



**National Park Service
Southern Appalachian Fire Ecology Annual Report
Calendar Year 2007**



Summary

The 2007 field season started off with two new additions. Huma Alvarado left the wilds of Montana to join us for some southern culture-filling out our field crew. The second addition has spent a pleasant summer being toted around by our lead, but should be exiting the womb soon in time to carry rebar for next season.

2007 was a busy year for NPS Fire staff in the Southern Appalachians. We had a very successful spring prescribed fire season, resulting in 24 immediate post-burn plot reads. A prolonged severe drought resulted in multiple wildfires and WFU events in Great Smoky Mountains NP (GRSM). One of the wildfires, the Buck Shank fire, grew to nearly 1000 acres. This fire was notable for several reasons; 1) the fire was managed with a confine/contain strategy that allowed it to persist on the landscape for over 14 days, mimicking a Fire-Use event, 2) it occurred in late May-early June, burning outside of the “normal” fire season, and 3) it burned over an area that had been prescribed-burned just two years prior, allowing managers to observe the effects of first-entry fuel reductions on fire behavior. Additionally, the fire burned through one of our long-term fire effects plots, allowing fire effects staff to document part of the range of effects of this important fire.

Despite the involvement of fire ecology/fire effects staff on this fire and several others, the fire effects staff completed an enormous amount of field work. Nearly all scheduled rereads were completed; only Gregory Ridge plots were not read, due to extreme hazards from snags and hanging deadfall. A large number of new forest plots were located and installed (17 total) in five different parks. In addition, an entire week during the field season was devoted to collecting CBI data at GRSM from the previous years’ WFU event, the Chilly Springs Fire. This collection of CBI data marks a renewed attempt to build a CBI database that can be used to define severity thresholds for the park’s growing DNBR dataset. In the coming year, we are planning to collect CBI data for the Buck Shank Fire and possibly others.

A good deal of work was accomplished at most of our satellite parks, with significant numbers of new plot installs completed at Cumberland Gap NHP (CUGA) and Big South Fork NRR (BISO), both of which have quickly growing prescribed fire programs. Cowpens National Battlefield (COWP) in South Carolina became the latest addition to our monitoring network. The crew

installed some traditional FMH-style plots at COWP and assisted researchers from the USFS Southern Research Station in conducting fire-effects research on *Hexastylis naniflora*, a Federally Threatened plant that grows within several proposed burn sites. We also completed another year of extensive data collection at King's Mountain NMP. We continue to build on a relatively large dataset on fire effects in the oak forests of KIMO, including data on second and third-entry burns. These existing data were summarized and presented to fire staff at KIMO early in 2007. Fire effects data (very preliminary) were also presented and discussed with BISO fire staff to help inform future burn planning.

Work continues on the Southern Appalachian fire history study, led by Drs. Henri Grissino-Mayer and Charles Lafon. Some incredible trees and fire history samples have been located in the past year of field work, including the oldest-known living shortleaf pine – 324 years old – with fire scars. These trees will help to tell the story of how complex patterns of disturbance history have interacted with potential natural vegetation to arrive at the condition we see today. We are looking forward this year to the addition of soil charcoal sampling that could help document the presence of fire on this landscape back into prehistoric times.

Finally, in October 2007, the GRSM Fire Ecology program helped to host the 2nd Southern Appalachian Fire Learning Network Workshop. Several members of the Fire Management staff gave presentations about the GRSM program and planned an outstanding field trip that stimulated a lot of good discussion among conference attendees. Overall, the workshop allowed us to showcase the park's fire management program and some of the fire effects work that has been done here for the past ten years. The information that was shared will help the interagency network to establish realistic and meaningful objectives for fire management in the Southern Appalachians.

Plot Work

A total of 88 plot reads were completed in 2007, with the vast majority of those (79) being intensive forest plots (Table 1, below). The season began with immediate post and year 1 reads for the three prescribed fires completed in GRSM last spring. The team continued long-term monitoring at Tabcat, the first prescribed burn area in GRSM. This unit was initially burned in 1997 and again in 2003. The plots illustrate a dramatic surge in species diversity and yellow pine regeneration since the plots were initially installed. After finishing in GRSM the team moved on to BISO where, in addition to postburn reads, we installed 5 new plots in the Dry Oak Forest Monitoring type. A similar workload was completed for CUGA, where we installed 6 Dry Oak Forest plots. Following tradition the crew completed their season in Kings Mountain National Military Park (KIMO).

