

# ANNUAL REPORT 2013



*Mahogany Rock Prescribed Burn, Blue Ridge Parkway, North Carolina. April 22, 2013*

Southern Appalachian/Piedmont Fire Effects Monitoring  
National Park Service



## Introduction

The Southern Appalachian/Piedmont fire-effects team conducted short and long-term monitoring at six NPS units during 2013 (**Table 1**), and supported prescribed burning operations at five parks. The annual total for plots completed was 54, representing a 64% decrease in productivity from CY2012, and a substantial reduction from our running average. The decrease in production was directly related to budget reductions for the NPS Hazard Fuels Management (HFM) Program. These budget cuts resulted in fewer prescribed burns, fewer payperiods for our subject-to-furlough staff, and a reduction of our funding for summer travel. Travel restrictions at our home park and the shutdown of the Federal Government also contributed to our inability to complete scheduled monitoring at network parks.

**Table 1. Fire Effects Plot Workload (2013) and Total Plots Installed**

| Park                         | Monitoring Unit                       | Plot Type                            | Pre-burn<br>2013 | Immed.<br>Post<br>2013 | Postburn<br>(1-20 yrs)<br>2013 | Annual<br>Total<br>(2013) | Total<br>Plots |
|------------------------------|---------------------------------------|--------------------------------------|------------------|------------------------|--------------------------------|---------------------------|----------------|
| Big South Fork (BISO)        | Fuels Transects                       | Fuel Transect                        |                  |                        |                                | 0                         | 4              |
|                              | Little Bluestem                       | FMH Forest Plot                      |                  | 2                      | 2                              | 4                         | 4              |
|                              | Shortleaf Pine                        | FMH Forest Plot                      |                  |                        | 0                              | 0                         | 2              |
|                              | White Oak                             | FMH Forest Plot                      |                  |                        | 4                              | 4                         | 13             |
|                              | LFEM (Landscape Fire Effects Mapping) | Modified FIREMON Species Composition |                  |                        |                                | 0                         | 5              |
|                              | CBI                                   | CBI                                  |                  |                        |                                | 0                         | 9              |
| Blue Ridge Parkway (BLRI)    | Chestnut Oak                          | FMH Forest Plot                      |                  |                        |                                | 0                         | 2              |
|                              | Fuels Transects                       | Fuel Transect                        | 6                |                        |                                | 6                         | 6              |
|                              | Photo Points                          | Photo Point                          | 2                |                        |                                | 2                         | 2              |
| Cape Hatteras (CAHA)         | Photo Points                          | Photo Point                          |                  |                        |                                | 0                         | 29             |
| Congaree Swamp (CONG)        | Loblolly Pine                         | FMH Forest Plot                      |                  |                        | 3                              | 3                         | 5              |
|                              | Longleaf Pine                         | FMH Forest Plot                      |                  |                        | 5                              | 5                         | 5              |
| Cowpens (COWP)               | Southern Red Oak                      | FMH Forest Plot                      |                  |                        |                                | 0                         | 2              |
| Cumberland Gap (CUGA)        | Scarlet Oak                           | FMH Forest Plot                      |                  | 2                      | 6                              | 8                         | 16             |
| Great Smoky Mountains (GRSM) | Yellow Pine                           | FMH Forest Plot                      |                  |                        |                                | 0                         | 27             |
|                              | Scarlet Oak                           | FMH Forest Plot                      |                  |                        | 2                              | 2                         | 15             |
|                              | LFEM                                  | Modified FIREMON Species Composition |                  |                        | 6                              | 6                         | 21             |
|                              | CBI                                   | CBI                                  |                  |                        |                                | 0                         | 70             |
| Kings Mountain (KIMO)        | Blackjack Oak                         | FMH Forest Plot                      |                  |                        | 2                              | 2                         | 8              |
|                              | Chestnut Oak                          | FMH Forest Plot                      |                  |                        |                                | 0                         | 21             |
|                              | LFEM                                  | Modified FIREMON Species Composition |                  |                        | 12                             | 12                        | 12             |
| Moores Creek (MOCR)          | Photo Points                          | Photo Point                          |                  |                        |                                | 0                         | 1              |
| Total                        |                                       |                                      | 8                | 4                      | 42                             | 54                        | 253            |

Budget cuts to HFM resulted in a 50% reduction in number of prescribed burns and prescribed-burned acreage in 2013, compared to 2012 (see **Table 2**). *Despite these statistical decreases in productivity, the real storylines of the 2013 season were much more encouraging.* In short, the burning and monitoring that were completed during 2013 contain two major themes:

1. An important continuation of the fantastic progress made in 2012 toward improving the quality of burns, ignition planning, and the application of fire to our landscapes,
2. A strong ability to adapt prescribed burning and monitoring programs to overcome tremendous adversity associated with short and long-term budget uncertainties.

**Table 2. Summary of 2013 Prescribed Burns and Monitoring**

| Park                  | Burn Unit           | Plots?           | Other Monitoring*   | Acres |
|-----------------------|---------------------|------------------|---------------------|-------|
| Big South Fork        | Monroe Fields       | No               | Yes (FEMO)          | 83    |
|                       | Newtie King         | Yes (full plots) | Yes (FEMO, Qualit.) | 130   |
| Blue Ridge Parkway    | Mahogany Rock       | No               | Yes (FEMO, Qualit.) | 136   |
| Cumberland Gap        | Tiprell A & B       | Yes (full plots) | Yes (FEMO, Qualit.) | 305   |
| Great Smoky Mountains | Upper Old Field     | No               | Yes (FEMO)          | 35    |
|                       | Increase Fields     | No               | Yes (FEMO)          | 250   |
|                       | Jesse Ridge         | No               | Yes (FEMO, Qualit.) | 372   |
|                       | Bald Top            | No               | Yes (FEMO, Qualit.) | 264   |
| Kings Mountain        | Eastline            | Yes              | Yes (FEMO, Qualit.) | 450   |
|                       | Garner Creek (West) | Yes              | Yes (FEMO, Qualit.) | 135   |
| Totals                | 10                  | 5                | 10                  | 2160  |

\*Other Monitoring includes burn-day (FEMO) and/or qualitative post-burn evaluation

In general, the burns listed in **Table 2** were marked by good planning and execution, and the subsequent monitoring revealed that each of these projects succeeded in meeting their respective short term objectives. The success of the Jesse Ridge burn at Great Smoky Mountains NP nicely encapsulates the two major themes of 2013. This burn represented a convergence of efficiency and effectiveness that has been a goal for prescribed burning in the park for many years. Knowledge of expected fire behavior combined with excellent ignition planning and recognition of good natural boundaries allowed the park's fire crew to safely meet ecological objectives at minimal cost. Notably, this success was repeated during the fall season with the Bald Knob prescribed burn, which was partially funded by the Rocky Mountain Elk Foundation. The use of Landscape Fire Effects Mapping techniques for these burns will reduce monitoring costs while actually providing greater resolution of site-specific fire effects. More complete discussions of

all 2013 burns, along with monitoring results, can be found in each park's respective section of this report.

The fire effects team roster remained stable for 2013, and all team members contributed greatly to the prescribed burning and monitoring successes of a very challenging year (**Table 3**). Highlights include: participation in every prescribed burn within our cluster, serving as FIRB, FEMO, and Ignitors during Rx burns, providing collaborative support to Northeast Region fire effects, assisting on local and national wildfires and incidents, and supporting a variety of regional research efforts.

**Table 3. Fire Ecology Staffing 2013**

| Ecologist and Monitors       | Starting Date | Ending Date | # of Pay Periods | READ Qualified (Yes or No) | Training, Development, and Major Accomplishments                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|------------------------------|---------------|-------------|------------------|----------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Rob Klein -- Fire Ecologist  | 1/1/13        | 12/31/13    | 26               | Yes                        | Worked as ignition planner, igniter and/or FIRB(t) on prescribed burns at GRSM, KIMO, and BLRI. Presentation at Indiana Bat Workshop. Prepared Rx Fire Restoration article for USFS GTR. Led Fire Ecology field trips for Highlands Biological Station and GRSM Volunteers. Prepared detailed Briefing Paper on Management of Fire-Maintained Forests at GRSM for park managers. Co-author on paper describing the Benefits of Fire to Pollinators in GRSM. Significant work on writing proposals to continue funding for for Rx burns at GRSM. |
| Wylie Paxton -- Lead Monitor | 1/1/13        | 12/31/13    | 26               | Yes                        | Assisted with prescribed burns at BISO, CUGA, GRSM, and KIMO, 2 week READ detail on Gulf Oil Spill, Assisted with GRSM herpetology fire research, Participated in Carolina Vegetation Survey annual PULSE, READ assignment on wildfire in Sierra NF, Assisted with local wildfires at GRSM and on adjacent BIA land                                                                                                                                                                                                                             |
| Matt Wood -- Assistant Lead  | 1/1/13        | 12/31/13    | 26               | No                         | Assisted with prescribed burns at BLRI, CUGA, GRSM, and KIMO, S-230 and S-231, Worked as FIRB (t) on 3 prescribed burns, Assisted with GRSM herpetology fire research, Traveled to SHEN to assist their fire effects crew with CBI, Assisted with local wildfires at GRSM and on adjacent BIA land                                                                                                                                                                                                                                              |
| Bob Dellinger -- Crewmember  | 3/10/13*      | 8/24/12     | 12               | Yes                        | * Note Bob worked on an extended READ detail on the Gulf Oil Spill in Jan. and Feb., Assisted with prescribed burns at BLRI, CUGA, GRSM, and KIMO, FIRB on Jesse Ridge Rx. Participated in Carolina Vegetation Survey annual PULSE, Assisted with GRSM herpetology fire research, Traveled to SHEN to assist their fire effects crew with CBI, Assisted with local wildfires at GRSM                                                                                                                                                            |
| Huma Alvarado -- Crewmember  | 4/1/13        | 9/7/13      | 12               | Yes                        | Assisted with prescribed burns at BLRI, CUGA, GRSM, and KIMO, Assisted with GRSM herpetology fire research, Participated in Carolina Vegetation Survey annual PULSE                                                                                                                                                                                                                                                                                                                                                                             |

## Research Update

Though starts for new research projects were very limited in 2013, several projects were either completed or continued to make progress. Final products began to come in from Joint Fire Science projects concerning fire history and Indiana Bat ecology at GRSM, and also from the Presettlement Fire Regime and Vegetation project at BISO. These products, and other ongoing research are briefly summarized below. These projects all have great potential to enhance our understanding and management of fire in the Southeast Region, and we are eager to work with folks at all our parks to identify additional research questions. As always, please contact Rob Klein or Caroline Noble (SER Regional Fire Ecologist) with any and all research needs, ideas, or interested partners.

### **Joint Fire Science Program (JFSP)**

#### **Southern Appalachian Dendrochronology/Fire History Study**

The final products continue to roll in from this project, which started in 2006. The second refereed publication from Will Flatley's work came out in Ecological Applications during 2013. This paper featured fire chronologies from three sites in the southern Appalachians, including Licklog Branch, an old-growth site in Great Smoky Mountains NP that contained *three centuries* of fire history. The earliest recorded fire was 1729, well before the first European settlers arrived. Fire scarred pine trees indicate that, prior to the 20<sup>th</sup> century fire-protection era, fires burned through the Table Mountain pine and Chestnut oak stands at Licklog Branch on average every 6.5 years, with a range of 2-19 years.

We've received copies of the LaForest and Flatley dissertations, and will be able to mine important information from both of these studies for years to come. Aside from the regional implications of these studies, they include complete stand chronologies from four distinct sites within GRSM, a total of over 230 fire-scarred trees, and nearly 1000 individual fire scars. These data provide strong evidence for a historical regime of frequent fire across large portions of the western Great Smoky Mountains. These studies also document a decline in beta diversity within the park, as xeric pine and oak forests are lost due to fire exclusion. It probably goes without saying that both authors strongly recommend prioritization and prescribed burning of high quality pine and oak stands.

**Publication:** Flatley, W.T., C.W. Lafon, H.D. Grissino-Mayer, L.B. LaForest. 2013. Fire history, related to climate and land use in three southern Appalachian landscapes in the eastern United States. Ecological Applications, 23(6), pp. 1250–1266

#### **Fire and Ecology of Indiana Bats in the Southern Appalachians**

This study officially ended just this past year, and the major news to report was the 2013 Indiana Bats and Fire Workshop held at Fontana Village. The researchers coordinated a highly successful workshop to educate fire managers from across the eastern U.S. about their findings and to encourage dialogue between fire managers and the Fish and Wildlife Service.

Presentations focused on the aspects of Indiana bat ecology that relate to fire and fire management actions. Data from this research has been invaluable to prescribed fire planning at GRSM and throughout the southern Appalachians.

### **NPS Fuels-Reserve Research Fund**

#### **Pre-settlement Vegetation and Fire Regimes at Big South Fork NRRA**

This project was completed during 2013, and the final report tells an interesting story of a pre-European-settlement Park landscape with over 16,000 acres of diverse, wooded grasslands dominated by species like shortleaf pine, post oak, white oak, black oak, little bluestem, and black needle-grass. Dr. Frost calculates that these communities were maintained by very frequent fires, averaging every 3-8 years. He also provides extensive documentation of the land-use changes, including the exclusion of fire, that have resulted in “serious loss of species diversity, along with food and habitat for wildlife.” Analysis of the specific geographic findings and recommendations will be completed in the coming year.

### **Natural Resources Preservation Project (NRPP) and Tallassee Fund**

#### **Avian Communities of Fire-Impacted Areas within GRSM**

The second year of this three year study was a big success. Aside from building a stronger understanding of the relationship between fire severity and bird communities, researchers made the exciting discovery of a brown-headed nuthatch in the heavily fire-influenced southwest part of the park. This interesting bird, which is an associate of red-cockaded woodpeckers in southern pine forests, had not been previously known from the park. Preliminary findings will be presented at the 2014 Great Smoky Mountains Science Colloquium.

### **USGS**

#### **Responses of Herpetological Communities to Fire Management Practices in Pine-Oak Forests of GRSM**

Year two of this study was completed in 2013, and the researchers have applied for an additional year to collect field data. Fire effects staff again played an important role in the planning and field sampling for this interesting study, providing burn maps, remotely-sensed severity data, and field support. Preliminary findings will be presented at the 2014 Great Smoky Mountains Science Colloquium.

## Other

### **Evaluation of Burn Severity Maps (dNBR) for Prediction of Fuel Treatment Effectiveness and Plant Community Response in Great Smoky Mountains NP**

Scott Abla, MS candidate from Western Carolina University, completed field work on this project during 2013, and is in the process of completing his thesis. He has presented his preliminary results at a professional forestry conference, and his work has been of great interest to other ecologists working on fire monitoring issues in the Appalachian mountains. He has been invited to present the results of this study at the 2014 Southern Blue Ridge Fire Learning Network Workshop in May.

### **Grassland Restoration in Cades Cove**

**Publication:** Fire Promotes Pollinator Visitation: Implications for Ameliorating Declines of Pollination Services. Lead Author – Michael E. Van Nuland.

[www.plosone.org](http://www.plosone.org). November 2013, Vol 8, Issue 11.

This paper was published from a small study conducted in Cades Cove, Great Smoky Mountains N.P. Researchers found that burned fields in Cades Cove contained higher numbers of a native forb, *Verbesina alternifolia*, and that these burned sites had significantly higher visitation by pollinator insects. The researchers conclude that fire may thus serve as an important means to offset widespread declines in arthropod pollinators. These findings are of great interest, as they provide evidence that one of the primary goals of our prescribed burn programs, to increase herbaceous abundance and diversity, fulfills an important natural process that may be crucial for maintaining insect populations.

## ***Results***

The following sections are divided alphabetically by park and each contains:

- an update on fire effects monitoring and fire ecology activities
- review of 2013 prescribed burns
- analysis of long-term fire-effects monitoring data

*A new analysis of long-term monitoring results has only been completed when the past year's monitoring has added data that is directly relevant to the long-term analyses. A new column in the monitoring results table indicates when the latest analysis was completed. In some cases, the past year's data may not fit into the long-term analyses, but are summarized in the review of last's years prescribed burns. As always, park resource and fire managers are encouraged to address any additional fire-effects questions or needs to the Fire Ecologist or Lead Monitor.*

For parks that don't have an updated analysis of long-term data, more attention has been given to the review of the past year's projects or additional data analyses. The information gained from the project reviews is often more valuable for making management decisions in the near term, and these reviews are the most valuable part of this annual report for stimulating adaptive management discussions. The fire effects team has spent a lot of time and effort over the past several years developing and implementing a variety of monitoring methods that have greatly enhanced our ability to provide more immediate and scientifically accurate feedback to managers about their prescribed burn programs and the most recent burns. Any comments, data requests, or feedback are always welcome.

# Big South Fork National River and Recreation Area (BISO): 2013 Fire Effects Monitoring Annual Report

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## Activity Summary

The Fire-Effects team made three trips to Big South Fork during 2013. In addition to participating in the prescribed burns at Monroe Field and Newtie King, the crew conducted vegetation and fuels monitoring during a week in July. A review of the Monroe Field and Newtie King prescribed burns and short term fire effects are included in this report. The Ecologist made one trip to participate in a discussion with the Park's Management Team.

Due to budget cuts, the crew was unable to complete all scheduled long-term monitoring plot visits in 2013. When we are unable to complete all monitoring, the field work is prioritized with the goal of collecting as much data as possible that is most pertinent to burn program improvement. Our prioritization typically uses the following order of importance:

- postburn monitoring of the most recent prescribed burns
- monitoring of sites that are scheduled to burn during the following year (planning)
- plot data that addresses key long-term program objectives
- items of special interest to managers.

Accordingly, field work for 2013 focused on plot data collection at Newtie King and Gobblers Knob. Additional qualitative assessments were completed at the Gobblers Knob B-1 subunit, which was burned in spring 2012.

## Program Goals and Objectives

One of the successes of our fire-effects monitoring program has been its contribution to the development of short and long-term objectives for the prescribed fire program. Monitoring data have been continually used to evaluate and improve objectives, and this is indicative of major advances in understanding Appalachian fire ecology over the past 15 years.

In past years' reports, we've used this space to communicate existing goals and objectives and to improve the objectives as new data have become available. There are no significant changes in goals and objectives for BISO, so in the interest of not being repetitive, the reader is referred to previous year's reports. A summary of long-term objectives can be found in **Table 2**.

## Review of 2013 Projects

### Monroe Field – March 14, 2013

The Monroe field unit is 84 acres North of Bear Creek road and associated with the Bear Creek Horse Camp. The majority of the unit is comprised of *Little Blue stem-Broomsedge grassland* vegetation of medium quality. The next largest polygon of vegetation is considered *mixed oak/Heath forest* of Medium to Low quality. The remaining portion of this unit is comprised of non-target vegetation and is mostly successional in nature.

The treatment of the unit began early in the day and was marginal at first, with firing of the west half of the road first. As time progressed the fire held over in the *mixed oak/Heath forest* vegetation type and continued to burn well into the evening, extinguishing itself in the cooler temperatures. Fuel consumption in the grass areas was well over 90%; in hardwood litter consumption was 50-70% over the entire unit and 90% in the target areas, as observed immediately post-burn.

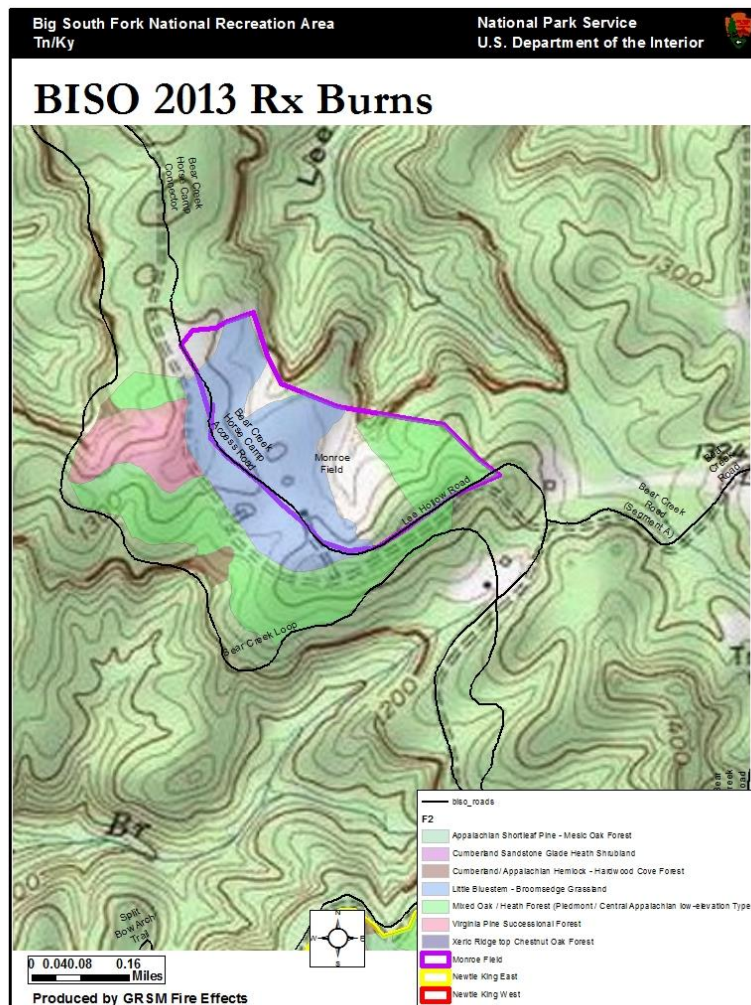


Figure 1: Monroe Field Unit Vegetation map

### Newtie King – March 14, 2013

Newtie King is a 137 acre burn unit in the Kentucky portion of BISO. The unit is divided into an East and West component with 10 of those acres occurring on the West side of the Bear Creek Road. The site contains a unique example of a grassy sandstone glade and wet meadow complex (blue area on map) 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 park's strategy has been to use manual thinning and frequent 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 graminoid and herbaceous species.



