



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

Summary

Calendar Year 2007 marked a complete transition in personnel for the NATR Fire Effects team. Mandi Callis rejoined the fire effects crew as the lead monitor. Two new monitors also joined the crew. Jennifer Falkey came in June from the University of Georgia/Jones Ecological Center. Angela Sokolowski came in August from Lake Mead Exotic Plant Management Team. This new fire effects team brings a wealth of knowledge and ability to the program.

The year was also a great year for prescribed fire. All parks scheduled to burn were burned successfully, with the exception of STRI. With the transition from FMH to FEAT being complete, we have increased flexibility in data management. With the upcoming transition from FEAT to FFI, much time was spent near the end of 2007 doing data entry and further refining/streamlining the database for each park.

Table 1. Fire Effects Plot Workload 2007

Park	Monitoring Unit	Type of Plot (FMH, photo point, other)	Pre-burn	Immed. Post	Postburn (1-20 yrs)	Total Plots
Gulf Islands	<i>Pinus clausa</i>	FMH Forest plot	0	7	2	12
Gulf Islands	<i>Pinus palustris</i>	FMH Forest plot	0	4	0	12
Gulf Islands	<i>Sarracenia alata</i>	FMH Forest plot	0	0	0	1
Mammoth Cave	<i>Juniperus virginiana</i>	FMH Forest plot	0	1	0	7
Mammoth Cave	<i>Sorghastrum nutans</i>	FMH Grass Plot	0	0	2	3
Mammoth Cave	<i>Andropogon gerardii</i>	FMH Grass Plot	0	5	0	5
Mammoth Cave	Oak/Hickory	FMH Forest Plot	4	3	1	8
Mammoth Cave	<i>Quercus montana</i>	FMH Forest plot	1	0	1	2
Little River	<i>Pinus echinata</i>	FMH Forest plot	1	4	2	12

Table 1. Fire Effects Plot Workload 2007, continued

Park	Monitoring Unit	Type of Plot (FMH, photo point, other)	Pre-burn	Immed. Post	Postburn (1-20 yrs)	Total Plots
Little River	<i>Sarracenia oreophila</i>	FMH Forest plot	0	1	2	6
Little River	<i>Quercus montana</i>	FMH Forest plot	1	3	0	6
Natchez Trace	Oak/Hickory	FMH Forest plot	0	1	0	3
Natchez Trace	<i>Juniperus virginiana</i>	FMH Brush plot	0	0	4	4
Natchez Trace	<i>Pinus taeda</i>	FMH Forest plot	1	4	4	14
Natchez Trace	<i>Microstegium vimineum</i>	FMH Grass plot	10	0	0	10
Horseshoe Bend	<i>Pinus palustris</i>	FMH Forest plot	0	1	2	5
Stones River	<i>Schizachyrium scoparium</i>	FMH Grass plot	0	0	0	14
Stones River	<i>Andropogon ternarius</i>	FMH Grass plot	0	0	8	9
Stones River	<i>Andropogon virginicus</i>	FMH Grass plot	3	0	1	10
Vicksburg	Exotics	Photo Plot	0	0	0	4
Total			21	35	29	147

Table 2. Fire Ecology Staffing 2007

Monitor	Starting Date	Ending Date	# of Pay Periods	Training and Development
Lisa McInnis (Ecologist)	1/1/07	12/31/07	26	COTR and EEO training, Annual Firefighter refresher.
Mandi Callis (Lead)	1/1/07	12/31/07	26	COTR, PLDO Operator Course, detail with SER as a helicopter as crew member, fire assignments with MEVE helitack and the CUGA Fire Use Module, and Type II western fire crew. Completed PLDO taskbook. Annual Firefighter refresher.
Jennifer Falkey	6/11/07	12/31/07	14	S-130/190, RX-310, S-110, S-134, S-190, L-180, and I-100
Angela Sokolowski	8/20/07	12/31/07	9	RX-310, Annual Firefighter refresher

Table 3. Management Objectives and Monitoring Results 2007

All results shown are 80% confidence intervals of the mean unless otherwise noted; means are reported in brackets. 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 achieved¹. Figures can be found in Appendix 1.

Monitoring Unit	Management Objective (Restoration)	Monitoring Results (80% confidence interval)	Objective Achieved? (minimum plots achieved/needed)
GUIS FPICL1D07 Sand pine-scrub oak forest <i>Pinus clausa</i>	20-40% litter and duff reduction immediate postburn ²	Litter/duff decrease of approximately 48%. Litter- [-74% (-53%) -31%] Duff- [-62 (-42%) -21%]. (n=4, 1 fire) Figure 1	Yes- but minimum sample size not met.
	40-60% reduction of pole-sized trees ³ by 2 nd year after 3 rd burn	Pole density reduction=21% by Year 2 [-14 (-21) -27%] (n=5, 2 fires) Figure 2	No- but minimum sample size not met.
	20-40% increase in herbaceous cover by 2 nd year after 3 rd burn	Increase in relative cover = 0.5% by Year 2 [-1% (0.5%) 1%] (n=3, 2 fires) Figure 3	No-but but minimum sample size not met and 3 burns not achieved
GUIS FPIPA1D07 Longleaf-slash pine forest <i>Pinus palustris</i>	50-90% hardwood pole reduction by one Year after the 3 rd burn.	Average hardwood pole density reduction =15% by Year 1 [-25 (-15) -4%] (n= <u>10</u> , 1 fire) Figure 4	No, but 3 fires not achieved.
	20-40% litter and duff reduction immediate postburn	Litter- [-66% (-61%) -56%] Duff- [-40% (-27%) -14%] (n=6, 1-2 fires) Litter and duff combined, average reduction was 44%. Figure 5	Yes
	20-40% increase of herbaceous cover by 2 nd year after 3 rd burn.	Cover change =<1% decrease by Year 1. [-0.5% (-0.2%) 0.2%] (n=10, 1-2 fires) Figure 6	No, but minimum sample size not met (10 of 18).

¹ Minimum sample size estimates were done in January, 2008 using the 'SS Two Samples' tool created by Ken Gerow (available online at www.statsalive.com). Use of the tool is being done under consultation with Ken Gerow.

² Fuel load calculations were done based on 1000 hr fuels being measured for 50' transects, but measurements were taken to 100' in the field (at GUIS only). Although this will affect absolute fuel load values, but relative fuel load estimates are unaffected because 50' transects have always been used in the calculations. The problem will be corrected after the transition to FFI.

Table 3. Management Objectives and Monitoring Results 2007, continued

GUIS FPIPA1D07 Longleaf-slash pine forest <i>Pinus palustris</i>	Limit overstory (longleaf and slash pine) mortality to 20%	Longleaf increase 3% by Year 1. [-1% (3%) 6%], and slash pine showed no change. (n=10, 1 fire, 95% CI). Figure 7.	Yes.
LIRI FPIEC1DG09 Shortleaf pine forest <i>Pinus echinata</i>	25-80% reduction in pole-sized trees by 3 rd burn	Pole reduction = was 12% by Year 2 ⁴ . [-26% (-12%) 3%]. (n=9, 1 fire) Figure 8	No, but minimum number of fires has not occurred.
	25-50% increase native grass and forb cover	Average forb and grass cover percent increase was 25% by Year 2. [8% (25%) 41%] (n=3, 1 fire) Figure 9	Yes, but sample size not met (5 of 7).
	50% reduction in downed woody fuel and litter/duff by 3 rd burn	Average fuel load reduction litter and duff =28% ⁵ . Litter [-55% (-18%) -0.5%] Duff [-10% (-48%) -42%] Woody- [-8% (20%) 49%] (n=10 plots, 1 fire) Figure 10	Yes.
LIRI FSAOR1G10⁶ Green pitcher plant forest <i>Sarracenia oreophila</i>	30-90% decrease in shrub cover by second year after 3 rd burn	Decrease in shrub cover of <1% by 02 Year 2 [-0.3% (-0.7%) 1%]. (n=3, 2 fires) Figure 11	No- but minimum sample size and required number of fires not met.
	20% increase cover of <i>S. oreophila</i> by second year after 3 rd burn	Presence/absence evaluated for more meaningful trend analysis. Approximately 70% of plots maintain 2% cover of SAOR. (3 fires) Figure 12	No- but minimum sample size not met
	30-90% decrease in pole-sized trees by second year after 3 rd burn.	Pole reduction = 86% for two plots ⁷ by 03 Year One. [-45%, (-14%) -17%] (n=3, 1 fires) Figure 13	No- but minimum sample size not met.

⁴ Data presented in 2006 showed a 25% reduction in error; incorrect sample area in FEAT was used in the density calculation.

⁵ Woody fuel load increase of 20% under investigation.

⁶ Plots within the SAOR monitoring type are not randomly distributed; plots were installed to encompass existing *Sarracenia* populations.

⁷ Two plots analyzed to look at reduction after multiple fires. More data for fewer fires exists.

Table 3. Management Objectives and Monitoring Results 2007, continued

LIRI FQUMO1G10 Chestnut oak forest <i>Quercus montana</i>	20-60% reduction in pole-sized trees	No change in pole density reduction by Year 2. (n=2, 1 fire) Figure 14	No- but minimum sample size not met
	25-50% increase native grass and forb cover	Increase in native forb cover <1% between Year 1 and Year 2. Data same as 2006. (n=2, 1 fires) Figure 15	No- but minimum sample size not met
MACA FOAHI1D09 Oak-Hickory forest ⁸	Decrease density of shade tolerant pole trees by 30-90%.	Pole reduction was 10% by Year 1. [-20% (-5%) 10%] (n=2, 1 fire) Figure 16	No, but minimum sample size not met.
	Limit mortality of overstory trees to less than 20%.	Approximate 3% increase. (n=2 plots, 1 fire). [1% (3%) 6%] Figure 17	Yes, but minimum sample size not met.
MACA FJUVI1D09 Red cedar glade forest <i>Juniperus virginiana</i>	Reduce litter/duff and downed woody fuel load by 25-50%	Average reduction was 4% immediately postburn. [-24% (3%) 32%] (n=5, 1 fire) Data from 2006. Figure 18	No, but minimum sample size not met
	Reduce pole-sized trees by 40-60%.	Average reduction was 56% by Year 1 [-56% (-53) -49%]. (n=5, 1 fire) Figure 19	Yes, but minimum sample size not met
	Limit mortality to overstory species to less than 20%.	Average change was 5% increase in overstory density [1% (5%) 9%] (n=5, 1 fire) Figure 20	Yes, but minimum sample size not met
MACA BSONU1T02 Indian grass grassland <i>Sorghastrum nutans</i>	Reduce density of shade tolerant seedlings 30% to 60% one year after second fire ⁹ .	Average <i>Acer</i> and <i>Juniperus</i> density decrease = 54% by Year 1 after 2 nd fire [-91% (-54%) -18%] (n=2, 2 fire) Figure 21	Yes- but minimum sample size and required number of fires not met for all plots
	Reduce density of shrubs 30% to 60% one year after second fire.	Shrub density reduction = 82% by Year 2. [-93% (-82%) -70%] (n=3 plots, 1 fire). Figure 22	Yes- but minimum sample size not met
	Cause no net gain in percent cover of exotic plants (Japanese honeysuckle) after five years of burning	Average reduction =64% by Year 2. [-90% (-64%) -38%] (n=2, 2 fire) Figure 23	Yes- but minimum sample size not met.

