark Ridge burn area. Continued collaboration with park resource managers to ensure herbicide treatments are conducted following burns is critical
- There is scattered but notable oak regeneration present within both the Dark Ridge A and C burn units. Dedication to consistent future burns will be important in favoring and expanding oak regeneration across this area.
- The Tiprell burn is also overdue for an additional burn treatment, however, the overstory remains largely intact except for areas of wind damage unrelated to previous burning, so understory resprouts are still at a manageable size.



Figure H-1: Photo illustrating the dense 8 ft plus resprouting hardwoods within portions of the Dark Ridge A unit. Some areas are dominated by mesic, fire intolerant hardwoods including tulip-poplar and black gum while other areas such as this picture contain significant oak regeneration.



Figure H-2: Photo showing additional dense oak regeneration within the Dark Ridge area



Figure H-3: Photo showing an example of a robust clump of the highly invasive Chinese silver grass observed within the Dark Ridge A burn unit.

Long-Term Monitoring Results

No updates have been made to the long-term results table for CUGA. Past table provided for reference.

Table H-1. Results of long-term fire effects monitoring at Cumberland Gap NHP.

Vegetation Type	Management Objective Restoration Phase- (After 4 burns)	Monitoring Results (80% confidence intervals)	Progress Towards Meeting Objectives	Year Last Analysis Completed
Dry Oak Forest (FQUC01) 16 plots	>50% Reduction in total fuel loading	Total Fuel Reduction: After 1 burn (n= <u>16</u>): 29% (± 3) After 2 burns (n= <u>11</u>): 26% (± 2)	Trend is favorable. More data needed.	2013
	>70% Reduction in pole-sized tree density (≤ 15 cm dbh)	Pole Reduction: After 1 burn (n= <u>16</u>): 39% (± 5) After 2 Burns (n= <u>11</u>): 67% (± 3)	Trend is very favorable. More data needed.	2013
	15-30% Reduction in overstory density (>15cm dbh)	Overstory Tree Reduction: After 1 burn (n= <u>16</u>): 5% (± 5) After 2 Burns (n= <u>11</u>): 8% (± 1)	Trend is very favorable. More data needed.	2013
	>200 tall (>1m) Oak seedlings /acre	Preburn (n=16 plots): 101/ac (± 12) After 1 burn(n=16): 91/acre (± 6)	Trend is very favorable. More data needed.	2011

Vegetation Type	Management Objective Restoration Phase- (After 4 burns)	Monitoring Results (80% confidence intervals)	Progress Towards Meeting Objectives	Year Last Analysis Completed
	>30% Cover by native herbs	Preburn cover (n=14): 2% ($\pm 1\%$) After 1 burn (n=14): 4% ($\pm 2\%$)	Minimal change. More data needed.	2011
	< 20 Invasive exotic plants/acre	Preburn avg (n=16): 0/acre Post burn mean (n=16): 20/acre (± 14)	Unclear due to high variability.	2011

Note: An underlined sample size number indicates minimum plots exist for 80% Confidence Level.

Appendix I. Great Smoky Mountains National Park (GRSM):

2022 Fire Effects Monitoring Annual Report

Activity Summary

Prescribed fire operations were limited at GRSM in 2022, with no spring burning and 2 fall Cades Cove burns. The APC Zone Fire Ecology team supported GRSM with planning, GIS, and fire effects monitoring. The Fire Ecologist led the APC Zone in updating the Fire Management Plan in 2021 and the update for 2022 was submitted and signed by the GRSM superintendent in June 2022. The Lead Monitor and Assistant Lead provided substantial GIS support for the fire program, providing detailed maps for all fuels projects, Community Wildfire Protection Plans, submission of maps for all wildfires and completed fuels projects, and extended burn severity mapping for the Thomas Divide Complex.

Highlights from 2022 fire effects monitoring included year two growing season monitoring of the Wear Cove Gap prescribed burn, coordination and mapping of mechanical fuels projects in Cades Cove, and GIS and FEMO support for fall Cades Cove prescribed burns.

Review of 2022 Projects

Spring 2022 Wildfires

The spring proved to be notably windy and dry, culminating in a handful of wildfires occurring outside the park and 2 on park lands that will be discussed under this section. The first of these wildfires was the Branham Hollow 2 Wildfire that started on 3/19/22 from debris burning on adjacent private lands and spread onto undeveloped NPS Foothills Parkway land (managed by GRSM) located near the Cosby/Pittman Center, TN communities on the northeast side of the park. The fire was contained at ~2 acres and it overlapped a portion of a larger 2017 spring wildfire of similar name (Branham Hollow). Although small, the fire was notable because dozer line was constructed across a short section of NPS property to contain the fire. A cooperative agreement with local USFS staff was utilized to provide rehabilitation support for the dozer line, and rehab was completed in mid-April. The GRSM vegetation ecologist who served as READ on the wildfire and fire effects staff conducted a site visit shortly following the rehabilitation to document the work. The site contained snags and downed logs along the ridgeline from the previous 2017 wildfire, which the dozer line traversed and then followed a small drainage on the east and south side of the burn.



Figure I-1. Photo taking along the ridgeline looking west along the rehabbed dozer line



Figure I-2. Photo taken from the ridgeline looking roughly south, downhill along the rehabbed line



Figure I-3. Photo taken from the drainage at the south end of the burn looking roughly north up the rehabbed dozer line



Figure I-4. Photo taken from the south drainage looking west along the rehabbed line

The second wildfire was actually a much larger complex of 2 wildfires that presumably started from downed powerlines during a 3/26/22 wind event. The following narrative was taken from the BAER report:

The Thomas Divide Complex consisted of the Stone Pile Gap and Coopers Creek fires, both originating near the Galbraith Rd area in Swain County, NC. On the 26th, an Incident team was formed and the decision made to bring in a dozer from NC State Forestry to help create fire breaks. Dozer work was accomplished both within and outside of the boundary of GRSM on this day, with dozer line on the park being restricted to a hiking trail that followed an existing old roadbed. Hand crews from NC Forestry and the Great Smoky wildland fire module worked the fire that night, creating handline and structure protection for areas outside of the park, and catching a slop-over of the dozer line within the park.

On March 27th, dozer work continued on the NW perimeter of the Stone Pile Gap fire to confirm sufficient line was in for that boundary of the fire. Stone Pile Gap was moving towards complete containment on the 27th, however the higher elevation Coopers Creek fire continue to burn into several steep drainages into the park, and crossing Thomas Divide Ridge itself. Effort on this fire involved structure protection and connection of handlines near on the southeast lower elevation boundaries during the day, and some suppression efforts on the NW side near Thomas Divide ridge that night. By the morning of the 28th, much of the southeastern edges of the fire were buttoned up on private property, with the most active fire being within the park in several steep drainages and on the west slope of Thomas Divide Ridge, where fire had crossed the ridge and began backing downslope. Efforts intensified this day with continuous bucket drops and handline creation, which showed improvement towards containment of the fire.

By March 29th, the fire was largely contained with only some active burning still occurring, and control was turned over to the ICT2 "Gold Team". Aerial and ground-based operations continued with the fire being largely contained during this shift. Incoming rains presumably knocked down the fire the night of the 29th, with efforts of crews shifting towards the fires of the Wears Valley region on the next day. No major suppression efforts were underway on Thomas Divide for the 30th or 31st, and incident command was released on April 1.

Currently available data shows the Stone Pile Gap fire perimeter as 358 acres, with 47 acres occurring within GSMNP, and Coopers Creek fire at 611 acres, with 343 acres within GSMNP (**Figure I-5**). Fuels were mostly in moderate leaf litter, with only occasional consumption of evergreen shrubs (Rhododendron, Mtn Laurel). Heavy fuels appeared largely un-receptive to the fire with larger logs only charred in most instances. Initial dNBR classified burn severity derived from remote sensing does however show higher intensity occurring on SW-facing slopes above Galbraith Creek and several unnamed tributaries of Coopers Creek (**Figure I-8**). On-the-ground observations showed higher fire severity along Thomas Divide Trail at the higher elevations of the fire, with occasional char heights of over 10 ft being discovered.

