



**National Park Service
Fire Ecology Annual Report
Calendar Year 2008:**

Southern Appalachian/Piedmont Fire Effects Monitoring Team

Based at Great Smoky Mountains NP and serving Big South Fork NRR, Blue Ridge Parkway, Congaree NP, Cowpens NB, Cumberland Gap NHP, and Kings Mountain NMP.

Introduction

2008 was another year of changes for the Southern Appalachian team. Early in the year, staff attended training for FFI (FEAT/FireMon Integration), a database program that is the new standard for NPS fire effects data management. This new database, as the name suggests, combined elements of two fire effects programs to create a more efficient national system. The team worked throughout the year to setup, learn and use this new data management tool. The past year also saw the long-awaited (10 years) move of the program out of the Twin Creeks horse barn and into the recently vacated Inventory and Monitoring office building. Needless to say, it's much nicer than the barn. On a more personal note, the crew welcomed a new member when Nunally gave birth to Mr. Waylon Newell Vaughn. The future of the program is bright.

As in years past, spring was very busy with prescribed burns, wildfires, and post-burn monitoring. Our team members contributed to the completion of 18 prescribed fires at 8 NPS units throughout the southeast, in addition to assisting with 5 wildfires at our home park. During this busy season, we were able to fill critical operational needs and make great progress in advancing staff fireline qualifications (see Table 1). The fire effects team remained dedicated to completing post-burn assessments for all plots that burned in 2008. In all, we completed 29 immediate post-burn plot reads from 6 different parks (see Table 2). The crew also assisted staff of the USFS Southern Research Station by collecting and sharing fuels and severity data from prescribed burns at Cowpens NB, in association with research on a federally Threatened plant, *Hexastylis naniflora*.

After a brief break in May for planning and vacations, work resumed on the long-term monitoring programs at our parks. In what can be viewed as an "average" year, the crew completed 48 post burn reads (year 1, year 2, etc.) and installed 4 new plots. In addition to the standard NPS plot workload, we also contributed heavily to interagency fire effects monitoring

efforts through the Southern Blue Ridge Fire Learning Network. From site evaluation and plot selection, our staff helped to complete monitoring of 5 long-term plots on two separate demonstration sites. This interagency collaboration will produce fire effects data from various sites that can be shared among partners and used to evaluate prescribed burning on a regional scale.

The Southern Appalachian crew provided a large measure of support for the Western fire season of 2008. The Ecologist and two Crew Members traveled with the Great Smoky Mt. NP Fire-Use Module for a 45-day tour that featured two 14 day assignments and an opportunity to meet with NPS Fire staff at the Interagency Fire Center in Boise, ID. The assignments ranged from holding a confine/contain fire on the Klamath NF (Caribou Fire-Bear Wallow Complex) to monitoring the first Wildland-Fire Use fire on the Sawtooth NF (South Barker WFU) to washing/rehabbing RAWS equipment at NIFC. All involved gained a wealth of knowledge and experience about countless aspects of Federal Fire Management in the United States.

In the final months of 2008, the focus of our program turned to data management and practicing adaptive management. As the Fire Effects team labored to enter the mountains of data and conduct quality control, the Ecologist made site visits to each park in the network, meeting with park managers, regional Inventory and Monitoring staff, and Fire Use Module folks to review completed burns and discuss future projects. The results of this approach have been particularly promising at Big South Fork NRR, where field trips, discussions and meetings have helped address key resource and planning concerns. BISO is now poised to treat 4000-7000 acres in FY09, with what we think are the most sensitive and effective prescribed burning practices for that area.

In this report, we have attempted to provide a useful overview of our program achievements and findings for a varied audience. First, we have tried to provide managers at each park with a section that they can cut out of this report for their own informational and programmatic needs. Second, we've intended for this report to serve as a solid reference for regional and national staff as to the status of the prescribed fire/monitoring programs at the range of parks where we work. Finally, based upon our own heavy use of past annual reports, we have structured this report as a reference for ourselves to use for learning and communicating with a wide range of interested parties. Each section contains a critical review of projects completed in Calendar Year 2008, short and long term objectives for the prescribed fire programs, updated results from the long term monitoring program, and a discussion of the management implications. Above all, we have tried to produce a document that contributes to the adaptive management process at the parks that we service.

Table 1. Fire Ecology Staffing 2008

Staff	Starting Date	Ending Date	# of Pay Periods	READ Qualified (Yes or No)	Training and Development
Rob Klein Ecologist	1/1/08	12/31/08	26	No	FFI training, completed FFT1 Taskbook, 45-day Western assignment
Nunally Benzing Lead Monitor	1/1/08	12/31/08	24 (13PP PT)	No	Attended AL Native Plant Conference
Wylie Paxton Assistant Lead Monitor	1/1/08	12/31/08	26	No	Wilderness 1 st Responder, FFI Training, Completed FFT1 Taskbook, NC Vegetation Survey
Bob Dellinger Crewmember	1/22/08	10/25/08	20	No	Continued work on Single Resource Taskbook, 45-day Western assignment
Huma Alvarado Crewmember	3/17/08	11/07/08	17	No	Completed HECM taskbook, NC Vegetation Survey, 45-day Western assignment
Eric Worthington Crewmember	6/9/08	10/25/08	10	No	Summer detail to assist with long-term fire effects monitoring

Table 2. Fire Effects Plot Workload 2008

Park	Monitoring Type	Type of Plot	Pre-burn	Immed. Post	Postburn (1-20 yrs)	Total Plots
Big South Fork (BISO)	Shortleaf Pine	FMH Forest plot	0	1	1	2
	White Oak	FMH Forest plot	0	1	1	2
	Little Blue Stem	FMH Shrub plot	0	2	2	4
Cumberland Gap (CUGA)	Virginia Pine	FMH Forest plot	0	0	0	0
	Scarlet Oak	FMH Forest plot	1	6	7	14
Congaree Swamp (COSW)	Loblolly Pine	FMH Forest plot	0	0	0	0
	Longleaf Pine	FMH Forest plot	0	3	0	3
Great Smoky Mountains (GRSM)	Scarlet Oak	FMH Forest plot	1	3	8	12
	Yellow Pine	FMH Forest plot	1	4	7	12
	Table Mt Pine	FMH Forest plot	0	0	2	2
Kings Mountain (KIMO)	Blackjack Oak	FMH Forest plot	0	2	5	7
	Chestnut Oak	FMH Forest plot	1	5	13	19
Cowpens (COWP)	Southern Red Oak	FMH Forest plot	0	2	2	4
Total			4	29	48	81

Management Objectives and Monitoring Results 2008

This section of the annual report details the long-term objectives for prescribed fire programs at six parks (BISO, CONG, COWP, CUGA, GRSM, and KIMO), and provides updated monitoring results for those objectives. Most of these parks have only completed one or two burns of the majority of their sites, and are thus still in the early stages of the restoration phase for their targeted vegetation types. For all of these parks, the restoration period is defined as 3-5 prescribed burns conducted within an approximately 20-year period. Though reducing hazardous fuels and restoring fire-adapted vegetation can mean different things for different parks, the overall strategy is the same: use a series of low/moderate severity and low/mixed intensity prescribed burns to gradually reduce hazardous fuels and woody stem densities while increasing regeneration of fire and drought adapted oaks and pines and increasing the abundance of native herbaceous species. Because these programs are still in their early stages, the long-term monitoring results should be viewed as preliminary data, and units that have been treated should be considered as works-in-progress.

This year's report also supplies park managers and fire practitioners with short-term data from calendar year 2008 prescribed burns in an attempt to further the goal of using adaptive management to make improvements to prescribed fire programs. There are some limitations to using short-term data for evaluating individual burns. Specifically, our sampling design is set up to evaluate the effectiveness of burn *programs*, not individual burns. Most burns have only a small number of plots, which means that making statistical inferences at the burn unit level is scientifically inappropriate. With that said, experience from extensive field reconnaissance suggests that plots frequently provide good examples of the effects of a given burn. Viewed with these caveats in mind, short term plot data can be the best available data for determining which prescriptions and ignition techniques are helping parks achieve their objectives.

Big South Fork National River Recreation Area (BISO): 2008 Fire Effects Monitoring Annual Report

I. Overview

The monitoring crew completed all scheduled plot reads at BISO for calendar year 2008, but did not install any new plots because there were no project funding requests made for FY09. Data collected include post burn monitoring of Divide Road and Newtie King, which were re-burned during spring 2008, and completion of preburn plot reads at Gobblers Knob A and Cottonpatch Knob, two burns that were planned but not completed in 2008. Monitoring results from the Divide Road and Newtie King burns are discussed below in section III.

Fire effects monitoring at BISO started in 2004. There are now 13 long term monitoring plots in three different vegetation types, with the primary focus on the dry oak woodlands that represent the dominant vegetation of the prescribed-burn sites. The small numbers of plots in shortleaf pine woodlands and sandstone glades reflect the scarcity of these vegetation types within burn areas. To date, 8 of the 13 plots have been burned, and updated results from the long-term monitoring of these plots are provided in section IV. The data provide examples of fire effects at BISO, but sample sizes are still very small, and inferences about the effectiveness of the prescribed burn program should not be made.

The goals for future monitoring at BISO are to: 1) continue building an adequate plot network for oak woodlands, and 2) make the strongest possible effort to locate and monitor additional examples of intact pine woodlands and sandstone glades within planned burns. Completion of the park's vegetation map in 2008 should provide a powerful new tool to aid in achieving these goals.