⁸ Data includes data from one QUMO and one OAHI plot at MACA.

⁹ Density analyzed for *Acer* and *Juniperus* genera only.

Table 3. Management Objectives and Monitoring Results 2007, continued

MACA BSONU1T02 Indian grass grassland <i>Sorghastrum nutans</i>	Increase relative cover of <i>Sorghastrum nutans</i> 15% after five years of burning	Increase of 11% by 2 years postburn [-16% (11%) 39%] (n=2 plots, 2 fire) Figure 24	No, but minimum sample and number of fires not met
MACA BANGE1D02 Big Bluestem grassland <i>Andropogon gerardii</i>	Cause no net gain in percent cover of exotic plants as measured one year and five years post burn.	Average increase of 9% between 1 and 2 years postburn. No preburn/postburn data pairs yet available. [-7% (9%) 25%] (n=2 plots, 1 fire). Figure 25	No- but minimum sample size not met.
	Decrease invading woody species by 30% as measured 1 year post burn.	Average decrease of 55% by 2 years postburn. [-99% (-55%) -10%] (n=2, 1 fire) Figure 26	Yes- but minimum sample size not met
NATR FPITA1D09 Loblolly pine forest <i>Pinus taeda</i>	Reduce total fuel load by 20-40% immediately postburn	Fuel load reduction = 46% by Year 1. [-48 (-43) -37] (n=9, 1 fire). Figure 27	Yes
	Reduce conifer poles (2.5-15.0 cm dbh) >25% one year after 3 rd fire	Density reduction = 19% by Year 1 after second fire. [-25% (-19%) -12%] (n=5, 2 fires) Figure 28	No, but all existing plots must burn to meet sample size.
	Cause no net gain in percent cover of exotic plants (e.g. kudzu, Chinese privet, Japanese honeysuckle, etc.) after 5 years of burning	Average reduction was 2%. [-3% (-2%) -0.3] (n=5, 2 fires) Figure 29	Yes, but all existing plots must burn to meet sample size.
NATR BJUVI1D06 Blackbelt prairie <i>Juniperus virginiana</i>	25-50% reduction of <i>Juniperus virginiana</i> density after 5 years of burning.	Density of <i>Juniperus virginiana</i> reduced by 67% after 4 th burn. [-69% (-67) -64%] Data from 2006 Figure 30	Yes, but minimum sample size not met. ¹⁰
	20-40% reduction in woody exotic species density vegetation by 4 th burn	Density of exotic species reduced by 25% after 4 th burn. [-102% (-25%) 52%] (n=4, 4 fires) Figure 31	Yes, but minimum sample size not met.

¹⁰ Additional plots will not likely be installed in this monitoring type, as monitoring is occurring using other methods in conjunction with local botanists.

Table 3. Management Objectives and Monitoring Results 2007, continued

STRI GSCSC1G02 Little Bluestem Grassland <i>Schizachyrium</i> <i>scoparium</i>	Reduce exotic species cover by 20-70% after 5 burns.	Exotic cover increase of 4% on average. [-78% (-57%) -35%] (n=5 plots, 1 fire) Figure 32	No, but additional fire requirement not met.
	Increase native grass and forb cover by 20-50% after 3 fires.	Average increase in native cover was 32% by Year 1. [2% (32%) 62%] (n=5 plots, 1 fire) Figure 33¹¹	No, but additional fire requirement not met.

Fire ecologist accomplishments and area of focus

Fire Ecologist Accomplishments/Focus Areas

Category	Percent Time	Accomplishments/Focus Areas
General Planning	15%	• Crew task planning • Monitoring schedule planning • Prescribed fire objective planning and burn plan review for GUIS, HOBE, NATR, LIRI, STRI • Burn planning trips to LIRI, GUIS, STRI, MACA
Monitoring Plans	5%	• Completion of NATR Fire Monitoring Plan. • Rewrite of NATR Fire Management Plan • Work with contractor for EA for FMP • Lit review for other park's mon plans begun.
Presentations	5%	• Prescribed burn success stories submitted to InsideNPS • Fire effects data reports to each park
NPS Meetings/ Task Groups	10%	• Fire Ecology Steering Committee Annual Meeting
Interagency Work	5%	• Interagency prescribed burns with FWS and USFS.
Fire Assignments and Fuels Projects	10%	• FEMO and/or FFT2 on 10+ prescribed fires • COTR on 1 WUI mechanical fuel reduction project • 2 on-park wildfires
Research	10%	• Literature reviews • Investigated potential for blackbelt prairie restoration with Columbia State University. • Worked with SFASU for CESU contract at MACA • Continue work with Auburn University for CESU at HOBE. • Short essay in <i>Ecological Restoration</i> journal published regarding blackbelt prairie restoration
Monitoring Field Work	15%	• Assisted monitoring crew with FMH plots at NATR, GUIS, STRI, LIRI, and MACA.
Data Entry	0%	• Monitors completed data entry
Data Management and Conversion	5%	• Troubleshooting FEAT ongoing; correspondence with FEAT forum • FFI conversion data submitted 12/2007. • Attended Sametime meetings
Data Analysis	5%	• Data analysis primarily for annual report

¹¹ Data for ANTE monitoring type at STRI undergoing further evaluation and not presented in this report.

Table 3. Management Objectives and Monitoring Results 2007, continued

Category	Percent Time	Accomplishments/Focus Areas
		• Response to individual park data requests for analyses
Training & Professional Development	5%	• PT (approximately 3 hrs per week) • Firefighter and chainsaw refresher • EEO Officer training • Supervisory training- SER
Miscellaneous	<5%	• GIS work- tutorials, consulting outside resources for help, etc. • Responses to emails asking for input or data
Supervision	10%	• Administrative tasks/training, travel, payroll review • Crew meetings (including safety meetings) • Employee orientation, IDP planning • Recruiting for 2 monitors

Fire effects crew accomplishments and area of focus.

Category	Percent Time	Notes
FMH plots	25%	
WUI plots	0	
CBI plots	0	
Other plot work	0	
Fire Assignments	25%	Lead Monitor: • 2 wildland fire assignments • Assignment with SER Fuels helicopter • 30 detail with CUGA FUM as FEMO • 13 prescribed fires • 5 on park wildfires
Fuels work	0	
Data entry	25%	Entering data from paper to PC, checking data sheets, scanning data sheets, copying and filing data sheets
Data conversion	10%	Prepared FEAT data for FFI conversion
Data analysis		
Supervision/Admin	5%	• Lead monitor hired and trained two monitors • Misc travel and time paperwork • Crew meetings and safety meetings
Training	5%	Lead Monitor: COTR and PLDO Training Monitor: S-130/190
Miscellaneous	5%	WUI COTR, GIS, fire education (Smokey Bear presentations)

APPENDIX 1

Gulf Islands National Seashore

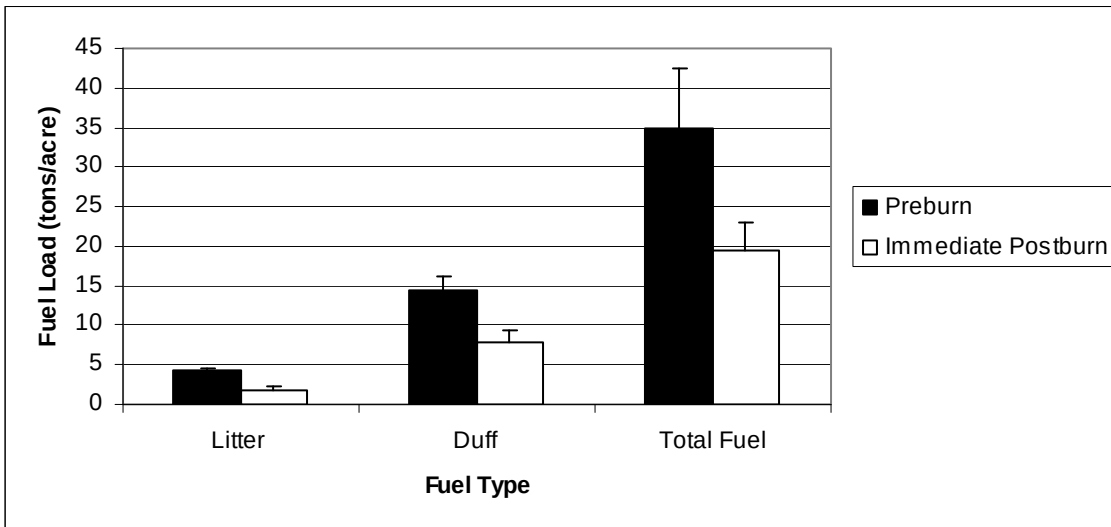


Figure 1. Average litter and duff loading for 4 *Pinus clausa* plots at GUIs ($\pm$ SE). Objective for litter and duff reduction is 20-40%; observed change was an average decrease of 48% (litter and duff combined).

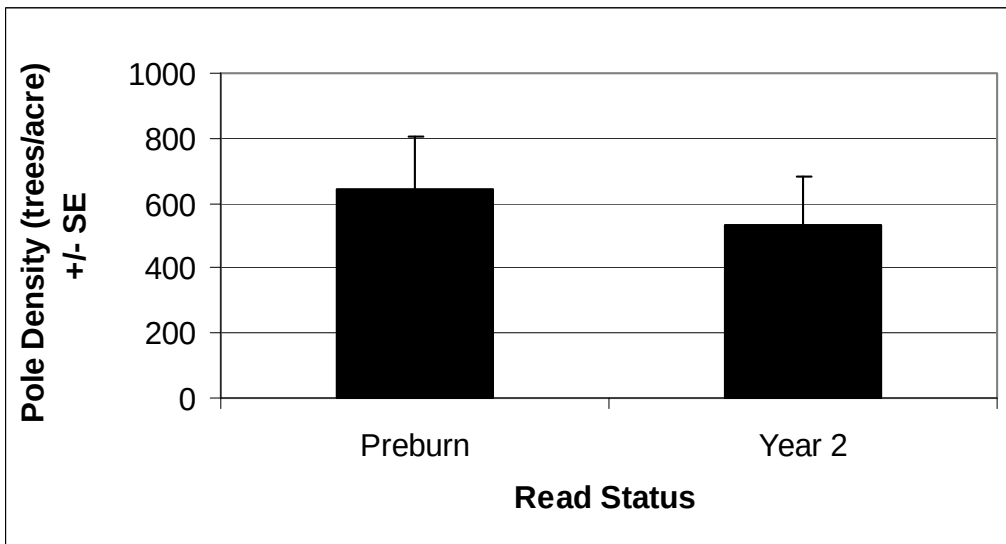


Figure 2. Average density of pole-sized trees in the *Pinus clausa* monitoring type at GUIs (n=5 plots). Year 2 data was taken 24-33 months postburn. Objective for pole reduction is 40%; actual reduction was approximately 21% by Year 2.

