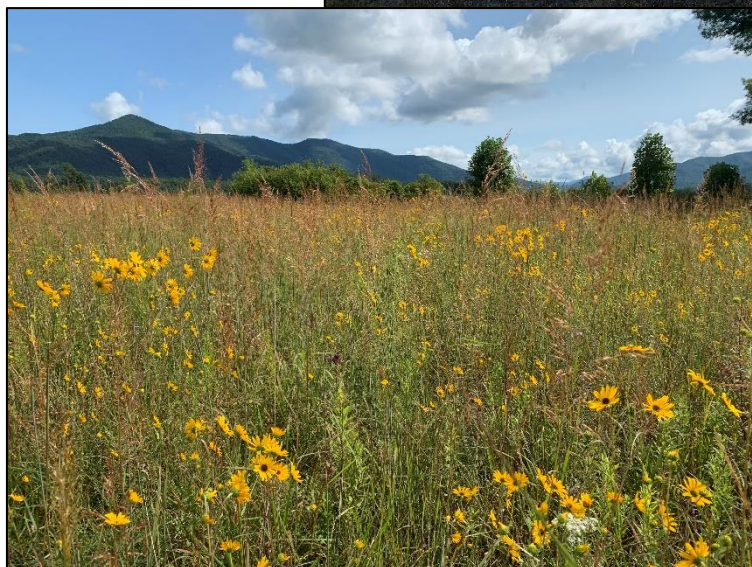




Appalachian/Piedmont/Coastal Fire Management Zone: Fire Ecology Annual Report, 2020





Remarkable results have been achieved at King's Mountain NMP following multiple prescribed burns and mechanical clearing. This site is a shortleaf pine woodland in the Midway burn unit. This work is meeting NPS goals for restoring the historical setting and habitat for native plants and wildlife.

Photo courtesy of Alex Scronce.

On the Cover: *With travel to Zone parks limited by the COVID 19 pandemic, much of the APC Zone Fuels and Ecology efforts were focused on Cades Cove at Great Smoky Mountains NP. Efforts ranged from building partnerships (with Southeastern Grassland Initiative botanists at the Feezell wetland, top left) to prescribed burning and mechanical clearing (Methodist Rx, center right) to monitoring (narrow-leaf sunflowers and Indian grass at Increase Fields, bottom center).*

Appalachian/Piedmont/Coastal Fire Management Zone: Fire Ecology Annual Report, 2020

Robert N. Klein Jr.

E. Wylie Paxton

J. Matthew Wood

Allyson R. Arulanantham (*now with GRSM Vegetation Management Program*)

National Park Service

Appalachian/Piedmont/Coastal Zone Fire Effects Monitoring Program

Great Smoky Mountains National Park

107 Park Headquarters Road

Gatlinburg, TN 37738

January 2021

Contents	Page
Introduction.....	5
Research Update.....	8
Big South Fork NRRRA Annual Report	9
Blue Ridge Parkway Annual Report.....	15
Cape Hatteras NS Annual Report	16
Chickamauga and Chattanooga National Military Park.....	20
Congaree NP Annual Report	22
Cumberland Gap NHP Annual Report	30
Great Smoky Mountains NP Annual Report	34
Kings Mountain NMP Annual Report	52
Moore's Creek National Battlefield.....	58
Additional Program Information.....	67
Fire Ecologist and Fire Effects Crew Accomplishments and Areas of Focus	69

Introduction

Travel restrictions associated with the coronavirus pandemic had a major impact on fire effects monitoring and fire ecology support for our network of parks in 2020. Field work was almost entirely limited to Great Smoky Mountains (GRSM), with only a single monitoring trip made to Kings Mountain (KIMO) in October (**Table 1**). Accordingly, the total number of plot reads was limited to 56, all completed at GRSM. This work ranged from long term monitoring of FMH plots to photo-monitoring of mechanical boundary treatments to development of a rapid monitoring protocol using Survey123.

Highlights included monitoring treatment lifespan in the Ski Mt. fuel break, an examination of high-elevation fire effects from the Chimney Tops 2 wildfire, and resampling of unburned control plots in Lynn Hollow that were originally established in 1998. Knowledge gained from some of this work is discussed in the GRSM section of this report. The annual reports for most parks contain little new information, but all feature the latest analysis of long-term monitoring data and a brief discussion of future plans for monitoring and data analysis. The report for Congaree NP (CONG) includes a new analysis of long-term changes to the herb layer following nearly 20 years of prescribed burning. As requested by park managers, a review of prescribed burn objectives, burn history, and fire effects analysis are included in the Moore's Creek (MOCR) report section.

Prescribed burning was also limited in 2020, although burns were completed at CONG, MOCR, and GRSM (**Table 2**). Mechanical fuel-reduction treatments were completed at 9 parks in our monitoring network. These projects are all briefly described in each park's section, though most of them have no accompanying monitoring information. Hopefully, on-site monitoring of most of these projects will be possible during 2021.

The APC fire-effects team lost an important member in 2020, as Allyson Arulanantham took a position on the GRSM Vegetation Management crew (**Table 3**). Allyson made tremendous contributions to the team in her 3½ seasons, and her work during the challenging first half of the 2020 field season was important for completing the long-term monitoring at GRSM. Fire Ecologist Rob Klein spent two months early in the year detailed into the Region 2 Deputy Regional FMO (Planning, Fuels, and Ecology) position, and the next two months detailed as the Region 1 Fire

Planner/Ecologist. Lead Monitor Wylie Paxton detailed as the Zone Fire Ecologist during these four months, while Matt Wood stepped up to ensure continuity in fire effects field operations and advance the capabilities for electronic data collection.



APC Zone Fire Effects Team 2020: (from left) Wylie Paxton, Matt Wood, Allyson Arulanantham, and Rob Klein

Table 1. 2020 Fire Effects Plot Workload and Total Plots by Park

Park	Monitoring Unit	Plot Type	Control 2020	Pre- burn 2020	Immediate Post-burn 2020	Postburn (1-20 yrs) 2020	Annual Total (2020)	Total Plots
Big South Fork (BISO)	Little Bluestem	FMH Forest Plot					0	4
	Shortleaf Pine	FMH Forest Plot					0	2
	White Oak	FMH Forest Plot					0	13
	LFEM	Modified FIREMON Species Composition					0	21
	CBI	CBI					0	9
	Fuels Transect	Fuels Transect					0	4
Blue Ridge Parkway (BLRI)	Chestnut Oak	FMH Forest Plot					0	2
	LFEM	Modified FIREMON Species Composition					0	7
	Fuels Transects	Fuel Transect					0	6
	Photo Points	Photo Point					0	6
Cape Hatteras (CAHA)	LFEM	Modified FIREMON Species Composition					0	17
	Photo Points	Photo Point					0	33
	Photo Points (Non-Permanent)	Photo Point					0	10
Chickamauga & Chattanooga (CHCH)	LFEM – Post Oak Woodland	Modified FIREMON Species Composition Forest					0	3
	LFEM – Glade	Grassland					0	6
Congaree (CONG)	Loblolly Pine	FMH Forest Plot					0	5
	Longleaf Pine	FMH Forest Plot					0	5
	Harry Hampton Mastication (LFEM)	Modified FIREMON Species Composition					0	17
Cowpens (COWP)	Southern Red Oak	FMH Forest Plot					0	2
Cumberland Gap (CUGA)	Scarlet Oak	FMH Forest Plot					0	16
	LFEM	Modified FIREMON Species Composition					0	10
Great Smoky Mountains (GRSM)	Black Oak	FMH Forest Plot	2			4	6	8
	Scarlet Oak	FMH Forest Plot				2	2	15
	Yellow Pine	FMH Forest Plot				3	3	40
	LFEM	Modified FIREMON Species Composition					0	49
	Mechanical Treatments	PhotoPoints –				18	18	18
	CBI						0	128
	Fuels Transect	Fuels Transect	8			8	16	18
	Survey123 Rapid Assessment Form					11	11	11
Kings Mountain (KIMO)	Blackjack Oak	FMH Forest Plot					0	8
	Chestnut Oak	FMH Forest Plot					0	21
	LFEM	Modified FIREMON Species Composition					0	20
	Fuels Transect	Fuels Transect					0	3
Moore's Creek (MOCR)	Photo Points	Photo Point					0	2
Total			10	0	0	46	56	539

Table 2. Summary of 2020 Fuels Treatments and Associated Monitoring

Park	Treatment Name	Plots ?	Other Monitoring	Acres
Big South Fork (BISO)	Newtie King Mech Trt	Yes	Mapping only	130
Cape Hatteras (CAHA)	South Nags Head Mech Trt	No	Mapping only	90
	Ocracoke Mech Trt	No	Mapping only	12
Chickamauga Battlefield (CHCH)	Battlefield Understory Restoration Mech Trt	No	Mapping only	116
Congaree (CONG)	Harry Hampton West Rx	No	Mapping only	28
	CONG Mech Fuels Trt	No	Mapping only	5
	HamptonVC Rx	No	Mapping only	17
Fort Raleigh (FORA)	Heritage Point Mech Trt	No	Mapping only	8
Great Smoky Mountains (GRSM)	Methodist Rx	No	Yes (FEMO, Qualitative)	85
	Increase Fields Rx	No	Yes (FEMO, Qualitative)	272
	Upper Tater Rx	No	Yes (FEMO, Qualitative)	31
	Cades Cove Mech Trt	No	Yes (Qualitative, Mapping)	248
	Ace Gap Mech Trt	Yes (Photo Points)	Yes (Rapid Assessment, Mapping)	9
Kennesaw Mountain (KEMO)	Hazard Fuel Reduction	No	Mapping only	3
Kings Mountain (KIMO)	Piedmont & Partner Mech Trt	No	Yes (Avenza, Mapping)	103
Moore's Creek (MOCR)	Savannah	Yes (Photo Points)	No	16
	Southwest (w/ Currie Woods)	No	No	80
Wright Brothers (WRBR)	West WUI Mech Trt	No	Mapping only	27
18		3	16	1280

Table 3. Fire Ecology/Fire Effects Staffing 2020

Team Member	Starting Date	Ending Date	# of Pay Periods	READ (Yes or No)	Training and Development
Rob Klein (Fire Ecologist)	1/1/20	12/31/20	26	Yes	60-day detail as R2 RFMO; 60-day detail as R1 Fire Planner/Ecologist; R Stats Training; Story Circles Science Communication; PEPC Training; FEMO
Wylie Paxton (Lead Monitor)	1/1/20	12/31/20	26	Yes	90-day detail as APC Zone Fire Ecologist; READ Training cadre; RT-130 cadre for NC and TNC; NEPA Training; Guest lecture for Austin Peay; InFORM Training; ENGBt assignment in CO; Story Circles Science Communication; Conflict Resolution training; RT-219, ATVO/UTVO, A110 @ Bell Buckle
Matt Wood (Assistant Lead)	1/1/20	12/31/20	26	No	R stats training, Developed Survey123 Rapid Assessment Monitoring form, Assisted w/ testing of FFI remote app, Maintenance and repair of 2 GRSM RAWS, Managed GRSM WIMS data, Assisted w/ Rx Burns @ GRSM
Allyson Arulanantham (STF Crewmember)	3/15/20	8/15/20	9	Yes	Detailed to Veg 1/7-3/14; WTREX; Detailed into Situation Unit for GRSM COVID IMT; Story Circles Science Communication; Took new job with Veg starting 8/2/20;

Research Update

Cape Hatteras

Historical Analysis Investigating the Change in Distribution of *Phragmites australis* at Cape Hatteras.

PI - Rachel Smaby

East Carolina University

Chattahoochee River

Terrestrial Vegetation Monitoring in Southeast Coast Network Parks

PI - Forbes Boyle,

NPS SECN I & M Program

Chickamauga and Chattanooga

Cumberland Piedmont Network Forest Vegetation Monitoring

PI - Clare Bledsoe,

National Park Service - Cumberland Piedmont I&M Network

Cumberland Gap

Update Status of Rare Plants in Cumberland Gap National Historic Park

PI - Zach Irick,

Austin Peay State University

Cumberland Piedmont Network Forest Vegetation Monitoring

PI - Clare Bledsoe,

National Park Service - Cumberland Piedmont I&M Network

Great Smoky Mountains

Overstory Mortality Effects on Fuel Accumulation from the Fall 2016 Chimney Tops 2 Wildfire.

PI - Don Hagan,

Clemson University

Wildfire Effects on Salamander Populations in Great Smoky Mountains National Park

PI - Bill Peterman, Dan Hocking, John Crawford, Joe Milanovich

Lindenwood University, Frostburg State U., Ohio State U., Loyola of Chicago U.

Evaluating the effects of 2016 wildfires on soil invertebrates in the southern Appalachians

PI - Mac Callahan and Bruce Snyder

Institution US Forest Service and Georgia College

Are there non-additive effects of fire and urbanization on soil properties and plant community assembly and functional traits?

PI - Jennifer Schweitzer and John Schwartz, as well as Karen Hughes and Charlie Driscoll

University of Tennessee

Big South Fork National River and Recreation Area (BISO): 2020 Fire Effects Monitoring Annual Report

Activity Summary

During 2020, the APC Zone fire effects 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. Early in the year, the fire ecologist and lead monitor provided a conference-call briefing of the 2019 Annual Report to park managers and MS River Zone Fire staff. This prompted some good discussion about the current status and future objectives for the native grasslands at Newtie King. Particularly on the need for more consistent and frequent burning to achieve long term objectives for the site.

Overall, services were limited in 2020 due to complications associated with the coronavirus pandemic. No prescribed burns were completed, and no monitoring trips were possible due to travel restrictions. A single mechanical fuels treatment was completed at the Newtie King site. Although no direct monitoring by our team was possible, this report contains a map of the project accomplishments and some notes from observations made by park staff.

The fire ecologist participated in several meetings and virtual presentations about the “Cumberland Plateau Ecozone Mapping Project” that was sponsored by the Tennessee Chapter of The Nature Conservancy. The maps produced by this project include the TN portion of BISO, CUGA, and OBED. These maps and associated data will be useful for continuing to build our understanding of the fire ecology and fire restoration priorities for those parks. The project is discussed in the “Review of 2020 Projects” section of this report.

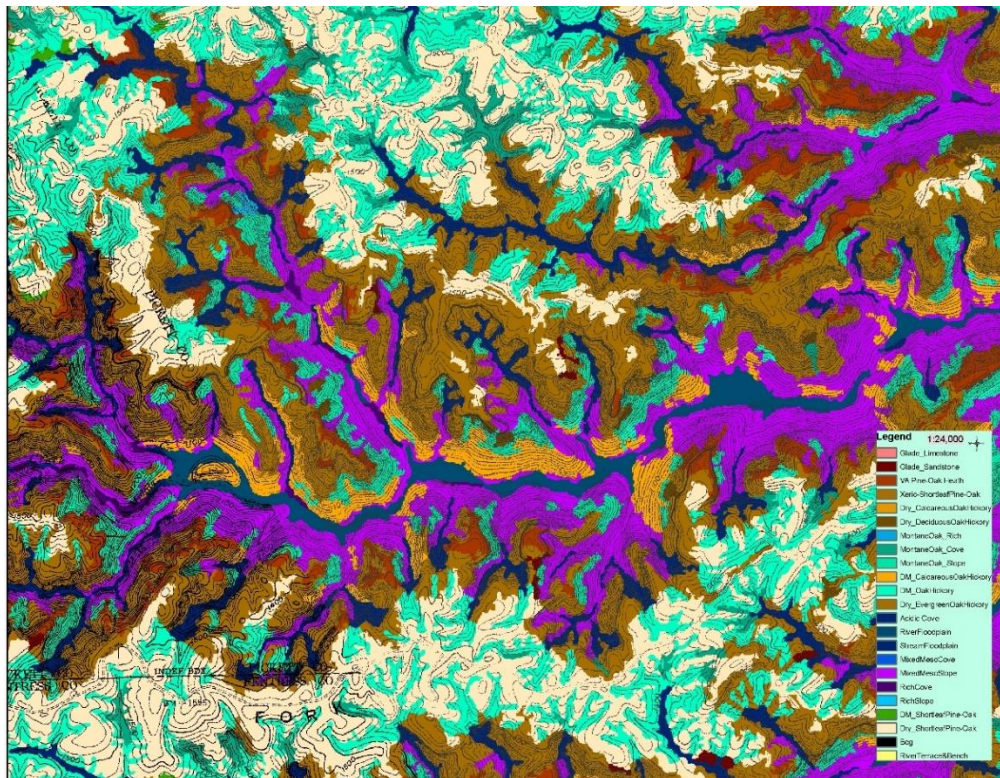
Review of 2020 Projects

1. Ecological Zones and “Ecomath” for the Cumberland Plateau and Cumberland Mountains in Tennessee:

In July of 2020, Steve Simon submitted the final report for this two-year project to map and describe “Ecozones” for the entire Tennessee portion of the Cumberland Plateau and Cumberland Mountains (CP/CM). Ecological zones are best understood as *potential natural vegetation* based on a suite of topographic variables, which include topographic features that affect the spread of fire across the landscape. Conceptually, these potential natural vegetation types can be thought of as the vegetation composition and structure that likely existed prior to widespread European settlement and development of the area. Over 1900 field plots were sampled to help establish map accuracy and provide reference data for all ecozones.