Fire ecology support for BISO during CY08 centered on evaluating potential impacts to non-target vegetation during burns, and working collaboratively with park managers, regional Inventory and Monitoring staff and the CUGA Fire-Use module to develop appropriate prescriptions for upcoming burns. These efforts have contributed to better communication and planning, and BISO is now poised to complete two landscape burns totaling over 6000 acres during the spring 2009 fire season, utilizing the most effective and sensitive burning techniques for this area.

II. Program Goals and Objectives

Goals – BISO is currently using fire to manage grasslands and upland forests. The primary goals are as follows:

1. Restore and maintain cultural and natural landscapes using fire to reduce woody encroachment into fields. A related cultural and natural resource goal is to encourage/enhance native species within field sites.
2. Restore and maintain structure, sustainability, and species diversity to oak and shortleaf pine woodlands.

Burn Objectives – Objectives for individual burns will, of course, vary according to fuel type, burn purpose (hazard fuels vs. WUI), or number of burns into the restoration cycle, but in general:

Burn objectives for fields are -

- > 80% consumption of fine fuels (=stand replacement) over 90% of unit
- > 70% topkill of woody stems (all size classes)

Burn objectives for forests are -

- Consume >75% of surface litter (fine fuels) over >75% of the area occupied by target vegetation. Target vegetation is typically oak and pine forests found on upper slopes and ridgetops.
- >30% topkill of saplings (<10cm dbh)
- Fire Intensities do not exceed the following spatial proportions within targeted vegetation types:
 - <5% high intensity (FL >8')
 - 5-20% moderate intensity (FL 3-8')
 - 75-90% low intensity (FL 1-3')
- Burn is conducted with appropriate fuel conditions (i.e. KBDI) to achieve 15-45% total fuel reduction. KBDI 35-100 will typically produce this result on a first entry burn at GRSM. KBDI on first entry burns should usually not exceed 200. The higher the KBDI, the less intensity is desired.

Long term objectives – Long term objectives are typically expected to be achieved only after multiple prescribed burns. Please see Table 3 below for specific objectives and data.

III. 2008 Projects

Newtie King

Newtie King is a 137 acre burn unit in the Kentucky portion of BISO. The site contains a unique example of a grassy sandstone glade and wet meadow complex that is surrounded by a 30-50 year old oak forest. Small pockets of dead pines resulting from southern pine beetle attacks over the past 10 years also exist within the oak forest matrix. The site was burned on April 8, 2008, and this was the third entry of fire into the Newtie King site in the past four years. The park's strategy has been to use manual thinning and near-annual prescribed burns to reduce woody encroachment into the open glade and meadow areas. Two grassland plots were established in 2004 to monitor the change in woody stem density over time and the abundance of native herbaceous species. Burn-day monitoring and photos taken within two weeks after the burn indicate that the burn objective of 80% consumption of fine fuels was achieved in both plots. Table 1 shows the progressive reduction of trees within these two plots, which culminates in a 32% reduction following the third burn. This is assumed to be fairly representative of at least the dry sandstone glade portion of the burn unit. For comparison, the long term objective for pole-tree reduction in these grassland sites calls for >70% reduction of poles after four burns. To achieve this objective at Newtie King, it may be necessary to either; a) increase the amount of manual thinning, or b) develop an

ignition plan that will produce sufficient intensity to top-kill some of the larger poles in the grassy areas.

Table 1. Tree mortality at Newtie King (n=2)

Burn Status	% Pole Mortality
After 1 burn	10%
After 2 burns	26%
After 3 burns	32%

Divide Road

Divide Road is an approximately 800 acre site on the western boundary of the park on the Tennessee side of the park. The area is dominated by young (30-50 year old) mixed oak forests with significant patches of beetle-killed pine. The combination of high fuel loading associated with beetle-killed pine and young stand conditions contributed to a first-entry burn that was slightly more severe than desired for a first-entry. One of the results of that first burn has been relatively high mortality and damage to overstory trees. Subsequent discussions between resource managers and fire staff should help to ensure that these lessons learned contribute to more effective burning in the future.

The second-entry of fire into Divide Road occurred on April 22, 2008. Monitoring from the day of the burn indicates that burn severity was low except for areas that contained extreme fuel loading associated with beetle-killed pine. Of these areas, it was observed that aerial ignition was effective at adapting the ignition intensity and pattern to minimize the fire intensity associated with burning these fuel loads.

Post-burn reconnaissance and data from post-burn plot monitoring (Table 2) suggest that the burn objective for consumption of litter was achieved, and that progressive reduction of duff fuels is also being achieved. The increase in total fuels after the second burn reflects the large increase in woody fuels that occurred after the first burn; as burned-out snags fell to the ground and became measureable fuel. This trend is to be expected in areas that have had high mortality due to beetle-kill or other disturbances. Future burns will need to take this increase in woody fuels into account during the planning stages to ensure that the impacts of burning these high fuel loads are mitigated.

Table 2. Fire effects at Divide Road (n=2).

Burn Status	% Overstory tree mortality	% Pole tree mortality	Woody fuel load change	Duff fuel load change	Litter fuel load change	Total fuel load change
After 1 burn	11%	70%	-32%	-19%	-100%	-50%
After 2 burns	33%	74%	+14%	-33%	-91%	-42%

All percentages are compared to preburn values except litter fuel load change. For litter, change after 2 burns is compared to measurements made prior to the second burn.

IV. Long term Monitoring Results

As mentioned previously, the number of plots and prescribed burns at BISO is insufficient to determine the effectiveness of the burn program with regard to the long term resource objectives. The data can, however, provide valuable insights into the effects and effectiveness of the early burns. Table 3 includes a listing of the long-term restoration objectives along with a summary of the most pertinent data available to date. Again, there are obvious limits to the inferences that can be drawn from these data, and efforts are underway to continue building a more statistically meaningful dataset.

Table 3. Objectives and long-term monitoring results for BISO

Vegetation Type	Management Objective Restoration Phase- (After 4 burns)	Monitoring Results (80% confidence intervals)	Objective Achieved?
Shortleaf Pine Woodland (FPIEC1) 1 plot <i>Note: This vegetation type has been decimated at BISO and plots are very difficult to find.</i>	>60% Reduction in total fuel loading	Total fuel reduction = 32% (no CI) Preburn: 27.7 tons/ac After 2 burns: 18.8 tons/ac (n=1 plot, 1 burn unit)	Not Enough Plots
	>70% Reduction in pole-sized tree density (trees ≤15cm or 6")	Pole reduction = 67% (no CI) Preburn: 40 live trees After 2 burns:13 live trees (n=1 plot, 1 burn unit)	Not Enough Plots
	25-50% Reduction in overstory tree density (trees ≥15cm or 6")	Overstory reduction = 20% (no CI) Preburn: 20 live trees After 2 burns:16 live trees (n=1 plot, 1 burn unit)	Not Enough Plots
	>200 tall (>1m) Shortleaf Pine seedlings /ac	Preburn: 0 pine seedlings After 2 burns: 0 pine seedlings (n=1 plot, 1 burn unit)	Not Enough Plots
	>40% Cover by native herbs	No Preburn data 28.3 % cover of native herbs @ 01yr1	Not Enough Plots
Dry Oak Forest (FQUAL1) 9 plots	>60% Reduction in total fuel loading	Total fuel reduction = 46% (±2%) Preburn: 36.1 tons/ac After 1 burn: 19.6 tons/ac (n=4 plots, 3 burn units)	Not Enough Plots
	>70% Reduction in pole-sized tree density (trees ≤15cm or 6")	Pole reduction = 96 % (±3%) Preburn avg: 22 live trees After 1 burn:1 live tree (n=3 plots, 2 burn units)	Not Enough Plots
	20-40% Reduction in overstory tree density (trees ≥15cm or 6")	Overstory Reduction = 9% (±5%) Preburn avg: 30 live trees After 1 burn:27 live trees (n=4 plots, 3 burn units)	Not Enough Plots
	>200 tall (>1m) Oak seedlings /ac	Preburn avg: 0 After 1 burn: 54 tall oak seedlings/acre (n=3 plots, 2 burn units)	Not Enough Plots
	>30% Cover by native herbs	Preburn cover: 14.0% (±23.5) After 1 burn: 15.0% (±19.2) (n=3 plots, 2 burn units)	Not Enough Plots
Little Bluestem Sandstone Glade/Savanna (FSCSC1) 3 plots	>70% Reduction in pole-sized tree density	Pole-sized tree change: 16% (±19%) (n= 3 plots, 2 burn units)	Not Enough Plots
	>100% Cover by native herbs	Preburn cover: 103.3% (±27.4) After 1 burn: 144.7% (±32.7) (n= 3 plots, 2 burn units)	Not Enough Plots

V. Discussion and Comments

The process of restoring fire-adapted natural communities at BISO is still in its early stages, as is the fire-effects monitoring program. One of the limitations of the NPS sampling design is that it is not tailored to provide short-term results for individual burn units. Instead, it seeks to provide long-term information about the effectiveness of *burn programs*. With that said, extensive reconnaissance and comparisons with similar areas in the southeast should allow us to provide some interpretation of individual burns, which we have attempted to do in this report.

With regard to achieving long-term objectives, BISO has demonstrated the potential for rapid progress in total fuel reduction and reductions in the density of woody stems. However, it may be more appropriate and effective in the long run to *limit* the reduction of total fuels and woody stems during first and even second-entry burns. The problem with such rapid reductions is that, over the course of the restoration period, upper levels for canopy mortality may be exceeded and the park could end up with more early-successional habitat than it desires. Another problem with rapidly removing significant canopy and duff is the possibility of invasive exotics. Though this has not been observed at BISO, it is a common occurrence after moderate to high severity fires throughout the southeast.