Gulf Islands National Seashore

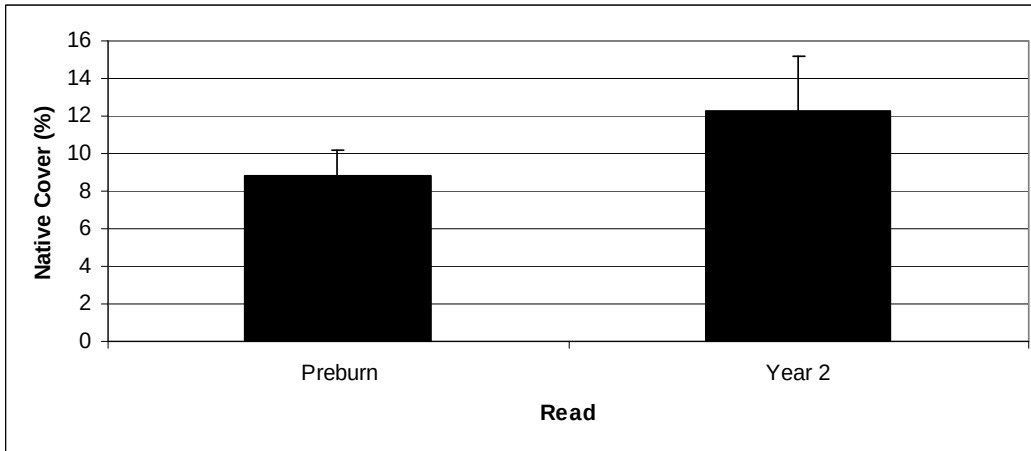


Figure 3. Mean percent cover $\pm$ SE of native grass and forb species for the *Pinus clausa* monitoring type at GUIS (n=3, $\pm$ SE). Objective for herbaceous cover increase is 20%; observed increase for forbs, grasses, grass-like species and vines was approximately 38%.

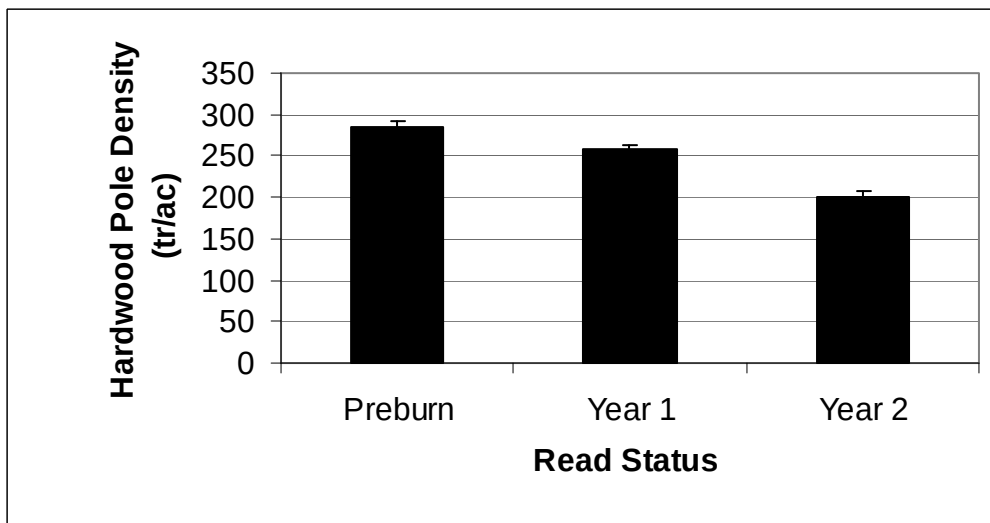


Figure 4. Average density of hardwood pole trees per acre for 10 *Pinus palustris* plots at GUIS ($\pm$ SE). Objective for pole reduction is 50%; actual reduction was approximately 15% by Year 2.

Gulf Islands National Seashore

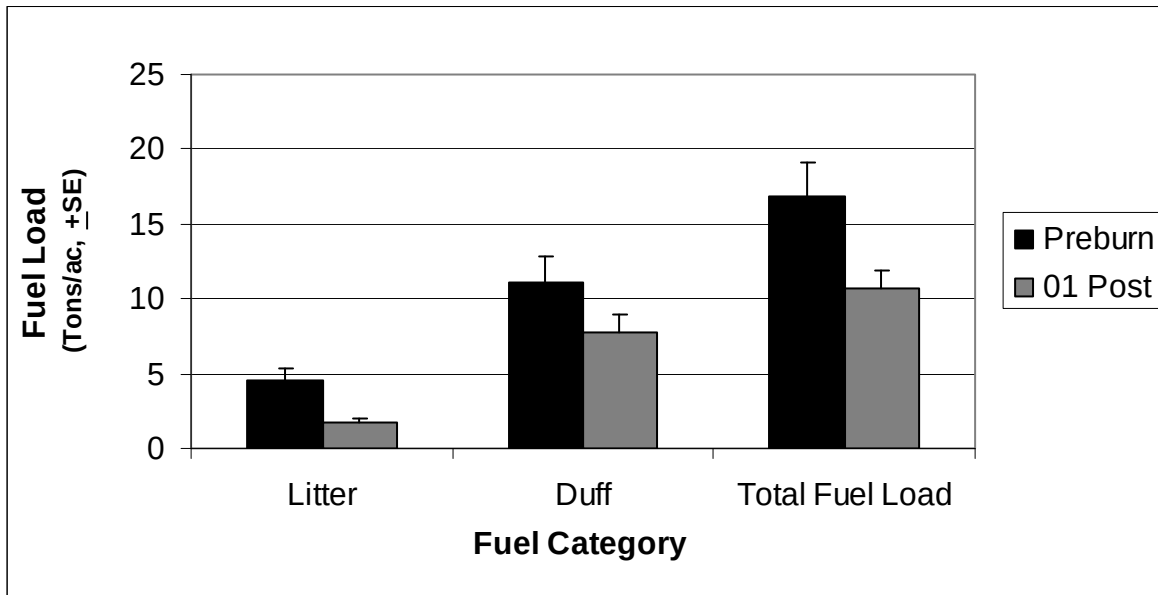


Figure 5. Average litter and duff load for the *Pinus palustris* monitoring type at GUIs (n=6 plots). Objective for litter and duff reduction is 20-40%; actual reduction for litter and duff combined was approximately 44% as measured immediately postburn.

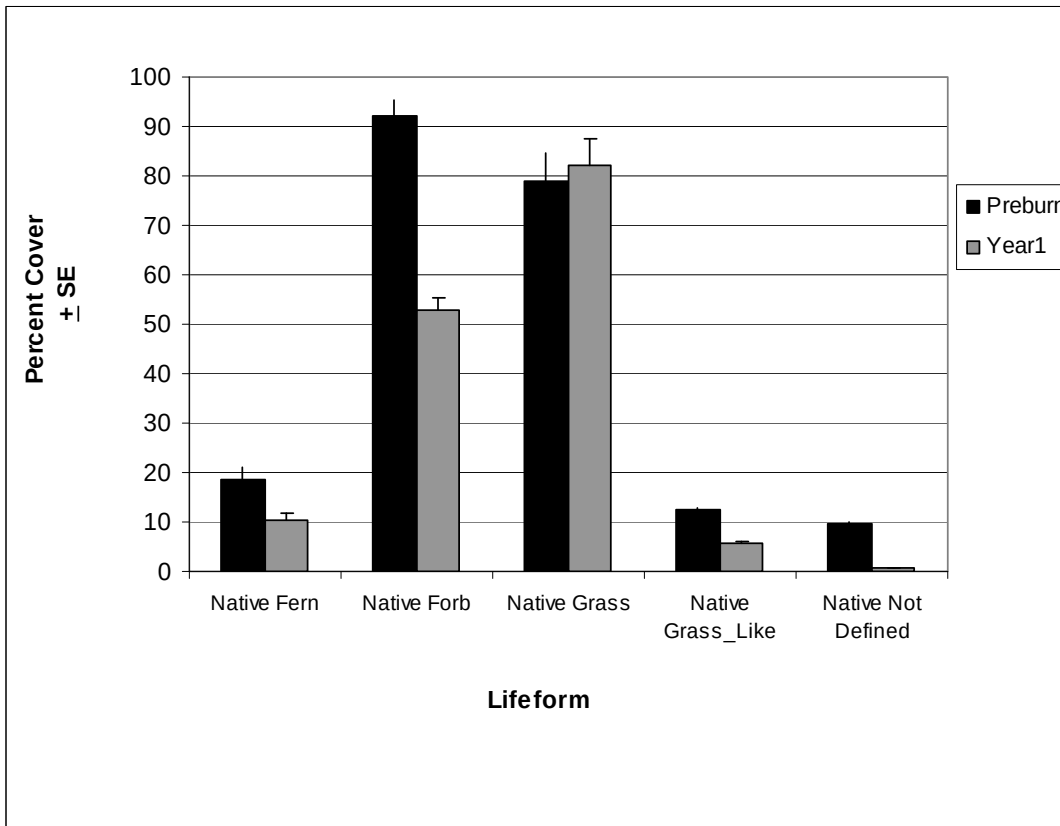


Figure 6. Mean percent cover of native herbaceous species 10 for the *Pinus palustris* monitoring type at GUIs. Year 1 data was taken from 12-18 months postburn. Objective for herbaceous cover increase is 20%; observed change was a 19% decrease. Further examination into high variability of data is needed.

Little River Canyon National Preserve

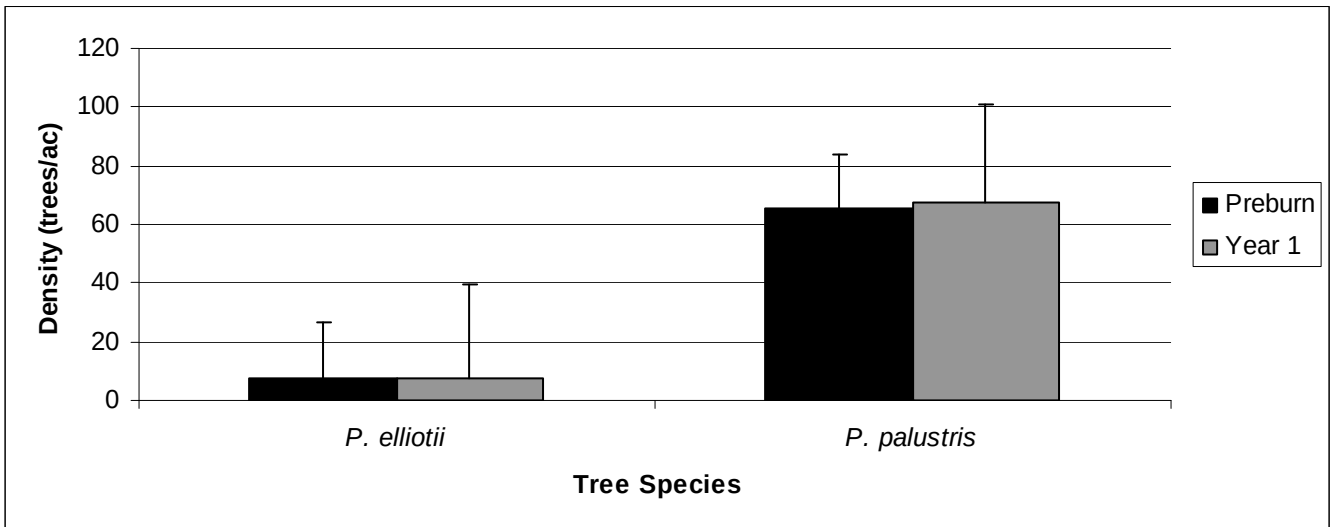


Figure 7. Mean density of slash (*P. elliotii*) and longleaf pines (*P. palustris*) overstory trees in the *Pinus palustris* monitoring type at GUIS ($\pm$ SE, n=10 plots). Year 1 data was taken from 12-18 months postburn. Objective for overstory mortality is less than 20% decrease; observed average change was a 3% increase for longleaf pine, and no change for slash pine.