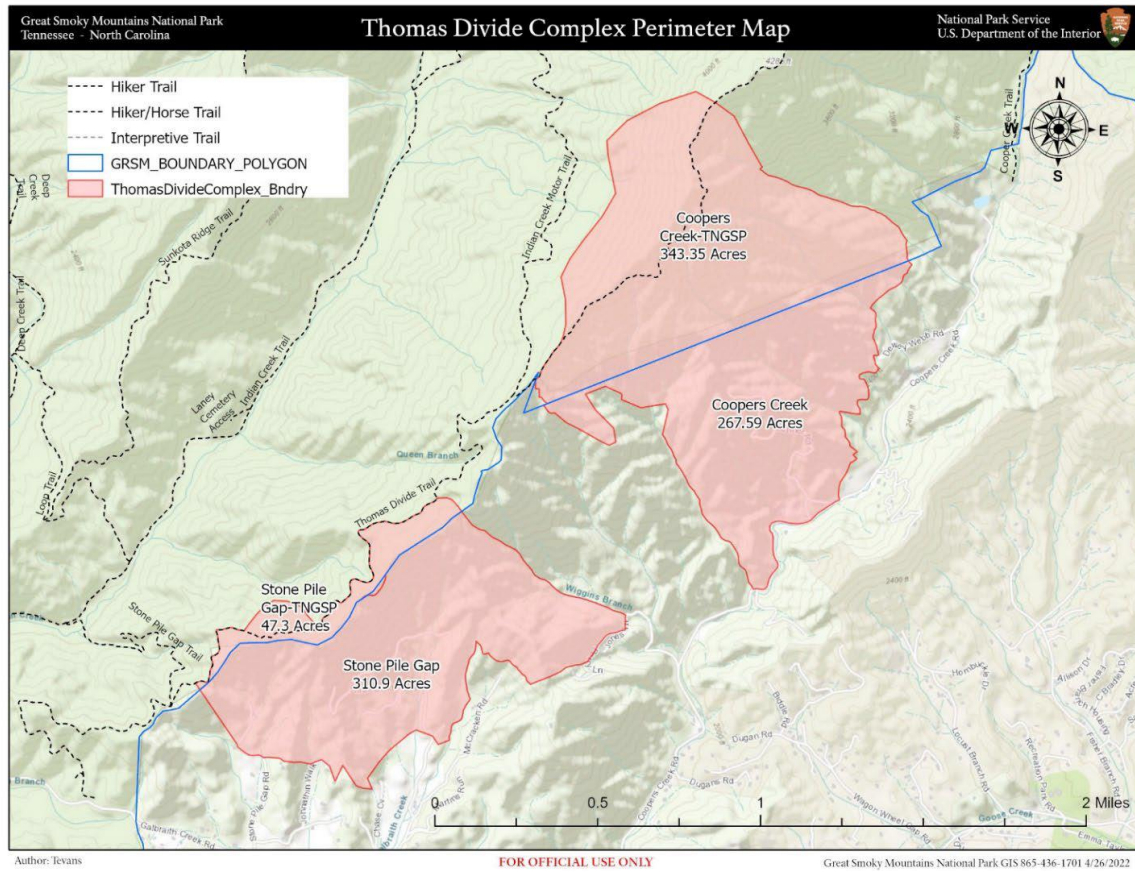


Figure I-5. A map showing Thomas Divide Complex approximate perimeters including final acreages for both NPS and private lands



Figure I-6 and 7. (Left) Photo showing an example of high char on trailside trees at the north end of the Coopers Creek WF, (Right) Photo showing typical low severity fire on the lower slopes of the complex

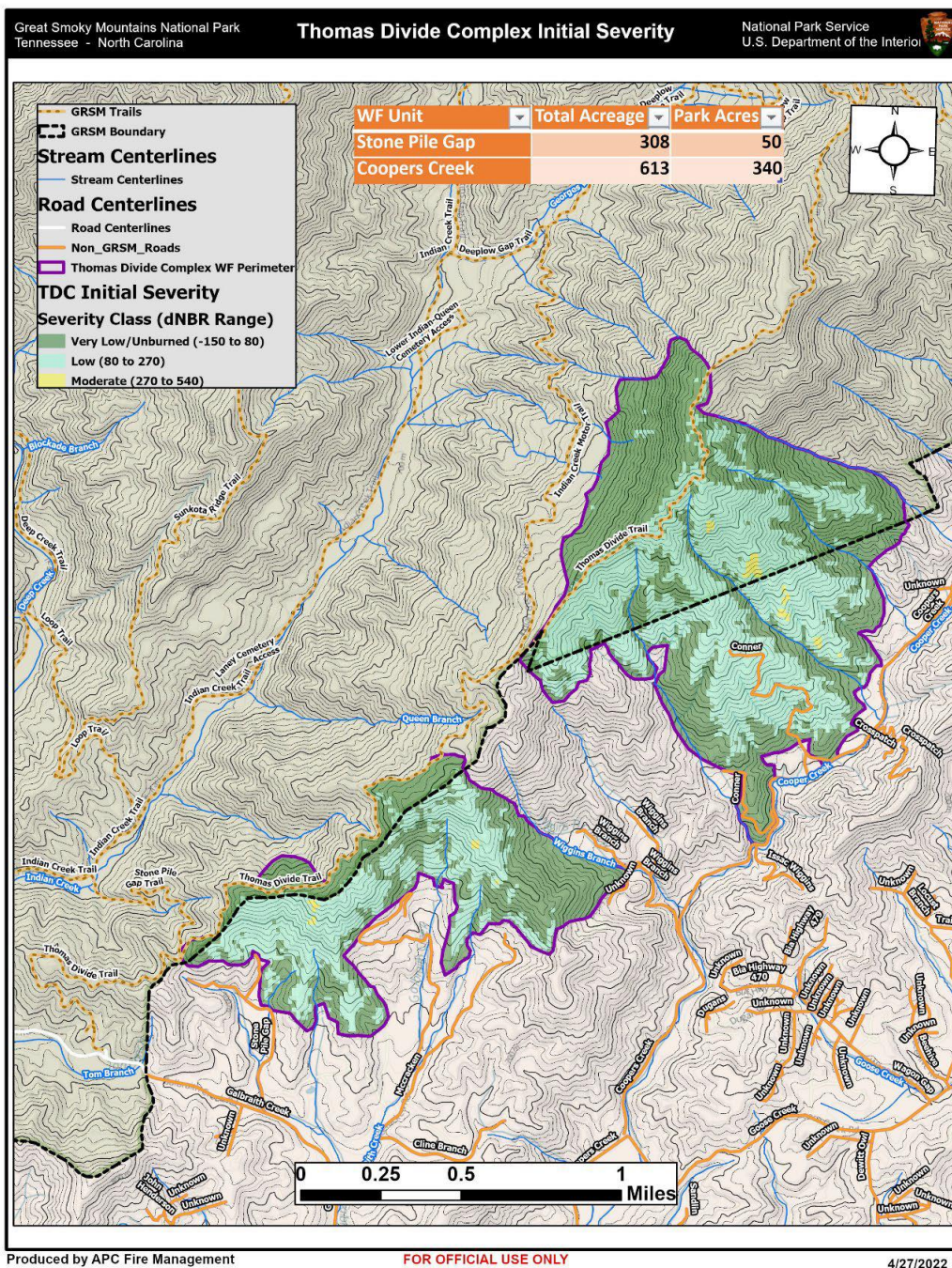


Figure I-8. Initial burn severity map of the Thomas Divide Complex. Note that most of the elevated severity occurred on private lands, with the highest severity on NPS property occurring along the high point of the Coopers Creek WF near/along the Thomas Divide Trail

Immediate ES funding and BAR funding over the next 2-3 years for this wildfire complex will primarily focus on trail rehab for 3.3 miles of affected trailside, especially hazard tree mitigation, and invasive exotic plant detection and removal.

Unfortunately, due to limited staffing and time constraints no sites visits were conducted during the 2022 field season to further ground truth the severity map and collect additional post burn monitoring data. Hopefully with the addition of new crew members in 2023, this site can be prioritized for further monitoring.

In addition to these spring wildfires affecting NPS property it should be briefly noted the 2 additional wind caused/driven fires occurred shortly after the Thomas Divide Complex on neighboring private lands north of the park in Sevier County. These wildfires included the Indigo Lane Wildfire, a 2675 acre fire that started on 3/30/22 resulting in the destruction of numerous homes, and the Seymour Wildfire, a 959 acre fire that began on 3/31/22. These fires further demonstrate the elevated fire danger conditions primarily driven by high wind events in March of 2022.

Cades Cove Late Summer 2022 Mechanical Treatments

Continuing to build off restoration work completed in Cades Cove over the last 5-6 years, local Cherokee NF field staff, through a cooperative agreement with the NPS, provided equipment and manpower to treat additional overgrown fields and re-treat select previous work areas. Three sites were treated in late August-early September of 2022 totaling 52 acres. These included mastication treatments of dense woody encroachment in 6 acres of the eastern portion of the Primitive Baptist burn unit and 4 acres behind the Elijah Oliver Homestead Barn. Additionally, 42 acres of the lower Old Field unit were re-mowed this season with the intent of returning the field back to the burn rotation in upcoming years.

