



**National Park Service
Fire Ecology Annual Report
Natchez Trace Fire Effects
Calendar Year 2008**

Summary

This year all crewmembers returned for the monitoring season, and therefore efficiency of operations was increased. The fire effects crew had a busy operational season, working on 45 prescribed fires at 6 parks, several wildfires, and detailing to the SER Fuels helicopter. The monitoring workload continued to increase, and the crew successfully rose to the challenge, completing 52 postreads.

Perhaps the biggest challenge was the conversion from FEAT to FFI. Much time was spent figuring out the new program, learning what (from FEAT) means what in FFI. The crew and fire ecologist attended FFI training in Asheville, and continue to learn about the new program from each other, the Google Group page, web trainings, and help from other crews/ecologists.

Table 1. Fire Effects Plot Workload 2008

Park	Monitoring Unit	Type of Plot (FMH, photo point, other)	Pre-burn	Immed. Post	Postburn (1-20 yrs)	Total Plots
Gulf Islands National Seashore	<i>Pinus clausa</i>	FMH Forest plot	0	0	5	12
	<i>Pinus palustris</i>	FMH Forest plot	0	6	3	12
	<i>Sarracenia alata</i>	FMH Forest plot	0	1	0	1
	Naval Live Oaks	Fuel Plot	1	0	0	1
	Davis Bayou	Fuel Plot	3	3	0	3
Mammoth Cave National Park	<i>Juniperus virginiana</i>	FMH Forest plot	0	0	1	7
	<i>Sorghastrum nutans</i>	FMH Grass Plot	4	0	3	7
	<i>Andropogon gerardii</i>	FMH Grass Plot	0	0	4	5
	Oak/Hickory	FMH Forest Plot	0	4	3	8
	<i>Quercus montana</i>	FMH Forest plot	1	0	0	3
Little River National Preserve	<i>Pinus echinata</i>	FMH Forest plot	0	5	6	12
	<i>Sarracenia oreophila</i>	FMH Forest plot	0	5	1	6
	<i>Quercus montana</i>	FMH Forest plot	1	0	4	7
Natchez Trace Parkway	Oak/Hickory	FMH Forest plot	1	2	1	4
	<i>Juniperus virginiana</i>	FMH Brush plot	0	4	0	4
	<i>Pinus taeda</i>	FMH Forest plot	0	3	7	14
	Blackbelt Overlook	FMH Grass Plot	0	4	0	4
	<i>Microstegium vimineum</i>	FMH Grass plot	0	10	0	20
Horseshoe Bend National Military Park	<i>Pinus palustris</i>	FMH Forest plot	2	1	2	5
Stones River National	<i>Schizachyrium scoparium</i>	FMH Grass plot	0	0	4	14
	<i>Andropogon ternarius</i>	FMH Grass plot	0	0	8	9
	<i>Andropogon virginicus</i>	FMH Grass plot	0	0	0	10
	<i>Juniperus virginiana</i>	FMH Forest Plot	1	0	0	1
Vicksburg National Military Park	Exotic/Kudzu	Photo Plot	0	3	0	3
Total			14	51	52	172

Table 2. Fire Ecology Staffing 2008

Complete or devise a staffing and personnel development table for fire ecologist and monitors. Include fire training (e.g. S-290, RX-310), distance learning or on-campus college credit, technology training, NWCG taskbooks initiated or completed, conferences attended, etc.

Ecologist and Monitors	Starting Date	Ending Date	# of Pay Periods	READ Qualified (Yes or No)	Training and Development
Lisa McInnis	1/1/08	12/31/08	26	No	Firefighter refresher, FFI training, Longleaf Alliance Conference, S-341, RX-310 (instructor and student) , Eastern Native Grass Conference, MACA Fire Interpretation Workshop, Agreements Technical Representative Training, ATV training
Amanda Callis	1/1/08	12/31/08	26	No	Firefighter refresher, FFI training, S-230, L-380, Fire Service Supervision online course, ATV training
Angela Sokolowski	1/1/08 9/14/08	4/12/08 12/31/08	8 8 (16 total)	Yes	Firefighter refresher, FFI training 2/2008. Acquired during furlough at Neal Smith NWR: S-211, ATV training, A-110, A-101, initiation of FF1/ICT5 taskbook.
Jennifer Falkey	1/1/08 8/31/08	4/26/08 12/31/08	9 9 (18 total)	No	Firefighter refresher, FFI training, S-290 and initiation of FEMO taskbook, ATV training, EMT certification, Restoration, Planning and Techniques for Forested Lands Conference

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. Note: Black font in Table 3 denotes data from 2007; blue font denotes data from 2008.

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.

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.

LIRI FQUM01G10 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	Decrease density of shade tolerant pole trees by 30-90%.	Pole reduction was 6% by Year 1. [-10% (-2%) -1%] (n=4, 1 fire) Figure 16	No, but minimum sample size not met.
	Limit mortality of overstory trees to less than 20%.	Average 2% decrease. (n=4 plots, 1 fire). [-9% (2%) 5%] Figure 16	Yes, but minimum sample size not met.
	Increase native herbaceous cover by 10-25% by 1 year after the 3 rd burn.	Average 8% increase. (n=4 plots, 1 fire). [-2% (8%) 18%] Figure 17	No, but minimum sample size not met.
	Reduce total fuel load by 25-50% immediately postburn.	Average reduction was 34% immediately postburn. [-47% (-34%) -20%] (n=6, 1 fire) Figure 18a	Yes, but minimum sample size not met.
MACA FJUUI1D09 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 ⁸ .	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

⁸ Density analyzed for *Acer* and *Juniperus* genera only.

MACA BSONU1T02 Indian grass grassland <i>Sorghastrum nutans</i>	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.
	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. ⁹

⁹ Additional plots will not likely be installed in this monitoring type, as monitoring is occurring using other methods in conjunction with local botanists.

NATR BJUVI1D06 Blackbelt prairie <i>Juniperus virginiana</i>	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.
STRI GSCSC1G02 Little Bluestem Grassland <i>Schizachyrium scoparium</i>	Reduce exotic species cover by 20-70% after 5 burns.	Cover of exotics reduced 41% (n=13) by one year after 1st fire. [-58% (-41%) -24%] Figure 32	Yes. Includes other treatments such as herbicide and mowing.
	Increase native grass and forb cover by 20-50% after 3 fires.	Native cover increased 3% (n=13 plots) by one year after 1st fire. [-13% (3%) 19%] Figure 32	
STRI GANTE1D05 <i>Andropogon ternarius</i> Middle Tennessee Barrens ¹⁰	Reduce exotic and eastern red cedar cover by 20% by 5 years postburn	Cover of exotics reduced 1% (n=5) and cedar cover reduction was 36% (n=8 plots) by one year after 2 nd fire. Figures 33 and 34	
	Increase native herbaceous species cover and diversity by 20-75%.	Native cover reduced 14% (n=8 plots) by one year after 2 nd fire [-19% (-14%) -10%]. Figure 35	

¹⁰ Note that data analyzed for 2008 has not been quality-checked; results may vary post-data checking.

Table 4. Fire Ecologist Accomplishments/Focus Areas

Category	Percent Time	Accomplishments and/or areas of activities
Planning	25	Reformatted NATR FMP Worked with contractors on EA and FONSI Consultation/Compliance for Rx Burns
Presentations	9	RX-310 (Tallahassee and Pearl, MS), Rx Fx Newsletter, MACA Fire Interpretation Workshop
NPS Meetings/ task groups	5	FESC member, host and satellite park meetings
Interagency work	1	Interagency burns, consultation with adjacent land managers
Fire Assignments	15	27 Prescribed fires at 5 NPS parks and 1 State park, 3 wildfires at NATR
Research	5	Planning/consultation and fieldwork for MACA and NATR CESUs Worked with I&M to share data at STRI
Data entry	0	Estimated amount of time spent entering data from paper to PC
Data Conversion	10	Estimated amount of time to convert FEAT data to FFI; includes verification of protocols, error checking, and learning to use FFI for querying and analysis
Data analysis	5	Estimated amount of time spent performing analyses, including data summaries and statistical tests.
Supervision/Admin	10	Hiring, supervision, travel, payroll, etc.
Training	5	Firefighter refresher, FFI training, Longleaf Alliance Conference, S-341, RX-310 (instructor and student) , Eastern Native Grass Conference, Agreements Technical Representative Training, ATV training, Physical training with crew
Miscellaneous	10	Postburn monitoring/fieldwork, GIS work, EEO counseling activities

Table 5. Fire Effects Crew Accomplishments/Focus Areas

Category	Percent Time	Notes
FMH plots	40%	
WUI plots	0%	
CBI plots	0%	
Other plot work	0%	
Fire Assignments	25%	Lead Monitor and crew members assisted on a total of 45 prescribed fires, 16 wildfires and 1 WFU Lead monitor and 1 crew member did 2 week details on SER Fuels Helicopter Lead monitor did a 2 week wildfire assignment and a 4 week wildfire assignment
Fuels Project work	0%	
Data entry	15%	
Data conversion	10%	
Data analysis	0%	
Supervision/Admin	<5%	Travel, time, credit card paperwork
Training	5%	Lead monitor and crew members completed wildfire refresher training and FFI training course Crew members completed RX-340, and ATV training Lead monitor completed L-380, S-230, Fire Service Supervision and ATV training
Miscellaneous	<5%	Fire Prevention and Education Events

Complete Attached Annual Report Supplement (“2008 Annual Report Supplement.xls”)

Provide additional explanation for the Annual Report Supplement spreadsheet here.

Be sure to **complete numbers 1 and 2**. Number 3 is optional.

1. Identify types of fire effects monitoring databases or spreadsheets being used (e.g., FFI, Access, Excel).

Currently we are using FFI and Excel.

2. Annual Meetings - Provide a brief description of the 2008 meeting(s) where fire ecologists present and discuss monitoring results with fire and non-fire park staff, and others have informal discussions.

Monitoring results were discussed informally with park staff at LIRI, GUIS, STRI, and NATR through onsite visits and park-customized monitoring result reports. Monitoring data was presented to Resource Management and Fire staff at MACA via a powerpoint presentation, informal meetings on site, and in hard copy via a monitoring report.

3. Any other information relating to the spreadsheet that you would like to include.

Optional

Attach additional material not already covered: Describe in narrative form alternative monitoring activities, unique solutions to problems, and challenges facing monitoring program. Include any collaboration with natural resource managers, other federal agencies, or research institutions. Provide graphics and/or tables of data analysis results presentations, photographs of monitoring and fire activities.

INSTRUCTIONS FOR UPLOADING 2008 ANNUAL REPORT and SUPPLEMENTAL SPREADSHEET

1. Go to the Fire folder (<ftp://63.220.43.40/Fire/>) and then place the report and spreadsheet in the FEP Annual Report folder. Instructions for how to access and log into the FTP site are below; instructions include username and password.
2. Please e-mail Nate Benson, MaryBeth Keifer, and your regional ecologist to let us know when you get your report uploaded.