The key product of this work is a fine-scale GIS database of Ecozones with a minimum mapping unit of 0.10 acre. The report itself is also quite informative, providing descriptions of the composition and structure of each Ecozone, along with representative photos. **Figure 1** (taken from Simon's report), below, provides an example of the map product from Station Camp Creek and Fork Ridge (BISO), highlighting the mesophytic communities within the steep drainages, dry shortleaf pine-oak communities of the upper slopes and ridges, and oak-hickory forests in the transitional areas.

Figure 1. *Ecozones of Station Camp Creek and Fork Ridge, Big South Fork NRR.*



Highlights from the report include:

- Nearly half of the 4-million acre CP/CM landscape supports or could support various forms of oak-hickory forests and woodlands
- Shortleaf pine – oak woodlands and savannas represent the single-largest ecozone, covering one-third of the CP/CM landscape, though intact examples of this once dominant vegetation type are difficult to find on today's landscape
- Rare vegetation types (glades, barrens, bogs, and fens) account for <1% of the pre-European vegetation cover, and these types are even more rare today due to habitat conversion and degradation
- Fire-adapted Ecozones (mostly dry pine and oak woodlands) are estimated to have covered over 85% of the pre-European landscape within the CP/CM project area.

Ecomath

An additional part of this project was the completion of “Ecomath” for the same project area. This effort was conducted by Josh Kelly, and centered on the use of Ecozones and a number of additional variables to highlight areas within the CP/CM with the greatest concentrations of fire-adapted natural communities. The map data resulting from this effort can be used to plan and develop priorities for prescribed-fire restoration for the entire region, or for specific land holdings within the region, such as BISO, CUGA, and OBED (**Figure 2**).

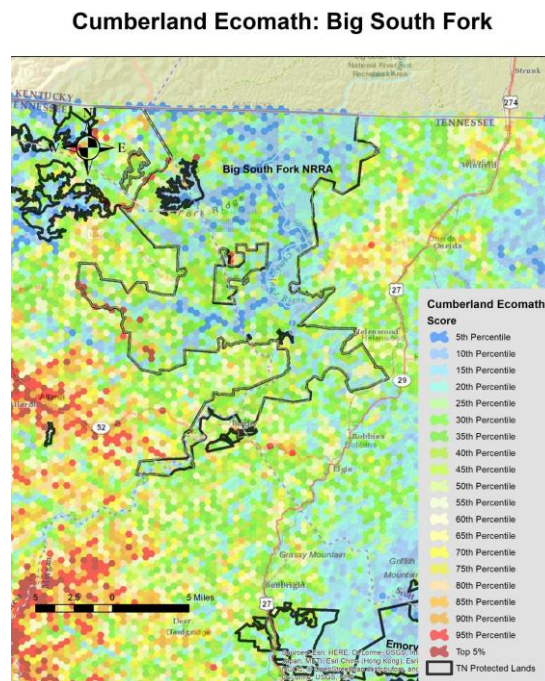
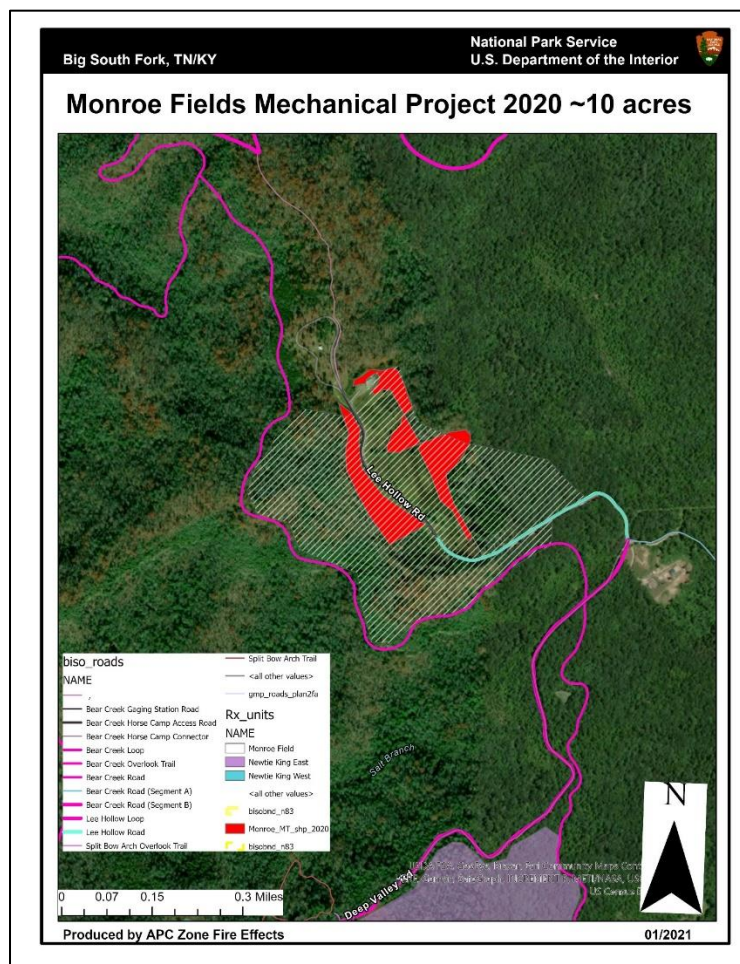
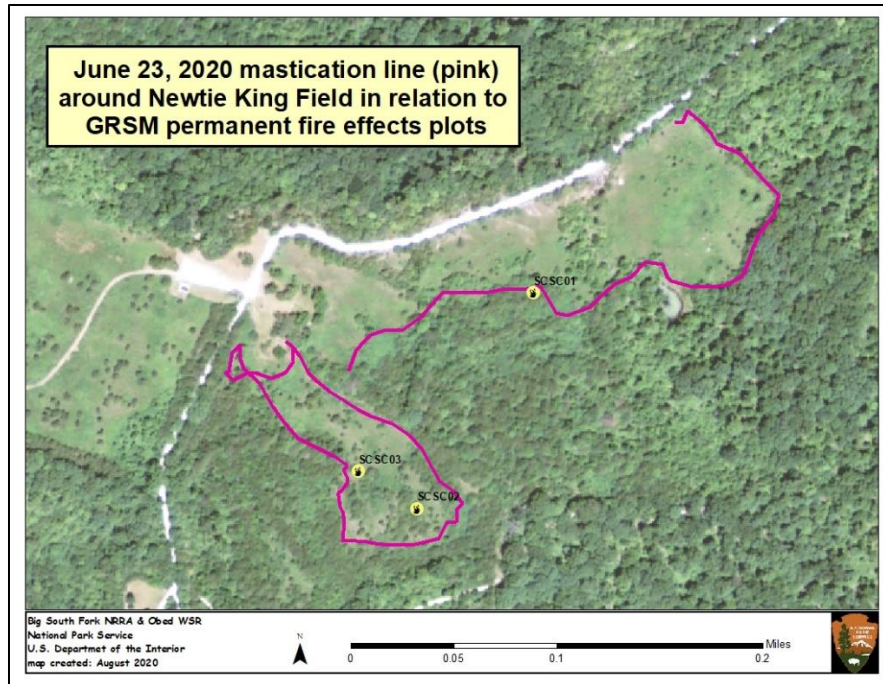


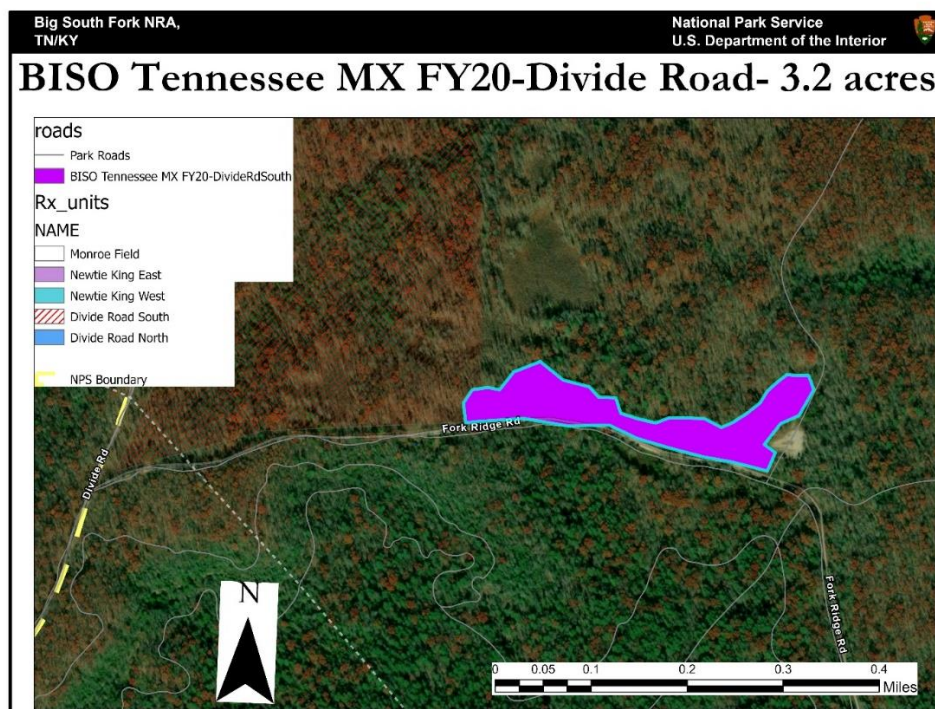
Figure 2. Ecomath results for TN portion of BISO (outlined in green). Red and orange pixels represent the highest scores for BISO as compared to the rest of the CP/CM landscape. These values can be re-scaled to more clearly depict the highest priorities within BISO.

2. Mechanical Fuels Treatments:

During the summer of 2020, APC Zone Fire Ops Specialist Alex Scronce worked with BISO staff and the MS River Zone staff to complete three mechanical fuel reduction projects with the skid-steer/masticator. The following table provides the project names and primary objectives, and maps are provided below that depict the work completed.

Project Area	Project Type	Project Objective
Newtie King	Perimeter cut	Establish perimeter around fields, so that glades/fields could be burned independent of surrounding woods
Monroe Field	Field clearing	Mulch encroaching woody stems in grassland restoration site
Divide Road	Invasive plant clearing	Cut and mulch large patch of Kudzu for follow-up chemical treatments





Kudzu removal at Divide Road RX unit

Long Term Monitoring Results

Updates for this year were limited to *herbaceous cover* of dry-oak forest plots. As with all of the long-term variables, none of the plots has burned enough times to provide a formal statistical answer to the question of whether prescribed burning objectives are being met. That said, the *trends* for herbaceous cover are quite positive, and are corroborated by numerous field observations at BISO. These trends need to be tracked over time as more of the plots are repeatedly burned.

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:

- 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
- 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 1. Objectives and long-term monitoring results for BISO.

Vegetation Type	Management Objective Restoration Phase- (After 4 burns)	Monitoring Results (80% confidence intervals)	Objective Achieved?	Year Last Analysis Completed
Dry Oak Forest (FQUAL1) 14 plots - <i>11 have burned once</i> <i>7 have burned twice (3 Fuel Transects have also burned twice)</i> <i>5 have burned three times</i> <i>3 remain unburned</i>	>50% Reduction in total fuel loading	<u>Total fuel load change</u> After one burn (n=10): -52% ($\pm 3\%$) After 2 burns (n=8): -43% ($\pm 7\%$) After 3 burns (n=3): 46% ($\pm 27\%$)	Insufficient data. Trends need to be reexamined.	2018
	>70% Reduction in pole-sized tree density ($\leq 15\text{cm dbh}$)	<u>Pole reduction</u> After one burn (n=10): 62% ($\pm 11\%$) After 2 burns (n=4): 93% ($\pm 10\%$) After 3 burns (n=2): 69% ($\pm 27\%$)	Insufficient data, but the trend is very positive	2018
	20-40% Reduction in overstory tree density ($>15\text{cm dbh}$)	<u>Overstory reduction</u> After one burn (n=11): 5% ($\pm 3\%$) After 2 burns (n=5): 36% ($\pm 17\%$) After 3 burns (n=3): 28% ($\pm 40\%$)	Insufficient data, but the trend is very positive	2018
	>200 tall ($>1\text{m}$) Oak seedlings /ac	<u>Oak Seedlings:</u> 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)	Insufficient data, but the trend is very positive. Objective may need to be revised.	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)	Insufficient data, but the trend is clear and positive	2021
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. Objective may need to be revised.	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

Note: Underscored sample size indicates that minimum plot numbers exist for $\alpha = 0.20$

Blue Ridge Parkway (BLRI): 2020 Fire Effects Monitoring Annual Report

Activity Summary

Overall, services were extremely limited in 2020 due to complications associated with the coronavirus pandemic. No prescribed burns or mechanical treatments were completed by NPS staff, and no monitoring trips were possible due to travel restrictions.

A cooperative burn of the ‘Lost Bear’ burn unit was planned by USFS Grandfather Ranger District, but was not completed. The most current multi-year treatment plan for future prescribed burns and other fuels treatments could not be located in the recently updated FMP, but the table below provides the most current list of planned projects from the NFPORS database. Note that all of the planned units are primarily USFS burns, so no NPS monitoring plots are present in those units. It is recommended that the multi-year fuels treatment plan be revisited during the upcoming annual update of the FMP. The only upcoming monitoring project is 5-year post-burn resampling of the long-term monitoring plots at the ‘Air Bellows’ burn unit near Doughton Park.

FY	Treatment Name and Type	Lead Agency	Monitoring Plots?
2021	Lost Bear Prescribed Burn	USFS	No
2021	Singecat Prescribed Burn	USFS	No
2022	Lost Bear Prescribed Burn	USFS	No

The retirement of Bob Cherry is a significant event for the BLRI prescribed-burn and monitoring programs. Bob took the lead for many years in identifying priority burn areas and coordinating multi-year treatment planning, fire effects monitoring, and prescribed fire operations between the Parkway and both NPS Fire staff and US Forest Service Fire staff. In the coming year, it would be beneficial for BLRI Fire program to identify a staff member or members who will take on these coordination roles.

Cape Hatteras National Seashore (CAHA): 2020 Fire Effects Monitoring Annual Report

Activity Summary

Overall, services were extremely limited in 2020 due to complications associated with the coronavirus pandemic. No prescribed burns were completed, and no monitoring trips were possible due to travel restrictions. Additional monitoring trips during 2021 will be contingent upon travel or health-related restrictions, and it is expected that any monitoring trips to Outer Banks parks in the coming year will focus on fire effects at Moore's Creek NB and/or fuels treatment planning at Cape Lookout NS.

Review of 2020 Projects

Four mechanical fuel-reduction projects were completed in 2020 (**Figures 1-4**). These projects consisted primarily of mowing and/or follow up treatments of existing fuel-breaks. Some of the boundary work at Wright Brothers represents the initiation of a new fuel break, and it is expected that these fuel breaks along the park's western boundary will be maintained going forward. Future monitoring will be needed to determine treatment lifespan and make recommendations about the scheduling of follow up treatments.