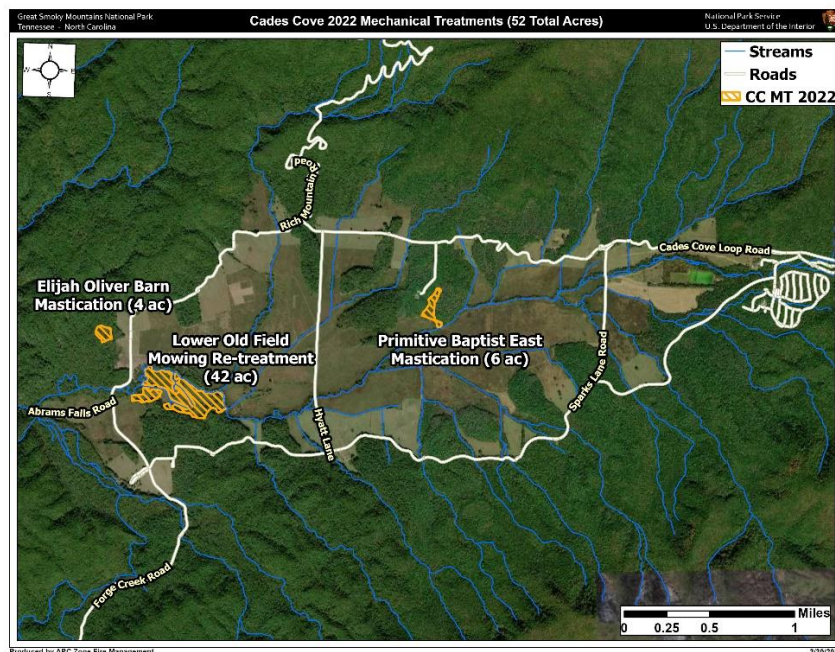


Figure I-9. Cades Cove 2022 Mechanical Treatment Overview Map

Cades Cove Fall 2022 Prescribed Burns

Prescribed burning at GRSM for 2022 was limited to fall burns (FY2023) in Cades Cove field units. For the fall 2 units were completed, Cable House and Sparks which were respectively conducted on 11/3/22 and 11/4/22 (**Figure I-10**). Dry conditions coupled with a 36 acre wildfire on the west end of the park on 11/6/22 prevented further prescribed fire operations in early November followed by a switch to wet weather bringing the beginning of winter conditions and the close of the 2022 burn season.

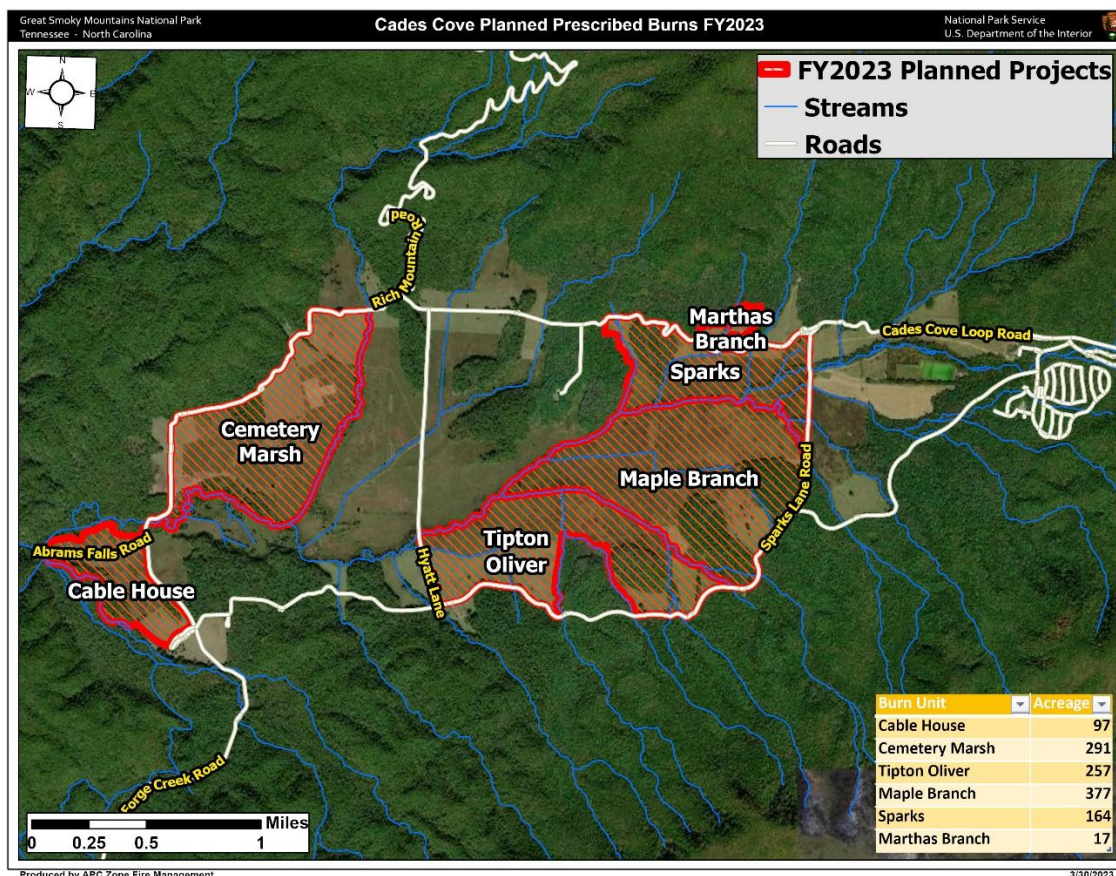


Figure I-10. Map of FY2023 planned Cades Cove Rx burns, note that only Cable House and Sparks were completed in the fall of 2022 leaving the rest of spring 2023.

The Cable House Rx is a roughly 97 acre field unit on the west end of Cades Cove near the Abrams Falls Trailhead and the Cades Cove Visitors Center. A small oak woodlot is present in the southeast corner of the unit and a strip of woods along the west side of the unit was included to help target sweetgum encroachment along the western field edge. The field has a smaller north section located north of the Abrams Falls Trail Access Road and a larger section south of the road. Fuels are moderate density tall native grass which typically carry fire very well with this burn being no exception. Ignitions were started near the trailhead in the northwest corner of the unit with limited spread in the adjacent woods, but

once operations moved into the field firing progressed rapidly across the north sections and transitioned into the south section where ignitors progress south along the eastern edge and west along the northern edge. Once again fire moved rapidly through the southern section, including the SE woodlots which is open from previous burns and contains receptive white oak litter. Notably for this burn UAS ignition operations were used for the first time on NPS lands to fill in ignition in the core interior of the field and along the narrow strip of woods on the western edge of the unit. Overall, this was a successful burn with high fuel consumption and excellent top-kill of encroaching woody stems within the field.



Figures I-11 and 12. (Left) Photo of rapid fire progression in the northern section of Cable House, (Right) Photo of fire rolling across the south field section



Figure I-13. Photo of fire behavior in the western strip of forest, given the proximity to a stream and variability of fuels, fire spread was patchy along this strip unlike the SE woodlot which is on a slope and contains more receptive oak litter

The 164 acre Sparks Lane Rx Burn is a long east-west running field bounded by the Cades Cove Loop Road to the north and Abrams Creek to the south. A wedge shaped woodlot is located on the northwest side of the unit partially dividing the field, however, due to dry conditions this area was excluded from the fall burn of Sparks. Fuels are primarily tall grass with moderate loading.

Firing started in the northwest corner of the unit, working around the south end of the woodlot and progressing east toward Sparks Lane. Gusty and sometimes shifty winds combined with warm dry conditions limited the day's focus to just the Sparks unit although Maple Branch was originally included in the planned operations for the day. UAS aerial ignition was again utilized to help complete interior firing operations, especially in areas along the east side of the unit where foot travel was extremely difficult due to the vegetation.

Despite difficulties presented by the weather, this was another successful treatment of the Sparks unit, with excellent coverage, good consumption of fuels, and widespread top-kill of encroaching woody stems.



Figures I-13, 14 and 15. (Top Left) Photo of fire rapidly rolling across the units viewed from the north line, (Top Right) Photo showing uniform consumption of fuels across the central portion of the field, (Bottom) Photo of UAS equipment used on the burn for interior ignition and recon

Long-Term Monitoring Results

Table I-1. Objectives and long-term monitoring results for GRSM. No updates from last year's report.

Monitoring Type	Management Objective Restoration Phase- (After 4 burns)	Monitoring Results (80% confidence intervals)	Progress Towards Meeting Objectives	Year Last Analysis Completed
Yellow Pine Woodland (FPIR11)	>50% Reduction in total fuel loading	<u>Total fuel reduction:</u> After 1 burn (n=27): 34% ($\pm 7\%$) After 2 burns (n=16): 37% ($\pm 6\%$) After 3 burns (n=5): 15% ($\pm 26\%$)	Objective may need to be revised.	2018
29 Total Plots	>70% Reduction in pole- sized tree density	<u>Pole reduction:</u> After 1 burn (n=28): 51% (± 8) After 2 burns (n=15): 77% (± 6) After 3 burns (n=5): 60% (± 27)	Trend is very positive. More data are needed.	2018
28 have burned once	25-50% Reduction in overstory tree density	<u>Overstory reduction:</u> After 1 burn (n=28): 18% (± 7) After 2 burns (n=15): 50% (± 13) After 3 burns (n=5): 10% (± 18)	Trend is very positive. More data are needed.	2018
17 have burned twice				
5 have burned three times	>200 tall (>1m) Yellow Pine seedlings /ac	<u>Yellow Pine Seedling Density:</u> Preburn density (n=28): 0 After 1 burn (n=24): 631/ac (± 300) After 2 burns (n=15): 1237/ac (± 849) After 3 burns (n=5): 130 (± 198)	Trend is positive. High variability.	2018
1 remains unburned	>40% Cover by native herbs/subshrubs	Preburn cover: 3% ($\pm 1\%$) (n=23) After 1 burn (n=23): 11% ($\pm 4\%$) After 2 burns (n=9): 10% ($\pm 6\%$)	Trend is positive.	2009
Dry Oak Forest (FQUCO1)	>50% Reduction in total fuel loading	<u>Total Fuel reduction:</u> After 1 burn (n=15): 29% (± 4) After 2 burns (n=7): 27% (± 17) After 3 burns (n=5): 26% (± 18)	Objective may need to be revised.	2018
24 total Plots				
17 have burned once	>70% Reduction in pole- sized tree density	<u>Pole reduction:</u> After 1 burn (n=17): 45% (± 10) After 2 burns (n=9): 49% (± 13) After 3 burns (n=5): 77% (± 16)	Trend is very positive. More data are needed.	2018
10 have burned twice	15-30% Reduction in overstory tree density	<u>Overstory reduction:</u> After 1 burn (n=17): 5% (± 5) After 2 burns (n=9): 9% (± 11) After 3 burns (n=5): 7% (± 11)	Trend is very positive. More data are needed.	2018
5 have burned three times	>200 tall (>1m) Oak seedlings /ac	<u>Oak Seedling Density:</u> Preburn density (n=17): 71 (± 66) After 1 burn (n=17): 229/ac (± 180) After 2 burns (n=9): 279/ac (± 152) After 3 burns (n=5): 16 (± 25)	Trend is very positive. High variability.	2018
7 remain unburned	>30% Cover by native herbs/subshrubs	Preburn cover (n=9): 4% ($\pm 2\%$) After 1 burn (n=9): 4% ($\pm 2\%$)	No change detected.	2011