Call Nate Benson (208-387-5219) or Marybeth Keifer (559-561-6802) if you have any questions or problems.

Public FTP Server

The Denver Service Center announces the availability of a new public FTP server for use by the staff to transfer files outside of the NPS.

This is a public FTP server meaning NPS staff, cooperators and contractors located outside the NPS computer network can access the site. No anonymous FTP connections are allowed. Therefore, uploading and downloading of data requires a username and password. NPS staff may share this account information with cooperators but all are reminded that this site is for use only for NPS business.

The following usage policies should be observed:

- Users must log on to the FTP server to download and upload files. No anonymous FTP access is allowed.

- To conserve limited storage space, all folders and files on the server will be deleted 15 days from the date posted. Users are strongly encouraged to delete files and folders as soon as their contact/cooperator has downloaded them.

- Users are reminded this is a public, non-reviewed site and therefore should **not** post sensitive or proprietary data on the site.

The Denver Service Center assumes no responsibility for the usage of this server.

Public FTP Site address: <ftp://63.220.43.40>

Username (UPDATED): [npsftpwin](#)

Password (UPDATED and case-sensitive): [FTP04npswin](#)

Please note: it is a zero, not an 'O'.

APPENDIX 1

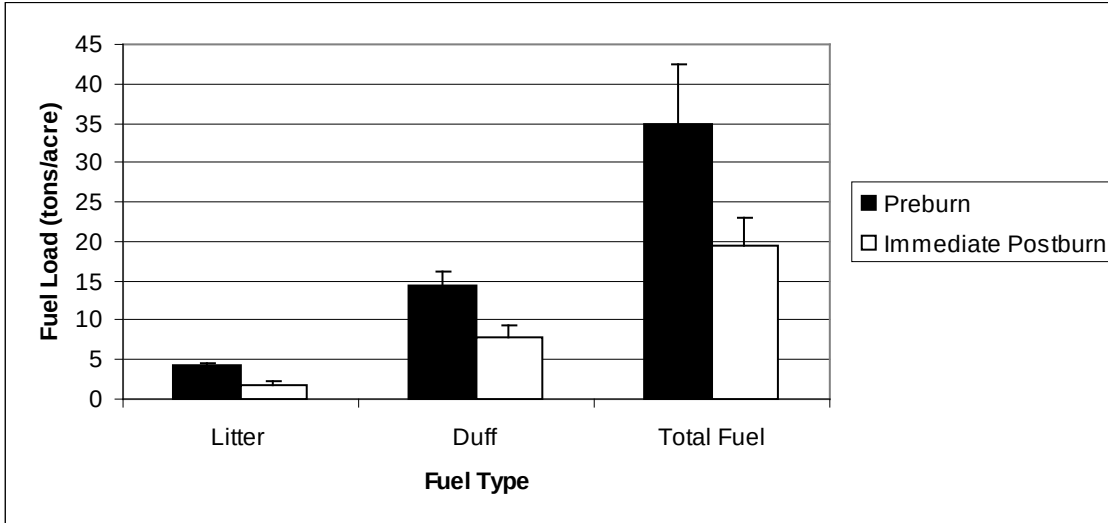


Figure 1. Average litter and duff loading for 4 *Pinus clausa* plots at GUIS ($\pm$ SE). Objective for litter and duff reduction is 20-40%; observed change was an average decrease of 48% (litter and duff combined).

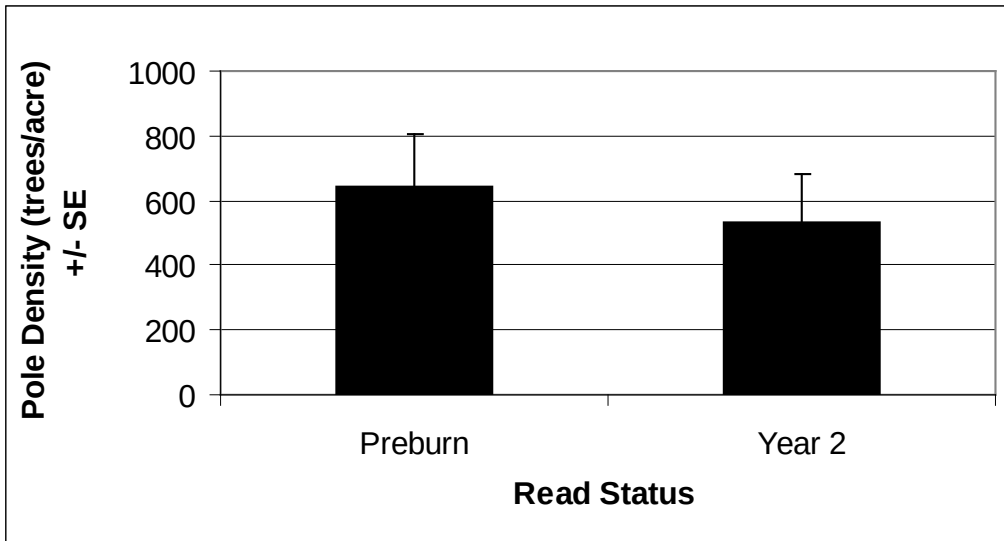


Figure 2. Average density of pole-sized trees in the *Pinus clausa* monitoring type at GUIS (n=5 plots). Year 2 data was taken 24-33 months postburn. Objective for pole reduction is 40%; actual reduction was approximately 21% by Year 2.

Gulf Islands National Seashore

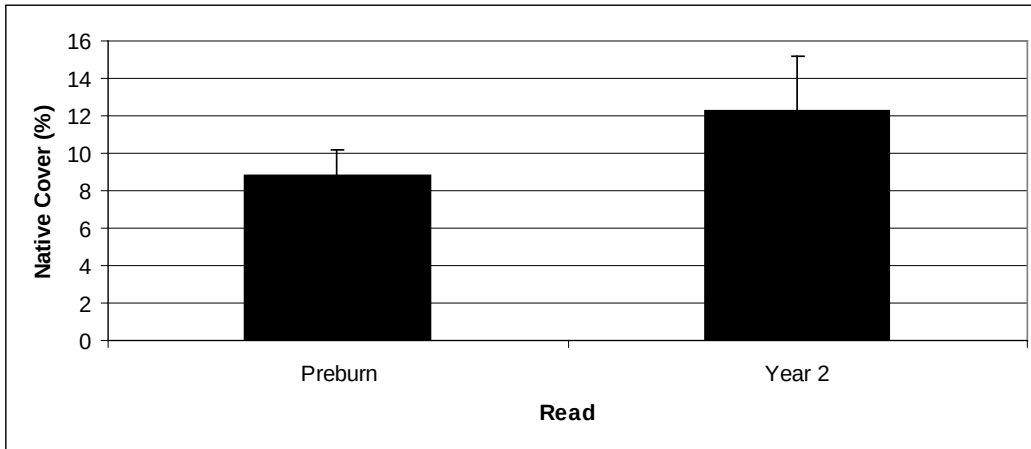


Figure 3. Mean percent cover $\pm$ SE of native grass and forb species for the *Pinus clausa* monitoring type at GUIS (n=3, $\pm$ SE). Objective for herbaceous cover increase is 20%; observed increase for forbs, grasses, grass-like species and vines was approximately 38%.

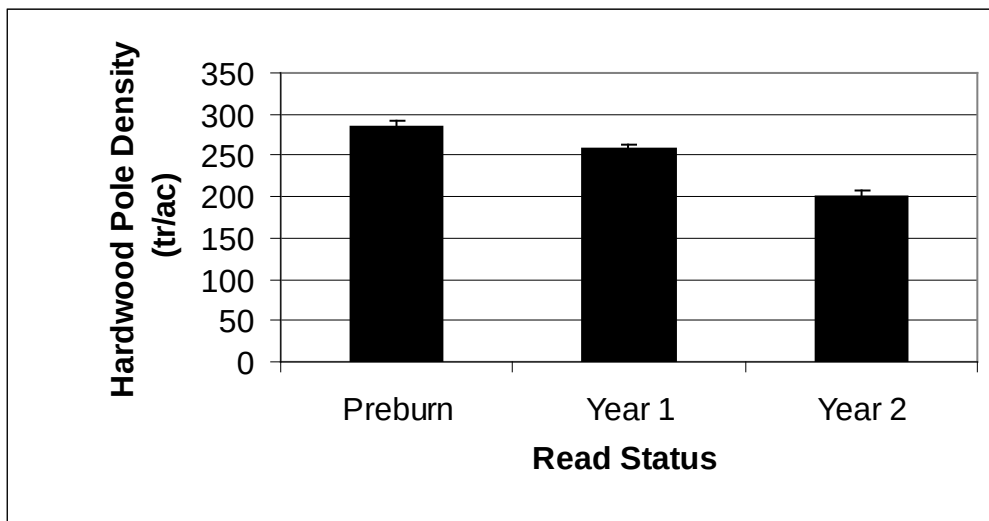


Figure 4. Average density of hardwood pole trees per acre for 10 *Pinus palustris* plots at GUIS ($\pm$ SE). Objective for pole reduction is 50%; actual reduction was approximately 15% by Year 2.

Gulf Islands National Seashore

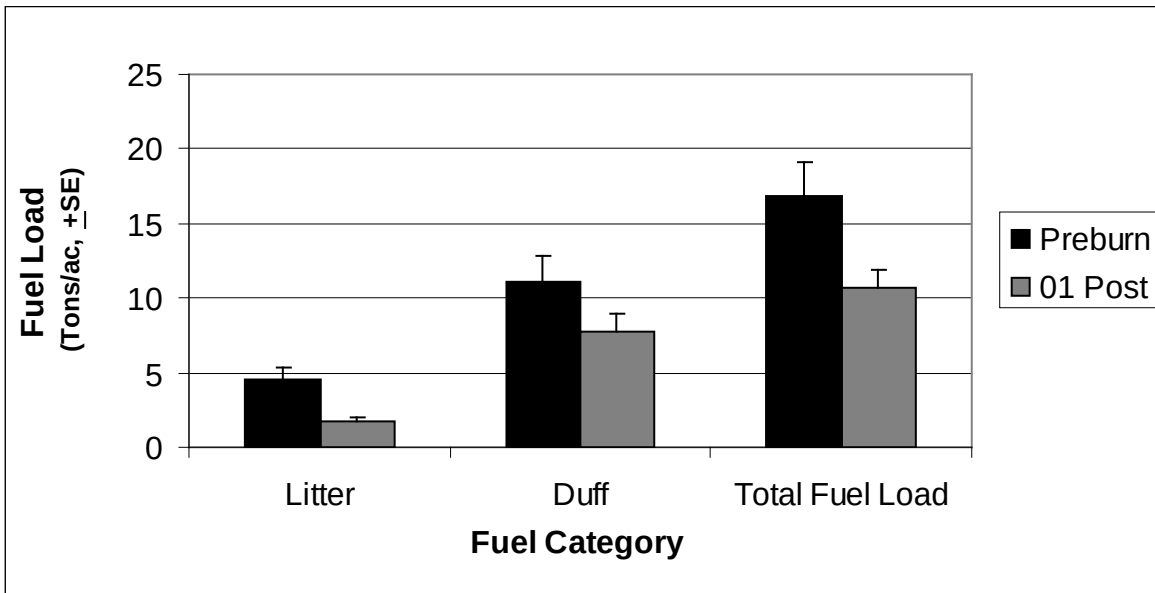


Figure 5. Average litter and duff load for the *Pinus palustris* monitoring type at GUIS (n=6 plots). Objective for litter and duff reduction is 20-40%; actual reduction for litter and duff combined was approximately 44% as measured immediately postburn.

