



**National Park Service
Fire Ecology Annual Report
Calendar Year 2004
Little River Canyon National Preserve**

Introduction

Monitoring of fire effects by the National Park Service began at Little River Canyon National Preserve in 1998, with the establishment of the first permanent vegetative monitoring plots. During 2004, the NATR Fire Effects Monitoring (FEM) crew worked in 9 different monitoring plots and 3 burn units. This report will summarize the fire effects monitoring data available through 2004. The purpose of this report is to inform fire and resource management personnel of the trends associated with prescribed fire, thereby facilitating the first steps of adaptive management.

The FEM program is undergoing transition from the current DOS-based data management program Fire Monitoring Handbook (FMH) to a Microsoft Access-based data management program referred to as the Fire Ecology Assessment Tool (FEAT). FEAT will allow for increased flexibility in data handling and analysis. Perhaps most importantly, FEAT will allow for the easy export of data into readily-available statistical software packages such as Minitab. The transition to FEAT is expected to be completed by September, 2005. Once the transition is complete, data will be analyzed using inferential statistics. Data presented here is analyzed descriptively.

Table 1. Burn units at and associated plot information (through 2004).

Burn Unit	Number of Plots	Year Plots Established	Year of Burn(s)
01/103 (Grogan's Bog)	3	1998 and 2002	1998 and 2002
Kral's Complex	5	1998, 1999, 2001, 2005	1999, 2001, 2005
Brook's Branch	5	2002	2002
07/08	4	2002	2002
02/103	1	2002	unburned
Slant Rock	2	2004	unburned
Field School	1	2003	unburned
Total	21		

Fire Effects Monitoring Methods

The fire effects monitoring that occurs at LIRI is adapted from the NPS Fire Monitoring Handbook protocol (see http://www.nps.gov/fire/fire/fir_eco_science_monitoring_FMH.html). In general, the monitoring consists of installation of permanent vegetation plots in representative monitoring types¹. Currently, there are 21 plots at LIRI in 3 different monitoring types (Table 1). The form referred to as the FMH-4 describes the characteristics and objectives of prescribed fire in the particular monitoring type. The FMH-4s for each monitoring type are given in Appendix 1. The FMH-4s are fluid documents, and are meant to be refined as more information is gained regarding appropriate burn prescriptions, seasons, and intervals. Input from the research community, resource management, fire managers, and local experts is also of the utmost importance in refining the FMH-4s.

The general goal is to install 10 plots in each monitoring type, and then to reevaluate the need for additional plots. Ideally there will be monitoring plots in each burn unit, but limitations of time and money can prevent installations in every unit (Table 2).

¹ A monitoring type is defined as a major fuel-vegetation complex or vegetation association subject to a particular burn prescription.

Table 2. Plot Monitoring and Install Schedule for LIRI.

Monitoring Type	PIEC	PIEC	PIEC	FPIEC	FPIEC	FPIEC	FPIEC	FPIEC	FPIEC	FPIEC	FPIEC
Plot #	19	21	22	23	24	25	26	27	28	29	30
Burn Unit	01/103	Kral's Complex	Kral's Complex	Kral's Complex	Brook's Branch	Brook's Branch	07/08	02-103	01-103	07/08	Slant Rock
Install Date	04.08.2002	10.19.1999	10.20.1999	10.21.1999	02.08.2002	02.25.2002	04.10.2002	10.24.2002	03.28.2002	04.09.2002	3.24.04
Burn Status	06.13.02	03.27.01 5.26.05	03.27.01	03.27.01 5.26.05	06.09.02	06.09.02	06.13.02	unburned	06.13.02	06.13.02	unburned
00Pre	Done (04.08.2002)	Done (10.19.1999)	Done (10.20.1999)	Done (10.21.1999)	Done (02.08.2002)	Done (02.25.2002)	Done (04.10.2002)	Done (Started 10.24.2002; Finished 4.01.03)	Done (03.28.2002)	Done (04.09.2002)	Done (03.24.04)
01Post	Done (06.25.2002)	Done (03.28.01)	Done (3.28.2001)	Done (3.28.2001)	Done (06.11.2002)	Done (07.23.2002)	Done (07.24.2002)	Waiting For Burn (if no burn: RR in June 2005)	Done (06.14.2002)	Done (06.27.2002)	Waiting For Burn (if no burn: RR in June 2006)
01Mo04	Done (08.27.2002)	Done (10.16.2001)	Done (10.16.2001)	Done (10.15.2001)	Done (08.29.2002)	Done (08.29.2002)	Done (08.28.2002)		Done (08.26.2002)	Done (08.27.2002)	
01Yr01	October 2003	Done (10.21.2002)	Done (10.23.2002)	Done (10.22.2002)	September 2003	September 2003	September 2003		October 2003	October 2003	
01Yr02	September 2004	Done (10.24.03)	Done (09.10.2003)	Done (10.24.03)	August 2004	August 2004	August 2004		August 2004	August 2004	
01Yr03	Done April 2005 See 2-Page 3	Done (9.24.04)	Done (9.24.04)	Done (9.24.04)	Done March 2005 See 4-Page 3	Done March 2005 See 4-Page 4	Done April 2005 See 2-Page 3		Done April 2005 See 2-Page 3	Done April 2005 See 2-Page 3	
01Yr05	To Be Done April 2007	N/A	To be Done October 2006	N/A	To Be Done February 2007	To Be Done February 2007	To Be Done April 2007		To Be Done April 2007	To Be Done April 2007	
02Post		Done (5.27.05)		Done (5.27.05)							
02Yr01		To be Done October 2006		To be Done October 2006							

Table 2, continued. Plot Monitoring and Install Schedule for LIRI.

Monitoring Type	FQUMO	FQUMO	FQUMO	FQUMO	FSAOR	FSAOR	FSAOR	FSAOR	FSAOR	FSAOR
Plot #	30	32	33	34	1	2	3	4	5	6
Burn Unit	07/08	07/08	Field School	Slant Rock	Kral's Complex	Kral's Complex	01-103/Grogan's Bog	Brook's Branch	Brook's Branch	Brook's Branch
Install Date	04.26.2002	04.10.2002	04.02.2003	03.22.04	7.28.1998	7.29.1998	7.28.1998	02.05.2002	02.07.2002	02.26.2002
Burn Status	06.13.02	06.13.02	unburned	unburned	04.04.99 03.27.01 5.26.05	04.13.99 03.27.01 5.26.05	05.11.00 06.13.02	06.09.02	06.09.02	06.09.02
00Pre	Done (04.26.2002)	Done (04.10.2002)	Done (04.02.2003) *Herb data collected 10.24.03	Done (03.24.04)	Done (07.28.1998)	Done (07.29.1998)	Done (07.28.1999)	Done (02.05.2002)	Done (02.07.2002)	Done (02.26.2002)
01Post	Done (06.27.2002)	Done (06.27.2002)	Waiting For Burn (if no burn: RR in June 2005?)	Waiting For Burn (if no burn: RR in June 2006)	Done (04.13.1999)	Done (04.14.1999)	No Post Read Taken	Done (06.12.2002)	Done (06.10.2002)	Done (06.13.2002)
01Mo04	Done (08.14.2002)	Done (08.14.2002)			Done (07.27.1999)	Done (07.27.1999)	Done (07.26.2000)	Done (08.12.2002)	Done (08.13.2002)	Done (08.13.2002)
01Yr01	October 2003	October 2003			Done (07.24.2000)	Done (07.25.2000)	Done (08.01.2001)	October 2003	October 2003	October 2003
01Yr02	August 2004	August 2004			N/A	N/A	N/A	August 2004	August 2004	August 2004
01Yr03	Done April 2005 See 2-Page 3	Done April 2005 See 2-Page 3			N/A	N/A	N/A	Done March 2005 See 4-Page 3	Done March 2005 See 4-Page 4	Done March 2005 See 4-Page 5
01Yr04	To Be Done April 2007	To Be Done April 2007			N/A	N/A	N/A			
01Yr05					N/A	N/A	N/A	To Be Done February 2007	To Be Done February 2007	To Be Done February 2007
02Post					Done (03.29.2001)	Done (03.28.2001)	Done (07.23.2002)			
02mo4					Done (07.31.2001)	Done (08.01.2001)	Done (08.14.2002)			
02yr01					Done (8.13.2002)	Done (8.13.2002)	Done (10.06.2003)			
02yr02					Done (09.11.2003)	Done (10.24.03)	Done 08.31.04			
02Yr05					N/A	N/A	To be Done Fall 2007			
03 Post					Done 5.27.05	Done 5.27.05				
03Yr01					To Be Done July 2006	To Be Done July 2006				

Table 2, continued. Plot Monitoring and Install Schedule for LIRI.

Notes

Some plots were read one and/or two years postfire but not necessarily in the same season in which the preread was done (see below) Bold font denotes affected plots. Herbaceous data impacted most significantly; in order to mitigate, herbaceous data was reread in the next applicable season.