Appendix J. King Mountain National Military Park (KIMO):

2022 Fire Effects Monitoring Annual Report

Activity Summary

During 2022, the APC Zone Fire Ecology team supported KIMO with fire operations, fire planning, GIS, and fire effects monitoring. The Fire Ecologist provided support for a comprehensive 2022 update of the Fire Management Plan. The Lead Monitor and Assistant Lead provided GIS support for the fire program, creating detailed maps for all fuels projects, submission of maps for all completed fuels projects, and severity mapping for the prescribed burns.

Highlights from 2022 fire effects monitoring included scouting and conducting Survey 123 monitoring of the WTP, Long Branch, and Partner 2022 prescribed burn units and conducting long-term monitoring in permanent plots in the Midway and Battlefield burn units. The focus of our program in the coming year will be to provide operational and monitoring support for any prescribed burns or non-fire fuels-management projects at KIMO. The other priority will be to complete the summer monitoring for any plots that burn during the 2023 burn season.

Review of 2022 Projects

WTP and Long Branch Prescribed Burns

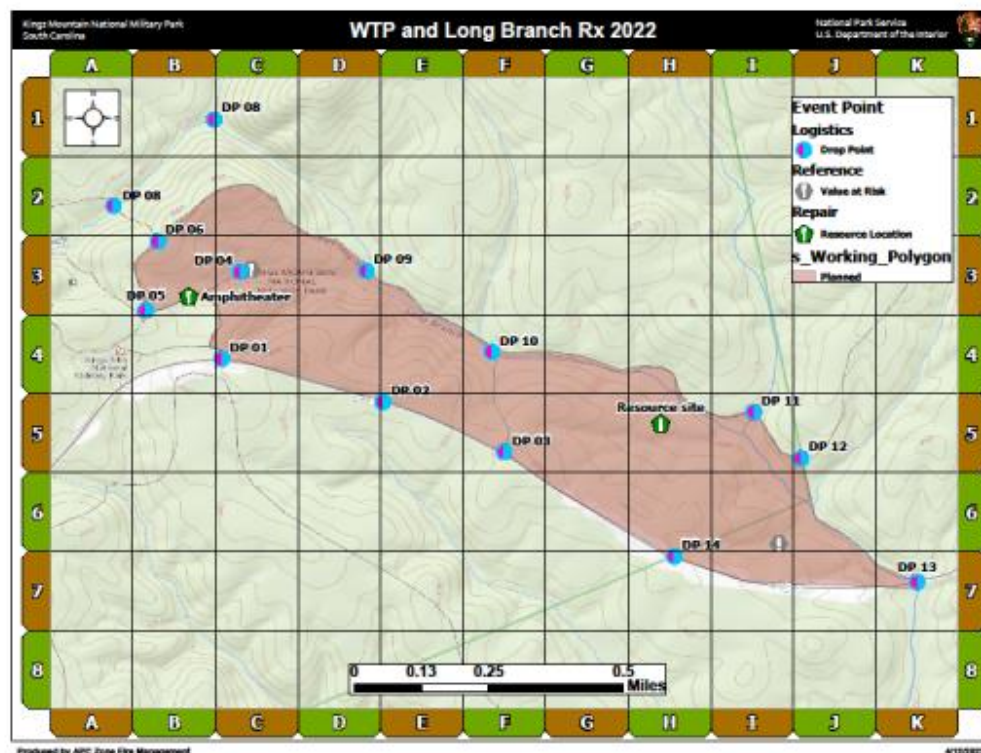


Figure J-1. IAP map of WTP-Long Branch Rx Burn

The WTP and Long Branch prescribed burn units (~170 acres) were burned together on 4/13/22. The combined unit lies adjacent to the Visitor Center parking area and extends southeast along the north side of Main Park Drive. The primary boundaries were Main Park Drive, Long Branch Creek, and the Long Branch Trail (**Figure J-1**). This marks the 3rd entry of fire into each of these units since 2004. Long Branch was burned separately in 2004 and 2009, while WTP was previously burned in 2006 and 2012. These units have also been the site of extensive mechanical treatments (mastication) over the past decade.

Vegetation in this unit is primarily mixed oak forest, but there are some small stands of shortleaf pine and remnant grassy woodlands scattered throughout the unit. Most notably, there is a nice stand of shortleaf pine just above Long Branch Creek near DP10 (**Figure J-1**) with at least one tree measuring ~75cm (30in) in diameter. Other indicators of grassy woodlands that were observed in this area included Post oak, black needle grass, *Carex* spp., downy poverty oats, and possibly an eastern featherbells (which does not currently appear on the park's plant list).

Perhaps the largest grassy woodland remnant is found due east of DP6 (**Figure J-1**). This area has several small stands of shortleaf pine, several post oaks, regeneration of shortleaf pine, and some large patches of black needle grass. The understory of this area is currently a thicket of hardwood sprouts (red maple, oak, etc.) that probably resulted from an earlier prescribed burn. Continued frequent burning of this area could result in development of a nice example of the native grassy woodlands that were probably much more abundant at KIMO during historic times.

Open areas of native grass (esp. broom sedge), forbs, and regenerating shortleaf pine are extensive in the unit along the Main Park Drive in areas that have been previously burned and mechanically treated. These areas provide visitors with glimpses of what the Park probably looked like during historical times, and add significantly to the habitat diversity within the park.

Other uncommon plants have been recently observed in this unit include fly poison (*Amianthemum muscotoxicum*) and Allegheny mountain goldenbanner (*Thermopsis mollis*). Importantly, these plants are typically found in more open meadows and woodlands, and provide additional indicators of the more open and diverse grassy conditions that were once widespread at KIMO.

Initial firing carried well in the open chestnut oak litter at the north end of the burn, despite notably high relative humidity (75%). The fire continued to carry well as ignition operations moved into more of a mixed oak litter fuel bed, and skies started clearing shortly after the test fire. The fire burned well throughout the day in most of the fuel types present in the unit, with the exception of the successional forest with high cover of club moss in the state park section of the unit (southeastern end). The coverage of the burn in the National Park was very high by the end of the day, with over 95% of the unit having burned in a low severity surface burn with >80% litter consumption.



Figure J-2. Example of typical fire behavior and fuels observed throughout the burn

No long term monitoring plots are established within either of the WTP or Long Branch units, so a burn severity map (**Figure J-3**) and qualitative monitoring were primarily used to evaluate the post burn effects.

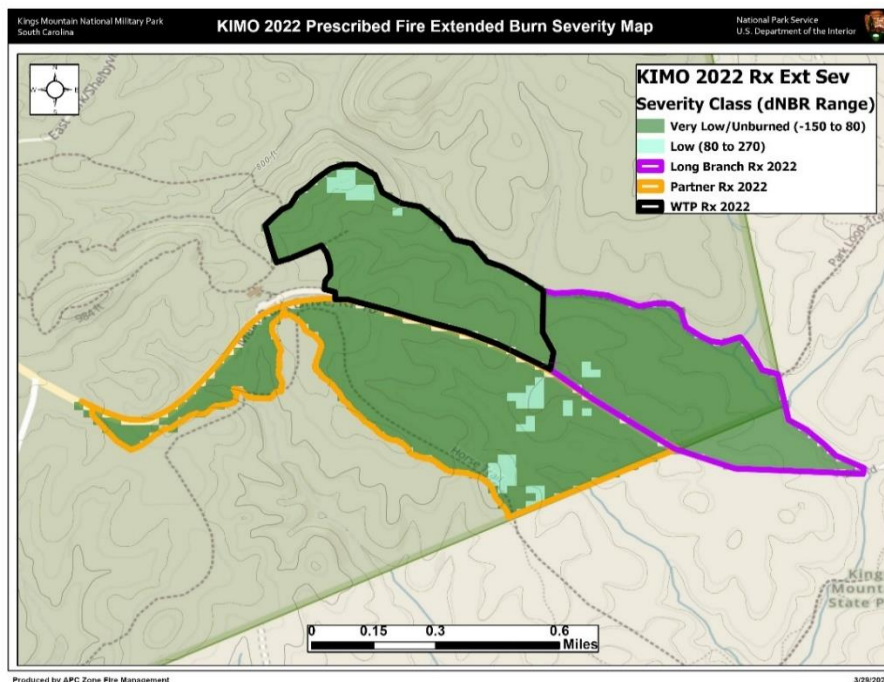


Figure J-3. Extended burn severity map for all combined 2022 KIMO prescribed burns. Note WTP is outlined in black, Long Branch is purple, and Partner is orange.