Figure 2. *Spiranthes* sp. observed in the Newtie King Unit

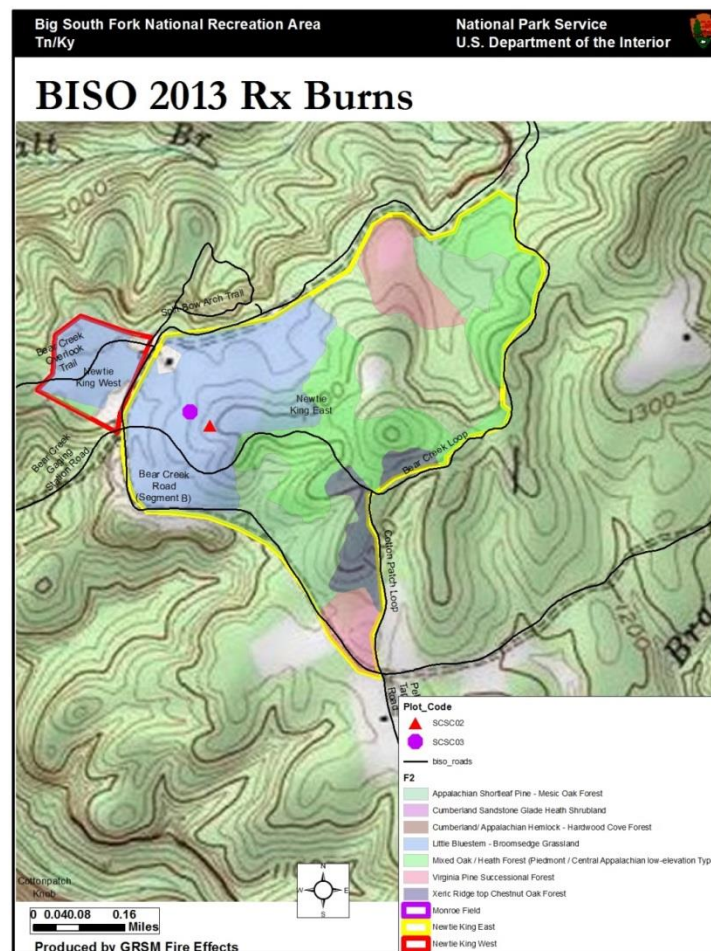


Figure 3. Map of Newtie King Unit

The ecological objectives were similar to other Field-type burns: reduce fine fuels (grass and leaf litter), reduce woody growth in glade areas, and maintain overstory in non-glade, forested areas. Increasing and/or maintaining the openness of the glade areas is a key restoration goal and, in general, this has been achieved through prior management actions.

Firing of this unit was well planned, and allowed for various techniques to achieve multiple objectives in the grassland/forest communities. Ignition began on top of the main knob in the unit and fanned out along the tops of ridges; blacklining along the boundary was used where appropriate. The temperature and relative humidity ranges remained within prescription, and fire behavior was mostly low-intensity backing fire. Occasional, short-duration head fires were used within the glade complex where taller woody stems were present. Burn-day monitoring and photos taken following the burn indicate that the burn objective of 90% consumption of fine fuels was achieved in both plots.

#### **Newtie East:**

A photo taken prior to the first burn of Newtie King (**00Pre -Figure 4**) indicates heavy encroachment and shading of groundcover. A photo taken from the same place last summer (**04yr01 – Figure 5**) shows a dramatic increase in amount of sunlight allowed to reach the herb layer. Woody resprouts are still present in these glades and can be clearly seen the 04yr01 image. Continued frequent burning and possibly growing-season burning of this site is highly recommended to further restoration efforts and maintain glade/grassland habitat.



Figure 4. SCSC 02 00Pre



Figure 5. SCSC 02 04yr01

### Newtie West:

The 10 acres to the west of the primary Newtie King unit is labeled by the park's vegetation map as "Little Bluestem-Broomsedge Grassland." Field observations reveal this to be marginally true, but this site is not of the same quality as the Newtie King glade in terms of the types of species that are present. The site contains broomsedge (*Andropogon virginicus*), although it is mostly comprised of weedier species such as blackberry (*Rubus species*), goldenrod (*Solidago species*), invasive exotic sericea lespedeza (*Lespedeza cuneata*), winged sumac (*Rhus copalina*) and a few scattered young shortleaf pines (*Pinus echinata*).

Objectives are the same for this side of the unit as the East and it is typically burned at the end of the day resulting in greater intensities. No fire effects plots exist in this sub-unit, but qualitative monitoring was done during the growing season following the burn.

Consumption of fine fuels was about 90% over the entire unit with good top-kill of stems < 2 meters tall. Very few of the larger trees were killed, but shortleaf pine sustained a heavy scorch and "limbing" effect of the lower branches. **Figure 6** depicts the Newtie West unit, and the savanna-like structure of the shortleaf pine as viewed from the South Hand-line during 04yr01 monitoring.



**Figure 6. Survival of Shortleaf Pine at Newtie West. These trees were heavily scorched following the burn, but nearly all have fully recovered.**

### Data Summary:

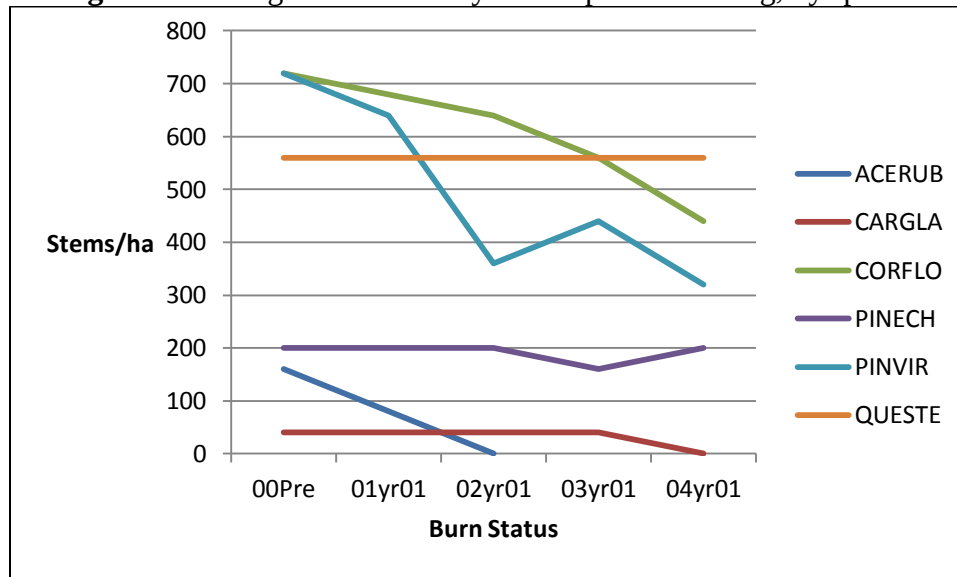
**Table 1** illustrates incremental success at reducing woody stems, as well as the long term investment that is needed in units such as Newtie King. Although the table shows a gradual reduction in pole-sized trees over time, after 4 prescribed burns we have not met the long term objective of reducing pole-sized trees by >70%.

**Table 1:** Change over time in trees per hectare

| Status<br>N=2 | Number of<br>trees > 2.5<br>cm DBH | % change in number of<br>stems |
|---------------|------------------------------------|--------------------------------|
| 00Pre         | 2400                               |                                |
| 01yr01        | 2200                               | -8%                            |
| 02yr01        | 1800                               | -25%                           |
| 03yr01        | 1760                               | -28%                           |
| 04yr01        | 1520                               | -37%                           |

**Figure 7** provides further insight into tree reductions in the Newtie King site. Species that are considered invasive in glade-savanna habitats have decreased with repeated burning. These species include red maple (ACERUB), hickory (CARGGLA), and Virginia pine (PINVIR). The density of species that are associated with glade-savanna habitats has actually remained constant following repeated burns. These species are shortleaf pine (PINECH) and post oak (QUESTE).

**Figure 7:** Change in tree density with repeated burning, by species



Although we have reduced many of the trees invading the Newtie King glades, more frequent burning and/or growing season burns may be needed to completely kill resprouts from these trees. Additional cutting may be required to remove larger diameter Virginia pine and even to thin out shortleaf pine. Overall, the 2013 prescribed fire treatments should be considered a successful step for the National Park Service in the process of restoring fire-maintained natural communities.

## Long Term Monitoring Results

There are no new data to add to the long-term monitoring results. Updates are available for the Little-Bluestem-Sandstone-Glade plots at Newtie King, and these are summarized in the previous section. The long-term monitoring results from last year's report (**Table 2**) are provided for reference.

**Table 2.** Objectives and long-term monitoring results for BISO

| Vegetation Type                                                           | Management Objective<br>Restoration Phase-<br>(After 4 burns)        | Monitoring Results<br>(80% confidence intervals)                                                                               | Objective Achieved?                               | Year Last Analysis Completed |
|---------------------------------------------------------------------------|----------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------|------------------------------|
| Dry Oak Forest<br>(FQUAL1)<br><br><b>14 plots</b>                         | >50% Reduction in total fuel loading                                 | Total fuel reduction<br>After one burn = 52% ( $\pm 2\%$ )<br>( <i>n</i> = <u>10</u> plots)                                    | <b>Yes, but will require more time to assess.</b> | <b>2012</b>                  |
|                                                                           | >70% Reduction in pole-sized tree density ( $\leq 15\text{cm dbh}$ ) | Pole reduction<br>After one burn = 58% ( $\pm 7\%$ )<br>( <i>n</i> = <u>10</u> plots)                                          | <b>Not yet, but on course.</b>                    | <b>2012</b>                  |
|                                                                           | 20-40% Reduction in overstory tree density ( $> 15\text{cm dbh}$ )   | Overstory reduction<br>After one burn = 4% ( $\pm 2\%$ )<br>( <i>n</i> = <u>11</u> plots)                                      | <b>Not yet, but this is a long-term objective</b> | <b>2012</b>                  |
|                                                                           | >200 tall ( $> 1\text{m}$ ) Oak seedlings /ac                        | Preburn mean: 96/acre ( $\pm 43$ )<br>Post-burn mean: 103/acre ( $\pm 35$ )<br>( <i>n</i> = <u>11</u> plots)                   | <b>Not after a single burn.</b>                   | <b>2012</b>                  |
|                                                                           | >30% Cover by native herbs                                           | After 1 burn: 14% ( $\pm 5$ )<br>( <i>n</i> = <u>11</u> plots)                                                                 | <b>Not after a single burn.</b>                   | <b>2012</b>                  |
| Little Bluestem Sandstone Glade/Savanna<br>(FSCSC1)<br><br><b>3 plots</b> | >70% Reduction in pole-sized tree density                            | Pole reduction:<br>After one burn = 16% ( $\pm 11\%$ )<br>After two burns = 30% ( $\pm 14\%$ )<br>( <i>n</i> = <u>3</u> plots) | <b>Not yet, but on course.</b>                    | <b>2011</b>                  |
|                                                                           | >100% Cover by native herbs                                          | Preburn cover: 98% ( $\pm 26$ )<br>After 1 burn: 123% ( $\pm 28$ )<br>After 2 burns: 133% (30)<br>( <i>n</i> = <u>3</u> plots) | <b>Yes, but not with 80% confidence</b>           | <b>2011</b>                  |

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

## Discussion

The long term outlook for NPS Hazard Fuel Reduction (HFR) Program is currently difficult to predict. HFR is, of course, the principal funding source for the prescribed burns and prescribed burn monitoring that has been ongoing at BISO since 2005, and HFR has received substantial cuts over the past few years. We do not know the status of FY14 prescribed burns at BISO, and if the most current budget projections hold true, the fire effects crew will have very limited funds to conduct monitoring activities. BISO has completed a significant amount of restoration burning since 2005, and Park managers and Fire practitioners have used monitoring to learn a

tremendous amount about how to operationally apply fire in ecologically appropriate ways. The recent work completed by Dr. Cecil Frost underscores the significance of the progress that has been made and the importance of continuing that work.

Given the uncertainty of funding and the importance of continuing the restoration that has been started, our recommendations are to do three things with respect to the BISO prescribed fire and monitoring program:

1. Re-evaluate restoration priorities and plan a best case/worst case schedule for future prescribed burning – the most obvious choice is to prioritize units that have already received one or more burns
2. Consolidate what we have learned about applying prescribed fire to the BISO landscape to maximize the effectiveness of any future burns
3. Continue to engage regional NPS partners and Fire staff to ensure adequate prioritization of BISO burns and effective planning.

The Fire Effects staff has abundant data and knowledge that could assist in these exercises, and would be glad to participate in any related effort. In the coming year, we will continue to prioritize monitoring, conduct monitoring, and summarize findings to our partners. We will also strive to remain engaged in prescribed burn planning and operations, in order to maximize the value of monitoring information and data.

# Blue Ridge Parkway (BLRI): 2013 Fire Effects Monitoring Annual Report

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## Activity Summary

The Parkway successfully completed its first landscape-scale prescribed burn in 2013. BLRI has done very small-scale burns in the past and continues to cooperate with USFS-NC to complete large prescribed burns, but Mahogany Rock was the first large burn completed solely on NPS lands by NPS staff. In addition to Mahogany Rock, Park managers and SER Fire Staff also made significant progress on planning future burns in the Doughton Park area.

The Fire Effects team made two trips to BLRI during 2013. The first trip was made in April to assist the Cumberland Gap and Great Smoky Mountains Wildland Fire Modules with the Mahogany Rock prescribed burn. The second trip was made in August to conduct qualitative post-burn monitoring at Mahogany Rock, and to establish photopoints/fuel transects in the Doughton Park D2-D3 unit. A description of these activities is provided later in this annual report.

## Program Goals and Objectives

The following goals and objectives constitute the general aims for the BLRI prescribed fire program. They provide broad guidelines for achieving restoration over multiple burns, and single-burn objectives that are complementary to achieving the long-term goals. As the prescribed burning program begins at BLRI, it is a great time to review the goals and restoration strategy, as well as the short-term and long-term objectives that will help to achieve those goals.

It is crucial for Park managers and SER Fire Staff to understand that these goals, strategies, and objectives, while not perfect, have been developed over many years with the benefit of abundant experience and monitoring data from similar forest types in several different NPS units. It is important to note that there remain some inconsistencies between the objectives listed below and those found in the *Doughton Park Prescribed Burn Plan*, particularly with respect to desired mortality of overstory trees following first-entry burns. Specific burn objectives should be reviewed and approved by park Resource Managers before each burn.

It is also important to realize that these objectives (especially the single-burn objectives) may need to be adapted or otherwise changed to meet the needs of a particular burn. This process involves using whatever site-specific data we have at our disposal in conjunction with on-the-ground reconnaissance and discussion of site conditions. Whatever the means, developing and communicating good site-specific objectives will be critical to our success, especially as sites that have been burned one or more times may have experienced vastly different fire effects.

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

1. Effectively manage and reduce large fuel loads resulting from years of fire exclusion, especially in the wildland-urban interface
2. Restore and maintain structure, sustainability, and native species diversity to pine and oak forests.

**Strategy** - Use a series (3-5) of low to low-moderate severity prescribed burns to **gradually** reduce woody stem densities in all strata and reduce total fuel loading (see long term objectives); producing the variety of conditions that are favorable for regeneration of yellow pines, dry-site oaks, native herbaceous species and low-growing shrubs.

**Minimize initial mortality** of mature yellow pines and oaks and prevent exotic plant invasions during first and second-entry burns by utilizing low-intensity/low-severity fires. Subsequent burns may increasingly use variable intensity and seasonality to achieve desired structure, fuel reduction, and composition. Fire-effects monitoring will be the basis for an adaptive-management approach to restoration. Monitoring can include simple visual assessments, burn severity maps, or various types of plots.

*It is important for Park Managers and SER Fire Staff to know that these goals, strategies, and objectives... have been developed over many years with the benefit of abundant experience and monitoring data in similar forest types...*

**Single - 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, we want to:

- Consume >75% of surface litter (fine fuels) over >50% of the area occupied by target vegetation. Target vegetation is oak and pine forests found on upper slopes and ridges.
- Top-kill >30% of saplings (<10cm dbh)
- Limit individual canopy gaps (due to fire) to less than 1/2 acre in size
- Limit the mortality of mature oak and yellow pine to <10%
- Use a range of **low-intensity** ignition (<4' flame length). In general, fire intensities should not exceed the following spatial proportions:
  - <5% should burn in high intensity (FL >8')
  - 5-20% should burn in moderate intensity (FL 3-8')
  - 75-90% should burn in low intensity (FL 1-3')
- Preferred timing is the dormant season (mid-March through late April). This is especially important during first and second-entry burns. If burning occurs after

green-up, it is desirable to have less intensity (lower flame lengths, slower moving fires), and not to burn during a pronounced drought.

**Long term objectives** – Also called “Restoration-Phase” objectives. These objectives vary by vegetation type and are typically expected to be achieved only after 3-5 prescribed burns. It is estimated that such a restoration cycle will take approximately 20 years. At the completion of this restoration phase *in the montane oak-pine forest vegetation type*, we would like to see:

- At least a 50% reduction in total fuel loading
- Greater than 70% reduction in pole-sized tree or tall shrub density
- A 20-40% reduction in overstory tree density, achieved with newly-formed gaps of less than 1/2 acre in size
- Greater than 200 tall (>1meter) oak or combined oak and yellow pine seedlings per acre
- Greater than 30% cover by native herbaceous species.

## **Review of 2013 Projects**

### **Mahogany Rock Rx – April 22, 2013**

The Mahogany Rock prescribed burn unit is located in North Carolina between milepost 235 and 234 along the south side of the Blue Ridge Parkway, just northeast of the Doughton Park Lodge and recreational area and roughly 12 miles from the Virginia-North Carolina state line. The approximately 140 acre unit was successfully burned for the first time on 4/22/2013. The unit encompasses a broad knob with moderate to steep slopes down to the parkway to the north and major spur ridges to the east, west, and south. An old paved road starts at the eastern corner of the unit, runs along the unit boundary to southern most point, then turns to the northwest into the interior of the unit and ascends to the top of the knob. The knob and the area immediately surrounding it was a former housing subdivision with a tramway system that ran from the high point on the knob down to the southwest. All structures were removed, presumably upon acquisition by the NPS, leaving the old road system and allowing the area to grow back into successional forest. The high point of the knob has become a large boneyard/dump for the Parkway maintenance and contains various piles of wood chips, fill dirt, gravel, construction debris, etc. surrounded by sparse vegetation.

The forest outside the area of old development is largely dominated by intact mature oak forest. The northern and northwestern aspects are obviously more mesic and the dominant trees tend to be Northern red oak (*Quercus rubra*), white oak (*Quercus alba*), and chestnut oak (*Quercus montana*) with a midstory and understory comprised of red maple (*Acer rubrum*), black birch (*Betula lenta*), white ash (*Fraxinus americana*), Eastern white pine (*Pinus strobus*), light to moderate rosebay rhododendron

(*Rhododendron maximum*) and scattered mountain laurel (*Kalmia latifolia*). The northwest aspect of the unit contains some of the largest mature oak in the entire unit. The southern aspects are dominated by dry oak forest with chestnut oak, scarlet oak (*Quercus coccinea*), and occasional pitch pine (*Pinus rigida*) with red maple, black gum (*Nyssa sylvatica*), and areas of light to moderate mountain laurel in the midstory and understory. The west spur and much of the southern aspects are rocky, and the forest across the various minor southern spur ridges tends to be more stunted due to the xeric conditions. Unfortunately, Japanese stilt-grass (*Microstegium vimineum*) is a wide spread non-native invasive occurring across much of the northern slope and in the drainages along the south side, with the seed source obviously radiating out from the gravel and dirt piles in the boneyard area. Additionally, there is a distinct deer browse-line throughout the unit, which is especially noticeable along the richer, denser northern aspects. **Figure 1** shows a simplified vegetation classification map for the Mahogany Rock burn unit that generally agrees with the on-site conditions described above except for the area represented as Table mountain pine (*Pinus pungens*), which was actually successional white pine forest.

**Figure 1. Mahogany Rock prescribed burn unit vegetation classification map.**

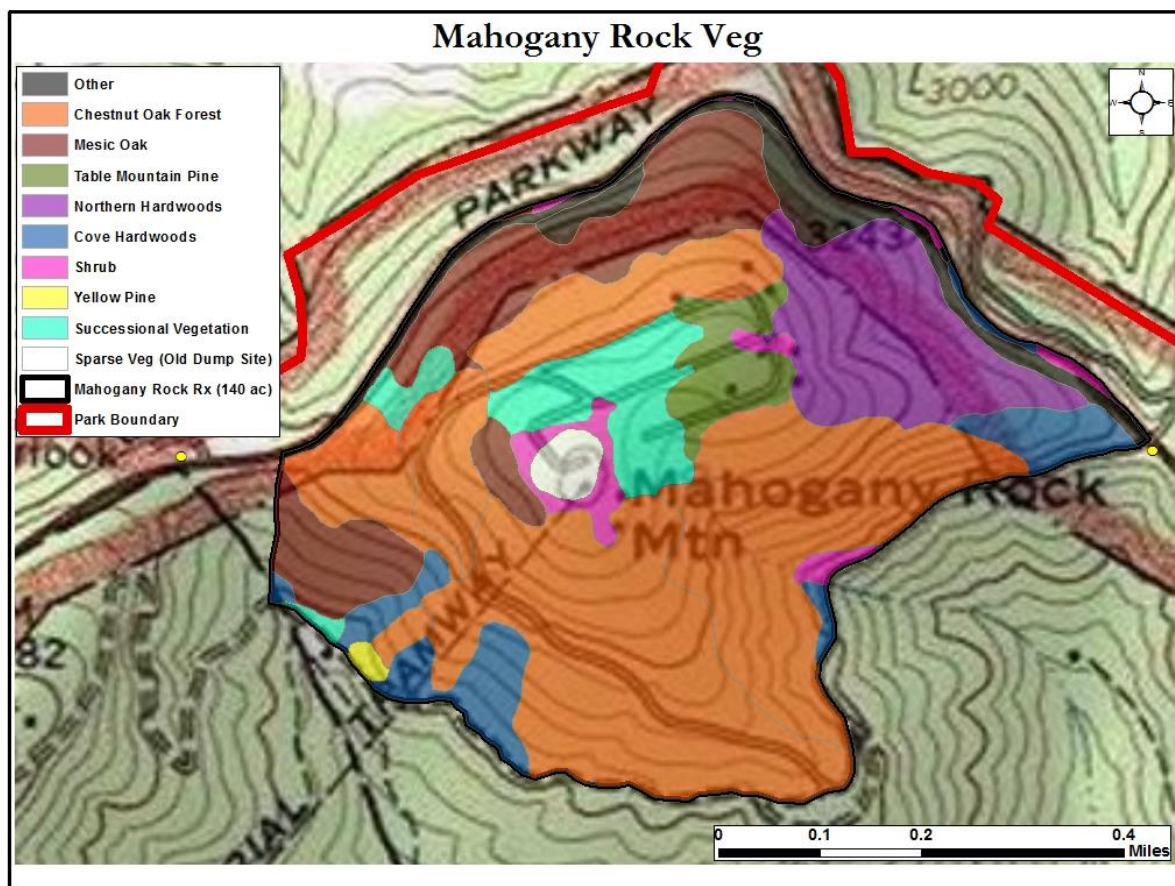


Table mountain pine (TMP), a known southern Appalachian fire-dependent yellow pine with serotinous cones, is a tree species of note for this unit. It has likely been maintained on the larger surrounding landscape through a combination of geology, soils, and various disturbance factors including fire along with grazing and landslides. However, the distribution of TMP at this site is predominantly due to human disturbance (land clearing, road construction, earth moving, etc.) as opposed to a particular previous fire event. Hence, it is most visible along the paved road on the south side of the unit. The most significant area of occurrence is along the minor southwest spur ridge that the old tramway line once crossed. This area is a small but significant stand of stunted TMP mixed with mountain laurel, which, although it was potentially created/maintained by clearing of the tramway corridor, could benefit from and be maintained by fire.