1) PIEC 19, 26, 28, 29 and QUMO 30, 32: **(a)** 01 YR 01 Read for these plots should have been completed in April 2003 to coincide with the season of the 00Pre-read. **(b)** 01 YR 02 Read should have been completed in April 2004 to coincide with the season of the 00Pre-Read.

(2) PIEC 19, 26, 28, 29 and QUMO 30, 32: We will sample the 50m Herbaceous Transect and the Nested Herbaceous Subplot in April 2005 to capture 01 YR 03 data (since 01 YR 01 and 01 YR 02 herbaceous data does not coincide with the 00Pre-Read season)

(3) PIEC 24, 25 and SAOR 4-6: **(a)** 01 yr 01 Read should have been completed in February 2003 to coincide with the season of the 00Pre-Read. **(b)** 01 yr 02 Read should have been completed in February 2004 to coincide with the season of the 00Pre-Read.

(4) PIEC 24, 25 and SAOR 4-6: We will sample the 50m Herbaceous Transect and the Nested Herbaceous Subplot in February 2005 to capture 01 yr 03 data (since 01 YR 01 and 01 YR 02 herbaceous data does not coincide with the 00Pre-Read season)

Little River Canyon National Preserve

Results

Results for objective variables are given in Table 3. All results shown are 80% confidence intervals of the mean unless otherwise noted. Fuel reduction objectives/results are mean percent reduction from preburn to immediate postburn, unless otherwise stated. An underlined number of plots denote that minimum sample sizes have been achieved. Figures associated with each objective variable follow Table 3.

Table 3. Management Objectives and Monitoring Results through 2004.

Monitoring Unit	Management Objective (Restoration)	Monitoring Results (80% confidence interval)	Objective Achieved? (minimum plots achieved/needed)
LIRI FPIEC1DG09 Shortleaf pine forest <i>Pinus echinata</i>	25-80% reduction in pole-sized trees by 3 rd burn	Pole reduction = 50% by Year 2. (n= <u>10</u> , 1 fire) Figure 1	Yes
	25-50% reduction in downed woody fuel and litter/duff by 3 rd burn	Average fuel load reduction = 22% (n= <u>9</u> plots, 1 fire) Figure 2	No, but required number of fires not met
	25-50% increase native grass and forb cover	Average forb and grass cover increase = 42% ² (n=3, 1 fire) Figure 3	Yes, but minimum sample size not met

Little River Canyon National Preserve

Table 3, continued. Management Objectives and Monitoring Results through 2004

Monitoring Unit	Management Objective (Restoration)	Monitoring Results (80% confidence interval)	Objective Achieved? (minimum plots achieved/needed)
LIRI FSAOR1G10³ Green pitcher plant forest <i>Sarracenia oreophila</i>	30-90% decrease in pole-sized trees by second year after 3rd burn.	Pole reduction = 7% by Year 2 (n=3, 1 fire) Figure 4	No- but minimum sample size and required number of fires not met (3/9).
	40-90% decrease in shrub cover by second year after 3rd burn	Increase in shrub cover of 19% by Year 2. (n=3, 2 fires) Figure 5	No- but minimum sample size and required number of fires not met (3/16)
	20% increase cover of <i>S. oreophila</i> by second year after 3 rd burn	Increase in <i>S. oreophila</i> cover of 28% by Year 2. (n=3, 2 fires) Figure 6	Yes- but minimum sample size and required number of fires not met (3/89)
	25% reduction in litter and duff fuel load	Litter and duff reduction =45% by Year 2 (n=5, 1 fire) Figure 7	Yes (on plots but not monitoring type as a whole; see footnote 7).
LIRI FQUMO1G10 Chestnut oak-dominated forests <i>Quercus montana</i>	20-60% reduction in pole-sized trees	Pole density reduction = 28% by Year 2. (n=2, 1 fire) Figure 8	Yes- but minimum sample size not met
	25-50% reduction in total fuel load	Total reduction =27% by Year 2 (n=2 1 fire) Figure 9	Yes- but minimum sample size not met (2/4)
	25-50% increase native grass and forb cover	Increase in native forb cover =50% between Year 1 and Year 2. (n=2, 1 fires) Figure10	No- but minimum sample size not met (2/35 with R=25)
	Limit mortality of overstory trees to less than 20%	Average increase in density = 5% by three years postburn (n=2, 1 fires) Figure 11	Yes- but minimum sample size not met.

³ Plots within the SAOR monitoring type are not randomly distributed; plots were installed to encompass existing *Sarracenia* populations. Therefore, minimum sample size suggestions are not particularly applicable and results cannot be extrapolated to the entire monitoring type.

Little River Canyon National Preserve

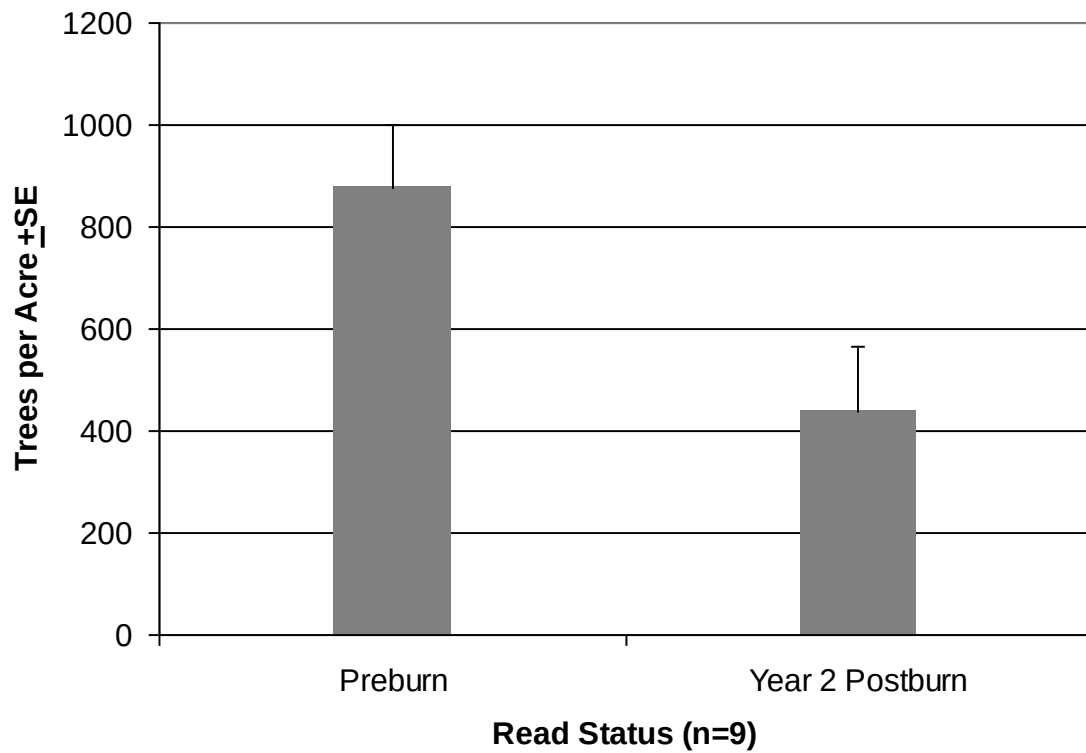


Figure 1. Average density of pole trees per acre for 9 *Pinus echinata* plots at LIRI ($\pm$ average standard error). Year 2 data was taken from 24-27 months postburn. Objective for pole reduction is 25%; actual reduction was approximately 50% by Year 2.

Little River Canyon National Preserve

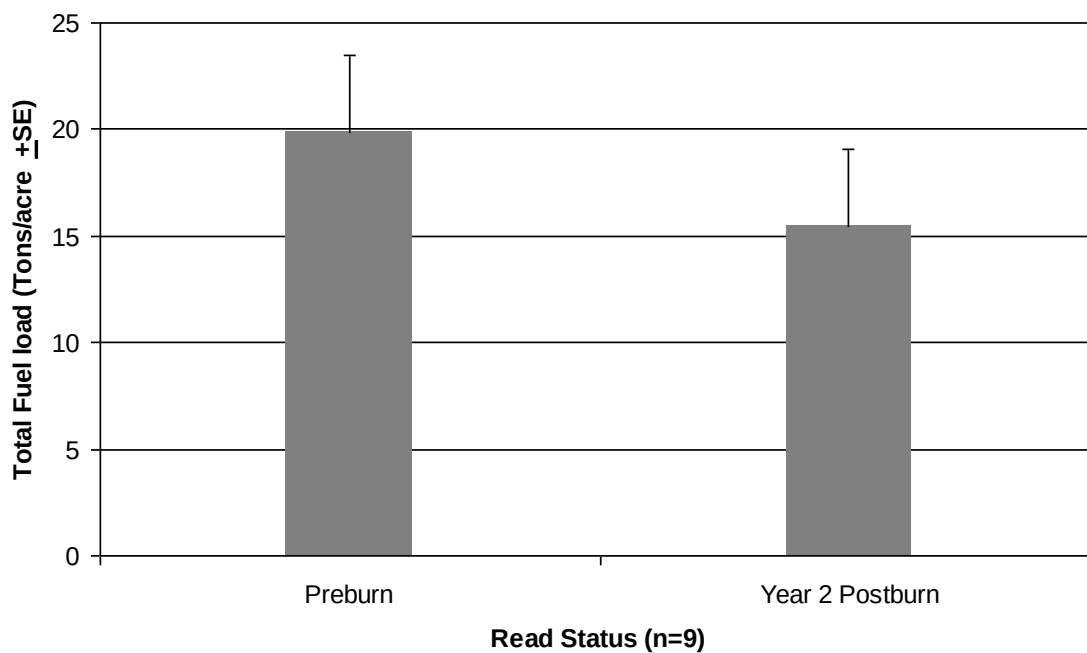


Figure 2. Average total fuel load in tons per acre for 9 *Pinus echinata* plots at LIRI ($\pm$ average standard error). Year 2 data was taken from 24-27 months postburn. Objective for fuel reduction is 25%; actual reduction was approximately 22% by Year 2.