Post burn scouting confirmed the extended burn severity map with overall very low to low observed severity. Effects were primarily limited to the understory with extensive top-kill of resprouting mixed hardwood stems, including some areas with fairly tall (8'-10') resprouts. Additionally the open native grass areas along Main Park drive responded well with a dense green-up of native grass and forb species. Some higher char was observed on the overstory bordering the open areas along Main Park Drive, but overall there was limited negative impact to the existing overstory.



Figures J-4, 5, and 6. (Top Left) Photo showing typical understory effects observed across much of the unit, (Top Right) post fire effects in both mechanically treated and untreated areas within the burn, note that most of the 8'+ tall hardwood resprouts in the untreated area were still top-killed by the burn, (Bottom) Photo showing extensive post burn green-up in native grass area along Main Park Dr.

Key Observations:

- 10-13 years between burn entries allows hardwood resprouts to attain a very advanced size that is often difficult to top-kill with fire. While parts of the dense, tall understory in this burn were top-killed, this effect was not consistent across the entire unit and supplemental mechanical treatment may be required combined with more frequent burning.
- The scattered woodland indicators of post oak, shortleaf pine, and various herbaceous species provide a glimpse of the former structure and composition of the landscape that was likely present across much of the lower flats and rolling hills within the park. More frequent burning and further thinning of the overstory/midstory will likely continue to favor these woodland species over time.
- Mechanical treatments combined with burning along Main Park Dr have allowed the native grass areas to significantly expand over the last 15-20 years.

Partner Prescribed Burn

The Partner burn unit borders the south side of Main Park Dr directly across from both the WTP and Long Branch units (**Figure J-3**) that were completed earlier in the season. After a lackluster attempt to burn a portion of the Partner unit in May 2021, the unit was revisited on 5/10/22, receiving a successful treatment. The unit was under full green-up conditions during the burn with heavy understory shading. This burn marks the 3rd entry for the Partner unit with previous burns occurring in 3/2004 and 4/2008.

The Partner prescribed burn unit is primarily dense closed canopy chestnut oak and low elevation mixed oak forest with areas of shortleaf pine forest located toward the southern end of the unit. Like WTP and Long Branch, areas bordering Main Park Dr as well as along the southern park boundary have received ongoing mastication treatments over the least 10-12 years, although native grass response has not been nearly as extensive in this area in part due to shading from the remaining overstory. Post oak is also commonly present in the midstory/overstory of the central flat/spur ridge and eastern edge of the burn unit often occurring with scattered clumps of black needle grass in the understory. Post oak stems within the central flat/spur ridge area generally appear to be older mature trees that were once open grown but now have heavy competition and shading from a younger mature cohort of mixed oak forest that has grown up around them in more recent years. In fact many of these trees are now dead snags, only discernable as post oaks from their remaining bark.

Despite the advanced green-up conditions, fire carried well across most of the burn unit throughout the day. Even with reduced flame lengths/overall intensity under the heavy shading, the convective heat generated by the flames did an excellent job of scorching and top-killing the freshly leafed-out understory, and in some case midstory. While a few scattered unburned areas were observed, particularly on the more protected parts of the landscape, an estimated 85-90% of the unit did burn.

Although no long term monitoring plots are located within the Partner burn unit, a burn severity map (**Figure J-3**) and post burn qualitative monitoring during the growing season provided a good picture of the overall effects. Other than a small patch of low-moderate intensity on the southern end of the unit

near Main Park Dr, most of the overstory remained generally unaffected from the burn with the primary effects limited to the understory and occasional patches of the midstory in drier, open parts of the landscape. Litter was 75-85% consumed across the unit with some char to partial consumption of the heavies, particularly in the dry, exposed sites.



Figure J-7. Typical fire behavior observed during the burn, note that despite the low intensity, the convective heat is readily scorching the woody understory resprouts as seen in the browning of the leaves within the burned portion of the photo.



Figures J-8 and 9. (Left) Photo showing typical understory scorch observed across most of the unit, (Right) Photo showing an example of scorch reaching into the midstory as observed in the drier sites.



Figure J-10. Typical low severity effects observed during the growing season, note the distinct line of understory mortality compared to the green surviving midstory and overstory



Figure J-11. Example of the highest observed severity, a small patch of moderate severity where the midstory and a few overstory trees were killed from scorch. This site was in a more open and exposed location that was burned during the hottest, driest part of the day



Figure J-12. Example of mature post oak (central tree in the foreground) surrounded by mixed oak forest in the central flat portion of the burn. While the understory was thinned out in this area, the basal area remains too high to promote extensive post oak regeneration or favor the remnant associated woodland herbaceous species. More frequent burning, possibly with mixed severity, is needed to further open this area.

Key Observation:

- This was another example of the effectiveness of early growing season burning at Kings Mountain. Despite the reduced intensity, scorch from convective heat is very effective at top-killing understory resprouts and in fact is capable of killing midstory and overstory trees.
- As previously stated, 10-15 year intervals between burns allow for dense woody resprout growth that becomes difficult to manage with fire alone, although more frequent burning would likely help to reduce these thickets of stems over time.
- Like WTP and Long Branch, there is remnant post oak woodland present within the Partner unit that would benefit from more frequent burns and further reduction of the overstory to restore a more open woodland structure.

Mechanical and Herbicide Treatments

In addition to prescribed burn monitoring, mapping of non-fire fuels treatments were conducted by the fire effects crew during the summer visit to the park. An overview map of the treatment areas is included below for reference (**Figure J-13**).

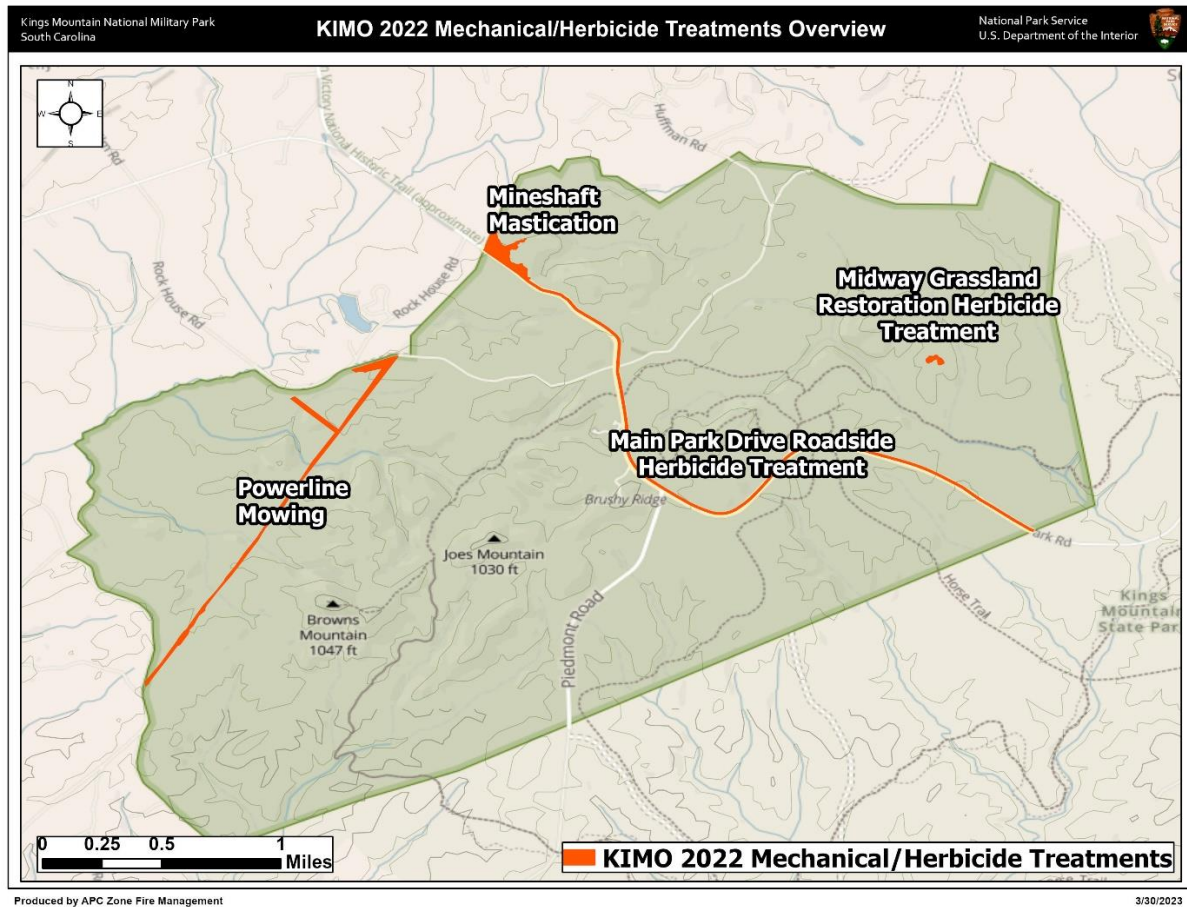


Figure J-13. This map provides a concise overview of the 2022 mechanical and herbicide treatments that were mapped and reported by the fire effects team

Long-Term Monitoring Results

Table J-1. Objectives and long-term monitoring results for KIMO. No updates to the table from last year's report.