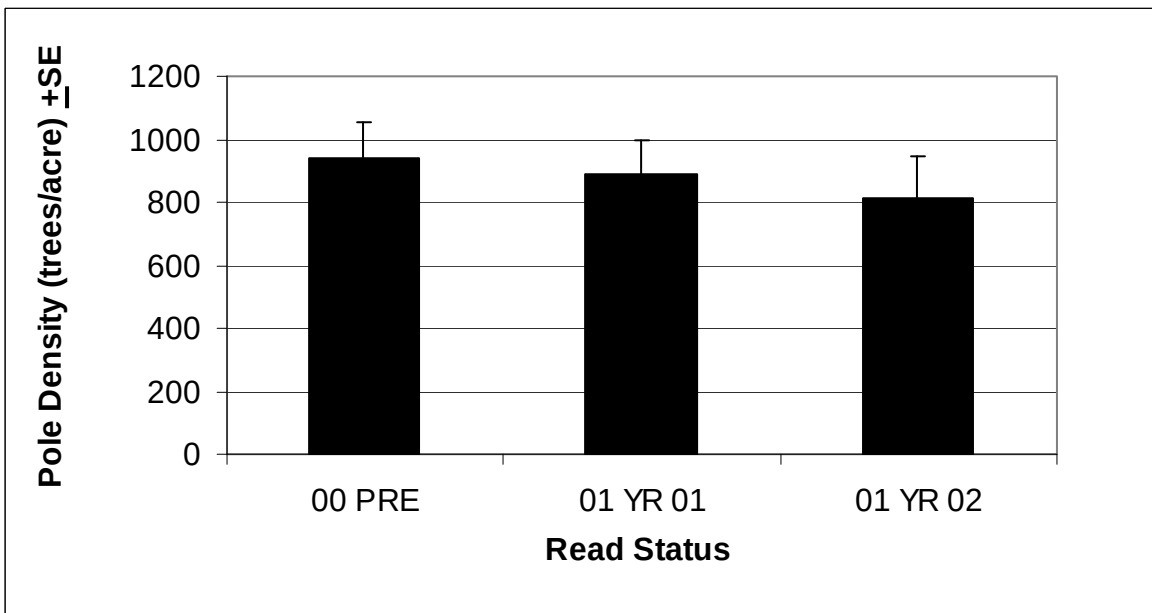


Figure 8. Average density of pole-sized trees per acre for the *Pinus echinata* monitoring type at LIRI ($\pm$ SE, n=9 plots). Objective for pole reduction is 30-90%; actual reduction was approximately 11% by Year 2.

Little River Canyon National Preserve

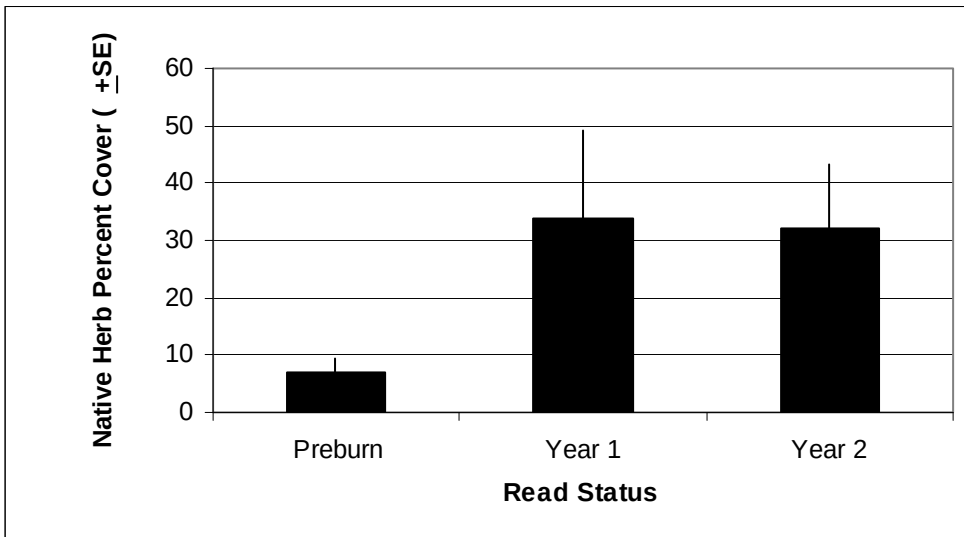


Figure 9. Percent cover of native herbaceous (ferns, forb, grass, and grasslike) species for the *Pinus echinata* monitoring type at LIRI (n=3). The objective was a 25% increase, and the average increase was 4%.

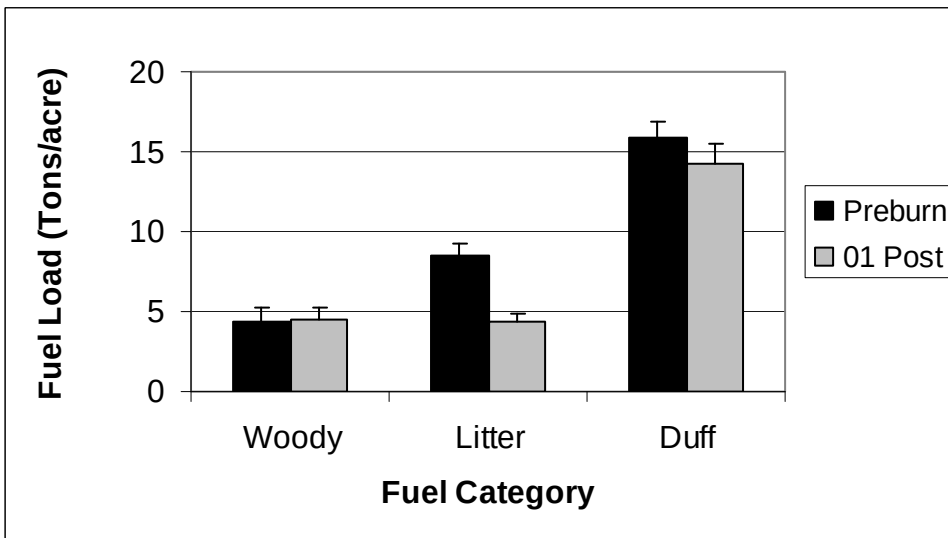


Figure 10. Average fuel load for the *Pinus echinata* monitoring type at LIRI (n=10 plots). Objective for fuel reduction was 25-50%, and actual observed average reduction was 28% for litter and duff.

Little River Canyon National Preserve

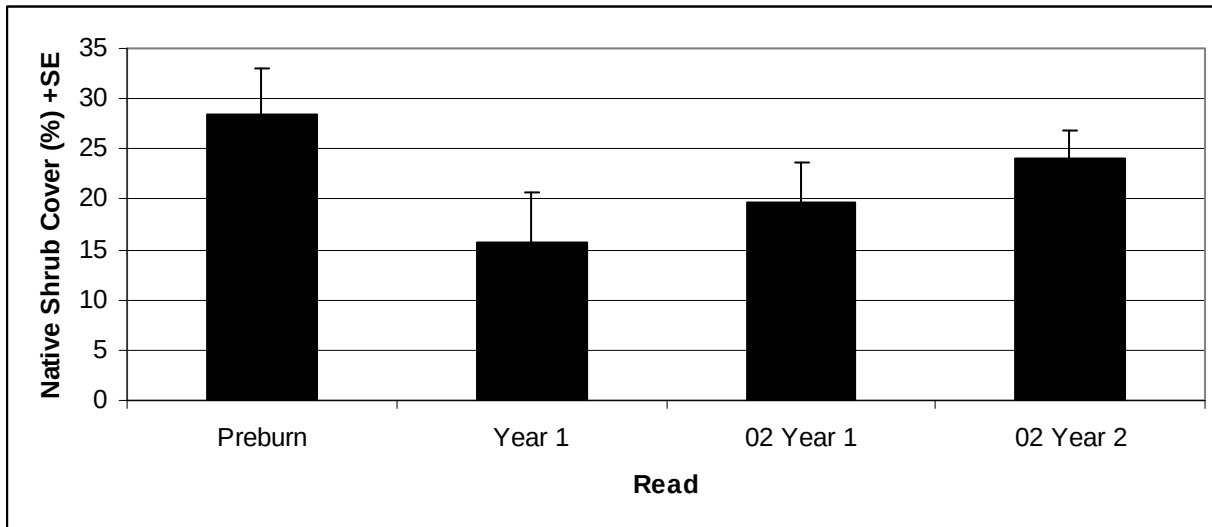


Figure 11. Average shrub cover for 3 *Sarracenia oreophila* plots at LIRI. Data shown compares shrub cover collected at one and two years after the second fire. Objective for shrub reduction is 30%; actual change was a decrease of 1% by Year 2.