Little River Canyon National Preserve

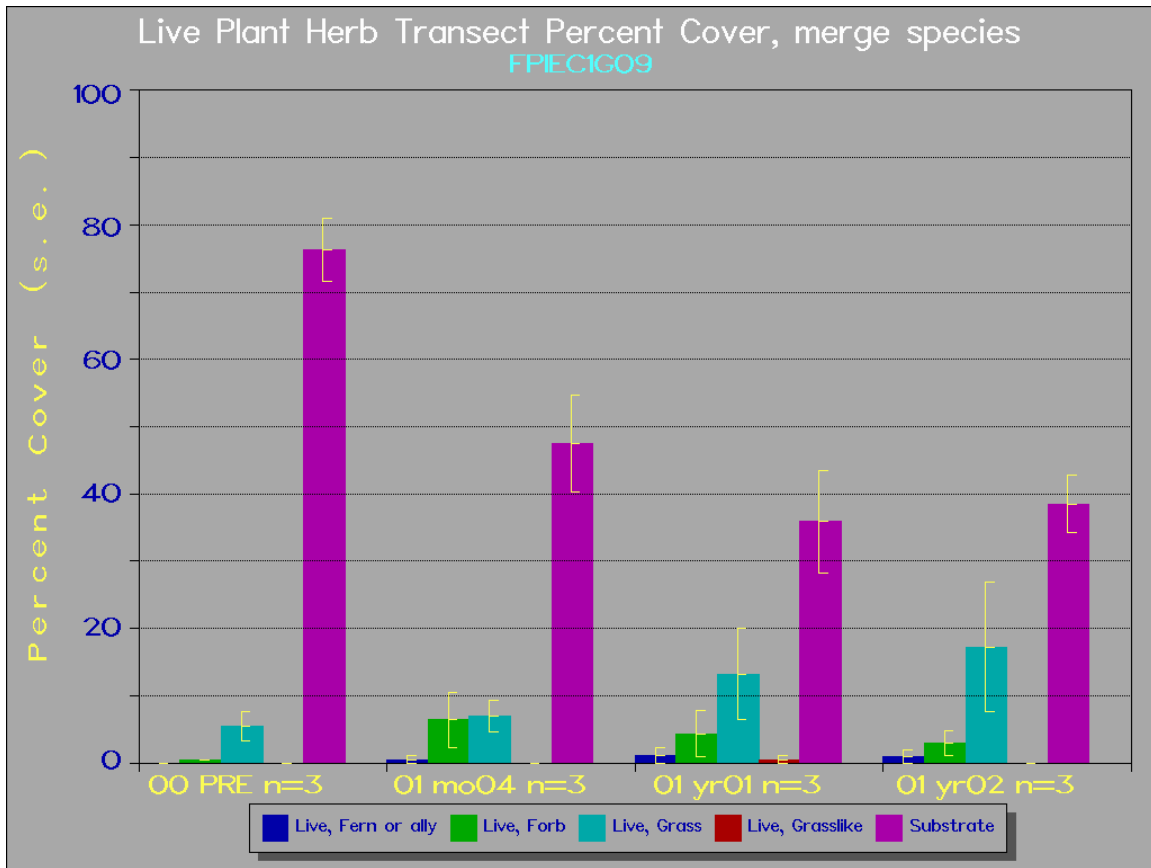


Figure 3. Herbaceous cover change LIRI ($\pm$ average standard error) on 3 *Pinus echinata* plots at LIRI. Average increase was 42%, while objective was 25% increase.

Little River Canyon National Preserve

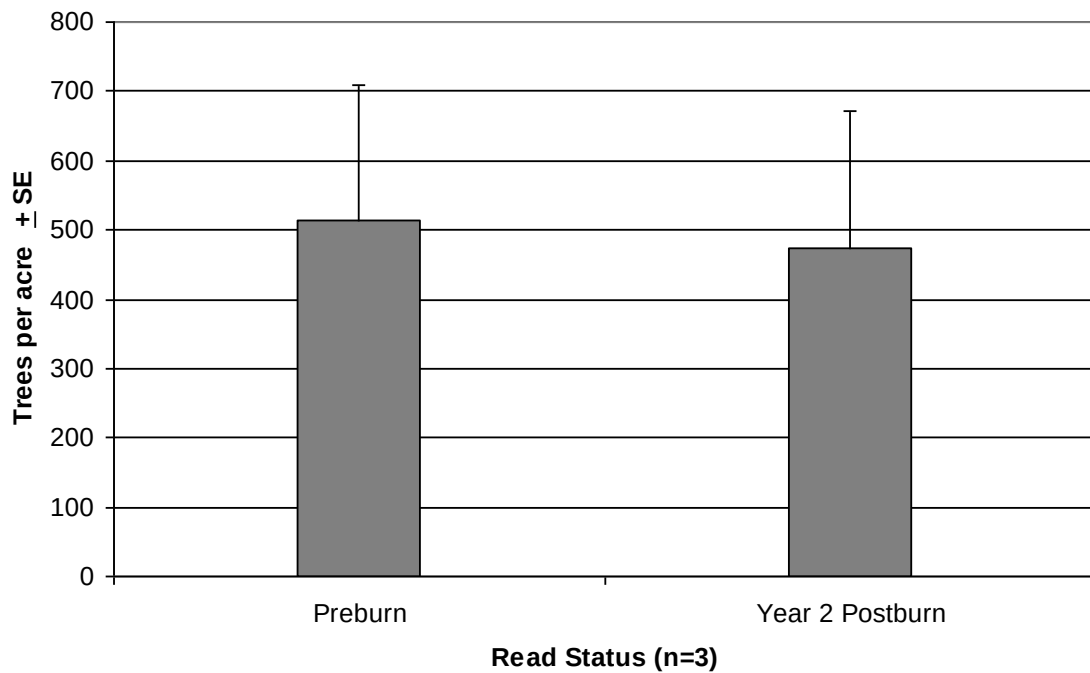
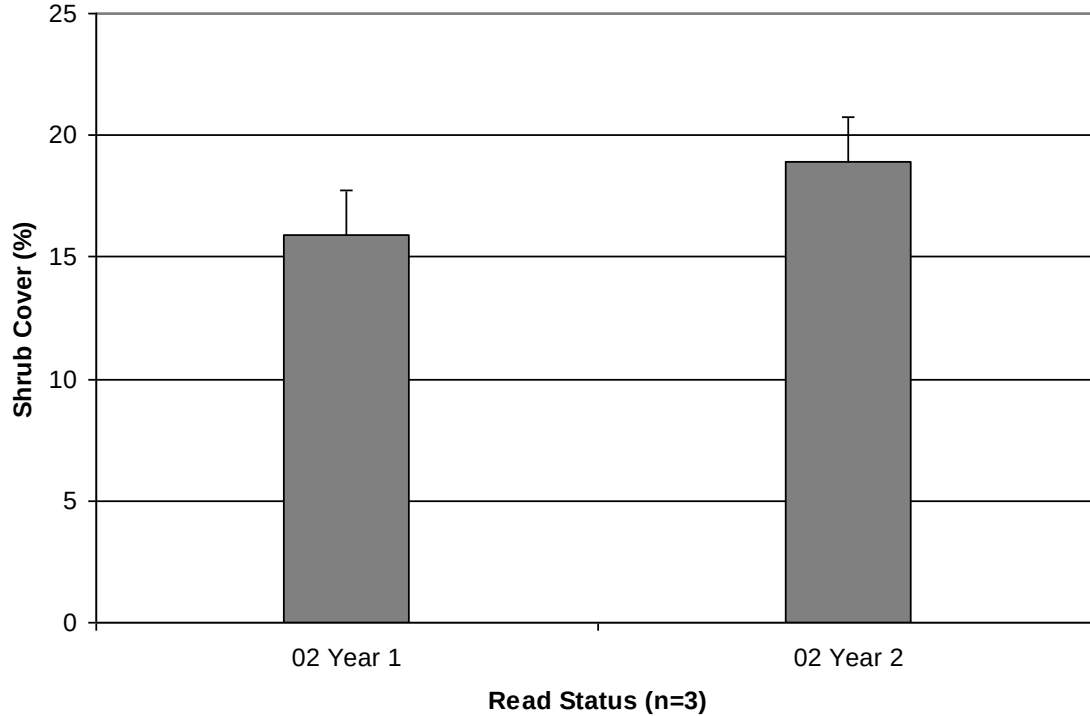


Figure 4. Average density of pole-sized trees per acre for 3 *Sarracenia oreophila* plots at LIRI ($\pm$ average standard error). Year 2 data was taken 26 months postburn. Objective for pole reduction is 30%; actual reduction was approximately 7% by Year 2.