Table 1. Fire Effects Plot Workload 2007

Park	Monitoring Unit	Type of Plot (FMH, photo point, other)	Pre-burn	Immed. Post	Postburn (1-20 yrs)	Total Plots
Big South Fork (BISO)	Shortleaf Pine	FMH forest plot	0	0	0	0
	White Oak	FMH forest plot	5	0	3	8
	Little Bluestem	FMH shrub plot	0	0	3	3
Cumberland Gap (CUGA)	Virginia Pine	FMH forest plot	0	0	0	0
	Scarlet Oak	FMH forest plot	6	0	5	11
Congaree Swamp (COSW)	Loblolly Pine	FMH forest plot	0	1	0	1
	Long Leaf Pine	FMH forest plot	0	0	0	0
Great Smoky Mountains (GRSM)	Scarlet Oak	FMH Forest plot	2	5	5	12
	Pitch Pine	FMH Forest plot	0	8	8	16
	RCW	FMH Forest plot	0	0	6	6
	Table Mt Pine	FMH Forest plot	0	5	0	5
Kings Mountain (KIMO)	Blackjack Oak	FMH Forest plot	2	2	4	8
	Chestnut Oak	FMH Forest plot	0	3	7	10
Cowpens (COWP)	Southern Red Oak	FMH Forest plot	2	0	0	2
		Fuels transects	6	0	0	0
Total			23	24	41	88

Prescribed Burns

FEM staff assisted the Great Smoky Mountains and Cumberland Gap Fire Use Module with prescribed burns at Great Smoky Mountains National Park (4 burn units), Kings Mountain National Military Park (3 burn units), Congaree Swamp (1 burn unit). We also assisted with multiple shifts on the Buck Shank suppression fire and Cattail wildland fire-use (WFU) fire as well as several other fires within Smoky Mountains National Park. Burns were conducted during the months of March and April.

Fire Assignments

All fire assignments took place within the Southeast region this year. Nunally Benzing completed a 2 week helitack detail with a regionally assigned ship. Bob Dellinger completed a suppression detail with the GRSM module in the Everglades. Rob Klein worked four weeks on fires within GRSM. Nunally Benzing and Wylie Paxton joined Dave Loveland to assist Big Cypress National Preserve on several prescribed burns.

Presentations

Desired Future Conditions for Yellow Pine Woodlands in GRSM.

Presentation by Bob Dellinger at the 2nd Southern Appalachian Fire Learning Network Workshop

Plan for Success: Objectives and Prescriptions to Achieve DFCs.

Presentation by Rob Klein at the 2nd Southern Appalachian Fire Learning Network Workshop

Personnel/Training

See table 2, below.

Table 2. Fire Ecology Staffing 2007

Monitor	Starting Date	Ending Date	# of Pay Periods	Training and Development
Rob Klein	1/1/07	12/31/07	26	Fire Learning Network (FLN), continued work on Squad Boss and Faller A taskbooks
Nunally Benzing	1/1/07	12/31/07	26	Nat'l Dendroecology Fieldweek, FLN, continued work on Squad Boss and Helitack taskbooks
Wylie Paxton	3/5/07	12/31/07	21	FLN, continued work on Squad Boss and Faller A taskbooks
Bob Dellinger	2/20/07	11/21/07	20	FLN, EVER detail, Performed as Information Officer in high visitor use area on GRSM WFU
Huma Alvarado	5/29/07	11/21/07	15	FLN

Management Objectives and Monitoring Results 2007

General

A new analysis of Monitoring Results has not been completed for 2007. The annual report from 2006 contains extensive documentation of our most recent management objectives and analyses of those objective variables. These objectives are currently in the ongoing process of being finalized and incorporated into fire planning documents, and there was not enough post burn data added to the databases in 2007 to justify a fresh analysis. Where additional preburn plots were established, I have added comments in the tables to indicate movement towards accomplishing our monitoring goals. The analyses will be revisited in 2008 if significant additions to the database are made. Meanwhile, pertinent analyses from individual parks will continue to be prepared and communicated to those parks. Efforts are also underway to publish findings from our longer-term dataset at GRSM.