The intent of this discussion is to provide background for evaluating the resource objectives listed in the incident action plan for the Mahogany Rock prescribed burn unit, which were heavily focused on and biased toward TMP restoration and management. As seen in the preceding narrative, the forests that occupy this site are actually dominated by oak species, with TMP playing a notable but comparatively small role. It seems misguided to focus the resource objectives and subsequent ignition strategy solely on TMP, especially when it could result in detrimental fire effects for the oak forest. The previous section of this annual report, **Program Goals and Objectives** for BLRI, outlines **single-burn objectives** appropriate for this unit along with the theory behind their development. An evaluation of this burn based on these objectives follows.

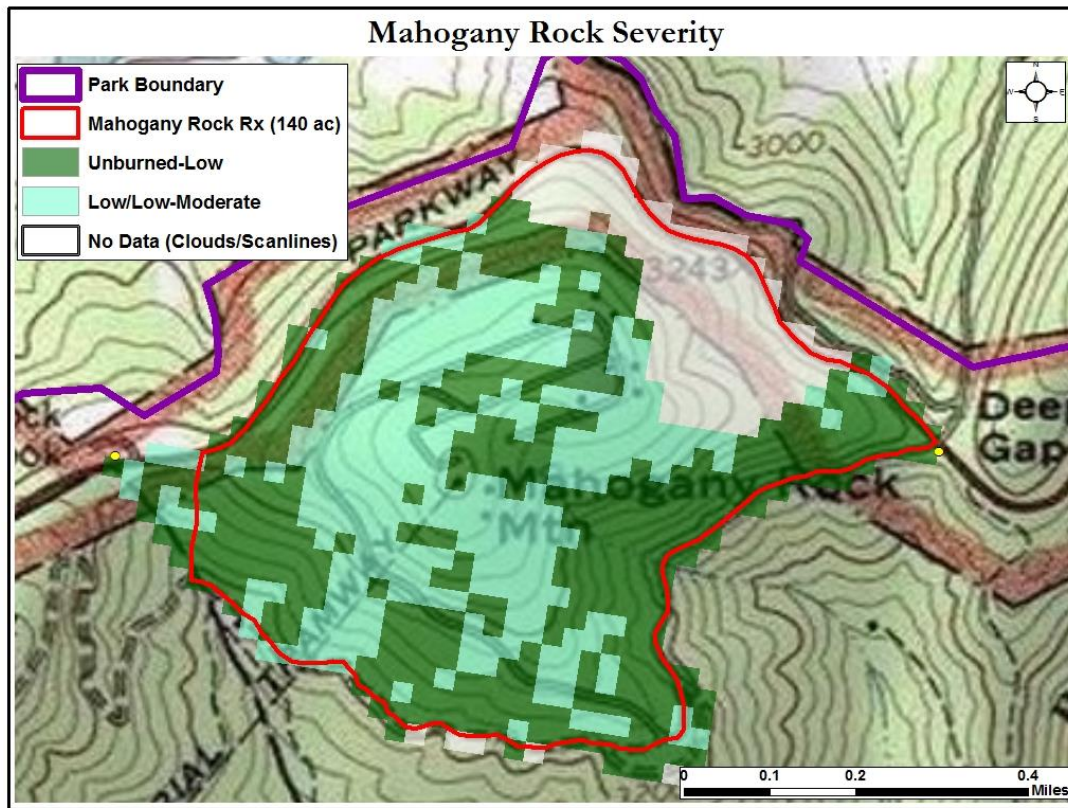
Concerns with objectives aside, this was a successful burn especially given the budgetary and time constraints placed on the leadership. The Cumberland Gap Wildland Fire Module had established a good foundation of prep and reconnaissance for this unit prior to the burn. This coupled with the experience and knowledge of many of the igniters helped to facilitate successful **low severity** effects for this burn despite the fact that most of the resources arrived the day of the burn and had little or no time for familiarization. **Figure 2** shows the extended (first growing season post burn) severity image for Mahogany Rock.

Post burn reconnaissance during the 2013 growing season generally confirmed the severity image, with the overall impact being low severity. The following covers the success of the burn as measured by the single-burn objectives provided in this annual report:

**Objective 1: Consume >75% of surface litter (fine fuels) over >75% of the area occupied by target vegetation. Target vegetation is oak and pine forests found on upper slopes and ridges.**

This objective was easily achieved as the leaf litter was almost completely consumed across most of the targeted oak forest.

**Figure 2. Extended Post Burn Severity for Mahogany Rock Prescribed Burn**



**Objective 2: Top-kill >30% of saplings (<10cm dbh)**

Deer browse has significantly reduced the small end of this size class, however this objective was probably close to being met for the driest southern spur ridges and exceeded in a few isolated spots. The oak forest on the northwest slope and west spur of the unit was probably <30%, with only limbing and partial scorch of white pine, rosebay rhododendron, and mountain laurel, but again deer browse has reduced all but the largest saplings in this size class thus somewhat masking the effects of fire.

**Objective 3: Limit individual canopy gaps (due to fire) to less than 1/2 acre in size**

This was met for the majority of the unit. There were a few small areas of greater severity on the southwest side of the unit, but even these areas will likely remain under ½ acre.

**Objective 4: Use a range of low-intensity ignition (<4' flame length). In general, fire intensities should not exceed the following spatial proportions:**

- <5% should burn in high intensity (FL >8')
- 5-20% should burn in moderate intensity (FL 3-8')
- 75-90% should burn in low intensity (FL 1-3')

Again some higher intensity fire occurred on the southwest portion of the unit but it still fell within these general parameters.

**Objective 5:** Preferred timing is the dormant season (mid-March through late April). This is especially important during first and second-entry burns. If burning occurs after green-up, it is desirable to have less intensity (lower flame lengths, slower moving fires), and not to burn during a pronounced drought.

Burned on 4/22/13 under late dormant season conditions.

**Key Points:**

- Japanese stilt-grass will continue to be a problem for this site, resulting in degradation of forest quality in the drainages and on the northern aspects.
- Deer browse, which is obviously an issue along many parts of the parkway, masks some of the potential fire effects on the vegetation by: reducing the visible impacts of fire, suppressing oak seedling recruitment, and reducing the general species density and diversity.
- Table Mountain Pine is a noteworthy fire-adapted species occurring in this unit, but the forest is primarily dominated by oak; hence, the resource objectives for this unit should be adjusted to match the actual ecology of the site.
- The overall effects of the burn were light with a few areas of slightly increased severity. This is ideal for a first-entry burn because it retains the oak overstory as a seed source while gradually thinning the midstory and understory. Past experience in similar forest communities throughout the southeast has shown that introducing moderate to high intensity fire during the 1<sup>st</sup> or 2<sup>nd</sup> burn only results in loss of mature trees while simultaneously aggravating the encroachment of fire intolerant tree species.

## Doughton Park Pre-Burn Monitoring



### *Summary of Work*

2013 was an exciting year for Blue Ridge Parkway and Fire Effects. One of the new units carved out for Rx fire is on one of the most largest sections of the Blue Ridge parkway. Doughton Park is an important piece of the BLRI and Southeast Region Fire Program, and it represents cooperation between NPS, North Carolina Wildlife Commission, and North Carolina State Parks.

Doughton Park is a 6000 acre landscape situated along the top of the Blue Ridge escarpment and along the Blue Ridge Parkway from Milepost 246 to 238. The bulk of the park lies on the slope of the escarpment from an elevation of 3800 feet to 1425 feet. Several drainages, cove forests, dry ridges, and xeric slopes add to the diversity of the area. Doughton Park has a long history of human settlement and use, and this is evident at upper elevations through observation of the forest structure.

In anticipation of an upcoming landscape burn, the Fire Effects Team made a pilgrimage to scout the ecological value and install fuel transects throughout the 2,372 acre sub-unit. The area targeted for the first treatment is comprised of subunits D2-D3 and is located between Basin Creek to the East and Cove Creek to the West.

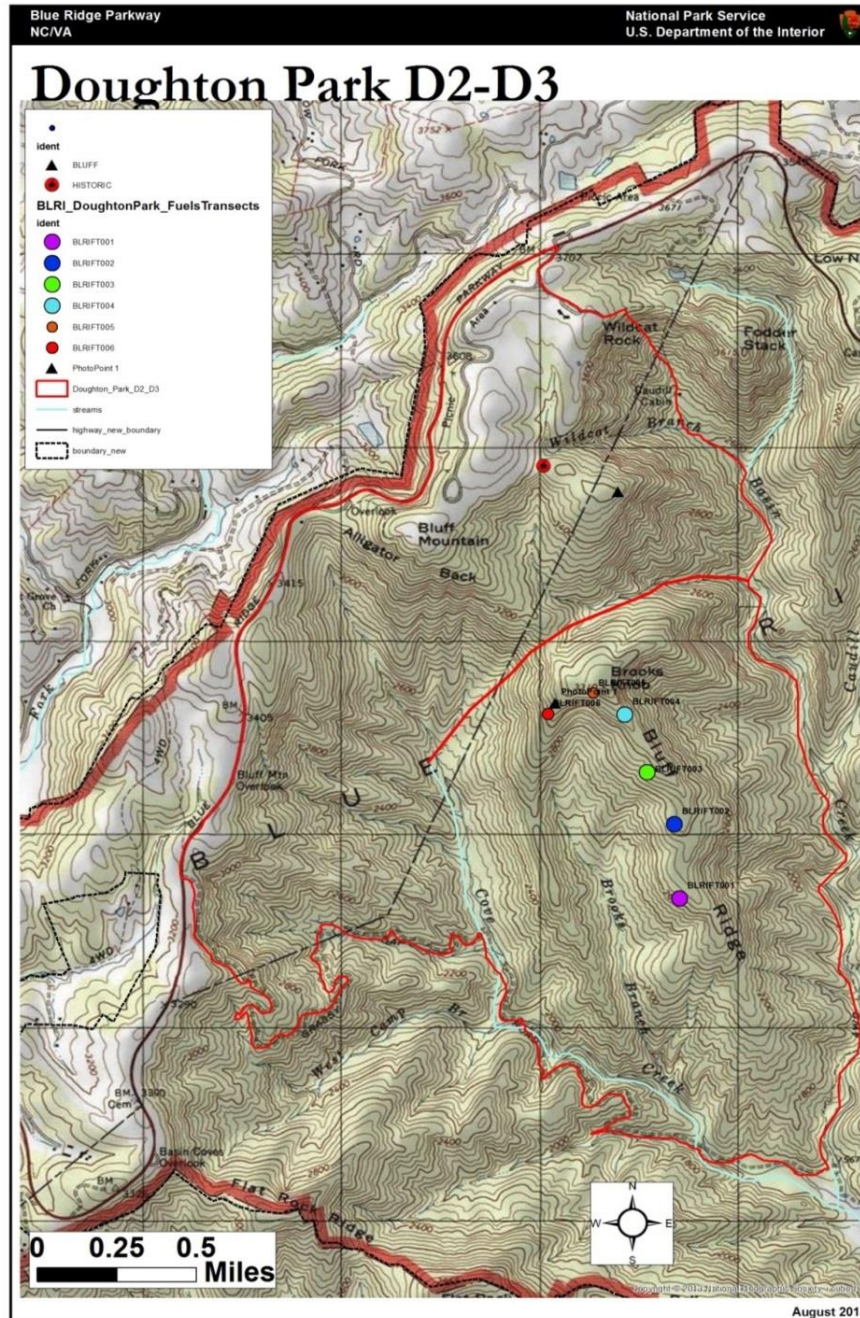
The benefits of scouting the area can be seen as two-fold for the Fire program. First, the field scouting gave the crew insight into where the “target” vegetation was located and, allowed us to install 6 fuel transects /Photopoints. These 6 fuels transect capture 1-50 foot Browns transect, 2 photos and a qualitative site description.

Secondly, our field work allows us to provide feedback to the Park staff, the Regional office, and the Wildland Fire Module as to the challenges associated with existing plans, condition of fire adapted vegetation, and possible changes to the sub-unit that may make the treatment a success operationally.

**Figure 3** shows the burn unit and plot locations. Other map items to note are as follows:

- The original unit, outlined in red, contains large amounts of park infrastructure and historical remnants – which will add a good deal of complexity to the burn. These areas are concentrated in the uppermost (northern) portion of the unit, while the vast majority of the hazard fuels and high-quality fire-maintained vegetation exist in the lower portions of the unit

**Figure 3: Doughton Park D2-D3 units and associated fuel transects/P.O.I.**



- The interior red line that runs from Cove Creek East to Basin Creek offers a possible simplification of the unit that would contain a high percentage of the fire-maintained vegetation while providing less holding concerns during the burn event. This idea would need further scouting to ensure feasibility and safety
- Photo Point 1 (Figure 4) represents a unique vegetation community with rich glade-like vegetation. The glade/woodland stretches from the triangle on the map Southwest for 200 yards and varies in richness within this span.

**Figure 3. *Amorpha fruticosa* and Hickory glade overview**



- The other Bluff feature is a second xeric glade with almost no canopy associated with it, and provides yet another example of diversity upon the Escarpment landscape
- Historic feature should be noted for protection considerations. There are numerous examples of them and not all are placed on map
- Various wooden fences along the Bluff mountain trail may present difficulties for holding resources

## Long Term Monitoring Results

No long-term data are available. Short-term results of the Mahogany Rock burn are discussed above in the *Review of 2013 Projects*.

## Discussion

2013 was a good year for the BLRI prescribed fire program. The Mahogany Rock prescribed burn was a great first-entry burn into a landscape dominated by montane xeric oak and montane oak-hickory forests, and including a small stand of Table-Mountain pine. Remote sensing and on-the-ground qualitative assessments were used to monitor the effects of the burn, and results suggest that the Mahogany Rock burn was successful at achieving the first-entry burn objectives (see **Single Burn Objectives**, above). Lessons learned about ignition operations, fire behavior, and vegetative response should be used to guide future burning at the Doughton Park area.

The Parkway also continued its cooperative burning with the USFS on the Lost Bear East and Lost Bear West prescribed burns. These burns incorporated approximately 180 acres of Parkway land, which greatly facilitated the safe and efficient completion of these efforts. Parkway staff participated in both burns by supplying an engine and engine crew, and the Fire Effects team will continue to cooperate with USFS partners to monitor the effects of these burns.

What does the future hold? The long term outlook for NPS Hazard Fuel Reduction (HFR) Program is currently difficult to predict. HFR is, of course, the principal funding source for the prescribed burns and prescribed burn monitoring that has been ongoing in the SER since 2002, and this program has received substantial cuts over the past few years. We do not know the status of FY14 prescribed burns at BLRI, and if the most current budget projections hold true, the fire effects crew will have very limited funds to conduct monitoring activities at the Parkway. This means, at most, a single four-day week during the summer. That being the case, monitoring needs will need to be carefully prioritized to provide the most important information to managers. These priorities will be determined primarily by two things: 1) Which, if any, prescribed burns are completed during the spring 2014 season, and 2) Which, if any, prescribed burns are planned for FY15? Concerns or requests for specific monitoring information should be addressed to Rob Klein.

# Cape Hatteras National Seashore (CAHA): 2013 Fire Effects Monitoring Annual Report

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## Activity Summary

There were no prescribed burns and the Fire Effects Team did not conduct any monitoring at Cape Hatteras during 2013. The Resource Management staff at the Seashore completed year-2 post-burn photo monitoring at the Bodie Island 1.4 and 1.5 units that were burned in 2012. Other work that was completed for CAHA centered on development of customized database protocols that will allow monitoring data to be entered into “FFI,” which is the NPS Fire Effects database software. Development of the CAHA database is still ongoing, but once completed, the data can be easily shared, queried, and analyzed.

## Program Goals and Objectives

The following goals and objectives were taken from the 2012-2017 Bodie Island Prescribed Burn Plan:

### **Resource Goals**

1. Reduce encroaching brush species from marsh habitats.
2. Reduce dead vegetation content of marsh grasses to improve marsh habitat for waterfowl and wading birds.
3. Maintain or improve herbaceous species diversity and cover in marsh and forested plant communities.
4. Maintain or improve shrub scrub habitat for resident and migratory avian species.
5. Maintain Mixed Maritime Forest to provide for quality wildlife habitat and visitor experiences.

### **Prescribed Fire Objectives**

1. Reduce hazardous fuel loading thru consumption of >70% of 1 hour fuels and >60% of 10 hour fuels within each burn unit.
2. Reintroduce fire disturbance regime into all appropriate vegetative communities in the park.
3. Top kill 50-75% woody brush vegetation in marsh habitats.
4. Reduce live and dead fuel loading by 50-80% in the shrub-scrub habitat.

## Review of 2013 Projects

There were no prescribed burns completed at CAHA in 2013.

## **Long Term Monitoring Results**

As the monitoring program at CAHA just began in 2012, there are no long-term data to discuss. Short term results from the 2012 prescribed burns were provided in last year's report. As monitoring protocols are implemented over the course of several years, there should be results from photo-monitoring, species cover data, and burn severity mapping that can help determine if objectives are being met, and to ensure that negative outcomes are minimized. The current inventory of monitoring plots is:

Bodie Island Unit 1.3 – 12 plots w/ photopoints and dominant vegetation cover

Bodie Island Unit 1.4 – 12 photopoints

Bodie Island Unit 1.5 – 2 photopoints

Bodie Island Unit 1.8 – 3 plots w/ photopoints and dominant vegetation cover

Bodie Island Unit 1.8 – 4 Wildland-Urban-Interface photopoints.

## **Discussion**

Again, with this very young program there is not too much to discuss at this time. Efforts over the coming year will focus on participating in all prescribed burns, continuing to work with CAHA staff on data collection, completing the fire effects database and data entry, and documenting monitoring protocols.

# Congaree National Park (CONG): 2013 Fire Effects Monitoring Annual Report

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## Activity Summary

The monitoring crew made a single visit to Congaree during 2013, to conduct long-term monitoring of plots in the RCW and Harry Hampton burn units. Due to an unusually high number of plots and cuts to our travel budget, we were unable to complete all scheduled plotwork. It appears that reduced travel funding may be the norm for the foreseeable future, which will impact our ability to provide monitoring services not only to Congaree, but to all of our network parks. When we are unable to complete all scheduled monitoring, we carefully prioritize field work in the following way at Congaree:

- plot data that addresses key long-term program objectives (selected variables/selected plots)
- postburn monitoring of the most recent prescribed burns
- planning needs for upcoming burns
- items of special interest to managers (may become higher priority).

Accordingly, field work for 2013 focused on collection of herb and seedling data at the oldest plots in RCW and Harry Hampton. Of the ten long term plots scheduled for field sampling, the crew completed high-priority data collection in six of them. Additional work included completion of photopoints in all six plots, and determination of tree mortality in four of them.

The fire ecologist made two visits to the Park during 2013, once to participate in planning meetings for the Fire Management Plan revision, and once to assist the monitoring crew in field sampling.

## Program Goals and Objectives

In past years' reports, we've used this space to communicate existing goals and objectives and to improve the objectives as new data have become available. The only notable change to the existing objectives may pertain to the protection of sensitive hardwoods and old-growth loblolly pines that are found in the bluff and along the edge of the floodplain forest; however, the actual objectives to reflect these resource values have not been fully discussed or finalized. Other objectives to possibly be determined in the coming year pertain to the mechanical tree removal being planned for parts of the Park. Past and future monitoring efforts should help guide the development of appropriate objectives.

Until such time as the objectives are updated, the reader is referred to previous year's reports for a review of the prescribed fire objectives at Congaree. Long-term objectives are summarized in **Table 1**.

## Review of 2013 Projects

There were no prescribed burns completed at Congaree during 2013.

## Long Term Monitoring Results

There has been no update to the standard analysis of long-term monitoring results. Consequently, **Table 1** has not been updated for this report, though we include it below as a reference point for reviewing the progress toward achieving program objectives. As noted in previous years, the results from CONG do not accurately represent the status and trends observed in the core longleaf area. However, the collective results are a good example of the trends in the more abundant loblolly pine forest type, and those results suggest that CONG is making reasonable progress in the long-term process of converting the dense loblolly forest into more of an open woodland structure characterized by lighter fuels. Discussion of data collected during 2013 can be found in the following section, **Additional Analyses**.