Little River Canyon National Preserve

Figure 5. Average shrub cover for 3 *Sarracenia oreophila* plots at LIRI ($\pm$ average standard error). Data shown compares shrub cover collected at one and two years after the second fire. Objective for shrub reduction is 30%; actual change was an increase of 19% by Year 2.

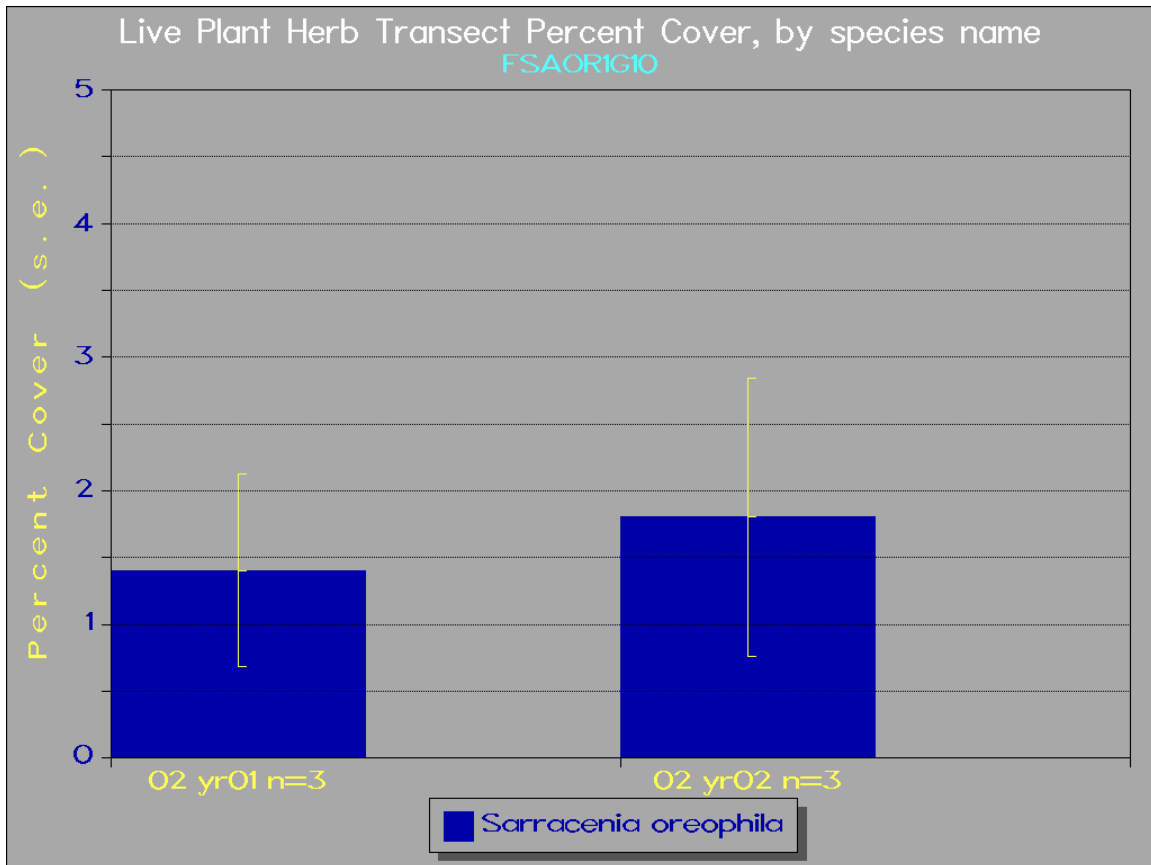


Figure 6. Average cover of *Sarracenia oreophila* on 3 plots at LIRI ($\pm$ average standard error). Data shown compares cover collected at one and two years after the second fire. Objective for cover increase is 20%; actual change was an increase of 28% by Year 2.

Little River Canyon National Preserve

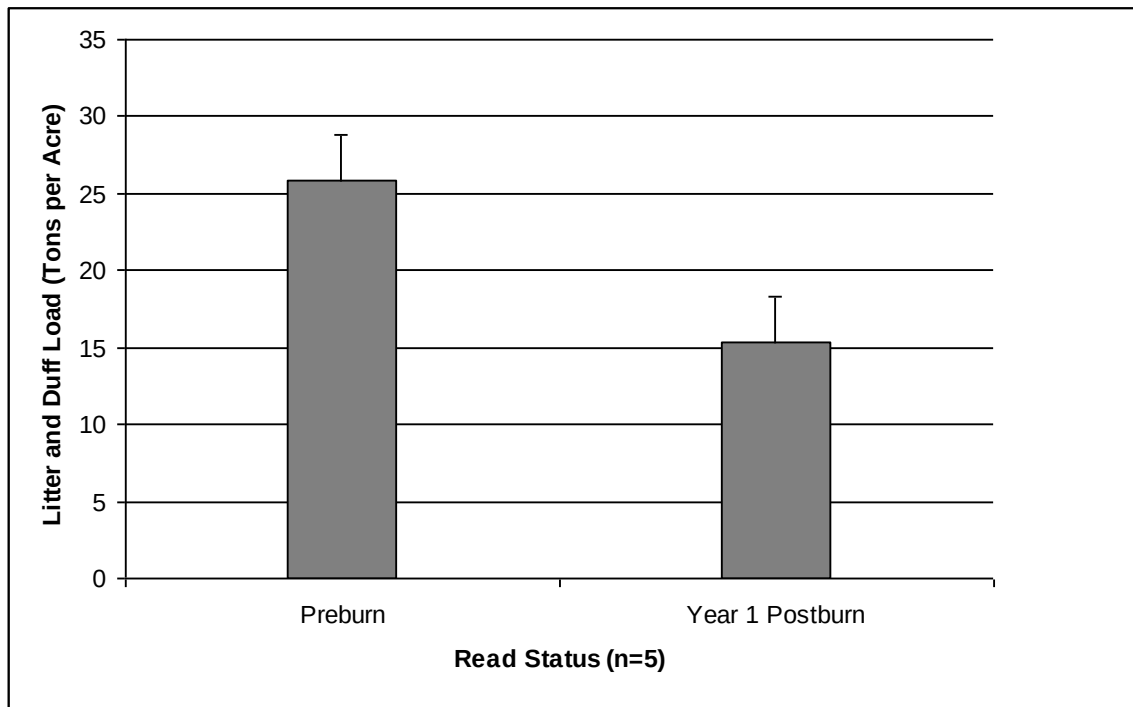


Figure 7. Average litter and duff in tons per acre for 6 *Sarracenia oreophila* plots at LIRI ($\pm$ average standard error). Year 2 data was taken 26 months postburn. Objective for fuel reduction is 25%; actual reduction was approximately 40% by Year 2.