We believe that the language that accompanied the objectives and analysis tables in 2006 is an important accompaniment to the tables, so it is excerpted below in italics.

An attempt has been made, in the sections that follow, to list a broad set of objectives for each monitoring unit that we collect fire effects information in. At this time, all objectives are scaled to a 20-year time frame that should encompass, on average, 4 prescribed burns. Though we currently do not have any data that match that time scale, this approach meets two important needs: 1) for the first time, a comprehensive set of ecologically meaningful restoration objectives are proposed for our monitoring units, and 2) an updated analysis of each of these potential objective variables is provided. This should provide a good framework in which to relate and discuss the fundamental aims of our prescribed fire programs and hopefully to select a core set of objectives that can be agreed upon.

At this time, most of the datasets (and burn programs) from our parks are quite small, and statistical inferences across landscapes are not appropriate. It is useful, however, to review these results as examples of what is occurring on the ground as a result of these early prescribed burns. In this sense, these preliminary results can help build a sense of the range-of variability for preburn conditions and first-entry fire effects within these vegetation types and also help us to develop better management objectives.

Big South Fork National River Recreation Area (BISO)

BISO had no prescribed burns in 2007 that included fire effects plots. This gave our staff a good opportunity to install five new plots in the oak woodland monitoring type, which accounts for the largest targeted acreage in the prescribed fire program there.

Big South Fork NRRA

Monitoring Unit	Management Objective (Restoration- After 4 burns/20 years)	Monitoring Results (80% confidence intervals)	Objective Achieved?
FPIEC – Shortleaf Pine Woodland 1 plot	>50% Reduction in total fuel loading	Total fuel reduction = 49% (no CI) From 25.5 t/ac to 12.9 t/ac (n=1 plot, 1 fire)	Not Enough Plots
	>70% Reduction in pole-sized tree density	Pole reduction = 47% (no CI) From 1600 stems/ha to 840 stem/ha (n=1 plot, 1 fire)	Not Enough Plots
	15-50% Reduction in overstory tree density	Overstory reduction = 0% (no CI) 200 stems/ha (n=1 plot, 1 fire)	Not Enough Plots
	>200 tall (>1m) Shortleaf Pine seedlings /ac	0 @ Preburn – 0 @ 01yr1 (n=1 plot, 1 fire)	Not Enough Plots
	>40% Cover by native herbs	No Preburn data at this time 28.3 % cover of native herbs @ 01yr1	Not Enough Plots
FQUAL – Dry Oak Forest 4 plots	>50% Reduction in total fuel loading	Total fuel reduction = 44-(46)-48 % From a mean of 36.1 t/ac to 19.6 t/ac (n=4 plots, 1 fire)	Not Enough Plots – 5 new plots in '07
	>70% Reduction in pole-sized tree density	Pole reduction = 66-(78)-89 % From mean of 710 stems/ha to 120 stem/ha (n=4 plots, 1 fire)	Not Enough Plots – 5 new plots in '07
	15-30% Reduction in overstory tree density	Overstory Reduction = -4-(1)-6% From mean of 303 stems/ha to 298/ha (n=4 plots, 1 fire)	Not Enough Plots – 5 new plots in '07
	>200 tall (>1m) Oak seedlings /ac	No change. 102 stems/ac PRE (± 166) and 102/ac @ 01yr1 (± 99) (n=4 plots, 1 fire)	Not Enough Plots – 5 new plots in '07
	>30% Cover by native herbs	Preburn cover = 14.0% (± 23.5) 01yr1 cover = 15.0% (± 19.2) (n=3 plots, 1 fire)	Not Enough Plots – 5 new plots in '07
FSCSC – Little Bluestem Sandstone Glade/Savanna 3 plots	>70% Reduction in pole-sized tree density	Pole-sized tree change = -3-(16)-35% (n= 3 plots, 1 fire)	Not Enough Plots
	>70% Cover by native herbs	Preburn cover = 103.3% (± 27.4) 01yr1 cover = 144.7% (± 32.7) (n= 3 plots, 1 fire)	Not Enough Plots

Cumberland Gap National Historic Park (CUGA)

CUGA had no prescribed burns in 2007 that included fire effects plots. This gave our staff a good opportunity to install 6 new plots in the oak woodland monitoring type, which accounts for the largest targeted acreage in the prescribed fire program there.