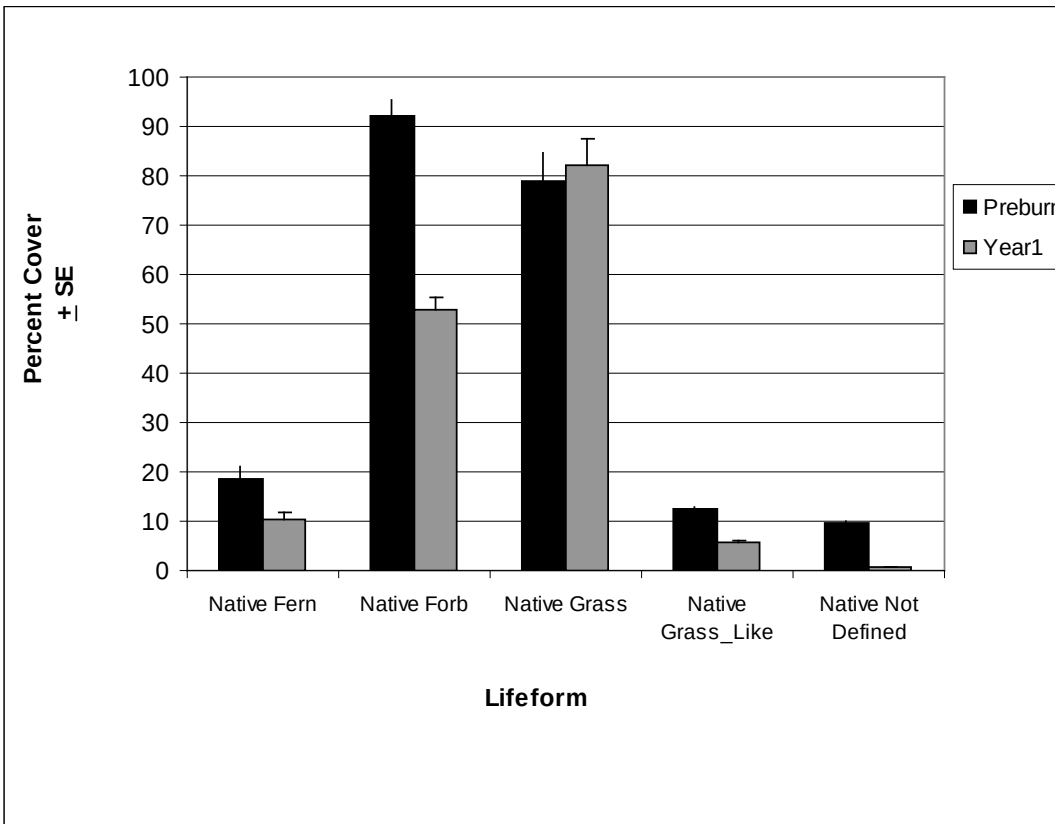


Figure 6. Mean percent cover of native herbaceous species 10 for the *Pinus palustris* monitoring type at GUIS. Year 1 data was taken from 12-18 months postburn. Objective for herbaceous cover increase is 20%; observed change was a 19% decrease. Further examination into high variability of data is needed.

Little River Canyon National Preserve

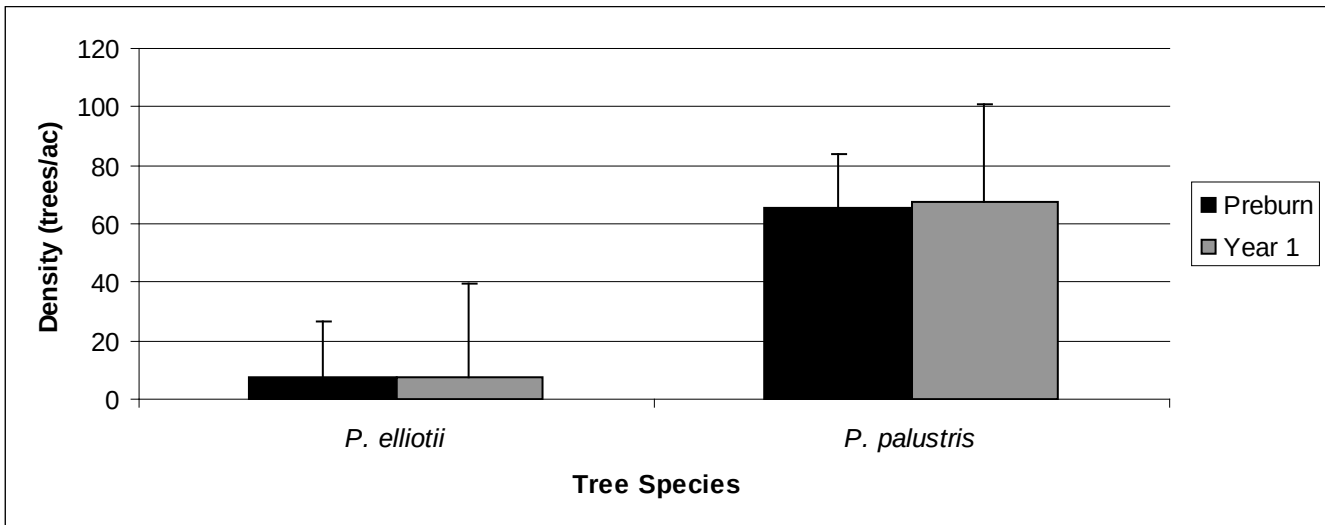


Figure 7. Mean density of slash (*P. elliotii*) and longleaf pines (*P. palustris*) overstory trees in the *Pinus palustris* monitoring type at GUIS ($\pm$ SE, n=10 plots). Year 1 data was taken from 12-18 months postburn. Objective for overstory mortality is less than 20% decrease; observed average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

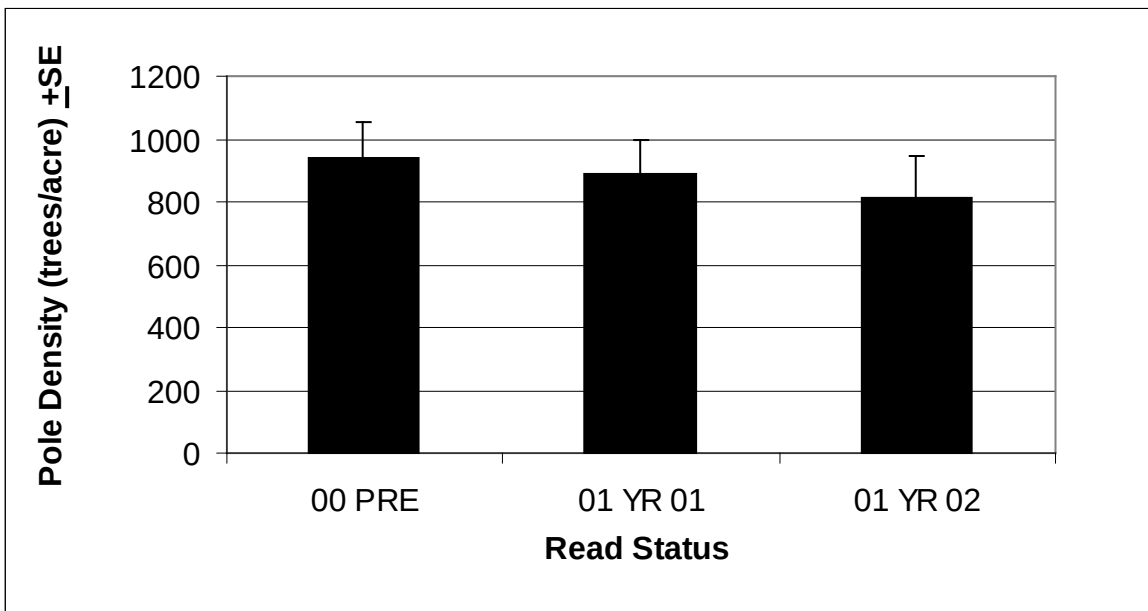


Figure 8. Average density of pole-sized trees per acre for the *Pinus echinata* monitoring type at LIRI ($\pm$ SE, n=9 plots). Objective for pole reduction is 30-90%; actual reduction was approximately 11% by Year 2.

Little River Canyon National Preserve

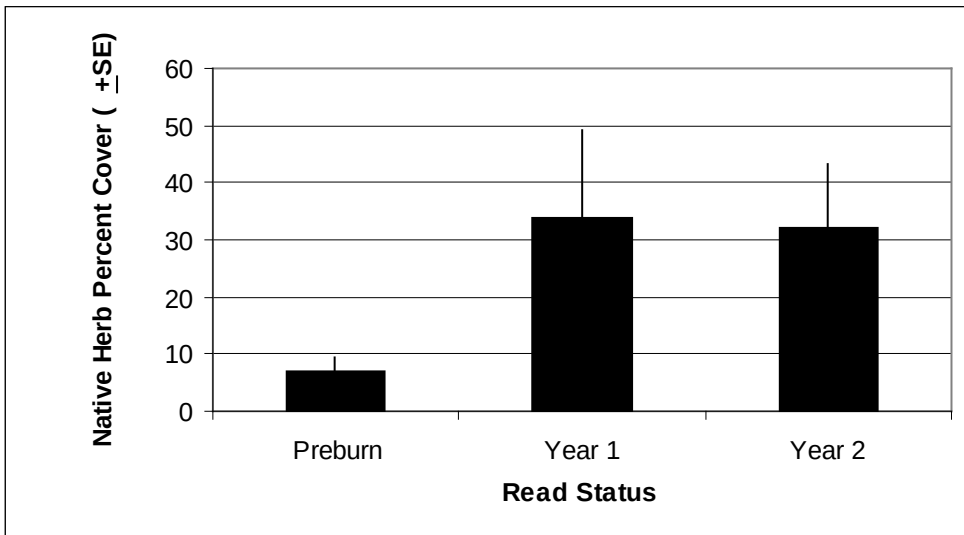


Figure 9. Percent cover of native herbaceous (ferns, forb, grass, and grasslike) species for the *Pinus echinata* monitoring type at LIRI (n=3). The objective was a 25% increase, and the average increase was 4%.

