

National Park Service
Fire Ecology Annual Report
Barrens to Bayous
Fire Monitoring Network



2014-15

Calendar Years



National Park Service Barrens to Bayous Fire Monitoring Network Fire Ecology Annual Report Calendar Year 2014/2015

Jesse Burton and Carol Fields

A. Summary

The two past years, the fire effects crew worked hard to prioritize monitoring needs and establish pre-burn data for developing parks within the monitoring network. In addition to fire and vegetation monitoring at CUIS, GUIS, HOBE, LIRI, MACA, NATR, SHIL, and STRI, the crew also assisted with the implementation of Rx fire within BICY, BISO, CONG, LIRI, NATR, STRI, and SHIL. The fire effects crew assisted with well over 20 prescribed fires throughout the Southern Area (NPS, BIA, FWS, and USFS), providing operational support as FFT2, FFT1, ATVO, READ, FIRB(T), ENOP, ICT5, and FEMO. The Barrens to Bayous crew installed a forest plot at the neighboring Noxubee National Wildlife Refuge in 2014, with more planned as time allows.

One important highlight for the 2014 season was the founding of an NPS fire monitoring program at Cumberland Island National Seashore. Eight monitoring plots were installed in August 2014, with the generous support of the Mountains-to-the-Sea and Everglades FX modules. The crew also installed and read 4 new FMH plots at Shiloh National Military Park in Tennessee prior to first-entry spring burns in 2014 and 2015. Even with restricted travel, budget stagnation, and minimal staffing, the crew read 69 long-term vegetation plots in 2014 and 65 in 2015.

As always, the entire crew was actively involved with local wildfires, serving in the roles of FFT2, FFT1, FAL3, and ICT5. During the 2014 wildfire season, Fields served as a HECM and as a READ at YOSE and the King Fire. Burton also covered some ground as a Squad Boss on a hand crew at the King Fire. In 2015, Fields supported Big Cypress National Preserve on a HECM detail and as a READ on the Mud Lake Complex. Burton is now working with the Southern Area Red Incident Management Team as a GISS trainee.

In 2014, all members of the crew taught segments of S130/190 and S-212 courses for AmeriCorps volunteers. Jennifer Falkey was the crew coordinator for the fire AmeriCorps crew. Jesse Burton presented information regarding fire ecology and endangered species management at the MidSouth Fire Tour at Stones River National Battlefield. Carol Fields discussed FMH data collection methodology at the Fire Tour. Additionally, Burton presented fire monitoring results and lead a tour at the 2014 Fire and Bat Workshop at Mammoth Cave National Park. Burton also led discussions and presented at local Mississippi Fire on the Forty extension programs. In the spring of 2014, Falkey accepted a position as a Resource Management Specialist with the US Forest Service, and Will Hilton accepted a position as a Fuels Technician for the Mississippi River Fire Management Zone. Anna Ramthun was hired as a seasonal fire effects monitor in the fall of 2015. She assisted with a multitude of prescribed fires and suppression fires in addition to monitoring duties.

Table 1a. Fire Effects Plot Workload (2014) and Total Plots Installed

Park	Monitoring Type	Type Code	Plot Type	Pre-burn 2014	Immed. Post 2014	Annual 2014	Annual Total (2014)	Total Plots
Cumberland Island National Seashore	Mixed Loblolly Pine Plantation	PLAN	Fuels Plot	4	0	0	4	4
	Longleaf Pine – Darlington Oak – Wiregrass Woodland	ARIS	FMH Forest Plot	4	0	0	4	4
Gulf Islands National Seashore	Sand Pine - Scrub Oak	PICL	FMH Forest Plot	0	0	1	1	12
	Longleaf - Slash Pine	PIPA	FMH Forest Plot	0	0	0	0	12
	Pitcher Plant Savannah	SAAL	FMH Forest Plot	0	0	1	1	1
	Fuels Monitoring	FUELS	Fuel Plot	0	0	0	0	4
Mammoth Cave National Park	Redcedar – Oak Glade	JUVI	FMH Forest Plot	0	0	0	0	7
	Indiangrass Grassland	SONU	FMH Grass Plot	0	0	0	0	8
	Big Bluestem Grassland	ANGE	FMH Grass Plot	0	0	0	0	5
	Oak-Hickory Woodland	OAHI	FMH Forest Plot	0	0	1	1	9
	Chestnut Oak Woodland	QUMO	FMH Forest Plot	0	0	0	0	3
	Fuels Monitoring	FUELS	Fuels Plot	0	0	0	0	4
	Old Field	OLFI	FMH Forest Plot	0	0	2	2	2
Little River National Preserve	Shortleaf Pine Forest	PIEC	FMH Forest plot	0	4	0	4	12
	Green Pitcher-plant Bog	SAOR	FMH Forest Plot	0	1	2	3	6
	Chestnut Oak Forest	QUMO	FMH Forest Plot	0	1	0	1	7
Natchez Trace Parkway	Oak-Hickory Woodland	OAHI	FMH Forest Plot	0	4	2	6	6
	Post Oak Savanna	QUST	Mod. F. Plot [†]	0	0	3	3	6
	Redcedar Encroached Prairie	JUVI	FMH Brush Plot	0	0	4	4	4
	Loblolly Pine Forest	PITA	FMH Forest Plot	0	0	6	6	14
	Redcedar Encroached Prairie	BLACK BELT	FMH Grass Plot	0	4	0	4	4
	Tennessee Barrens	TNBA	Mod. F. Plot [†]	0	0	0	0	3
	Japanese Grass Invaded Streamside Forest	MIVI	FMH Grass Plot	0	5	0	5	10
Horseshoe Bend NMP	Mixed Montane Longleaf Forest	PIPA	FMH Forest Plot	0	0	4	4	5
Stones River National Battlefield	Little Bluestem Fields	SCSC	FMH Grass Plot	0	2	0	2	15
	Central Basin Barrens	ANTE	FMH Grass Plot	0	0	8	8	9
	Grassland Restoration Areas	ANVI	FMH Grass Plot	0	1	0	1	10
	Fuels Monitoring	FUELS	Fuels Plot	0	0	1	1	3
	Redcedar Woodland	JUVI	FMH Forest Plot	0	0	0	0	1
Russell Cave NM	Chestnut Oak Forest	QUMO	FMH Forest Plot	0	0	0	0	1
Vicksburg NMP	Exotics Monitoring	VICK	Photo Plot	0	0	0	0	6
Shiloh NMP	Oak-Hickory Woodland	OAHI	FMH Forest Plot	2	2	0	4	4
Total				10	24	35	69	201*

In addition to the above plots installed on NPS lands, 1 interagency FMH plot was installed on an adjacent FWS Refuge.

[†]See 2011 B2B Annual Report for plot layout and methods.

*Total plot numbers have been adjusted from 2013 to account for both retired/abandoned and newly installed plots.

Table 1b. Fire Effects Plot Workload (2015) and Total Plots Installed

Park	Monitoring Type	Type Code	Plot Type	Pre-burn 2015	Immed. Post 2015	Annual 2015	Annual Total (2015)	Total Plots
Cumberland Island National Seashore	Mixed Loblolly Pine Plantation	PLAN	Fuels Plot	0	0	0	0	4
	Longleaf Pine – Darlington Oak – Wiregrass Woodland	ARIS	FMH Forest Plot	0	0	0	0	4
Gulf Islands National Seashore	Sand Pine - Scrub Oak	PICL	FMH Forest Plot	0	0	3	3	12
	Longleaf - Slash Pine	PIPA	FMH Forest Plot	0	0	0	0	12
	Pitcher Plant Savannah	SAAL	FMH Forest Plot	0	0	0	0	1
	Fuels Monitoring	FUELS	Fuel Plot	0	0	0	0	4
Mammoth Cave National Park	Redcedar – Oak Glade	JUVI	FMH Forest Plot	0	0	0	0	7
	Indiangrass Grassland	SONU	FMH Grass Plot	0	0	0	0	8
	Big Bluestem Grassland	ANGE	FMH Grass Plot	0	0	0	0	5
	Oak-Hickory Woodland	OAHI	FMH Forest Plot	0	0	0	0	9
	Chestnut Oak Woodland	QUMO	FMH Forest Plot	0	0	0	0	3
	Fuels Monitoring	FUELS	Fuels Plot	0	0	0	0	4
	Old Field	OLFI	FMH Forest Plot	0	0	0	0	2
Little River National Preserve	Shortleaf Pine Forest	PIEC	FMH Forest plot	0	0	9	9	12
	Green Pitcher-plant Bog	SAOR	FMH Forest Plot	0	0	6	6	6
	Chestnut Oak Forest	QUMO	FMH Forest Plot	0	0	0	0	7
Natchez Trace Parkway	Oak-Hickory Woodland	OAHI	FMH Forest Plot	0	1	2	3	6
	Post Oak Savanna	QUST	Mod. F. Plot [†]	0	3	5	8	6
	Redcedar Encroached Prairie	JUVI	FMH Brush Plot	0	4	0	4	4
	Loblolly Pine Forest	PITA	FMH Forest Plot	0	0	1	1	14
	Redcedar Encroached Prairie	BLACK BELT	FMH Grass Plot	0	0	4	4	4
	Tennessee Barrens	TNBA	Mod. F. Plot [†]	0	0	0	0	3
	Japanese Grass Invaded Streamside Forest	MIVI	FMH Grass Plot	0	0	10	10	10
Horseshoe Bend NMP	Mixed Montane Longleaf Forest	PIPA	FMH Forest Plot	0	0	4	4	5
Stones River National Battlefield	Little Bluestem Fields	SCSC	FMH Grass Plot	0	0	4	4	15
	Central Basin Barrens	ANTE	FMH Grass Plot	0	0	0	0	9
	Grassland Restoration Areas	ANVI	FMH Grass Plot	0	0	4	4	10
	Fuels Monitoring	FUELS	Fuels Plot	0	0	0	0	3
	Redcedar Woodland	JUVI	FMH Forest Plot	0	0	0	0	1
Russell Cave NM	Chestnut Oak Forest	QUMO	FMH Forest Plot	0	0	0	0	1
Vicksburg NMP	Exotics Monitoring	VICK	Photo Plot	0	0	1	1	6
Shiloh NMP	Oak-Hickory Woodland	OAHI	FMH Forest Plot	0	2	2	4	4
Total				0	10	55	65	201