Early burns at the park have also displayed a strong herbaceous response that has proven more elusive in other sites. Ironically, the relatively recent disturbance history of BISO (i.e. logging and grazing just prior to park establishment) may have allowed many native herbaceous species to maintain higher populations than in some other public lands. These same disturbances, followed by fire suppression/exclusion policies, also led to the types of successional pine forests that were so susceptible to southern pine beetle attacks during the past decade, and that now present a major fuel hazard to the resources in and around BISO. The central challenge for managers at BISO will be to manage these fuel loads while preserving the health of the remaining mature oak and pine trees, and while taking advantage of opportunities to restore the native herbaceous layer.

Congaree National Park (CONG): 2008 Fire Effects Monitoring Annual Report

I. Overview

There were no prescribed burns that contained monitoring plots during spring 2008, and no fire-effects monitoring plot reads scheduled at CONG during the summer field season. No plots were installed in the Griffin's Creek prescribed burn area due to uncertainties about management objectives for Loblolly pine-dominated sites. The fire Ecologist did, however, participate in the burn and conduct a site visit during the late summer to take note of the fire effects. Additionally, the Griffins Creek burn was submitted to USGS for Burn Severity mapping. Units 1-4 (RCW & Harry Hampton VC) were burned during the fall, and the 8 plots within those units were visited before and after the burn. Results from both plot and non-plot monitoring of these most recent burns are discussed below in section III.

Long term fire-effects monitoring was established at CONG in 1998. Original efforts focused on the remnant longleaf pine stand in Burn Unit #4 (RCW). Four 0.1ha plots were originally established within this site, though all of the original four are actually dominated by loblolly pine. Long term data indicate that prior to 1999, these four original plots averaged 3 overstory longleaf trees/plot. After 10 years and 6 burns, those plots now average 2 overstory longleaf, and sampling of tree seedlings has detected no longleaf seedlings within the plots.

A fifth plot was established in the RCW site in 2006. Because of the small size of the remnant longleaf stand and strong management interest in the fire-effects, this plot was subjectively placed within the longleaf-dominated stand. For comparison, this fifth plot contains 19 mature longleaf pines, and also contains 3 longleaf seedlings within the 5x10m seedling subplot. This plot is a reasonable example of the longleaf-dominated area, which has been nicely restored by five prescribed burns within the past ten years. A quick survey of that portion of the RCW site reveals a classic longleaf pine savanna/woodland structure with a dense herbaceous layer and hundreds of longleaf seedlings in a variety of size classes. The original four plots are representative of much of the rest of the unit, which has traditionally not burned as well, and lacks the same restoration potential as the longleaf-dominated area. Resource objectives for these loblolly pine-dominated areas may need to be revised.

Between 2002 and 2005, 5 plots were established in areas dominated by loblolly pine and devoid of any longleaf pine. Management objectives for these sites have focused on hazard fuel reduction, while ecological restoration objectives have been complicated by a disturbance history that has resulted in undesirable loblolly pine forests that may not be altered by fire alone. Multiple burns have resulted in some reasonable fuel reduction and clearing in the subcanopy, and monitoring has even uncovered rare sundews within one site (Burn Unit #1). However, these burns have proven largely ineffective at causing significant reductions in the dense evergreen overstory. Results of long term monitoring of key variables for both longleaf and loblolly areas can be found in Table 2 (section IV).

Efforts in the coming years will focus on continuing to sample all plots, and looking for opportunities to increase the number of plots. This will remain somewhat problematic due to the

lack of additional longleaf sites and the lingering uncertainties about long term goals and objectives for the loblolly-dominated forests. Accordingly, other work will focus on helping to determine meaningful and achievable ecological objectives for these loblolly-dominated areas.

Fire ecology support for CONG in 2008 centered on continuing to observe the range of variability both in vegetation and in past fire effects. A trip was made in early spring to participate in the Griffin's Creek prescribed burn and another trip was made in early autumn to look at the effects of that burn and also to survey the restored Longleaf pine area of the RCW site. Continuing to observe these areas and others will be critical to maintaining the successes of the RCW area and mapping out a set of meaningful objectives for those areas that are dominated by planted or successional loblolly pine.

II. Program Goals and Objectives

Goals – CONG is currently using fire to manage upland pine forests. The primary goals are as follows:

1. Restore and maintain all remaining remnants of longleaf pine woodland/savanna, using fire to reduce the density of hardwoods and loblolly pine. A related natural resource goal is to encourage/enhance herbaceous species abundance and diversity within these sites.
Note: This vegetation type is limited to around 70 acres within burn units 3 and 4, much of which has shared dominance by loblolly pine.
2. Restore the woody and herbaceous structure and composition within sites currently dominated by loblolly pine. An analysis of historical vegetation suggests that these areas were once dominated by a variety of longleaf pine natural communities.

Burn Objectives – Objectives for individual burns will, of course, vary according to fuel type, burn purpose (hazard fuels vs. WUI), or number of burns into the restoration cycle, but in general:

Burn objectives for longleaf pine remnants are -

- Reduce the 1-hour fuels between 50-85% over 75% of the unit measured immediately post burn.
- Reduce the density of pole and sapling-sized hardwoods and loblolly pines by 30-70% each burn as measured within 1 year post burn.

Burn objectives for loblolly pine-dominated forests are -

- Reduce the 1-hour fuels between 50-85% over 75% of the unit measured immediately post burn.
- Reduce the density of pole and sapling-sized hardwoods and loblolly pines by 30-70% each burn as measured within 1 year post burn.
- *Induce over-story mortality*, where possible, to as much as 30% as measured 1 year post fire, per burn without compromising safety and/ or holding concerns.

Long term objectives – Long term objectives are typically expected to be achieved only after multiple prescribed burns. Please see Table 3 below for specific objectives and data.

III. 2008 Projects

Griffins Creek

Griffin's Creek is a 340 acre site on the northeast corner of CONG that is comprised of three separate burn units (7, 8, & 9). The area is believed to have been occupied by a variety of wet to dry longleaf pine communities prior to European settlement, but is currently dominated by planted or successional loblolly pine forests. The Griffin's Creek prescribed burn was implemented on February 10, 2008. This fire was the first entry of prescribed fire into these units, though portions of the area (Unit 9?) had burned in a wildfire within the past 10 years. Notes from the monitoring report written immediately after the burn indicate that, overall, this was a low intensity-low severity burn that was successful at achieving the burn objectives for 1-hour fuels. Additionally, dry and breezy conditions on the second day of the burn resulted in greater intensity of burning for some interior sites. Indications immediately following the burn were that, on average, very little overstory tree mortality had been achieved and that less than 30% of pole trees (2.5-15cm dbh) had been top-killed. Finally, the old home site that had been mechanically and chemically treated for exotic plants burned very hot during the first day of burning, and heavy mortality of woody stems was expected.

An additional visit to this site was made on October 7, 2008 to observe the first-season effects of the burn. Overall observations were as follows:

- Older, more open stands of loblolly pine received a good first entry burn that was successful at opening up the understory, but with little impact to the midstory/overstory
- Younger, closed stands of planted loblolly pine seemed to have carried fire well, but with little impact to woody stems greater than 5cm dbh
- Much of the exotic woody vegetation at the home site was eliminated and replaced with early successional weeds such as lovegrass and dog fennel; some resprouting of privet was observed; the large pecan tree seems to have survived the burn
- *Lespedeza cuneata* (sericea) was observed along several roads, trails, and firelines. It is likely that these populations existed before the burn, but they should be monitored, as sericea is known to be invasive in disturbed areas.

One final point of interest was a "glade"- like area directly behind the current in-holdings within the unit (i.e. trailers). This area was noticed during the burn, but the October reconnaissance revealed an interesting herbaceous community of little bluestem, golden aster, plume grass and several species of native legumes, among others. These species are typical of dry longleaf pine savanna, though no longleaf were observed in the area. A fair amount of *Lespedeza cuneata* was also observed in this site. Future reconnaissance of this unit should include a look at this area.

RCW/Harry Hampton VC (Units 1-4)

The RCW/Harry Hampton VC prescribed burn took place on October 29, 2008. It was (at least) the sixth entry of fire into the RCW area (Unit #4) and the fourth entry of fire into Units 1-3. Overall, this was a very light burn that was successful as a maintenance burn for the primary longleaf pine area within Unit #4. Though a full post-burn reconnaissance of the entire area was not completed, it is likely that those areas with flashy, herbaceous fuels carried fire during this burn while those areas with shaded pine litter fuels generally did not. There are eight fire effects monitoring plots within these units, and only two (plots 3 and 5 in Unit #4) burned completely during this fire event (Table 1). Immediate post-burn monitoring data indicate that both of these plots experienced a very light burn, which is to be expected in areas that have a predominantly herbaceous fuel type. Overall this burn was a successful maintenance burn for the RCW/longleaf area, but other sections of this combined area (esp. Unit 1) could be considered for re-burning as early as 2009 or 2010.

Table 1. Immediate post-burn effects of plots in Units 1 and 4.