Figure 1. Ocracoke Fuel Break, Ocracoke Island

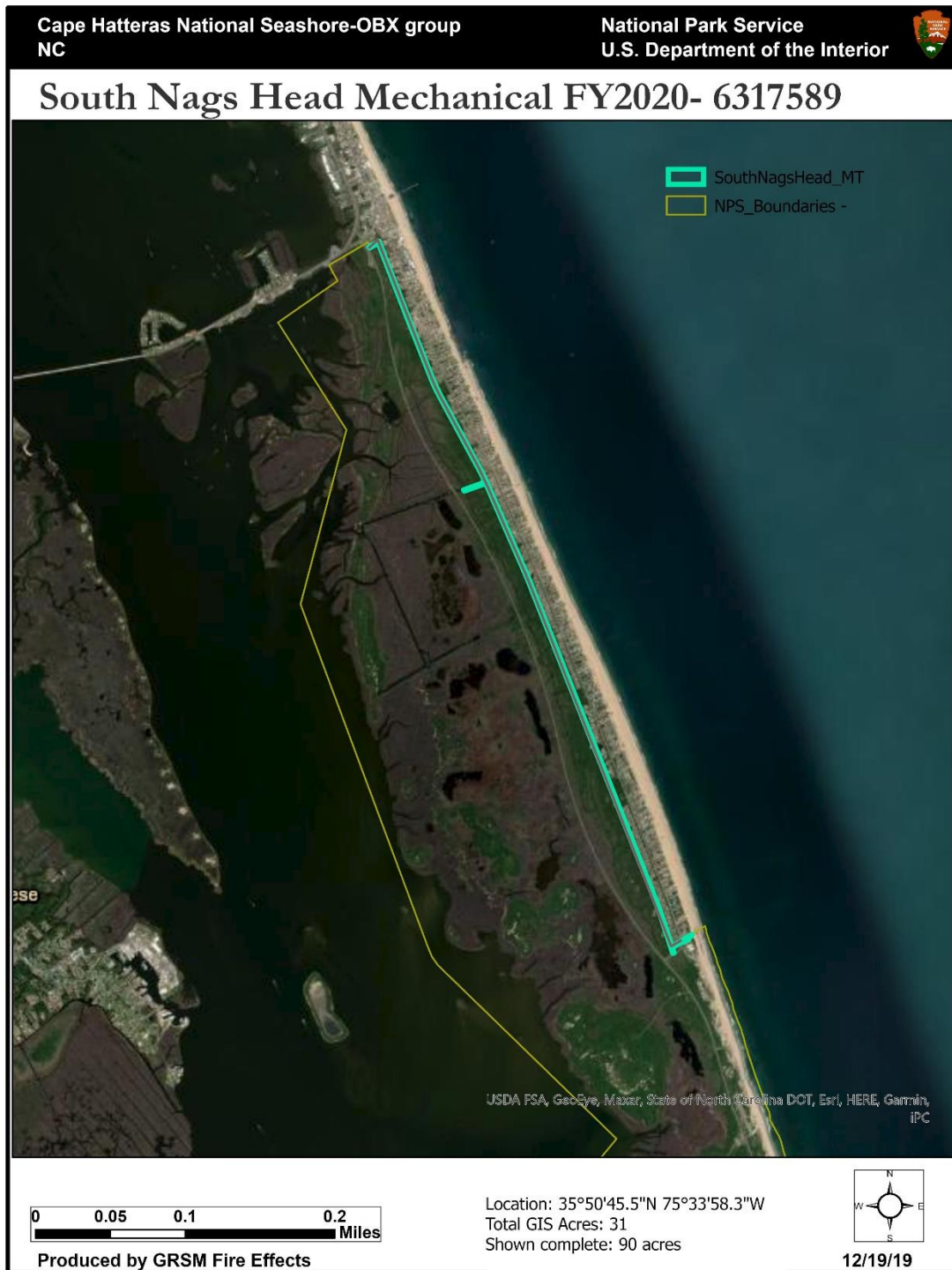


Figure 2. *South Nags Head Fuel Break, Bodie Island*



Heritage Point MT_6317622nfpors-6 acres



Produced by APC Fire Effects

3/2020

Figure 3. *Heritage Point Fuel Break, Roanoke Island*



**Wright Brothers Memorial West WUI Fuels Treatment-
6317625- ~ 25 acres**

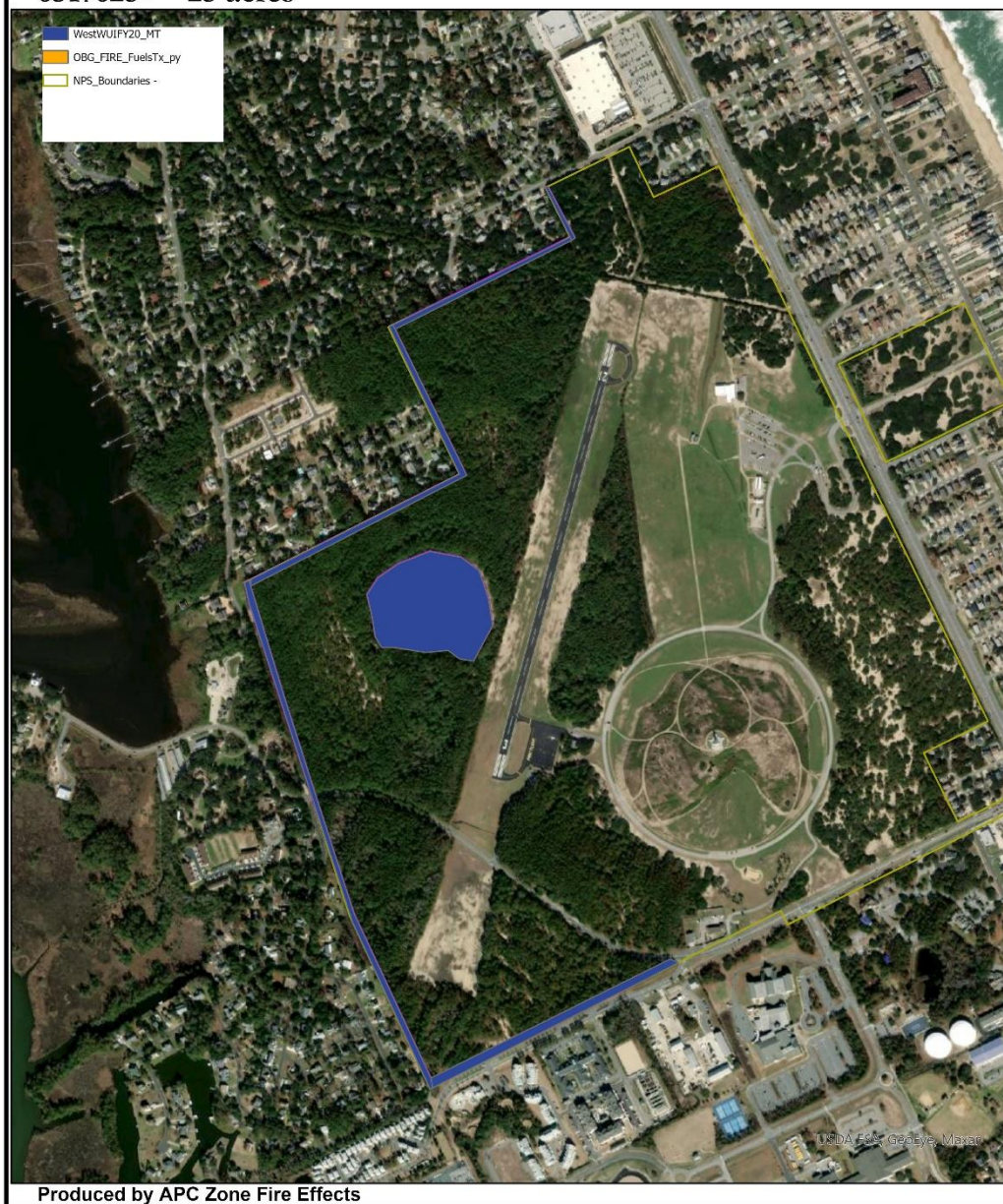


Figure 4. Wright Brothers Fuel Break, Kill Devil Hills, NC

Chickamauga/Chattanooga National Military Park (CHCH): 2020 Fire Effects Monitoring Annual Report

Activity Summary

Overall, services were extremely limited in 2020 due to complications associated with the coronavirus pandemic. No prescribed burns were completed, and no monitoring trips were possible due to travel restrictions. As a result, the ‘Viniard-Alexander Central’ prescribed burn, which was scheduled to be the inaugural project for a prescribed-fire restoration program, was postponed. Pre-burn monitoring for that project is complete, and we hope to complete the burn in the coming year.

Once the burn has been completed, monitoring efforts will focus on post-burn sampling of the long-term plots within that burn unit. Additional pre-burn monitoring may also be completed for the ‘Viniard-Alexander East’ and ‘V-A West’ burn units, which are scheduled for future burning. The goals and objectives for the Viniard-Alexander prescribed burns, 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:

A. *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.

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

B. *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.

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

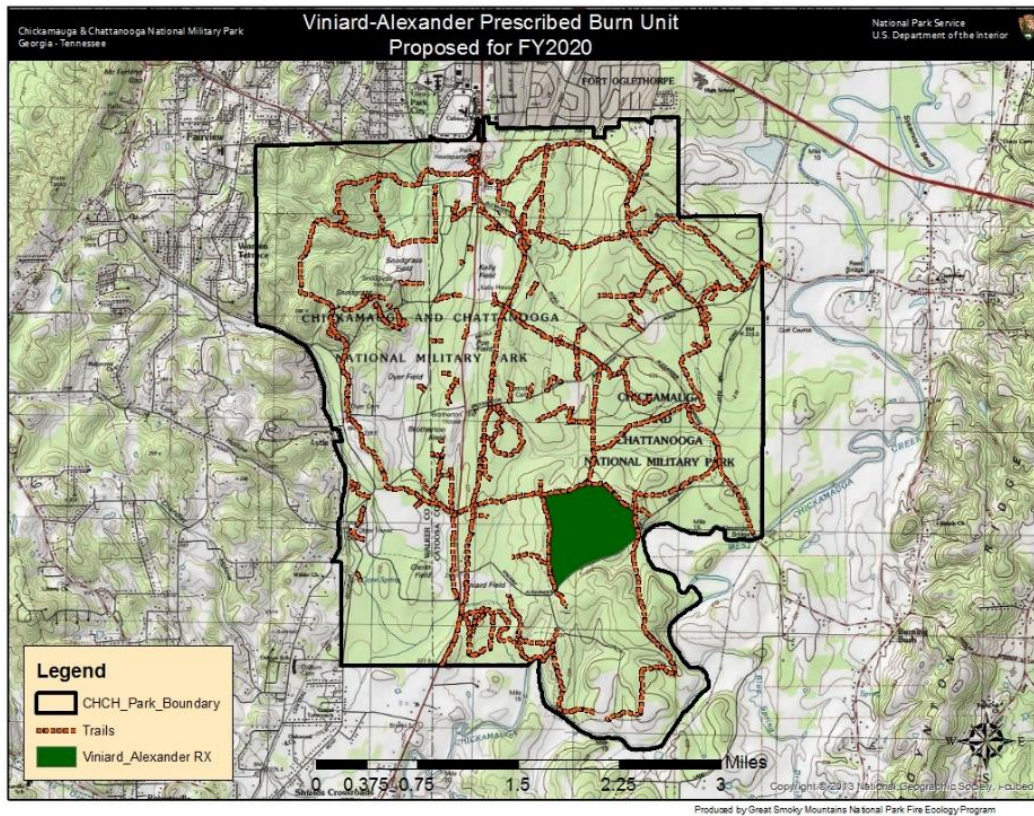


Figure 1. Location of proposed 'Viniard-Alexander Central' prescribed burn unit.

Congaree National Park (CONG): 2020 Fire Effects Monitoring Annual Report

Activity Summary

Overall, services were extremely limited in 2020 due to complications associated with the coronavirus pandemic. Two small prescribed burns and 25 acres of mechanical fuel-reduction were completed in 2020. No formal monitoring was associated with these projects, but maps and basic information are provided in the ‘Review of 2020 Projects’ section of this report.

No long-term monitoring trips were possible due to travel restrictions, so there are no updates to the monitoring results for long-term objectives in **Table 1**. Additional analyses were completed to examine long-term changes in the forest understory. Monitoring results from over 20 years of understory sampling are provide in the “Long Term Monitoring Results” section of this report.

Review of 2020 Projects

2020 Prescribed Burning and Mechanical Treatments

Congaree NP completed 2 small-scale burns with local staff and Alex Scronce as burn boss. The first was a series of sprWUI burns around the maintenance area, the Longleaf campground, and across the road from the Science Center (**Figure 2**). Burn Boss notes reported successful test burn in green grass of campground, slow burning and heavy torch-fuel use near LE and Learning center, good consumption of pine litter in unit south of Simms road. The second burn occurred November 4, 2020. It was the narrow strip of land between the park boundary and west of the entrance road. A few pictures were available where the treatments occurred (**Figures 1 and 3-4**), but no FEMO report was available and no post-burn monitoring took place. A 5-acre block was mechanically treated as a demonstration with a new piece of equipment. This area was North of Bluff backcountry campground in the open canopy area.



Figure 1. Fire effects near location of planted longleaf south of Simms Road

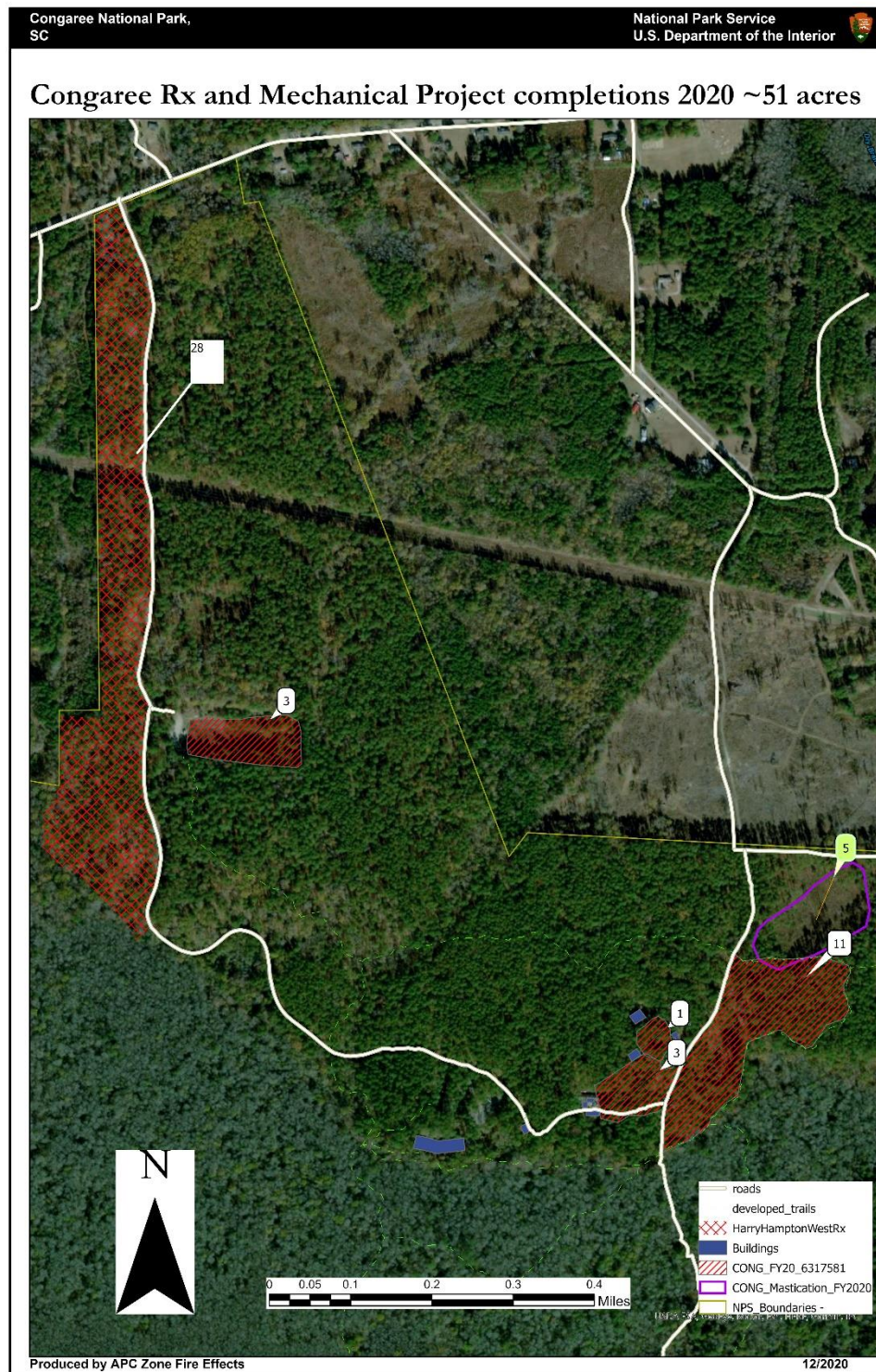


Figure 2. Map of completed fuel projects for 2020



Figure 3. Fire Behavior along entrance road and Harry Hampton West burn



Figure 4. Fire Behavior near powerline area on Harry Hampton West burn

Long Term Monitoring Results

As mentioned above, no plots were burned, and no new data were collected during the 2020 field season. **Table 1** below provides the most up-to-date monitoring results from the available data. As noted in previous reports, these objectives need to be reviewed and possibly revised to make them more achievable and meaningful.

Table 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	Objective Achieved?	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

Additional Long-Term Monitoring Results:

Changes in Herb-Layer Cover in the RCW and Harry Hampton burn units: 1998 - 2018

Introduction and Methods

The goals and objectives listed in the Congaree NP Fire Management Plan focus on restoration of longleaf pine and red-cockaded woodpecker (RCW) habitat, and they do not specifically include objectives relating directly to the understory. However, the understory of longleaf pine habitat throughout its range is typified by high cover and diversity of native herbaceous species. Although most of the areas currently being prescribed-burned at Congaree are dominated by successional loblolly pine forest, one of the changes that managers hope and expect to see with prescribed burning is an increase in the cover of

native grasses and forbs. An analysis of data from 20 years of sampling using the “Cover (points)” FFI protocol was conducted to explore changes in understory cover in combined plots from the “RCW” and Harry Hampton (“HH”) burn units. Additional analysis was also performed to look at differences in the understory response separately within each unit.

To help provide context for these changes, **Table 2** below provides the prescribed burn history for the RCW and HH burn units. Both of these units contain monitoring plots, but those plots have not always burned completely during every burn event. We have kept track of which plots haven’t burned, but for the purposes of this analysis, plots in RCW are assumed to have burned 10 times, and plots in HH are assumed to have burned 8 times.

Table 2. Prescribed burn history of RCW and Harry Hampton burn units.

Number of Burns	RCW* 10 Burns	Harry Hampton 8 Burns
1 st	4/8/1999	Spring 2002
2 nd	4/27/2001	4/29/2004
3 rd	5/16/2002	3/3/2006
4 th	4/29/2004	10/29/2008
5 th	3/3/2006	3/13/2012
6 th	10/29/2008	5/6/2014
7 th	3/13/2012	4/18/2016
8 th	5/6/2014	3/28/2018
9 th	4/18/16	-
10 th	5/7/18	-

*The RCW burn unit was burned several times prior to 1999, though no monitoring was done, so it’s not clear how many times these plots burned.