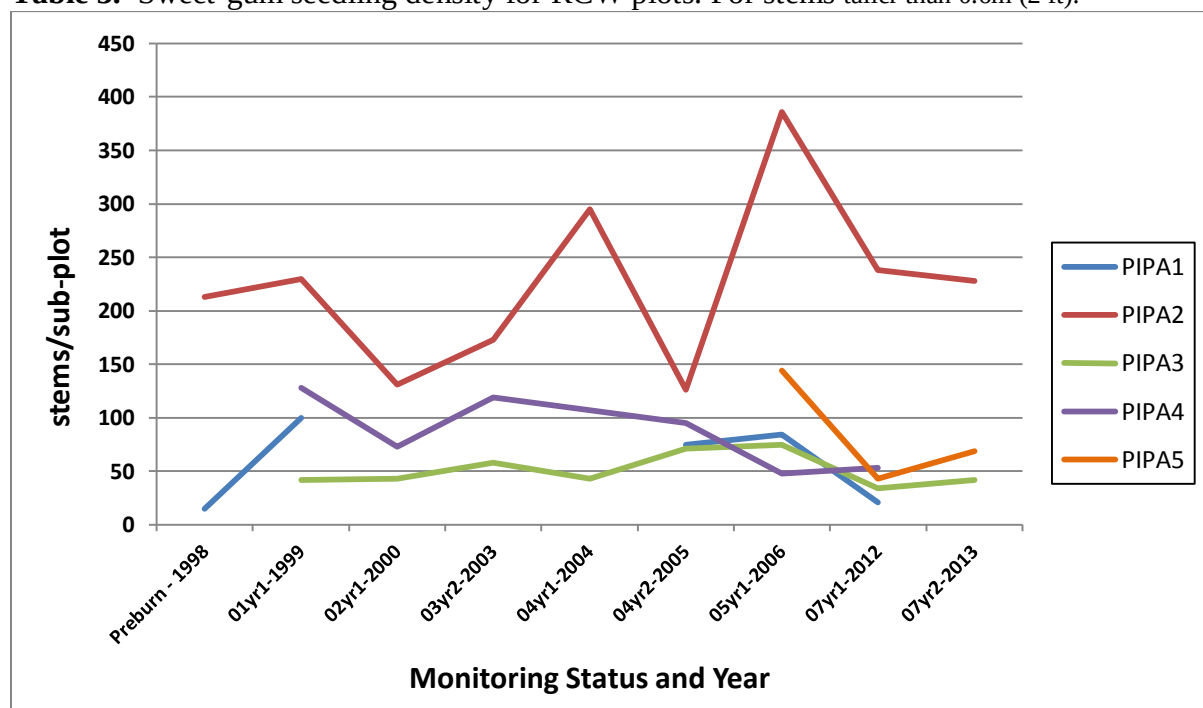
**Table 1.** Objectives and long-term monitoring results for CONG

| Vegetation Type                                                                    | Management Objective<br>Restoration Phase-<br>After ?? burns | Monitoring Results<br>(80% confidence intervals)                                                                                 | Objective Achieved? | Year Last Analysis Completed |
|------------------------------------------------------------------------------------|--------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------|---------------------|------------------------------|
| <b>Longleaf/<br/>Loblolly Pine<br/>Woodland<br/>(FPIPA1)</b><br><br><i>5 plots</i> | >50% Reduction in total fuel loading                         | Fuel reduction after 6 burns: 18%<br>( <i>n=4 plots, 1 burn unit</i> )                                                           | <b>No</b>           | <b>2008</b>                  |
|                                                                                    | 15-30% Reduction in overstory tree density                   | Overstory reduction after 5 burns: 4%<br>( <i>n=4 plots, 1 burn unit</i> )                                                       | <b>No</b>           | <b>2008</b>                  |
|                                                                                    | >200 tall (>1m) Longleaf pine seedlings /ac                  | Preburn density: data not clean<br>After 5 burns: 0<br>( <i>n=4 plots, 1 burn unit</i> )                                         | <b>No*</b>          | <b>2008</b>                  |
| <b>Loblolly Pine Forest<br/>(FPITA1)</b><br><br><i>5 plots</i>                     | >50% Reduction in total fuel loading                         | Total fuel reduction = 38%<br>Preburn avg.: 33.0 tons/acre<br>After 3 burns: 20.6 tons/acre<br>( <i>n=3 plots, 1 burn unit</i> ) | <b>No</b>           | <b>2008</b>                  |
|                                                                                    | >70% Reduction in pole-sized tree density                    | Pole reduction:<br>After 1 burn: 38%<br>After 2 burns: 46%<br>After 3 burns: 65%<br>( <i>n=3 plots, 1 burn unit</i> )            | <b>No</b>           | <b>2008</b>                  |
|                                                                                    | 25-50% Reduction in overstory tree density                   | Overstory reduction:<br>After 1 burn: 3%<br>After 2 burns: 3%<br>After 3 burns: 8%<br>( <i>n=3 plots, 1 burn unit</i> )          | <b>No</b>           | <b>2008</b>                  |

## Additional Analyses

Last year, in an effort to shed light on the understory vegetation dynamics in burned areas of Congaree, we presented stem density data for seedlings and poles of sweetgum (*Liquidambar styraciflua*) from the past 14 years of fire effects monitoring. We have included the seedling charts again in this year's report, with a couple small improvements. First, the sampling year is provided; next, the figures are updated with this year's data; and finally, the title of the y-axis is corrected. We also conducted another round of QA/QC to fix a few small errors in the data. The following tables are presented with minimal commentary to help clarify important trends in postfire vegetation dynamics at CONG. For further context, please see last year's report.

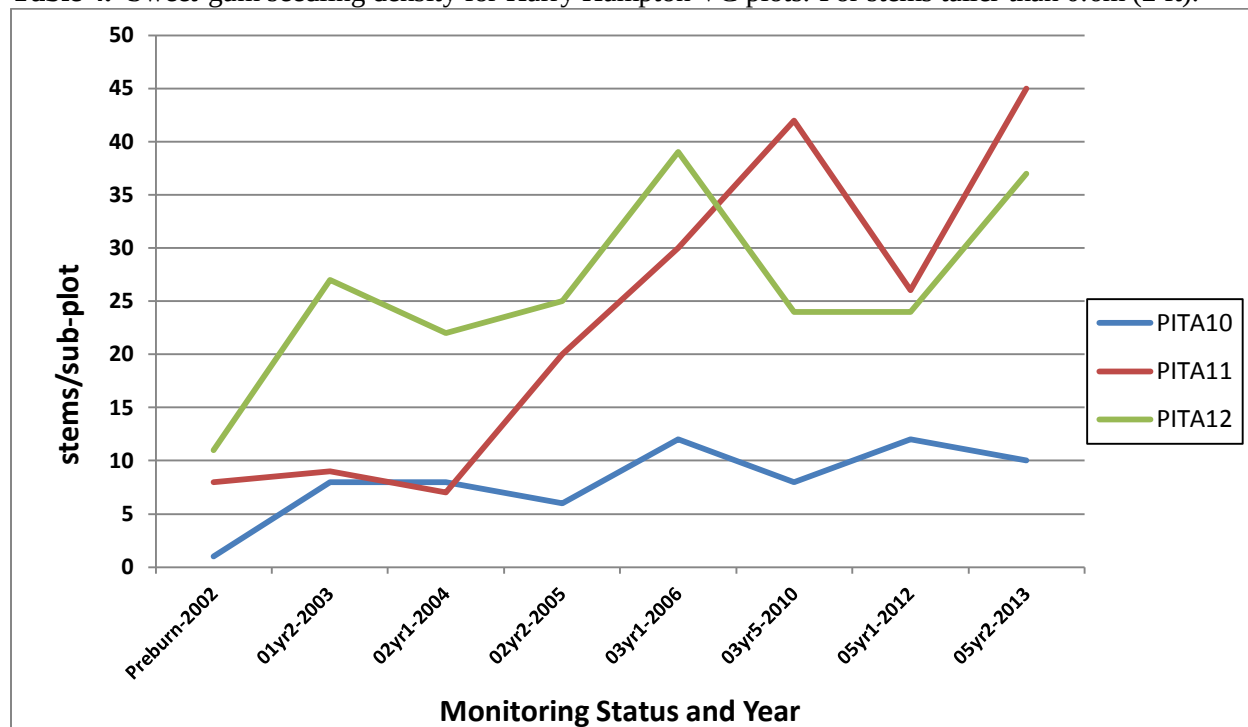
**Table 3.** Sweet-gum seedling density for RCW plots. For stems taller than 0.6m (2 ft).



### Notes:

- The first number in monitoring status tells how many times the plot has been burned. Year 1 ("yr1") data are collected the first growing season following the burn, while year 2 ("yr2") data are collected during the second growing season.
- Missing data were simply not collected. There are no "0" values for sweet-gum seedlings.
- Numbers provided are actual stem counts from each plot. The average number of sweet-gum seedling stems per 50m<sup>2</sup> sub-plot was 77.8 in 2012. This is roughly equivalent to 15,600 stems per hectare or 6,315 per acre.

**Table 4.** Sweet-gum seedling density for Harry Hampton VC plots. For stems taller than 0.6m (2 ft).



Note: Numbers provided are actual stem counts from each plot. The average number of sweet-gum seedling stems per 50m<sup>2</sup> sub-plot was 30.7 in 2013. This is roughly equivalent to 6,200 stems per hectare or 2,510 per acre.

## Discussion

This year's monitoring revealed incredibly rapid regrowth of sweetgum sprouts, despite the outstanding burns of 2012. Though total numbers did not increase tremendously in RCW, the average height of those sprouts increased dramatically. This underscores issues that have been discussed in previous reports and discussions with CONG staff. To summarize:

### ***Burn Frequency***

These sites need to be burned on a frequent schedule. Again, a 2-3 year rotation may be the most feasible under current budget constraints, and should be effective at *controlling* sweetgum. Monitoring data and field observations suggest that burning every 2-3 years during the dormant season may not allow effective restoration of longleaf pine regeneration and herbaceous species in areas that currently have high stem densities of sweetgum. A one-year rotation may be possible in grassier portions of RCW, but will likely not provide widespread burn coverage into areas where fire spread is more dependent on pine-needle litter.

### ***Burn Effectiveness/Coverage***

Of the nearly 1000 acres that are currently managed with prescribed fire in the RCW, Harry Hampton, and Red Bluff Road burn units, only a small percentage

(10%?) have a grass fuel type that can support annual burning. The remaining acreage is covered with pine-needle litter and hardwood leaf litter, which likely require a minimum of 2-3 years between burns before effective coverage and intensity can be achieved. As documented in previous annual reports, patchy burns with incomplete coverage can also result from variability in weather, soil moisture, and ignition pattern. Patchy burns have certainly contributed to high densities of pole-sized sweetgum in parts of the upland. All of these factors need to be considered when planning prescribed burns at Congaree.

### ***Seasonality***

Frequent growing season burns have been effective at reducing sweetgum density at other sites in the Southeast; however true growing season burns present a difficult proposition at Congaree. Though several burns at Congaree have occurred during the early growing season (after mid-April – see **Table 2**), consistently implementing burns during this time of year has been elusive. This is primarily due to availability of burn staff, questionable reliability of good burn windows during that time of year, and public concerns about impacts to wildlife. One planning approach would be to prioritize prescribed burning at Congaree during the mid-April to early-May time period. This would require Regional coordination, but is made easier by the fact that GRSM, CUGA, BISO, and MACA are all required to have prescribed burns completed by early-mid April in order to protect Indiana bats. If burns can't be reliably completed during the early growing season, then the Park could continue to supplement dormant-season burning with manual and chemical control methods for undesirable species.

**Table 2.** Prescribed burning of the RCW site. Provided for reference.

| Date                     | Acres Burned    | Notes                                                                                    |
|--------------------------|-----------------|------------------------------------------------------------------------------------------|
| <b>March 24, 1984</b>    | 80              | Prior to monitoring program                                                              |
| <b>March 28, 1985</b>    | 78              | Prior to monitoring program                                                              |
| <b>February 12, 1992</b> | 142             | Prior to monitoring program                                                              |
| <b>April 19, 1995</b>    | 193             | Prior to monitoring program                                                              |
| <b>April 8, 1999</b>     | 300             | Full extent unknown                                                                      |
| <b>April 27, 2001</b>    | 300?            | Full extent unknown                                                                      |
| <b>May 16, 2002</b>      | 575 (units 1-4) | Full extent unknown                                                                      |
| <b>April 29, 2004</b>    | 575 (units 1-4) | Not a complete burn                                                                      |
| <b>March 3, 2006</b>     | 575 (units 1-4) | Full extent unknown                                                                      |
| <b>November 29, 2008</b> | 575 (units 1-4) | Incomplete, cool burn                                                                    |
| <b>March 14, 2012</b>    | 575 (units 1-4) | Very complete burn, low-moderate intensity and severity – burned into edge of floodplain |

# Cowpens National Battlefield (COWP): 2013 Fire Effects Monitoring Annual Report

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## Activity Summary

There were no prescribed burns at Cowpens and the Fire Effects team did not visit the park during 2013. It appears that reduced prescribed burning and travel funding will be the norm for the foreseeable future, which will impact our ability to provide monitoring services not only to Cowpens, but to all of our network parks. When we are unable to complete all scheduled monitoring, we will prioritize field work in the following way at Cowpens:

- planning needs for upcoming burns
- postburn monitoring of the most recent prescribed burns
- items of special interest to managers (may become higher priority).

## Program Goals and Objectives

In past years' reports, we've used this space to communicate existing goals and objectives and to develop the objectives as new data have become available. There are no significant changes in goals and objectives for COWP, so in the interest of reducing the length of this report, the reader is referred to previous years reports.

## Review of 2013 Projects

There were no prescribed burns conducted at Cowpens during 2013.

## Long Term Monitoring Results and Discussion

There is not much to say about long-term monitoring at COWP at this time. There were no additional plot data collected during 2013, and the existing data come from plots situated in areas where fire has been discontinued. Given the current focus of the prescribed fire program on using fire only inside the area bounded by the Tour Loop Road, the establishment of additional permanent plots to monitor fire effects is not practical. The focus of the monitoring program going forward will be to participate/document the planning and implementation of prescribed burns, and continue to conduct qualitative assessments of burned areas.

# Cumberland Gap National Historic Park (CUGA): 2013 Fire Effects Monitoring Annual Report

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## Activity Summary

The monitoring crew made two trips to Cumberland Gap during 2013, once to participate in the Tiprell A/B prescribed burn, and later in the summer to conduct short and long-term plot monitoring at Tiprell, Dark Ridge A/B, Lewis Hollow, and Harlan Road. Due to an unusually high number of plots and cuts to our travel budget, we were unable to complete all scheduled plotwork. It appears that reduced travel funding may be the norm for the foreseeable future, which will impact our ability to provide monitoring services not only to Cumberland Gap, but to all of our network parks. When we are unable to complete all scheduled monitoring, we will prioritize field work in the following way at CUGA:

- postburn monitoring of the most recent prescribed burns
- plot data that addresses key long-term program objectives (selected variables/selected plots)
- planning needs for upcoming burns
- items of special interest to managers (may become higher priority).

Accordingly, field work for 2013 focused on collection of tree and tree seedling data in several of the most recent burn sites, along with critical longer-term data from Dark Ridge. Additional work included completion of photopoints in all plots that were visited, and fairly extensive qualitative assessments for each of the four burn units listed above. The fire ecologist made one trip to the Park during 2013, to assist the monitoring crew in summer field sampling.

## Program Goals and Objectives

One of the successes of our fire-effects monitoring program has been its contribution to the development of short and long-term objectives for the prescribed fire program. Monitoring data have been continually used to evaluate and improve objectives, and this is indicative of our major advances in understanding Appalachian fire ecology over the past 15 years.

In past years' reports, we've used this space to communicate existing goals and objectives and to improve the objectives as new data have become available. There are no significant changes in goals and objectives for CUGA, so in the interest of reducing the length of this report, the reader is referred to previous years reports.

## Review of 2013 Projects

### Tiprell A&B – April 3, 2013

Figure 1. Fire behavior East of drop point 6



Tiprell A & B are a combined 305 acre prescribed fire unit located on Poor Valley Ridge in Claiborne County, TN at the southern foot of Cumberland Mountain. The western boundary of the units is adjacent to the hamlet of Tiprell, where there are 10-15 private residences immediately adjacent to the park boundary. The eastern boundary was a combination of ridge-top trails and hand line with Lincoln Memorial University Forest to the east. The north and south boundaries were also a combination of trails and hand line.

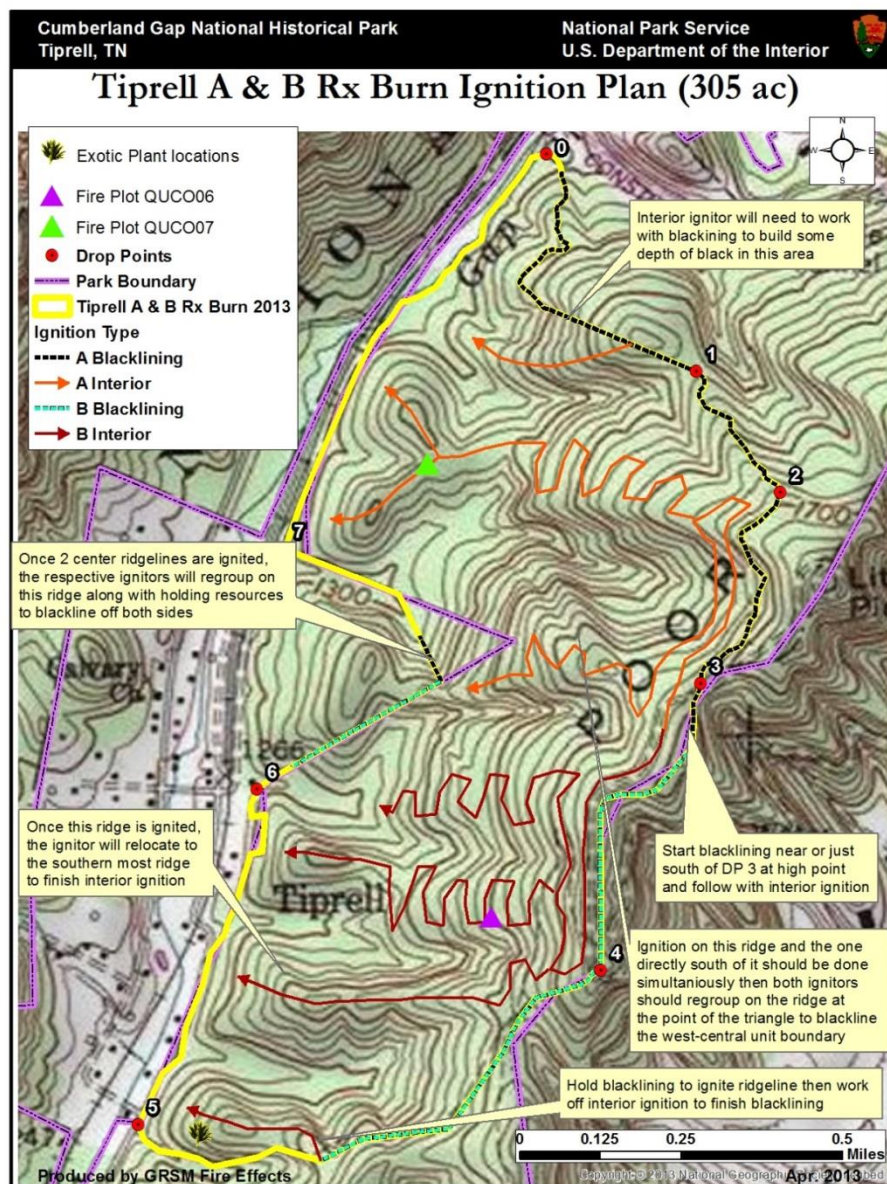
These units have a general west-northwest aspect and are composed of broad slopes and narrow, low-lying ridges. Elevations range from approximately 1300-1700 feet. Vegetation is dominated by mature mixed-oak forests, with pockets of oak-pine forest on exposed ridges and slopes, and mixed hardwoods in sheltered draws and low slopes. Fuels are primarily composed of oak leaf-litter. The disturbance history of these sites is not currently understood, though logging, grazing, and crop farming are all likely to have occurred.

The April 3 burn was the third entry of fire into units A and B (first burn: 4/26/06), second on (3/5/2009). The primary goal for these prescribed burns was to reduce hazardous fuels in the Wildland-Urban-Interface. Secondary goals include restoration of fire-adapted natural communities and restoration of the historic landscape.

The weather conditions for the burn day were moderate but dry, with a low relative humidity predicted and observed at 1530 of 19%. There were some gusting winds observed at 1530 gusting to 12mph mostly from the North. This low RH was mitigated by early ignition time and allowing fire to become established on the driest parts of the landscape before the hottest part of the day.

Most of the fire behavior was relegated to backing fire (**Figure 1**), which was the result of a well-planned Ignition pattern seen in **Figure 2**. This planning helped mitigate any large-scale intensity and severity upon the overstory. All ignitions halted when relative humidity dropped out of prescription, and resumed once RH reached the correct prescription levels.

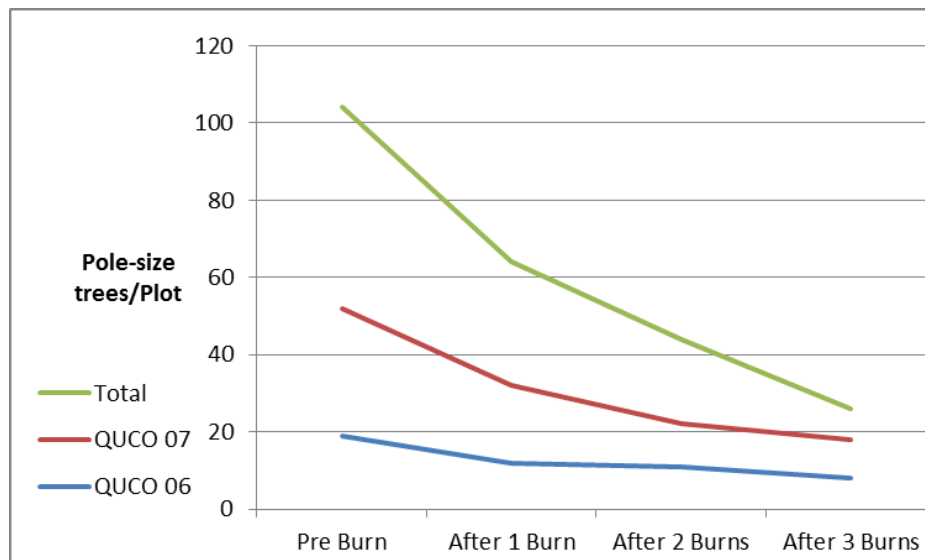
**Figure 2. Ignition Routes - Tiprell A & B**



Severity images were difficult to find this year without some cloud cover. With the best images found, Tiprell was depicted as light burn, which qualitatively equates to mostly litter removal, very minimal duff removal, seedling top-kill, and top-kill of pole-sized trees < 5 cm. Long-term monitoring was conducted in two plots located within the unit.