Cumberland Gap NHP

Monitoring Unit	Management Objective (Restoration-After 4 burns)	Monitoring Results (80% confidence intervals)	Objective Achieved?
FQUCO – Dry Oak Forest 6 plots	>50% Reduction in total fuel loading	Total Fuel Reduction = 23-(31)-39% From 24.7 t/ac to 16.8 t/ac (n=6 plots, 1 fire)	Not Enough Plots – 6 new plots in '07
	>70% Reduction in pole-sized tree density	Pole reduction = 15-(27)-39% From 1051 stems/ha to 714 stem/ha (n=6 plots, 1 fire)	Not Enough Plots – 6 new plots in '07
	15-30% Reduction in overstory tree density	Overstory reduction = 1-(3)-5% From 286 stems/ha to 280 stems/ha (n=6 plots, 1 fire)	Not Enough Plots – 6 new plots in '07
	>200 tall (>1m) Oak seedlings /ac	Preburn density = 32 stems/ac (± 50) 01yr1 density = 49 stems/ac (± 50) (n=5 plots, 1 fire)	Not Enough Plots– 6 new plots in '07
	>30% Cover by native herbs	Preburn cover = 3% (± 1.4) 01yr1 cover = 7% (± 4) (n=5 plots, 1 fire)	Not Enough Plots – 6 new plots in '07
	<20 Invasive Exotic plants/ac	Preburn density = 0 stems/ac 01yr1 density 81 stems/ac (± 96) (n=5 plots, 1 fire)	Not Enough Plots– 6 new plots in '07

Congaree National Park (COSW)

Two previously unburned plots were included in prescribed burns at COSW in 2007, but neither of the plots burned effectively during the operation. This failure to burn was documented in the immediate postburn data. No additional work was done at COSW in 2007.

Congaree Swamp NP

Monitoring Unit	Management Objective (Restoration-After 4 burns)	Monitoring Results (80% confidence intervals)	Objective Achieved?
FPIPA – Longleaf/ Loblolly Pine Woodland 5 plots	>50% Reduction in total fuel loading	Total fuel reduction = data not clean Total fuel load @04yr2 = 16 t/ac (± 6) (n=3 plots, 4 fires, 04yr2)	Not Enough Plots
	>70% Reduction in pole-sized tree density	Pole reduction = data not clean Density @ 04yr2 = 30 stems/ha (± 31) (n=3 plots, 4 fire, 04yr2)	Not Enough Plots
	15-30% Reduction in overstory tree density	Overstory reduction = -12-(4)-20% From 185 stems/ha to 170 stems/ha (n=4 plots, 4 fires)	Not Enough Plots
	>100 tall (>1m) Longleaf or Loblolly pine seedlings /ac	Preburn density = data not clean 04yr2 density = 41 stems/ac (± 66)--all PITA (n=4 plots, 4 fires)	Not Enough Plots
	>50% Cover by native herbs	Preburn cover = 43% (± 20) 04yr2 cover = 92% (± 34) (n=4 plots, 4 fires)	Not Enough Plots
FPITA – Loblolly Pine Plantation 5 plots	>50% Reduction in total fuel loading	Total fuel reduction = 27-(28)-29% From 36 t/ac to 26 t/ac (n=3 plots, 2 fires, 02yr2)	Not Enough Plots
	>70% Reduction in pole-sized tree density	Pole reduction = 46-(58)-70% From 1480 stems/ha to 560 stem/ha (n=3 plots, 2 fire, 02yr02)	Not Enough Plots
	25-50% Reduction in overstory tree density	Overstory reduction = 0-(3)-6% From 377 stems/ha to 367 stems/ha (n=3 plots, 2 fire, 02yr02)	Not Enough Plots
	>40% Cover by native herbs	Preburn cover = 4% (± 3) 02yr2 cover = 5% (± 7) (n=3 plots, 2 fire, 02yr02)	Not Enough Plots

Great Smoky Mountains National Park (GRSM)

GRSM moved forward towards getting enough burns to evaluate by conducting a second-entry burn on Stony and Arbutus Ridges for a total of 8 monitoring plots burned. Additional work was done in 2006 and 2007 to continue building the Dry Oak forest dataset (5 new installs).