Table 2a. Fire Ecology Staffing 2014

Ecologist and Monitors	Starting Date	Ending Date	# of Pay Periods	READ Qualified	Training and Development
Jesse Burton Ecologist	01/01/14	12/31/14	26	Yes	FFT1 on CA handcrew assignment, RT-130, RT-271, RT-212, S-230 & S-231, ENOP(T) on OK engine assignment, S130/190/212 assistant instructor, JFSP Funding Review Panel, 7 Habits of Highly Effective People Supervisory Training, attained ICT5 & ENOP qualifications, GISS(T) task-book initiated, lead presenter for MidSouth Fire Tour and Fire & Bats Workshop, South Atlantic IMT sand-table exercise, IS200, All-hazard DOI READ training, HECM refresher
Carol Fields Lead Monitor	01/01/14	12/31/14	26	Yes	Annual Fire/Saw Refresher, S-203, ICT5 taskbook completed, Botany Field Trip to Canyon Creek Preserve, Carolina Vegetation Survey, NATR Breeding Bird Surveys, Audubon Christmas Bird Count Compiler, Presenter at MidSouth Fire Tour, READ on western fire assignment, HECM on eastern fire assignment, HECM refresher
Jennifer Falkey Monitor	01/1/14	05/16/14	11 (11 total*)	Yes	Annual Fire/Saw Refresher, S-211, S130/190 & 212 assistant instructor, Americorps coordinator & squad-boss, eastern engine assignment, Botany Field Trip to Canyon Creek Preserve, NPS Fundamentals V
William Hilton Monitor	01/01/14 09/22/14	05/03/14 10/04/14	9 1 (10 total*)	Yes	Annual Fire/Saw Refresher, B3, FFT1(T) on eastern engine assignment, detail with Alpine Hotshots, FALB & FFT1 taskbooks completed, ENOP taskbook initiated, S-211, S-290, RT-271, S-230, S-231, & S-234



Jennifer Falkey educating wildland fire AmeriCorps crewmembers in the importance of fire weather and fire behavior.
(NATR) March 2014



Team members from Mountains to the Sea, Everglades, and Barrens to Bayous fire effects modules worked together to get 8 FMH plots installed at Cumberland Island prior to prescribed fire treatments.
(CUIS) August 2014



Will Hilton leading a squad of BIA firefighters holding a burn-out operation directed by FIRB(T) Jesse Burton.
Medicine Man Fire, OK March 2014

Table 2b. Fire Ecology Staffing 2015

Ecologist and Monitors	Starting Date	Ending Date	# of Pay Periods	READ Qualified	Training and Development
Jesse Burton Ecologist	01/01/15	12/31/15	26	Yes	S341 - GIS Specialist for Incident Management, NWCG IQCS Supervisor Training, RT-130, NWCG IQCS FMO/Certifying Official Training, Detailed into Zone FMO position for 120 days, continued to work on FIRB and FAL2 qualifications.
Carol Fields Lead Monitor	01/01/15	12/31/15	26	Yes	ArcGis Training (Albright Grant), RT-130, Vegetation Map Accuracy Assessment Training, Breeding Bird Survey Coordinator, Audubon Christmas Bird Count Compiler, Instructed Segments of S-271, HECM,, Engine and READ Assignments
Anna Ramthun Monitor	10/05/15	12/31/15	6	No	FFI Online Training, RT-130, Travel Credit Card Training, IS-800
Vacant Monitor					

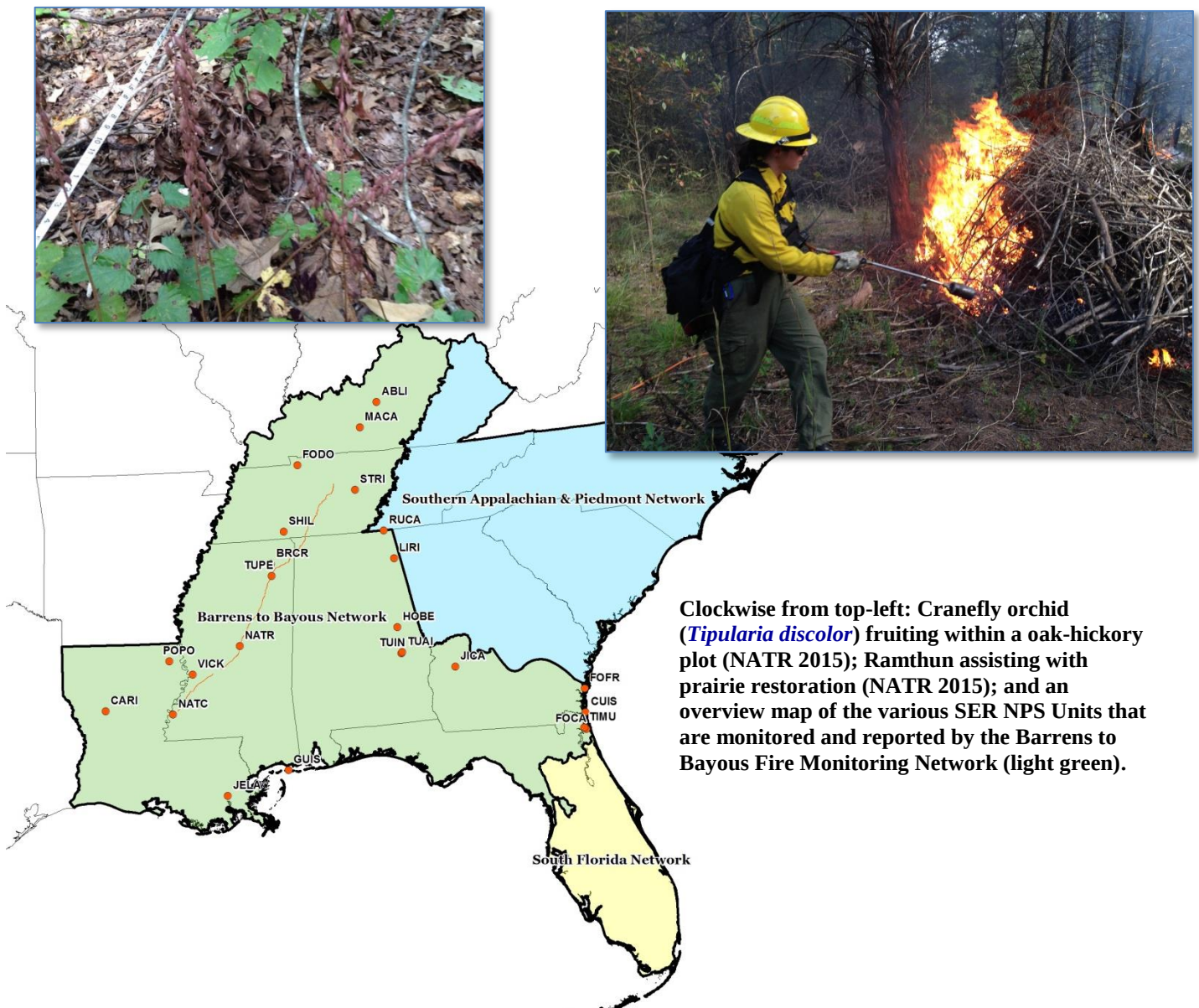


Table 3. Management Objectives and Monitoring Results 2015

The monitoring results for this report are broken down by park in the following pages. Data entry is current up to the end of calendar year 2014 and all analyses conducted this year have used the most recent data entered and checked in January 2016. Results are reported with 80% confidence intervals of the mean unless otherwise noted. Basic formulas for each analysis are now displayed in the management objectives column. **Significant** changes in monitoring results are in **bold** font. An underlined number of plots denote that minimum sample sizes have been achieved. Estimations of minimum sample size were conducted in 2010 with the ‘SS Two Samples’ tool created by Ken Gerow (available online at www.statsalive.com). Sample sizes needed with current variance are given in brackets when minimum size has not been achieved. When brackets are not given, variance and correlation of samples do not yet allow for an estimate of minimum sample size.



Clockwise from top left: The federally threatened Price's potato-bean (*Apios priceana*) was discovered to be flourishing within one of NATR's Rx burn units in the summer of 2014; Rob Klein, fire ecologist from the Southern Appalachian/Piedmont FEM, assists with the 6 post-burn FMH plots that were read at LIRI in 2014; this small restored Black Belt Prairie site at NATR contains nearly a dozen state-tracked species; the federally endangered Pyne's ground-plum (*Astragalus bibullatus*) reestablished within a burn unit at STRI.

Table 2.1. Summary of Long-term Monitoring Results at Cumberland Island National Seashore

Vegetation Type	Management Objectives (Restoration)	Monitoring Results (80% Confidence Intervals)	Objective Achieved?	Year Analysis Completed (Range)
Longleaf Pine – Darlington Oak – Wiregrass Woodland (FARIS1D09)	20-40% litter reduction immediate post-burn $\frac{\beta_{Post} - \text{before } \beta}{\text{before } \beta}$	Decrease of Litter =	Uncertain Monitoring plots have not yet been burned	(2014-)
	20-40% reduction of pole-sized trees by 2 nd year after 2 nd burn $\frac{\beta_{YR02} - 00Pre}{00Pre}$	Pole density reduction =	Uncertain Monitoring plots have not yet been burned	(2014-)
	> 50% increase in herbaceous cover by 2 nd year after 3 rd burn $\frac{\beta_{YR02} - 00Pre}{00Pre}$	Increase in relative cover =	Uncertain Monitoring plots have not yet been burned	(2014-)
	Reestablishment of wiregrass within at least 25% of FMH plots by 2 nd year after 3 rd burn	Percent cover of <i>Aristida beyrichiana</i> =	Uncertain Monitoring plots have not yet been burned	(2014-)
Mixed Loblolly Pine Plantation (FPLAN1D09)	20-40% litter and duff reduction immediate post-burn $\frac{\beta_{Post} - \text{before } \beta}{\text{before } \beta}$	Decrease of Litter & Duff =	Uncertain Monitoring plots have not yet been burned	(2014-)



This male ox beetle was one of many we observed within areas that had experienced the highest overstory mortality during the South Cut Wildfire that occurred in 2008.