Little River Canyon National Preserve

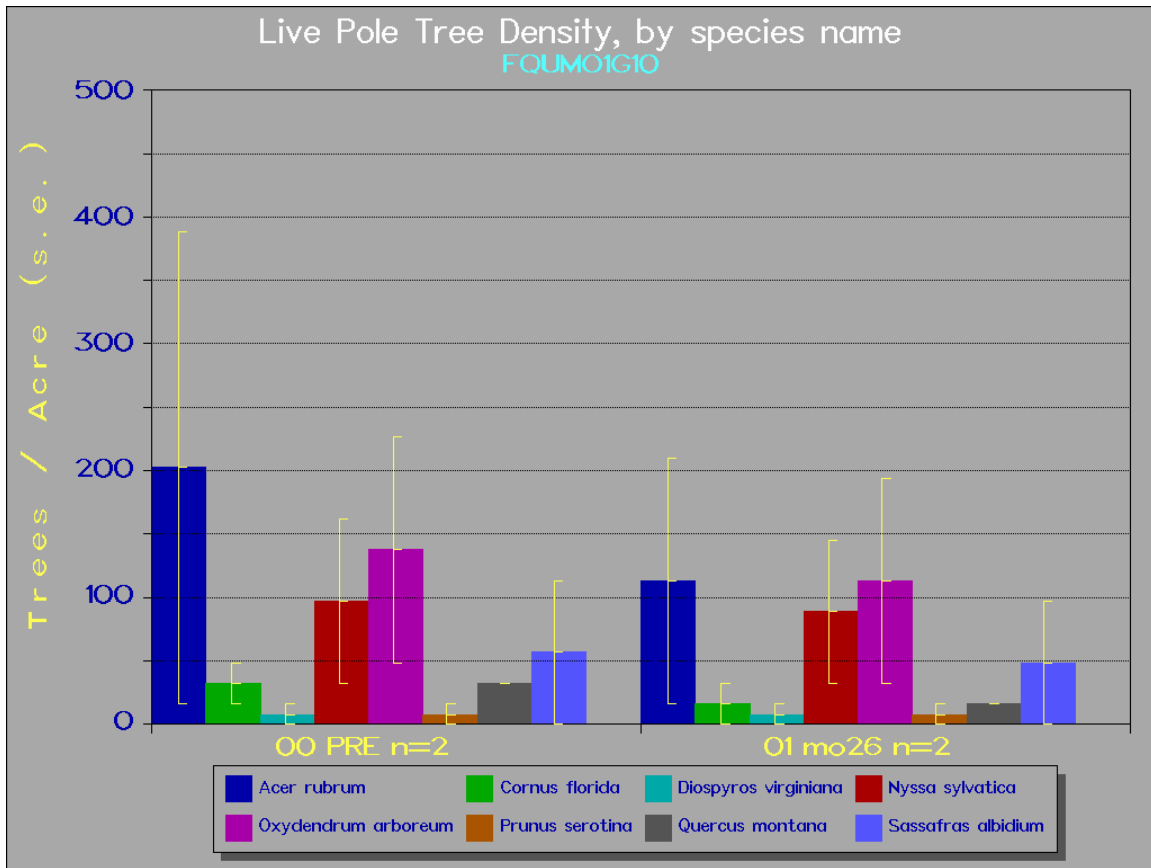


Figure 8. Average density of pole-sized trees per acre for 2 *Quercus montana* plots at LIRI ($\pm$ average standard error). Year 2 data was taken 26 months postburn. Objective for pole reduction is 20%; actual reduction was approximately 28% by Year 2.

Little River Canyon National Preserve

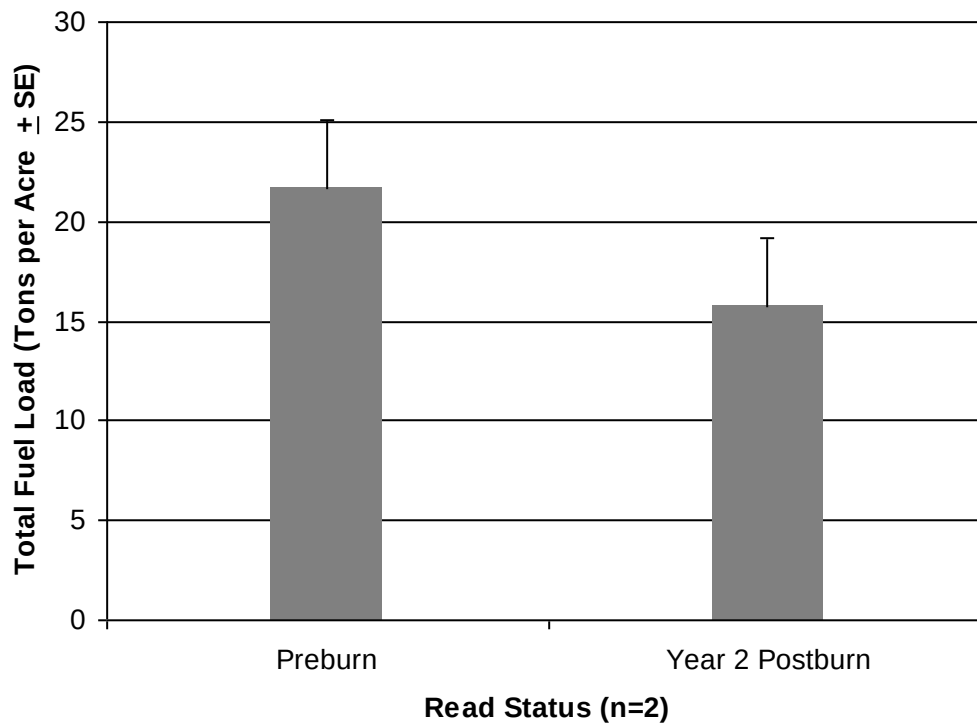


Figure 9. Mean total fuel load $\pm$ SE on 2 *Quercus montana* plots at LIRI. Data was taken 26 months postburn. Objective for fuel load reduction is 25% from preburn levels; observed reduction was 27%.

Little River Canyon National Preserve

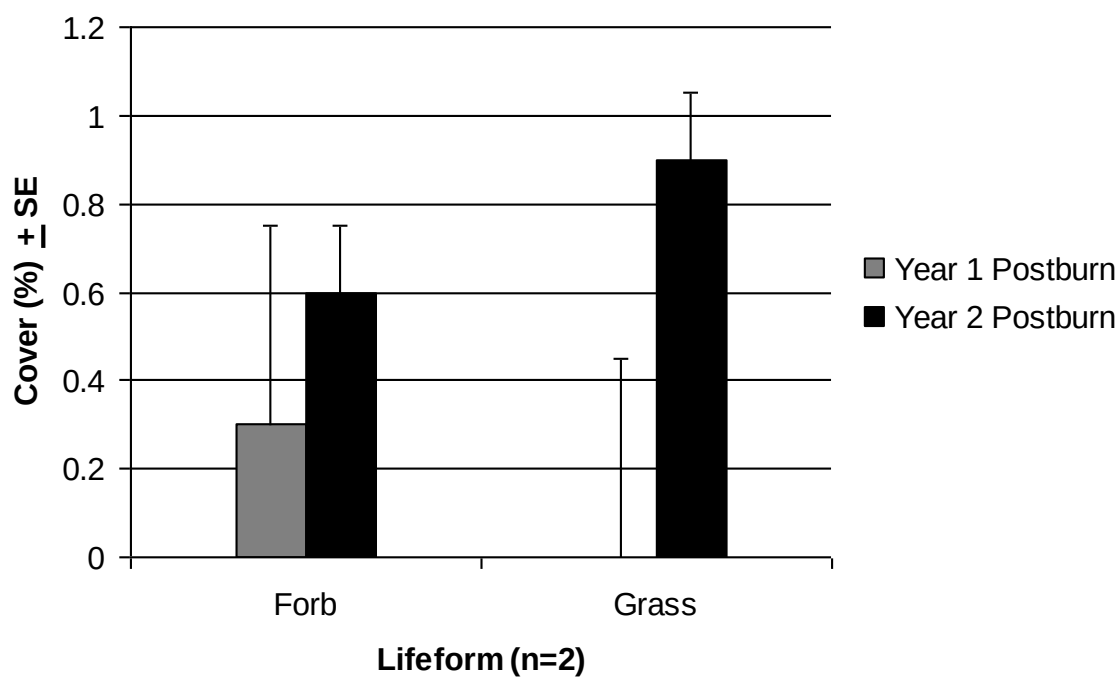


Figure 10. Mean percent cover $\pm$ SE of native grasses and forbs on 2 *Quercus montana* plots at LIRI. Data was taken 16 and 26 months postburn. Objective for herbaceous cover increase is 25% from preburn levels; observed change for forbs was 50%. No preburn data is available.