Great Smoky Mountains NP

Monitoring Unit	Management Objective (Restoration-After 4 burns)	Monitoring Results (80% confidence intervals)	Objective Achieved?
FPRI – Yellow Pine Woodland 25 plots	>50% Reduction in total fuel loading	Total fuel reduction = 36% ($\pm 8\%$) Preburn mean = 46 tons/ac 01 Post mean = 30 tons/ac (n=23, 1 burn)	Not enough burns to evaluate
	>70% Reduction in pole-sized tree density	Pole reduction = 50% ($\pm 8\%$) Preburn mean = 1637 stems/ha 01yr1 mean = 742 stems/ha (n=25, 1 burn)	Not enough burns to evaluate
	15-50% Reduction in overstory tree density	Overstory reduction = 17% ($\pm 6\%$) Preburn mean = 453 stems/ha 01yr1 mean = 371 stems/ha (n=25, 1 burn)	Not enough burns to evaluate
	>200 tall (>1m) Yellow Pine seedlings /ac	Preburn density = 0 stems/ac 01yr5 density = 243 stems/ac ($\pm 110\%$) (n=9, 1 burn)	Not enough plots
	>40% Cover by native herbs	Preburn cover = 4% ($\pm 1\%$) 01yr2 cover = 17% ($\pm 6\%$) (n=15, 1 burn)	Not enough burns to evaluate
FQUCO – Dry Oak Forest 9 plots	>50% Reduction in total fuel loading	Total fuel reduction = 23% ($\pm 7\%$) Preburn mean = 34 tons/ac 01 Post mean = 26 tons/ac (n=5, 1 burn)	Not enough plots – 5 new plots in '07
	>70% Reduction in pole-sized tree density	Pole reduction = 18% ($\pm 4\%$) Preburn mean = 1272 stems/ha 01yr2 mean = 1024 stems/ha (n=5, 1 burn)	Not enough plots- 5 new plots in '07
	15-30% Reduction in overstory tree density	Overstory reduction = 2% ($\pm 2\%$) Preburn mean = 394 stems/ha 01yr1 mean = 386 stems/ha (n=5, 1 burn)	Not enough plots- 5 new plots in '07
	>200 tall (>1m) Oak seedlings /ac	Preburn density = 49 stems/ac (± 75) 01yr2 density = 0 stems/ac (n=5, 1 burn)	Not enough plots- 5 new plots in '07
	>30% Cover by native herbs	Preburn cover = 6% ($\pm 5\%$) 01yr2 cover = 6% ($\pm 5\%$) (n=5, 1 burn)	Not enough plots -5 new plots in '07

Kings Mountain National Military Park (KIMO)

Two additional plots were installed and burned within the Chestnut Oak-Blackjack Oak Woodland monitoring unit. KIMO has burned nearly every acre of burnable ground at this point, so it is likely that we will not be able to install any additional plots there in the future. Hence, while the sample size for the Chestnut Oak Forest is adequate, we may never achieve a statistically adequate sample size in the Woodland community.