Like the majority of the FMH monitoring plots installed at CUIS in 2014, ARIS01 is within the area severely burned by the South Cut Wildfire. This fire caused significant overstory mortality and consumed much of the duff layer, creating a great site for longleaf pine seedlings. However, repeated low-intensity fire will be needed to reestablish the diverse understory and exclude hardwood competition

Table 3.2. Summary of Long-term Monitoring Results at Gulf Islands National Seashore

Vegetation Type	Management Objectives (Restoration)	Monitoring Results (80% Confidence Intervals)	Objective Achieved?	Year Analysis Completed (Range)
Sand Pine – Scrub Oak (FPICL1D07)	20-40% litter and duff reduction immediate post-burn $\frac{\beta_{Post} - \beta_{before}}{\beta_{before}}$	Decrease of Duff = 14.9 % (± 26 %) after 1 st fire <i>n</i> =8 [32], 3 <i>burn units</i> 1.1 % (± 58 %) after 2 nd fire <i>n</i> =6 [25], 4 <i>burn units</i> 54.5 % (± N/A) after 3 rd fire <i>n</i> =1, 1 <i>burn units</i> Decrease of Litter = 42.0 % (± 19 %) after 1st fire <i>n</i> =8, 3 <i>burn units</i> +20.0 % (± 98 %) after 2nd fire <i>n</i> =6 [42], 4 <i>burn units</i> 8.7 % (± N/A) after 3 rd fire <i>n</i> =1, 1 <i>burn units</i>	Uncertain Data are highly variable, may be confounded by hurricanes Ivan, Dennis, & Katrina [Objective to be changed in 2013 to reflect long-term management of fuel loading]	2012 (2000-2012)
	40-60% reduction of pole-sized trees by 2 nd year after 3 rd burn $\frac{\beta_{YR02} - 00Pre}{00Pre}$	Pole density reduction= 9.6 % (± 4 %) after 1st fire <i>n</i> =10, 5 <i>burn units</i> 21.8 % (± 8 %) after 2nd fire <i>n</i> =3, 2 <i>burn units</i>	Uncertain Plots have not been burned three times and objective reduction has not been met	2010 (2000-2010)
	20-40% increase in herbaceous cover by 2 nd year after 3 rd burn $\frac{\beta_{YR02} - 00Pre}{00Pre}$	Increase in relative cover = 96.1 % (± 65 %) after 1st fire <i>n</i> =8 [80], 4 <i>burn units</i> 210.7 % (± 124 %) after 2nd <i>n</i> =3 [230], 2 <i>burn units</i>)	Yes/Uncertain Plots have not burned three times	2010 (2000-2010)
	50-90% hardwood pole reduction by one Year after the 3 rd burn. $\frac{\beta_{YR01} - 00Pre}{00Pre}$	Density Reduction = 59.3 % (± 15 %) after 1st fire <i>n</i> =9, 4 <i>burn units</i> 67.6 % (± 15 %) after 2nd fire <i>n</i> =9, 4 <i>burn units</i> 82.6 % (± N/A %) after 3 rd fire <i>n</i> =1, 1 <i>burn units</i>	Yes All plots have not burned three times	2010 (2000-2010)
Longleaf – Slash Pine Savanna (FPIPA1D07)	20-40% litter and duff reduction immediate post-burn $\frac{\beta_{Post} - \beta_{before}}{\beta_{before}}$	Decrease of Duff = 14.2 % (± 15 %) after 1 st fire <i>n</i> =8 [18], 3 <i>burn units</i> 19.2 % (± 15 %) after 2nd fire <i>n</i> =10 [18], 4 <i>burn units</i> 42.3 % (± 12 %) after 3rd fire <i>n</i> =8, 3 <i>burn units</i> 28.3 % (± 30 %) after 4 th fire <i>n</i> =3, 2 <i>burn units</i> Decrease of Litter = 61.9 % (± 6 %) after 1st fire <i>n</i> =8, 3 <i>burn units</i> 59.7 % (± 13 %) after 2nd fire <i>n</i> =10 [19], 4 <i>burn units</i> 38.6 % (± 28 %) after 3rd fire <i>n</i> =8 [68], 3 <i>burn units</i>) +36 % (± 99 %) after 4th fire <i>n</i> =3 [68], 2 <i>burn units</i>)	Yes Reductions of litter with initiation of Rx fire and duff reductions occurred in later treatments [Objective to be changed in 2013 to reflect long-term management of fuel loading]	2012 (2000-2012)
	20-40% increase of herbaceous cover by 2 nd year after 3 rd burn. $\frac{\beta_{YR02} - 00Pre}{00Pre}$	Increase in cover = 36.7 % (± 31 %) after 1 st fire <i>n</i> =7 [13], 3 <i>burn units</i> 147.5 % (± 76 %) after 2 nd fire (<i>n</i> =6 [191], 3 <i>burn units</i>) -3.9 % (± 44 %) after 3rd fire	Uncertain Increase in graminoid, fern, and forb cover by second burn; however, few plots	2016 (2000-2015)

		(n=4, 2 burn units)	have burned three times with 2-year post burns completed	
	Limit mortality of longleaf and slash pine to 20%	Density Reduction = 13.2 % (± 14%) after 1 st fire <i>n</i> =10, 4 burn units 22.8 % (± 21 %) after 2 nd fire <i>n</i> =6 [22], 3 burn units 19.5 % (± 11.7 %) after 3 rd fire <i>n</i> =4, 3 burn units	Uncertain Confidence interval falls within 20% limit and mortality may be a result of hurricanes Ivan, Dennis, & Katrina	2016 (2000-2015)
	$\frac{\beta_{YR02} - 00Pre}{00Pre}$			
Pitcherplant Savannah (FSAAL1G010)	Decrease duff loading by 0-20 % immediate post burn	Decrease of Duff = 12.5 % (± 14 %) after 1 st fire <i>n</i> =4, 1 burn units 11.8 % (± 0 %) after 2nd fire <i>n</i> =2, 1 burn units	Yes/Uncertain [Objective changed in 2013 to limit duff reduction to >20 %]	2012 (2001-2012)
Wet Pine Savanna/Mesic Flatwoods Fuels (added to increase sample size of fuels analysis)	Decrease litter loading by 20-40% immediate post-burn	19.0 % (± N/A %) after 3 rd fire <i>n</i> =1, 1 burn units Decrease of Litter = 63.2 % (± 5 %) after 1st fire <i>n</i> =4, 1 burn units		
	$\frac{\beta_{Post} - before \beta}{before \beta}$	23.3 % (± 72 %) after 2 nd fire <i>n</i> =2, 1 burn units 17.4 % (± N/A %) after 3 rd fire <i>n</i> =1, 1 burn units		
	Limit mortality of overstory pine trees to less than 20% measured 2 years post burn	Density Reduction = 4.5 % (± N/A %) after 1 st fire <i>n</i> =1, 1 burn units 25.0 % (± N/A %) after 2 nd fire <i>n</i> =1, 1 burn units	Yes/Uncertain* Mortality after 2 nd fire is likely a result of hurricanes Ivan, Dennis, & Katrina	2010 (2001-2010)
	$\frac{\beta_{YR02} - 00Pre}{00Pre}$			
	Reduce pole tree density by 40-90%	Density Reduction = 0 % (± N/A %) after 1 st fire <i>n</i> =1, 1 burn units 16.7 % (± N/A %) after 2 nd fire <i>n</i> =1, 1 burn units	No/Uncertain* Pole densities were very low at pre-burn levels (< 50 per/acre)	2010 (2001-2010)
	$\frac{\beta_{YR02} - 00Pre}{00Pre}$			
	Reduce shrub density by 40-90%	Density Reduction = +108 % (± N/A %) after 1st fire <i>n</i> =1, 1 burn units +92.5 % (± N/A %) after 2nd fire <i>n</i> =1, 1 burn units	No/Uncertain*	2010 (2001-2010)
	$\frac{\beta_{YR02} - 00Pre}{00Pre}$			
	Cause no net decrease in cover of yellow trumpets (<i>Sarracenia alata</i>)	Increase in cover = 100 % (± N/A %) after 1 st fire <i>n</i> =1, 1 burn units 100 % (± N/A %) after 2 nd fire <i>n</i> =1, 1 burn units	Yes/Uncertain* Only one plot is installed in this monitoring type	2010 (2001-2010)
	$\frac{\beta_{YR02} - 00Pre}{00Pre}$			
	Increase herbaceous component of the understory by 20-40% measured 2 years after the 3rd burn	Increase in cover = -1.4 % (± N/A %) after 1st fire <i>n</i> =1, 1 burn units -36.6 % (± N/A %) after 2nd fire <i>n</i> =1, 1 burn units	No/Uncertain* Only one plot is installed in this monitoring type and plot has not burned three times	2010 (2001-2010)
	$\frac{\beta_{YR02} - 00Pre}{00Pre}$			

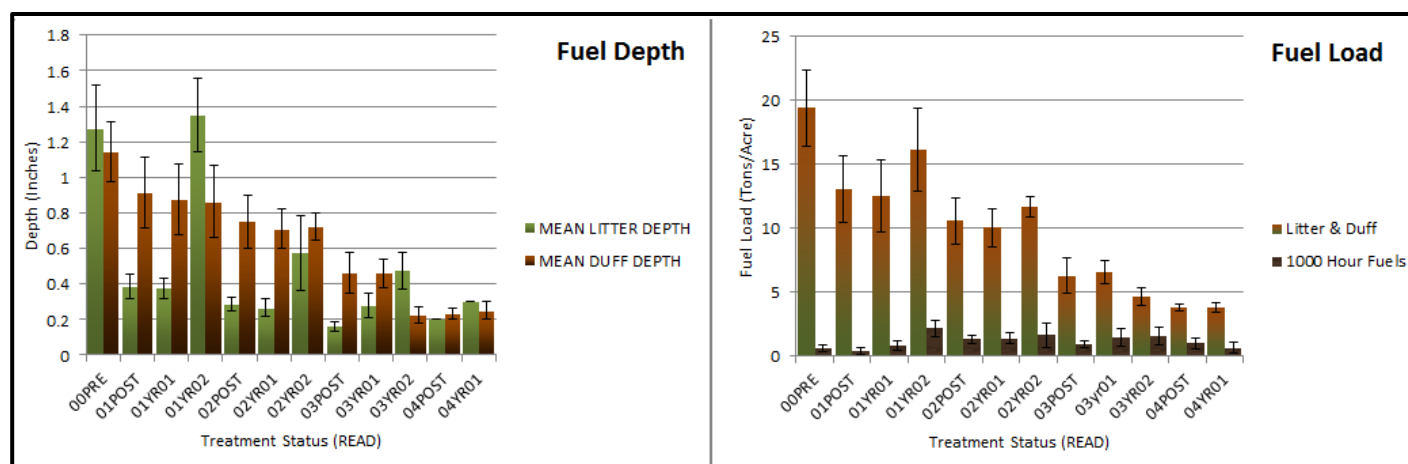
*No statistical analysis was conducted on the FSAAL1G01 plots because of the limited number of plots.