<i>Plot Number</i>	<i>Location</i>	<i>1-hr Fuel Reduction</i>	<i>Average Char Height on Trees</i>	<i>Average Overstory Crown Scorch</i>
PIPA 1	RCW (Unit 4)	78%	Only 25% of plot burned	4%
PIPA 2	RCW (Unit 4)		Did Not Burn	
PIPA 3	RCW (Unit 4)		0.25cm (9")	
PIPA 4	RCW (Unit 4)		Did Not Burn	
PIPA 5	RCW (Unit 4)	70% visual estimate	1m (3.3')	<1%
PITA 10	Unit 1		Did Not Burn	
PITA 11	Unit 1		Did Not Burn	
PITA 12	Unit 1		Did Not Burn	

IV. Long term Monitoring Results

As mentioned previously, long term fire effects monitoring has been ongoing at CONG for over 10 years now. Collection of meaningful fire effects data has been hampered somewhat by lack of an accurate baseline in the RCW unit and lack of clear management objectives for loblolly forests. Other major difficulties include the inability to build an adequate sample size for monitoring of the longleaf remnant. There is simply not enough of that vegetation type at the park to ever achieve a suitable number of plots using the existing NPS monitoring design. With that all said, there is a wealth of data available that can and should be used to help formulate a more meaningful set of management objectives for the use of fire at CONG. Once those objectives are developed, it should be possible to build upon the existing monitoring program to provide better information to park managers. Until such time, the following information provides a glimpse into the successes and shortfalls of the prescribed burning program at CONG. The data need to be viewed with the following caveats:

- The longleaf/loblolly plots included in this analysis are dominated by loblolly pine and are thus not representative of the restored longleaf remnant
- Neither vegetation type has enough plots to accurately describe the range of variability in the vegetation or the fire effects.

Table 2. Long term fire effects monitoring at Congaree Swamp NP

Vegetation Type	Management Objective Restoration Phase- After ?? burns	Monitoring Results (80% confidence intervals)	Objective Achieved?
Longleaf/ Loblolly Pine Woodland (FPIPA1) 5 plots	>50% Reduction in total fuel loading	Fuel reduction: 18% Preburn avg.: 21.1 tons/acre After 6 burns: 17.3 tons/acre (n=4 plots, 1 burn unit)	Not Enough Plots
	15-30% Reduction in overstory tree density	Overstory reduction = 4% ($\pm 16\%$) Preburn avg: 18.5 live trees After 5 burns: 17 live trees (n=4 plots, 1 burn unit)	Not Enough Plots
	>200 tall (>1m) Longleaf pine seedlings /ac	Preburn density: data not clean After 5 burns: 0 (n=4 plots, 1 burn unit)	Not Enough Plots

Vegetation Type	Management Objective Restoration Phase- After ?? burns	Monitoring Results (80% confidence intervals)	Objective Achieved?
Loblolly Pine Forest (FPITA1) 5 plots	>50% Reduction in total fuel loading	Total fuel reduction = 38% Preburn avg.: 33.0 tons/acre After 3 burns: 20.6 tons/acre (<i>n=3 plots, 1 burn unit</i>)	Not Enough Plots
	>70% Reduction in pole-sized tree density	Pole reduction: After 1 burn: 38% After 2 burns: 46% After 3 burn: 65% (<i>n=3 plots, 1 burn unit</i>)	Not Enough Plots
	25-50% Reduction in overstory tree density	Overstory reduction: After 1 burn: 3% After 2 burns: 3% After 3 burn: 8% (<i>n=3 plots, 1 burn unit</i>)	Not Enough Plots

V. Discussion and Comments

The park has been successful at meeting the primary goal of restoring the unique remnant of longleaf pine in the RCW unit. A quick walk through that site reveals a diverse and productive herb layer, healthy mature longleaf trees, and abundant regeneration of longleaf pine. Monitoring data from the recently established plot in this restored area can be used as an example of what the park hopes to achieve in other upland restoration projects.

Areas within the RCW site that are currently dominated by loblolly pine have even seen dramatic improvements in woodland structure and herbaceous abundance. These stands in Units 3 and 4 provide some indication that loblolly pine can serve as structural proxy for the longleaf pine community type in certain areas, though reestablishing longleaf pine in these areas will require substantially more time or a more aggressive restoration strategy. Still other stands that are closer to the bluff have developed such a dense midstory and understory that getting fire to spread into them has been problematic. Plots in this area indicate that new approaches are needed during prescribed burns: options might include fine-tuning the burn prescriptions or utilizing a helicopter for interior ignition.

It is doubtful that any change in prescribed burning prescriptions or tactics will allow the park to make appreciable progress in reducing the density or basal area of the loblolly pine that dominates most of the burn sites within CONG. As is repeated throughout this report, objectives and management strategies will need to be revised to reflect this reality. This process is underway and should be a focus of continued interaction between park managers and regional fire staff in the coming year.

An alarming trend that has been observed during fire effects monitoring over the past couple of years is the increase in wild hog activity in the RCW area. There are now many small and several large wallows and trails throughout even the best longleaf pine site in Unit #4. The effects of this wildlife activity ranges from damage to individual longleaf seedlings and saplings

to creation of bare patches that slow or stop the spread of fire during prescribed burns. A result of this kind of soil disturbance is a reduction in native herbaceous cover and diversity, and these areas may contribute to future spread of invasive exotic plants such as *Lespedeza cuneata*, which has been seen throughout the park. The fire effects crew can provide further information about specific hog sightings and large wallows within the RCW area.

Cowpens National Battlefield (COWP): 2008 Fire Effects Monitoring Annual Report

I. Overview

Fire effects monitoring began at COWP in 2007, with the installation of plots in the Westside and Hayes burn units. Due to the fragmented nature of the vegetation types and age classes, and the small size of the park, the decision was made to use a modified sampling approach to monitor fire effects there. Our approach has been to establish a network of small plots in the park to collect quantitative information on the remnants of the dry oak/pine forest community type that probably best represents a potential natural vegetation type for the area. We are also cooperating with the US Forest Service Southern Research Station (SRS) to research the effects of prescribed burning on the Federally Threatened plant *Hexastylis naniflora*. The large populations of this plant at COWP represent some of the most important resources that may be impacted by fire at the park. Finally, the monitoring team will conduct regular informal reconnaissance of burned areas in the park to make note of other significant occurrences with respect to fire-induced changes (e.g. exotic plant invasions).

Both the Westside and Hayes burn units were burned in spring 2008, and the fire effects crew completed all postburn and year 1 monitoring. Results from this monitoring can be seen in Table 1 (section IV). The crew also assisted SRS with burning and monitoring the *H. naniflora* study plots in conjunction with the larger prescribed burns. Our NPS crew provided training and assistance to the FS researchers to collect fuels and severity data before and after the burns. The report on that research is expected in the coming year. Finally, several members of the crew, the fire ecologist, the Cumberland Gap FUM, and the park Superintendent performed burn site reconnaissance to help fill out the monitoring picture.

II. Program Goals and Objectives

Goals – COWP is using prescribed fire to manage grasslands and forests throughout the park. The primary goals are:

1. Restore and maintain the historical battlefield landscape by using fire to reduce woody encroachment into fields. A related cultural and natural resource goal is to encourage/enhance native species within field sites.
2. Restore and maintain the historical structure and species diversity of oak and shortleaf pine woodlands.

Burn Objectives -- Objectives for individual burns will, of course, vary according to fuel type, burn purpose (hazard fuels vs. WUI), or number of burns into the restoration cycle, but in general:

Burn objectives for fields are -

- > 80% consumption of fine fuels (=stand replacement) over 90% of unit

- > 70% topkill of woody stems (all size classes)

Burn objectives for forests are -

- Reduce the 1-hour fuels between 50-85% over 75% of the unit measured immediately post burn
- Reduce the density of pole and sapling-sized hardwoods by 30-70% each burn as measured within 1 year post burn
- Maintain > 80% of existing mature oaks and pines.

Long term objectives – Long term objectives are typically expected to be achieved only after multiple prescribed burns. Please see Table 3 below for specific objectives and data.

III. 2008 Prescribed Burns

Westside, Hayes, Eastside

These three burns were conducted during the spring of 2008. Westside was a dormant season burn completed on February 20, while Hayes and Eastside were burned in the early growing season on April 25 and 26. All three burns were first entries, had similar fuels (mostly fuel models 8 and 9), and all experienced burns that were generally low in intensity and severity. The results in Table 1 (section IV) are averaged between a single plot in Westside and a plot in Hayes, and offer an example of the effects of these first-entry burns at COWP. It should be emphasized that there are a wide range of fuel types within each of these units (from grass to old field succession to forest) and our data is not representative of fuel types other than oak litter.

Each of these units also contains riparian habitat with populations of *Hexastylis naniflora*, and there is a lot of interest in the impacts to the habitat and populations. Over the course of these burns, fire effects monitors had the opportunity to observe fires that were intentionally lit within *H. naniflora* study plots and fires that more naturally progressed into this plant's habitat. These observations provide mixed indications about the fire ecology of these sites. Fuels within the study plots in the Eastside unit were somewhat discontinuous, compact, and moist which resulted in an incomplete burn that would be classified as a "scorch" severity by fire monitoring standards, even though ignition of these plots was deliberate. Fuels in the streamside habitat within the Westside unit, by contrast, were more continuous and dry, allowing low intensity fires to progress naturally and completely through the populations in what would be classified as a "low" severity burn. Intentional burning of study plots in the Hayes unit displayed a similar behavior and severity. Monitoring of fuels within and adjacent to these sites revealed a combined average of 90% reduction of litter and a 49% reduction of total fuels. SRS staff will be preparing of report of their findings in the coming year.

Loop Project – (Units 1,2,4,6)

These fields and woodlots surrounding the main Battlefield were burned on November 19, 2009. This was the second entry of fire in the past five years, and burn-day observations suggest that the burn objectives were achieved. It is expected that these burns will help to control woody stems and invasive exotics such as *Ligustrum spp.* (privet) and *Rosa multiflora* (multiflora rose), but the abundance of *Lespedeza cuneata* (sericea) will need to be monitored over time, as it may benefit from burning.