The most useful data gleaned from the repeated burns of this site is the reduction in pole sized trees (trees > 2.5cm and < 15.1 cm dbh). In two plots, the average pole reduction is 35% after 3 burns (Figure 3). The data also show a large decrease initially and a steady decline over the long term.

**Figure 3. Depicts pole-sized tree data taken from 2 long term vegetation plots**



As a visual depiction of what can be expected throughout the burn unit from qualitative assessments the photo below shows the general “opening up” of the forest understory. One observation is that poles less than 2” have been top-killed and those greater than 2” in diameter may not have been killed, but fire sensitive species have severe wounding (yellow arrow).



Repeated burns will be needed to achieve top-kill of these larger, damaged pole trees. Other options for future burns includes the use of low intensity growing season burns to further reduce pole tree density, though this strategy has implications for Indiana bat protection, and will need to be carefully discussed with the USFWS.

Low-intensity burning has greatly limited the occurrence of exotic invasive plants at CUGA, however these species are clearly present in the area and may continue to appear in burned or otherwise disturbed sites. One of the primary plants of concern is Chinese Silvergrass (*Miscanthus sinensis*), which was observed in the Tiprell A/B unit following this spring's burn (see photo below). This occurrence was mapped and reported to CUGA Resource Managers.



## Long Term Monitoring Results

There has been no update to the standard analysis of long-term monitoring results. Consequently, **Table 1** has not been updated for this report, though we include it below as a reference point for reviewing the progress toward achieving program objectives.

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

| Vegetation Type                                   | Management Objective<br>Restoration Phase-<br>(After 4 burns) | Monitoring Results<br>(80% confidence intervals)                                                                                                      | Objective Achieved?              | Year Last Analysis Completed |
|---------------------------------------------------|---------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------|------------------------------|
| Dry Oak Forest<br>(FQUCO1)<br><br><b>16 plots</b> | >50% Reduction in total fuel loading                          | <b>Total Fuel Reduction:</b><br>After 1 burn = 29% ( $\pm 3$ )<br>(n = <u>16</u> plots)<br>After 2 burns = 26% ( $\pm 2$ )<br>(n = <u>11</u> plots)   | Not yet, but on course           | 2013                         |
|                                                   | >70% Reduction in pole-sized tree density ( $\leq 15$ cm dbh) | <b>Pole Reduction:</b><br>After 1 burn = 39% ( $\pm 5$ )<br>(n = <u>16</u> plots)<br>After 2 Burns = 67% ( $\pm 3$ )<br>(n = <u>11</u> plots)         | Not yet, but close               | 2013                         |
|                                                   | 15-30% Reduction in overstory tree density (>15cm dbh)        | <b>Overstory Tree Reduction:</b><br>After 1 burn = 5% ( $\pm 5$ )<br>(n = <u>16</u> plots)<br>After 2 Burns = 8% ( $\pm 1$ )<br>(n = <u>11</u> plots) | Not yet, but on course           | 2013                         |
|                                                   | >200 tall (>1m) Oak seedlings /acre                           | Preburn mean: 101/acre ( $\pm 12$ )<br>After 1 burn: 91/acre ( $\pm 6$ )<br>(n=16 plots)                                                              | Not yet.                         | 2011                         |
|                                                   | >30% Cover by native herbs                                    | Mean preburn cover = 2% ( $\pm 1\%$ )<br>Mean after 1 burn = 4% ( $\pm 2\%$ )<br>(n=14 plots)                                                         | No, but more burns are needed.   | 2011                         |
|                                                   | < 20 Invasive exotic plants/acre                              | Preburn avg: 0/acre<br>Post burn mean: 20/acre ( $\pm 14$ )<br>(n=16 plots)                                                                           | Unclear due to high variability. | 2011                         |

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

## Discussion

Though summer field work was much more limited in 2013 than in past years, there were several important observations made, particularly during qualitative monitoring (essentially walking through a burn unit and recording observations with a camera, GPS, or in writing). One of the most encouraging signs was evidence of excellent oak reproduction in the Lewis Hollow burn unit and (limited) shortleaf pine regeneration in Dark Ridge A/B. As discussed in previous reports, regeneration of oak and shortleaf pine are perhaps the key indicators of successful prescribed-fire restoration. Having completed only two burns of most sites at Cumberland Gap,

we are still in the early stages of restoration, and increased regeneration of oak and pine have not been captured in our plot sampling. It is also important to note that all instances of oak and pine regeneration are accompanied by abundant competition by other sprouting hardwoods. However, most of our unburned eastern oak and pine forests have virtually zero pine and oak regeneration, so the appearance of these species is a positive thing.

We were able to spend the better part of a day conducting plot sampling and qualitative monitoring in the Dark Ridge A/B burn unit, and made some interesting finds. Though the early flush of woody invasive exotics (*Paulownia* and *Ailanthus*) has been almost completely diminished, there remain numerous occurrences of *Miscanthus sinensis* within the unit. A map of these locations has been created by the fire effects staff and sent to the CUGA Resource Management Specialist. Perhaps more importantly, there has been an excellent herbaceous response and abundant oak (and some shortleaf pine) regeneration occurring in the unit, though these species are still outnumbered by other hardwood sprouts. Given the patches of open canopy that occur throughout this unit, many of these sprouts are growing very quickly, and it seems prudent to conduct a third prescribed burn in this unit. Such a burn should aid oaks and pines in competing with the less fire-tolerant hardwoods. Here are a few recommendations for the Dark Ridge A/B site:

- low intensity backing fires that are allowed to spread naturally downslope and go out in the moister fuels of the lower slopes
- conduct the burn as late in the spring as possible to maximize impacts to fire-tolerant hardwoods. With Indiana bat restrictions, this probably means late March or early April
- protect/prep around remaining pine and oak seed trees in and near canopy gaps
- be prepared to conduct follow-up spraying for *Miscanthus* in the first and second growing seasons following the burn
- continue to conduct extensive monitoring for a number of invasive species.

Finally, we were able to walk through a great deal of the Harlan Road burn unit, which was burned for the second time in spring 2012. Both burns of this unit have occurred under fairly mild conditions, and ignitions focused on allowing fire to creep through the unit from the top down. The result is a beautiful open understory with very little impact to the oak-dominated overstory. This unit is a model for the current strategy of easing fire back into these forests, and represents a major success for the Cumberland Gap prescribed fire program. Such an approach allows desirable species to accumulate in the light shade of the oak overstory, thus preventing the runaway hardwood resprouting and invasive plant invasions observed in other sites, such as Dark Ridge.

# Great Smoky Mountains National Park (GRSM): 2013 Fire Effects Monitoring Annual Report

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## Activity Summary

The Fire Effects Team played a vital role in the success of the Jesse Ridge and Bald Top prescribed burns. Collaboration between the Fire-Effects crew and the Wildland Fire Module was directly responsible for excellent burns at both of these sites in Cataloochee Valley. Accumulated years of experience conducting prescribed burns and monitoring in the Park allowed team members to identify key ignition targets within these units, establish ecologically meaningful objectives, and develop specific ignition plans to meet those objectives – all in a very short time span.

Despite being challenged by reductions in staffing and support funding, the Fire Effects team completed all scheduled plot-work at GRSM during 2013. The team also completed additional Landscape Fire-Effects Mapping (LFEM) plots in three separate burn sites ranging from a 1986 wildfire (Hickory Fire –Bote Mt.) to a 2005 prescribed burn (Hatcher Mt.) to a 2009 wildfire (Laurel Fall II). These efforts are providing us with great insights into long-term fire effects that will aid in our ability to predict the effects of future fires. The concepts and basic methods of Landscape Fire-Effects Mapping were described in last year's report.

These efforts are providing us with great insights into long-term fire effects that will aid in our ability to predict the effects of future fires.

Some of the most interesting observations of the year were gained while conducting qualitative monitoring (essentially walking through a burn unit or wildfire site and recording observations with a camera, GPS, or in writing). Such reconnaissance is an essential monitoring technique that allows us to rapidly observe fire-effects across a range of complex terrain and vegetation types. Combined with FMH-plots and LFEM data, qualitative information is vital for 1) making adaptive management decisions in prescribed burning and wildfire management, and 2) providing descriptions of fire-effects to managers and cooperators. Qualitative monitoring observations of the 2013 Jesse Ridge prescribed burn and the 2007 Buck Shank wildfire are included in this report.

Team members provided support for a number of exciting fire-related research projects that were either completed or are still ongoing at GRSM. Some of these projects are described in the *Research Update* section of this Annual Report. Finally, the Fire Ecologist prepared a 12-page briefing paper summarizing the fire ecology, history of fire management, and the current prescribed-fire restoration strategy for GRSM.

## Program Goals and Objectives

One of the successes of our fire-effects monitoring program has been its contribution to the development of short and long-term objectives for the prescribed fire program. Monitoring data have been continually used to evaluate and improve objectives, and this is indicative of major advances in understanding Appalachian fire ecology over the past 15 years.

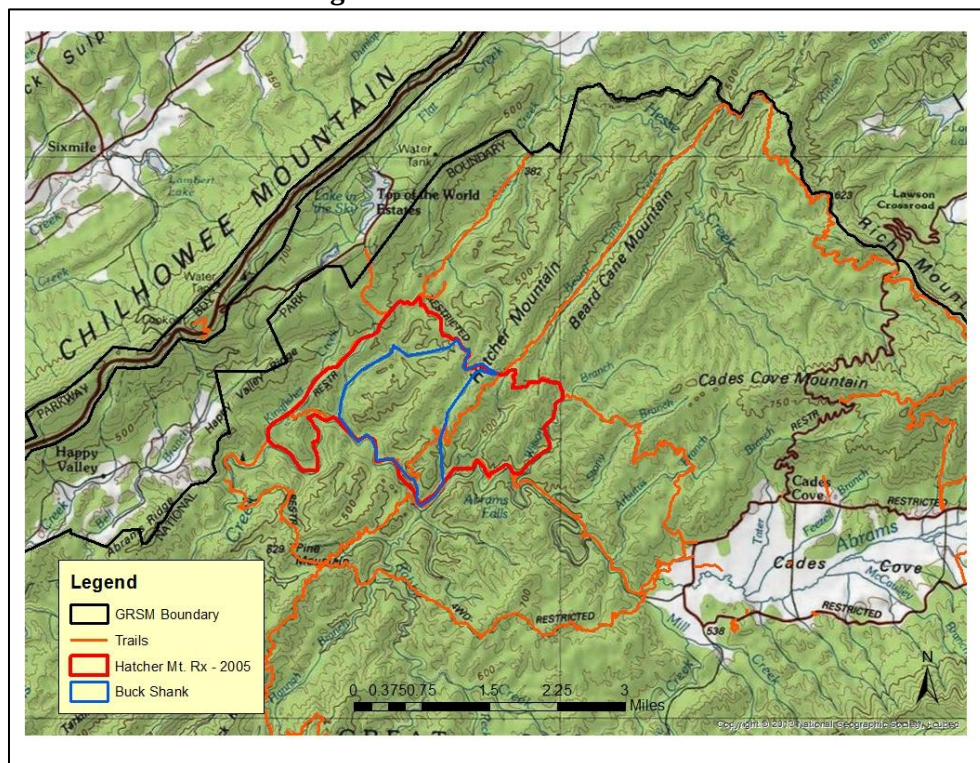
In past years' reports, we've used this space to communicate evolving goals and objectives as new data and knowledge have become available. This year there are no significant changes in goals and objectives for GRSM, so in the interest of reducing the length of this report, the reader is referred to previous year's reports. The long term objectives are summarized in **Table 4**.

## Review of 2013 Projects

### Review of the Buck Shank Wildfire (2007 – 1000 acres):

**Background -** The Buck Shank wildfire burned between May 23 and June 11 of 2007, with the primary burning occurring between May 23 and June 1. This human-caused fire burned nearly 1000 acres during the early stages of an exceptional drought year (see **Table 1** for fire weather), and was one of the more interesting fires in recent park history. The site occurs (roughly) between Abram's Creek and the Cooper Road Trail, and to the west of the Hatcher Mt. Trail (**Figure 1**). It lies completely within the boundaries of the 2005 Hatcher Mountain prescribed burn, so the 2007 wildfire was the second burn of this landscape within a two year period.

**Figure 1.** Buck Shank Wildfire Location.



This fire was recognized as exceptional while it was still burning. Along with the fact that the site had burned two years earlier, the seasonality, duration, scale, and severity of the Buck Shank fire all contribute to make this a very notable fire with important implications for managing fire-maintained vegetation in the Southern Appalachians. During the first days of the fire, it was determined that building extensive fire-line would not be possible due to steep and rugged terrain. Fire managers made the decision to drop back and attempt to confine the fire using Abrams Creek to the south, Oak Flats Branch to the east, Cooper Road Trail to the north, and Buck Shank Branch to the west. Holding actions were limited to construction of small sections of hand-line at the heads of a Buck Shank tributary and Oak Flats Branch, and blacklining along those hand-lines and Cooper Road.

As a result of this strategy, once the fire completed its initial run to the ridge from Campsite 17 (the point of origin), it essentially burned across a large landscape in a manner identical to a lightning-ignited fire. Direct observations of the fire as it burned along the major ridgelines revealed an actively spreading surface fire with 1' - 2' (4') flame lengths and rates of spread typically  $\frac{1}{2}$  - 2 chain/hr – essentially a low-moderate intensity fire. Occasional slope reversals resulted in higher-intensity upslope runs. The defining characteristic of the fire was the moderate to moderate-high severity to the forest surface that was characterized by significant reduction of heavy fuels and duff.

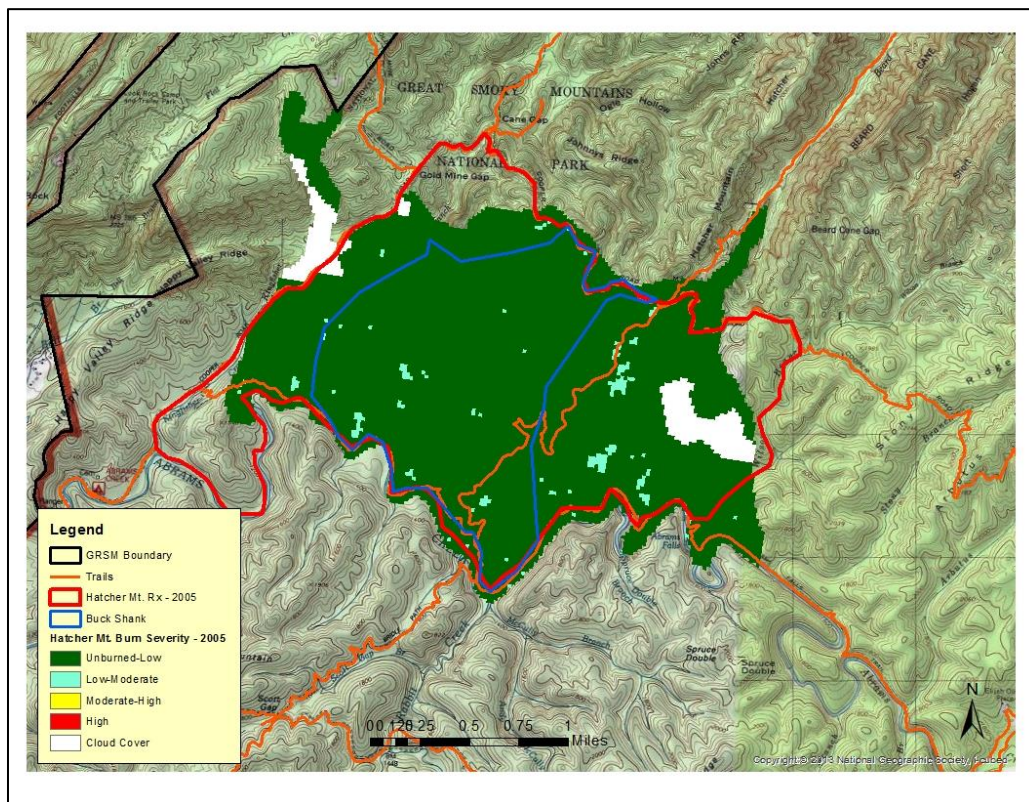
**Table 1.** Fire Weather observations from the Buck Shank Fire. KBDI is Keetch Byram Drought Index and PDSI is Palmer Drought Severity Index.

| Date    | Temp (°F) | Relative Humidity (%) | Sky/Winds          | KBDI | PDSI            | Notes                                             |
|---------|-----------|-----------------------|--------------------|------|-----------------|---------------------------------------------------|
| 5/23/07 | --        | --                    | --                 | 208  | Severe drought  |                                                   |
| 5/24/07 | 79        | 54                    | lt. winds          | 218  | Severe drought  | Active, low intensity spread                      |
| 5/25/07 | 75        | 51                    | lt. winds          | 228  | Severe drought  | Active, low intensity spread                      |
| 5/26/07 | --        | --                    | --                 | 241  | Severe drought  | Active, moderate intensity                        |
| 5/27/07 | 85        | 42                    | lt. winds          | 253  | Severe drought  | Fire did not burn all the way to Oak Flats Branch |
| 5/28/07 | 86        | 42                    | lt. winds          | 264  | Severe drought  | Base of pine trees and stumps smoldering          |
| 5/29/07 | 86        | 42                    | lt. rain/lt. winds | 275  | Severe drought  | Short high intensity run – black smoke            |
| 5/30/07 | 87        | 28                    | breezy             | 287  | Severe drought  | Very active fire                                  |
| 5/31/07 | 84        | 35                    | lt. winds          | 299  | Severe drought  | Fire most active in SW corner                     |
| 6/1/07  | 78        | 60                    | cloudy/lt. rain    | 309  | Extreme drought | Fire activity light                               |
| 6/2/07  | 74        | 74                    | cloudy             | 314  | Extreme drought | No real fire activity                             |
| 6/3/07  | --        | --                    | rain               | 320  | Extreme drought |                                                   |
| 6/4/07  | 73        | 65                    | cloudy/breezy/rain | 306  | Extreme drought | Minimal light smokes                              |

### Monitoring -

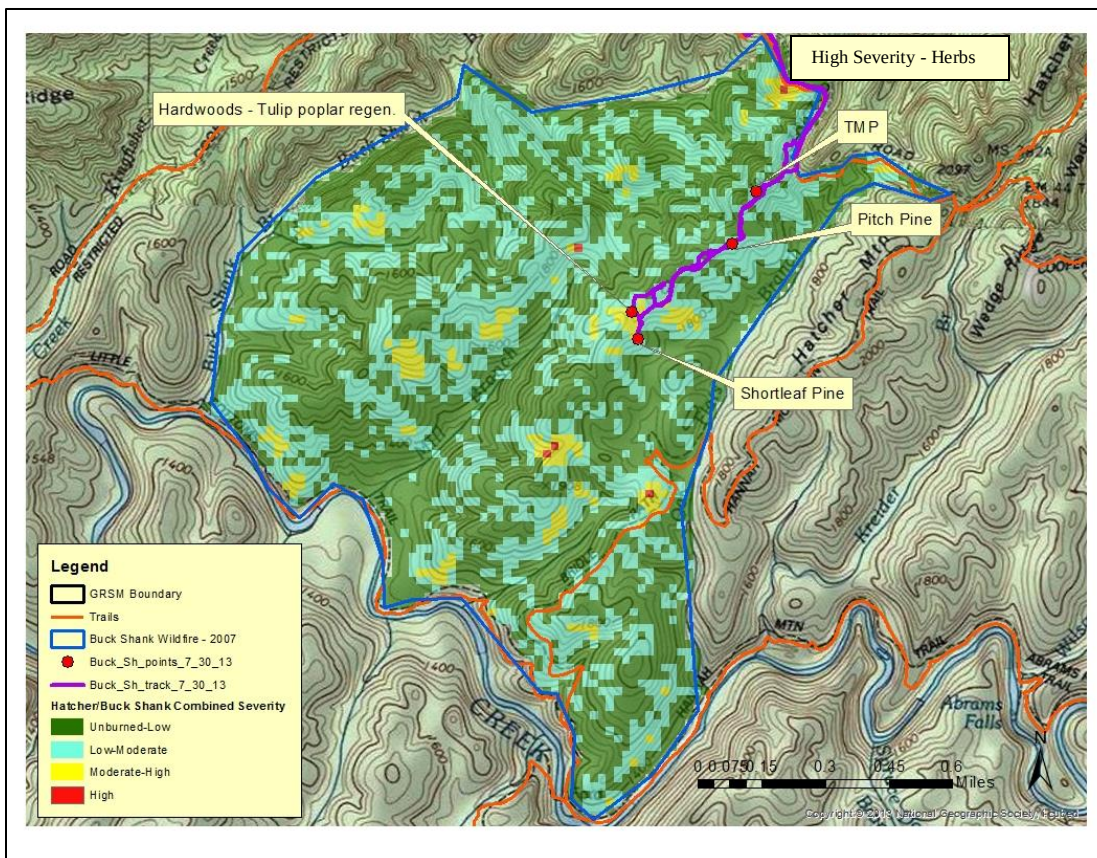
This site has been monitored since 2001 in conjunction with the 2400-acre Hatcher Mt. prescribed burn project. Long-term monitoring plots and remote sensing from after the 2005 Hatcher Mt. prescribed burn tell the story of a low-severity prescribed burn. A dNBR severity map of the Hatcher Mt. burn is provided for reference (**Figure 2**). Of the six long-term monitoring plots in the Hatcher Mt. unit, only a single plot fell within the footprint of the Buck Shank fire, and the fire effects in that plot were not considered to be widely representative of either burn.

**Figure 2.** Burn severity map (dNBR) of 2005 Hatcher Mt. Prescribed Burn. The map depicts a very low severity burn, including the area burned during the Buck Shank wildfire.



During the summer of 2013, the Fire Effects crew developed an “experimental” burn severity map for the Buck Shank fire that combined the effects of the 2005 prescribed burn with the effects of the 2007 wildfire (**Figure 3**). This effort was part of our larger Landscape Fire Effects Mapping (LFEM) work, and the goal was to determine how to best deal with remotely-sensed severity data from sites with repeated burns. To produce this map, the dNBR pixel values from the 2005 fire were simply added to the dNBR values from the 2007 fire, and standard severity thresholds were applied. The central idea behind this approach was to try and illustrate the cumulative effects of multiple burns. A visit to the Buck Shank fire site was undertaken during the summer of 2013 with the dual goals of ground-truthing the severity map and conducting qualitative monitoring of this interesting burn site.