Pitcherplant Savanna (SAAL01) after 3 burns and 13 years, Davis Bayou, MS (GUIS)



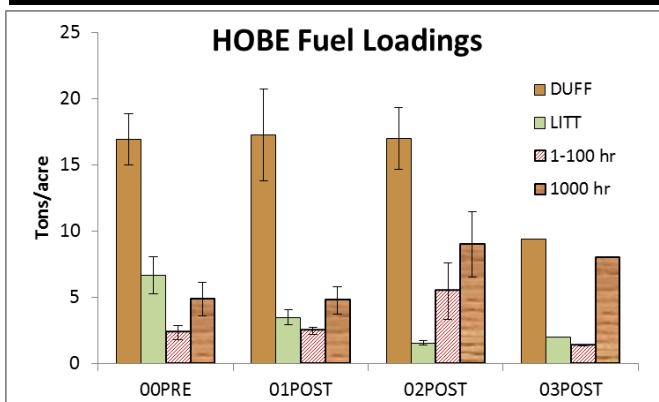
Longleaf – Slash Pine Savanna (PIPA06) after 4 burns and 11 years, NLO, FL (GUIS)



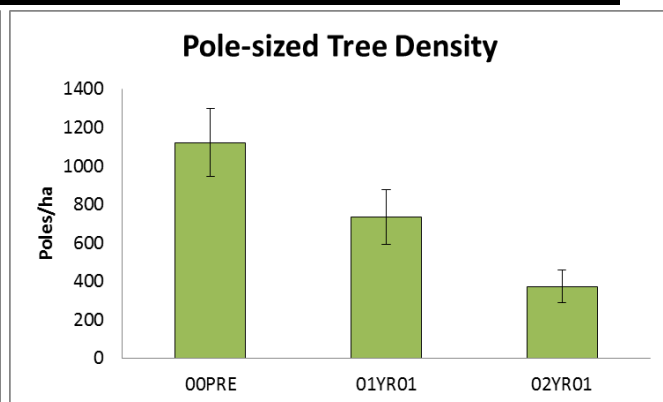
Depths and loading for primary fuel constituents of Naval Live Oaks' longleaf – slash pine savanna (PIPA) over the last 10 years. There has been an 82% reduction in litter & duff fuel depth (inches) and an 80% reduction in load (tons/acre) from 00PRE to 04POST. Hurricanes Ivan and Katrina are responsible for the significant increase in 1,000 hour fuels between 01YR01 and 02POST monitoring. Subsequent burning is beginning to reduce coarse woody debris to pre-hurricane levels.

Table 3.3. Summary of Long-term Monitoring Results at Horseshoe Bend National Military Park

Vegetation Type	Management Objectives (Restoration)	Monitoring Results (80% Confidence Intervals)	Objective Achieved?	Year Analysis Completed (Range)
Mixed Montane Longleaf Pine Forest (FPIPA1D07)	Decrease density of all pole trees by 20-90% as measured 1 year post burn $\frac{\beta_{YR01} - 00Pre}{00Pre}$	Density Reduction = 33.8 % (± 9.2 %) after 1 st fire <i>n</i> =5 [19], 4 units, P-value 0.04 66.1 % (± 6.2 %) after 2 nd fire <i>n</i> =5, 4 units, P-value 0.01 61.5 % (± N/A %) after 3 rd fire <i>n</i> =1, 1 burn unit	Yes The density of pole sized (DBH < 15 cm) trees has been reduced by > 50 % for all plots.	2016 (2004-2015)
	Decrease duff and litter loading by 40-90% as measured immediately post burn $\frac{\beta_{Post} - before \beta}{before \beta}$	Decrease of Duff = 2.3 % (± 13 %) after 1 st fire (<i>n</i> =5, 4 burn units) +53.2 % (± 7.5 %) after 2nd fire (<i>n</i>=5, 2 burn units) +46.8 % (± N/A %) after 3rd fire (<i>n</i> =1, 1 burn units) Decrease of Litter = 38.5 % (± 16 %) after 1 st fire <i>n</i> =5 [6], 4 burn units) 55.2 % (± 9 %) after 2 nd fire <i>n</i>=5, 2 burn units) 42.7% (± N/A %) after 3 rd fire (<i>n</i> =1, 1 burn units)	Yes/Uncertain Litter Objectives have been met; however, duff load has increased or remained variable since monitoring began. (see below graph)	2013 (2004-2013)
	Limit mortality of overstory longleaf pine (<i>Pinus palustris</i>) trees to less than 10% as measured 2 years post burn $\frac{\beta_{YR02} - 00Pre}{00Pre}$	Change in Density = +3.9 % (± 9.7 %) after 1 st fire <i>n</i> =5 [7], 4 burn units +3.0 % (± 10.2 %) after 2 nd fire <i>n</i> =5, 4 burn units	Yes Mean tree density is not significantly different from preburn.	2016 (2004-2015)
	Cause no net gain in percent cover of exotic plants as measured one year and five years post burn $\frac{\beta_{YR01} - 00Pre}{00Pre}$	Increase in cover = 0.0 % (± N/A %) after 1 st fire (<i>n</i> =5, 4 burn units) 0.0 % (± N/A %) after 2 nd fire (<i>n</i> =5, 4 burn units)	Yes Only one instance of an exotic species (<i>Lonicera japonica</i>) was measured in 2012; however, it is no longer present in the plot after subsequent burns.	2016 (2004-2015)



Mean fuel loads for mixed montane longleaf pine forests within Horseshoe Bend National Military Park after three prescribed fire treatments.



The density of pole-sized trees was reduced by at least 30% after the first two prescribed fire treatments.

Table 3.4. Summary of Long-term Monitoring Results at Little River National Preserve

Vegetation Type	Management Objectives (Restoration)	Monitoring Results (80% Confidence Intervals)	Objective Achieved?	Year Analysis Completed (Range)
Shortleaf Pine Forest (FPIEC1DG09)	25-80% reduction in pole-sized trees by 3 rd burn <i>$\beta YR01 - 00Pre$</i> <i>00Pre</i>	Density Reduction = 6.2 % (± 4 %) after 1 st fire <i>n=11, 4 burn units</i> 36.0 % (± 20 %) after 2 nd fire <i>n=9 [27], 4 burn units</i> 69.1 % (± 20 %) after 3 rd fire <i>n=4 [14], 2 burn units</i>	Yes	2010 (1999-2010)
	25-50% increase native grass and forb cover <i>$\beta YR02 - Earliest Read$</i> <i>Earliest Read*</i>	Increase in Cover = 225.2 % (± 103 %) after 1 st fire <i>n=5, 2 burn units</i> 194.5 % (± 136 %) after 2 nd <i>n=6, 3 burn units</i> 418.2 % (± 129 %) after 3 rd <i>n=2, 1 burn units</i>	Yes	2010 (1999-2010)
	20% reduction in total fuel loading by 3 rd burn <i>$\beta Post - 00Pre$</i> <i>00Pre</i>	Decrease of fuels = 12.9 % (± 9 %) after 1 st fire <i>n=12, 6 burn units</i> 31.8 % (± 8 %) after 2 nd fire <i>n=9, 5 burn units</i> 26.6 % (± 12 %) after 3 rd fire <i>n=10, 5 burn units</i> 24.9 % (± 7 %) after 4 th fire <i>n=4, 2 burn units</i>	Yes/Uncertain Plot average fuel loading has been reduced > 20%. [Objective changed in 2013]	2016 (1999-2015)
	> 25% reduction in litter fuel loading after each burn <i>$\beta Post - before \beta$</i> <i>before \beta</i>	Decrease of Litter = 51.3 % (± 6 %) after 1 st fire <i>n=12, 6 burn units</i> 46.0 % (± 16 %) after 2 nd fire <i>n=9, 5 burn units</i> 48 % (± 13 %) after 3 rd fire <i>n=10, 5 burn units</i> 18.5 % (± 18 %) after 4 th fire <i>n=4, 2 burn units</i>	Yes	2016 (1999-2015)
Green Pitcherplant Bog Forest (FSAOR1G10)	30-90% decrease in shrub cover by second year after 3 rd burn <i>$\beta YR02 - Earliest Read$</i> <i>Earliest Read</i>	Decrease in cover = 29.3 % (± 12 %) after 2 nd fire <i>n=6, 3 burn units</i> 32.1 % (± 25 %) after 3 rd fire <i>n=2 [3], 1 burn units</i> +61.6 % (± 56 %) after 4 th fire <i>n=2 [6], 1 burn units</i>	Uncertain All plots must burn 3 times	2010 (1998-2010)
	20% increase cover of green pitcherplant (<i>Sarracenia oreophila</i>) by second year after 3 rd burn <i>$\beta YR02 - Earliest Read$</i> <i>Earliest Read</i>	Increase in cover = 21.4 % (± 26 %) after 2 nd fire <i>n=6 [18], 3 burn units</i> 80.1 % (± 26 %) after 3 rd fire <i>n=2 [26], 1 burn units</i> 70.1 % (± 90 %) after 4 th fire <i>n=2, 1 burn units</i>	Yes/Uncertain Plots have not burned 3 times and high variability due to low numbers of individuals along transects; additional methods have been added to these plots to address this issue	2010 (1998-2010)
	30-90% decrease in pole-sized trees by second year after 3 rd burn <i>$\beta YR02 - 00Pre$</i> <i>00Pre</i>	Pole reduction = 13.2 % (± 21 %) after 1 st fire <i>n=3 [5], 1 burn units</i> 57.8 % (± 15 %) after 2 nd fire <i>n=5 [10], 3 burn units</i> 68.7 % (± 20 %) after 3 rd fire <i>n=3 [20], 2 burn units</i> 58.3 % (± 34 %) after 4 th fire <i>n=2 [7], 1 burn units</i>	Yes Local park staff is also applying mechanical treatment to pole size trees	2010 (1998-2010)

Chestnut Oak Forest (FQUM01G10)	20-60% reduction in pole-sized trees $\frac{\beta YR01 - 00Pre}{00Pre}$	Density Reduction = 37.6 % (± 14 %) after 1st fire <i>n</i>=4 [19], 3 burn units 41.0 % (± 0 %) after 2 nd fire <i>n</i> =2 [6], 1 burn units 69.0 % (± 17 %) after 3 rd fire <i>n</i> =2 [7], 1 burn units	Yes/Uncertain All plots must burn and have annual read to reach minimum sample size	2010 (2002-2010)
	25-50% increase native grass and forb cover $\frac{\beta YR01 - 00Pre}{00Pre}$	Increase in Cover = 145.1 % (± 197 %) after 1 st fire <i>n</i> =4 [10], 3 burn units 383.7 % (± 105 %) after 2 nd fire <i>n</i> =2, 1 burn units 0.0 % (± 0.0 %) after 3 rd fire <i>n</i> =2, 1 burn units	Uncertain All plots must burn and have annual read to reach minimum sample size	2010 (2002-2010)

* “Earliest Read” indicates the earliest vegetation data available for each plot as some plots did not have vegetation transects read prior to the initial burn.