King's Mountain NMP

Monitoring Unit	Management Objective (Restoration- After 4 burns)	Monitoring Results (80% confidence intervals)	Objective Achieved?
FQUMA – Chestnut Oak-Blackjack Oak Woodland 6 plots	>50% Reduction in total fuel loading	Total fuel reduction = 43% ($\pm 9\%$) Preburn mean = 31 tons/ac 01 Post mean = 18 tons/ac (n=5, 1 burn)	Not enough plots-Installed 2 new plots in 07
	>70% Reduction in pole-sized tree density	Pole reduction = 27% ($\pm 18\%$) Preburn mean = 700 stems/ha 01yr2 mean = 473 stems/ha (n=6, 1 burn)	Not enough plots-Installed 2 new plots in 07
	15-30% Reduction in overstory tree density	Overstory reduction = 9% ($\pm 6\%$) Preburn mean = 248 stems/ha 01yr1 mean = 221 stems/ha (n=6, 1 burn)	Not enough plots-Installed 2 new plots in 07
	>30% Cover by native herbs	Preburn cover = 17% ($\pm 6\%$) 01yr2 cover = 20% ($\pm 11\%$) (n=5, 1 burn)	Not enough plots-Installed 2 new plots in 07
FQUMO – Dry Oak Forest 19 plots	>50% Reduction in total fuel loading	Total fuel reduction = 46% ($\pm 11\%$) Preburn mean = 37 tons/ac 02 Post mean = 18 tons/ac (n=14, 2 burns)	Not enough burns to evaluate
	>70% Reduction in pole-sized tree density	Pole reduction = 67% ($\pm 8\%$) Preburn mean = 1127 stems/ha 02yr2 mean = 393 stems/ha (n=12, 2 burns)	Not enough burns to evaluate
	15-30% Reduction in overstory tree density	Overstory reduction = 13% ($\pm 7\%$) Preburn mean = 325 stems/ha 02yr2 mean = 283 stems/ha (n=12, 2 burns)	Not enough burns to evaluate
	>200 tall (>1m) Oak seedlings /ac	Preburn density = 54 stems/ac (± 33) 02yr2 density = 9 stems/ac (± 13) (n=9, 2 burns)	Not enough burns to evaluate
	>15% Cover by native herbs	Preburn cover = 1% ($\pm 1\%$) 02yr2 cover = 4% ($\pm 2\%$) (n=9, 2 burns)	Not enough plots

Accomplishments/Areas of Focus

Fire ecologist accomplishments and area of focus

Category	Percent Time	Accomplishments/Focus Areas
General Planning	15%	Biological evaluation for COWP, general review of burn plans, development/revision of rx burn schedules, evaluation of future burn units, including site visits to most parks. WUI planning for GRSM
Monitoring Plans	<5%	Continued work on protocol reviews and Monitoring Unit Descriptions (FMH-4s) for all parks. Develop a conceptual monitoring plan for COWP.
Presentations	<5%	Presentation of prescribed fire objectives and restoration at the SA-FLN.
Fire Assignments and Fuels Projects	15%	FFT1(t), FEMO, ignition, and/or holding on 5 rx fires. 14 days in a number of roles on Buck Shank fire (GRSM). 14 days on 2 WFU fires in GRSM.
Research	5%	Assisted with planning and field work of SA dendrochronology research. Assisted with planning on FT plant research at COWP.
Monitoring Field Work	15%	Pre-monitoring reconnaissance. Continued to collect immediate postburn, preburn and year-postburn reads at all parks. Conducted CBI monitoring at GRSM.
Data Entry	<5%	
Data Management	10%	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 • OJT of CBI techniques
Miscellaneous	10%	Hosted Fire Learning Network (logistics, fieldtrip planning, coordinating several presentations). Other.

Fire Effect 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%	Chilly Springs WFU
Other plot work	5%	Nested subplots data collection in each FMH plot, assisting dendrochronology/fire history project
Fire Assignments	20%	Crew assisted with 8 prescribed burns, 2 fire- use and 3 suppression One member completed a 2 week helitack detail. Two members completed a 2 week detail in Big Cypress. One member completed a 2 week detail with the GRSM module in Everglades.
Fuels Project work	0	
Data entry	10%	All FMH plot data has been entered for 2007
Data conversion	0	
Data analysis	1%	Some analysis was completed on fuel loading for FEMO reports
Supervision/Admin	2%	Lead monitor hired one monitor and supervised three. Maintained misc travel, time and purchasing paperwork
Training	5%	One crew member attended the North American Dendroecological Fieldweek 1-3 hours of physical training a week was completed for each employee
Miscellaneous	5%	Entire crew worked together organizing and presenting for the Fire Learning Network (FLN)