IV. Long term Monitoring Results

There is not much to say about long-term monitoring at COWP at this time. The prescribed fire program has been active for only a few years, and the monitoring plots were burned for the first time in 2008. These results can only be viewed as an example of the fire effects in some of the more intact oak forests within COWP.

Table 1. Short term fire effects monitoring at Cowpens NB

Monitoring Type	Management Objective Restoration Phase- (After 4 burns)	Monitoring Results	Objective Achieved?
Piedmont Dry Oak Forest (FQUFA1) 2 plots	>60% Reduction in total fuel loading	Total Fuel Reduction = 58% Preburn avg: 30.0 tons/ac Postburn avg: 12.7 tons/ac (n=2 plots, 2 burn units)	Not Enough Plots
	>70% Reduction in pole-sized tree density	Pole reduction = 75% Preburn avg: 16 live trees 01yr1 avg: 4 live trees (n=2 plots, 2 burn units)	Not Enough Plots
	>200 tall (>1m) Oak seedlings /ac	Preburn avg: not collected 01yr1 avg: 0.5 tall oak seedlings (41/ac) (n=2 plots, 2 burn units)	Not Enough Plots
	>20% Cover by native herbs	Preburn cover = not collected 01yr1 cover = <1% (n=2 plots, 2 burn units)	Not Enough Plots
	<20 Invasive Exotic plants/ac	Preburn avg: not collected 01yr1 avg: 0 (n=2 plots, 2 burn units)	Not Enough Plots

V. Discussion and Comments

Given the fragmented and successional nature of the vegetation at COWP, it will be difficult to gain quantitative information about the impacts of prescribed burning to any single vegetation type. The decision was made to use a multi-pronged approach to monitoring at COWP, with a limited number of long term monitoring plots, cooperative research, and qualitative observations comprising the monitoring plan. Over time, it is hoped that this approach will yield information and insights that will contribute to the formation of more clearly defined desired future conditions for the fields and woodlands of this park. So far, the results from monitoring suggest three things:

1. Habitat for the Threatened plant *Hexastylis naniflora* **can** burn under prescription conditions – ongoing research should determine the relative harm or benefit to those populations and management decisions should be made accordingly
2. Stands of mature oak and shortleaf pine within the park are limited in size and number; these stands make up some of the best remnant vegetation in the park and efforts should be made to identify these areas and burn them with some care
3. The park likely contains every major invasive exotic plant in the southeast – burn sites will need to be surveyed regularly to ensure that prescribed burning is not exacerbating this problem.

Cumberland Gap National Historic Park (CUGA): 2008 Fire Effects Monitoring Annual Report

I. Overview

The monitoring crew completed all scheduled plot reads at CUGA for calendar year 2008, and installed one new oak forest plot in the Tiprell E burn unit. A considerable amount of postburn data were collected at the Lewis Hollow and Harlan Road burn sites, which were both burned for the first time during the spring 2008 fire season. Monitoring results from these two burns are discussed below in section III.

Fire effects monitoring at CUGA started in 2004. There are now 15 long term monitoring plots in two different vegetation types, with the primary focus on the dry oak woodlands that represent the dominant vegetation of the prescribed burn sites. An effort was initially made to provide monitoring for successional pine communities, but has proven difficult to expand due to safety concerns with the numerous snags in these stands. We continue to monitor a single plot in this type, but results from that plot are not included in this report. To date, 13 of the 14 oak forest plots have been burned, with only a partial burn of one of those (Plot 5). Updated results from the long term monitoring of these plots are provided in section IV (Table 3). The sample size is now adequate to make inferences about fuel load reduction and overstory and pole tree changes at the 80% confidence level, but additional plots will be needed to achieve that same confidence level for oak seedling and herbaceous cover variables.

Goals for future monitoring at CUGA are to: 1) continue building the oak forest plot network to achieve the 80% confidence level for all variables, 2) expand efforts to monitor exotic plant encroachment into burned areas, and 3) provide the park with monitoring information for other vegetative communities of interest.

Fire ecology support for CUGA during CY08 centered on completing Section 7 (ESA) compliance, data analysis and continued refinement of burn objectives and prescriptions. A goal in the coming year will be to work with park managers to identify potential burn sites and develop a multi-year project list that addresses the park's goal of using prescribed fire to restore the health and sustainability of the park's fire-adapted vegetation types.

A noteworthy achievement for CY08 was the effective mitigation of prescribed fire impacts to federally endangered Indiana bats within CUGA. One of the prescribed burns in '08 (Lewis Hollow A) was within 0.5 miles of a known hibernaculum (cave) for Indiana bats. The park coordinated with the Gloucester, Virginia office of the USFWS to use specific temperature, wind direction and dispersion values to avoid impacting the hibernaculum. The mouth of the cave was monitored continuously throughout the prescribed burn, and no significant reports of smoke were made. Such coordination with USFWS will be vital as the prescribed fire program at CUGA proceeds.

II. Program Goals and Objectives

Goals – CUGA is using prescribed fire to manage upland forests, primarily those near developed areas or near the park boundary. The primary goals are to:

1. Reduce and manage fuels in the Wildland-Urban Interface to prevent the spread of unwanted fire off of or onto park lands
2. Restore and maintain natural and cultural landscapes using fire to manage fire-adapted oak and oak/pine forests throughout the park.

Burn Objectives -- Objectives for individual burns will, of course, vary according to fuel type, burn purpose (hazard fuels vs. WUI), or number of burns into the restoration cycle, but in general:

Burn objectives for oak forests are -

- Reduce the 1-hour fuels by at least 50% over 75% of the unit as measured immediately post burn
- Reduce the density of pole and sapling-sized hardwoods by at least 30% each burn as measured within 1 year post burn
- Maintain > 80% of existing mature oaks and pines.

Long term objectives – Long term objectives are typically expected to be achieved only after multiple prescribed burns. Please see Table 3 below for specific objectives and data.

III. 2008 Prescribed Burns

Wilderness Road Campground B

This 35 acre first-entry burn was implemented on March 25, 2008. The burn was generally very light, leaving several large unburned patches in the interior. Southern pine beetle attacks on the successional pine forests in the unit have left a great deal of dead and down woody fuels in the interior of this unit that were actually unable to be ignited during this burn. As these fuels will remain a hazard to the campground and developed areas, there was some discussion about the merits of conducting some pile burns at this site in the future. No plots have been installed in this unit.

There were some complaints that fire had consumed the spring wildflowers along the Lewis Hollow Trail on the northeast side of the unit. Though no long-term negative impact to these perennial herbs is to be expected, this scenario could be avoided in the future by restricting the blacklining operation along this boundary. Given the very mesic nature of this habitat, the fire could reasonably be expected to go out before it backed down to the creek and trailside where the wildflowers are. Simple monitoring could be used to ensure that the boundary remained secure.

Lewis Hollow A

Lewis Hollow A is 102 acre site adjacent to the Wilderness Road Picnic Area that was burned on March 26, 2008. It was an outstanding first entry that seems to have achieved the burn objectives, based upon burn-day monitoring and data from 2 plots

(Table 1). This burn was also notable for two things: 1) fire staff were successful at conducting an outstanding burn while preventing impacts to a sensitive smoke receptor (see Overview), and 2) planning and implementation of ignition in stands with heavy fuel load from beetle-killed pine was well done, minimizing impacts to remaining live trees and hopefully minimizing exotic plant occurrence.

Table 1. Fire effects from Lewis Hollow A (n=2).

Burn Status	1000-hr load	Duff load	Litter load	Total load	Overstory trees	Pole trees
Preburn	3.4	8.1	7.1	21.2	30	7
Postburn	1.5	7.1	0.4	11.4	29	3
% change	-56%	-12%	-94%	-46%	-3%	-57%

Fuel loads are tons/acre.

Sugar Run B

Sugar Run was burned on April 1, 2008. The 45 acre unit lies directly on the park boundary near the northwestern corner of the park. This was another good first-entry burn in predominantly dry to dry-mesic oak fuels. Burn-day monitoring suggests that fuel reduction targets were met and, again, the burn crew did an excellent job at minimizing intensity in beetle-affected stands

Harlan Road A

At 234 acres, Harlan Road was one of the largest prescribed burns done to date at CUGA. The unit is located between the Pinnacle Road, KY State Highway 988, and the Harlan Road Trail. This first-entry burn occurred on April 7, 2008, and occurred one day after a week that saw over 2" of rainfall. Accordingly, fire intensity was very low and severity ranged from a "low" to "scorch." Based upon burn-day monitoring and data from 4 plots, the objective for 1-hour fuel reduction was achieved, though during the first growing season after the burn, objectives for reduction of pole-sized trees had not been achieved (Table 2). Increases in 1000-hr fuel load and duff load are due to sampling error. These are the heaviest fuels, and when there is no real change following a burn, small differences in measurement are amplified in the loading calculation. Despite the extremely low severity and minimal top-kill of pole trees, this burn should be considered a relative success. There is an emerging understanding that cool first-entry burns are preferred in this fuel type in order to minimize mortality of large oaks and prevent exotic plant invasions. This burn was probably close to the extreme end of the cool spectrum.

Table 2. Fire effects from Harlan Road A (n=4).

Burn Status	1000-hr load	Duff load	Litter load	Total load	Overstory trees	Pole trees
Preburn	2.0	12.5	6.9	25.7	36	23
Postburn	2.4	13.3	1.5	21.5	35	18
% change	No change	No change	-78%	-16%	-3%	-22%

Fuel loads are tons/acre.