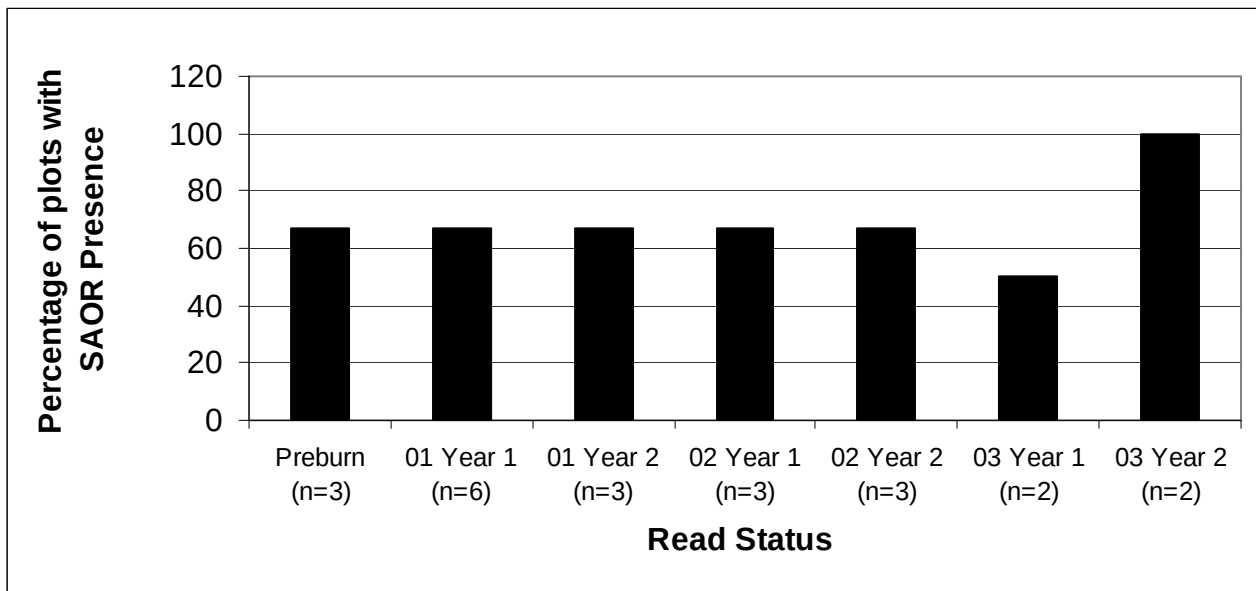


Figure 12. Presence of *Sarracenia oreophila* in SAOR plots at LIRI. Varying availability of data for the existing 6 plots necessitated viewing the data in terms of whether or not *Sarracenia oreophila* was present for plots that have available herbaceous data. For example, of the 6 plots, only 3 have available preburn data; of those 3 plots, 2 have *S. oreophila* present, resulting in 2/3 or 66% of plots having *S. oreophila* present. On average, cover of *S. oreophila* is approximately 2% for all reads.

Little River Canyon National Preserve

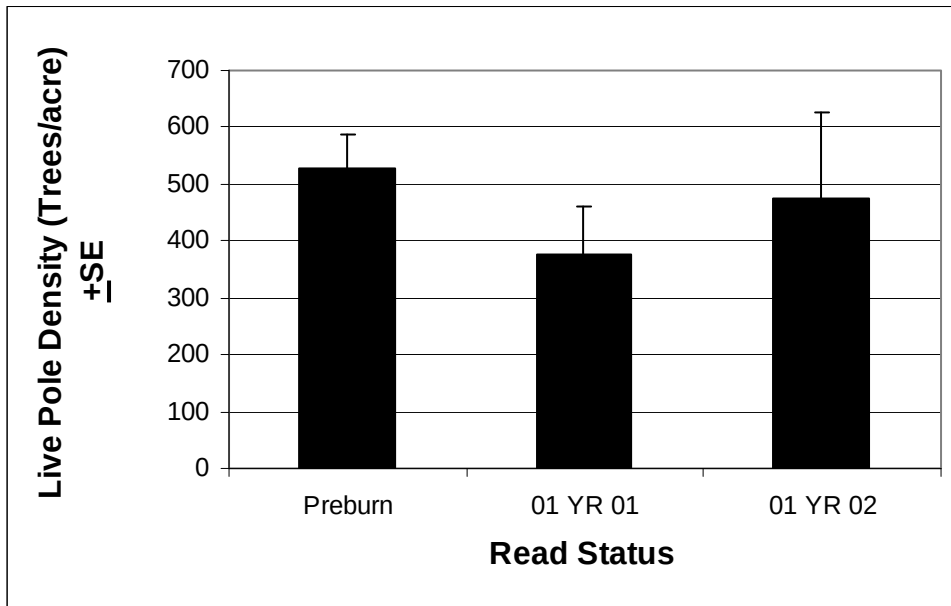


Figure 13. Average density of live pole-sized trees per acre for 3 *Sarracenia oreophila* plots at LIRI. Objective for pole reduction is 20%; actual reduction was approximately 14% by Year 2). Some mechanical thinning took place in 2 of the three plots (SAOR 4 and SAOR 6).

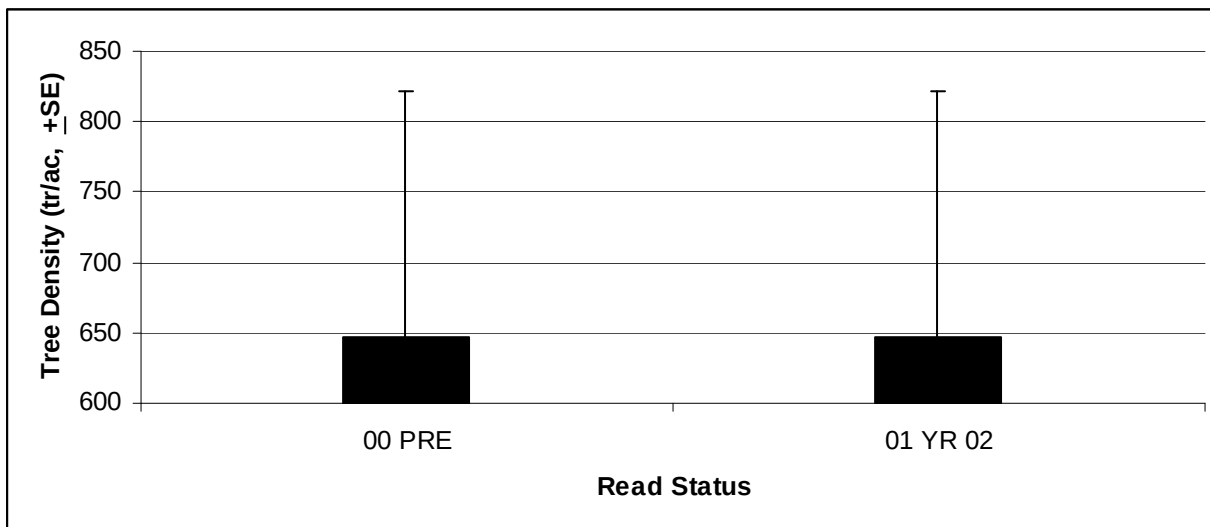


Figure 14. Average density of pole-sized trees per acre for 2 *Quercus montana* plots at LIRI. Year 2 data was taken 26 months postburn. Objective for pole reduction is 20%, no change observed at Year 2.

Little River Canyon National Preserve

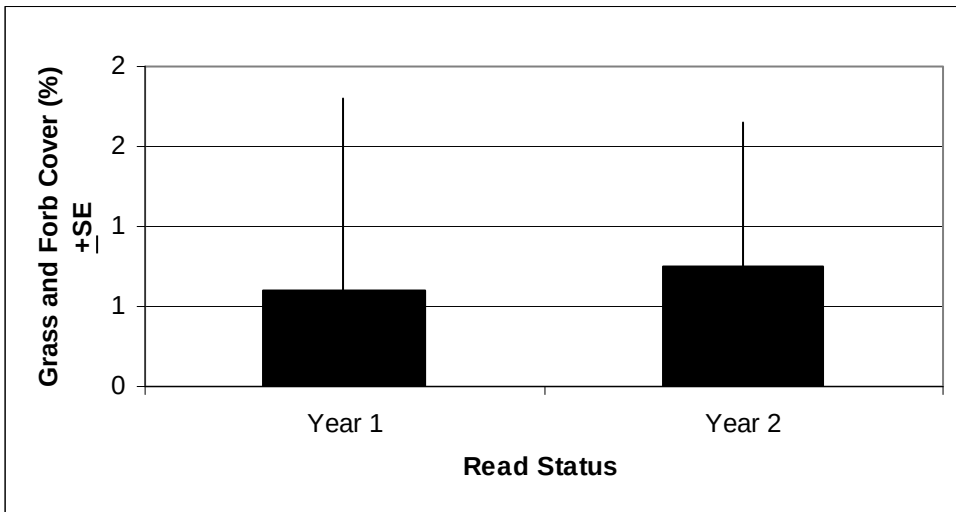


Figure 15. Mean percent cover $\pm$ SE of native grasses and forbs on 2 *Quercus montana* plots at LIRI ($\pm$ SE). Data was taken 16 and 26 months postburn. Objective for herbaceous cover increase is 25% from preburn levels; observed change for grass and forbs was 25%. No preburn data for plots that have burned to date is available (n=2 plots with postburn data, n=3 unburned plots with preburn data).

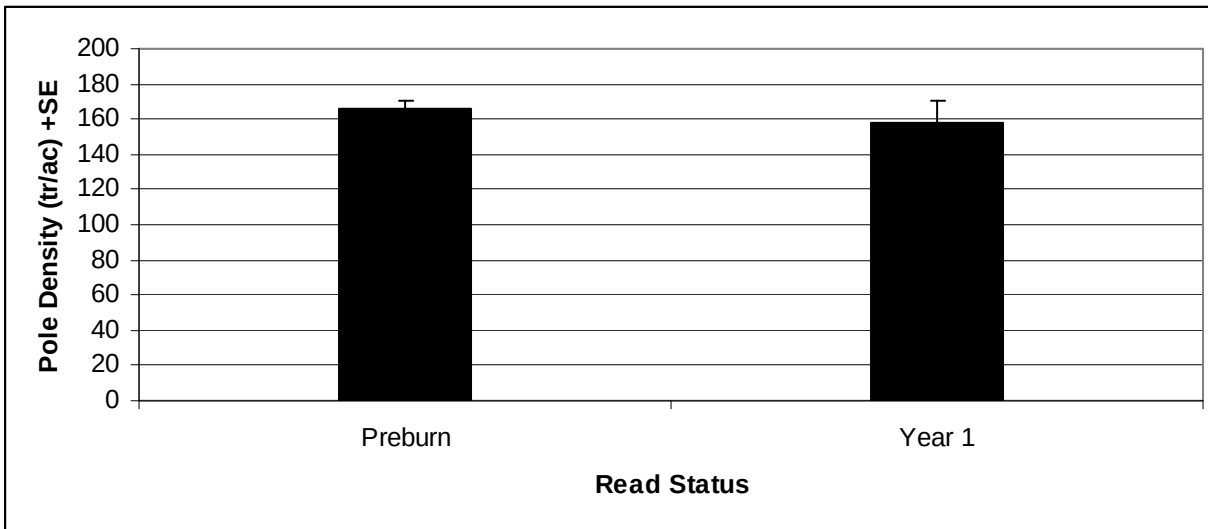


Figure 16. Number of pole trees in the oak-hickory monitoring type MACA. Objective for pole density reduction is 20% or less; actual reduction was approximately 10% by Year 1.