Monitoring Type	Management Objective Restoration Phase- (After 4 burns)	Monitoring Results (80% confidence intervals)	Progress Towards Meeting Objectives	Year Last Analysis Completed
Dry Oak Forest (FQUM01) 21 plots: 20 have burned once 19 have burned twice 17 have burned 3 times 9 have burned 4 times	>50% Reduction in total fuel loading	Total fuel reduction: After 1 burn (n=19): 40% ($\pm 6\%$) After 2 burns (n=18): 46% ($\pm 5\%$) After 3 burns (n=17): 57% ($\pm 5\%$) After 4 burns (n=7): 61% ($\pm 6\%$)	Trends suggest that the objective is being accomplished after 3 burns	2018
	>70% Reduction in pole-sized tree density	Pole reduction: After 1 burn (n=20): 42% (± 9) After 2 burns (n=17): 58% (± 8) After 3 burns (n=15): 71% (± 7) After 4 burns (n=5): 76% (± 12)	Trends suggest that the objective is being accomplished after 3 burns	2018
	15-30% Reduction in overstory tree density	Overstory reduction: After 1 burn (n=20): 7% (± 4) After 2 burns (n=17): 11% (± 5) After 3 burns (n=17): 21% (± 7) After 4 burns (n=6): 26% (± 16)	Trends suggest that the objective is being accomplished after 3 burns	2018
	>200 tall (>1m) Oak seedlings/acre	Oak Seedling Density (stems/acre): Preburn density (n=15): 183 (± 132) After 1 burn (n=20): 77/ac (± 47) After 2 burns (n=17): 233/ac (± 171) After 3 burns (n=16): 182 (± 137)	Insufficient data. High variability. Objective needs to be revised to include shortleaf pine seedlings.	2018
	>15% Cover by native herbs/subshrubs	Preburn cover (n=19): <1% After 1 burn (n=19): 1% After 2 burns (n=19): 1-2%	No change, but more burns are needed.	2009
	>50% Reduction in total fuel loading	Total fuel reduction: After 1 burn (n=7): 47% ($\pm 4\%$)	Trend is positive.	2009
Chestnut Oak-Blackjack Oak Woodland (FQUMA1) 8 plots	>70% Reduction in pole-sized tree density	Pole reduction: After 1 burn (n=8): 45% ($\pm 12\%$) After 2 burns (n=4): 62% ($\pm 12\%$)	Trend is positive.	2009
	15-30% Reduction in overstory tree density	Overstory reduction: After 1 burn (n=8): 30% ($\pm 11\%$)	Trend is positive.	2009
	>30% Cover by native herbs	Preburn cover (n=7): 6% Cover after 1 burn (n=7): 9%	No change, but more burns are needed.	2009

Appendix K. Moores Creek National Battlefield (MOCR):

2022 Fire Effects Monitoring Annual Report

Activity Summary

During 2022, the APC Zone Fire Ecology team continued conversations with the MOCR Superintendent on burn program review, fire planning, and fire effects monitoring. Highlights from 2022 fire effects monitoring included a site visit with detailed monitoring of the Savannah and Southwest burn units, the installation of 3 new photo points within the Southwest burn, and the introduction of species composition data collection at all photo points (5 total). The results of this monitoring are discussed further in the “Review of 2022 Projects” section of this report. The focus of our program in the coming year will be to provide operational and monitoring support for any prescribed burns or non-fire fuels-management projects at MOCR.

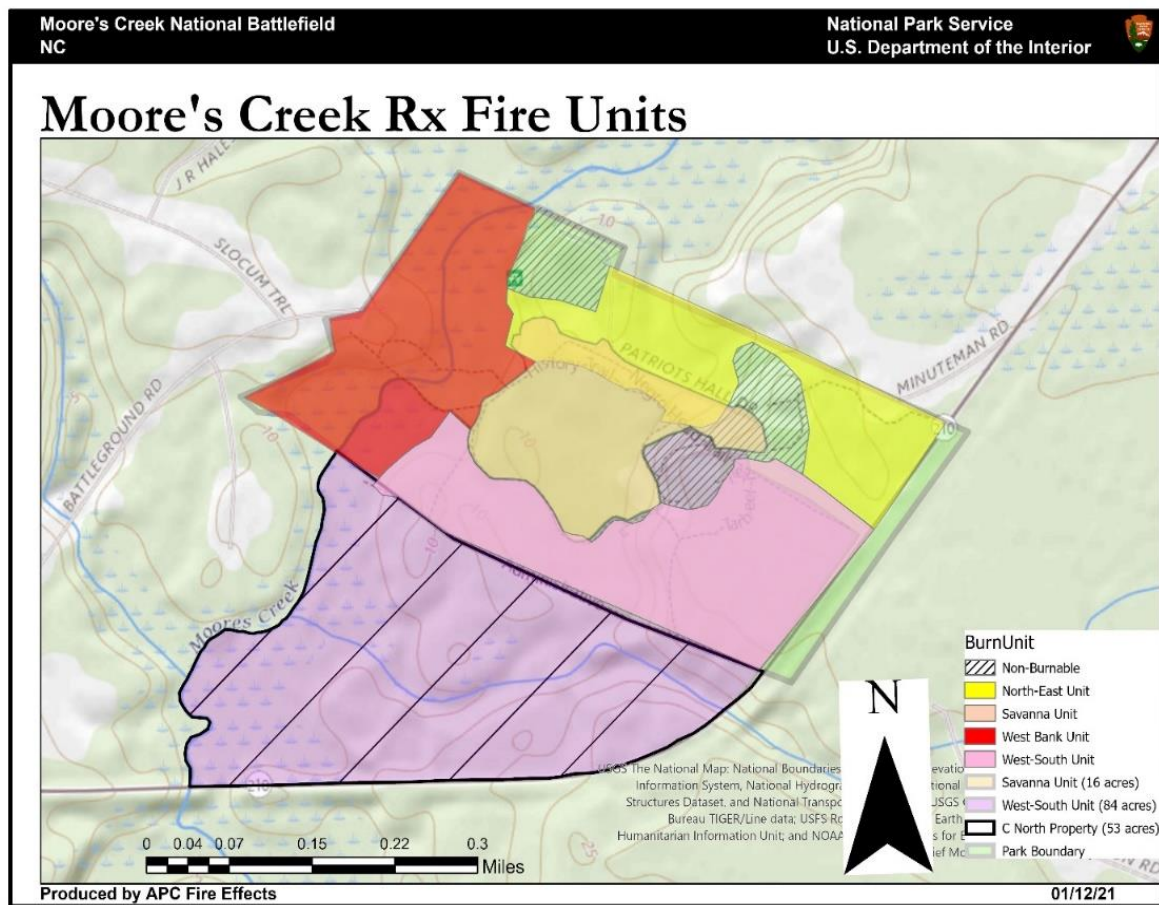


Figure K-1. Prescribed burn units of Moores Creek NB. Treatments for 2022 included the Savannah unit (central tan area) and the Southwest unit (pink). Additionally for 2022, private lands adjacent to and south of the Southwest Rx where also treated (purple area with wide hatch marks called “C North Property”)

Review of 2022 Projects

The Fire Ecology Team visited the Park in June and collected species composition data at each of 5 photo points (2 pre-existing in the Savannah unit and 3 new in the Southwest unit), conducted qualitative monitoring of the Southwest burn unit, and assisted the SECN Inventory and Monitoring crew with installing long-term vegetation monitoring plots in the Savannah and Southwest units.

Brief evaluations based on this monitoring are provided for each unit. The map of the MOCR units (**Figure K-1**) and an extended severity map of the 2022 prescribed burns (**Figure K-2**) are provided for reference.