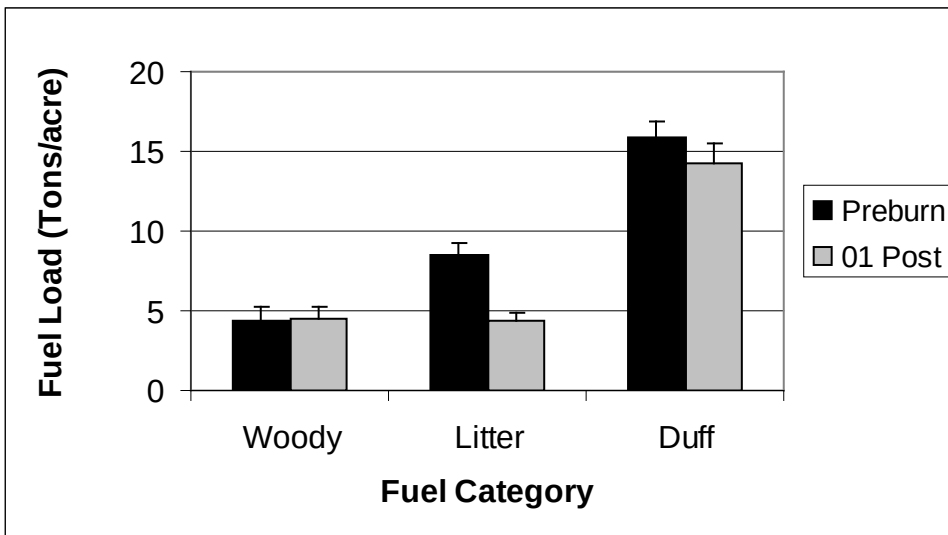


Figure 10. Average fuel load for the *Pinus echinata* monitoring type at LIRI (n=10 plots). Objective for fuel reduction was 25-50%, and actual observed average reduction was 28% for litter and duff.

Little River Canyon National Preserve

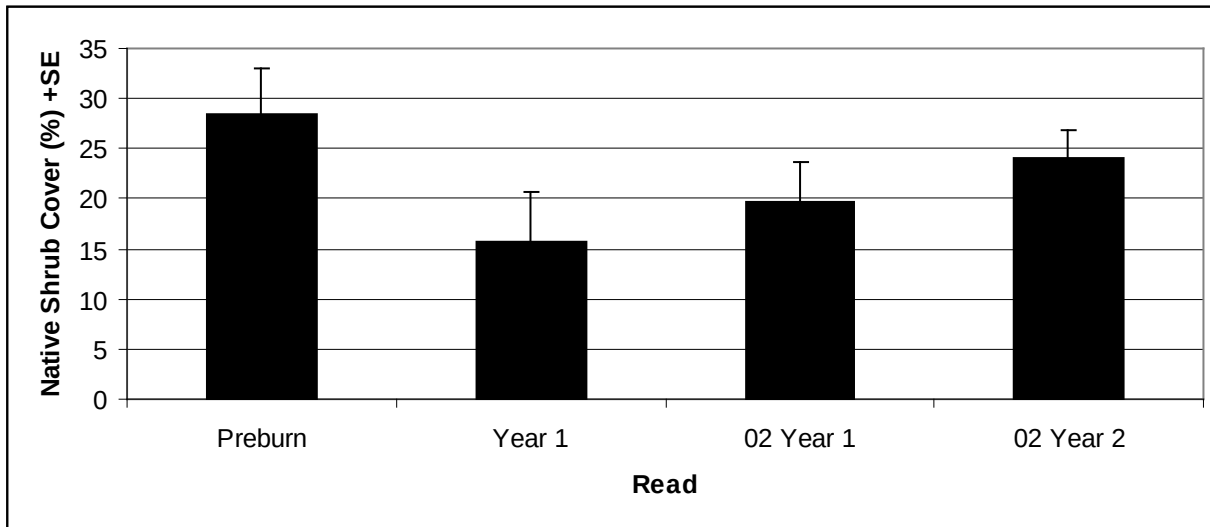


Figure 11. Average shrub cover for 3 *Sarracenia oreophila* plots at LIRI. Data shown compares shrub cover collected at one and two years after the second fire. Objective for shrub reduction is 30%; actual change was a decrease of 1% by Year 2.

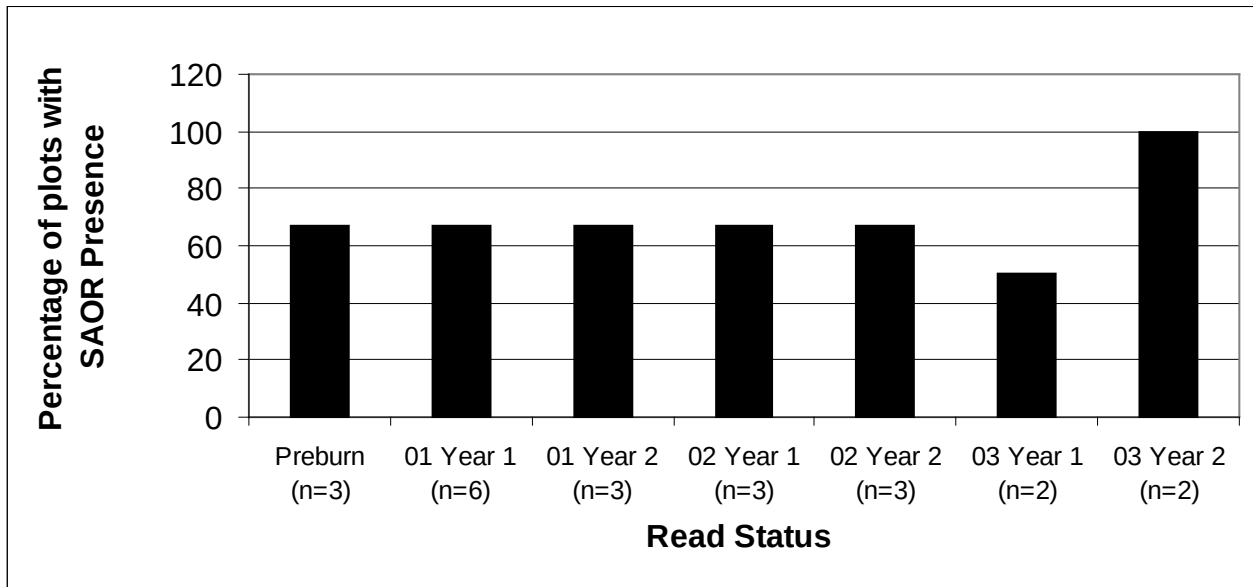


Figure 12. Presence of *Sarracenia oreophila* in SAOR plots at LIRI. Varying availability of data for the existing 6 plots necessitated viewing the data in terms of whether or not *Sarracenia oreophila* was present for plots that have available herbaceous data. For example, of the 6 plots, only 3 have 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

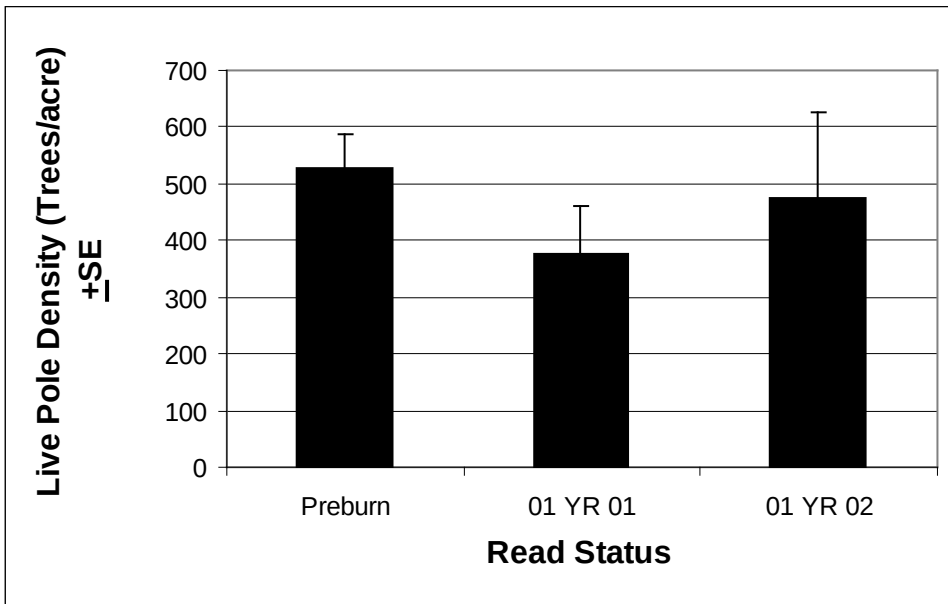


Figure 13. Average density of live pole-sized trees per acre for 3 *Sarracenia oreophila* plots at LIRI. Objective for pole reduction is 20%; actual reduction was approximately 14% by Year 2). Some mechanical thinning took place in 2 of the three plots (SAOR 4 and SAOR 6).

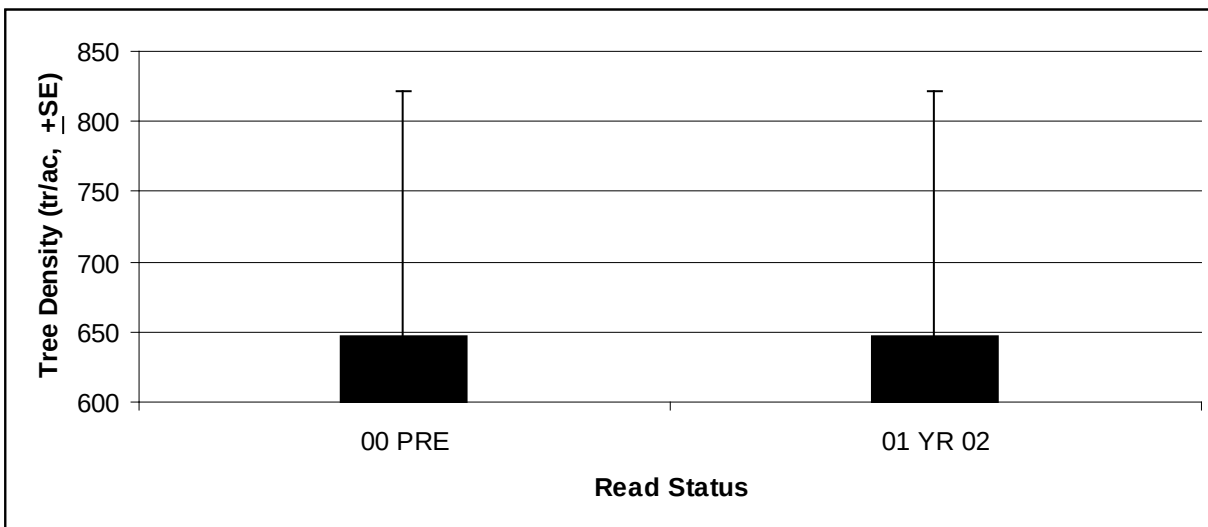


Figure 14. Average density of pole-sized trees per acre for 2 *Quercus montana* plots at LIRI. Year 2 data was taken 26 months postburn. Objective for pole reduction is 20%, no change observed at Year 2.