Little River Canyon National Preserve

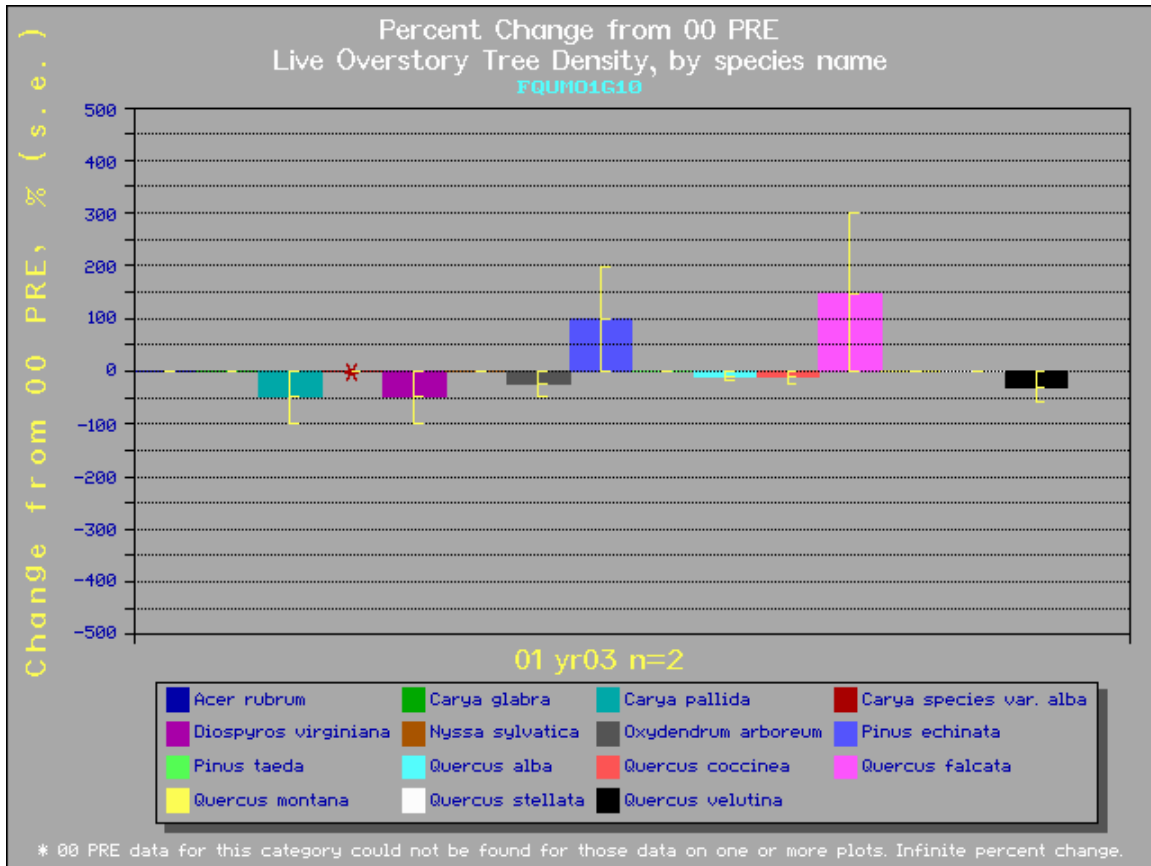


Figure 11. Overstory mortality $\pm$ SE on 2 *Quercus montana* plots at LIRI. Data was taken 3 years postburn. Objective for overstory density is less than 20% mortality; observed trend change was an average increase of 5%. Note significant variability in the data.

Little River Canyon National Preserve

Discussion

Pinus echinata Monitoring Type

The objective for pole density reduction in the PIEC monitoring type is 25-80%, and the observed reduction of 50% fell within this accepted range (Figure 1). Pole density decreased from approximately 800 trees per acre to 400 trees per acre, and this trend reflects that the objectives for pole reduction were reasonable in this ecosystem. Similar desirable trends in fuel reduction were evident, with total fuel load decrease of approximately 22% (Figure 2). Although the minimum desired decrease was 25%, the requisite number of fires has not occurred (one of three fires), so this objective will be reevaluated after additional fire treatments. Reduction in pole density and fuel load may have resulted in the concomitant increase in native herbaceous cover observed in the PIEC monitoring type; average grass and forb cover increased by 42%, thereby meeting the objective of a 25-50% increase (Figure 3).

Sarracenia oreophila Monitoring Type

Increased pole tree density due to fire suppression has contributed to the decline of *Sarracenia oreophila* in the SAOR monitoring type. Although a trend in pole density reduction in the SAOR monitoring type was evidenced by a 7% decrease at two years postburn, this reduction did not meet the minimum objective decrease of 30% (Figure 4). However, the recommended number of fires has not yet occurred for all plots. Preliminary evaluations of severity data suggest that the fires may not have been hot enough to cause significant mortality to pole-sized trees.

Shrub cover in the SAOR monitoring type was associated with an increase of 19%, whereas the objective was a 30% decrease (Figure 5). The main shrub species in this monitoring type, such as *Rhododendron* spp. and *Vaccinium* spp. are known to become established in the absence of fire. It is likely that additional fire treatments are needed before significant decreases in the shrub component are observed.

Even though observed pole density and shrub cover reductions did not meet minimum objectives, trends for percent cover of *Sarracenia oreophila* revealed an increase of 28% by two years after the second fire (Figure 6). In addition, the fuel reduction objective of 25% was exceeded as average litter and duff load was reduced by approximately 45% (Figure 7).

It is important to keep in mind that plots within the SAOR monitoring type were installed to encompass existing SAOR populations, and were therefore not distributed randomly. This means that if all SAOR populations were monitored, the observed results can be applied to the whole monitoring type. Since we cannot be absolutely sure that all populations have been monitored, we cannot extrapolate the observed results to the entire monitoring type. Nonetheless,

Little River Canyon National Preserve

it is still possible to determine the effects of fire on the identified SAOR populations even if the results cannot be applied to the monitoring type as a whole.

Quercus montana Monitoring Type

In preliminary evaluations of the two available QUMO plots, it appears that both pole density and fuel load were reduced by approximately 27% (Figures 8 and 9). Native forb cover appeared to increase by approximately 50% between one and two years postburn⁴ (Figure 10), but cover of grass species decreased. Note that cover of both native herbs and grasses accounts for less than 1% of total cover in this monitoring type, as herbaceous vegetation is generally sparse. Overstory density decreases averaged much less than 20% (Figure 11).

Status of Planning Documents

As stated in RM-18 Chapter 11, fire monitoring plans are required for all park units using prescribed fire or wildland fire use. These plans are necessary in order to ensure that treatments are effective and that management goals and objectives are met. The fire monitoring plan is an appendix to the Fire Management Plan, which is tiered to both the Resource Management Plan and the General Management Plan. Currently, a fire monitoring plan for LIRI is scheduled for completion during FY06. It is anticipated that a draft version of the plan should be forwarded to the appropriate personnel at LIRI in the summer of 2006, so that the document can become collaborative in nature. Continued input from LIRI fire and resource management personnel is critical.

⁴ . No preburn herbaceous data was available for the two QUMO plots that have burned.

Appendix 1

Monitoring Type Descriptions

Note: Monitoring Type Descriptions are in review. Suggestions for improvement are welcomed. Final descriptions will be available in the LIRI Fire Monitoring Plan. A draft of the LIRI Fire Monitoring Plan is planned for Summer 2006. Areas in red need particular attention.

Little River Canyon National Preserve
SAOR Monitoring Type Description Sheet

FMH-4

PARK: LIRI

Monitoring Type Code: F S A O R 1 G 0 1 0

Date Described: 4/99

Revised: 6/03 and 7/05

Monitoring Type Name: Green Pitcher Plant bog forests.

Preparers: Nate Benson. Revised by Mary Shew and Lisa McInnis.

Burn Prescription Burning of units will occur between March and October.

Flame lengths 0.5-6 feet, Optimum - 2-3 feet

Air Temperature 50-95 degrees, Optimum - 65-85 degrees

Relative Humidity 15-90%, Optimum - 30-40%

1 hour fuel moisture 3-12%, Optimum - 5-6%

10 hour fuel moisture 5-14%, Optimum - 6-8%

Fire Management Objective(s): Decrease pole tree density by 30-90% and shrub cover 40-90% by the second year after third burn. Increase percent cover of *S.oreophila* by 20% by second year after third burn. Reduce total fuel load by 20-40% immediately postburn.

Fire Monitoring Objective(s): Sample pole-size trees, shrub cover, fuel load and *S. oreophila* cover with adequate sample size to be 80% confident in detecting a 30% decrease in pole density, a 40% decrease in shrub density, a 20% increase in *S. oreophila*, and a 20% decrease in total fuel load, accepting a 20% chance of concluding that these changes took place when they really did not.

Fire Monitoring Variable(s): Pole density, shrub cover and *S. oreophila* cover, total fuel load

Physical Description: Rocky seepage bogs within upland plateau forests with slope 0-10% (all aspects). Elevation 1100-1400 feet. Water table at or near the surface. **Add soils information and geological description.**

Biological Description: Bog vegetation communities consisting (or potential to consist) of *Sarracenia oreophila*. Associated vegetation variable between sites, but includes successional species such as red maple (*Acer rubrum*), sweetgum (*Liquidambar styraciflua*), loblolly pine (*Pinus taeda*), as well as (*Oxydendrum arboreum*) and southern red oak (*Quercus falcata*). The dominant shrub species include blueberry (*Vaccinium* spp.) and chokeberry (*Aronia arbutifolia*). Herbaceous species include cinnamon fern (*Osmunda cinnamomea*), dwarf iris (*Iris verna*), *Dicanthelium* spp., and various asteraceous species.

Rejection Criteria: None identified as monitoring is intended to be a complete census.

Notes: Plots not random. Placed over *S. oreophila* populations already being monitored by LIRI staff. Bogs are generally smaller than FMH plots; therefore, partial plots (1 or 2 quarters) are sometimes monitored. SAOR plots 1 and 5 consist of one quarter (quarter plots) and SAOR plots 3 and 4 consist of 2 quarters (half plots). Data will not be extrapolated to other bogs. Due to the need to increase light to the forest floor quickly, LIRI staff mechanically thinned SAOR plots 4, 5, and 6 in the spring of 2004 under advisement from the FWS (**confirm that these were the only plots thinned**).