Mammoth Cave National Park

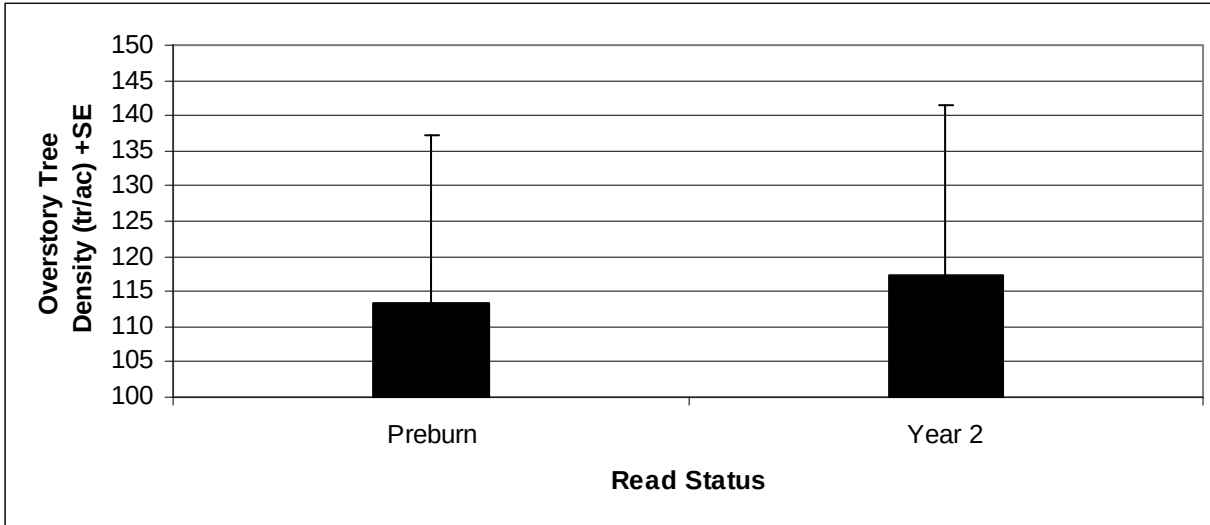


Figure 17. Average density of overstory trees per acre for 2 oak-dominated (QUMO and OAH) monitoring types at MACA (n=2 plots). Objective for pole reduction is 20% or less; actual change was an approximate 3% increase by Year 2.

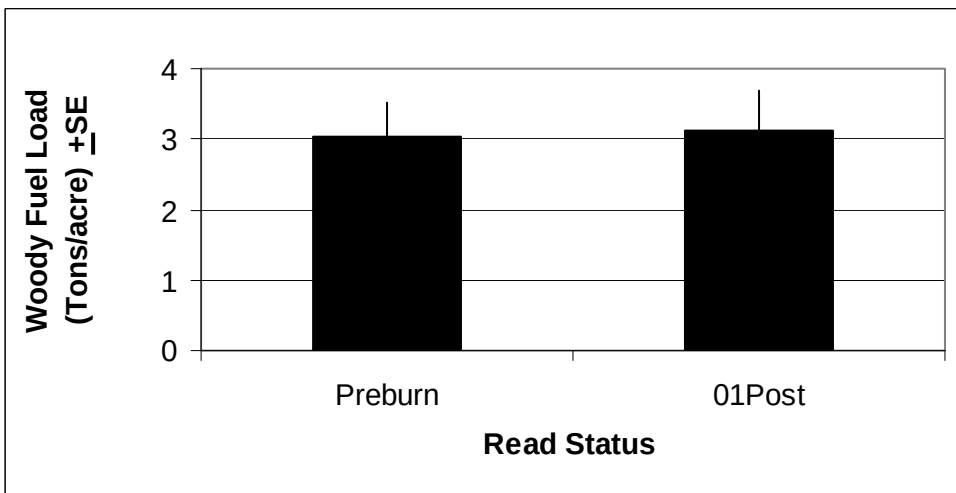


Figure 18 . Woody fuel load in the *Juniperus virginiana* glade monitoring type at MACA (n=5). Objective for fuel load reduction was 25%, and observed change was a 3% increase immediately postburn. Data from 2006.

Mammoth Cave National Park

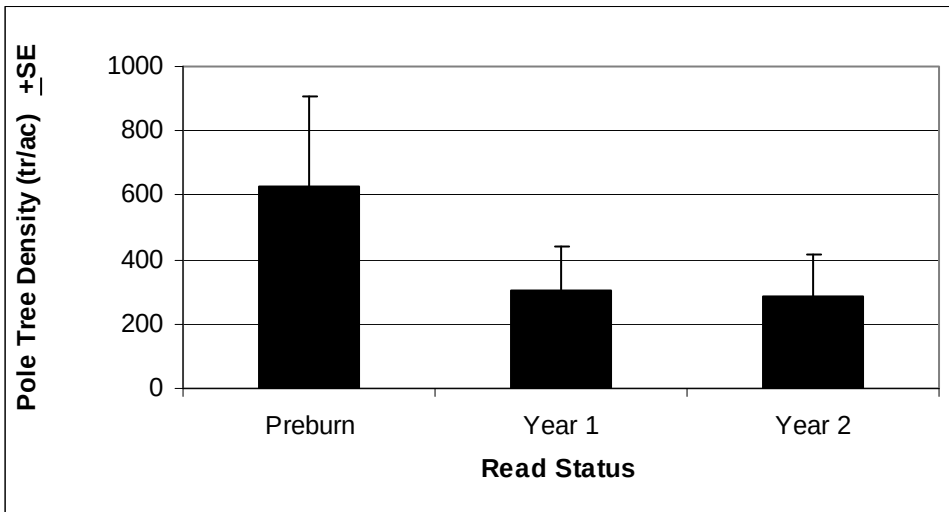


Figure 19 . Pole density the *Juniperus virginiana* monitoring type at MACA (n=5 plots). Objective for pole reduction was 25-50%, and observed reduction was 53% by Year 2.

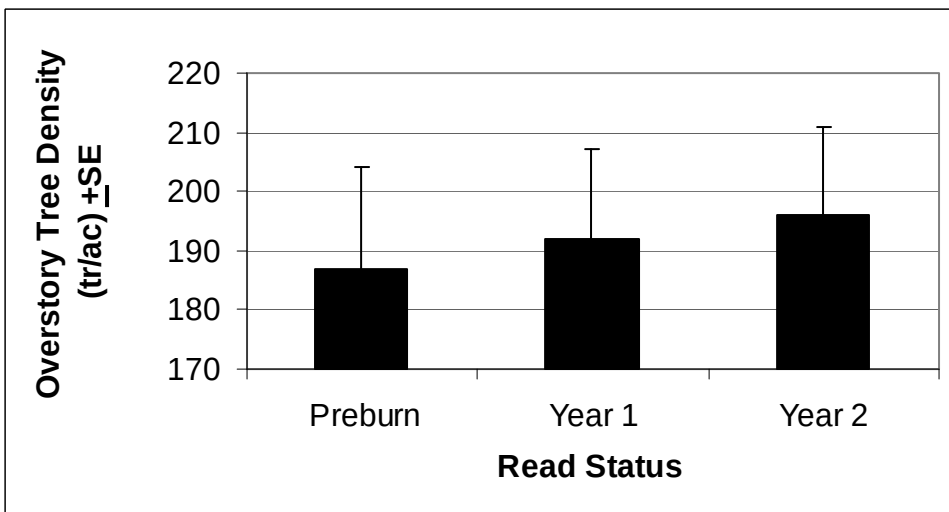


Figure 20. Overstory density in the *Juniperus virginiana* glade monitoring type at MACA (n=5, ±SE). Objective was a 20% limit on overstory mortality and observed change was a 5% increase by Year 2.

Mammoth Cave National Park

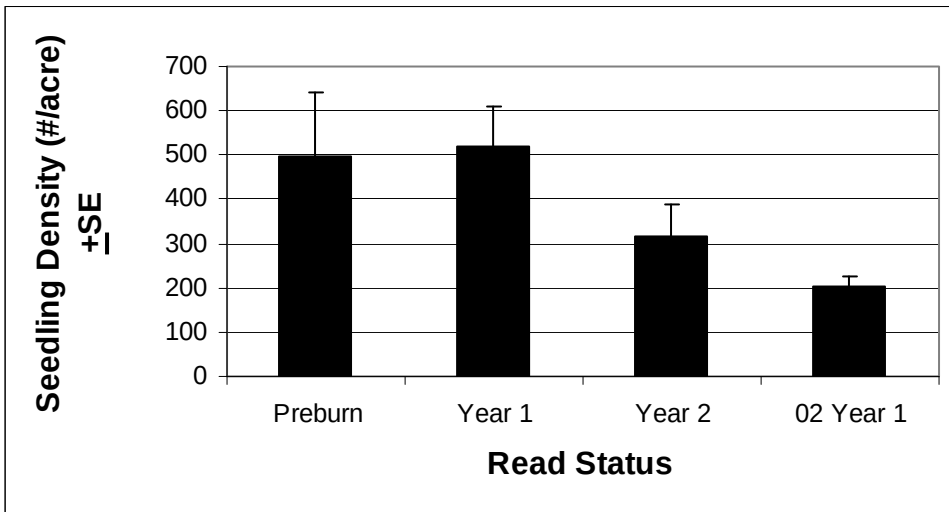


Figure 21 . Average density of *Acer* and *Juniperus* tree species on 2 *Sorghastrum nutans* transects at MACA ($\pm$ average standard error). Objective for seedling reduction is 30%; actual change was a 54% decrease for *Juniperus*, and *Acer* species combined.

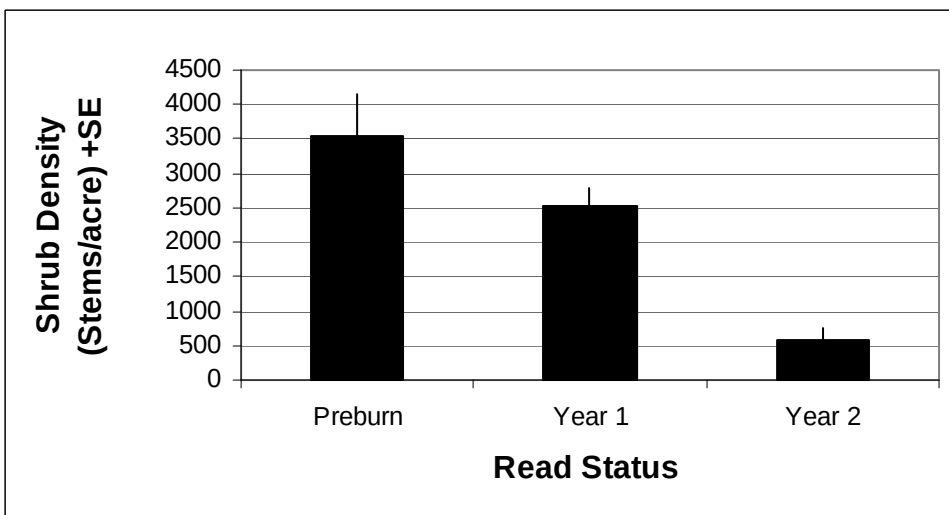


Figure 22 . Density of shrub species in the *Sorghastrum nutans* monitoring type at MACA ($\pm$ standard error, n=3 plots). Data shown compares shrub density collected preburn and at two years postburn. Objective is 30% reduction in shrub species density; average reduction was 82% by Year 2

Mammoth Cave National Park

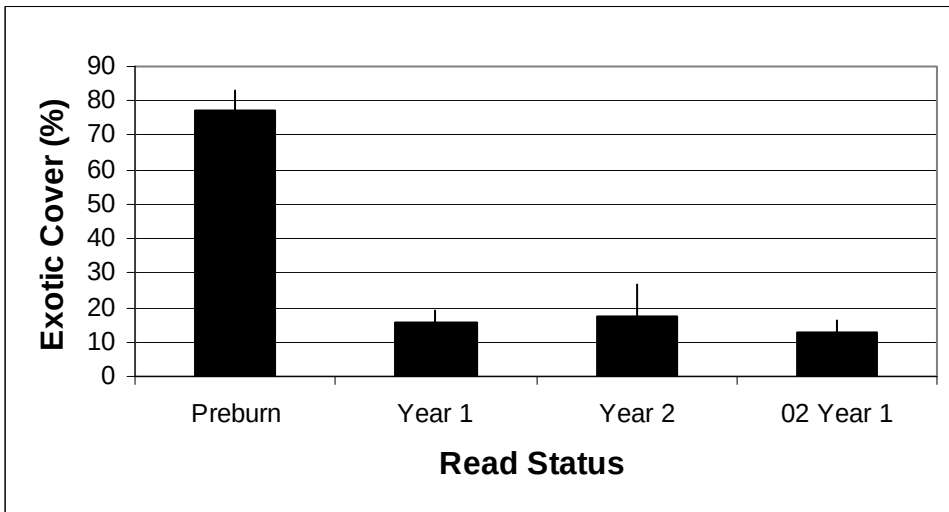


Figure 23. Percent cover of exotic species (herbaceous and woody) in the *Sorghastrum nutans* monitoring type at MACA ($\pm$ average standard error, $n=2$ plots). Objective is to cause no net gain in cover of exotic species; average exotic cover reduction was 64% by Year 1 after the 2nd fire.