First burned in 1999, this green pitcher-plant bog (SAOR01) has been treated six times over the last sixteen years. Understory tree density was reduced after the initial treatments; however, subsequent dormant season fire has only appeared to limit height of persistent resprouts. The wet nature of these Southern Appalachian Low Mountain Seepage Bogs in the early spring greatly reduces fire intensities when surrounding upland mixed forests burn well. (LIRI)



Mixed Shortleaf Pine Forest (PIEC30) after three burns and nine years. On average, understory tree density has been reduced 69% and native herbaceous cover increased by over 400% for this monitoring type. (LIRI)

Table 3.5. Summary of Long-term Monitoring Results at Mammoth Cave National Park

Vegetation Type	Management Objectives (Restoration)	Monitoring Results (80% Confidence Intervals)	Objective Achieved?	Year Analysis Completed (Range)
Oak-Hickory Forest (FOAHI1D09)	Decrease density of shade tolerant pole trees by 30-90% ¹ $\frac{\beta YR01 - 00Pre}{00Pre}$	Density Reduction = 58.5 % (± 15 %) after 1st fire n=7 [9], 5 burn units	Yes Density of shade intolerant species significantly reduced by > 30%, All plots must burn and be monitored during annual read to meet min sample size	2010 (2005-2010)
	Limit mortality of overstory trees to less than 20% $\frac{\beta YR01 - 00Pre}{00Pre}$	Density Reduction = 7.4 % (± 5 %) after 1st fire n=7, 5 burn units	Yes	2010 (2005-2010)
	Increase native herbaceous cover by 10-25% by 1 year after the 3 rd burn $\frac{\beta YR02 - 00Pre}{00Pre}$	Increase in cover = 148.3 % (± 63 %) after 1st fire n=7, 5 burn units	Yes All plots have experienced increases in herbaceous cover; however, plots have not burned 3 times	2010 (2005-2010)
	Reduce total fuel load by 25-50% immediately postburn. $\frac{\beta Post - before \beta}{before \beta}$	Decrease in total fuels = 33.3 % (± 10 %) after 1st fire n=7, 5 burn units	Yes Reduction objective does not fall outside range of confidence	2010 (2005-2010)
Redcedar Glade Forest (FJUUV1D09)	Reduce litter, duff, and downed woody fuel load by 25-50% $\frac{\beta Post - before \beta}{before \beta}$	Decrease of Duff = +24.1 % (± 32 %) after 1st fire n=7 [9], 4 burn units 25.7 % (± 32 %) after 2 nd fire n=3 [25], 1 burn units Decrease of Litter = 46.3 % (± 10 %) after 1st fire n=7 [21], 4 burn units 31.3 % (± 27 %) after 2 nd fire n=3 [27], 1 burn units Decrease in Total Wood = 3.4 % (± 19 %) after 1st fire n=7 [8], 4 burn units 36.5 % (± 27 %) after 2 nd fire n=3 [4], 1 burn units	No/Uncertain Significant reductions in litter fuel loading; however, duff and downed woody fuels do not yet show responses to treatment [Objective to be changed in 2013]	2010 (2002-2010)
	Reduce pole-sized trees by 40-60% $\frac{\beta YR01 - 00Pre}{00Pre}$	Density Reduction = 12.3 % (± 12 %) after 1st fire n=6, 3 burn units	No This objective is being reevaluated as very low fire intensities are advised for this ecotype	2010 (2002-2010)
	Limit mortality to overstory species to less than 20% $\frac{\beta YR01 - 00Pre}{00Pre}$	Density Reduction = +2.2 % (± 4 %) after 1st fire n=6, 3 burn units	Yes	2010 (2002-2010)

Chestnut Oak Woodland (FQUM01D09)	Decrease density of shade tolerant pole trees by 30-90 % ¹ $\frac{\beta_{YR01} - 00Pre}{00Pre}$	Density Reduction = 33.3 % (± N/A %) after 1 st fire <i>n</i> =1, 1 burn units	Yes/Uncertain Limited sample size	2010 (2000-2010)
	Limit mortality of overstory trees to less than 20 % $\frac{\beta_{YR01} - 00Pre}{00Pre}$	Density Reduction = 4.0 % (± N/A %) after 1 st fire <i>n</i> =1, 1 burn units	Yes/Uncertain Limited sample size	2010 (2000-2010)
	Reduce total fuel load by 25-50 % after 3 burns $\frac{\beta_{Post} - \text{before } \beta}{\text{before } \beta}$	Decrease in total fuels = 20.2 % (± 7 %) after 1st fire <i>n</i>=3, 2 burn units +14.4 % (± N/A %) after 2st fire <i>n</i> =1, 1 burn units	Yes/Uncertain Significant reduction in total fuels; however, fuels not reduced by > 25% after first treatment	2010 (2000-2010)
	Increase native grass and forb cover by 10-25 % after 3 burns $\frac{\beta_{YR01} - 00Pre}{00Pre}$	Increase in cover = -68.3 % (± 18 %) after 1st fire <i>n</i>=2, 1 burn units 21.7 % (± N/A %) after 2 nd fire <i>n</i> =1, 1 burn units	Uncertain Limited sample size and plots have not burned three times	2010 (2000-2010)
Indian Grass Grassland (BSONU1T02)	Reduce density of shade tolerant seedlings 30% to 60% one year after second fire ² $\frac{\beta_{YR01} - 00Pre}{00Pre}$	Density Reduction = 39.1 % (±21 %) after 1 st fire <i>n</i> =3 [20], 1 burn unit 45.8 % (±25 %) after 2nd fire <i>n</i>=2 [4], 1 burn unit	Yes/Uncertain Reductions are occurring; however, >30% is not outside the confidence interval	2010 (2002-2010)
	Reduce density of shrubs 30% to 60% one year after second fire $\frac{\beta_{YR01} - 00Pre}{00Pre}$	Density Reduction = 35.3 % (±9 %) after 1st fire <i>n</i>=3, 1 burn unit 23.2 % (±54 %) after 2 nd fire <i>n</i> =2 [43], 1 burn unit	Uncertain Significant reduction occurred after first treatment; however, all plots must burn 2 two times	2010 (2002-2010)
	Cause no net gain in percent cover of exotic plants after five years of burning ³ $\frac{\beta_{YR02} - 00Pre}{00Pre}$	Increase in cover = 156.1 % (± 136 %) after 1 st fire <i>n</i> =3, 1 burn units 371.2 % (± 550 %) after 2 nd fire <i>n</i> =2, 1 burn units	Uncertain Plots have not burned 5 times and minimum sample size not met	2010 (2002-2010)
	Increase relative cover of Indiangrass (<i>Sorghastrum nutans</i>) 15% after five years of burning $\frac{\beta_{YR02} - 00Pre}{00Pre}$	Increase in cover = 534.6 % (± 319 %) after 1 st fire <i>n</i> =3, 1 burn units 81.9 % (± 142 %) after 2 nd fire <i>n</i> =2, 1 burn units	Uncertain Plots have not burned 5 times and minimum sample size not met	2010 (2002-2010)

¹ Shade intolerant species include *Carya*, *Pinus*, and *Quercus* genera. Density analyzed for all other species.

² Density analyzed for *Acer*, *Juniperus*, *Sassafras*, and *Ulmus* genera.

³ Exotics in SONU plots include; *Digitaria* spp., *Kummerowia* spp., *Lespedeza cuneata*, *Lonicera japonica*, *Microstegium vimineum*, *Ligustrum* spp., and *Setaria* spp.

Big Bluestem Grassland (BANGE1D02)	Cause no net gain in percent cover of exotic plants as measured one year and five years post burn <u>$\beta_{YR01} - 00Pre$</u> 00Pre	Decrease in cover = 56.4 % (± 12 %) after 1st fire $n=2$, 1 burn units 96.3 % (± 1 %) after 2nd fire $n=2$, 1 burn units	Yes Limited sample size and all plots must burn	2010 (2000-2010)
	Decrease invading woody species by 30% as measured 1-year post burn <u>$\beta_{YR01} - 00Pre$</u> 00Pre	Density Reduction = +38.5 % (± 135 %) after 1 st fire $n=4$ [13], 1 burn unit 49.7 % (± 5 %) after 2nd fire $n=2$ [4], 1 burn unit	Yes/Uncertain Limited sample size and all plots must burn	2010 (2000-2010)
Old Field (FOLFI1D08)	Increase density of oak and hickory seedlings after three burns, as measured one year post-burn <u>$\beta_{YR01} - 00Pre$</u> 00Pre	Density Increase = +73.7 % (± 169 %) after 1 st fire $n=2$, 1 burn unit	Yes/Uncertain Limited sample size, but initial monitoring shows an increase after first treatment	2015 (2011- 2014)
	Reduce density of shade tolerant pole-sized trees by greater than %50 after three burns* <u>$\beta_{YR01} - 00Pre$</u> 00Pre	Density Reduction = N/A	No/Uncertain Plots have only burned one time, and have increased from a mean of 0 to 80 poles/ha	2015 (2011- 2014)
	Reduce total fuel load by >25 % after 3 burns <u>$\beta_{Post} - before \beta$</u> before β	Decrease in total fuels = 7.1 % (± 19 %) after 1 st fire <u>$n=2$</u> , 1 burn units	Uncertain Plots have not burned 3 times and fire had very limited spread into OLFI plots	2012 (2011-2012)

*Species currently include *Acer rubrum*, *Fraxinus americana*, *Oxydendrum arborum*, *Ulmus alata*



Mammoth Cave NP Chestnut Oak Woodland (QUMO31) after 2 fires and 10 years.