The RCW burn unit has five long-term monitoring plots, and there are 3 plots in the Harry Hampton unit. The understory is sampled using one to two 50-meter point-intercept transects, where all species encountered at each sample point is listed, and the height of the tallest “hit” is recorded. This method provides cover, frequency, and average height for the dominant species in the understory. All herbs, vines, shrubs, and trees < 2 meters tall are included in the sample, and cover values can be viewed for individual species or grouped by lifeform. For this analysis, species were grouped by lifeform. The “Herb” lifeform includes all grasses, grass-like plants, forbs, and ferns. Follow-up analyses can be conducted if managers have questions about the changes in cover of individual species.

Results and Discussion

Figure 1 provides the primary results of this analysis. Mean cover of all vegetation (herbs + trees + shrubs + vines) prior to burning was 59%, and this increased to 95% following 8-10 burns. Changes in

the mean cover of trees, shrubs, and vines were relatively small, while herb cover increased from 23% pre-burn to 64% following 8-10 burns. The most frequently encountered species within each lifeform category are listed in **Table 3**. Species with an asterisk are widespread, occurring in most plots, while species without the asterisk are very abundant, though only within 1-2 plots.

Figure 1. Changes in mean herb layer cover, grouped by lifeform, for all plots. n=8

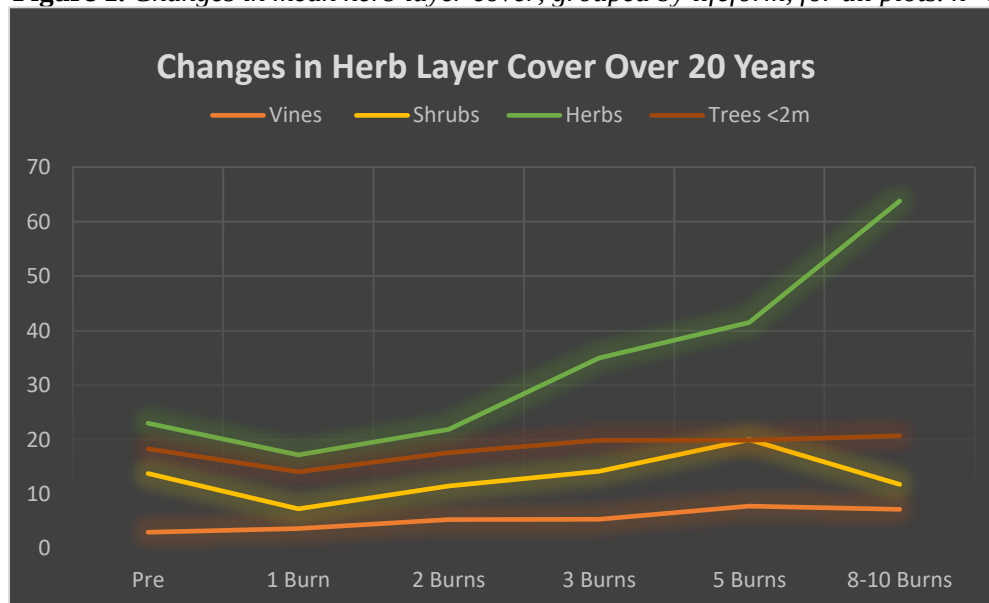
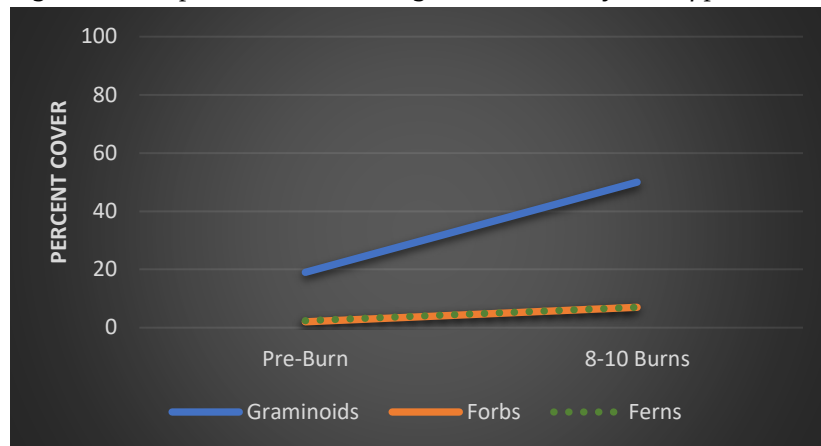


Table 3. Most frequently observed species within each lifeform group. Species with an asterisk are widespread while the others are only abundant within 1-2 plots.

Herbs	Trees	Shrubs	Vines
*Dichanthelium spp. (Witchgrass) *Schizachyrium scoparium (Little Bluestem) *Chasmanthium sessiliflorum (Longleaf wood oats) Pteridium aquilinum (Bracken fern) Elephantopus spp. (Elephant's foot)	*Liquidambar styraciflua (Sweetgum) *Pinus taeda (Loblolly pine) Quercus phellos (Willow oak) Quercus nigra (Water oak)	*Morella cerifera (Wax myrtle) *Vaccinium tenellum (Small black blueberry) Aralia spinosa (Devil's walking stick) Vaccinium/Lyonia spp. (Blueberry/Fetterbush)	Vitis rotundifolia (Muscadine) Gelsemium sempervirens (Yellow jessamine)

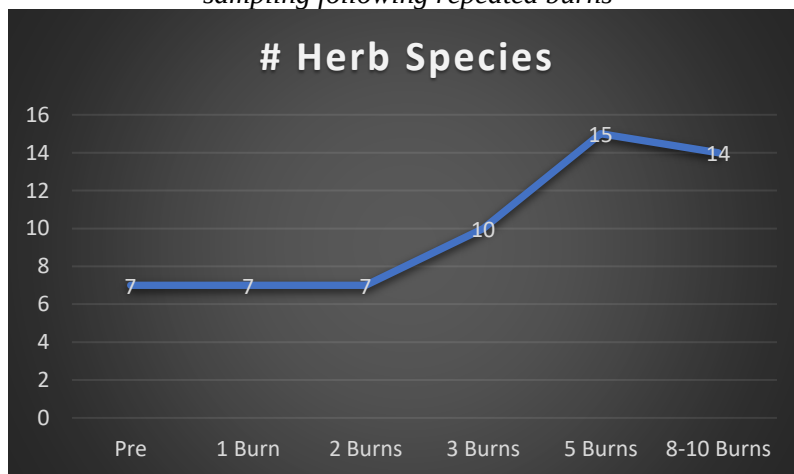
This increase in herb cover was driven primarily by an increase in graminoids (grasses and sedges) (**Figure 2**). Most plots also saw modest increases in forb cover, and two plots experienced substantial increases in fern abundance. This increase in graminoids represents an important change in fuel type for some areas within these burn units, from a 'pine needle' fuel type to a flashier 'grass-pine needle' fuel type. The photos series in **Figure 4** provides a dramatic illustration of this change in graminoid cover.

Figure 2. Changes in mean percent cover among herbs over 20 years of prescribed burning. $n=8$



Not surprisingly, the transition to a more grass/herb-dominated understory has also been accompanied by an increase in the diversity of species that are encountered during sampling (**Figure 3**). ***Finally, it is important to note that there is a lot of variability in this response. Even within the same plots that show an increase in herb cover, there are areas that remain dominated by woody resprouts. Continued frequent burning will be needed to maintain the success that has been achieved and make further advances in restoration.***

Figure 3. Mean number of herb species encountered during sampling following repeated burns





2005



2019

Figure 4. *Change in grass cover - Plot PITA10 (Harry Hampton burn unit). 2005 -2019*

Cumberland Gap National Historical Park (CUGA): 2020 Fire Effects Monitoring Annual Report

Activity Summary

During 2020, the APC Zone fire effects 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. Overall, services were extremely limited in 2020 due to complications associated with the coronavirus pandemic. No prescribed burns were completed, and no monitoring trips were possible due to travel restrictions. We hope to be able to return to normal services in the coming year.

The fire ecologist participated in several meetings and virtual presentations surrounding the “Cumberland Plateau Ecozone Mapping Project” that was sponsored by the Tennessee Chapter of The Nature Conservancy. The maps produced by this project include the TN portion of BISO, CUGA, and OBED. These maps and associated data will be useful for continuing to build our understanding of the fire ecology and fire restoration priorities for those parks. The project is discussed in the “Review of 2020 Projects” section of this report.

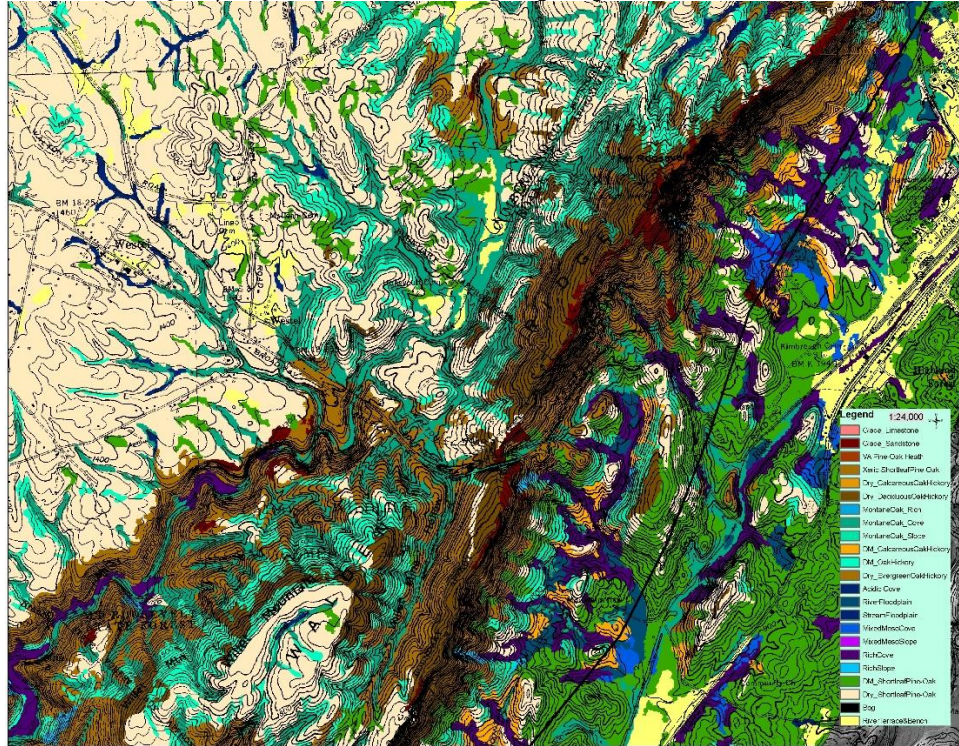
Review of 2020 Projects

Ecological Zones and “Ecomath” for the Cumberland Plateau and Cumberland Mountains in Tennessee:

In July of 2020, Steve Simon submitted the final report for this two-year project to map and describe “Ecozones” for the entire Tennessee portion of the Cumberland Plateau and Cumberland Mountains (CP/CM). Ecological zones are best understood as *potential natural vegetation* based on a suite of topographic variables, which include topographic features that affect the spread of fire across the landscape. Conceptually, these potential natural vegetation types can be thought of as the vegetation composition and structure that likely existed prior to widespread European settlement and development of the area. Over 1900 field plots were sampled to help establish map accuracy and

The key product of this work is a fine-scale GIS database of Ecozones with a minimum mapping unit of 0.10 acre. The report itself is also quite informative, providing descriptions of the composition and structure of each Ecozone, along with representative photos. **Figure 1** (taken from Simon’s report), below, provides an example of the map product from Walden Ridge, near Oak Ridge, TN. Similar data are available for the TN portion of CUGA.

Figure 1. Ecozones of Walden Ridge on the Eastern Escarpment of the CP/CM
(Provided as an example of the product – we're working on getting the data so we can make maps like this of CUGA).



Highlights from the report include:

- Nearly half of the 4-million acre CP/CM landscape supports or could support oak-hickory forests and woodlands
- Shortleaf pine – oak woodlands and savannas represent the single-largest ecozone, covering one-third of the CP/CM landscape, though intact examples of this once dominant vegetation type are difficult to find on today's landscape
- Rare vegetation types (glades, barrens, bogs, and fens) account for <1% of the pre-European vegetation cover, and these types are even more rare today due to habitat conversion and degradation
- Fire-adapted Ecozones (mostly dry pine and oak woodlands) are estimated to have covered over 85% of the pre-European landscape within the CP/CM project area.

Ecomath

An additional part of this project was the completion of “Ecomath” for the same project area. This effort was conducted by Josh Kelly, and centered on the use of Ecozones and a number of additional variables to highlight areas within the CP/CM with the greatest concentrations of fire-adapted natural communities. The map data resulting from this effort can be used to plan and develop priorities for prescribed-fire restoration for the entire region, or for specific land holdings within the region, such as BISO, CUGA, and OBED (Figure 2).

Cumberland Mountains: Cumberland Gap

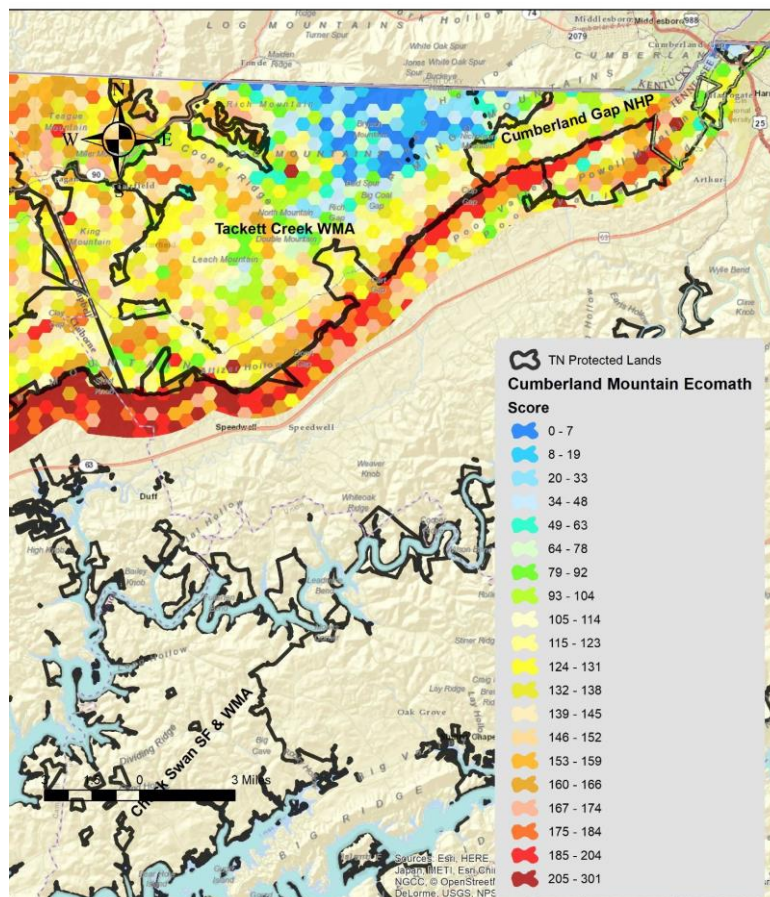


Figure 2. Ecomath results for CUGA. Red and orange pixels represent the highest scores for CUGA as compared to the rest of the CP/CM landscape, but these values can be re-scaled to more clearly depict the highest priorities within CUGA.

Long Term Monitoring Results

There has been no update to the standard analysis of long-term monitoring results. Consequently, **Table 1** has not been updated for this report, though we include it below as a reference point for reviewing the progress toward achieving program objectives. As more data are collected in the coming year(s), this table will be updated to reflect the most current information.

Table 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)	Objective Achieved?	Year Last Analysis Completed
Dry Oak Forest (FQUCO1) <i>16 plots</i>	>50% Reduction in total fuel loading	<u>Total Fuel Reduction:</u> After 1 burn (n= <u>16</u>): 29% (± 3) After 2 burns (n= <u>11</u>): 26% (± 2)	Not yet, but on course	2013
	>70% Reduction in pole-sized tree density ($\leq 15\text{cm dbh}$)	<u>Pole Reduction:</u> After 1 burn (n= <u>16</u>): 39% (± 5) After 2 Burns (n= <u>11</u>): 67% (± 3)	Not yet, but close	2013
	15-30% Reduction in overstory density ($>15\text{cm dbh}$)	<u>Overstory Tree Reduction:</u> After 1 burn (n= <u>16</u>): 5% (± 5) After 2 Burns (n= <u>11</u>): 8% (± 1)	Not yet, but on course	2013
	>200 tall ($>1\text{m}$) Oak seedlings /acre	Preburn (n=16 plots): 101/ac (± 12) After 1 burn(n=16): 91/acre (± 6)	Not yet.	2011
	>30% Cover by native herbs	Preburn cover (n=14): 2% ($\pm 1\%$) After 1 burn (n=14): 4% ($\pm 2\%$)	No, but more burns are 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.

Great Smoky Mountains National Park (GRSM): 2020 Fire Effects Monitoring Annual Report

Activity Summary

The fire effects monitoring team completed all scheduled sampling of long-term monitoring plots in 2020, and were also able to resample two “control” plots at Lynn Hollow that were originally established in 1998. Those plots had not been maintained since 1998, so there was a significant workload associated with re-locating plots and performing maintenance. Comparisons of data from the control plots with 22 years of data from the burned plots at Lynn Hollow should be interesting, and that analysis work will be done in the coming year.