**Figure 3.** Combined burn severity (dNBR) from two burns in the site of the Buck Shank wildfire. To produce this experimental map, dNBR values from the 2005 Hatcher Mt. prescribed burn were added to dNBR values from the 2007 Buck Shank fire.



#### *Ground-Truthing:*

**Figure 3** shows the gps track log and selected waypoints from our July 30 site visit, and **Figures 4 – 7** provide images from each of those selected waypoints. Ground-truthing was more or less exploratory. General observations of on-the-ground severity were compared with predictions from the dNBR severity model at numerous points along the route, and these observations confirmed that the severity thresholds modeled by dNBR represent detectable differences in the field, particularly with respect to total canopy cover. In general:

- unburned-low pixels (green) had little to no loss of tree canopy cover
- low-moderate pixels (aqua) had detectable impacts to canopy (estimate 15-30% reduction)
- moderate-high pixels (yellow) had clear and strong impacts to canopy cover (estimate 40-80% reduction)
- Only a single high severity pixel (red) was assessed, and this area was known to have had the canopy removed by southern pine beetles prior to the 2005 burn. “High” severity in this case represents strong impacts to the existing canopy in this spot, which was likely a 5-10’ hardwood resprout thicket.

Another key observation was that the dNBR model was **not** useful for predicting the occurrence of yellow pine regeneration or strong herbaceous responses. In general, these occurrences were always observed in areas mapped as moderate to high (blue to red) severity, but not all moderate to high severity sites contained pine seedlings or herbs. These sites had a range of vegetation responses, primarily driven by the composition and structure of pre-burn vegetation. These findings support our previous observations that dNBR is most useful at detecting changes in total canopy cover in our eastern forests. Co-variables such as drought index (KBDI) and preburn vegetation could possibly be combined with dNBR values to create a model that can predict important changes in a number of vegetation and fuels variables.

#### *Qualitative Monitoring:*

The trip to the Buck Shank fire easily ranks as one of the most important monitoring efforts of the year. After only two burns, this site contains tremendous examples of several key fire restoration indicators, including prolific reproduction of all four yellow pine species known from the park (**Figures 5-7**). Not only does that make this site one of the few in the park with any yellow pine regeneration, but this site is somewhat unique in that the pine seedlings occur under a living, pine overstory. Most of the other known sites of high-density pine reproduction in the park have very little mature living pine (or any species) in the canopy, due to high-intensity fires and southern pine beetle effects.

*This {unique} site contains ... prolific reproduction of all four yellow pine species known from the park ... under a living, pine overstory.*

Though limited, this site also includes examples of excellent herbaceous response (**Figure 4**). In general, herb cover in much of the interior of the site remains low; however, grasses and herbs appear to be more diverse, abundant, and productive than in most similar unburned sites. Spots with good diversity and abundance can be observed along Cooper Road Trail, and these areas offer a glimpse of vegetation composition that was once much more common in pine and oak woodlands in the park. Grass dominated “glades” have also been reported in the past 5 years from the southern end of the burn, on the slopes above Abrams Creek. These areas likely represent uncommon vegetation types within the park, and should be more fully documented during the year ahead.

Though there are many positive developments contained within this site, there are also numerous stands where the canopy has been removed (by intense fire or by pre-fire southern pine beetle), and hardwood resprouts form a dense regeneration thicket. These areas are typically dominated by such species as red maple, tulip poplar, sassafras, and sourwood. These stands also contain oaks and some pine, but it remains to be seen whether the oaks and pines will outcompete the other hardwoods without additional burning.

It is difficult to overstate the value of compiling knowledge about this site. As a place where yellow pines have reproduced under a pine canopy after just two fires, this place is truly uncommon in today’s forest. However, it likely represents processes that have occurred in the Southern Appalachians for thousands of years. As such, the Buck Shank fire is a valuable demonstration site and should serve as a model for restoring fire-maintained forests.



Figure 4. High severity – Herbs. Cooper Road Trail.  
Species pictured include *Hypericum stragalum*, *Coreopsis major*, *Eurybia surculosa*, *Polygala curtissii*, *Sorghastrum nutans*, *Danthonia sericea*, and *Robinia hispida*.  
Also pictured are saplings of Pitch pine, Virginia pine, and Scarlet oak.



Figure 5. TMP. Table Mountain Pine with seedlings.



Figure 6. Pitch Pine. Regeneration under live canopy.



Figure 7. Shortleaf Pine. Regeneration under live canopy.

## **Canadian Top Overview - Jesse Ridge and Bald Top**

In 2001, the Big Cataloochee valley, located in the southeast corner of the park, saw the release of the first elk herd as part of an experimental reintroduction program. The Cataloochee area was selected in part based on location and amount of open fields for grazing. Along with the reintroduction program came interest in using fire to improve habitat for elk in the surrounding forest. Wash Ridge, located on the west end of the Big Cataloochee valley, was the first area burned for this purpose and has since been burn twice, first in 2004 and again in 2007.

The roughly 3500-acre Canadian Top prescribed burn unit was also identified as another promising project area. This unit is a prominent ridge system situated between the Big Cataloochee and Little Cataloochee valleys, which were both heavily homesteaded in the early 1800s. Several historic structures remain in both of these valleys and are currently maintained by the national park. Much of the lower slopes of the unit were cleared for farming and grazing, but have since regrown into successional hardwood forest that include more fire intolerant species such as tulip-poplar (*Liriodendron tulipifera*), red maple, and Eastern white pine. Many of the upper slopes and ridges, however, still contain fire-adapted xeric and dry-mesic oak communities, including some remnant old growth high-elevation oak.

The general goals of this project are twofold, restoration and maintenance of fire adapted oak communities, and to open the understory and increase herbaceous cover with the idea of increasing elk habitat. This prescribed burn unit was originally proposed as a single, multi-operational-period burn unit utilizing both ground and aerial ignition resources. However, budgetary constraints have, in recent years, made the cost of using a helicopter prohibitive for most NPS burns in the southern Appalachian region. This coupled with the logistics of moving needed resources to and from the burn site has made this project seem unattainable at times. A small entry into this project area was made in 2010 with a 26 acre burn on a minor ridge near the historic Little Cataloochee Church. However, 2013 saw a renewed effort to burn some significant portion of the project area. This was approached with a different ignition strategy that focused on firing just the ridgetops and upper slopes along with any critical areas along the fireline and utilizing natural and man-made barriers (streams, roads, trails, etc.) to contain the fire as it backs down the slopes to the bottom of the unit. This method has twofold benefits:

- 1) It reduces where and how much fire is place on the landscape by hand, which if well planned can reduce the potential for less desirable fire effects, and it allows the fire to move across the landscape in a somewhat more natural pattern often only lightly under-burning or sometimes extinguishing in more mesic lower slope forests before it ever reaches the unit boundary. This allows more time to focus on igniting the target oak communities in a way that best meets the goals and objectives, and it reduces the amount and intensity of fire in the more mesic/ fire intolerant forest communities on the lower slopes and drainages near the unit boundary.
- 2) It can significantly reduce the overall time spent conducting the burn and sometimes the number of resources needed, because there is no need to blackline significant portions of the unit boundary.

This can translate into significant cost savings, which is paramount given the current budget situation for NPS fire.

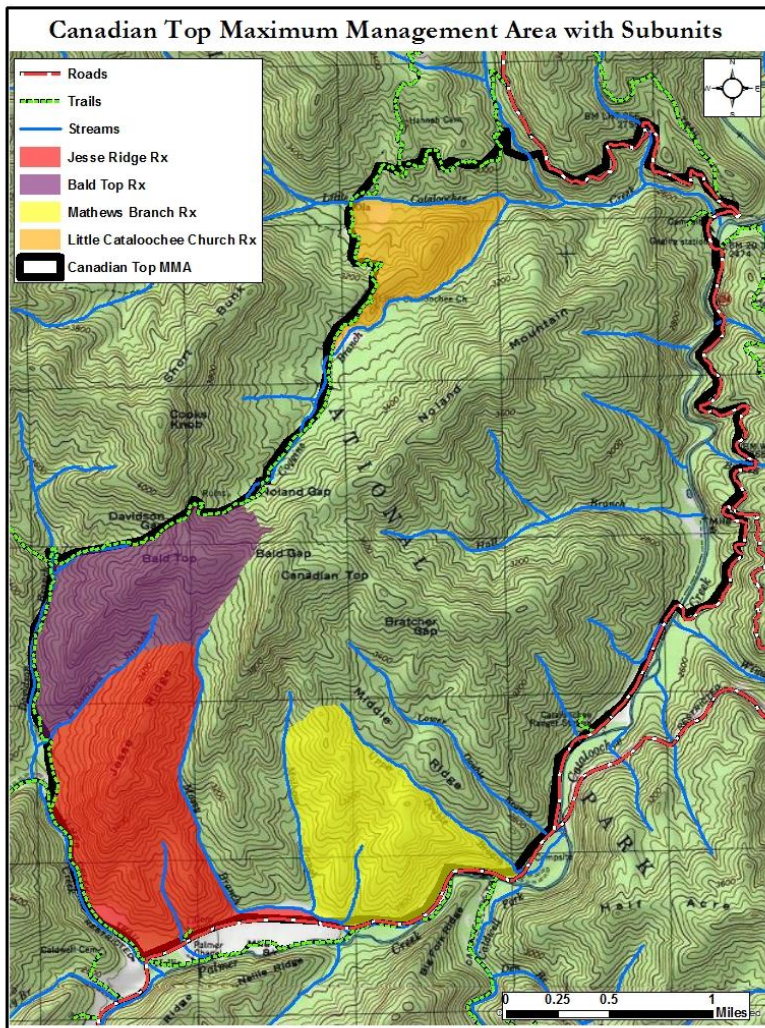


**Figure 1. Canadian Top Project Area with Past and Current Subunits Identified**

The other significant step in the process of introducing fire to the Canadian Top project area was identifying subunit that could be safely and effectively burned in 1 to 2 operational periods with reduced staffing. **Figure 1** shows a map of the Canadian Top project area with subunits that were completed or attempted this year. The Little Cataloochee Church subunit has also been included for reference.

### **Jesse Ridge Rx**

The 370 acre Jesse Ridge subunit is located in the southwest corner of the Canadian Top project area. It is a long spur ridge originating off the south side of Bald Top, a prominent knob in the northwest corner of Canadian Top. The unit is bounded by Mossy Branch to the east, Lower Davidson Branch on the northwest side, trails and Palmer Creek to the west, and the Big Cataloochee Entrance Road to the south. Additionally, there is a distinct saddle between Jesse Ridge and Bald Top that was used as the northern holding line. Notably this was the only area of handline construction. The south portion of Jesse Ridge is a steep slope that divides into 2 distinct spur ridges separated by a minor drainage. The west spur terminates just alongside a drive-up campsite for horseback riders in a flat by Palmer Creek, which has sparse, compact moist fuels and is unlikely to burn. The east spur ends at a historic cemetery

just above the Big Cataloochee Entrance Road. The north holding line and the cemetery constituted the only serious holding concerns for this unit.

As with most of the Canadian Top project area, the lower slopes of Jesse Ridge were mostly cleared at one time and have since grown back into successional forest. This is especially true along the south and west sides of the unit. The drier south slope is a fairly short stature second-growth forest with scarlet oak, chestnut oak, and occasional pitch and table mountain pines along with other mixed hardwoods. Dense mountain laurel is ubiquitous in this area due to fire suppression, making travel difficult. The 2 southern spurs have been heavily encroached upon by white pine but also contain a few pockets of scarlet oak and white oak. The forest quickly becomes more successional off the west side potentially indicating the main ridge was a property boundary and everything below the ridgeline on this side was cleared. Also, much of the west side has a dense rosebay rhododendron and/or mountain laurel shrub layer that covers most of the upper slopes often from the ridgeline down, making it almost impossible to traverse. The northwestern slope above Lower Davidson Branch was heavily cleared and now is mostly successional tulip-poplar forest. Remnant mature dry and dry-mesic oak forest communities comprised of chestnut oak, white oak, scarlet oak, and northern red oak (*Quercus rubra*) occur along the main ridgeline and many of the minor spurs and convex slopes of the east side of the ridge. Additionally, a handful of small pitch pine stands occur along the main ridge.

**Figure 2. Fire backing off the main ridge of the Jesse Ridge Burn Unit**

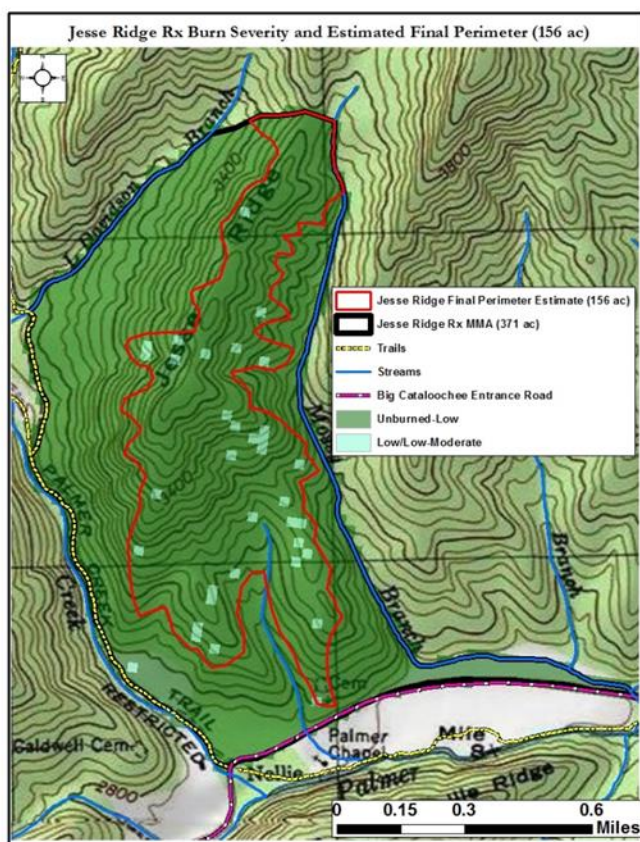


Initial scouting and prep for the Jesse Ridge prescribed burn unit were done within a narrow 2 week window culminating in the burn, which occurred on 5/1/13 and 5/2/13. The first day of firing operations began near the northern handline, and while holders secured the handline with fire, the igniters progressed south to the top of the southern slope taking time to work fire off the ridge and onto the spurs and convex slopes, primarily on the east side since the west slope generally did not allow for safe or fast travel. **Figure 2** shows a photo of the general fire activity along the main ridgeline. Interestingly, it rained overnight but the band of rain stopped before reaching the Big Cataloochee Valley. So, on day two firing operations focused on the south slope with igniters breaking into 2 team, one bringing fire down the south slope unto the west spur above the horse camp and the other bringing it down onto the east ridge and burning out around the cemetery.

Fire had backed a significant distance down the south slope overnight reducing the amount of area left to ignite which was a time saver because dense mountain laurel made travel through this area slow. Fire was worked down approximately to the 3000 ft elevation point then allowed to back until it went out.

Fire intensity was low across most of the unit with flame length generally staying below 1-2 ft with occasional flame length greater than 4 ft. Some attempts were made to introduce hotter fire into the successional white pine stands on the 2 southern spurs, but even in these areas intensity was only low to moderate. Post burn scouting during the growing season confirmed that this was a solid low severity burn, ideal for first entry into the target oak communities. **Figure 3** shows the extended (growing season) post burn severity image derived from reflectance data using pre and post burn Landsat satellite images of the Jesse Ridge area along with an approximation of the final perimeter overlaid on top.

**Figure 3. Jesse Ridge Extended Post Burn Severity with Estimated Final Perimeter.**



Regarding objectives, at least 70% if not more of the leaf litter was consumed across probably 75% or more of the target oak communities on the ridgeline, the east spurs and convex slopes, and the south slope and spurs. Flame lengths were maintained within acceptable levels, typically less than 2 ft especially in the absence of active hand ignition where fire was allowed to back down the slope. Most of the dense bear huckleberry (*Gaylussasia ursina*) understory cover was top-killed within the target area along with many of the smaller hardwood seedlings. However, seedlings greater than 2-3 ft tall or larger than 1" in diameter generally survived. Many of the white pine saplings and the dense, well developed areas of mountain laurel and rhododendron were only limbed by the fire. Still this constitutes a successful first entry into this unit because progress was made on reducing the understory without compromising the

overstory oaks. Future burns can always be conducted to further thin the midstory and understory, but one severe burn can result in damage that takes decades to recover and significantly complicates subsequent burns. Although limited fire spread occurred along the western slopes, much of this area was successional forest and contained very little target vegetation. As discussed below in the Bald Top burn review, fall burning could be an option to increase fire spread under the dense rhododendron and mountain laurel the covers the west slope.

### Key Points:

- Relying on existing barriers to hold the fire was a great success. This required minimal prep and holding, it allowed igniters to focus on the target communities, and it reduced the overall time investment and cost for the burn.
- Minimizing ignitions and allowing fire to back off the ridge and upper slopes reduced the potential for less desirable effects because it maintained the fire at a low intensity.
- Overall fire effects and spread of fire through the target area was within the desirable range for this burn unit.
- Despite budgetary and time constraints, the GRSM fire management staff worked as an efficient team, combining experience and technical ability, to make this a successful burn, thereby laying the groundwork for success not only on future Canadian Top burns, but also for similar landscape scale projects in GRSM and throughout the southeast.

### **Bald Top Rx**

Through the assistance of the Rocky Mountain Elk Foundation, GRSM fire management was able to conduct an additional fall prescribed burn in the Canadian Top project area. Two potential subunits had been pre-identified, Bald Top, adjacent to and north of Jesse Ridge, and Mathews Branch a lower elevation unit located 2 ridges to the east of Jesse Ridge off the southeastern side of the actual Canadian Top knob. Funding was acquired for the burning the Bald Top unit and the hope was that any unused funds could be used for burning Mathews as well. Both units were scouted and prepped and ignition planning was completed.

The Bald Top subunit encompasses a 264 acre area that includes Bald Top knob along with the upper portion of Jesse Ridge, and a prominent unnamed spur ridge that runs to the southwest off of Bald Top. The unit is bounded by trails to the north, Davidson Branch to the west, Lower Davidson Branch and the former north handline for the Jesse Ridge burn unit along the south side, and on the east side a major handline cut that runs from the Little Cataloochee Valley on the north side up through Bald Gap and down to the south, tying into the headwaters of Mossy Branch. Elevation ranges from 3960ft at the high point on Bald Top knob down to roughly 3000ft at the confluence of Davidson Branch and Lower Davidson Branch in the southwest corner of the unit.

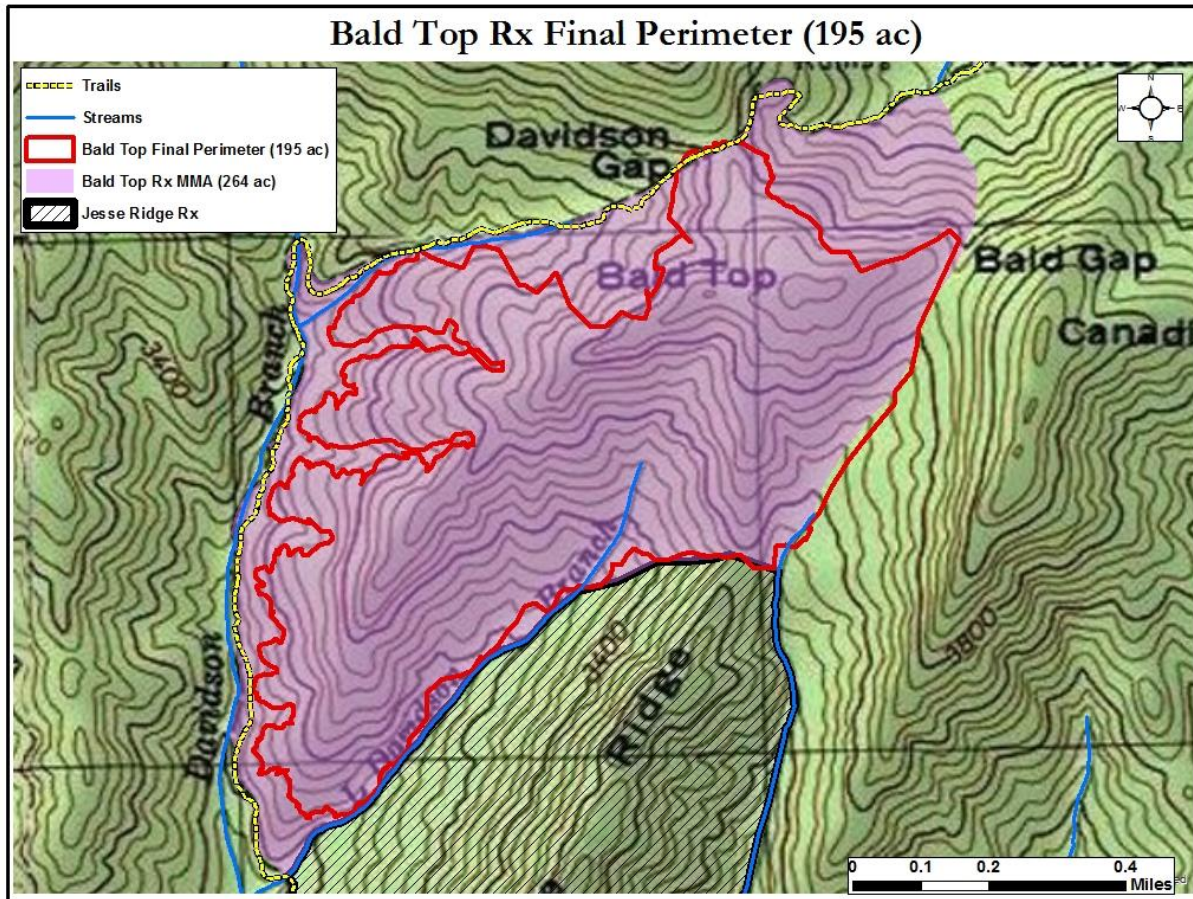
The majority of Bald Top knob was formally cleared, presumably for a cooler place to graze livestock during the summer months. However, a stringer of large old, broadly scattered oaks, mostly Northern red oak and a few chestnut oak, run from Davidson Gap up to the top of Bald Top knob and just off the northeastern slope. It is possible, given the frequent evidence of logs and stumps, that this stringer of oak was part of a former stand of American chestnut, which was previously preserved for the purpose of seed collection amongst other uses. The rest of Bald Top knob is an open understory successional hardwood forest, mostly containing tulip-poplar, red maple, and hickory (*Carya* spp.), as are much of the northeastern and southeastern slopes off either side of Bald Gap on the east side of the unit. A narrow band of older oak forest, primarily chestnut oak and white oak with occasional individuals of pitch pine,

runs along the ridgeline on the upper portion of Jesse Ridge then abruptly grades into successional mixed hardwoods off either side, much like an old fence line or boundary line. The upper portion of prominent southwest spur ridge contains a fairly extensive stand of old growth high elevation oak forest, mostly comprised of Northern red oak and chestnut oak along with scattered white oak and black oak. Below this forest, the ridge divides into 3 spurs, one running the northwest, a central one running west, and the third running to the southwest. Much of this area along the west side of the unit contains a dense shrub layer of mountain laurel which begins roughly at 3600ft in elevation and extends to the trailside below, frequently grading into dense rhododendron wherever Davidson Branch closely parallels the trail. The forest along these west side spurs grades into more of a dry oak community, commonly including scarlet oak and chestnut oak. The west slope of the southwest spur was formally cleared and is now a stunted dry oak and mixed hardwood forest with a dense wall of mountain laurel running from the ridgeline down. The large bowl surrounding Lower Davidson Branch was formerly cleared and much like the eastern slopes, has regrown in successional tulip-poplar forest with a relatively open understory generally lacking the dense ericaceous shrub layer found on the western slopes.