Big Bluestem Grassland (ANGE03) after 2 fires and 12 years. Since its last fire in 2007, shrub and tree encroachment is rapidly occurring at this restored Kentucky Barren site at Chaumont Prairie. (MACA)

Table 3.6. Summary of Long-term Monitoring Results at Natchez Trace Parkway

Vegetation Type	Management Objectives (Restoration)	Monitoring Results (80% Confidence Intervals)	Objective Achieved?	Year Analysis Completed (Range)
Mixed Loblolly Pine Forest (FPITA1D09)	Reduce total fuel load by 20-40% immediately post-burn $\frac{\beta_{Post} - before \beta}{before \beta}$	Total fuel reduction = 40.2% (± 5 %) after 1st fire $n=12$, 7 burn units 2.0 % (± 15 %) after 2 nd fire $n=6$ [9], 2 burn units 4.6 % (± 17 %) after 3 rd fire $n=6$ [8], 2 burn units 28.4 % (± 14 %) after 4th fire $n=4$ [7], 2 burn units	Yes Significant reduction after 1 st and 4 th burns; however, only first treatment exceeds 20 % reduction	2010 (2001-2010)
	Reduce conifer poles (2.5-15.0 cm dbh) > 25% one year after 3 rd fire $\frac{\beta_{YR01} - 00Pre}{00Pre}$	Density reduction = 8.3 % (± 10 %) after 1 st fire $n=4$ [10], 3 burn units +12.5 % (± 14 %) after 2nd fire $n=4$ [11], 2 burn units 41.7 % (± 29 %) after 3rd fire $n=4$ [34], 2 burn units 33.3 % (± 33 %) after 4 th fire $n=3$ [15], 2 burn units	Yes/Uncertain Significant reduction after 3 rd treatment and few plots now contain conifer poles	2010 (2001-2010)
	Cause no net gain in percent cover of exotic plants after 5 burns ⁴ $\frac{\beta_{YR01} - earliest read}{earliest veg. read}$	Average reduction = +10.0 % (± 3.1 %) after 1st fire $n=2$, 2 burn units + 1.5 % (± 1.5%) after 2nd fire $n=2$, 1 burn unit 5.8 % (± 3.4 %) after 3 rd fire $n=4$, 2 burn unit	Uncertain All existing plots must burn to meet sample size and plots containing exotic species have not experienced five treatments	2010 (2001-2010)
Black Belt Prairie (BJUVI1D06)	25-50% reduction of redcedar (<i>Juniperus virginiana</i>) density after 5 years of burning $\frac{07YR01 - 00Pre}{00Pre}$	Density reduction = 86.2 % (± 17 %) after 7th fire $n=4$ [18], 1 burn units	Yes Significant reduction after 7 th burn, data not available immediately after 5 th burn	2011 (2002-2011)
	20-40% reduction in woody exotic species density by 4 th burn $\frac{07YR01 - 00Pre}{00Pre}$	Density reduction = +1580 % (± N/A %) after 7th fire $n=4$, 1 burn units	No Plots are highly variable in exotic species density and plots that did not have exotics now do	2011 (2002-2011)
Midsouth Savanna (FQUEST1D09)	Increase cover of native herbaceous plants by >200% after three burns $\frac{\beta_{YR01} - 00Pre}{00Pre}$	Increase in Herb Cover = 0.0 % (± N/A %) after 1 st fire $n=2$, 2 burn units 34.5 % (± 45 %) after 3 rd fire $n=3$, 2 burn units	Uncertain All plots have not yet been monitored 1 year post burn	2016 (2011-2015)
	Reduce mean density of pole-sized trees by >50% after 3 burns $\frac{\beta_{YR01} - Pre00}{Pre00}$	Density reduction = N/A	Uncertain Plots have not yet been monitored one year post burn	2011 (2011- _)

⁴ Exotics in PITA plots include; privet (*Ligustrum spp.*), Japanese honeysuckle (*Lonicera japonica*), & and others.

Oak-Hickory Woodland (FOAHI1D09)	Reduce litter and duff load by 30-40% after 3 burns $\frac{\beta Post - 00Pre}{00Pre}$	Duff Reduction = 52.1 % (± 8) after 1 st fire $\underline{n=3}$, 2 burn units Litter Reduction = 66.3 % (± 21) after 1 st fire $n=3$ [7], 2 burn units	Yes All plots must burn three times to meet minimum sample size requirements	2010 (2006-2010)
	Reduce mean density of pole-sized trees by 20-30% after 3 burns $\frac{\beta YR01 - Pre00}{Pre00}$	Density reduction = 19.8 % (± 7 %) after 1 st fire $n=3$ [5], 2 burn units	Yes/Uncertain Plots have not been burned three times and all plots must burn to meet minimum sample size requirements	2010 (2006-2010)
Japanese Grass Invaded Streamside Forest (FMIVID09)	Decrease percent cover of Japanese grass (<i>Microstegium vimenium</i>) by 50% one year post treatment $\frac{\beta YR02 - Pre00}{Pre00}$	Cover reduction = 90.0 % (± 4 %) 1 st treatment $n=10$, 1 burn units	Uncertain A significant reduction occurred; however, there was no significant difference in the control and the experimental plots	2010 (2007-2010)



Mixed Loblolly Pine Forest (PITA12) after two fires & six years. Rocky Springs, MS (NATR)



Hilton and Falkey provide holding support for a prairie restoration burn, Black Belt Overlook Unit, MS.

(NATR)
January 22, 2014

Table 3.7. Summary of Long-term Monitoring Results at Stones River National Battlefield

Vegetation Type	Management Objectives (Restoration)	Monitoring Results (80% Confidence Intervals)	Objective Achieved?	Year Analysis Completed (Range)
Little Bluestem Grassland (GSCSC1G02)	Reduce exotic ⁷ species cover by 20-70% after 5 burns $\frac{\beta YR01 - 00Pre}{00Pre}$	Exotic Cover Reduction = 42.5 % (± 17%) after 1 st fire n=11 [27], 3 burn unit	Yes/Uncertain Significant reductions in exotic species after one burn; however, plots have not been burned five times and include additional treatments such as mowing and herbicide	2010 (2003-2010)
	Increase native grass and forb cover by 20-50% after 3 fires $\frac{\beta YR01 - 00Pre}{00Pre}$	Native Herb Cover = 14.1 % (± 18%) after 1 st fire n=11 [21], 3 burn unit	Uncertain All plots must burn three times	2010 (2003-2010)
Central Basin Glades (GANTE1D05)	Reduce exotic ⁵ and eastern redcedar cover by 20% by 5 years post-burn $\frac{\beta YR01 - 00Pre}{00Pre}$	Exotic Cover Reduction = 0.0 % (± 23%) after 1 st fire n=8 [41], 1 burn unit -11.5 % (± 25%) after 2 nd fire n=8 [104], 1 burn unit Redcedar Reduction = 82.4 % (± 11 %) after 1 st fire n=8 [23], 1 burn unit 73.1 % (± 17 %) after 2 st fire n=8 [22], 1 burn unit	Yes/Uncertain Redcedar is being reduced; however, significant reductions in exotic cover have not yet occurred Plots have not been monitored five years post burn	2010 (2003-2010)
	Increase native herbaceous species cover and diversity ⁶ by 20-75% $\frac{\beta YR01 - 00Pre}{00Pre}$	Native Herb Cover = -16.7 % (± 8%) after 1 st fire n=8, 1 burn unit -26.1 % (± 10%) after 2 nd fire n=8, 1 burn unit Native Herb Richness = -37.4 % (± 4%) after 1 st fire n=8, 1 burn unit -38.2 % (± 8%) after 2 nd fire n=8, 1 burn unit Native Herb Diversity = -15 % (± N/A%) after 1 st fire n=1, 1 burn unit -15.5 % (± N/A%) after 2 nd fire n=1, 1 burn unit	No/Uncertain Native species have not increased in cover; however, this may be a result of changes in the seasonality of monitoring and misidentification of species in the past Native herbaceous cover, richness, and diversity was reassessed during the growing season in 2010 resulting in increases of -14.8%, +5.7%, +12.6% respectively	2010 (2003-2010)

⁵ Exotic invasives include *Albizia julibrissin*, *Kummerowia* spp., *Leucanthemum vulgare*, *Ligustrum sinense*, *Lonicera japonica*, *Paspalum dilatatum*. *Lespedeza cuneata* is present at the site(s) but is not included in the current analysis as it may have been misidentified in previous reads.

⁶ Calculations conducted on relative changes in plots' herbaceous species richness and then on total change in diversity utilizing Shannon's diversity index.

Table 3.8. Summary of Long-term Monitoring Results at Shiloh National Military Park

Vegetation Type	Management Objectives (Restoration)	Monitoring Results (80% Confidence Intervals)	Objective Achieved?	Year Analysis Completed (Range)
Oak-Hickory Woodland (FOAHI1D09)	Reduce litter and duff load by 30-40% after 3 burns	Litter & Duff Reduction = 21.4 % ($\pm 11\%$) after 1 st fire <i>n=4, 3 burn units</i>	Yes/Uncertain All plots must burn three times to meet minimum sample size requirements	2016 (2014-2015)
	$\frac{\beta_{Post} - 00Pre}{00Pre}$ Reduce mean density of pole-sized trees by 20-30% after 3 burns	Density Reduction = 15.9 % ($\pm 3\%$) after 1 st fire <i>n=2, 1 burn units</i>	Yes/Uncertain Plots have not been burned three times and all plots must burn to meet minimum sample size requirements	2016 (2014-2015)
	$\frac{\beta_{YR01} - Pre00}{Pre00}$			



Shiloh Oak-Hickory Woodland (OAH131) after 1 fire and 2 years.

(SHIL)



Typical fire behavior during the Northern Spain Branch Rx fire.