Monitoring was also completed for boundary fuel-reduction projects at Ski Mountain (year 2) and Ace Gap (immediate), and highlights of that work can be found in the “Review of 2020 Projects” section of this report. We will continue to monitor these projects to photo-document results and help determine ‘treatment lifespan’ for boundary mastication. Monitoring of Cades Cove prescribed burning is also covered in the “Review” section below.

Review of 2020 Projects

1. Chimney Tops 2 Burn Severity Mapping

Field sampling for this 2-year project was completed in 2018, and work continues on the final analysis and reporting. Preliminary results from this work were presented at the 2017 Association for Fire Ecology Congress, Southern Blue Ridge Fire Learning Network Workshop, and provided to the Park. All data have now been entered, quality-checked, and compiled; the goal for 2021 is to complete the final report for publication in the NPS Natural Resource Report series.

Additional work was completed during the 2019 and 2020 field seasons to support this project and provide additional qualitative information for high-elevation sites which were under-represented in the study. Efforts will be made during the coming year to revisit and complete year-5 post-fire sampling of a subset of the 39 permanent plots established during this study.

2. Ski Mountain Boundary Fuel Reduction

In previous annual reports, we have reported on the mechanical fuel-reduction (mastication) work that was done in 2018 and 2019 on the Gatlinburg/Ski Mountain portion of the Park boundary. Photo-points have been used to illustrate the changes in vegetation/fuels following the initial treatment. During the 2020 field season, the fire-effects team revisited the site to repeat the photos, monitor the regrowth of vegetation, and try to build an understanding of the treatment lifespan of this kind of fuel reduction work.

The results can be seen in the following photo pairs. In general, 2 years after the initial treatment, areas of shaded fuel break have dense regrowth, but that growth is still mostly short in stature ($< 2'$) (**Figures 1-2**). Occasional sprouts of red-maple and sourwood have achieved heights of 3' - 5', but regrowth of the evergreen shrub Mt. Laurel (which is the primary species of concern as a live fuel) was generally limited to heights of 1' or less.



Figure 1. Immediately Post-Treatment, August 2018



Figure 2. 2 Years After Treatment, shaded. August 2020

Figures 3-4 illustrate the difference in regrowth where the tree canopy is more open. Here, the regrowth is dense, and more uniformly tall, achieving average heights of 4' - 6'. In these more open areas, Mt. Laurel is either not present or still short ($< 2'$), but the hardwood resprouts are forming a tall, dense thicket, which may impede visibility and access.



Figure 3. Immediately Post-Treatment, August 2018



Figure 4. 2 Years After Treatment, exposed. August 2020

These observations suggest that the treatment lifespan for boundary fuel reduction will vary tremendously, depending upon shading and species of concern. Maintaining visibility and accessibility in shaded fuel breaks might be achieved with a treatment cycle of every 5-6 years. However, many of the exposed sections of the fuel break will grow into dense thickets with anything less than a 3-4 year treatment cycle. While these thickets will mostly be composed of deciduous hardwood sprouts (which are generally not considered as much of a fuel hazard), the fuel break will have limited visibility and accessibility, which may be important factors to consider.

There is also a possibility that the fuel break could convert to more of a grass/herb-dominated fuel type after multiple treatments, though there is no evidence that this will occur quickly. Some scattered grasses and herbs (mostly bracken fern and goldenrods) were observed during 2020 monitoring, but the regrowth was almost completely dominated by tree sprouts, shrub sprouts, and vines. To the extent possible, leaving suitable trees and encouraging the development of a **shaded fuel-break** may be the best long-term strategy for these boundary projects (**Figure 6.**)



Figure 5. Slow regrowth in a shaded fuel break 2 years after treatment. Encouraging shaded fuel breaks may be a good long-term strategy for maintaining boundary fuel-reduction projects.

3. Ace Gap Boundary Fuel Reduction

The Ace Gap Mechanical Project was completed December 6-10, 2020 by Alex Scronce and Lead APC Fuels Technician Tom Edwards. The planned project was approximately 9 acres of Park boundary near the Laurel Valley and Ace Gap Trail. There are 8 private structures adjacent to the park boundary, and fuel types are dry oak and pine with scattered areas of evergreen heath (Mt. Laurel). A thinning/pile burning project took place in February of 2004 in the same location, but the effects of the pile burning were negligible after 16 years.

There were 9 points (**AG01-09**) installed prior to treatment, and these were revisited following project completion. The treated area is approximately 5.5 acres out of the planned 9 acres and cleared vegetation typically included white pine, Mt. Laurel, and hardwood saplings (**Figure 7**).

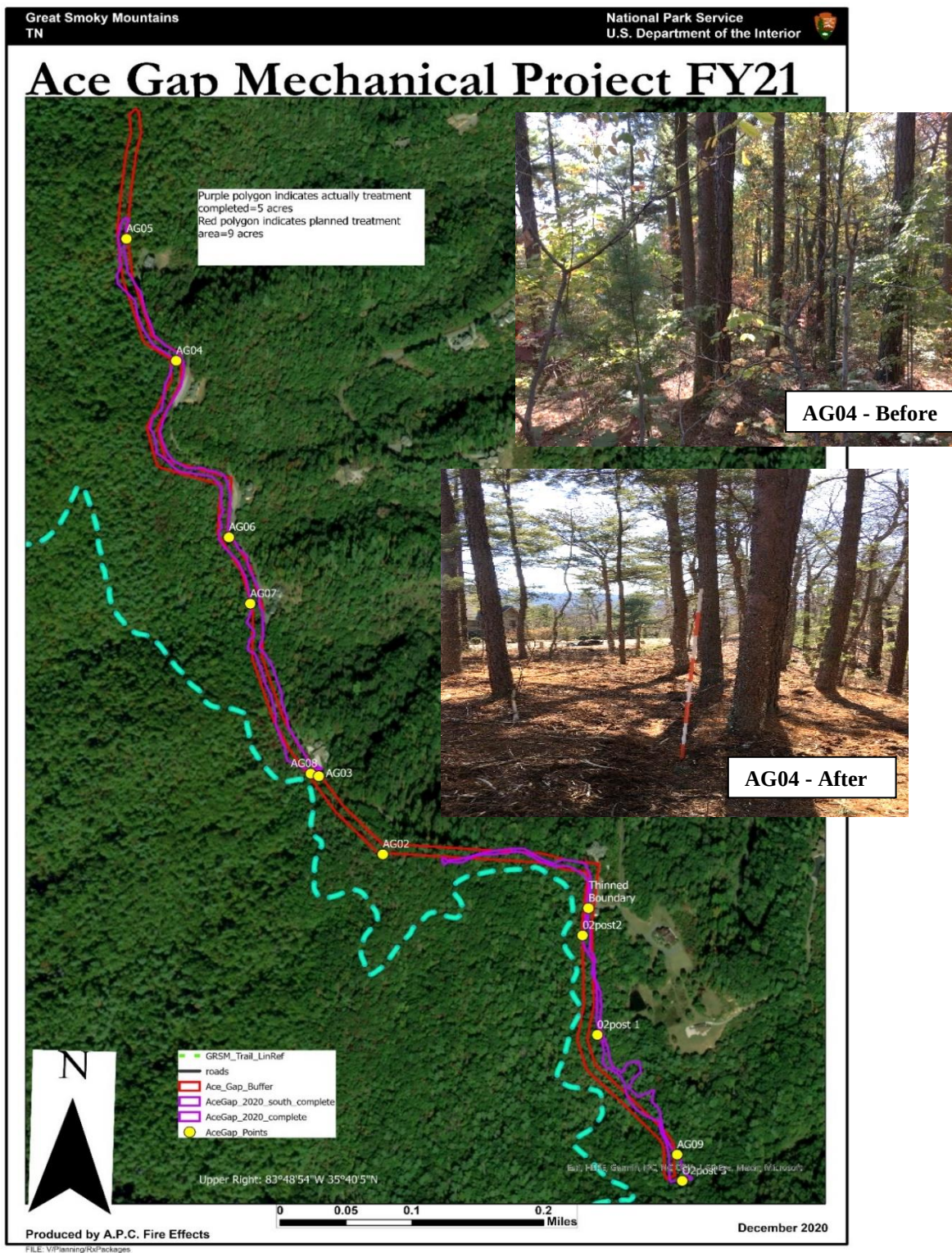


Figure 7. Map of treatment area and ‘Before and After’ photos of plot ‘AG04’

Figure 8 illustrates the post-treatment mulch bed and the 30' width which was the goal for the treatment. **Figure 9** shows the change in one of the heaviest areas of Mt. Laurel. Future monitoring will be conducted to determine treatment lifespan.



Figure 8. Average width of the Ace Gap treatment is 30'. Point '02Post2'; SE Corner.



Figure 9. Before and after photos of Ace Gap fuel reduction, illustrating dramatic reduction of Mt. Laurel. Photopoint AG07 – North view.

4. Cades Cove Prescribed Burning – Fall 2020

Cades Cove is a large valley located in the western end of Great Smoky Mountains National Park (GRSM) predominately covered in open grassland interspersed with small woodlots. It has a rich cultural history of both Native American and European use and settlement. Previous high impact land use history has included agriculture, cattle grazing, and alteration of hydrology through stream channelization. Park management efforts in recent years have included removal of cattle with the end of grazing leases, localized restoration of native grasses and forbs, and some targeted hydrology restoration efforts. The primary management goal for the majority of the Cades Cove landscape is to maintain the open field structure through the use of mowing and prescribed burning. Fire management staff stationed at GRSM have been actively conducting burns in Cades Cove since the 1990s with a significant restructuring in 2009 of the burn units into larger blocks and a renewed focus on timing and burn frequency resulting in most units being burned in the fall on a roughly 3 year rotation over the last 10-11 years.

Out of 5 planned burns for FY21, 3 were completed in November 2020 for a total of 370 acres. The units included Methodist Church, Upper Tater, and Increase Fields, all located the NW corner of Cades Cove (Figure 10).

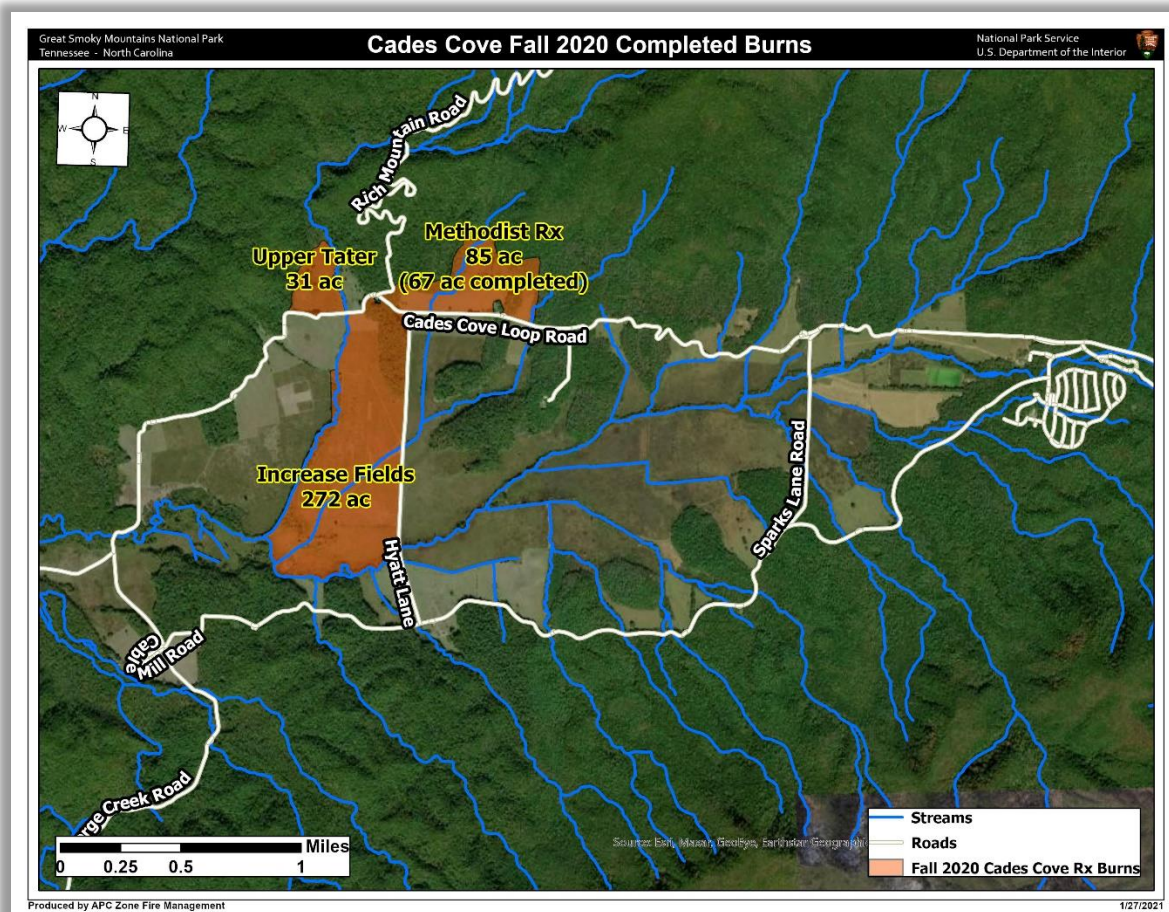


Figure 10. Fall 2020 completed Cades Cove prescribed burns

Methodist Church Rx

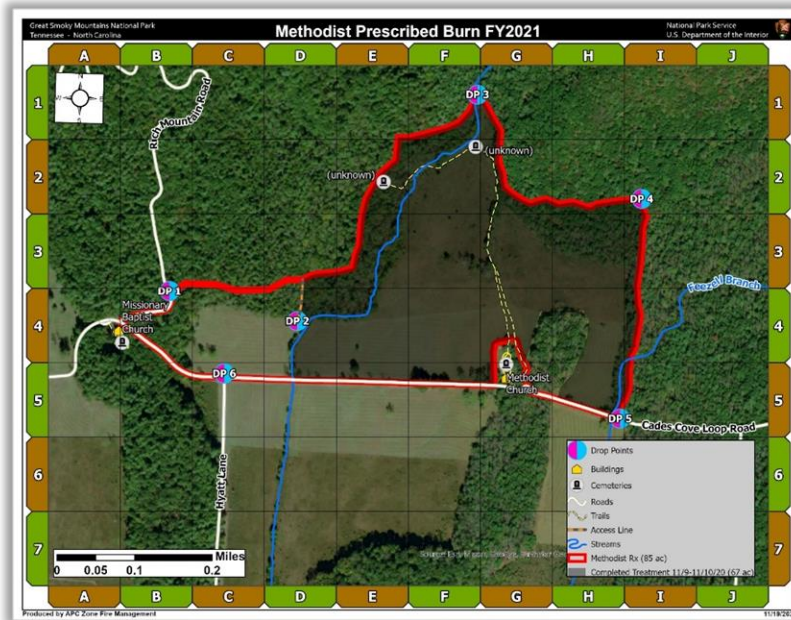


Figure 11. Fall 2020 Methodist Rx Burn, note the completed portion shaded in black

The Methodist Church prescribed burn (85 ac planned/67 ac completed) was initiated on 11/9/20 with some additional areas completed the following day (**Figure 11**). The unit was largely comprised of open field with an included strip of forest along the northern edge. Dry weather (10 days since last significant rainfall), above average temperatures, and freshly fallen leaf litter created holding concerns which, in addition to a problematic slop-over, significantly slowed operations on the first day (**Figure 12**).



Figure 12. Typical fire behavior in the forested areas, fresh leaf litter, dry conditions, and burning heavies created holding concerns that slowed the operation

Despite late ignition during the evening hours, the un-mowed field portion of the unit carried fire well and much of the encroaching woody vegetation appeared to be top-killed (**Figure 13**). A strip of mowed field along the southern edge of the unit was also burned the following day.



Figure 13. Wide-spread scorch likely resulted in top-killed of much of the encroaching yellow pine saplings in the main field area.

Dry windy conditions during the 2nd day prevented the completion of the far western portion of the unit which included another wooded section and a mowed field. Overall, the burn was a success with favorable effects in the main field portion generally meeting the primary burn objectives. The unit has roughly been burned on a 3-4 year rotation since the consolidation/restructuring of the Cades Cove burn units in 2009, and while this is close to the desired frequency established in 2009, it has become more clear in the preceding 10-11 years that for many of the fields, including parts of this unit, this is not often enough to completely restrict woody encroachment from establishing. Hence, mechanical treatments have been used over the last few years to reclaim overgrow portions of several units. Moving forward a combination of more frequent burning possibly in conjunction with mowing might better help to maintain the desired open field structure.

Upper Tater

The Upper Tater burn unit (31 acres) was burned on 11/17/20 and it was comprised of a sloping field with a small strip of oak forest along the south and west corner (**Figure 14**).