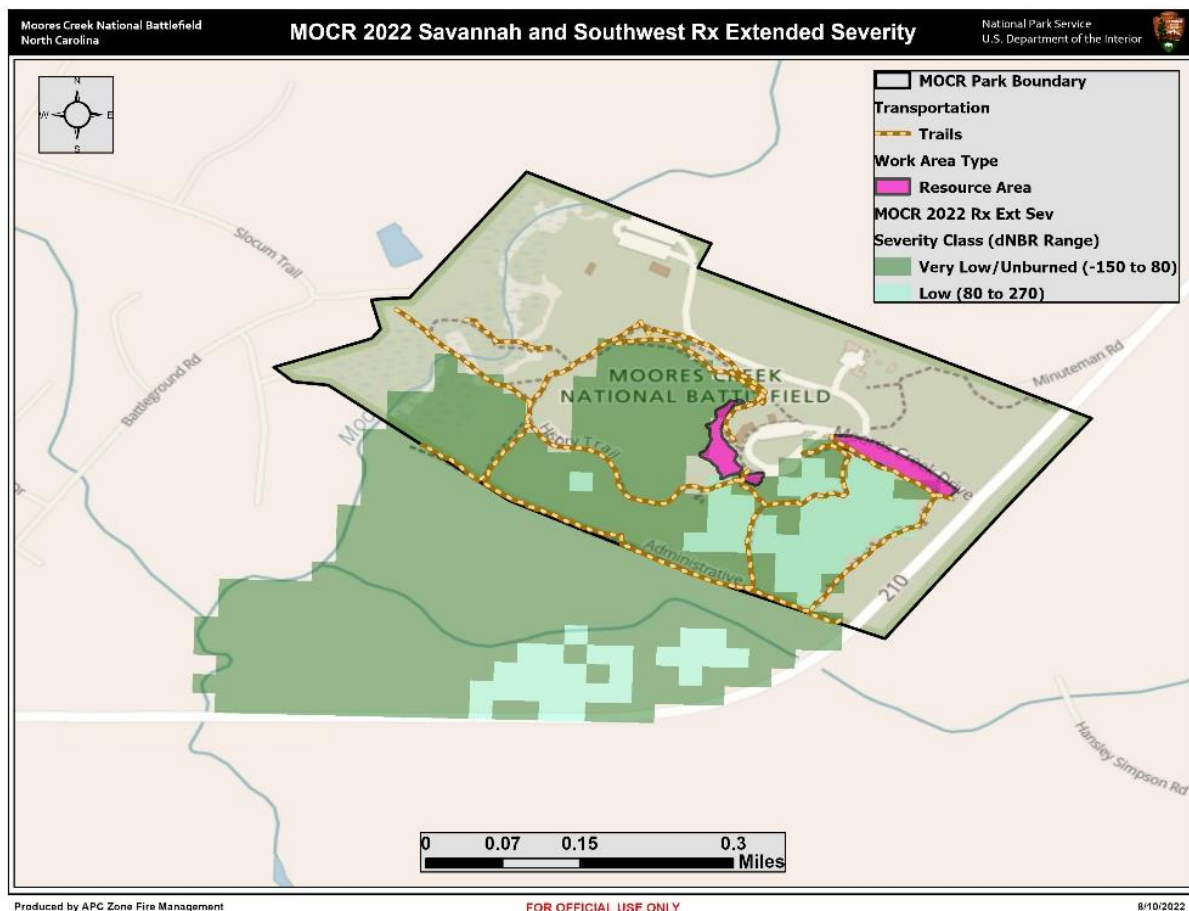


Figure K-2. Extended Burn Severity map for the 2022 Moore's Creek Burn Prescribed Burn Units. Note that most of the burned areas are very low (green pixels) or low severity (aqua blue) largely indicating retention of the existing overstory

Date	Unit(s)	Acres
March 8, 1989	Savannah	3
March 19, 1990	Savannah 5	5
April 9, 1991	Savannah 3	3
March 9, 1992	Savannah 3	3
March 1, 1993	South wildfire and Savannah	5
February 24, 1995	Wildfire 0.1	.1
2004	Mechanical treatment Savannah-Rx?	2,3
2005	Mechanical treatment	2
March 17, 2010	Savannah	4.5
February 10, 2012	Savannah	12
April 22, 2014	Savannah, South and West	24
April 21, 2016	Savannah, South and West	37
April 11, 2017	Savannah, North and East	42
March 29, 2018	Savannah and Southwest	9, 26
April 11, 2019	Savannah and Northeast	24,30
March 1, 2020	Savannah and Southwest (including Currie private)	24, 128
April 22, 2021	Savannah and Northeast	12, 9
March 22, 2022	Savannah and Southwest (including Currie private)	9, 77

Table K-1: History of Prescribed Burning at Moore’s Creek NB. From 1989 to 1995 and possibly ‘04-‘05, burns were conducted by the State (in gray). Beginning in 2010, burns were conducted by the NPS.

Savannah Burn Unit

This year marks the tenth NPS burn treatment of the Savannah unit, which has been the focus of the Park’s prescribed burn program for over 20 years, including a combination of NPS and prior state burn treatments (**Table K-1**). This unit is listed as 12 acres, though only about half of that can be considered wet savannah. It has been burned annually since 2016, and was last burned in late March of 2022. The primary site is a grass/sedge-dominated wetland that is bordered to the west by a young, dense stand of loblolly pine. Monitoring in 2022 was focused on the 2 existing photo points generally located within grass-dominated wetland. Additionally, following a discussion with the park Superintendent, basic species composition data were collected at each photo point to better capture information on changes in woody encroachment over time.



Figures K-3 and K-4. Comparison of Photo Point 1 from 2010 (Top) just prior to the first NPS Rx burn and 2022 (Bottom) the summer following the tenth burn. Note the reduction of woody stems.



Figures K-5 and K-6. Comparison of Photo Point 2 from 2010 (Top) just prior to the first NPS Rx burn and 2022 (Bottom) the summer following the tenth burn. Again, note the apparent reduction of woody stems.

Annual burning from 2016 to present has proven to be very effective at managing woody encroachment within the Savannah unit and the small stand of loblolly pine on the west side remains intact with a moderate reduction in litter and duff buildup and general thinning of the understory. Additionally, for 2022 a narrow strip of woods along the east side of the unit was excluded from burning to allow the understory to regrow and provide a visual screen between the visitor's center and the history battlefield scene.

South/West Burn Unit

The South/West unit has been burned five times since 2014, and was last burned in 2022. This unit is dominated by even-aged loblolly pine forest, with occasional hardwoods, longleaf pine, and pond pine. The upper midstory is quite open, likely as a result of repeated burning. However, there are large amounts of resprouting sweetgum and a variety of other woody trees and shrubs in the lower midstory.

The overall structure of this unit is excellent, with pine canopy cover of 25-50% and an open midstory. The understory has remained fairly open in the first summer following the burn but is expected to quickly fill in with woody resprouts 2-3 years following a given burn. The new photo points and coarse species composition data will provide a better picture of how quickly the understory regrows over time.

A small population of mature Atlantic white cedar that has been heavily thinned from previous burns treatments had one surviving individual prior to the 2022 burn with only a small portion of live canopy. Unfortunately, summer monitoring revealed that this individual did not survive following the burn, apparently receiving too much heat at the base of the trunk. Future burns should carefully focus on ignition patterns, weather conditions, and time of day to help best achieve objectives within the forested areas, especially retaining a live overstory across the unit without creating extensive new canopy gaps.

The following photos are a sampling of pictures from the newly added photo point monitoring:



Figure K-7. Example photo form the newly added Photo Point 3, located on the east side of the unit.



Figure K-8. Example photo from the new Photo Point 4 located along the south edge of the burn



Figure K-9. Example photo from the new Photo Point 5 located relatively near the VC parking lot

In addition to the main Southwest burn unit, the adjacent Currie Woods private land received a second entry burn treatment this spring with significantly better fire spread and higher intensity compared to the initial 2020 burn, resulting in significant thinning of the understory and in some cases midstory.



Figure K-10. Photo of Currie Woods private land that was burned in conjunction with the Southwest unit. Note the thinning of the understory and patch of dead midstory in the center of the photo. Understory thinning like this was common with occasional scattered patches midstory thinning.



Figure K-11. Photo of the Currie Woods unit taken along the highway at the area of highest severity. This is a fairly small scale patch where dense volatile understory live shrub fuels and vine ladder fuels resulted in moderate severity impacts to the understory and midstory with some thinning of the overstory. Given the heavy fuel loading, future burns conducted on a 2-3 year rotation should be less severe.

This year's monitoring was the second attempt to conduct structured monitoring of fire effects on vegetation and fuels at Moores Creek. Additional years of monitoring are needed to understand the trends in fire effects and vegetation change, but some important points come from this year's work:

1. Burning has been very beneficial for structure and diversity of the Savannah unit. Continued annual burning is recommended.
2. Burning has created more open stand conditions in South/West, though rapidly-growing tree sprouts and shrubs dominate the understory vegetation. The newly added photo points with coarse species composition data should help quantify and document change over time.
3. The Currie Wood private land burned very well this year, effectively reducing much of the heavy fuel loading, particularly along the highway. Burning on a 2-3 year rotation with the Southwest unit is recommended to avoid dense regrowth of live shrub understory fuels that contribute to higher fire intensity
4. Collaborating with the SECN I&M was successful and the new baseline long term monitoring plots will provide excellent tracking of longer term change in species composition and structure.
5. Continued dialogue with the park superintendent will help to refine the monitoring needs and direction moving forward.

Appendix L. Outer Banks Group (OBG):

2022 Fire Effects Monitoring Annual Report

Includes: Fort Raleigh National Historic Site (FORA), Wright Brothers National Memorial (WRBR), and Cape Hatteras National Seashore (CAHA).

Activity Summary

During 2022, the APC Zone Fire Ecology team support for OBG was limited to mechanical treatment mapping and reporting and RAWS maintenance. Given the lack of crew members during the typical monitoring period and general time constraints, site visits were limited to a brief trip to CAHA in December to primarily deal with the RAWS station.