(SHIL) March 13, 2014

D. Additional Program Information

Table 4. Planning – 2014-15

Park	Does Park have written DFCs? (yes or no)	Date Park-level Monitoring Plan completed (or revised)	Number of Project- or Community-level Monitoring Plans	BAER Plan Assists in 2014-15
Abraham Lincoln Birthplace NHP	No	N/A	0	0
Chickamauga and Chattanooga NMP	No	N/A	0	0
Cumberland Island National Seashore	No*	2014 (Draft)	0 (2) †	0
Fort Donelson National Battlefield	No*	N/A	0	0
Gulf Islands National Seashore	No*	2010 (Draft)	0 (3)	0
Horseshoe Bend National Military Park	No	N/A	0 (1)	0
Jean Lafitte NHP and Preserve	No	N/A	1	0
Little River Canyon National Preserve	No	N/A	0 (3)	0
Mammoth Cave National Park	No	2013 (Draft)	0 (6)	0
Natchez Trace Parkway	No	2007	0 (6)	0
Russell Cave National Monument	No	N/A	0 (1)	0
Shiloh National Military Park	No*	N/A	0 (1)	0
Stones River National Battlefield	No*	N/A	0 (3)	0
Vicksburg National Military Park	No*	N/A	0	0

*Does not have written DFCs that have measurable objectives for park vegetation, but does have general desired landscape goals.

†Number in brackets represents number of Monitoring Type Descriptions (FMH 4).

Table 5a. Monitoring – 2014

Park	% 2014 Data Entered	% 2014 Data Quality Checked	# Prescribed Fires Monitored*	# Non-fire Fuels Treatments Monitored*	# Wildfires Monitored*	# BAER Treatments Monitored*
Cumberland Island National Park	100%	100%	0	0	0	0
Gulf Islands National Seashore	100%	100%	5	0	0	0
Horseshoe Bend National Military Park	100%	100%	7	0	0	0
Little River Canyon National Preserve	100%	100%	14	0	0	0
Mammoth Cave National Park	100%	100%	2	0	0	0
Natchez Trace Parkway	100%	70%	33	1	0	0
Shiloh National Military Park	100%	100%	1	0	0	0
Stones River National Battlefield	100%	100%	8	0	0	0

* Number of treatment units with treatment effects monitoring conducted. Include pre-burn and post-burn monitoring but not burn-day monitoring. (Most fire effects monitoring is conducted on previous year's projects)

Table 5b. Monitoring – 2015

Park	% 2015 Data Entered	% 2015 Data Quality Checked	# Prescribed Fires Monitored*	# Non-fire Fuels Treatments Monitored*	# Wildfires Monitored*	# BAER Treatments Monitored*
Cumberland Island National Park	<i>N/A%</i>	<i>N/A%</i>	<i>0</i>	<i>0</i>	<i>0</i>	<i>0</i>
Gulf Islands National Seashore	<i>50%</i>	<i>50%</i>	<i>5</i>	<i>0</i>	<i>0</i>	<i>0</i>
Horseshoe Bend National Military Park	<i>50%</i>	<i>33%</i>	<i>7</i>	<i>0</i>	<i>0</i>	<i>0</i>
Little River Canyon National Preserve	<i>100%</i>	<i>40%</i>	<i>17</i>	<i>0</i>	<i>0</i>	<i>0</i>
Mammoth Cave National Park	<i>N/A%</i>	<i>N/A%</i>	<i>0</i>	<i>0</i>	<i>0</i>	<i>0</i>
Natchez Trace Parkway	<i>100%</i>	<i>90%</i>	<i>28</i>	<i>1</i>	<i>0</i>	<i>0</i>
Shiloh National Military Park	<i>100%</i>	<i>0%</i>	<i>3</i>	<i>0</i>	<i>0</i>	<i>0</i>
Stones River National Battlefield	<i>50%</i>	<i>40%</i>	<i>8</i>	<i>0</i>	<i>0</i>	<i>0</i>

* Number of treatment units with treatment effects monitoring conducted. Include pre-burn and post-burn monitoring but not burn-day monitoring. (Most fire effects monitoring is conducted on previous year's projects)

Table 6a. Communicating Results - 2014

Park	# of Project Monitoring Reports completed in 2014	# of Annual meeting(s) with Park staff	# of Formal presentations of results	Do you use Minitab?†
Cumberland Island Nat. Seashore	0	1	0	Yes
Gulf Islands National Seashore	0	0	0	Yes
Horseshoe Bend NMP Park	0	0	0	Yes
Jean Lafitte NHP and Preserve	0	0	0	No
Little River Canyon National Pres.	1	1	0	Yes
Mammoth Cave National Park	0	1	1	Yes
Natchez Trace Parkway	5	0	0	Yes
Russell Cave National Monument	0	0	0	No
Shiloh National Military Park	1	1	0	Yes
Stones River National Battlefield	1	1	0	Yes
Vicksburg National Military Park	0	0	0	No

† An individual SER site license is used by the Barrens to Bayous Fire Monitoring Network, Minitab Release 14.

Table 6b. Communicating Results - 2015

Park	# of Project Monitoring Reports completed in 2015	# of Annual meeting(s) with Park staff	# of Formal presentations of results	Do you use Minitab?*
Cumberland Island Nat. Seashore	0	0	0	Yes
Gulf Islands National Seashore	0	0	0	Yes
Horseshoe Bend NMP Park	0	1	0	Yes
Jean Lafitte NHP and Preserve	0	0	0	No
Little River Canyon National Pres.	1	1	0	Yes
Mammoth Cave National Park	0	0	0	Yes
Natchez Trace Parkway	2	1	0	Yes
Russell Cave National Monument	0	0	0	No
Shiloh National Military Park	1	1	0	Yes
Stones River National Battlefield	1	1	0	Yes
Vicksburg National Military Park	0	0	0	No

Table 7. Research – 2014-15

Park	Are research needs identified in FMP or Monitoring Plan? (yes or no)	# of Proposals Submitted in 2014-15	# of Proposals Funded in 2014-15	# of Research Projects Supported in 2015*	Additional Comments
Cumberland Island National Seashore	Yes	0	0	0	
Gulf Islands National Seashore	Yes	0	0	0	
Horseshoe Bend National Military Park	No	0	0	0	
Jean Lafitte NHP and Preserve	Yes	0	0	0	Pre-burn floatant marsh monitoring has been established by Southern Illinois University ~2008
Little River Canyon National Preserve	No	0	0	0	
Mammoth Cave National Park	Yes	1	1	1	Ongoing research concerning fire and Indiana bat habitat/LIDAR vegetation mapping by the University of Kentucky
Natchez Trace Parkway	Yes	0	0	0	
Shiloh National Military Park	No	0	0	0	
Stones River National Battlefield	No	0	0	0	
Vicksburg National Military Park	No	0	0	0	

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

C. Fire ecologist accomplishments and areas of focus

Table 8a. Fire Ecologist 2014 Accomplishments/Focus Areas

Category	Percent Time	Accomplishments and/or areas of activities
Planning	17%	Wrote and maintained Sec.7 PEPC compliance concerning fire and research projects Reviewed 2014 STRI, SHIL, GUIS, & NATR Burn Plans Consultation, compliance, and site visits for Rx burns Generate and check Rx fire and wildfire maps for SER Fire GIS Summarized Monitoring Trends in Burn Severity (MTBS) maps within network
Presentations	4%	Fire ecology presentations for AmeriCorps crews Assist with fire ecology and fire effects sections in local S130/190 courses Presented summary of fire monitoring to MACA Fire & Bat Workshop Lead field exercises with local community college's dendrology course Presented and lead workshop for MidSouth Fire Tour at STRI
NPS Meetings/ task groups	4%	Attended park meetings with resource management staff at local and network parks Attended regional and national fire conference calls Collaborated with USGS-NPS Vegetation Characterization Program for Network's vegetation mapping
Interagency work	3%	Member of Tennessee and Mississippi Rx Fire Councils Information sharing with U.S. Forest Service, U.S. FWS, and TN Div. of Nat. Areas Reviewed manuscripts for Interagency Conference Proceedings Meetings with local federal and state cooperators regarding operational logistics
Wildfire assignments	28%	Served as FFT2, FFT1, FEMO, ICT5, ENOP, & FALB(T) - NATR wildfire incidents in MS & TN - Engine Assignment to OK for BIA Severity - Handcrew Assignment to CA as FFT1
Prescribed fire projects	7%	Served as FFT2, FEMO, FFT1, FALA, ENOP, & FIRB(T) NATR, STRI, & LIRI
Non-fire projects	1%	Assisted with WUI vegetation monitoring, clearing, & saw work Developed monitoring program for endangered species within Rx fire unit
Research	3%	Reviewed, summarized, and shared historical and recent ecological literature Correspondence with FWS and Universities to summarize T&E plants research
Data collection	9%	Assisted with the collection of FMH, non-FMH vegetation, and fuel moisture data Installed FMH and modified fire effects plots Calibration of fuel moisture monitoring equipment
Data entry	4%	Assisted with entering backlogged data and made corrections to data in FFI Troubleshooting FFI database issues
Data analysis	3%	Performed statistical tests and analysis of fire effects data Summarized and shared fire effects data with USGS and NPS I&M Networks
Supervision/Admin	5%	Supervised fire effects monitors, training, payroll, & misc. Timesheets, travel, and other administrative paperwork
Training	4%	Physical Training, firefighter refresher, and other safety programs S-211, S-230, S-231, A-110, HECM refresher, FISSA, No FEAR Act
Travel out-of-park for plot or project work	2%	Plot installations at SHIL prior to initiating FY2015 Rx projects Plot installations at CUIS prior to initiating FY2015 Rx & fuels projects General travel to network parks for long-term FMH monitoring
Miscellaneous	6%	Served as Fire Ecology Associate Editor for Natural Areas Journal Peer reviewed manuscripts concerning fire ecology, disturbance, and fire management in a diversity of journals and publications Coordinated wildland fire GIS projects with SER Fire GIS Contractor Assisted with wildland fire outreach tasks (parades, programs, etc.) Submitted daily electronic unit logs to FMO