When the Bald Top burn was conducted on 11/5/13, the ground was covered by significant fresh leaf-fall that had been cured by recent frosts making it dry and lofty. It should be noted that most of the leaves that had fallen up to this point were tulip-poplar, red maple, black gum, etc., while the oaks still retained the majority of their leaves as is common for trees in this family (*Fagaceae*). This is significant because leaves from these species of trees usually do not carry fire well because they are compacted and partially decomposed by the spring, our typical prescribed fire season. This is partially due to the structural differences at the cellular level of tulip-poplar, red maple, etc. leaves as compared to oak leaves. In general, oaks tend to have a greater lignin content in their cellular makeup, forming a more rigid and “woody” structure thereby resisting weathering and decomposition over the winter months and quickly becoming lofty and crisp with dry weather. Tulip-poplar, red maple, black gum, and many other mesic, fire intolerant species lack this higher lignin content making them much more susceptible to structural decomposition and compaction with the rain, snow, and freeze-thaw cycles of the winter months.

Ignition for this unit initially focused on Bald Top knob, with fire carried from Davidson Gap across Bald Top along the northeast slope and down to Bald Gap. Firing operations then split into 2 teams, one working fire down the southeast slope to the east handline and off both sides of upper Jesse Ridge, and the other team firing along the south and west slopes of Bald Top knob then focusing on the southwest spur, eventually break off as individual igniters to light the various spurs along the west side of the unit. **Figure 4** show a fairly accurate final perimeter for the Bald Top prescribed burn. Note that aspect played a major role in limiting fire spread on the northeast and northwest slopes of Bald Top knob as anticipated in the firing plan.

Figure 4. Final Perimeter of Bald Top Prescribed Burn



The east line required a greater holding effort than would have normally been expected during a spring burn. This was largely due to the ability of the freshly fallen and cured red maple and tulip-poplar leaf litter to carry fire all the way to the unit boundary as compared to a spring burn when the same litter would be much more compacted resulting in reduced fire intensity and spread, and possibly restricting fire from progressing below the mid to lower slopes. Due to the reliable natural barriers that Davidson and Lower Davidson branches provided, fire was largely allowed to back from the ridgetops down along the southwest ridge and its associated spurs along the west side of the unit. Fire coverage in this area was excellent, especially considering the minimal amount of hand ignition used. Much of this area burned through the night and all the following day until rain came in the evening. It is likely that fire would have completely burned the entire southwest corner given a slightly longer burn window. One other item of note was that fire was able to cross the headwaters of Lower Davidson Branch where fresh leaf fall was able to cover the shallow, somewhat seasonably drier stream bed. This was a non-issue as a handline was already in place to mitigate this potential problem.

Overall firing operations went well and fire intensities were maintained within acceptable levels. At least 90% of the litter was burned across 100% of the target area, exceeding this objective in a positive way. The overstory is largely expected to remain unaffected across much of the unit as flame lengths were generally below 2ft (**Figure 5**). Although further growing season reconnaissance needs to be completed, it is probable that at least 1/3 of the tree seedlings and saplings (commonly dominated by red maple) < 6" in diameter were top-killed. There were some areas



**Figure 5. Typical backing fire on Bald Knob Rx**

where mountain laurel and rhododendron were top-killed or received heavy scorch but the majority of the dense areas of ericaceous shrub received only light to moderate scorch. However, this stands in contrast to similar areas on the Jesse Ridge unit which simply did not burn. In the future fall burning might be a consideration where there is a desire for more continuous fire spread through these dense areas of understory shrub.

#### Key Points:

- Fall burning resulted in significantly increased fire spread and increased intensity.
- Careful planning and application of fire resulted in low severity effects including retention of the overstory across almost all of the unit.
- Some lower slope and successional forest areas where we typically would expect to see limited fire activity in the spring saw almost complete coverage of fire with higher than expected flame lengths and rates of spread. Again this is due to availability of leaf litter in these areas after fresh leaf fall as compared to the spring when winter compaction has occurred. Negative effects were generally kept to a minimum on this burn, however, care should always be taken to minimize fire activity in the more naturally mesic areas through careful planning and application of fire and through varied seasonality.
- Even with highly receptive fall leaf litter, aspect still played a predictable role in determining fire spread.
- Fall burning may be useful in increasing fire spread under areas of dense mountain laurel and rhododendron (such as the west slope of Jesse Ridge).

## Long Term Monitoring Results

No fire effects plots have been burned at GRSM since 2010, and consequently there are no updates to the long-term monitoring results for the park.

**Table 4.** Objectives and long-term monitoring results for GRSM

| Monitoring Type                                     | Management Objective<br>Restoration Phase-<br>(After 4 burns) | Monitoring Results<br>(80% confidence intervals)                                                                                   | Objective Achieved?                                               | Year Last Analysis Completed |
|-----------------------------------------------------|---------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------|------------------------------|
| <b>Yellow Pine Woodland (FPRI1)</b><br><br>27 plots | >50% Reduction in total fuel loading                          | Total fuel reduction:<br>After one burn = 36% ( $\pm 5\%$ )<br>(n=23)<br>After two burns = 37% ( $\pm 4\%$ )<br>(n=16)             | <b>Not yet, but on course.</b>                                    | <b>2011</b>                  |
|                                                     | >70% Reduction in pole-sized tree density                     | Pole reduction:<br>After one burn = 54% ( $\pm 5\%$ )<br>(n=25)<br>After two burns = 75% ( $\pm 7\%$ )<br>(n=11)                   | <b>Yes</b>                                                        | <b>2009</b>                  |
|                                                     | 25-50% Reduction in overstory tree density                    | Overstory reduction:<br>After one burn = 20% ( $\pm 5\%$ )<br>(n=25)<br>After two burns = 41% ( $\pm 9\%$ )<br>(n=11)              | <b>Yes, but more burns are needed before drawing conclusions.</b> | <b>2009</b>                  |
|                                                     | >200 tall (>1m) Yellow Pine seedlings /ac                     | Preburn density: 0 (n=25)<br>After 1 burn: 97/ac ( $\pm 49$ )<br>(n=25)<br>After 2 burns 49/ac ( $\pm 40$ )<br>(n=11)              | <b>No, but more burns are needed.</b>                             | <b>2009</b>                  |
|                                                     | >40% Cover by native herbs/subshrubs                          | Preburn cover: 3% ( $\pm 1\%$ )<br>(n=23)<br>After 1 burn: 11% ( $\pm 4\%$ )<br>(n=23)<br>After 2 burns 10% ( $\pm 6\%$ )<br>(n=9) | <b>No, but more burns are needed.</b>                             | <b>2009</b>                  |
| <b>Dry Oak Forest (FQUCO1)</b><br><br>15 plots      | >50% Reduction in total fuel loading                          | Total fuel reduction:<br>After one burn = 29% ( $\pm 3\%$ )<br>(n=11)                                                              | <b>Not yet, but on course.</b>                                    | <b>2011</b>                  |
|                                                     | >70% Reduction in pole-sized tree density                     | Pole reduction:<br>After one burn = 34% ( $\pm 7\%$ )<br>(n=11)                                                                    | <b>Not yet, but on course.</b>                                    | <b>2011</b>                  |
|                                                     | 15-30% Reduction in overstory tree density                    | Overstory reduction:<br>After one burn = 5% ( $\pm 2\%$ )<br>(n=11)                                                                | <b>Not yet, but good gradual movement.</b>                        | <b>2011</b>                  |
|                                                     | >200 tall (>1m) Oak seedlings /ac                             | Preburn density: 20/acre ( $\pm 23$ )<br>(n=10)<br>After 1 burn: 4/ac ( $\pm 6$ )<br>(n=10)                                        | <b>No, but more burns are needed.</b>                             | <b>2011</b>                  |
|                                                     | >30% Cover by native herbs/subshrubs                          | Preburn cover: 4% ( $\pm 2\%$ )<br>(n=9)<br>After 1 burn: 4% ( $\pm 2\%$ )<br>(n=9)                                                | <b>No, but more burns are needed.</b>                             | <b>2011</b>                  |

## Discussion

2013 was a fantastic year for Fire Managers at Great Smoky Mountains National Park. Despite serious challenges, including a record-setting rainfall and an abysmal budget, we were able to complete some great burns and continue to build a strong ecological foundation for our program. The efficiency and effectiveness of these burns should serve as a model for future burns in the park. We can't always complete burns as elegantly as Jesse Ridge and Bald Top, but the same principles used during those burns can be used to improve the outcomes of nearly every forested burn that we do.

A variety of monitoring methods and tools are being used to continue learning about the role of fire in this park, and to determine the most effective ways to continue to restore fire-maintained natural communities. In particular, the monitoring of the Buck Shank wildfire shines a light into the future of what a successful fire restoration site can look like. Knowledge and understanding about the combination of factors that produced those results offer a path forward toward achieving similar goals at a larger scale. A great deal of knowledge was also gained from observations made during and after the highly successful burns in Cataloochee Valley, particularly with regard to fall burning in oak forest. Finally, ongoing fire-related research continues to illustrate the importance of these restored habitats to a number of beautiful plants and animals.

# Kings Mountain National Military Park (KIMO): 2013 Fire Effects Monitoring Annual Report

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## Activity Summary

The monitoring crew made three trips to KIMO during 2013. Two trips were made during the spring fire season; one to burn Eastline and the other to complete a partial burn of Garner Creek (Garner West). A single trip was made during the summer to conduct short and long-term monitoring of Eastline, Garner Creek, and North-Central. A detailed account of this year's burns can be found later in this report. The crew also completed 12 Landscape Fire Effects Monitoring (LFEM) plots, which represents the first time that this work has been done at KIMO. The concept and methods for this new monitoring technique were discussed in some detail in last year's BISO and GRSM annual reports.

Due to the typically large number of plots at KIMO and cuts to our travel budget, we were unable to complete all scheduled plotwork. It appears that reduced travel funding may be the norm for the foreseeable future, which will impact our ability to provide monitoring services not only to King's Mountain, but to all of our network parks. When we are unable to complete all scheduled monitoring, we will prioritize field work in the following way at KIMO:

- postburn monitoring of the most recent prescribed burns
- plot data that addresses key long-term program objectives (selected variables/selected plots)
- planning needs for upcoming burns
- items of special interest to managers (may become higher priority).

Accordingly, summer field work for 2013 focused on collection of data from Eastline, Garner Creek, and North-Central. Since Eastline and Garner East contain no long-term monitoring plots, they were excellent candidates for LFEM work, which focuses on collecting post-burn vegetation and fuels data to use for ground-truthing remote-sensed burn severity maps (dNBR). LFEM data collection is well suited to this period of reduced funding for monitoring, because it is greatly streamlined as compared to our FMH protocols, which allows us to collect data from more locations in a shorter amount of time. A discussion of these data will possibly be ready for next year's Annual Report.

## Program Goals and Objectives

One of the successes of our fire-effects monitoring program has been its contribution to the development of short and long-term objectives for the prescribed fire program. Monitoring data have been continually used to evaluate and improve objectives, and this is indicative of major advances in understanding Appalachian and Piedmont fire ecology over the past 15 years.

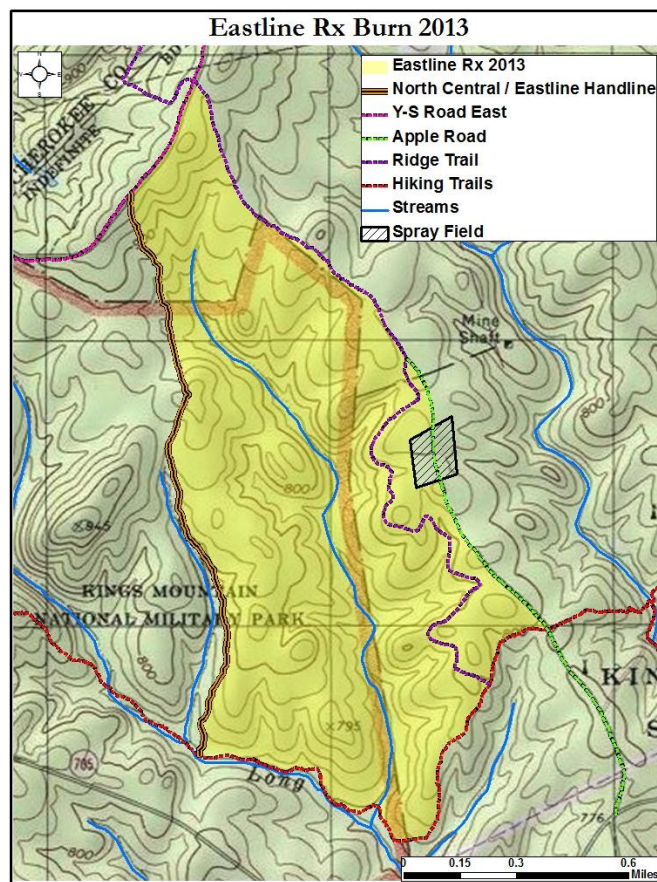
In past years' reports, we've used this space to communicate existing goals and objectives and to improve the objectives as new data have become available. There are no significant changes in goals and objectives for KIMO, so in the interest of reducing the length of this report, the reader is referred to previous year's reports.

## Review of 2013 Projects

### Eastline Rx

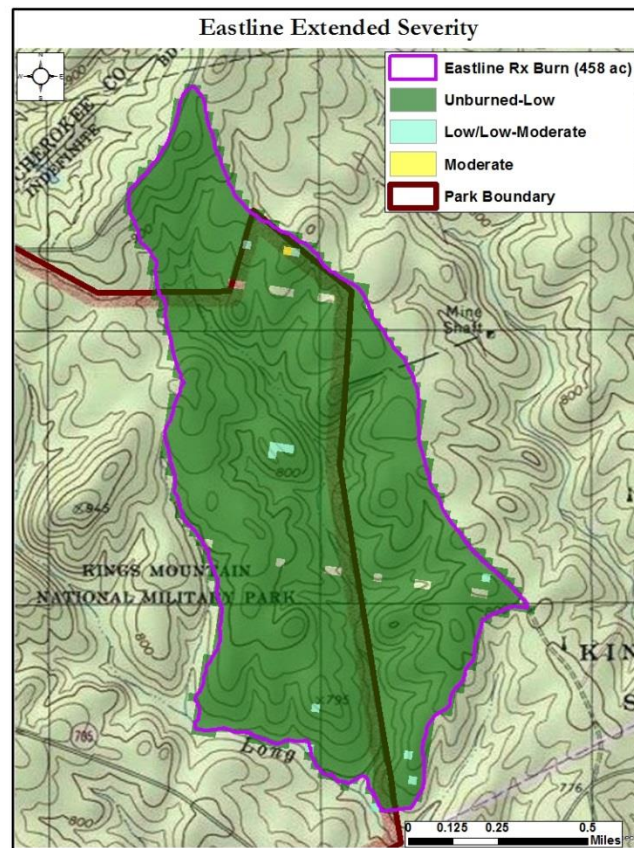
The Eastline prescribed burn unit is a 450 acre project area located in the northeast corner of Kings Mountain National Military Park (KIMO). This burn also included sections of adjacent state park land to make the unit boundaries more logical and to assist the state park with their burn program. This was the second prescribed burn for this unit with the first occurring on 4/10/2008 minus a portion of the southeast corner. The project area boundaries include the Yorkville-Shelbyville (Y-S) road to the north, an extensive handline along the west side, trails, Long Branch creek and a tributary to the south, and on the east side a combination of the state park Ridge Trail and Apple Road along with a short exclusion line around a waste water spray field. A major drainage runs from the northwest side of the burn area down to the south, roughly bisecting the unit. The high point of the unit is along the Y-S road to the north with broad, slightly rolling ridges gradually descending toward the south along the east and west flanks of the unit. **Figure 1** is a general overview map of the Eastline burn unit boundaries discussed above.

**Figure 1. 2013 Eastline prescribed burn unit**



Much of the unit is dry oak forest with scattered stands of shortleaf pine (*Pinus echinata*). The northern portion of the unit, adjacent to the Y-S road, is primarily open understory chestnut oak forest. The east and west ridges contain a mix of scarlet oak, Southern red oak (*Quercus falcata*), and chestnut oak with occasional individuals and small stands of post oak (*Quercus stellata*) and shortleaf pine. The central drainage and the south end of the unit transition into narrow areas of mesic, more fire intolerant riparian forest comprised of tulip-poplar, red maple, American beech (*Fagus grandifolia*), hornbeam (*Carpinus caroliniana*), and river birch (*Betula nigra*). There were some fire scarred trees and small canopy gaps created during the first burn, especially along the west ridgeline, and fuel loading included moderate to heavy oak litter with scattered jackpots and downed trees.

**Figure2. Eastline extended post burn severity image**



The current second entry burn for Eastline occurred on 3/28/2013 with lower than expected relative humidity and very high ventilation. Interestingly, the decision was made to work from the south end of the unit up the ridge to the high point along the Y-S road based on predicted winds. However, careful ignition and gradual elevation gain generally made this tactic a non-issue. Firing was split into 2 teams, east side and west side, which worked up the respective east and west ridges. The major challenge for this burn was adjusting ignition patterns as the ventilation rate soared throughout the day (predicted ventilation rate: 107,200) creating very active fire behavior that was at times difficult to control with technique alone. When the relative humidity dropped below 20% active firing was held up and the fire was nursed along in critical

areas. This certainly helped to significantly reduce overstory mortality, especially with firing operations being at the highest driest part of the unit by this point in the day.

Field assessment of post burn severity immediately following the fire revealed almost complete coverage of the unit, with fire even burning through the mesic riparian portions of the unit that typically would be expected to burn with less frequency and intensity. Overall fire intensity appeared to be low-moderate which meant duff was only lightly charred and damage to overstory trees through basal char was low enough to preclude outright mortality; however long term dieback and mortality would have been expected if weather conditions had remained dry. Fortunately, this was a wet spring and summer, which provided significant stress relief for this unit. Prior to this year, South Carolina has had long term drying, creating an added level of stress for burns at KIMO. Growing season scouting indicated very little apparent loss of vigor in the overstory across much of this unit, generally indicating a low severity burn. **Figure 2** shows the Landsat satellite derived growing season burn severity image for Eastline, which appears to agree with observed effects.

*The major challenge for {these burns} was adjusting ignition patterns as the ventilation rate soared throughout the day creating very active fire behavior that was at times difficult to control with technique alone.*

With regard to resource objectives, leaf litter was almost entirely consumed across most of the unit including the mesic areas of the landscape that do not require much fire disturbance. Generally, igniters endeavored to apply fire in a low intensity manner, however, dry air and high ventilation often resulted in fire moving vigorously across the landscape with more moderate intensity, which made control through firing technique difficult. Initial growing season reconnaissance seems to indicate that at least 30% top-kill in both the understory and midstory trees and shrubs is possible 1 year post burn, but wet weather may have reduced this effect. Overstory oak mortality appears to have been limited to less than 10% given the post burn rainfall. Additionally, creation of new overstory canopy gaps appear to be limited in number and size although some of the preexisting gaps may have been slightly enlarged.

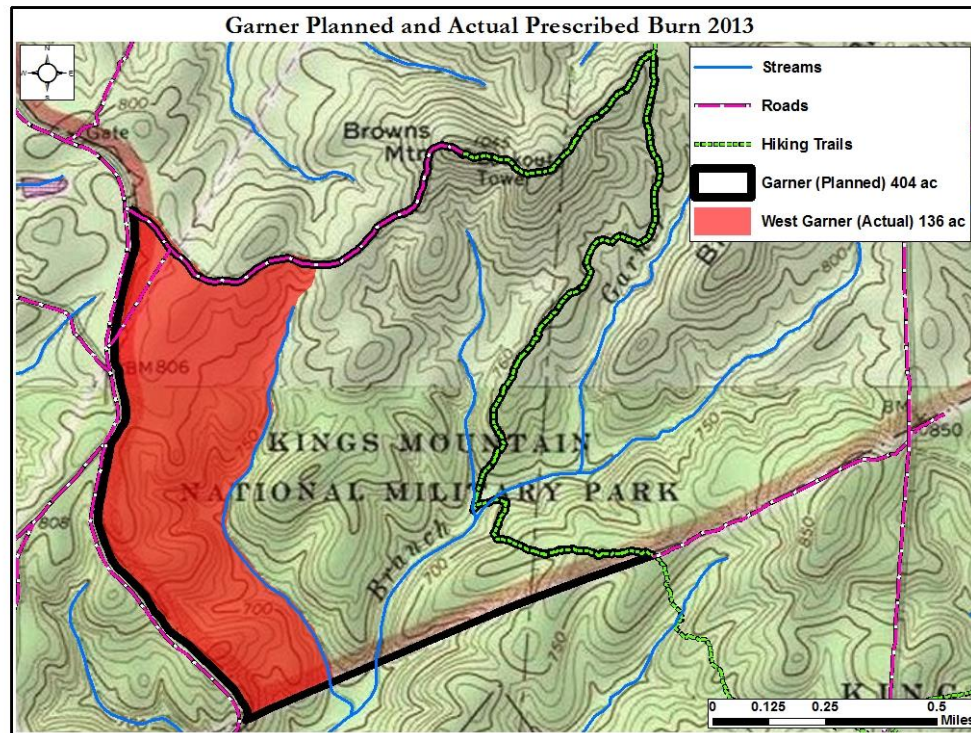
### **Key Points:**

- High ventilation burn days make control of fire intensity difficult, significantly increasing the chance for undesirable effects to the overstory. (predicted ventilation rate: 107,200)
- Careful attention to changing fire activity coupled with appropriate adjustment of firing strategy greatly helped to reduce the overall burn severity given the difficult weather conditions.
- Post burn rainfall likely played an important role in post burn forest recovery and vigor.
- Future burns for this unit should try to reduce fire activity in riparian areas as much as possible.