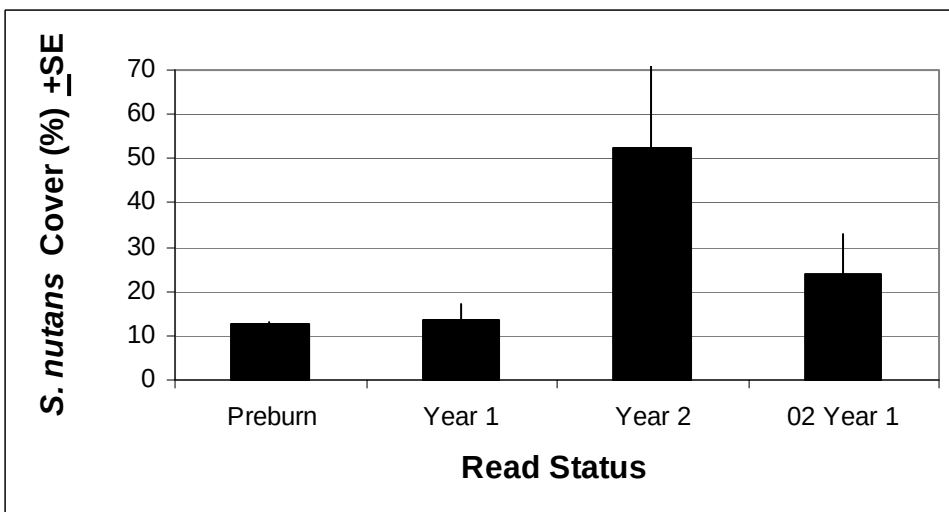


Figure 24. Percent cover of *Sorghastrum nutans* ($\pm$ SE, $n=2$ plots) at MACA, through 2 fires. Average increase in percent cover was 12% by 1 year after the 2nd fire, and minimum objective increase is 15% after 5 years of burning.

Mammoth Cave National Park

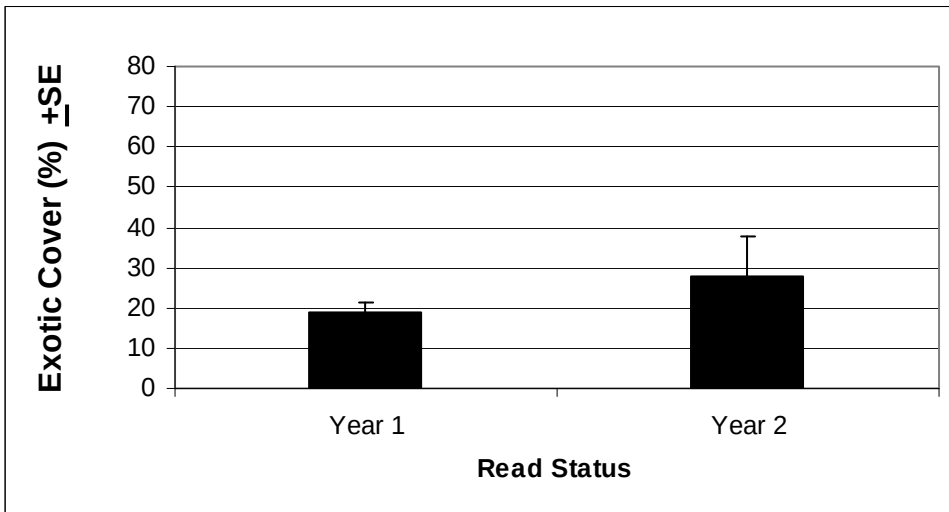


Figure 25 . Average exotic species cover for the *Andropogon gerardii* monitoring type at MACA (n=3 plots). Data is from Year 1 and Year 2 postburn, as no preburn/postburn data pairs are available at this time. Objective is no net gain in exotic cover, and observed average change was a 9% increase.

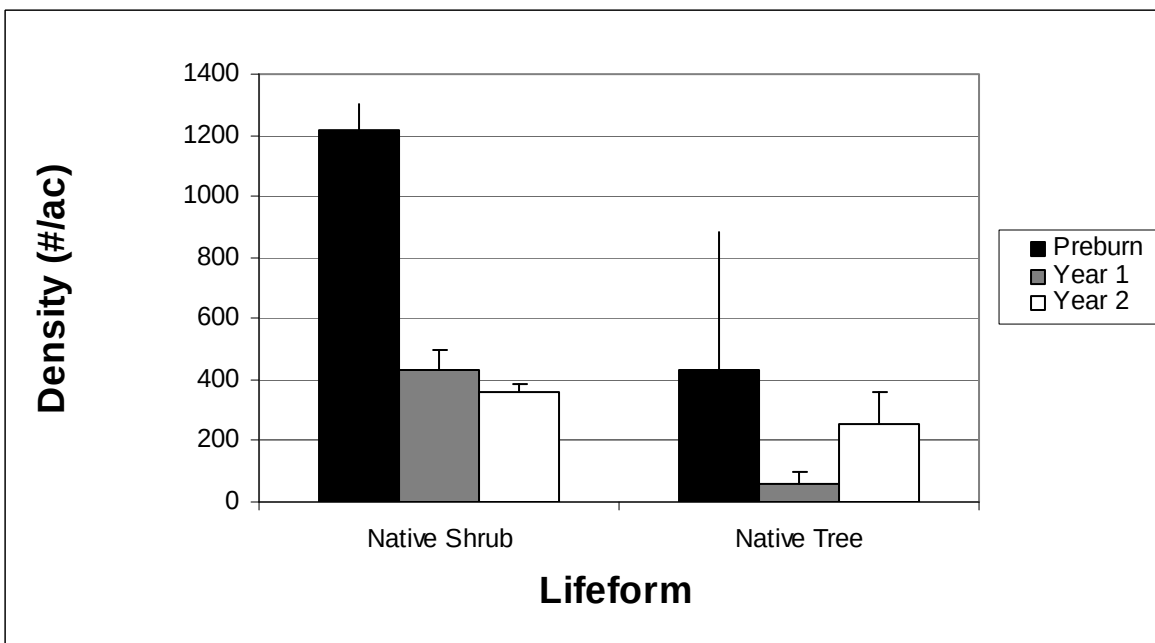


Figure 26. Average woody species density of native shrubs and trees for the *Andropogon gerardii* monitoring type at MACA (n=3 plots). Objective is a 30% decrease, and observed average change was a 1% decrease.

Mammoth Cave National Park

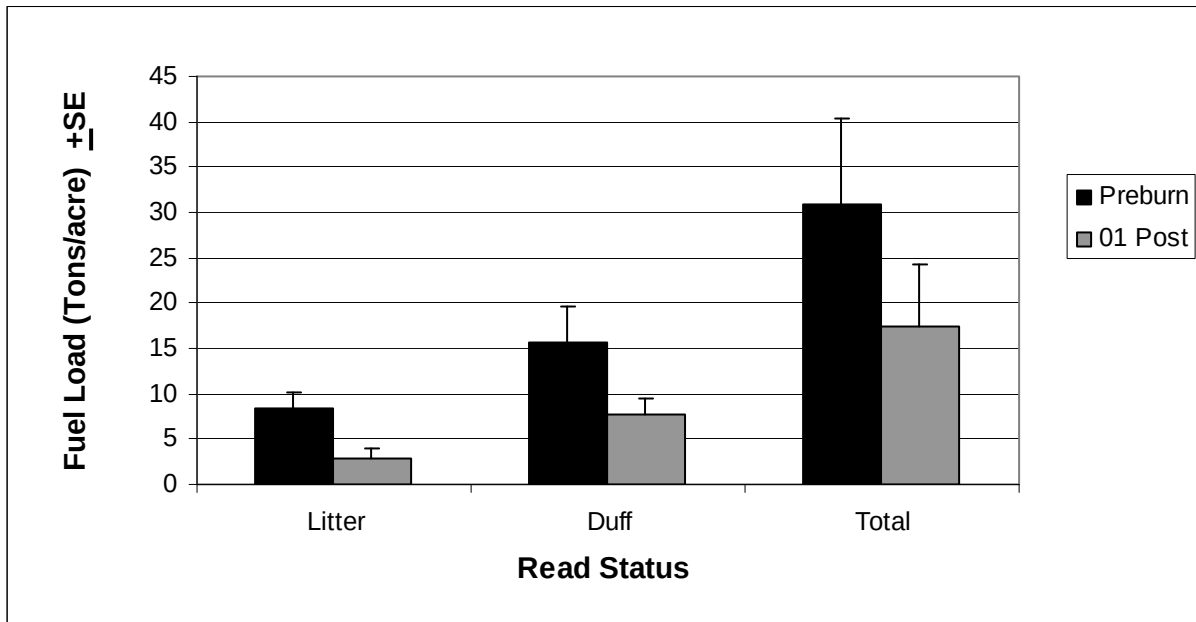


Figure 27. Average fuel load (litter, duff, and total fuel load) for the *Pinus taeda* monitoring type at NATR (n=9 plots). Objective for fuel load reduction was 20-45%, and observed change was a 43% in total fuel load as measured immediately postburn.