Little River Canyon National Preserve

SAOR Monitoring Type Description Sheet

GENERAL PROTOCOLS		Yes/No	
Preburn			
	Control Plots	No	
	OP/Origin Buried	No	
	Voucher Specimens	Yes	
	Abbreviated Tags	Yes	
	Herb Fuel Load	No	
	Brush Fuel Load	No	
	Stakes (REBAR) Installed: 17		
Burn			
	Duff Moisture	No	
	Flame Depth	No	
FOREST PLOT PROTOCOLS			
Preburn Read (00 Pre)			
Overstory			
	Trees Tagged	Yes	Area Sampled: 50 x 20 m
	Trees Mapped	Yes	Quarter(s) Sampled: All 4 quarters (Q1-Q4)
	DBH	Yes	
	Dead Recorded	Yes	
	Live Crown Position Coded	Yes	
	Live Damage Coded	Yes	
	Dead Crown Position Coded	Yes	
	Dead Damage Coded	No	
Pole-Size			
	Trees Tagged	Yes	Area Sampled: 25 x 10 m
	Trees Mapped	Yes	Quarter(s) Sampled: 1 quarter (Q1)
	DBH	Yes	
	Dead Recorded	Yes	
	Height Code Recorded	Yes	
Seedling			
	Seedlings Mapped	No	Area Sampled: 10 x 5 m belt along P1-P2 line
	Dead Recorded	No	Quarter Sampled: Q1
	Height Code Recorded	Yes	
	Tally Count	Yes	
Brush			
	Tally Count	N/A	
	Age (immature, resprout, mature)	N/A	
	Dead Recorded	N/A	
	Area Sampled: none		
	Quarters Sampled: none		

Little River Canyon National Preserve

SAOR Monitoring Type Description Sheet

FOREST PLOT PROTOCOLS		Yes/ No	[continued]
Preburn Read (00 Pre) [continued]			
Herbaceous			
	Point Intercept Method	Yes	
	Tallest Species Height Recorded	Yes	
	All Species Intercepted Recorded	Yes	
	Point Intercept Recorded for full length of Q4-Q1 (start tape @ Q4)		
	Nested subplots (in 1 quarter) to augment the herbaceous transect. These are taken as 1m x 1m, 10m x 10m, 10m x 25m. In Q1 and Q3, the 1x1 is near the origin, in Q2 it is near P2 and in Q4 it is near P1. Record the quarter with the most sample reads (e.g. If Q1,Q2,Q3, and Q4 were recorded @ 00Pre, Q1,Q3, and Q4 were recorded @ 01yr1, Q1 and Q3 were recorded at 01 yr2 then you should choose between either Q1 or Q3 (not Q2 or Q4) next time the plot is monitored)		
Fuel Loadings			
	Sampling Plane Lengths along Brown’s Transects:		
	1 hour fuels: 0-6 feet		
	10 hour fuels: 0-6 feet		
	100 hour fuels: 0-12 feet		
	1,000 hour fuels (rotten and solid): 0-50 feet		
	Litter and Duff Measurements: 1,5,10,15,20,25,30,35,40, and 45 feet		
Immediate Postburn Read (01 Post, 02 Post, 03 Post, etc...)			
Overstory			
	Record Tag #	Yes	
	Record Tree Status (alive, dead, resprout, consumed)	Yes	
	DBH	No	
	Maximum Scorch Height	Yes	
	% Crown Scorched	Yes	
	Char Height	Yes	
Pole-Size			
	Record Tag #	Yes	
	Live and Dead Recorded	Yes	
	DBH	No	
	Height	No	
	Maximum Scorch Height	Yes	
	% Crown Scorched	Yes	
	Char Height	Yes	
Fuel Loadings			
	Sampling Plane Lengths along Brown’s Transects:		
	1 hour fuels: 0-6 feet		
	10 hour fuels: 0-6 feet		
	100 hour fuels: 0-12 feet		

Little River Canyon National Preserve

SAOR Monitoring Type Description Sheet

1,000 hour fuels (rotten and solid); 0-100 feet

Litter/Duff Measurements along Brown's Transects: 1,5,10,15,20,25,30,35,40, and 45 feet

Burn**Severity**

Burn severity recorded along all 4 Brown's Transects: 1,5,10,15,20,25,30,35,40, and 45 feet

Post Burn Reads (01 yr 01, 01 yr 2, etc...)

***Same as 00 Pre-Read**

Little River Canyon National Preserve

QUMO Monitoring Type Description Sheet

FMH-4

PARK: LIRI

Monitoring Type Code: F Q U M 0 1 G 0 9

Date Described: 7/99

Revised: 6/03, 7/05

Monitoring Type Name: Forests dominated by chestnut oak.

Preparer: Bob Dellinger / Chris Revels. Revised by Mary Shew and Lisa McInnis.

Burn Prescription Burning of units will occur between March and October.

Flame lengths 0.5-6 feet, Optimum - 2 feet

Air Temperature 32-95 degrees, Optimum - 65-85 degrees

Relative Humidity 20-75%, Optimum - 25-30%

1 hour fuel moisture 3-12%, Optimum - 4%

10 hour fuel moisture 4-14%, Optimum - 5%

100 hour fuel moisture N/A

Rate of spread 0.5-15 ch/hr

Fire Management Objective(s)

- 1) Decrease density of shade tolerant pole trees by 30-90%
- 2) Limit mortality of overstory trees to less than 20%
- 3) Reduce total fuel load by 25-50% after 3 burns.
- 4) Increase native grass and forb cover by 10-25% after 3 burns.

Fire Monitoring Objective(s)

Sample monitoring variables with an adequate sample size to be 80% confident of detecting the following: a 30% reduction in pole-sized tree density; a 20% change in overstory tree density; a 25% reduction in fuel load; and a 10% increase in native herbaceous species cover.

Fire Monitoring Variable(s) Overstory and pole tree density, total fuel load, and native herbaceous species cover.

Physical Description: Elevation of 750-1200 feet (all aspects) and slope of 0-30% **Add soils information and geological description.**

Biological Description Forests comprised of approximately 30-40% canopy cover of chestnut oak (*Quercus montana*). Other canopy species include scarlet oak (*Q. coccinea*), shortleaf pine (*Pinus echinata*), southern red oak (*Q. falcata*), black jack oak (*Q. marilandica*), white oak (*Q. alba*), black oak (*Q. velutina*), post oak (*Q. stellata*), pignut hickory (*Carya glabra*), mockernut hickory (*C. tomentosa*), and Virginia pine (*P. virginiana*). Common midstory species include American beech (*Fagus grandifolia*), sourwood (*Oxydendron arboreum*), blackgum (*Nyssa sylvatica*), red maple (*Acer rubrum*), and dogwood (*Cornus florida*). The shrub layer is not uniform, but includes blueberry (*Vaccinium* spp.), blackberry (*Rubus* spp.), serviceberry (*Amelanchier arborea*), oak-leaf hydrangea (*Hydrangea quercifolia*) and catbriar (*Smilax rotundifolia* and *S. glabra*). Herb layer is sparse with species such as bracken fern (*Pteridium aquilinum*), ginger (*Hexastylis* spp.), spear grass (*Stipa* spp.), partridgeberry (*Mitchella repens*), and *Dicanthelium* spp.

Rejection Criteria Areas less than 20 m from a trail, road or riparian area, anomalous vegetation patches, or highly disturbed areas (including beetle kill or ice storm areas).

Little River Canyon National Preserve

QUMO Monitoring Type Description Sheet

GENERAL PROTOCOLS		Yes/No
Preburn		
Control Plots	No	
OP/Origin Buried	No	
Voucher Specimens	Yes	
Abbreviated Tags	Yes	
Herb Fuel Load	No	
Brush Fuel Load	No	
Stakes (REBAR) Installed:	17	
Burn		
Duff Moisture	No	
Flame Depth	No	
FOREST PLOT PROTOCOLS		
Preburn Read (00 Pre)		
Overstory		
Trees Tagged	Yes	Area Sampled: 50 x 20 m Quarter(s) Sampled: All 4 quarters (Q1-Q4)
Trees Mapped	Yes	
DBH	Yes	
Dead Recorded	Yes	
Live Crown Position	Yes	
Coded		
Live Damage Coded	Yes	
Dead Crown Position	Yes	
Coded		
Dead Damage Coded	No	
Pole-Size		
Trees Tagged	Yes	Area Sampled: 25 x 10 m Quarter(s) Sampled: 1 quarter (Q1)
Trees Mapped	Yes	
DBH	Yes	
Dead Recorded	Yes	
Height Code Recorded	Yes	
Seedling		
Seedlings Mapped	No	Area Sampled: 10 x 5 m belt along P1-P2 line Quarter Sampled: Q1
Dead Recorded	No	
Height Code Recorded	Yes	
Tally Count	Yes	
Brush		
Tally Count	N/A	
Age (immature, resprout, mature)	N/A	
Live and Dead Recorded	N/A	
Area Sampled: none		
Quarters Sampled: none		

Little River Canyon National Preserve

QUMO Monitoring Type Description Sheet

FOREST PLOT PROTOCOLS Yes/No [continued]

Preburn Read (00 Pre) [continued]

Herbaceous

Point Intercept Method Yes

Tallest Species Height Yes

Recorded

All Species Intercepted Yes

Recorded

Point Intercept Recorded for full length of Q4-Q1 (start tape @ Q4)

Nested subplots (in 1 quarter) to augment the herbaceous transect. These are taken as 1m x 1m, 10m x 10m, 10m x 25m. In Q1 and Q3, the 1x1 is near the origin, in Q2 it is near P2 and in Q4 it is near P1. Record the quarter with the most sample reads (e.g. If Q1,Q2,Q3, and Q4 were recorded @ 00Pre, Q1,Q3, and Q4 were recorded @ 01yr1, Q1 and Q3 were recorded at 01 yr2 then you should choose between either Q1 or Q3 (not Q2 or Q4) next time the plot is monitored)

Fuel

Loadings

Sampling Plane Lengths along Brown's Transects:

1 hour fuels: 0-6 feet

10 hour fuels: 0-6 feet

100 hour fuels: 0-12 feet

1,000 hour fuels (rotten and solid): 0-50 feet

Litter and Duff Measurements: 1,5,10,15,20,25,30,35,40, and 45 feet

Immediate Postburn Read (01 Post, 02 Post, 03 Post, etc...)