### West Garner Rx

West Garner is a 136 acre portion of the larger 404 acre Garner unit that was prepped to burn in 2013 (**Figure 3**). The 2013 Garner unit included the original 2006 Garner Creek unit along with the adjacent Turkeybeard unit, which previously burned in both 2001 and 2005. The current Garner burn was planned as a 2 day event with West Garner completed on the first day, and the remainder scheduled for day 2. However, burn conditions on day 1 led to the decision to postpone the plans for Day 2.

**Figure 3. Map of the 2013 planned Garner burn unit with the actual completed West Garner area**



West Garner, as the name implies, encompasses the west portion of the original Garner Creek unit, with a tributary of Garner Branch forming the eastern dividing line. The general unit location is the southwest corner of KIMO, with state roads along the west boundary, the NPS lookout tower road to the north, and a boundary line cut to the south. West Garner also included a small triangle of the Aster burn unit on the northwest corner, which was originally excluded using a short section of powerline corridor. Much of the unit is comprised of dry oak, primarily chestnut oak along with scarlet oak and Southern red oak, but the area also includes stands of shortleaf pine and xeric rocky blackjack oak (*Quercus marilandica*) communities. Generally, this portion of the original (2006) Garner Creek burn was lower severity with some basal wounding, but an overall intact overstory and thinned understory/midstory. However, there is also previous wildfire history within West Garner along the state road on the southwest side of the unit which resulted in a large canopy gap on the southern-most spur ridge that runs east from the roadside. The current West Garner burn occurred under full overstory green-up on 5/14/2013 with high ventilation rates. Firing operations began in the northwest corner, initially completing the small triangle portion of the included Aster unit. Firing then progressed along the north side of the unit then moved south with one team lighting the main ridgeline and major spurs, then allowing fire

to back down to the stream in the east drainage, and a second team securing the west line along the state road. Fire was finally secured along the south boundary cut.

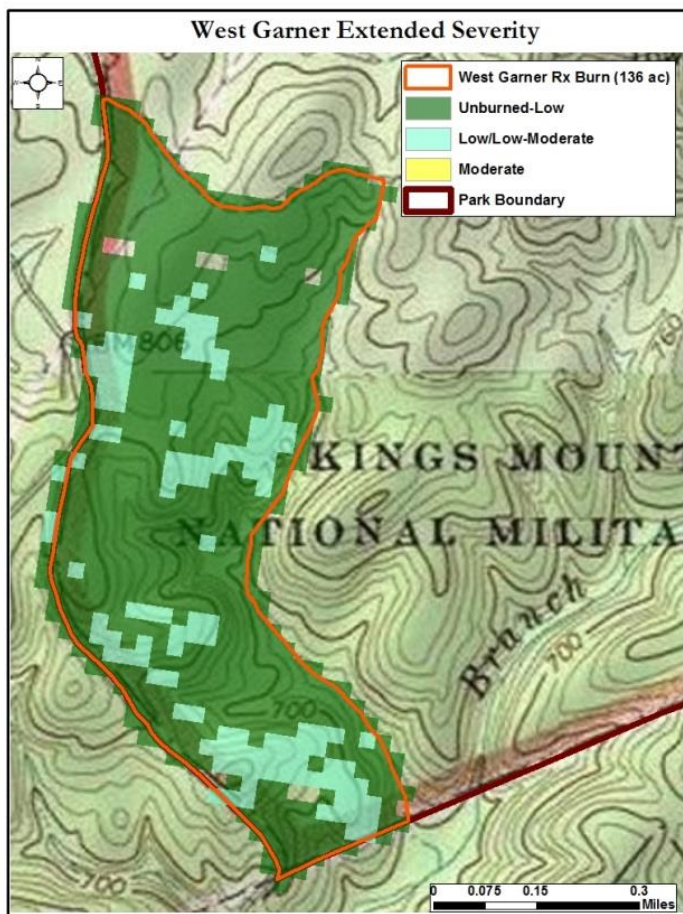


Figure 4 Extended post burn severity image for West Garner from the 2013 growing season

Overall, burn severity was moderated by post burn rainfall, with general severity being low to low-moderate. However, a few hotspots did occur where convective heat severely scorched the fully leafed-out oak overstory resulting in outright mortality. Much like the Eastline unit, high ventilation rates (predicted vent rate: 100,300) resulted in very active fire behavior, but the addition of growing season conditions added a greater level of sensitivity to the overstory. **Figure 4** shows an image of the post burn growing season severity for West Garner. It should be noted, however, that for growing season burns, extended severity is often better represented using satellite imagery from the follow growing season, so this image possibly underestimates the severity.

Like Eastline, most of the leaf litter burned across the majority of the unit, including down to the streamside on the east boundary. Again, high ventilation rates increased fire intensity despite general efforts to

moderate intensity through ignition technique. Midstory trees and shrubs, frequently including red maple, black gum and sourwood (*Oxydendrum arboreum*) along with patches of mountain laurel, was easily top-killed by 30-60% across most of the target area. Mortality of overstory oak is still to be determined. As mentioned, some overstory oak mortality and new canopy gap creation did occur as a direct result of severe scorch from convective heat, but field reconnaissance during the upcoming growing season should better determine long term effects to the overstory. The previous wildfire canopy gap on the southwest spur ridge was expanded during the current burn, partly due to availability of jackpots of fuel created from the prior overstory mortality.

#### Key Points:

- As with the Eastline burn, high ventilation rates made control of fire intensity difficult. (predicted vent rate: 100,300)

- Growing season conditions significantly increased sensitivity of the deciduous oak forest to fire caused damage and mortality, especially through scorch.
- Given these challenges of weather and seasonality, careful application and adjustment of firing technique is imperative throughout the burning period. This unit appears to have turned out fairly well across much of the burn with only a few new hotspots. However, second growing season scouting is necessary to fully determine long term overstory effects.
- Again, post burn rainfall likely help moderate overall severity

## Long Term Monitoring Results

2009 was the last time that long-term monitoring results for KIMO were updated (**Table 1**), but there was not enough data collected during 2013 to improve the current analysis. As noted before, the results indicate that KIMO is on track toward achievement of its management objectives. Despite the large number of plots at KIMO, however, there are significant trends in fire effects that are not being captured in the plot data. These trends are still being explored, and have been discussed in previous reports and presentations.

**Table 1.** Objectives and long-term monitoring results for KIMO

| Monitoring Type                                                           | Management Objective<br>Restoration Phase-<br>(After 4 burns) | Monitoring Results<br>(80% confidence intervals)                                                                         | Objective Achieved?                   | Year Last Analysis Completed |
|---------------------------------------------------------------------------|---------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------|---------------------------------------|------------------------------|
| <b>Chestnut Oak-Blackjack Oak Woodland (FQUMA1)</b><br><br><i>8 plots</i> | >50% Reduction in total fuel loading                          | Total fuel reduction:<br>After one burn = 47% ( $\pm 4\%$ )<br>( $n=7$ )                                                 | <b>Not yet, but on course.</b>        | <b>2009</b>                  |
|                                                                           | >70% Reduction in pole-sized tree density                     | Pole reduction:<br>After one burn = 45% ( $\pm 12\%$ )<br>( $n=8$ )<br>After two burns = 62% ( $\pm 12\%$ )<br>( $n=4$ ) | <b>Not yet, but on course.</b>        | <b>2009</b>                  |
|                                                                           | 15-30% Reduction in overstory tree density                    | Overstory reduction:<br>After one burn = 30% ( $\pm 11\%$ )<br>( $n=8$ )                                                 | <b>Yes</b>                            | <b>2009</b>                  |
|                                                                           | >30% Cover by native herbs                                    | Preburn cover: 6%<br>Cover after 1 burn: 9%<br>( $n=7$ )                                                                 | <b>No, but more burns are needed.</b> | <b>2009</b>                  |
| <b>Dry Oak Forest (FQUMO1)</b><br><br><i>21 plots</i>                     | >50% Reduction in total fuel loading                          | Total fuel reduction:<br>After two burns = 41% ( $\pm 5\%$ )<br>( $n=19$ )                                               | <b>Not yet, but on course.</b>        | <b>2009</b>                  |
|                                                                           | >70% Reduction in pole-sized tree density                     | Pole reduction:<br>After one burn = 43% ( $\pm 2\%$ )<br>After two burns = 58% ( $\pm 5\%$ )<br>( $n=19$ )               | <b>Not yet, but on course.</b>        | <b>2009</b>                  |
|                                                                           | 15-30% Reduction in overstory tree density                    | Overstory reduction:<br>After one burn = 7% ( $\pm 3\%$ )<br>After two burns = 12% ( $\pm 3\%$ )<br>( $n=19$ )           | <b>Not yet, but on course.</b>        | <b>2009</b>                  |

|  |                                                      |                                                                                                                                     |                                       |             |
|--|------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------|-------------|
|  | >200 tall (>1m) Oak or shortleaf pine seedlings/acre | Preburn density = 85/ac ( $\pm 49$ )<br>After one burn = 55/ac ( $\pm 34$ )<br>After two burns = 55 stems/ac ( $\pm 32$ )<br>(n=19) | <b>No, but more burns are needed.</b> | <b>2009</b> |
|  | >15% Cover by native herbs/subshrubs                 | Preburn cover: <1%<br>After 1 burn: 1%<br>After 2 burns: 1-2%<br>(n=19)                                                             | <b>No, but more burns are needed.</b> | <b>2009</b> |

## Program Review and Discussion

The King's Mountain prescribed burn program continues to make great progress, both in terms of annual accomplishments and overall quality of work. Monitoring continues to play a key role in this success, providing both information for ignition planning and feedback from evaluation of all prescribed burns. Previous year's reports have discussed concerns with burning practices that were contributing to undesirable levels of overstory tree mortality. As the evaluations of the 2013 burns contained in this report confirm, information from the long-term monitoring program at KIMO has contributed directly to operational adjustments that has helped to mitigate those concerns.

The long term outlook for NPS Hazard Fuel Reduction (HFR) Program is currently difficult to predict. We do not know the status of FY14 prescribed burns at KIMO, and if the most current budget projections hold true, the fire effects crew will have very limited funds to conduct monitoring activities. KIMO has completed a significant amount of restoration burning since 2001, and Park managers and Fire practitioners have used monitoring to learn a tremendous amount about how to operationally apply fire in ecologically appropriate ways. Future monitoring at KIMO will continue to focus on contributing detailed, site-specific information and burning recommendations for upcoming burns. To accomplish our monitoring goals, field work will need to be carefully prioritized and streamlined.

Given the uncertainty of funding and the importance of continuing the restoration that has been started, our recommendations are to do three things with respect to the KIMO prescribed fire and monitoring program:

1. Re-evaluate restoration priorities and plan a best case/worst case schedule for future prescribed burning – the most obvious choice is to prioritize units that have already received one or more burns
2. Consolidate what we have learned about applying prescribed fire to the KIMO landscape to maximize the effectiveness of any future burns
3. Continue to engage regional NPS partners and Fire staff to ensure adequate prioritization of KIMO burns and effective planning.

The Fire Effects Program has abundant data and knowledge that could assist in these exercises, and would be glad to participate in any related effort. In the coming year, the Fire Effects Team

will continue to prioritize monitoring, conduct monitoring, and summarize findings to our partners. Fire-effects staff will also strive to remain engaged in prescribed burn planning and operations, in order to maximize the value of monitoring information and data.

## Fire Ecologist and Fire Effects Crew Accomplishments and Areas of Focus

**Table 1. Fire Ecologist Accomplishments/Focus Areas**

| Category                 | Percent Time | Accomplishments and/or areas of activities                                                                                                                                                             |
|--------------------------|--------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <i>Planning</i>          | 20%          | Planning meetings at CONG, CARL, BISO, and GRSM. SER burn prioritization scheme. FMP reviews for CONG and CARL. fire effects program planning. development of site-specific objectives for CY13 burns. |
| <i>Writing</i>           | 15%          | Prepared fire ecology paper for GRSM managers. Fire-restoration document for USFS. Work on monitoring plans. Proposal writing. Annual report. Detailed correspondence.                                 |
| <i>Data Collection</i>   | 10%          | Field work at several parks. Plot work and qualitative surveys. Immediate postburn and growing season.                                                                                                 |
| <i>Data analysis</i>     | 10%          | Estimated amount of time spent performing analyses, including data summaries and statistical tests. Tabular and spatial data.                                                                          |
| <i>Research</i>          | 5%           | Involvement with numerous research projects, mostly at GRSM (see Research Update). Data support, field support, support letters. Co-author on paper.                                                   |
| <i>Supervision/Admin</i> | 10%          | Budget/Realignment issues. Supervision, Performance evaluations, IDPs, travel, payroll, crew support, purchasing etc. Meetings.                                                                        |
| <i>Fire Assignments</i>  | 5%           | Prescribed burns at GRSM, KIMO, and BLRI. Wildfire at GRSM.                                                                                                                                            |
| <i>Presentations</i>     | 2%           | Presenter at Indiana bat Workshop. Led Highlands Biological Station Forest Ecology Field Trip. Conducted field trip for GRSM volunteers.                                                               |
| <i>Funding Proposals</i> | 5%           | Servicewide combined call (had to learn PMIS). Disney Nature grants for GRSM and support for CUGA.                                                                                                     |
| <i>Data management</i>   | 10%          | Completion of SCA Fire Database for several parks. Protocol/Database development for LFEM                                                                                                              |
| <i>Training</i>          | 3%           | OJT for Firing Boss. Participation in various classes.                                                                                                                                                 |
| <i>Miscellaneous</i>     | 5%           | Mostly communication.                                                                                                                                                                                  |

**Table 2. Fire Effects Crew 2013 Accomplishments/Focus Areas**

| <b>Category</b>                 | <b>Percent Time</b> | <b>Notes</b>                                                                                                                                                                                                                                                                                                                                                                                                    |
|---------------------------------|---------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <i>FMH plots</i>                | 20%                 | <i>Some FMH plot work was waived due to snag hazards and/or Fire Ecologist determination of need for data</i>                                                                                                                                                                                                                                                                                                   |
| <i>Qualitative Monitoring</i>   | 20%                 | <i>BISO, BLRI, CUGA, GRSM, KIMO had burn units that received qualitative monitoring</i>                                                                                                                                                                                                                                                                                                                         |
| <i>CBI plots</i>                | 0%                  |                                                                                                                                                                                                                                                                                                                                                                                                                 |
| <i>Landscape fire Effects</i>   | 5%                  | <i>New monitoring technique used to capture greater range of fire effects unit /fire wide. Parks that have had some LFEM include GRSM and KIMO</i>                                                                                                                                                                                                                                                              |
| <i>Fire Assignments</i>         | 5%                  | <ul style="list-style-type: none"> <li>• <i>Lead served as READ for 1 week assignment for the Alpine Fire in Sierra National Forest</i></li> <li>• <i>Assistant and Lead worked several small intra-Park fires</i></li> </ul>                                                                                                                                                                                   |
| <i>Prescribed fire projects</i> | 10%                 | <ul style="list-style-type: none"> <li>• <i>Crew assisted with preparation on 6 prescribed fires</i></li> <li>• <i>3 Crew members served as FEMO/FFT2 on 4 prescribed fires</i></li> <li>• <i>Assistant Lead served as FIRB on 3 fires</i></li> <li>• </li> </ul>                                                                                                                                               |
| <i>Non-fire fuels projects</i>  | <5%                 | <ul style="list-style-type: none"> <li>• <i>Lead Crew member served on a READ assignment for the Gulf Oil spill for 3 weeks</i></li> <li>• <i>Crew assisted Field Research related to Fire and Herpetology at GRSM</i></li> </ul>                                                                                                                                                                               |
| <i>Data entry</i>               | 25%                 | <i>75% data is entered. Some proofing remains</i>                                                                                                                                                                                                                                                                                                                                                               |
| <i>GIS</i>                      | 5%                  | <i>Map and data projects</i>                                                                                                                                                                                                                                                                                                                                                                                    |
| <i>Supervision/Admin</i>        | 6%                  | <i>Lead monitor supervised 1 assistant and two monitors; Travel to other parks for Fire Effects Monitoring and associated paperwork</i>                                                                                                                                                                                                                                                                         |
| <i>Training</i>                 | <5%                 | <ul style="list-style-type: none"> <li>• <i>Each crew member had fire Refresher</i></li> <li>• <i>Lead took S-234 Ignition Operations</i></li> <li>• <i>Assistant took S-230-231 Single Resource course</i></li> <li>• <i>Crew assisted Carolina Vegetation Survey Pulse Event on the Escarpment of Blue Ridge</i></li> <li>• <i>1 Crew member attended Fire Learning Network meeting in Georgia</i></li> </ul> |
| <i>Miscellaneous</i>            | <5%                 | <i>Crew assist with CBI and the SHEN fire effects</i>                                                                                                                                                                                                                                                                                                                                                           |

## Additional Program Information

**Table 1. Planning - 2013**

| Park | Does Park<br>have written<br>DFCs?<br>(yes or no) | Date Park-level<br>Monitoring Plan<br>completed<br>(or revised) | Total # of Project-<br>or Community-level<br>Monitoring Plans<br>(not just 2013) | Assisted with<br>how many<br>BAER plans in<br>2013? |
|------|---------------------------------------------------|-----------------------------------------------------------------|----------------------------------------------------------------------------------|-----------------------------------------------------|
| BISO | yes                                               | n/a                                                             | 0                                                                                | 0                                                   |
| BLRI | yes                                               | n/a                                                             | 0                                                                                | 0                                                   |
| CAHA | no                                                | n/a                                                             | 0                                                                                | 0                                                   |
| CONG | yes                                               | n/a                                                             | 0                                                                                | 0                                                   |
| COWP | no                                                | n/a                                                             | 0                                                                                | 0                                                   |
| CUGA | yes                                               | n/a                                                             | 0                                                                                | 0                                                   |
| GRSM | yes                                               | n/a                                                             | 0                                                                                | 1                                                   |
| KIMO | yes                                               | n/a                                                             | 0                                                                                | 0                                                   |

**Table 2. Monitoring - 2013**

| Park                                       | % 2013<br>Data<br>Entered | % 2013<br>Data<br>Quality<br>Checked | #<br>Prescribed<br>Fires<br>Monitored* | # Non-fire<br>Fuels<br>Treatments<br>Monitored* | # Wildfires<br>Monitored* | # BAER<br>Treatments<br>Monitored* |
|--------------------------------------------|---------------------------|--------------------------------------|----------------------------------------|-------------------------------------------------|---------------------------|------------------------------------|
| Big South Fork National<br>Recreation Area | 25%                       | 0%                                   | 1                                      | 0                                               | 0                         | 0                                  |
| Blue Ridge Parkway                         | 0%                        | 0%                                   | 1                                      | 0                                               | 0                         | 0                                  |
| Cape Hatteras National<br>Seashore         | None                      | None                                 | 0                                      | 0                                               | 0                         | 0                                  |
| Congaree National Park                     | 75%                       | 75%                                  | 0                                      | 1                                               | 0                         | 0                                  |
| Cowpens National<br>Battlefield            | None                      | None                                 | 0                                      | 0                                               | 0                         | 0                                  |
| Cumberland Gap<br>National Historic Park   | 100%                      | 0%                                   | 1                                      | 0                                               | 0                         | 0                                  |
| Great Smoky Mountains<br>National Park     | 100%                      | 0%                                   | 2                                      | 0                                               | 0                         | 0                                  |
| Kings Mountain National<br>Park            | 100%                      | 0%                                   | 0                                      | 0                                               | 0                         | 0                                  |

\*Includes units with Pre and Post burn monitoring only

**Table 3. Communicating Results - 2013**

| Park | # of Project Monitoring Reports completed in 2013 | # of Annual meeting(s) with Park staff | # of Formal presentations of results | Do you use Minitab?* |
|------|---------------------------------------------------|----------------------------------------|--------------------------------------|----------------------|
| BISO | 2                                                 | 1                                      | 0                                    | Yes                  |
| BLRI | 2                                                 | 0                                      | 0                                    | Yes                  |
| CAHA | 0                                                 | 0                                      | 0                                    | Yes                  |
| CONG | 0                                                 | 1                                      | 0                                    | Yes                  |
| COWP | 0                                                 | 0                                      | 0                                    | Yes                  |
| CUGA | 1                                                 | 0                                      | 0                                    | Yes                  |
| GRSM | 3                                                 | 1                                      | 0                                    | Yes                  |
| KIMO | 2                                                 | 0                                      | 0                                    | Yes                  |

**Table 4. Research - 2013**

| Park | Are research needs identified in FMP or Monitoring Plan? (yes or no) | # of Proposals Submitted in 2013 | # of Proposals Funded in 2013 | # of Research Projects Supported in 2013* | Additional Comments |
|------|----------------------------------------------------------------------|----------------------------------|-------------------------------|-------------------------------------------|---------------------|
| BISO | yes                                                                  | 0                                | 0                             | 0                                         |                     |
| BLRI | yes                                                                  | 0                                | 0                             | 0                                         |                     |
| CONG | yes                                                                  | 0                                | 0                             | 0                                         |                     |
| COWP | yes                                                                  | 0                                | 0                             | 0                                         |                     |
| CUGA | yes                                                                  | 0                                | 0                             | 0                                         |                     |
| GRSM | yes                                                                  | 1                                | 0                             | 6                                         | Heavy support       |
| KIMO | yes                                                                  | 0                                | 0                             | 0                                         |                     |

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

*The End*