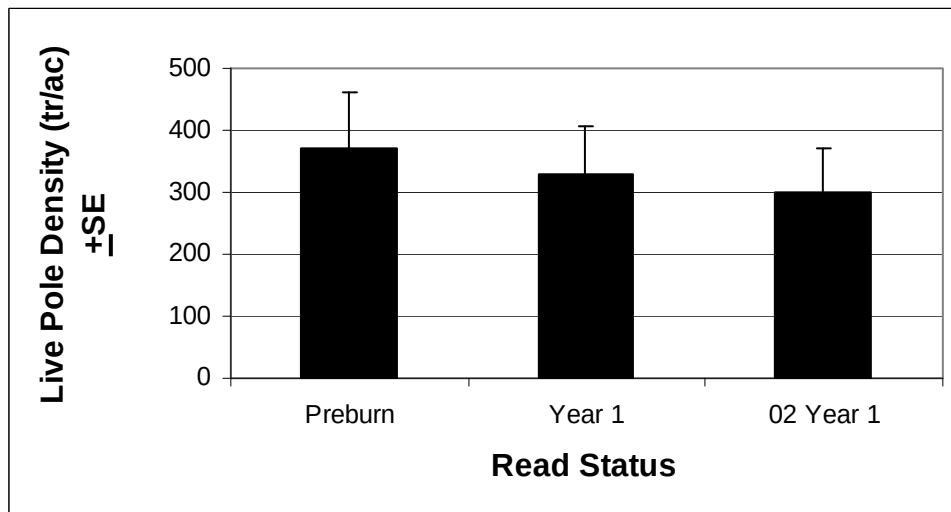


Figure 28. Average pole density for the *Pinus taeda* monitoring type at NATR (n=5 plots). Data presented is from preburn, one year after the first fire, and 1 year after the second fire (02 Year 1). Objective for density reduction was 20-40%, and observed change was 20% by one year after the second fire.

Natchez Trace Parkway

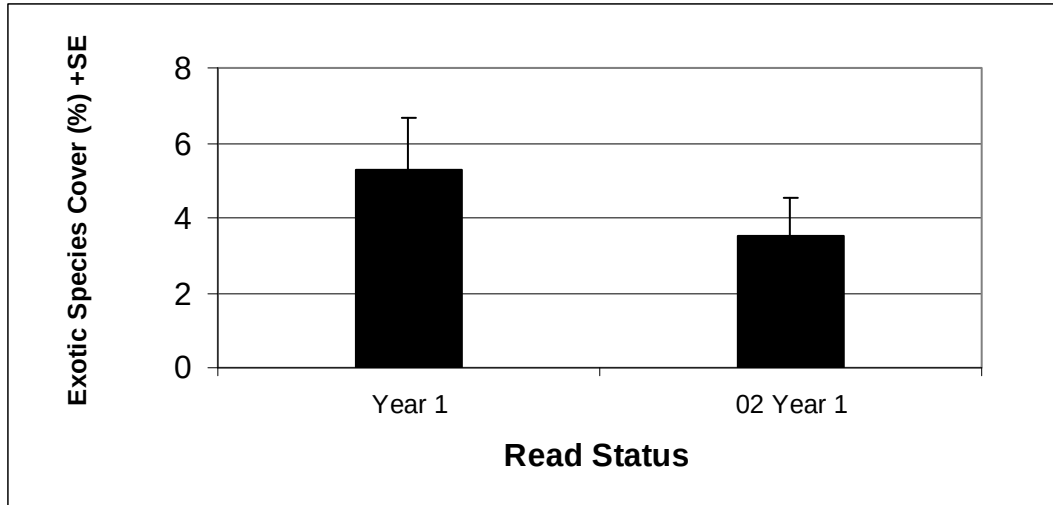


Figure 29 . Average exotic species cover for the *Pinus taeda* monitoring type at NATR (n=5 plots). . Objective for exotics cover is no net gain, actual average change was a 2% decrease between one year after the first fire and one year after the second fire.

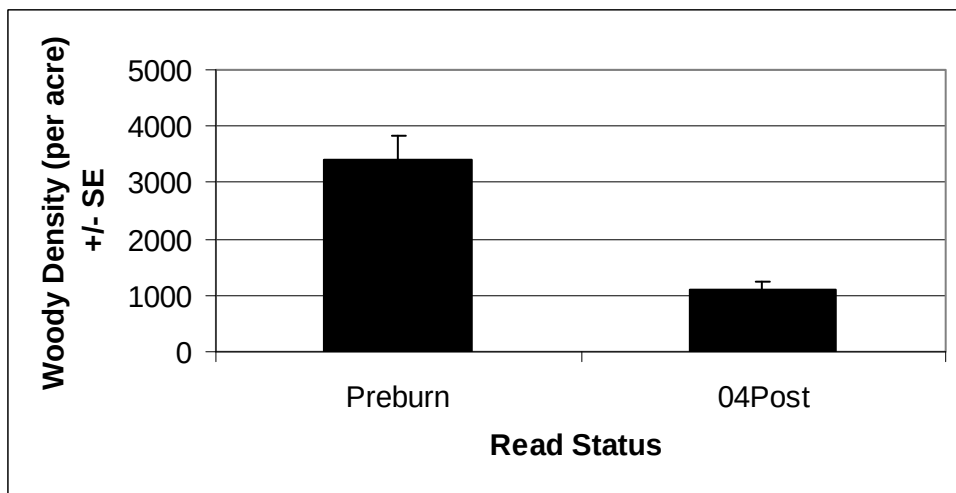


Figure 30 . Average shrub density for 4 *Juniperus virginiana* plots at NATR ($\pm$ SE). Postburn data within 2 weeks after the fourth fire. Objective for shrub density reduction was 25%, and observed reduction was 67% after the 4th fire. Data from 2006.

Natchez Trace Parkway

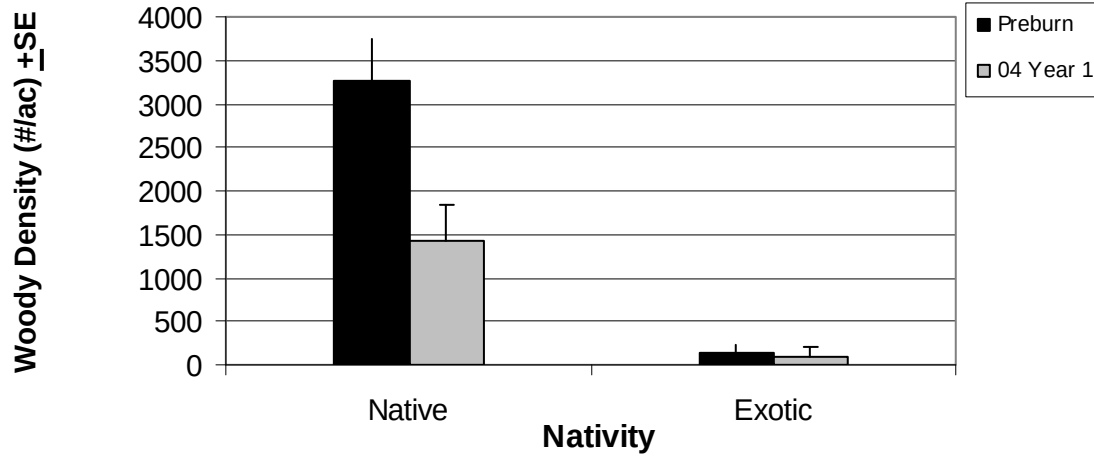


Figure 31. Average exotic and native woody density for 4 *Juniperus virginiana* plots at NATR ($\pm$ SE). Postburn data taken one year after the fourth fire. Objective for shrub density reduction was 25%, and observed reduction was 25% after the 4th fire.

Stones River National Battlefield

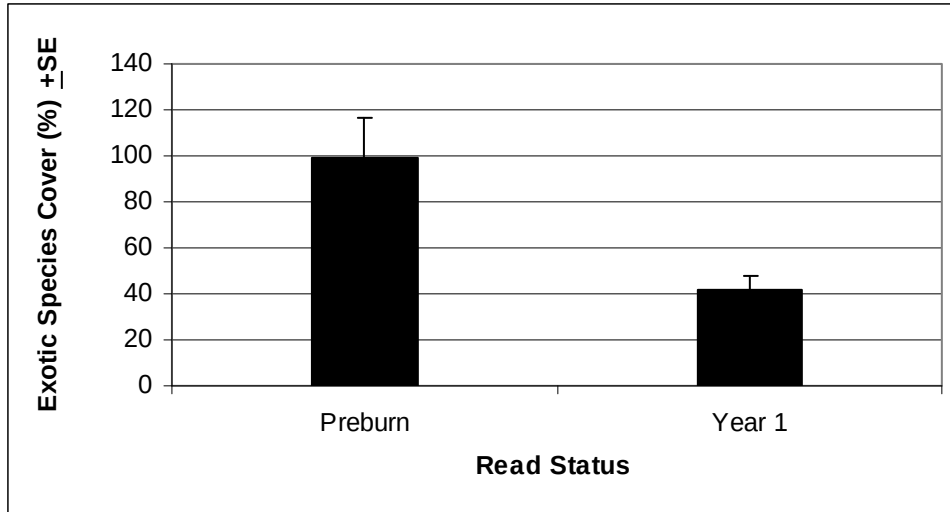


Figure 32 . Cover of exotic species for the *Schizachyrium scoparium* monitoring type at STRI (n=5 plots). Objective for exotic species cover reduction was 20%, and average change was a 57% decrease. Data includes plots from units that may have had treatment in addition to fire (herbicide and/or mowing).

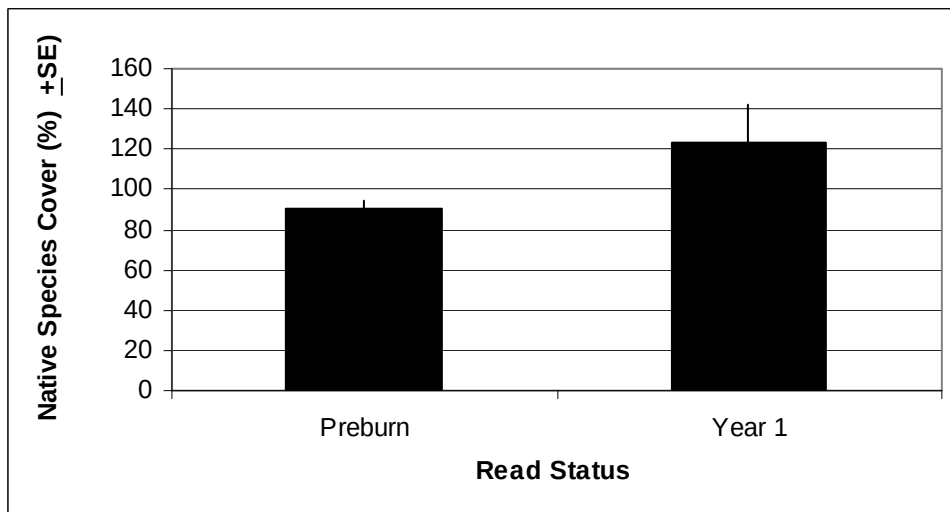


Figure 33. Cover of native herbaceous species for the *Schizachyrium scoparium* monitoring type at STRI (n=5 plots). Objective for native species cover increase was 20%, and average increase was 32%. Data includes cover of the native lifeforms forb, grass, shrub, and vine.