Little River Canyon National Preserve

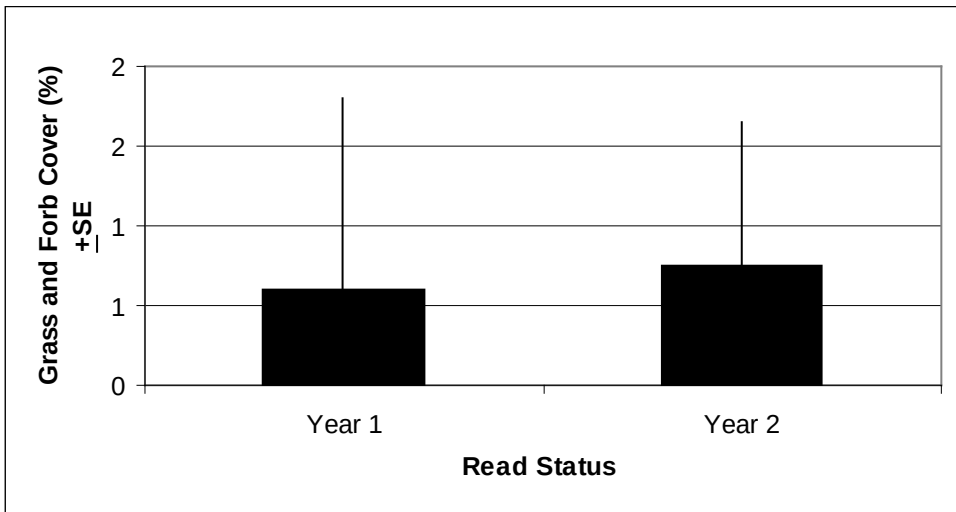


Figure 15. Mean percent cover $\pm$ SE of native grasses and forbs on 2 *Quercus montana* plots at LIRI ($\pm$ SE). Data was taken 16 and 26 months postburn. Objective for herbaceous cover increase is 25% from preburn levels; observed change for grass and forbs was 25%. No preburn data for plots that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

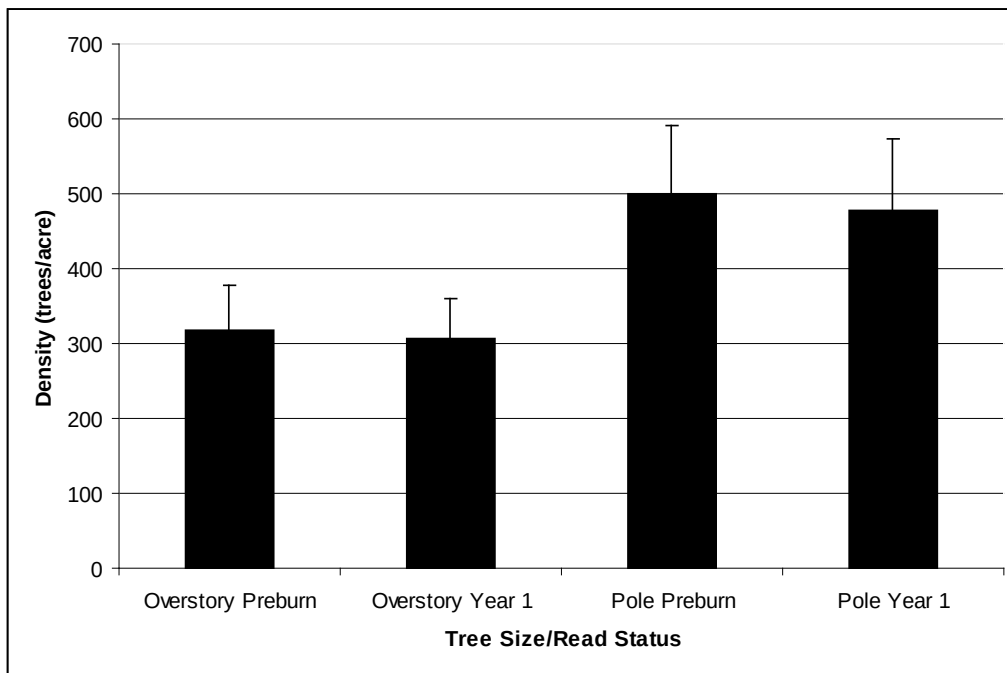


Figure 16. Average density of overstory and pole-sized trees per acre for the oak-hickory monitoring types at MACA (n=4 plots). Objective for overstory mortality is 20%, and observed average was a 2% decrease. Objective for pole reduction is 20% or less; actual change was an approximate 6% (all species) by Year 1.

Mammoth Cave National Park

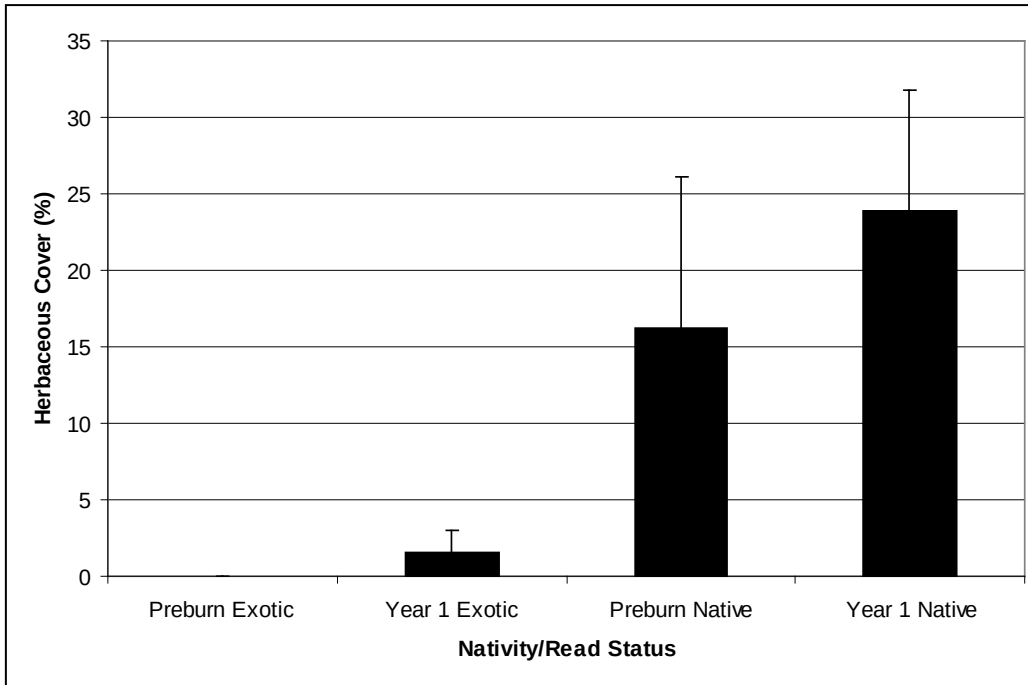


Figure 17. Exotic and native herbaceous cover for the oak hickory monitoring type at MACA ($\pm$ SE, n=4). Objective for native herbaceous cover increase is 10% by 1 year after the third burn. Observed results after one fire include an increase of 8%. Exotic cover on one plot increased (*Microstegium vimineum* on OAH1 7 in Crystal Cave).

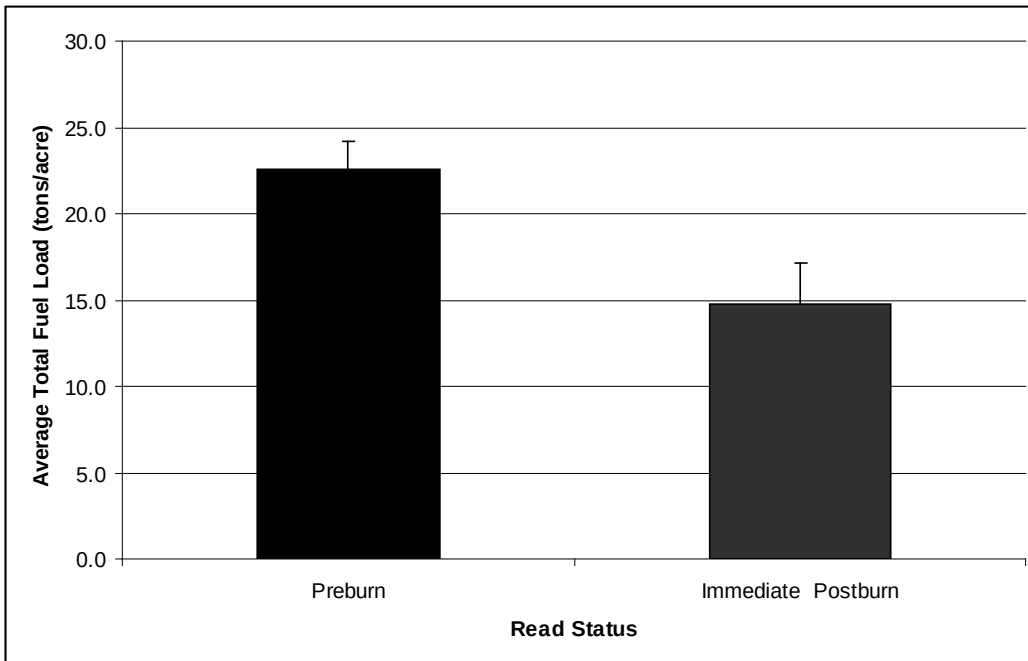


Figure 18a . Total fuel load in the oak-hickory monitoring type at MACA ($\pm$ SE, n=6 plots). The objective for fuel reduction is 25-50% immediately postburn, and the observed average decrease was 34%.

Mammoth Cave National Park

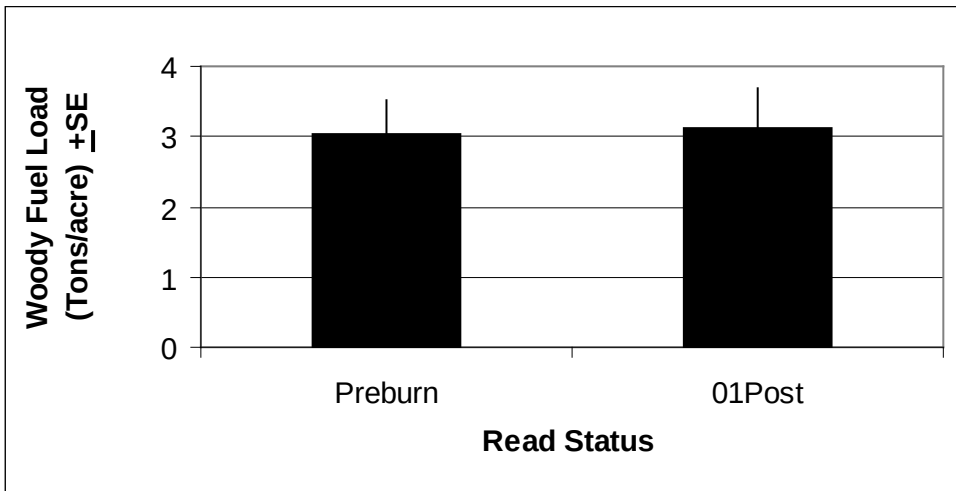


Figure 18 . Woody fuel load in the *Juniperus virginiana* glade monitoring type at MACA (n=5). Objective for fuel load reduction was 25%, and observed change was a 3% increase immediately postburn. Data from 2006.