IV. Long term Monitoring Results

As mentioned previously, the number of plots in dry oak forest at CUGA is now sufficient to make program-wide inferences (Confidence level = 80%) regarding the effectiveness of the burn program at reducing total fuel load and reducing density of overstory and pole trees. Five to six additional plots will be required to achieve a similar level of confidence in the results for oak seedlings and herbaceous cover. Regardless of which variable is considered, the CUGA dataset is remarkably clean and has the advantage of having sampled the effects of six first-entry burns. These data are a strong indicator of a program that is moving in a positive direction with respect to the long term objectives for most variables that are being measured.

Table 3. Results of long-term monitoring at Cumberland Gap NHP

Monitoring Type	Management Objective Restoration Phase- (After 4 burns)	Monitoring Results (80% confidence intervals)	Objective Achieved?
Dry Oak Forest (FQUCO1) 14 plots	>60% Reduction in total fuel loading	Total Fuel Reduction = 29% ($\pm 4\%$) Preburn avg: 24.7 tons/ac Postburn avg (1 burn): 17.5 tons/ac ($n=12$ plots, 6 burn units)	No. Not Enough Burns
	>70% Reduction in pole-sized tree density	Pole reduction = 29% ($\pm 6\%$) Preburn avg: 22 live trees 01yr1 avg: 15.6 live trees ($n=13$ plots, 6 burn units)	No. Not Enough Burns
	15-30% Reduction in overstory tree density	Overstory reduction = 2% ($\pm 1\%$) Preburn avg: 31 live trees 01yr1 avg: 30 live trees ($n=13$ plots, 6 burn units)	No. Not Enough Burns
	>200 tall (>1m) Oak seedlings /ac	Preburn avg: 0.3 tall oak seedlings (25/ac) 01yr1 avg: 0.5 tall oak seedlings (41/ac) ($n=13$ plots, 6 burn units)	Not Enough Plots Minimum plots = 19
	>30% Cover by native herbs	Preburn cover = 2% ($\pm 1\%$) 01yr1 cover = 3% ($\pm 2\%$) ($n=13$ plots, 6 burn units)	Not Enough Plots Minimum plots = 20
	<20 Invasive Exotic plants/ac	Preburn avg: 0/acre *(Multiflora rose present in plot 9 Preburn) 01yr1 avg: 1.7 exotic plants (68/acre) ($n=13$ plots, 6 burn units)	Not Enough Plots

V. Discussion and Comments

The process of restoring fire-adapted natural communities at CUGA is still in its early stages, as is the fire-effects monitoring program. One of the limitations of the NPS sampling design is that it is not tailored to provide short-term results for individual burn units. Instead, it seeks to provide long-term information about the effectiveness of *burn programs*. With that said, extensive reconnaissance and comparisons with similar areas in the southeast should allow us to provide some interpretation of individual burns, which we have attempted to do in this report.

With regard to achieving long-term objectives, the park's fire program has been very successful at moderating expectations for first-entry burns in order to achieve the long-term objectives. As

evidenced in Table 3, above, the park is making solid moves forward toward achieving those goals. A hallmark of the prescribed fire program at CUGA has been its responsiveness to fire effects monitoring information. One of the first prescribed burns of the modern program was Dark Ridge A/B, which was generally a fine burn, but which killed some larger oaks and increased the size of canopy gaps where southern-pine beetle had killed the overstory pines. One of the results of this burn that was picked up by monitoring was a modest invasion by exotic trees. Since that time, the fire effects staff has worked with the CUGA Fire Use Module to develop more sensitive ignition strategies for the park's burns. The results from prescribed burns of 2008 are strong evidence that this strategy is moving the park in the right direction.

Despite this more moderate approach to burning, it is possible that exotic plants could find their way into these burned areas following future burns. Most of the burns units thus far occur directly on the park's boundary, near disturbed sites that are a haven for a number of invasive species. While good data is collected for exotics that happen to occur in plots, the sampling design that is currently being used at CUGA is not going to be an effective way to monitor the frequency of exotics in these areas. The fire effects staff is currently looking at some new methods to survey and monitor burn units for these occurrences.

Great Smoky Mountains National Park (GRSM): 2008 Fire Effects Monitoring Annual Report

I. Overview

The monitoring crew completed most of the scheduled plot reads at GRSM for calendar year 2008, and completed installation of one new pine forest plot in the North Hatcher burn unit and three oak plots in Canadian Top and Wear Cove Gap. Table mountain pine plots at Gregory Ridge were not completed for the second year following the burn, due to hazards associated with snags. Yellow pine plots at Wedge Ridge were also not completed due to concerns about dangerous snags, though these plots will be sampled in the coming year. The program continued to expand the dataset for second-entry burns by completing second year reads for pine and oak plots at the Stony, Arbutus and Wash Ridge sites. Data for fire effects on oak forests were also expanded with the completion of first-entry sampling of the Beard Cane burn. Monitoring results from the Beard Cane prescribed burn are discussed below in Section III. Finally, the crew collected a small amount of burn severity data within the Buck Shank wildfire of 2007.

Fire effects monitoring has been in place at GRSM since 1997. There are currently 75 plots in six major vegetation types, though only 43 are actively being monitored. There are 9 plots in northern red oak or table mountain pine that have been installed in units that haven't been burned, and 23 grassland plots in Cades Cove that have been suspended due to a lack of clear monitoring objectives. The core of the program at this time is the low-elevation yellow-pine and dry-oak plot networks. Updated results from the long term monitoring of these vegetation types are provided in section IV (Table 3). The minimum sample size (80% confidence level) for most variables in the yellow-pine type has been achieved, while more plots are needed in the dry-oak type before minimum plot calculations can be made.

Goals for future monitoring at GRSM are to: 1) complete all scheduled reads of existing plots while providing for safety first, 2) continue to expand the dry oak forest plot network in future burn units, and 3) continue to build a burn severity (CBI) dataset that can be used in conjunction with spatial data (dNBR) to monitor large scale fire effects from wildland fires.

Fire ecology support for GRSM during CY08 centered on completing Section 7 (ESA) compliance, data analysis and continued refinement of burn objectives and prescriptions. Other projects included continuing to support the ongoing JFSP-funded fire history research, helping to develop a research proposal to study fire's impacts to Endangered Indiana bats, and serving on the steering committee for the Southern Appalachian Fire Learning Network (FLN). These projects will continue in the coming year, and should contribute a great deal of critical information for the continued success of the GRSM prescribed fire program.

II. Program Goals and Objectives

Goals – GRSM is currently using fire to manage grasslands and upland forests. The primary goals are as follows:

1. Restore and maintain structure, sustainability, and species diversity to pine and oak woodlands
2. Restore and maintain cultural and natural landscapes using fire to reduce woody encroachment into fields. A related cultural and natural resource goal is to encourage/enhance native species within field sites
3. Reduce and manage fuels in the Wildland-Urban Interface to prevent the spread of unwanted fire off of or onto park lands.

Burn Objectives – Objectives for individual burns will, of course, vary according to fuel type, burn purpose (hazard fuels vs. WUI), or number of burns into the restoration cycle, but in general:

Burn objectives for fields are -

- > 80% consumption of fine fuels (=stand replacement) over 90% of unit
- > 70% topkill of woody stems (all size classes)

Burn objectives for forests are -

- Consume >75% of surface litter (fine fuels) over >75% of the area occupied by target vegetation. Target vegetation is typically oak and pine forests found on upper slopes and ridgetops.
- Fire Intensities do not exceed the following spatial proportions within targeted vegetation types:
 - <5% high intensity (FL >8')
 - 5-20% moderate intensity (FL 3-8')
 - 75-90% low intensity (FL 1-3')
- Burn is conducted with appropriate fuel conditions (i.e. KBDI) to achieve 15-45% total fuel reduction. KBDI 35-100 will typically produce this result on a first entry burn at GRSM. KBDI on first entry burns should usually not exceed 200. The higher the KBDI, the less intensity is desired.

Long term objectives – Long term objectives are typically expected to be achieved only after multiple prescribed burns. Please see Table 3 below for specific objectives and data.

III. 2008 Prescribed Burns

Beard Cane

Beard Cane is an 1800 acre site in the park's western end. The unit contains significant stands of yellow pine and dry to mesic oak forests on ridgetops and mid to upper slopes. A high percentage of pine and pine-oak stands on the ridges of this unit have been heavily impacted by southern-pine beetle and are

characterized by a standing dead overstory and extreme fuel loads. Mixed hardwood and conifer forests dominate the more mesic sites on lower slopes and northern exposures, and a dense layer of great rhododendron dominates the understory on many mid-slope positions. The Beard Cane burn unit also contains Wedge Ridge, which is a small ridge that was burned in a prescribed fire on October 30, 1998. That '98 fire was a hot burn that resulted in high mortality among overstory trees and bountiful pine regeneration. Most of the remainder of the unit had no known fires since the park's inception (75 years). The first entry of prescribed fire into this unit occurred on April 24, 2008. The KBDI was 78, and most of the deciduous trees had not leafed out.

Due to the specific circumstances of this burn event (unit size and terrain, remote aerial ignition, a major slopover), no burn-day monitoring data exist for the burn and no FEMO report was filed. The best information available suggests that ignition was along the upper west-facing slope of Beard Cane Mt. and along the ridge tops of Short Mountain and Wedge Ridge. A lack of clear landmarks for unit boundaries and poor visibility due to smoke hindered aerial ignition somewhat, but the entire unit was ignited on April 24. Late in the afternoon, a slopover occurred on Hatcher Mountain during black-lining operations around Wedge Ridge, which pulled almost all resources away from the Beard Cane burn for the following 3 days. Both fires burned through the night of April 24, and it is uncertain how much longer the fire on Beard Cane remained active.