Overstory

Record Tag # Yes

Record Tree Status (alive, dead, resprout, consumed) Yes

DBH No

Maximum Scorch Height Yes

% Crown Scorched Yes

Char Height Yes

Area Sampled: 50 x 20 m

Quarter(s) Sampled: 4 quarters (Q1-Q4)

Pole-Size

Record Tag # Yes

Live and Dead Recorded Yes

DBH No

Height No

Maximum Scorch Height Yes

% Crown Scorched Yes

Char Height Yes

Fuel

Loadings

Sampling Plane Lengths along Brown's Transects:

1 hour fuels: 0-6 feet

10 hour fuels: 0-6 feet

100 hour fuels: 0-12 feet

1,000 hour fuels (rotten and solid): 0-50 feet

Litter/Duff Measurements along Brown's Transects: 1,5,10,15,20,25,30,35,40, and 45 feet

Burn

Severity

Burn severity recorded along all 4 Brown's Transects: 1,5,10,15,20,25,30,35,40, and 45 feet

Post Burn Reads (01 yr 01, 01 yr 2, etc...)

***Same as 00 Pre-Read**

Little River Canyon National Preserve

PIEC Monitoring Type Description Sheet

FMH-4

PARK: LIRI

Monitoring Type Code F P I E C 1 G 0 9

Date Described: 10/99

Revised: 6/03

Monitoring Type Name: Shortleaf pine-dominated forests.

Preparers: Bob Dellinger / Leon Konz. Revised by Mary Shew and Lisa McInnis.

Burn Prescription: Burning of units will occur between March and October.

Flame lengths - 1.0-6.0 feet

Air Temperature 35-95 degrees

Relative Humidity 20-75%

1 hour fuel moisture 4 - 12%

10 hour fuel moisture 15%

100 hour fuel moisture 20%

Rate of spread 1.0-10.0 ch/hr

Fire Management Objective(s): Reduce pole-sized trees by 25-80%, increase native grass and forb cover by 25-50% and reduce total fuel load by 25-50% by the 3rd burn.

Fire Monitoring Objective(s): Measure density of pole trees, native grass/forb cover, and woody fuel load with an adequate sample size to be 80% confident of detecting a 25% change in pole density and native herbaceous species cover, and a 25% reduction in total fuel load, accepting a 20% chance of concluding that a change took place when it really did not.

Fire Monitoring Variable(s): Pole tree density, native grass and forb cover, and total fuel load.

Physical Description: Upland plateau forests with elevation 1100-1400 feet (all aspects) and slope of 0-40% **Add soils information and geological description.**

Biological Description: Mixed evergreen and deciduous forest with *Pinus echinata* as the dominant overstory species (25-30% crown cover) mixed with *P. taeda* and *P. virginiana*, and various oaks (*Quercus coccinea*, *Q. montana/prinus*), *Q. falcata*, *Q. alba*, *Q. coccinea*, *Q. stellata*, *Q. velutina*, *Q. shumardii*), and hickories (*Carya pallida*, *C. alba*). Other common overstory species include sweetgum (*Liquidambar styraciflua*) and sourwood (*Oxydendrum arboreum*). Shrub species include blueberries (*Vaccinium* spp.), blackberry (*Rubus* spp.), and catbriar (*Smilax rotundifolia* and *S. glabra*). Herb layer is sparse with species such as bracken fern (*Pteridium aquilinum*), goldenrod (*Solidago* spp.), spear grass (*Stipa* spp.), partridgeberry (*Mitchella repens*), and *Dicanthelium* spp.

Rejection Criteria: Areas less than 10 m from roads, trails, water features, park boundary, or private property.

Little River Canyon National Preserve

PIEC Monitoring Type Description Sheet

GENERAL PROTOCOLS		Yes/No
Preburn		
Control Plots	No	
OP/Origin Buried	No	
Voucher Specimens	Yes	
Abbreviated Tags	Yes	
Herb Fuel Load	No	
Brush Fuel Load	No	
Stakes (REBAR) Installed: 17		
Burn		
Duff Moisture	No	
Flame Depth	No	
FOREST PLOT PROTOCOLS		
Preburn Read (00 Pre)		
Overstory		
Trees Tagged	Yes	Area Sampled: 50 x 20 m Quarter(s) Sampled: All 4 quarters (Q1-Q4)
Trees Mapped	Yes	
DBH	Yes	
Dead Recorded	Yes	
Live Crown Position Coded	Yes	
Live Damage Coded	Yes	
Dead Crown Position Coded	Yes	
Dead Damage Coded	No	
Pole-Size		
Trees Tagged	Yes	Area Sampled: 25 x 10 m Quarter(s) Sampled: 1 quarter (Q1)
Trees Mapped	Yes	
DBH	Yes	
Dead Recorded	Yes	
Height Code Recorded	Yes	
Seedling		
Seedlings Mapped	No	Area Sampled: 10 x 5 m belt along P1-P2 line Quarter Sampled: Q1
Dead Recorded	No	
Height Code Recorded	Yes	
Tally Count	Yes	
Brush		
Tally Count	N/A	
Age (immature, resprout, mature)	N/A	
Dead Recorded	N/A	
Area Sampled: none		

Little River Canyon National Preserve

PIEC Monitoring Type Description Sheet

Quarters Sampled: none

FOREST PLOT PROTOCOLS Yes/ No [continued]

Preburn Read (00 Pre) [continued]

Herbaceous

Point Intercept Method Yes

Tallest Species Height Yes

Recorded

All Species Intercepted Yes

Recorded

Point Intercept Recorded for full length of Q4-Q1 (start tape @ Q4)

Nested subplots (in 1 quarter) to augment the herbaceous transect. These are taken as 1m x 1m, 10m x 10m, 10m x 25m. In Q1 and Q3, the 1x1 is near the origin, in Q2 it is near P2 and in Q4 it is near P1. Record the quarter with the most sample reads (e.g. If Q1,Q2,Q3, and Q4 were recorded @ 00Pre, Q1,Q3, and Q4 were recorded @ 01yr1, Q1 and Q3 were recorded at 01 yr2 then you should choose between either Q1 or Q3 (not Q2 or Q4) next time the plot is monitored)

Fuel

Loadings

Sampling Plane Lengths along Brown's Transects:

1 hour fuels: 0-6 feet

10 hour fuels: 0-6 feet

100 hour fuels: 0-12 feet

1,000 hour fuels (rotten and solid): 0-50 feet

Litter and Duff Measurements: 1,5,10,15,20,25,30,35,40, and 45 feet

Immediate Postburn Read (01 Post, 02 Post, 03 Post, etc...)

Overstory

Record Tag # Yes

Record Tree Status (alive, Yes

dead,
resprout, consumed)

DBH No

Maximum Scorch Height Yes

% Crown Scorched Yes

Char Height Yes

Area Sampled: 50 x 20 m

Quarter(s) Sampled: 4 quarters (Q1-Q4)

Pole-Size

Record Tag # Yes

Live and Dead Recorded Yes

DBH No

Height No

Maximum Scorch Height Yes

% Crown Scorched Yes

Char Height Yes

Little River Canyon National Preserve

PIEC Monitoring Type Description Sheet

Fuel Loadings

Sampling Plane Lengths along Brown's Transects:

1 hour fuels: 0-6 feet

10 hour fuels: 0-6 feet

100 hour fuels: 0-12 feet

1,000 hour fuels (rotten and solid): 0-50 feet

Litter/Duff Measurements along Brown's Transects: 1,5,10,15,20,25,30,35,40, and 45 feet

Burn

Severity Burn severity recorded along all 4 Brown's Transects: 1,5,10,15,20,25,30,35,40, and 45 feet

Post Burn Reads (01 yr 01, 01 yr 2, etc...)

***Same as 00 Pre-Read**

Literature Cited

Campbell, Julian. 1999. Physical environment, terrestrial ecosystems, and fire history (Mammoth Cave National Park). The Nature Conservancy.

USDI National Park Service. 2003. Fire Monitoring Handbook. Boise (ID): Fire Management Program Center, National Interagency Fire Center. 274p.