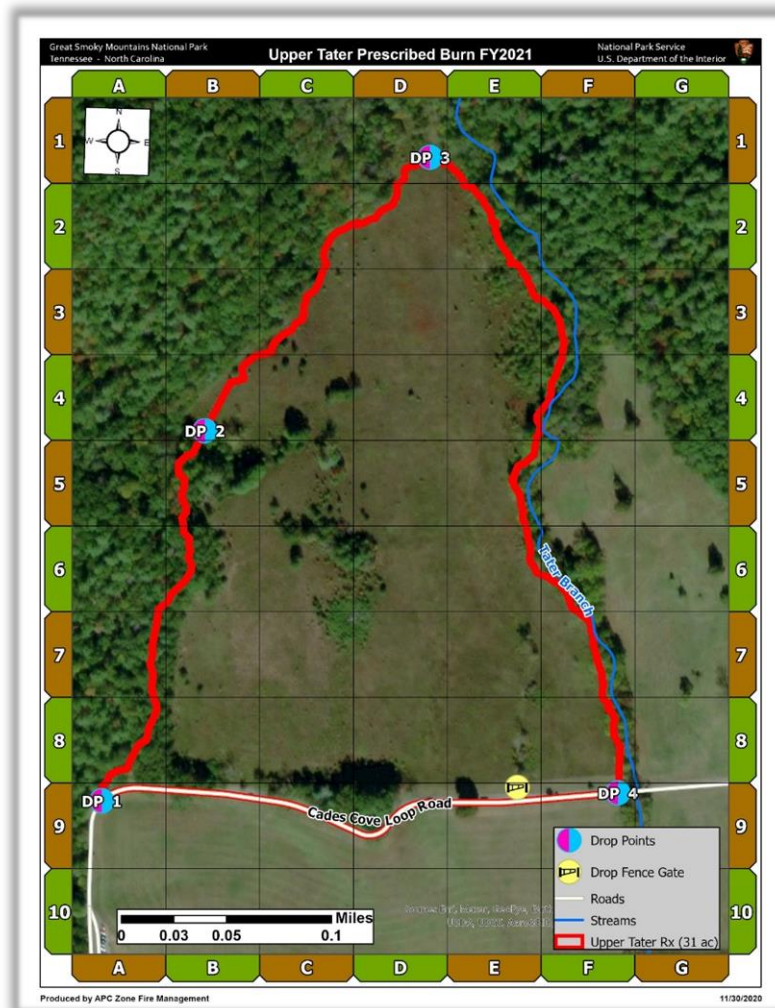


Figure 14. The Upper Tater burn unit is a small sloping field with a narrow strip of woods along the SW side.

Fire carried well through the moderate density grass fuels covering much of the unit, while the forested areas generally experienced low intensity fire behavior (**Figs 15-16**). Significant rainfall during the interim period between the Methodist Rx burn and this burn appeared to have a lingering effect on the availability of the forest fuels. The operation was quick and efficient given the limited holding concerns, and the results in the main field generally meet objectives with a high percentage of top-kill of woody stems expected based on observed immediate post burn effects (**Figure 17**). However, like many of the Cades Cove fields, a 3 year rotation has not been effective at completely eliminating woody encroachment at Upper Tater (see the west central portion of the field on the burn unit map), allowing establishment of several small trees capable of surviving subsequent burns (**Figure 18**).



Figure 15. Fire carried very well through much of the main field with moderate to high intensity



Figure 16. Fire behavior was low and somewhat patchy in the forest fuels with very little involvement of heavies.



Figure 17. Many of the encroaching woody stems received significant basal damage, likely resulting in widespread top-kill.



Figure 18. An area of advanced woody encroachment along the west-central portion of the field where fire was once again unable to top-kill the stems

Increase Fields

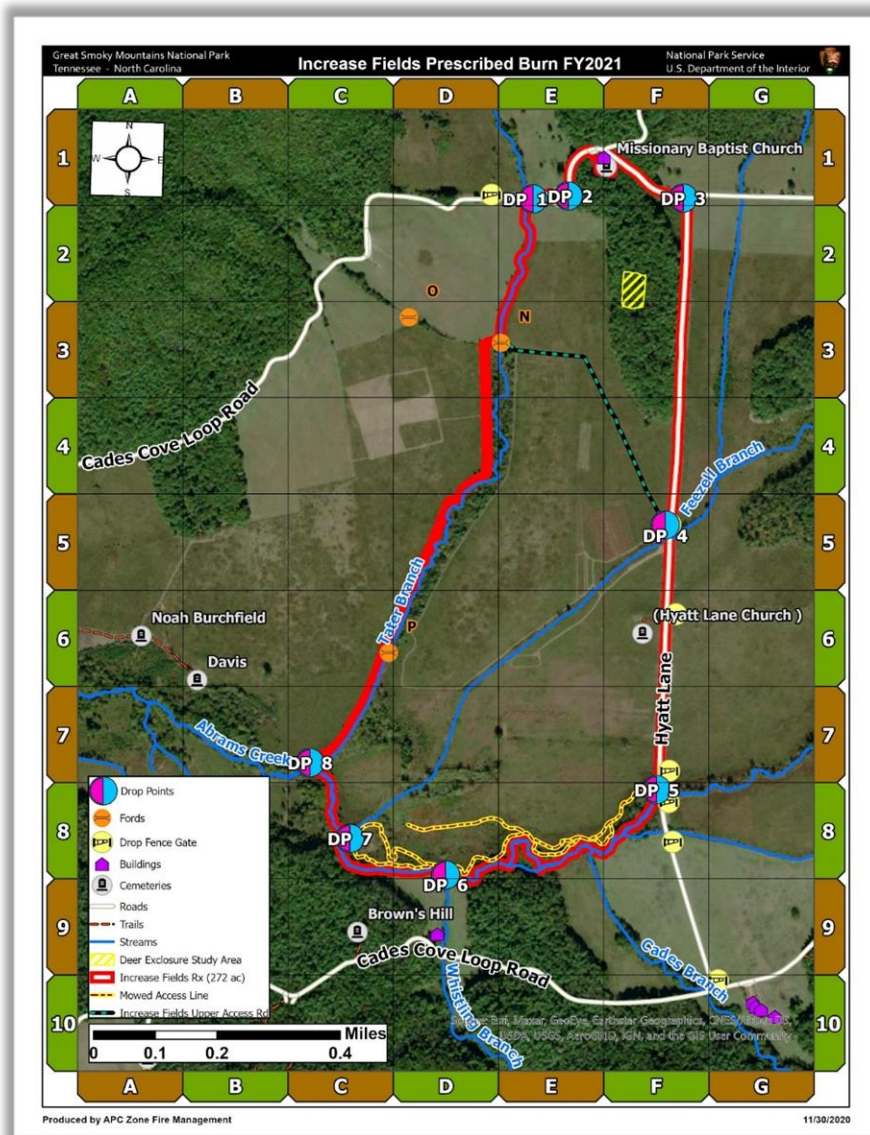


Figure 19. Increase Fields burn unit map

The Increase Fields prescribed burn was by far the largest of the 3 burns for November 2020 (272 acres) and it was completed on 11/18/20 (**Figure 19**). This unit was also the most diverse structurally and vegetatively, including a large patch of wild quinine (*Parthenium integrifolium*) located SW of the central field area and a herbaceous wetland centered on the lower reaches of Feezell Branch near the confluence with Abrams Creek that was dominated by *Carex trichocarpa*. Additionally, there was a prominent forested knob in the NE corner of the unit.

While fire behavior was initially subdued in the tall forb and sparse grass fuels along Abrams Creek at the southern edge of the unit, fire intensity and spread rapidly increased as ignition squads moved into the denser grass fuels (**Figure 20**). Operations progressed steadily from south to north with fire carrying well through the open fields, reaching the northern woodlot early in the afternoon.



Figure 20. Fire intensity rapidly increased in the dense grass fuels that occurred throughout much of the unit

The NE woodlot burned very well in comparison to the forested area of Upper Tater from the previous day's burn. Fire carried in a continuous manner through the oak litter, even burning under areas of dense understory white pine (*Pinus strobus*) and partially consuming heavies and snags (**Fig. 21-22**).



Figure 21. Fire carried well through the oak litter fuels in the NE woodlot



Figure 22. Snags and heavies were more readily burning compared to the previous day's burn at Upper Tater

Overall, the main field portion of Increase Fields burned with excellent coverage and good top-kill of most of the woody stems (**Figure 23**). Additionally, the NE woodlot experienced the best observed coverage and intensity compared to all previous burns, with high consumption of leaf litter (>75%) and likely good thinning of the smaller understory trees. The edge of the woodlot also burned well with significant top-kill of the smaller woody stems encroaching into the field (**Figure 24**).



Figure 23. Grass fuel consumption in the main field was excellent



Figure 24. Encroaching woody stems along the edge of the woodlot experienced moderate to high fire intensity likely resulting in significant top-kill of the smaller stems

The wild quinine area burned very well with almost 100% consumption of fine grass and forb fuels in many areas, exhibiting heavy scorch and char on most of the woody stems (**Figure 25**). Additionally, the sedge wetland burned quite well although the thick mat-like fuels were not completely consumed but fire did generally carry through the entire area (**Figure 26**).



Figure 25. Fire carried with high intensity and excellent consumption through the wild quinine area, likely top-killing many of the woody stems



Figure 26. *Carex trichocarpa* wetland: Although the sedge fuels did not completely consume because of the dense mat-like structure, overall consumption was generally high and fire did burn completely through the area

As mentioned with the other burns, establishment of woody stems remains a problem in Increase Fields as well, especially in the southern edge along Abrams Creek (**Figure 27**) as well as in the area just south of the wild quinine. Mechanical treatment followed by more frequent burning will likely be required to reclaim and maintain these areas as open field.



Figure 27. Well established tulip-poplar along the southern edge of the unit was generally not top-killed with the recent burn and will likely continue to grow into a forest under the current burn rotation.

Long Term Monitoring Results

Table 2. Objectives and long-term monitoring results for GRSM

Monitoring Type	Management Objective Restoration Phase- (After 4 burns)	Monitoring Results (80% confidence intervals)	Objective Achieved?	Year Last Analysis Completed
Yellow Pine Woodland (FPRI1) 29 Total Plots 28 have burned once 17 have burned twice 5 have burned three times 1 remains unburned	>50% Reduction in total fuel loading	Total fuel reduction: After 1 burn (n=27): 34% ($\pm 7\%$) After 2 burns (n=16): 37% ($\pm 6\%$) After 3 burns (n=5): 15% ($\pm 26\%$)	Insufficient data. <i>Objective may need to be revised.</i>	2018
	>70% Reduction in pole-sized tree density	Pole reduction: After 1 burn (n=28): 51% (± 8) After 2 burns (n=15): 77% (± 6) After 3 burns (n=5): 60% (± 27)	Insufficient data. But trend is positive.	2018
	25-50% Reduction in overstory tree density	Overstory reduction: After 1 burn (n=28): 18% (± 7) After 2 burns (n=15): 50% (± 13) After 3 burns (n=5): 10% (± 18)	Insufficient data.	2018
	>200 tall (>1m) Yellow Pine seedlings /ac	Yellow Pine Seedling Density: 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)	Insufficient data. But trend is positive. High variability.	2018
	>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% ($\pm 6\%$)	Insufficient data.	2009
Dry Oak Forest (FQUO1) 24 total Plots 17 have burned once 10 have burned twice 5 have burned three times 7 remain unburned	>50% Reduction in total fuel loading	Total Fuel reduction: After 1 burn (n=15): 29% (± 4) After 2 burns (n=7): 27% (± 17) After 3 burns (n=5): 26% (± 18)	Insufficient data. <i>Objective may need to be revised.</i>	2018
	>70% Reduction in pole-sized tree density	Pole reduction: After 1 burn (n=17): 45% (± 10) After 2 burns (n=9): 49% (± 13) After 3 burns (n=5): 77% (± 16)	Insufficient data. But trend is positive.	2018
	15-30% Reduction in overstory tree density	Overstory reduction: After 1 burn (n=17): 5% (± 5) After 2 burns (n=9): 9% (± 11) After 3 burns (n=5): 7% (± 11)	Insufficient data.	2018
	>200 tall (>1m) Oak seedlings /ac	Oak Seedling Density: 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)	Insufficient data. But trend is positive. High variability.	2018
	>30% Cover by native herbs/subshrubs	Preburn cover (n=9): 4% ($\pm 2\%$) After 1 burn (n=9): 4% ($\pm 2\%$)	Insufficient data.	2011

Kings Mountain National Military Park (KIMO): 2020 Fire Effects Monitoring Annual Report

Activity Summary

Overall, services were extremely limited in 2020 due to complications associated with the coronavirus pandemic. None of the planned prescribed burns were completed, but Alex Scronce completed 80 acres of mechanical mastication in the northeast section of the Park. This area is the heart of a 1000-acre restoration area that is being treated with prescribed burning and mechanical fuel treatments to create/improve habitat for shortleaf pine, native herbs such as Georgia Aster, and bobwhite quail. This project, and the associated monitoring, are described in the “Review of 2020 Projects” section of this report. The annual monitoring trips were not possible due to travel restrictions, though the Lead Monitor made a one-day trip to conduct monitoring of the Quail habitat-restoration project area.

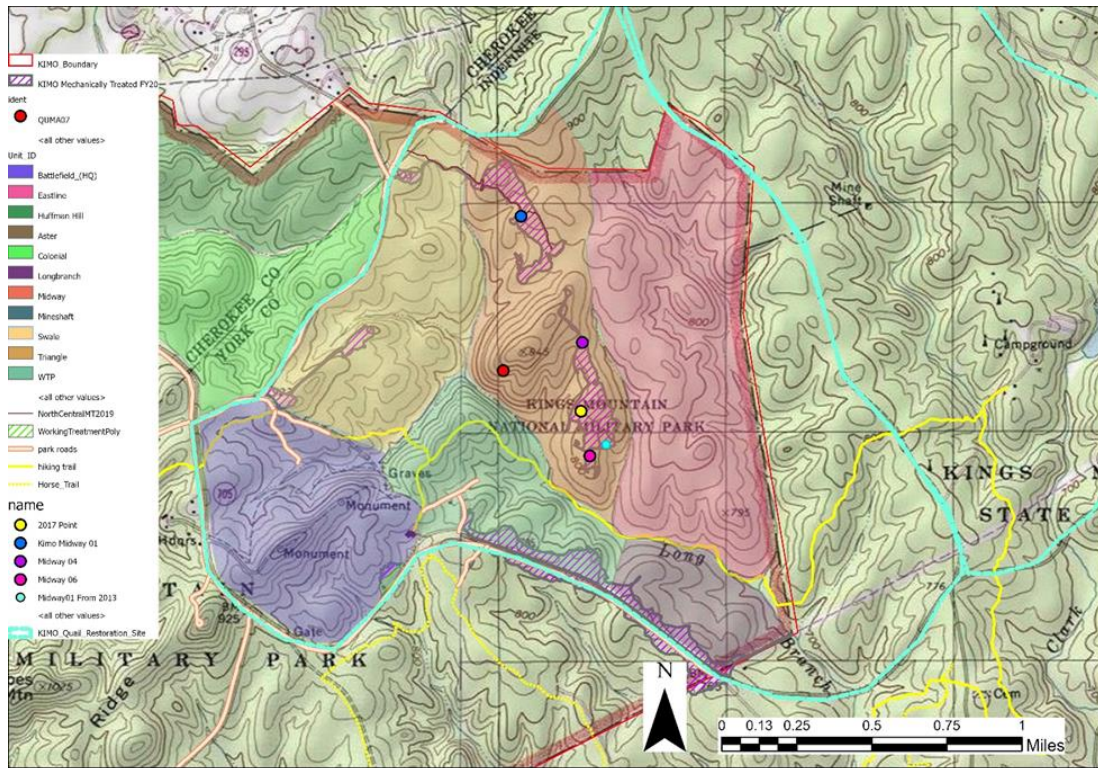
Review of 2020 Projects

Mechanical Treatment and Monitoring of the Quail/Shortleaf Restoration Project

In 2018, Fire Operations Specialist Alex Scronce, along with former Chief Ranger Chris Revels, began a partnership restoration project with NPS-NRSS, SC-DNR, Quail Unlimited, SC State Parks, HARP Environmental services and Shortleaf Pine Initiative. The goal was to identify and implement landscape scale restoration with prescribed fire (already a focus at KIMO), mechanical fuel treatments, and rare-plant plantings to restore landscapes and reintroduce Northern Bobwhite quail back to the woodlands of the Piedmont. Quail populations historically were higher but with the loss of native grasslands throughout the region, populations have plummeted as forest canopies began closing in. Northern Bobwhite (quail) need a variety of habitat such as bunch grasses (native warm season grass), mixed broadleaf forbs, and brushy areas for cover, foraging, nesting, and brood-rearing. With its existing vegetation and history of prescribed burning, the area identified for the Quail restoration provided a perfect opportunity to achieve historical, ecological, and wildlife objectives (**Figure 1**).

The restoration area is comprised of open oak forests, shallow-soil barrens, riparian streams and seeps, successional forest, and former farmsteads. The vegetation in the Midway unit of the restoration area has particularly notable features such as Post oak woodlands with black needle-grass understory, Blackjack oak barrens, young successional forest, and open shortleaf pine woodlands.

The burn units in the restoration area have been prescribed-burned 1-3 times since 2000, and collectively they have experienced a wide variety of fire effects. Mechanical mastication has been done at various locations within the project area in the past 3 years. The 2020 mechanical treatments encompassed approximately 80 acres of formerly forested area in the Midway, Swale, Partner and Battlefield burn units (see **Figure 1**). The focus area for monitoring was the Midway burn unit (aka North-Central), which has been burned 3 times since 2007. Monitoring consists of 5 photo-points and 1 long-term monitoring plot.



Kings Mountain National Military Quail Project

Figure 1. Quail Restoration Site at KIMO, highlighting 2020 mastication sites and monitoring locations.