Post-burn reconnaissance and data from post-burn plot monitoring (Table 1) suggest that objectives for fuel reduction were achieved for this burn, though the upper slopes and ridgetop of Beard Cane Mt. burned with a slightly higher intensity than desired. A strong reduction in pole-sized trees was accompanied by a minimal reduction in overstory trees (Table 1). Such an outcome is typically highly desirable for a first-entry burn, but a closer inspection of the fire impacts to overstory trees (Table 2) and post burn reconnaissance suggests that additional mortality of mature oaks could be expected on ridgetop sites on Beard Cane Mountain. The effects on Short Mt. are more indicative of the backing fires that are preferred for the majority of the landscape. Additional monitoring will be required to assess the full impacts of this burn on the mature oaks and remnant pines of Beard Cane Mountain.

Table 1. Fire effects at Beard Cane (n=3).

Burn Status	1-100 hr load	1000-hr load	Duff load	Litter load	Total load	Avg # of live overstory	Avg # of live poles
Preburn avg	2.4	7.0	22.1	8.6	40.1	45	24
Postburn avg	1.6	3.4	18.1	0.2	23.2	44	12
Average % change	-34%	-52%	-18%	-98%	-42.1%	-3%	-50%

Fuel loads are tons/acre.

Table 2. Overstory tree damage at Beard Cane

Plot ID	Location	Avg Char Height	Avg Scorch Height on Evergreens	Avg % Scorch on Evergreens
QUCO 3	Beard Cane Mt.	0.9m (3')	19m (62')	76%
QUCO 4	Short Mt.	0.5m (1.6')	4m (13')	32%
QUCO 5	Beard Cane Mt.	1.8m (6')	11m (36')	51%

Cades Cove Fields

Burns in Cades Cove for 2008 included the fields behind the Methodist Church, the Increase Fields of Hyatt Lane and fields to the west and east of Sparks Lane. The west part of Methodist Church and the Increase Fields were burned on March 10 and the east part of Methodist Church was burned on March 12. Both burn days produced good results that seemed to meet the objectives for fields. Encroaching pitch pines within the Methodist field site were mostly top-killed, though by late in the season, they were observed to be resprouting vigorously. A three year rotation of fire only may not be adequate to completely remove these trees. The burn of the Increase Fields was very effective at meeting objectives, though, again, a three year rotation of fire alone will not be adequate to control the blackberry that exists on portions of that site. No information exists for the Sparks Lane burns.

IV. Long term Monitoring Results

As mentioned previously, the number of plots in yellow pine woodlands at GRSM is now sufficient to make program-wide inferences (Confidence level = 80%) regarding the effectiveness of the burn program at reducing total fuel load and reducing the density of pole trees. Due to high variability in overstory mortality between plots, five additional plots will be required to achieve the desired confidence level for overstory mortality. Additional burns will be required to adequately assess pine seedling and herbaceous cover increases, though outstanding results for these variables have been achieved in individual plots.

There have not been enough burns of dry-oak forest plots to make any strong statements about the relative success of achieving management objectives in this type. In general, the existing data show moderate impacts that are complementary to achieving the long-term objectives in this vegetation type.

Table 3. Long-term fire effects monitoring at Great Smoky Mountains NP

Monitoring Type	Management Objective Restoration Phase- (After 4 burns)	Monitoring Results (80% confidence intervals)	Objective Achieved?
Yellow Pine Woodland (FPIR11) 26 plots	>50% Reduction in total fuel loading	Total fuel reduction = 36% ($\pm 5\%$) Preburn mean = 43 tons/ac 01 Post mean = 28 tons/ac ($n=23$, 6 burn units)	No, but not enough burns to evaluate
	>70% Reduction in pole-sized tree density	Pole reduction = 75% (± 7) Preburn avg: 37.6 live trees 02yr1 avg: 7.9 live trees ($n=11$, 3 burn units) Reduction after 1 burn ($n=25$): 54% (± 5)	Yes
	25-50% Reduction in overstory tree density	Overstory reduction = 41% (± 9) Preburn avg: 47.7 live trees 02yr1 avg: 27.5 live trees ($n=11$, 3 burn units) Reduction after 1 burn ($n=25$): 20% (± 5)	Yes, but not enough plots Minimum plots =31
	>200 tall (>1m) Yellow Pine seedlings /ac	Preburn avg: 0 tall pine seedlings Avg. After 1 burn ($n=25$): 97/ac (± 49) Avg. After 2 burns ($n=11$): 49/ac (± 40)	No, but not enough burns to evaluate
	>40% Cover by native herbs/subshrubs	Preburn cover = 3% ($\pm 1\%$) Avg. After 1 burn ($n=23$): 11% ($\pm 4\%$) Avg. After 2 burns ($n=9$): 10% ($\pm 6\%$)	No, but not enough burns to evaluate

Monitoring Type	Management Objective Restoration Phase- (After 4 burns)	Monitoring Results (80% confidence intervals)	Objective Achieved?
Dry Oak Forest (FQUCO1) 12 plots	>60% Reduction in total fuel loading	Total fuel reduction = 30% ($\pm 4\%$) Preburn mean = 34 tons/ac 01 Post mean = 24 tons/ac ($n=8$, 3 burn units)	No, but not enough burns to evaluate
	>70% Reduction in pole-sized tree density	Pole reduction = 22% ($\pm 7\%$) Preburn avg: 28.9 live trees 01yr1 avg: 23.1 live trees ($n=8$, 3 burn units)	No, but not enough burns to evaluate
	15-30% Reduction in overstory tree density	Overstory reduction = 2% ($\pm 1\%$) Preburn avg: 41.5 live trees 01yr1 avg: 40.5 live trees ($n=8$, 3 burn units)	No, but not enough burns to evaluate
	>200 tall (>1m) Oak seedlings /ac	Preburn avg: 0.4 tall oak seedlings (33/ac) 01yr1 avg: 0 tall oak seedlings ($n=8$, 3 burn units)	No, but not enough burns to evaluate
	>30% Cover by native herbs/subshrubs	Preburn cover = 4% 01yr2 cover = 2% ($n=8$, 3 burn units)	No, but not enough burns to evaluate

V. Discussion and Comments

Fire-effects monitoring has been in place at GRSM for over ten years now, and much knowledge has been gained about the effects of prescribed burning on pine and oak forests in the southern Appalachians. Monitoring data has continually provided information that can be used to refine long-term objectives as well as prescriptions and tactics for individual burns. That being said, the process of restoring fire-adapted natural communities at GRSM is still in its early stages. It is estimated that a minimum of 3-5 burns (20+ years) will be required to meet the restoration objectives laid out in Table 3. With this in mind, it is critical to also use monitoring data to examine individual burns and ensure that short term objectives and effects are supportive of the longer term goals. The brief analysis of the Beard Cane prescribed burn represents an attempt to use limited monitoring data and more extensive post-burn reconnaissance for this purpose.

With regard to long-term objectives, the park's prescribed fire program has been successful at reducing hazardous fuels and creating a range of structural and compositional effects across the landscape. The mean values for most of the objective variables in pine and oak systems indicate progress in a positive direction, while low overall values for pine/oak regeneration and herbaceous cover illustrate the long-term challenges of restoring these communities. Viewing the pooled data from multiple burns, however, misses the important point that effects vary dramatically from burn to burn and even plot to plot. For example, early burns at GRSM were successful at creating conditions for regeneration of yellow pines, while more recent burns have not yet created these conditions. This is largely a result of altering the seasonality of burning, but it underscores the need to examine fire effects at a range of scales. Such a process will be critical for developing more site-specific prescriptions in the coming years.

Kings Mountain National Military Park (KIMO): 2008 Fire Effects Monitoring Annual Report

I. Overview

The monitoring crew completed all scheduled plot reads at KIMO for calendar year 2008, and installed one new oak forest plot in the Piedmont burn unit. Immediate postburn data were collected at the Dellingham and Brushy North burn sites, which were both burned for the second time during the spring 2008 fire season. Monitoring results from these two burns are discussed below in section III.

Fire-effects monitoring at KIMO started in 1999. There are now 28 long term monitoring plots in two different vegetation types, with the primary focus on the dry oak woodlands that represent the dominant vegetation of the prescribed burn sites. The small number of plots in the blackjack-chestnut oak woodland reflects the scarcity of this vegetation type within burn areas, and it is doubtful that additional plots of this type will be added. To date, all of these plots have been burned, many of them two or even three times. Updated results from the long-term monitoring of these plots are provided in section IV (Table 3). The sample size in the dry-oak forest type is now adequate to make program-wide inferences about fuel load reduction and overstory and pole tree changes at the 80% confidence level, but results from additional burns will be needed to achieve that same confidence level for oak seedling and herbaceous cover variables.

Goals for future monitoring at KIMO are to: 1) complete all scheduled reads of existing plots, 2) communicate results to park managers, and 3) provide the park with monitoring information for other vegetative communities or species of interest.

Fire ecology support for KIMO during CY08 centered on data analysis and participation in prescribed burns and monitoring efforts. A goal in the coming year will be to develop a more thorough analysis of data concerning fire-effects in oak woodlands for presentation or publication.

II. Program Goals and Objectives

Goals – KIMO is using prescribed fire to manage oak and pine forests and woodlands. The primary goals are to:

1. Restore and maintain cultural and natural landscapes using fire to manage fire-adapted oak and oak/pine forests throughout the park
2. Reduce and manage fuels to prevent the spread of unwanted fire off of or onto park lands.

Burn Objectives -- Objectives for individual burns will, of course, vary according to fuel type, burn purpose (hazard fuels vs. WUI), or number of burns into the restoration cycle, but in general:

Burn objectives for oak forests are -

- Reduce the 1-hour fuels by at least 50% over 75% of the unit as measured immediately post burn
- Reduce the density of pole and sapling-sized hardwoods by at least 30% each burn as measured within 1 year post burn
- Maintain > 70% of existing mature oaks and pines.