Mechanical treatment accomplishments are generally a repeat of last year with maps of treatment areas displayed under “Review of 2022 Projects” section of this report. The focus of our program as we hopefully rebuild crew capacity in the coming year will be to provide operational and monitoring support for any fuels-management projects at OBG, particularly reassessing the Bodie Lighthouse burn unit at CAHA as there is interest in re-treating this area after a roughly 10 year lapse.

Review of 2022 Projects

Fort Raleigh- Heritage Point Fuel Break

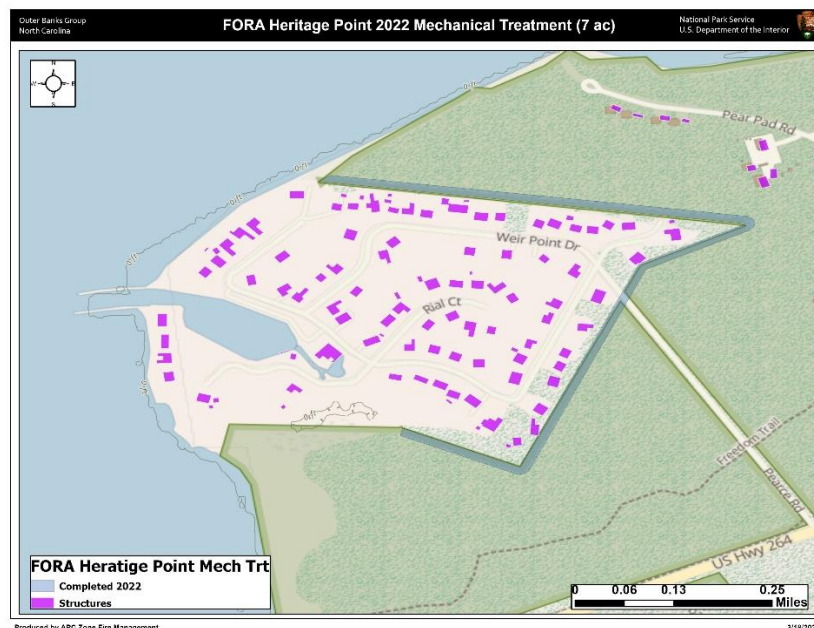


Figure L-1: Map of 2022 Heritage Point Mechanical Treatment

The Heritage Point Fuel Break lies on the Northwest tip of Roanoke Island and is the boundary of Fort Raleigh National Historic Site at the Heritage Point subdivision. The fuel break was first begun in 2011 by the Kings Mountain NMP masticator.

Following this initial mulching, the treatment became more consistent as an annual treatment by USFWS staff starting in 2018. The area treated is approximately 7 acres, with a fuel break width of approximately 20 -30 ft. Fuels along the boundary are variable, and includes thick needle cast and areas of live shrub fuels.

No new monitoring was conducted for this fuel break during 2022 and the treated area remains the same as last year

Wright Brothers Boundary Fuel Reduction

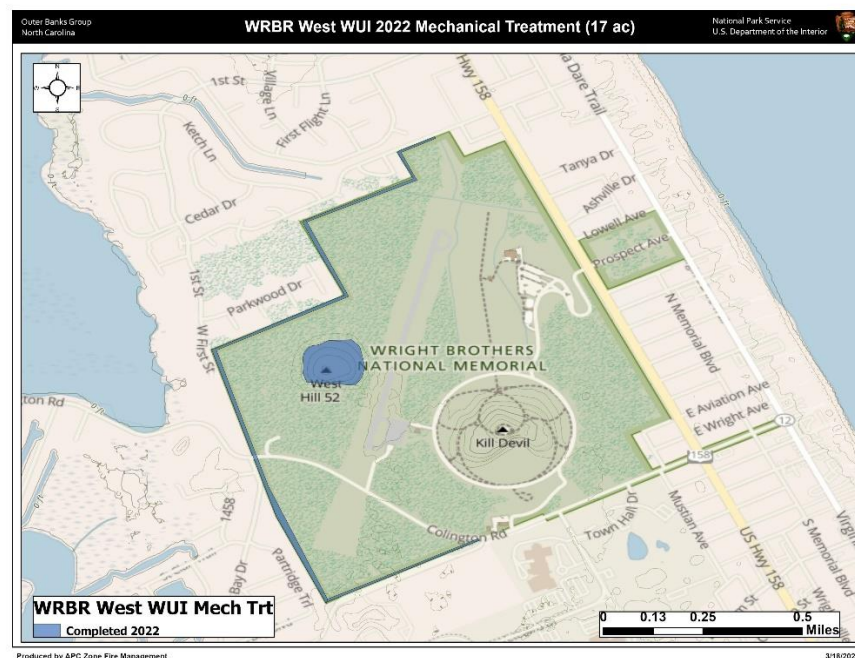


Figure L-2. Wright Brothers NM West WUI 2022 boundary fuels treatment.

The WRBR West WUI mechanical treatment primarily consists of a western boundary mow line along with some interior mowing in the northwest portion of the monument. This 17 acre treatment remains consistent from previous years and no additional monitoring was conducted for WRBR during 2022.

Cape Hatteras National Seashore

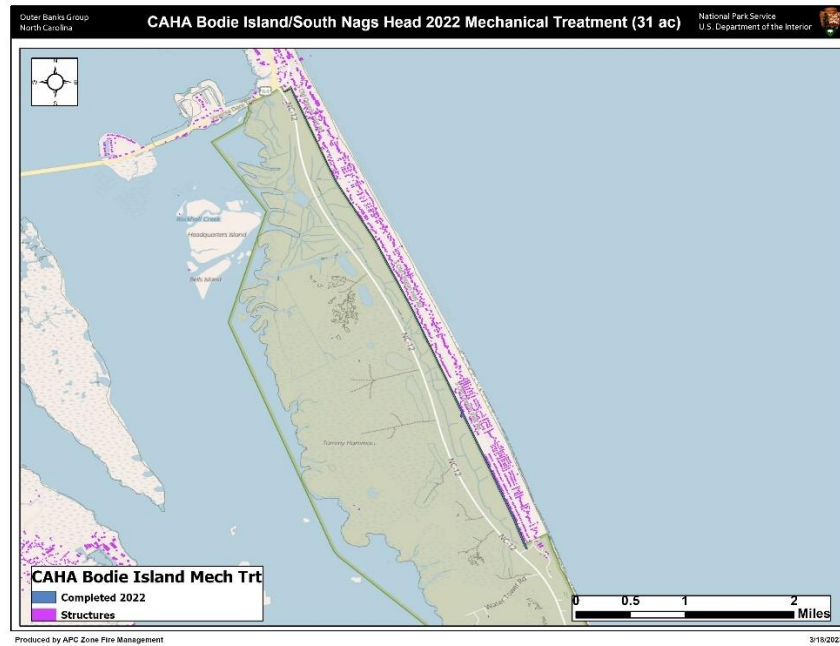


Figure L-3: Map of the South Nags Head Boundary Mechanical Treatment

The CAHA Bodie Island/South Nags Head mechanical treatment is an approximate 4.5 mile cut along the park boundary behind numerous residential structures. The 31 acre treatment area remains consistent with last year's treatment and no additional monitoring was completed in 2022.

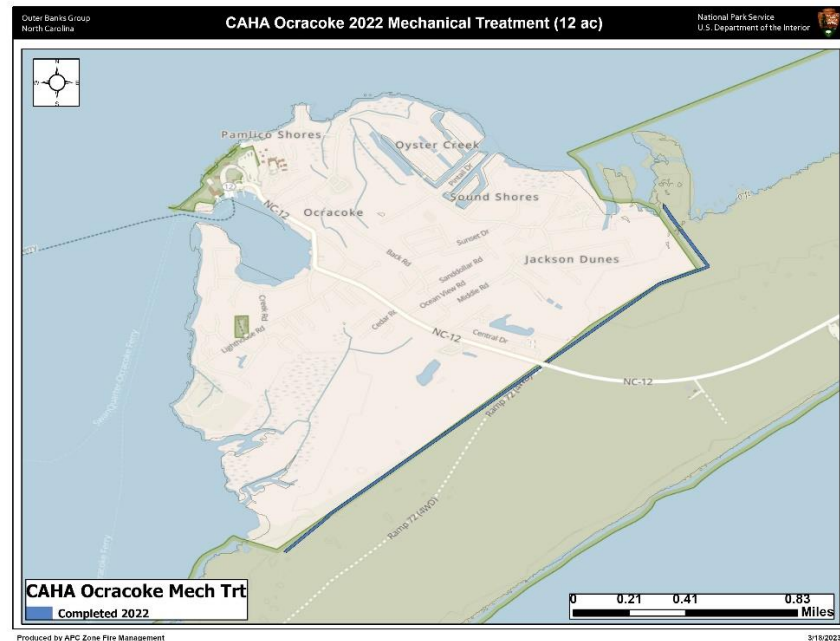


Figure L-4: Map of 2022 Ocracoke Mechanical Treatment Area

Additionally, the CAHA Ocracoke mechanical treatment is a roughly 1.7 mile cut along the park boundary south of the Ocracoke Island community. This 12 acre treatment area replicates the previous year's treatment and no additional monitoring was completed in 2022.