Figure 2. Photopoint “2017 Point” (yellow dot) on above map. This area was masticated in March 2020. This photo illustrates how areas of shortleaf pine regeneration are left to allow future recruitment of the species. Prior to the initial prescribed burn in 2007, this was a mature oak-pine forest.



Figure 3. Photopoint “Midway 06.” March 2020, immediately following mastication. The focus of this treatment is to create an open woodland structure to facilitate restoration of native herbaceous species and to provide habitat for quail and other species.



Figure 4. Photopoint “Midway 06.” October 2020. Many of the herbs here are native colonizing-species (“weeds”). With frequent repeated burning, it is expected that higher-quality native perennials will become established.



Figure 5. Shortleaf pine stand immediately following mastication. Midway unit. March 2020.



Figure 6. Shortleaf pine stand. December 2020. The open woodland, the patchy native grasses, and the scattered brush should develop into good habitat for quail.



Figure 6. Another part of the project will be supplementing Georgia aster (T&E Candidate species) populations within the Midway portion of North Central Unit by Habitat Assessment and Restoration Professionals (HARP).

Long Term Monitoring Results

No new data were collected in 2020, and no updates have been made to the long-term monitoring results for this report. Most of **Table 2** was updated recently, and there are good indications that the burn program is moving in a positive direction. Moving forward, the challenge will be to continue burning frequently enough to maintain these changes and make additional gains.

Table 2. Objectives and long-term monitoring results for KIMO

Monitoring Type	Management Objective Restoration Phase- (After 4 burns)	Monitoring Results (80% confidence intervals)	Objective Achieved?	Year Last Analysis Completed
Dry Oak Forest (FQUM01) <i>21 plots:</i> <i>20 have burned once</i> <i>19 have burned twice</i> <i>17 have burned 3 times</i> <i>9 have burned 4 times</i>	>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)	Insufficient data. But trend is positive.	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)	Insufficient data. But trend is positive.	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, but more burns are needed.	2009
	>50% Reduction in total fuel loading	Total fuel reduction: After 1 burn (n=7): 47% ($\pm 4\%$)	Insufficient data.	2009
Chestnut Oak-Blackjack Oak Woodland (FQUMA1) <i>8 plots</i>	>70% Reduction in pole-sized tree density	Pole reduction: After 1 burn (n=8): 45% ($\pm 12\%$) After 2 burns (n=4): 62% ($\pm 12\%$)	Insufficient data.	2009
	15-30% Reduction in overstory tree density	Overstory reduction: After 1 burn (n=8): 30% ($\pm 11\%$)	Insufficient data.	2009
	>30% Cover by native herbs	Preburn cover (n=7): 6% Cover after 1 burn (n=7): 9%	Insufficient data.	2009

Moore's Creek National Battlefield (MOCR): 2020 Fire Effects Monitoring Annual Report

Activity Summary

Overall, monitoring services were extremely limited in 2020 due to complications associated with the coronavirus pandemic. The Savannah and South-West burn units were burned in early March, along with approximately 50 acres of private land adjacent to the Park. These burns are briefly described in the following section of this report, along with a review of the burn program to date.

No monitoring trips were possible due to travel restrictions that began shortly after the burns were completed. The fire ecologist and APC Zone Fuels AFMO are planning a trip in early February to meet with Park managers to review burn program objectives and overall effects of the burn program. It is a high priority for the fire-effects monitoring team to conduct monitoring activities during Summer 2021, and we will be in touch with Park staff to coordinate that visit.

Review of 2020 Projects



Figure 1. Fire behavior along the Tar Heel Trail, South-West Burn Unit. March 1, 2020.
Photo courtesy of Chad Dunelew.

The Savannah and South-West units (see **Figure 2**, below) were burned on March 1, 2020. The private land to the south added approximately 50 acres to the burn. This private section was mostly loblolly pine plantation that was last known to be clear cut in 1998 based on aerial imagery. The South-West unit and combined private burn were completed within approximately 2 hours. Weather conditions were as follows:

Extremes/time	Temperature	RH %	Winds direction/speed	Drought Index
Observed Hi/Lo	60/42	44/25	NW Light – 3 mph WNW WNW_S gusts 7 mph	
Prescription	Temp - 40-90	25-70%	20ft Winds – 0-15 mph Wind Direction – Any	KBDI – <500
Forecast	58/36	69/25	Winds Light becoming 5mph SW in the afternoon	

The ignition strategy was based on NW winds. From approximately 1100-1245 the private section was burned. A wind shift prompted the beginning of burning of the NPS South-West unit where the firing plan used winds and flanking patterns to achieve favorable fire effects. Beginning at 1200 the fire behavior began to increase in rate-of-spread and flame lengths. Flame lengths of 6-10 ft were observed in “jackpots” within the private land.

Observed fire behavior in the Park included isolated runs in fetterbush (*Lyonia lucida*) and wax myrtle (*Morella cerifera*) up to 6 ft and 4-5 chains per hour. Where oak litter was present in the South-West unit, good consumption was observed. In Loblolly pine litter and cane, litter consumption was observed as complete. When bay (*Persea* spp.) was present with loblolly litter, consumption of the live shrubs was observed. No information exists with regards to effects of the burn on the Atlantic White Cedar vegetation complex

At 1435, ignition of the Savannah unit began and was complete by 1505. Ignition began on the East side of the unit, using a ring-fire technique. Grass areas burned well except where depressions occurred and likely achieved top-kill of woody species in all burned areas. Fire behavior was typically 10ft flame lengths and 20 ch/hr in the Fuel Model 3 areas (tall grass>3 ft). Oak litter areas did not burn well.

Both the South/West and Savannah were deemed successful in terms of burn objectives for reducing shrub and woody coverage in forested and grassland areas.

Review of Prescribed Burn Program

Burn History and Objectives:

Small-scale prescribed burning has been done at Moore’s Creek since 1989 (**Table 1**). From 1989 to 2005, the burns (in conjunction with mowing) were done exclusively in what is known at the “Savannah” in support of a project to restore a wet pine savanna that was known historically from the site. The project included some attempted restoration of hydrological patterns and planting of grass species that are characteristic of wet pine savanna. This site is unique in the park, and is monitored by the SECN I&M program.

Table 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.

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, South and West	37
April 11, 2019	Savannah and Northeast	24,30
March 1, 2020	Savannah and Southwest (including Currie private)	24, 128

Beginning in 2010, there was a renewed effort to begin regular burning of the Savannah site, and in 2014 additional burn units were added (**Figure 2**). A single burn plan was written in 2017 to encompass burning of all these burn units, and the goals and objectives are as follows:

Goals:

1. To restore, protect, and maintain the historic and cultural landscape
2. Restore and maintain fire dependent plant communities
3. Reduce hazard fuels accumulations
4. Eradicate invasive woody and exotic vegetation species which compete with native vegetation and alter the historic (1776) landscape.

Objectives:

1. Use low intensity fire in areas where Atlantic White Cedar are present
2. Reduce overstory / midstory vegetation density by 40-70%
3. Reduce litter load by >70% in over >75% area of target vegetation
4. Reduce woody encroachment in Savanna unit by >50%
5. In the long term, reduce overstory by 15-30% without creating large gaps in the canopy.

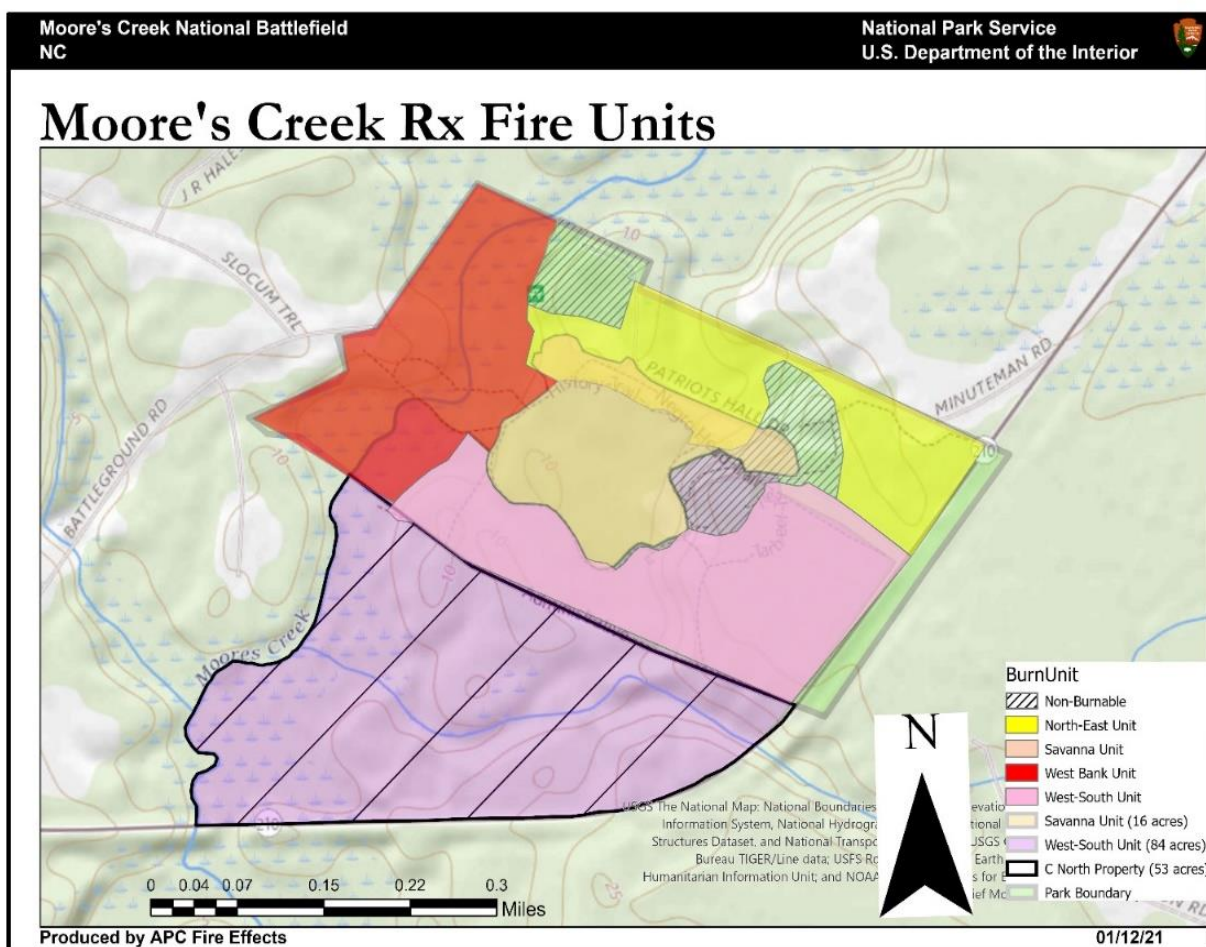


Figure 2. Prescribed-Burn units of Moore's Creek NB.
Private lands included in 2020 burning also shown ("C North Property")

Recent Flooding Events

Flooding is a significant disturbance factor at Moore's Creek NB, and may be impacting the achievement of long-term prescribed burning goals and objectives. The purpose of this section is simply to provide reference information regarding recent flood events. It is beyond the scope of this report to determine the relative or cumulative impacts of flooding and burning on the Park's vegetation.

Over the past several years, there have been two historic flood events; following Hurricane Matthew (October 2016) and Hurricane Florence (September 2018). **Table 2** below provides stream gauge data from the nearby Cape Fear River. These storms produced historic rainfall amounts in the Black River and Cape Fear basins, producing flooding at Moore's Creek Battlefield up to 6 feet near Patriots Hall. There were apparently 3 more recent flood events that affected Pender County and to a small degree, Moore's Creek Battlefield, two of which are not on the table below. The first occurred February 12, 2020, the second in May 2020, and a more recent event in November 2020. No information exists on how these events affected the park.

Table 2. Stream gauge data taken from USGS gauge along the Cape Fear River (which the Black River and Moore's Creek eventually flow into). The gauging station is approximately 10 miles from the Park.

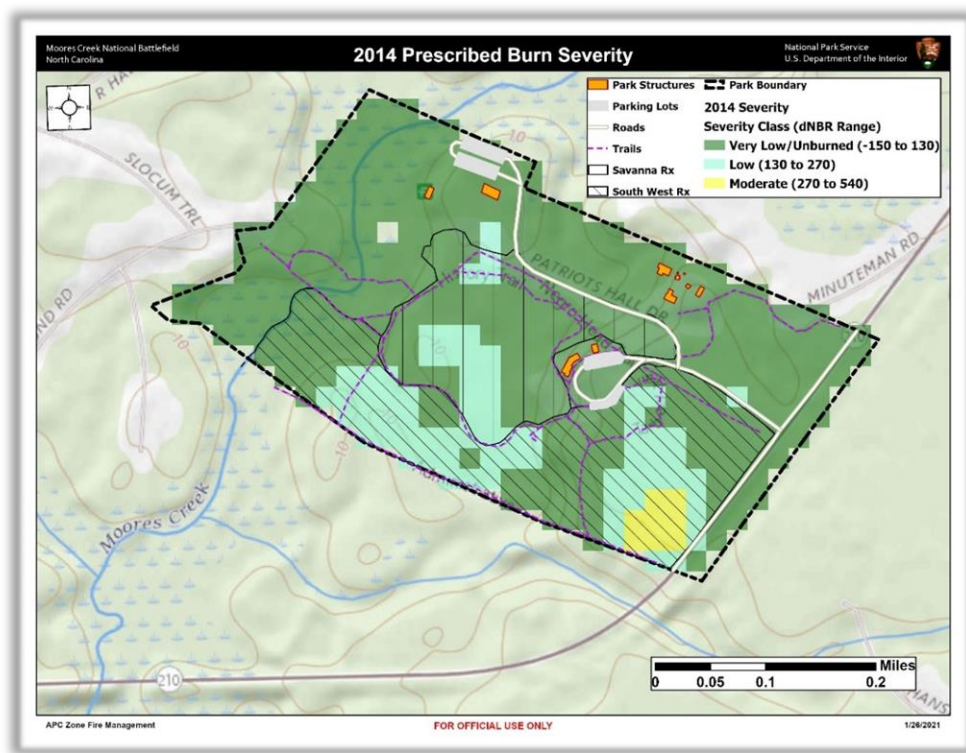
Cape Fear River At Lock 1 (CPFN7) <i>Historic Flood Events greater than 22 ft.</i> (1) 30.68 ft on 09/21/2018 (2) 29.80 ft on 09/23/1945 (3) 28.58 ft on 10/13/2016 (4) 26.00 ft on 10/09/1964 (5) 24.92 ft on 03/03/1979 (6) 24.90 ft on 09/12/1996 (7) 24.77 ft on 02/08/1973 (8) 24.30 ft on 07/21/1975 (9) 24.20 ft on 04/06/1973 (10) 24.16 ft on 03/24/1998 (11) 23.75 ft on 11/19/2018 (12) 23.72 ft on 04/15/2003 (13) 23.61 ft on 03/06/1987	(14) 23.50 ft on 03/22/1975 (15) 23.34 ft on 08/19/1969 (16) 23.34 ft on 03/08/1971 (17) 23.30 ft on 09/20/1999 (18) 23.27 ft on 02/12/2020 (19) 22.90 ft on 01/18/1975 (20) 22.88 ft on 12/21/1972 (21) 22.88 ft on 01/31/1978 (22) 22.75 ft on 02/22/1995 (23) 22.71 ft on 02/23/1998 (24) 22.71 ft on 11/27/2006 (25) 22.68 ft on 02/09/1998 (26) 22.59 ft on 02/11/2010 (27) 22.51 ft on 12/28/2015 (28) 22.34 ft on 03/14/1998 (29) 22.34 ft on 09/10/1977 (30) 22.07 ft on 03/23/1983	Flood Categories (in feet) Major Flood Stage: 28 Moderate Flood Stage: 26 Flood Stage: 24 Action Stage: 22 Recent Hurricanes
---	---	---

Remote Sensing of Burn Severity: 2014-2020

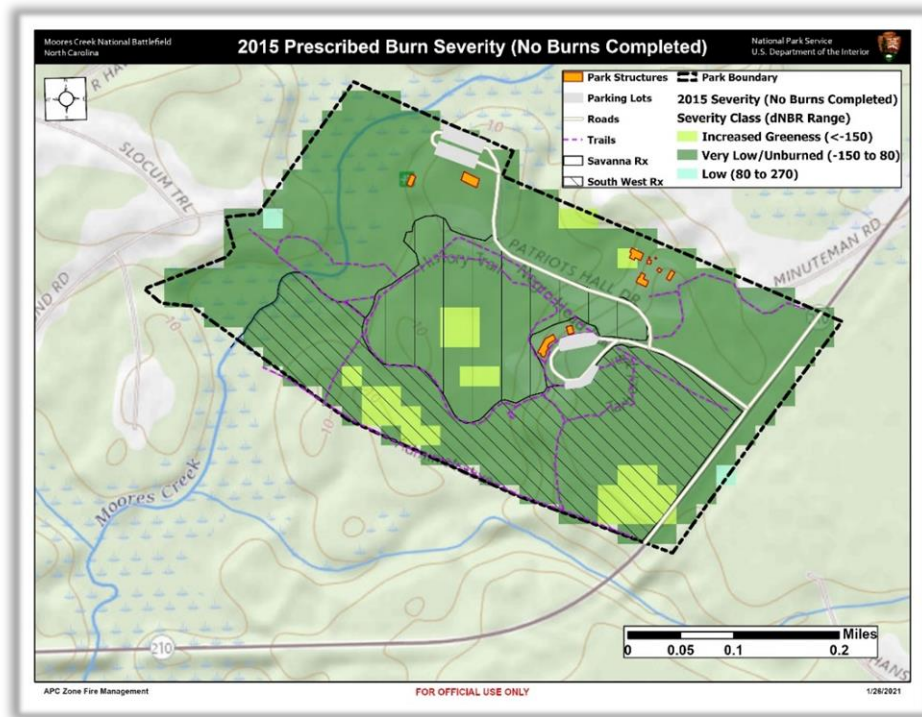
A limited amount of on-site fire-effects monitoring has occurred at Moore's Creek since the renewed onset of prescribed burning in 2010. Most of the burn events from 2012-2020 have some degree of burn-day monitoring similar to the report of the 2020 prescribed burns included in this year's report, and photo-monitoring has been done for the Savannah unit since 2012. These efforts are documented in previous year's annual reports, which are available on the NPS Datastore, or from the APC Zone Fire Ecologist.