Table 8b. Fire Ecologist 2015 Accomplishments/Focus Areas

Category	Percent Time	Accomplishments and/or areas of activities
Planning	15%	Wrote and maintained Sec.7 PEPC compliance concerning fire projects Reviewed 2015 GUIs & CUIS Burn Plans Consultation, compliance, and site visits for Rx burns & zone implementation Generate and check Rx fire and wildfire maps for SER Fire GIS
Presentations	5%	Assist with general and fire ecology sections in local S130/190 courses Presented at and lead local Mississippi Extension Fire on the 40 Workshops
NPS Meetings/ task groups	3%	Attended park meetings with resource management staff at local and network parks Attended regional and national fire conference calls Collaborated with USGS-NPS Vegetation Characterization Program for Network's vegetation mapping
Interagency work	5%	Member of Tennessee and Mississippi Rx Fire Councils Information sharing with U.S. Forest Service, U.S. FWS, and TN Div. of Nat. Areas Reviewed manuscripts for Interagency Conference Proceedings Meetings with local federal and state cooperators regarding operational logistics Board of Directors for the Southern Fire Exchange NPS representative for the DOI RESTORE Act Fire Team
Wildfire assignments	5%	Served as FFT2, FFT1, ICT5, ENOP, & FALB(T), FEMO - NATR wildfire incidents in MS & AL - SHIL and GUIs wildfires
Prescribed fire projects	7%	Served as FFT2, ATVO, FFT1, FEMO, ENOP, & FIRB(T), FEMO NATR, SHIL, BISO, & Tennessee Dept. of Environment & Conservation
Non-fire projects	1%	Led southern pine beetle monitoring and documentation Attended IMT meetings as GISS(t) & READ (SA Red T1 & South Atlantic T3)
Research	5%	Reviewed, summarized, and shared historical and recent ecological literature Correspondence with FWS and Universities to summarize T&E plants research Review, upload, and revise FFI tree data for USFS research project (Keyser et al.)
Data collection	8%	Assisted with the collection of FMH, non-FMH vegetation, and fuel moisture data
Data entry	10%	Assisted with entering backlogged data and made corrections to data in FFI Troubleshoot FFI software issues, tested Panasonic Toughpad for National Office
Data analysis	5%	Performed statistical tests and analysis of fire effects data Summarized and shared fire effects data with USFS, USGS, and NPS I&M Networks
Supervision/Admin	5%	Supervised fire effects monitor, training, payroll, & misc. Timesheets, travel, hiring seasonal, and other administrative paperwork Managed zone fire staff during FMO detail; budgets, accident reporting, etc.
Training	5%	Physical Training, firefighter refresher, and other safety programs Aviation Safety, FISSA, No FEAR Act, Veterans Hiring Training, etc. S-341 GIS Specialist for Incident Management, NWCG IQCS Training
Travel out-of-park for plot or project work	1%	Travel to network parks for long-term FMH monitoring, prescribed fire prep, post-burn plot reads and unit assessments, and meetings with network/zone park staff
Miscellaneous	20%	Served as Fire Ecology Associate Editor for Natural Areas Journal Peer reviewed manuscripts concerning fire ecology, disturbance, and fire management in a diversity of journals and publications Coordinated wildland fire GIS projects with SER Fire GIS Contractor Assisted with wildland fire outreach tasks (parades, interpretive programs, etc.) Submitted daily electronic unit logs to FMO Detail as Zone FMO from May-August 2015 Ministered various fire program budget tracking

D. Fire effects crew accomplishments and areas of focus

Table 9a. Fire Effects Crew 2014 Accomplishments/Focus Areas

Category	Percent Time	Notes
FMH plots	25%	Monitored 69 standard FMH Plots
WUI plots	0%	No scheduled WUI plots for 2014
CBI plots	0%	Post burn photo monitoring on wildfire
Other plot work	1%	Duff and live vegetation fuel moisture monitoring Assist with NPS I&M plots, NATR Breeding Bird Survey
Wildfire assignments	16%	Served in variety of roles including: FFT2, FFT1, FEMO, HECM, FALB, READ - NATR wildfire incidents - Wildfire assignments in California, Mississippi, Oklahoma,
Prescribed fire projects	10%	Served in variety of roles including: FFT2, ATVO, FFT1, FEMO, ENB(T), EMT(B), Holding NATR, CONG, STRI, Holly Springs NF Assisted with burn unit prep work Consultation for Rx burns
Non-fire fuels projects	2%	NATR Blackbelt Restoration, exotic, and hazard fuels removal projects Assisted with WUI vegetation clearing/saw work AmeriCorps Crew Project Lead
Travel out-of-park for plot or project work	5%	Installed FMH plots at CUIS, SHIL and Noxubee NWR FMH monitoring at STRI, SHIL, MACA, GUIS, LIRI
Data entry	15%	Entered, scanned and checked FMH and other fire effects data
Data analysis	1%	Fuels Analysis
Supervision/Admin	4%	Payroll, travel authorization/voucher, etc.
Training	5%	Firefighter Refresher, S-211, S-290, S-203 First Aid/CPR Emergency Medicine and Trauma Conference Taught segments of S-130/190, S-212
Miscellaneous	20%	Co-Instructed in house First Aid/CPR course for fire management Collected, identified, and preserved plant specimens for long-term data collection consistency and reference NATR Recycling Committee Herpetile and Bat Monitoring Organized local Audubon Christmas Bird Count Wrote PMIS proposal for funds



Fields and members of the Mountains to the Sea Fire Effects Module measuring vegetation cover and height within the longleaf pine – Darlington oak – wiregrass woodland of Cumberland Island.

(CUIS)
August 27, 2014

Table 9b. Fire Effects Crew 2015 Accomplishments/Focus Areas

Category	Percent Time	Notes
FMH plots	25%	Monitored 65 standard FMH Plots
WUI plots	0%	No scheduled WUI plots for 2015
CBI plots	0%	Post burn photo monitoring on wildfire
Other plot work	1%	Duff and live vegetation fuel moisture monitoring Assist GRSM FX crew at BISO, NATR Breeding Bird Survey
Wildfire assignments	16%	Served in variety of roles including: FFT1, ICT5, FEMO, HECM, READ - NATR wildfire incidents - Wildfire assignments in Louisiana and Florida
Prescribed fire projects	10%	Served in variety of roles including: ATVO, FFT1, FEMO, Holding NATR, SHIL, Merritt Island NWR Assisted with burn unit prep work Consultation for Rx burns
Non-fire fuels projects	2%	NATR Blackbelt Restoration, exotic, and hazard fuels removal projects Assisted with WUI vegetation clearing/saw work
Travel out-of-park for plot or project work	15%	FMH plot work at BISO, GUIS, LIRI, HOBE, SHIL, STRI and VICK
Data entry	15%	Entered, scanned and checked FMH and other fire effects data
Data analysis	1%	Fuels Analysis
Supervision/Admin	4%	Payroll, travel authorization/voucher, seasonal employee hiring
Training	5%	Firefighter Refresher, First Aid/CPR Taught segments of S-271 ArcGis Training (Albright Grant)
Miscellaneous	15%	Collected, identified, and preserved plant specimens for long-term data collection consistency and reference NATR Recycling Committee Herpetile and Bat Monitoring Organized local Audubon Christmas Bird Count NATR breeding bird surveys READ assignment to INDE for Papal Visit



Fields recording fire effects data within a post oak savanna rapid assessment plot.

(NATR, MS)
December 2015

Ramthun assisting with hazard fuel reduction and prairie restoration.

(NATR, MS)
November 2015



E. 2016 Direction

Budget & Staff Changes

2014 saw the departure of two of our permanent crew members, Jennifer Falkey and William Hilton. To provide temporary relief for the crew, a seasonal was hired for the end of the 2015 year. In 2016 & 2017, we will be working hire two career seasonals, returning us on a path to the Regional Future Target Organization.

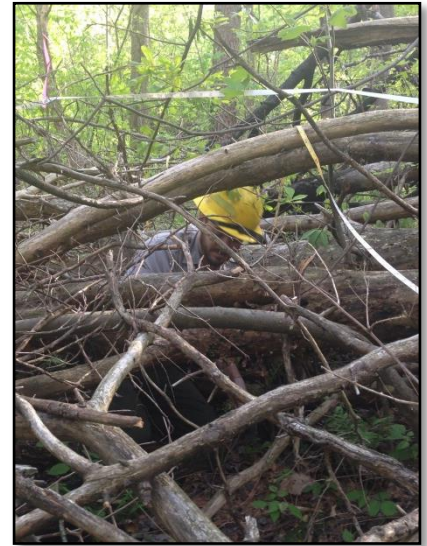


Discovered within the park's boundary and within an Rx fire unit, the federally threatened Price's potato-bean will be closely monitored by fire FX personnel in 2016-17.
(NATR, MS) Summer 2014

Planning

Our network is already working with staff and contractors on the development of a new Fire Management Plan (FMP) and Environmental Assessment (EA) at Jean Lafitte National Historical Park and Preserve. In 2016, we will also be working with staff and contractors for the development of a new FMP for Fort Donelson National Battlefield. This upcoming year will also bring about the new operational fire management zones in the Southeast Region. In addition to developing new plans, our crew will be working to ensure continuity and information sharing in the new organization structure.

We will also continue to closely collaborate with Tara Keyser and Virginia McDaniel from the U.S. Forest Service Southern Research Station on a study evaluating tree mortality of various southern tree species after prescribed fires.



Burton measuring fuel loading within degraded "old fields" at Mammoth Cave National Park. (MACA) Summer 2014



STRI resource management staff and Jesse Burton discuss the importance of fire and chemical treatments in the restoration of native grasses at Stones River National Battlefield during the 2014 Mid-South Fire Tour. (STRI) Spring 2014

F. Overall Data Entry Status and FFI Suggestions

As of March 2016, our fire monitoring network has all data collected through 2015 entered into FEAT/FIREMON Integrated (FFI). Roughly 50% of 2015's data has been quality checked. Since 2013, all data is scanned, entered, and digitally stored on off-site NPS servers. All standard FMH collected data is stored in FFI and annually backed-up to the NPS Integrated Resource Management Application (IRMA) Data Store. As a default, all FFI Fire Effects Monitoring Data will be posted within IRMA as visible to "Public," but only "Internal" for file access as many of our plots contain rare, threatened, and/or endangered species. Outside entities may request data access via one of the Reference Owners. Special threatened/endangered plant monitoring within burn units that is not saved within FFI is stored within Excel on a secure network drive.

In the last year, we have not encountered any major issues or problems with FFI. We do not have any migration needs to input into FFI. We borrowed and tested a Toughbook from Boise in 2015 and provided feedback. We did have some trouble getting FFI-Lite to operate efficiently in the field, and new security protocols requiring PIV credentials made using the Toughbook in the field more challenging.