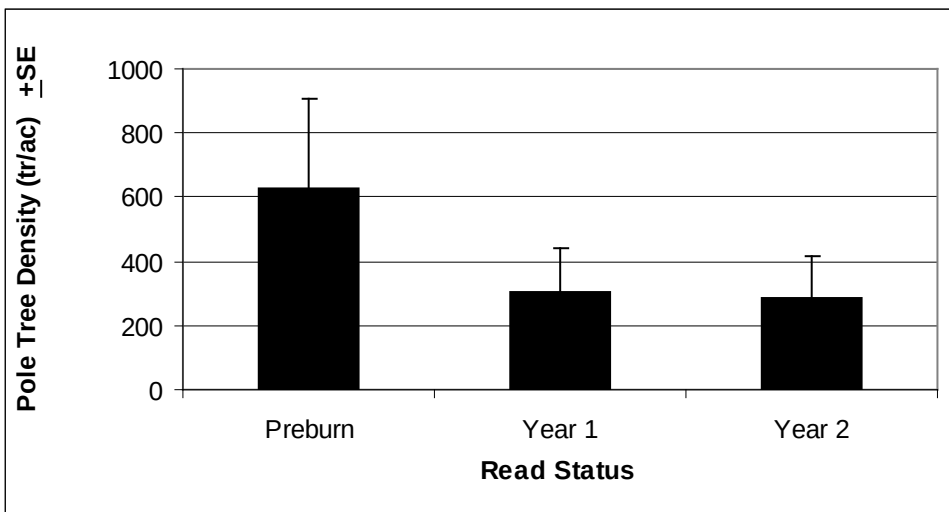


Figure 19 . Pole density the *Juniperus virginiana* monitoring type at MACA (n=5 plots). Objective for pole reduction was 25-50%, and observed reduction was 53% by Year 2.

Mammoth Cave National Park

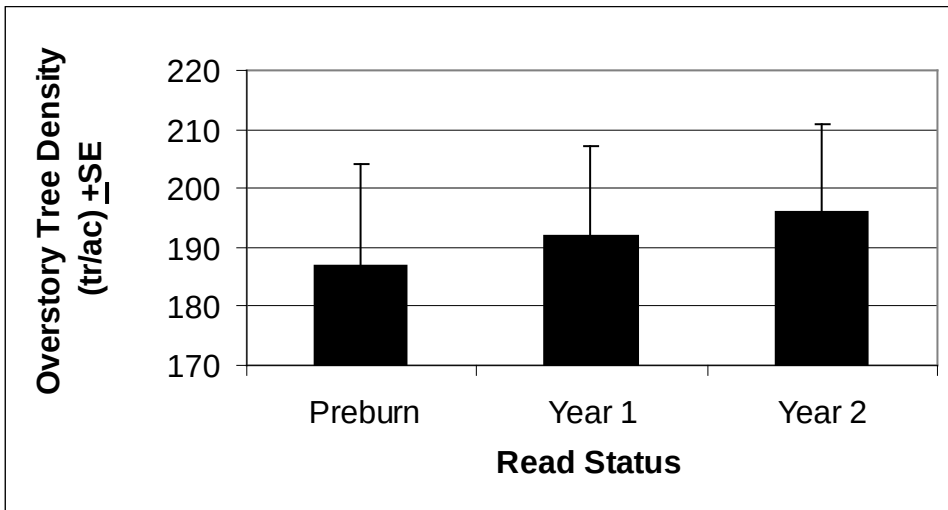


Figure 20. Overstory density in the *Juniperus virginiana* glade monitoring type at MACA (n=5, $\pm$ SE). Objective was a 20% limit on overstory mortality and observed change was a 5% increase by Year 2.

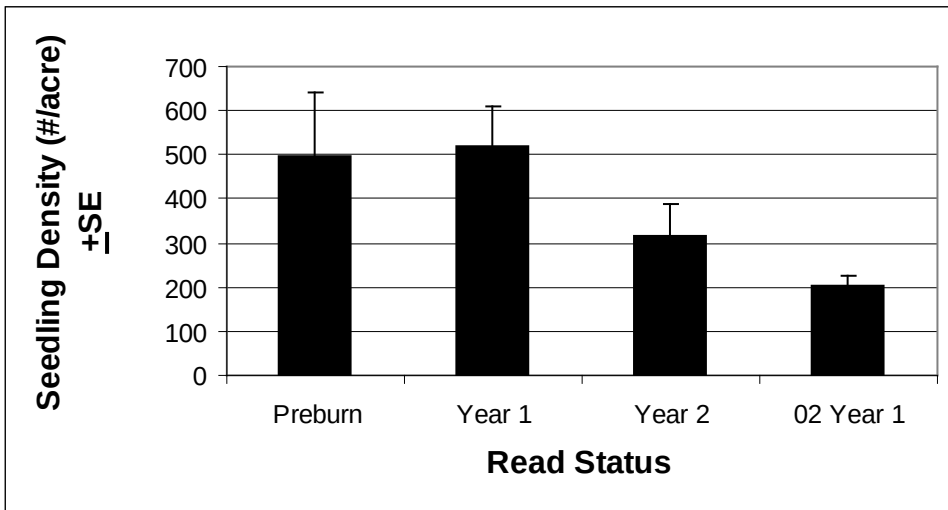


Figure 21 . Average density of *Acer* and *Juniperus* tree species on 2 *Sorghastrum nutans* transects at MACA ($\pm$ average standard error). Objective for seedling reduction is 30%; actual change was a 54% decrease for *Juniperus*, and *Acer* species combined.

Mammoth Cave National Park

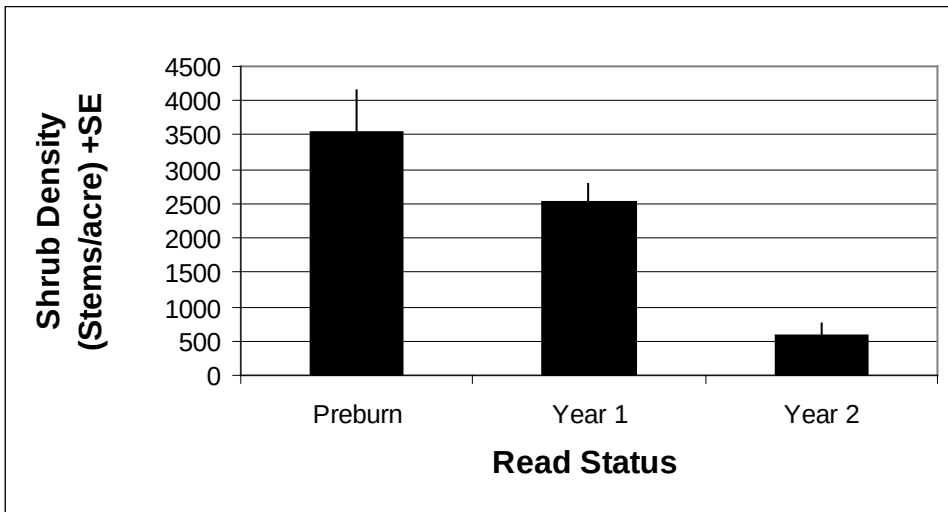


Figure 22 . Density of shrub species in the *Sorghastrum nutans* monitoring type at MACA ($\pm$ standard error, n=3 plots). Data shown compares shrub density collected preburn and at two years postburn. Objective is 30% reduction in shrub species density; average reduction was 82% by Year 2

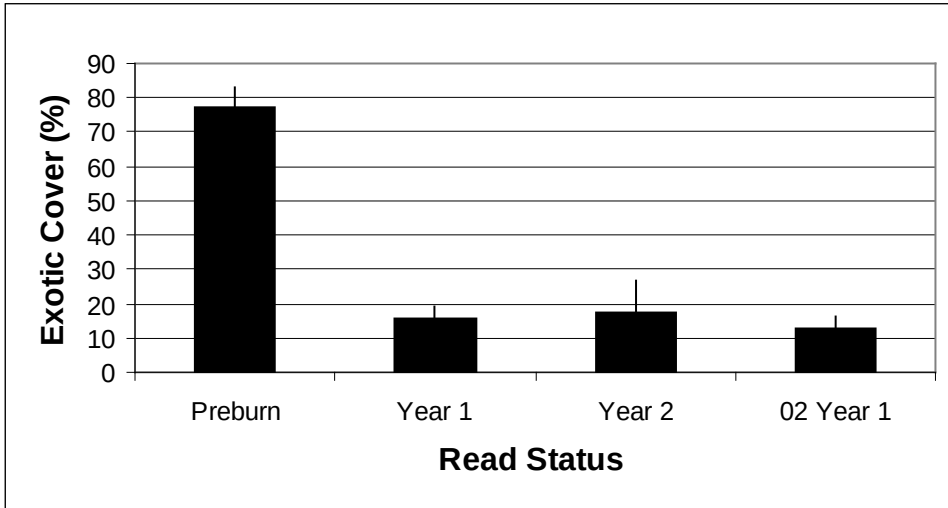


Figure 23. Percent cover of exotic species (herbaceous and woody) in the *Sorghastrum nutans* monitoring type at MACA ($\pm$ average standard error, n=2 plots). Objective is to cause no net gain in cover of exotic species; average exotic cover reduction was 64% by Year 1 after the 2nd fire.