With limited data to assess the effects of burning on vegetation and fuels at Moore’s Creek, we are challenged to understand whether objectives are being achieved, and also challenged to make effective adjustments to the burning program. Other tools that we can use to assess the effects of prescribed burning at Moore’s Creek include remote sensing and on-site post-burn assessments. These tools can give us insights into how fire has affected the varied natural communities at the Park, and can be used to inform adaptive management discussions to help steer future burning.

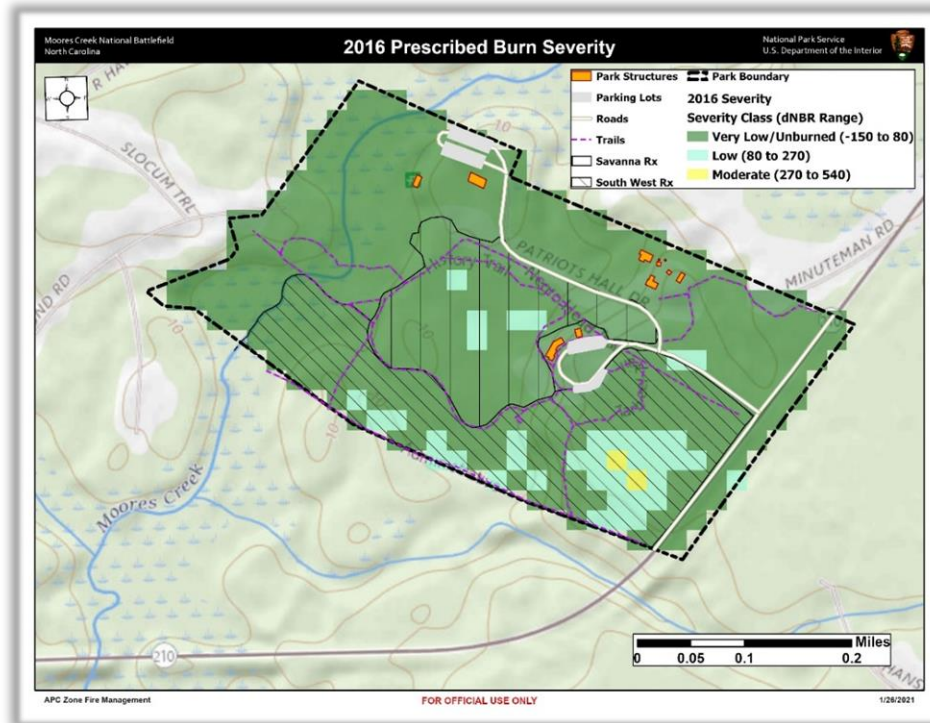
Remote sensing of burn severity (“dNBR”) is a well-established method of fire-effects monitoring that is typically applied to landscapes where large-scale burning or wildfire has occurred (<https://www.frames.gov/firemon/landscape-assessment>). The APC Zone Fire-Effects Team has been using these methods to monitor prescribed burns and wildfires in the NPS-SER for several years, and have had some success using them to monitor small fires. Ultimately, they provide a good way to view the relative impacts of fire (or other disturbances) on a landscape. Additional on-the-ground monitoring is required to provide the details needed to more fully interpret the maps. Below, we provide a series of dNBR burn-severity maps for all prescribed burns at Moore’s Creek since 2014. Some interpretive comments are provided, but full interpretation will require on-site data collection. The field data collection will be the focus of our next full monitoring trip to the Park.



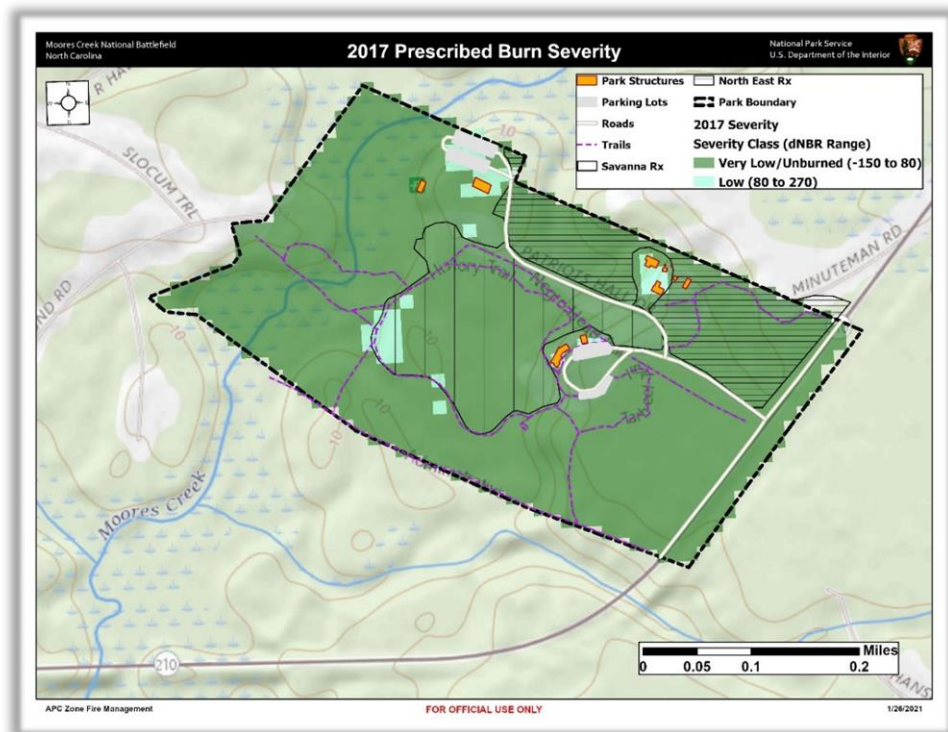
2014 MOCR Burn Severity: Savannah and South-West burns. This was the first known burn of the South-West unit, and a significant patch of “moderate” severity (yellow pixels) can be seen in the southeastern corner of the unit. Our experience suggests that forested areas with moderate severity often have substantial (20-50%) canopy tree mortality. “Low” severity typically has <20% canopy mortality, and notable effects in the understory. “Very low” severity typically means that areas either did not burn, or had minimal impacts to the canopy and subcanopy. This type of monitoring is not as useful for understanding impacts to grassland areas such as the Savannah.



2015 MOCR Burn Severity (No Burns Completed). This product shows “increased greenness” during the second growing season after the 2014 burns. This reflects rapid vegetation recovery in the understory, as the canopy gaps created during the earlier prescribed burning begin to fill in at the ground level.



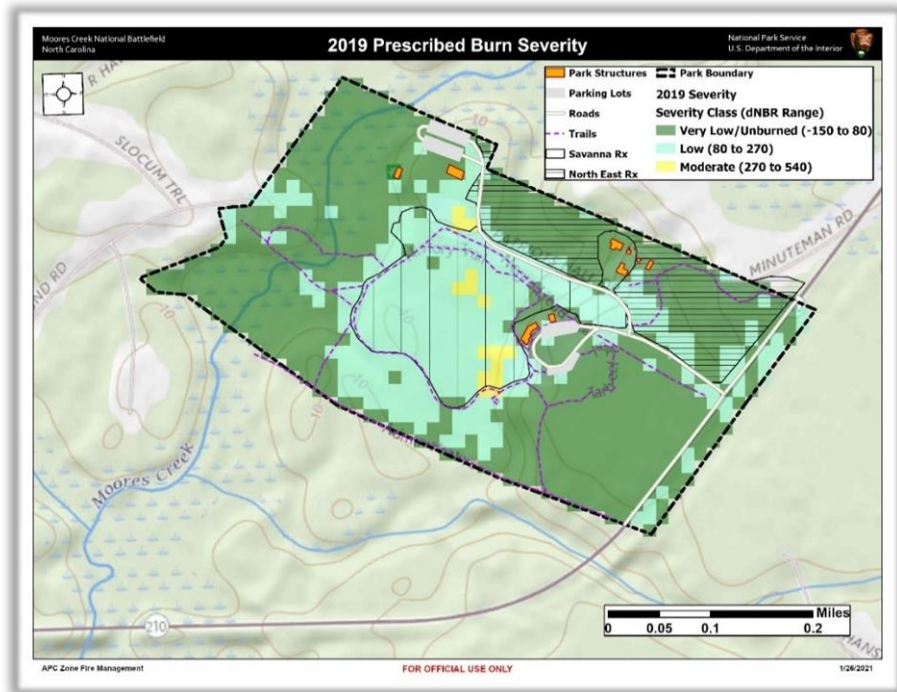
2016 MOCR Burn Severity: Savannah and South-West burns. A common pattern during re-burns is greater severity occurring in the same place or adjacent to areas that previously had enhanced severity. Here you can see new areas of canopy mortality (yellow) adjacent to areas of the South-West unit that were impacted in 2014.



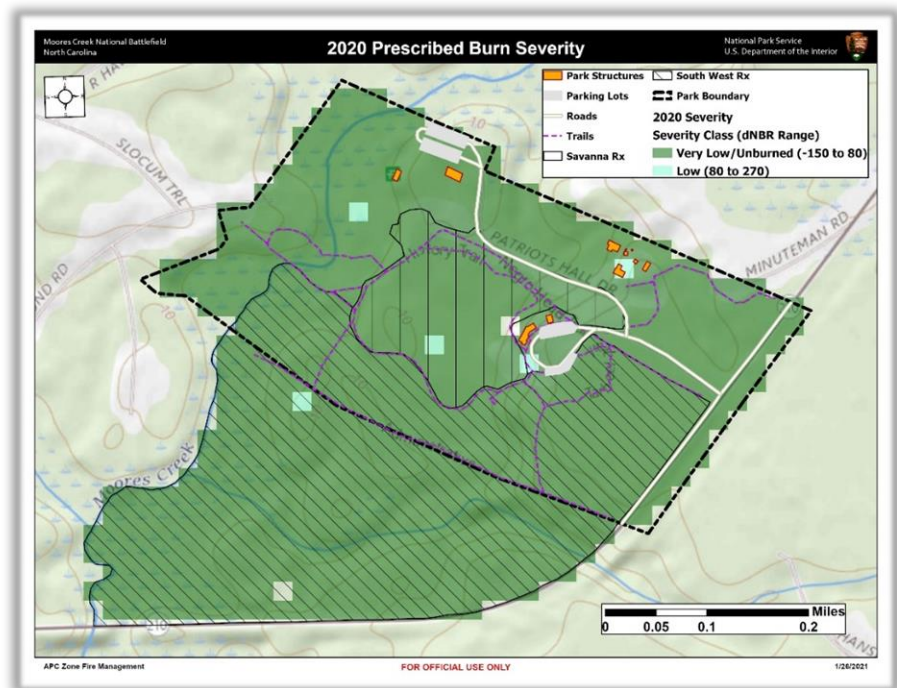
2017 MOCR Burn Severity: Savannah and North-East burns. “Very low” severity typically means that areas either did not burn, or had very minimal impacts to the canopy and subcanopy layers.



2018 MOCR Burn Severity: Savannah and South-West burns. Again, “Very low” severity typically means that areas either did not burn, or had very minimal impacts to the canopy and subcanopy layers.



2019 MOCR Burn Severity: Savannah and North-East burns. Considerably more uniform “Low” severity could indicate more substantial fire effects to canopy layers. These impacts may also be related to the extraordinary flooding that occurred late in 2018 following Hurricane Florence.



2020 MOCR Burn Severity: Savannah, South-West, and private lands burns. The impacts of the 2020 burns appear to be limited to the understory. Additional on-site monitoring is needed to more fully assess the fire effects.

Additional Program Information

Table 1. Planning - 2020

Park	Does Park have written DFCs? (yes or no)	Date Park-level Monitoring Plan completed (or revised)	Total # of Project- or Community-level Monitoring Plans (not just 2020)	Assisted with how many BAER plans in 2020?
BISO	yes	n/a	0	0
BLRI	yes	n/a	0	0
CAHA	no	n/a	0	0
CHCH	yes	n/a	0	0
CONG	yes	n/a	0	0
COWP	no	n/a	0	0
CUGA	yes	n/a	0	0
GRSM	yes	n/a	0	1
KIMO	yes	n/a	0	0
MOCR	no	n/a	0	0

Table 2. Monitoring - 2020

Park	% 2020 Data entered	%2020 Data Quality Checked	# of Prescribed Fires Monitored	# Non-Fire Fuels Treatments Monitored	#Wildfires Monitored	#BAER Treatments Monitored
BISO	100	100	0	3	0	0
BLRI	n/a	n/a	0	0	0	0
CAHA	n/a	n/a	0	4	0	0
CHCH	100	100	0	0	0	0
CONG	100	100	0	0	0	0
COWP	n/a	n/a	0	0	0	0
CUGA	100	100	0	0	0	0
GRSM	100	100	3	3	1	0
KIMO	100	100	0	1	0	0
MOCR	n/a	n/a	0	0	0	0

Table 3. Communicating Results - 2020

Park	# of Project Monitoring Reports completed in 2020	# of Annual meeting(s) with Park staff	# of Formal presentations of results	Do you use Minitab?*
BISO	2	1	1	Yes
BLRI	0	0	0	Yes
CAHA	3	0	0	Yes
CHCH	0	0	0	Yes
CONG	2	0	0	Yes
COWP	0	0	0	No
CUGA	1	0	0	Yes
GRSM	5	3	2	Yes
KIMO	1	1	0	Yes
MOCR	2	0	0	No

Table 4. Research - 2020

Park	Are research needs identified in FMP or Monitoring Plan? (yes or no)	# of Proposals Submitted in 2020	# of Proposals Funded in 2020	# of Research Projects Supported in 2020*	Additional Comments
BISO	yes	0	0	0	
BLRI	yes	0	0	0	
CONG	yes	0	0	0	
COWP	yes	0	0	0	
CUGA	yes	0	0	0	
GRSM	yes	0	2	2	
KIMO	yes	0	0	0	
MOCR	yes	0	0	0	

*Number of funded research projects, new or ongoing, supported by the fire ecology program including logistical info or support, staffing, etc.

Fire Ecologist and Fire Effects Crew Accomplishments and Areas of Focus

Table 1. Fire Ecologist 2020 Accomplishments/Focus Areas

Category	Percent Time	Accomplishments and/or areas of activities
Details	30%	60-day detail Region 2 DRFMO; 60-day detail Region 1 Planner/Ecologist
Data Collection	10%	Field work at GRSM. FMH plots, LFEM plots, Photo-monitoring, and qualitative surveys.
Planning	15%	Fire effects program planning. APC Zone planning. Fuels program planning meetings at GRSM.
Data analysis	5%	Work completed on 2019 and 2020 Annual Reports.
Data management	10%	Routine data management tasks. Fire records. GIS data.
Supervision/Admin	20%	Supervision, Performance evaluations, Training, IDPs, travel, payroll, crew support, purchasing etc.
Fire Operations	1%	Limited support.
Writing	4%	Annual report. Detailed correspondence.
Miscellaneous	3%	Mostly communication; E-mails, phone calls, informal planning discussions.
Training	2%	Statistics training; Supervisory and required NPS training; fire refresher;

Table 2. Fire Effects Crew 2020 Accomplishments/Focus Areas

Category	Percent Time	Notes
Planning	15%	Planning related to monitoring, prescribed fire projects, and mechanical fuels projects including meetings, mapping, records, preparation for burns and communications of objectives
Detail	15%	Paxton 90-day detail as APC Zone Fire Ecologist
Plot work	35%	FMH plots, LFEM, Survey 123, Mechanical treatment photo-points at GRSM and KIMO
Wildfire/All-Hazard assignments	5%	Paxton –ENGBt assignment in Colorado Arulanantham – COVID IMT at GRSM
Prescribed fire projects	3%	Assisted with implementation of burns at GRSM
Data entry	2%	100% entered
Data analysis	2%	Assistance with Annual Report
Supervision/Admin	10%	Supervision of crew for completing field and office work, as well as time, travel credit card and purchasing paperwork. Other Administrative duties accomplished were submitting CY2020 fire polygons to Regional Fire GIS coordinator. Quality Checking AP Zone Fire Occurrence Data
Training	3%	Basic NPS stuff; Refresher;
Miscellaneous	10%	Survey 123 development; Data management; GIS