Long term objectives – Long term objectives are typically expected to be achieved only after multiple prescribed burns. Please see Table 3 below for specific objectives and data.

III. 2008 Prescribed Burns

Dellingham

The second-entry of fire into the Dellingham unit occurred on March 11, 2008. Little additional information exists regarding the circumstances of this burn, but post-burn monitoring data suggests that it was successful at achieving the burn objectives.

Table 1. Fire effects at Dellingham (n=2).

Burn Status	% Overstory tree mortality	% Pole tree mortality	1000-hr fuel load change	Duff fuel load change	Litter fuel load change	Total fuel load change
After 1 burn	No change	-5%	-----Data not taken-----			
After 2 burns	-8%	-39%	-50%	-25%	-90%	-37%

All percentages are compared to preburn values

Brushy Ridge North

Brushy Ridge was burned on March 12, 2008. This was the second entry of fire into this unit, and it appears to have been successful at achieving the burn objectives for fine fuel reduction and top-kill of pole trees (Table 2). Additionally, there was a substantial reduction in the duff layer, which seemed to be particularly evident at the base of both live and dead shortleaf pines. The effects of this fuel consumption at the root crown of living shortleaf pines are unknown. The aerial ignition pattern used to ignite the interior of the unit was particularly efficient, and major smoke production from this burn was very limited in time span. Aside from the effects documented in Table 2, post-burn reconnaissance revealed significant leaf scorch and top-kill of mountain laurel throughout the unit, which is generally seen as positive progress toward restoring the historical open woodland structure.

Table 2. Fire effects at Brushy North (n=5).

Burn Status	% Overstory tree mortality	% Pole tree mortality	Duff fuel load change	Litter fuel load change	Total fuel load change
After 1 burn	No change	-10%	-8%*	-27%*	-2%
After 2 burns	-3%	-38%	-41%	-93%	-48%

All percentages are compared to preburn values.

*n=3

Partner

This second entry burn was completed on April 8, 2007. The first entry occurred during spring 2004. No monitoring plots exist within the unit and no FEMO report was filed. General observations were that this was a very light burn.

Eastline

Eastline was a first entry burn that included King's Mt. State Park lands. The burn was completed on April 10, 2008. Interior ignition was done aerially. Again, there were no monitoring plots within the unit and no FEMO report was filed.

IV. Long term Monitoring Results

As mentioned previously, the number of plots in dry oak forest at KIMO is now sufficient to make program-wide inferences (Confidence level = 80%) regarding the effectiveness of the burn program at reducing total fuel load and reducing density of overstory and pole trees. Though none of those objectives have yet been achieved, the data indicate that the burn program is on target to achieve them within the restoration period. It is less certain whether objectives for oak/pine regeneration and herbaceous cover will be achieved on a program-wide basis. As an interesting sidebar, plot QUMO12 in the Y/S Road unit was resampled this year (5 years after the 2nd burn), and provides an interesting glimpse of some of the more advanced restoration in the park. This plot is literally full of shortleaf pine regeneration that is 5-10' tall and has an impressive herbaceous cover that is unlike other burned areas in the park.

The number of plots in the blackjack oak type is more limited by the scarcity of this vegetation type, though data from plots also indicate good progress toward achievement of restoration objectives. Regardless of which vegetation type or which variable is considered, the KIMO dataset is remarkably clean and has the advantage of having sampled the effects of six first-entry burns as well as multiple second and third entry burns. These data are a strong indicator of a program that is moving in a positive direction with respect to the long term objectives for most variables that are being measured.

Table 3. Results of long-term monitoring at King's Mountain NMP

Monitoring Type	Management Objective Restoration Phase- (After 4 burns)	Monitoring Results (80% confidence intervals)	Objective Achieved?
Chestnut Oak- Blackjack Oak Woodland (FQUMA1) 8 plots	>50% Reduction in total fuel loading	Total fuel reduction = 47% ($\pm 4\%$) Preburn mean = 34 tons/ac 01 Post mean = 17 tons/ac ($n=7$, 4burn units)	No, but not enough burns to evaluate
	>70% Reduction in pole-sized tree density	Pole reduction (1 burn): 45% ($\pm 12\%$) Pole reduction (2 burns): 62% ($\pm 12\%$) ($n=8$ for 1 burn, $n=4$ for 2 burns)	No, but not enough burns to evaluate
	15-30% Reduction in overstory tree density	Overstory reduction (1 burn): 30% ($\pm 11\%$) ($n=8$, 5 burn units)	Yes, but not enough plots
	>30% Cover by native herbs	Preburn cover: 6% Cover after 1 burn: 9% ($n=7$, 4 burn units)	No, but not enough burns to evaluate

Monitoring Type	Management Objective Restoration Phase- (After 4 burns)	Monitoring Results (80% confidence intervals)	Objective Achieved?
Dry Oak Forest (FQUMO1) 20 plots	>50% Reduction in total fuel loading	Total fuel reduction = 41% ($\pm 5\%$) Preburn mean = 33 tons/ac 02 Post mean = 18 tons/ac (<i>n</i> =19, 6 burn units)	No, but not enough burns to evaluate
	>70% Reduction in pole-sized tree density	Pole reduction (1 burn): 43% ($\pm 2\%$) Pole reduction (2 burns): 58% ($\pm 5\%$) (<i>n</i> =19, 6 burn units)	No, but not enough burns to evaluate
	15-30% Reduction in overstory tree density	Overstory reduction (1 burn): 7% ($\pm 3\%$) Overstory reduction (2 burns): 12% ($\pm 3\%$) (<i>n</i> =19, 6 burn units)	No, but not enough burns to evaluate
	>200 tall (>1m) Oak or shortleaf pine seedlings/acre	Preburn density: 85 stems/ac (± 49) Density after 1 burn: 55 stems/ac (± 34) Density after 2 burns: 55 stems/ac (± 32) (<i>n</i> =19, 6 burn units)	No, but not enough burns to evaluate
	>15% Cover by native herbs/subshrubs	Preburn cover: <1% Cover after 1 burn: 1% Cover after 2 burns: 1-2% (<i>n</i> =19, 6 burn units)	No, but not enough burns to evaluate

V. Discussion and Comments

In general, the KIMO prescribed fire program is making (outstanding) steady progress toward achieving its management goals. There is a lingering concern about oak regeneration, but expectations are that this will start to be resolved as more burn units enter their third and fourth entry of fire. This will be a focus of continued monitoring throughout the park. Results from the above mentioned Y/S Road site provide evidence that shortleaf pine regeneration and strong herbaceous responses can be achieved where canopy gaps align with existing seed sources. The desired trajectory for blackjack oak woodlands is less clear, though continued burning and monitoring of this unique community should yield insights that can be used to refine restoration objectives and develop desired future conditions.

Table 4. Fire Ecologist Accomplishments/Focus Areas

Category	Percent Time	Accomplishments/Focus Areas
General Planning	10%	Biological evaluations/section 7 compliance for CONG, GRSM, and BISO. General review of burn plans, development/revision of rx burn objectives, evaluation of past and future burn units, including site visits to most parks.
Monitoring Plans	<5%	Continued work on protocol reviews and Monitoring Unit Descriptions (FMH-4s) for all parks. Develop conceptual models for oak and pine vegetation types that exist at most parks.
Presentations	<5%	Presentation of demo site objectives and monitoring at the SA-FLN.
Fire Assignments and Fuels Projects	20%	FFT1(t), FEMO, ignition, and/or holding on many rx fires. 45-day western tour with GRSM FUM. ICT5(t), FFT1, FEMO on several WFU and wildfires in GRSM.
Research	5%	Assisted with planning and field work of SA dendrochronology research. Assisted with planning and proposal development for Indiana bat research at GRSM.
Monitoring Field Work	15%	Pre-monitoring reconnaissance. Continued to collect immediate postburn, preburn and year-postburn reads at all parks.
Data Entry	<5%	Familiarization with FFI
Data Management	15%	I can't succinctly say what this entails exactly-but it takes a lot of time.
Data Analysis	15%	Estimated amount of time spent analyzing monitoring data.
Supervision/Admin	7%	Budget management, Hiring, supervision, new performance plans, various training experiences
Training	<5%	• Firefighter refresher • PT • Lots of OJT on western tour • FFI workshop
Miscellaneous	10%	Significant work on monitoring publication and participation in Fire Learning Network.

Table 5. Fire Effects Crew Accomplishments/Focus Areas

Category	Percent Time	Notes
FMH plots	50%	Plot data collecting and preparing plot folders and equipment for field.
WUI plots	0	
CBI plots	2%	Buckshank WFU
Other plot work	5%	Nested subplots data collection in each FMH plot, assisting dendrochronology/fire history project, assisting USFS NC
Fire Assignments	25%	Crew assisted with 12 prescribed burns, 2 fire- use and 1 suppression Two members completed helitack details. One member completed a 2 week southeastern detail with the GRSM module Two members completed 6 week western details with the GRSM module
Fuels Project work	0	
Data entry	10%	80% of plot data has been entered for 2008
Data conversion	3%	FEAT to FFI troubleshooting
Data analysis	1%	Some analysis was completed on fuel loading for FEMO reports
Supervision/Admin	2%	Assistant Lead monitor supervised crew of three most of season and maintained misc travel, time and purchasing paperwork
Training	2%	Refresher Training 1-3 hours of physical training a week was completed for each employee. One member completed Wilderness First Responder Training

The End