Mammoth Cave National Park

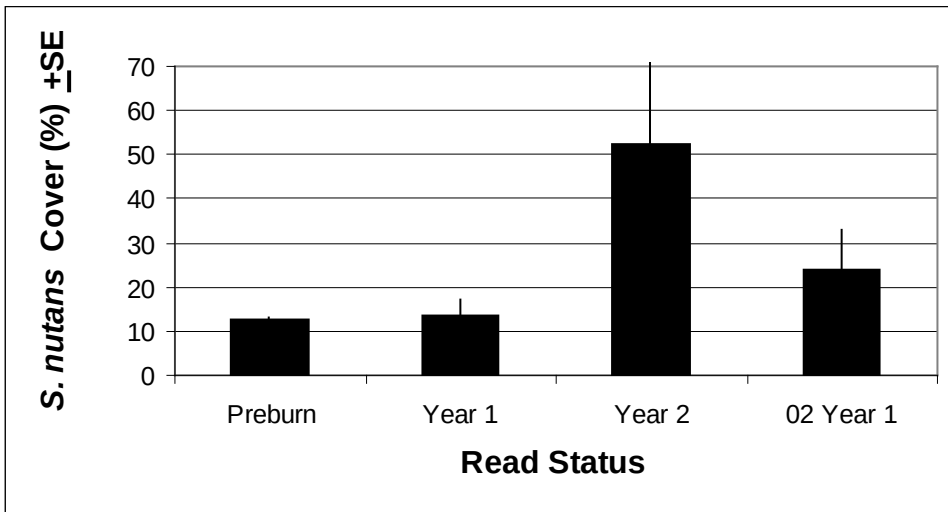


Figure 24. Percent cover of *Sorghastrum nutans* ($\pm$ SE, n=2 plots) at MACA, through 2 fires. Average increase in percent cover was 12% by 1 year after the 2nd fire, and minimum objective increase is 15% after 5 years of burning.

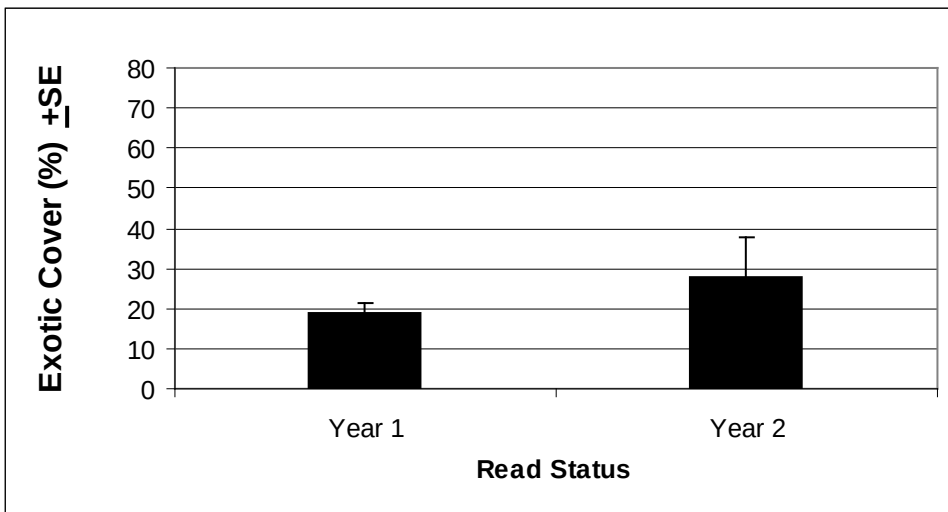


Figure 25 . Average exotic species cover for the *Andropogon gerardii* monitoring type at MACA (n=3 plots). Data is from Year 1 and Year 2 postburn, as no preburn/postburn data pairs are available at this time. Objective is no net gain in exotic cover, and observed average change was a 9% increase.

Mammoth Cave National Park

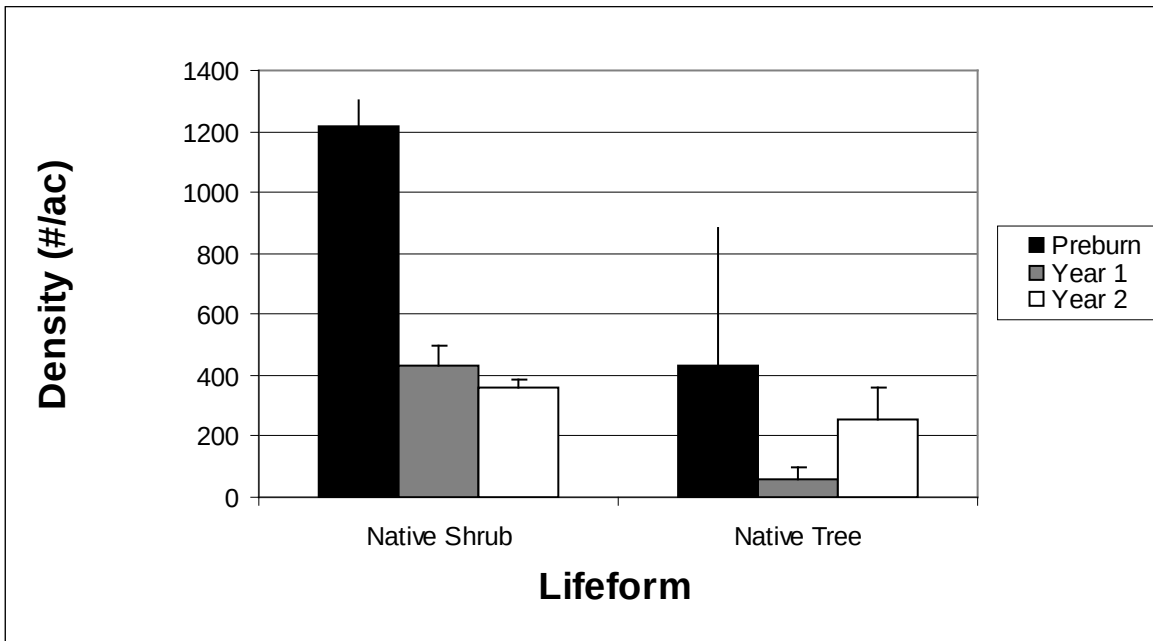


Figure 26. Average woody species density of native shrubs and trees for the *Andropogon gerardii* monitoring type at MACA (n=3 plots). Objective is a 30% decrease, and observed average change was a 1% decrease.

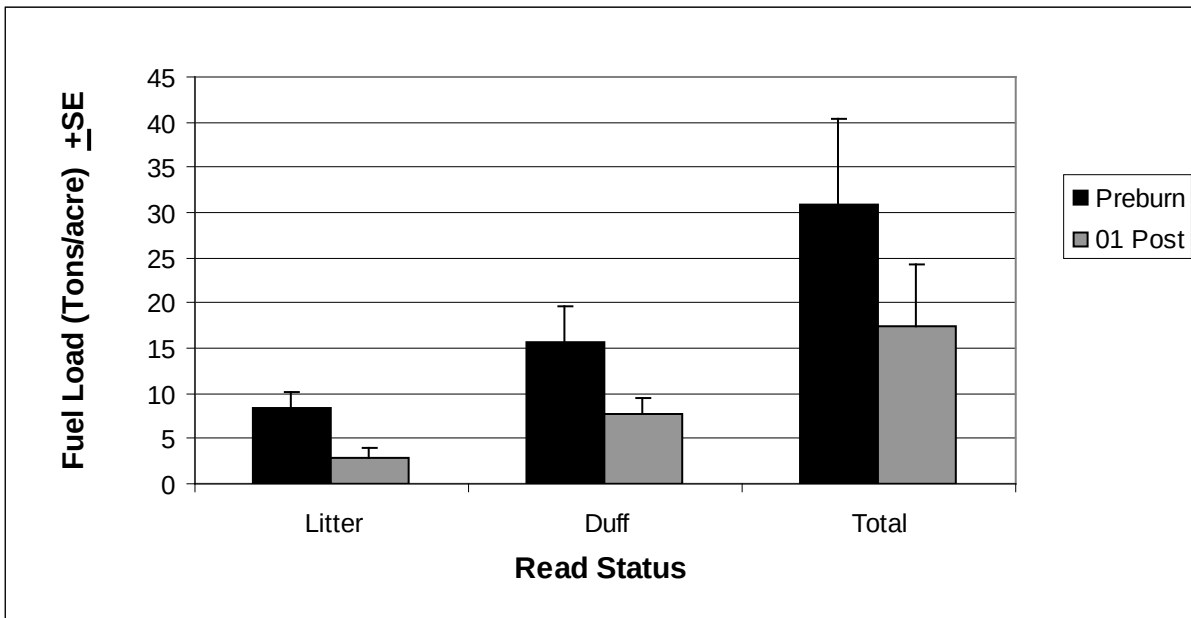


Figure 27. Average fuel load (litter, duff, and total fuel load) for the *Pinus taeda* monitoring type at NATR (n=9 plots). Objective for fuel load reduction was 20-45%, and observed change was a 43% in total fuel load as measured immediately postburn.

Natchez Trace Parkway

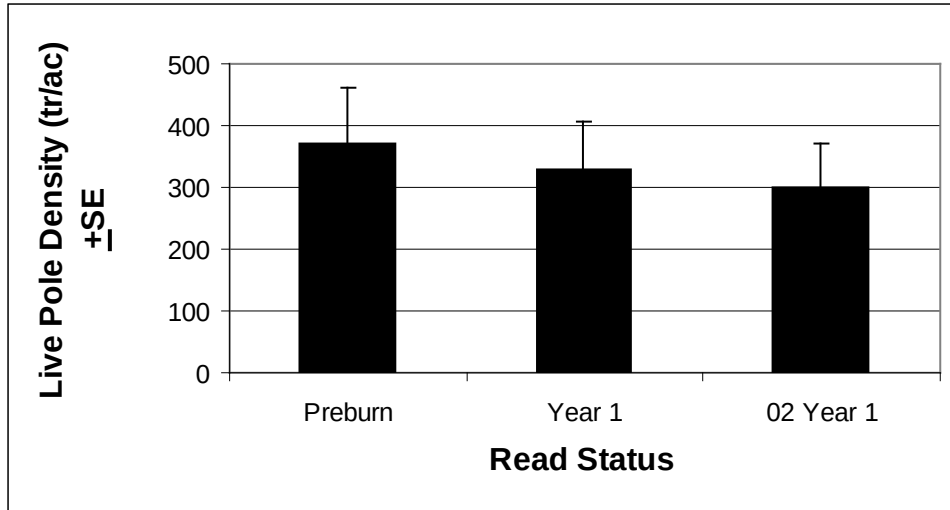


Figure 28. Average pole density for the *Pinus taeda* monitoring type at NATR (n=5 plots). Data presented is from preburn, one year after the first fire, and 1 year after the second fire (02 Year 1). Objective for density reduction was 20-40%, and observed change was 20% by one year after the second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

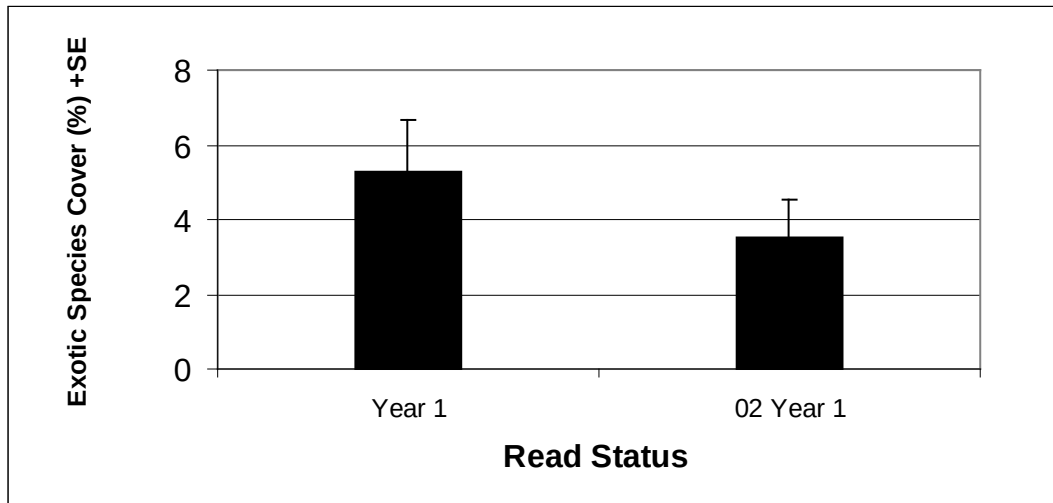


Figure 29 . Average exotic species cover for the *Pinus taeda* monitoring type at NATR (n=5 plots). . Objective for exotics cover is no net gain, actual average change was a 2% decrease between one year after the first fire and one year after the second fire.

Natchez Trace Parkway

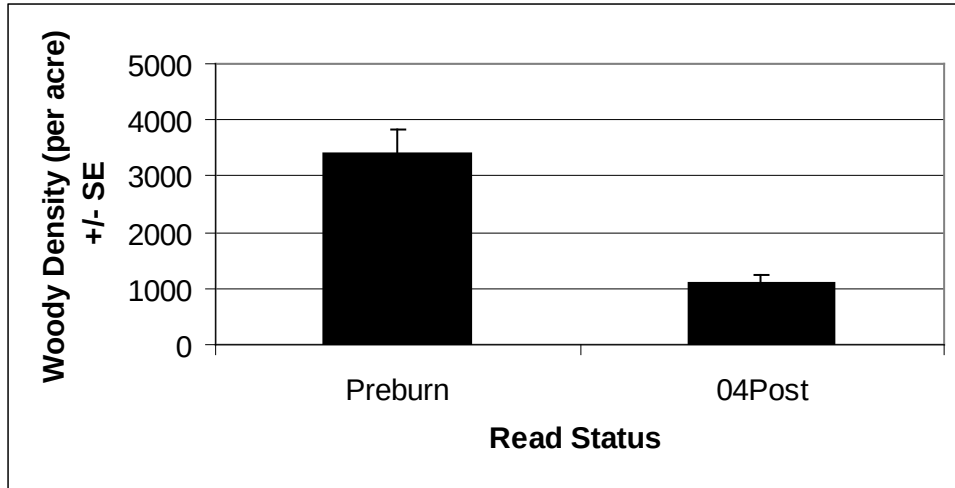


Figure 30 . Average shrub density for 4 *Juniperus virginiana* plots at NATR ($\pm$ SE). Postburn data within 2 weeks after the fourth fire. Objective for shrub density reduction was 25%, and observed reduction was 67% after the 4th fire. Data from 2006.

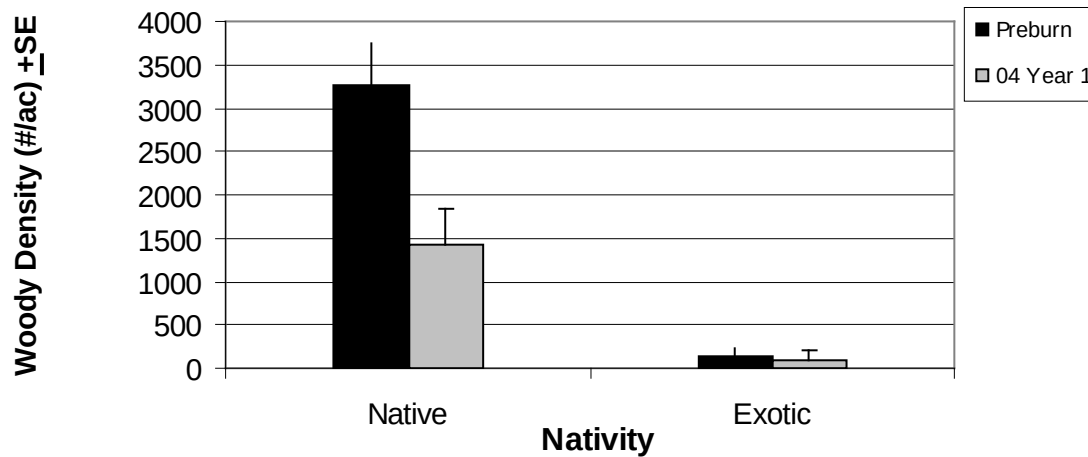


Figure 31. Average exotic and native woody density for 4 *Juniperus virginiana* plots at NATR ($\pm$ SE). Postburn data taken one year after the fourth fire. Objective for shrub density reduction was 25%, and observed reduction was 25% after the 4th fire.

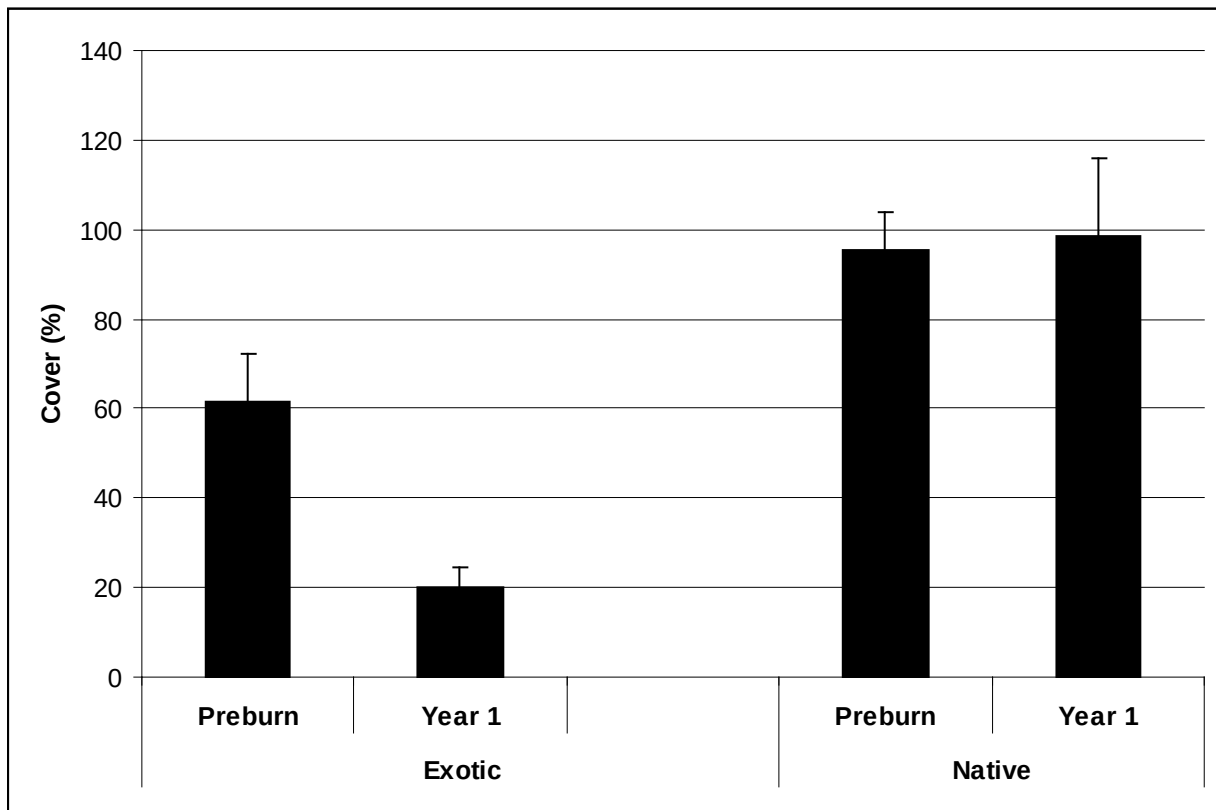


Figure 32 . Cover of native and exotic herbaceous species for the *Schizachyrium scoparium* monitoring type at STRI (n=13 plots). Objective for native species cover increase was 20%, and average increase was 3%. Objective for exotic species cover reduction was 20%, and average decrease was a 42%. Data includes plots from units that may have had treatment in addition to fire (herbicide and/or mowing). Lifeforms included in analyses include forb, fern, grass, grasslike, graminoid, and vine.

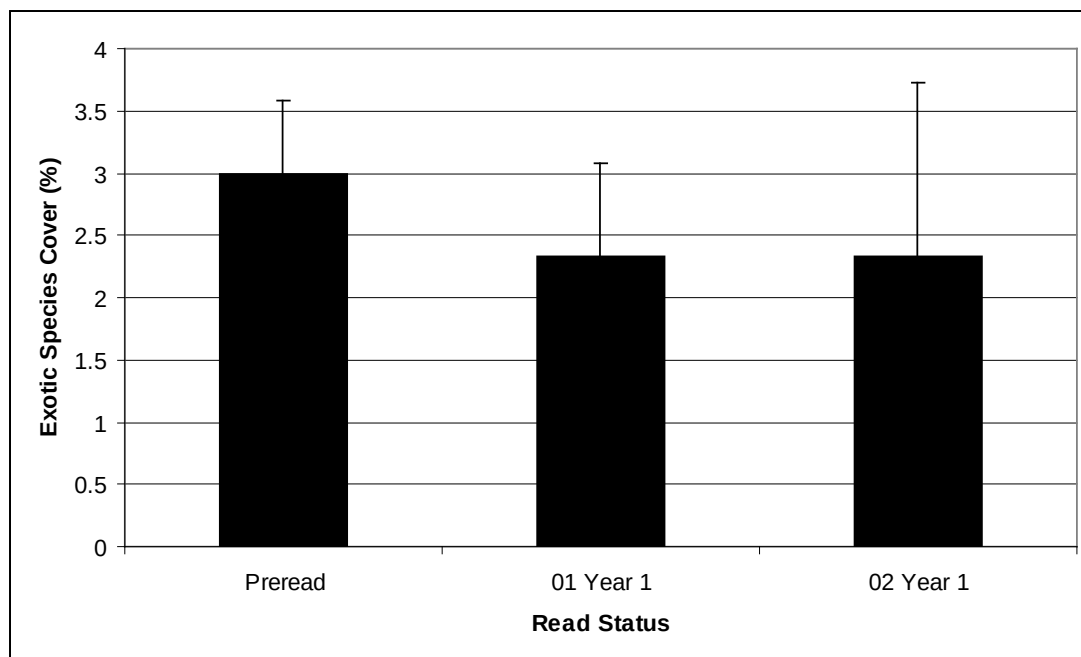


Figure 33. Cover of exotic species for the *Andropogon ternarius* (barrens) monitoring type at STRI (n=5 plots). Objective for exotic species cover reduction was 20%, and average change was a 1% decrease after 2 fires. Exotic species include ALJU, LISI, LOJA, LEVU and PAD13.

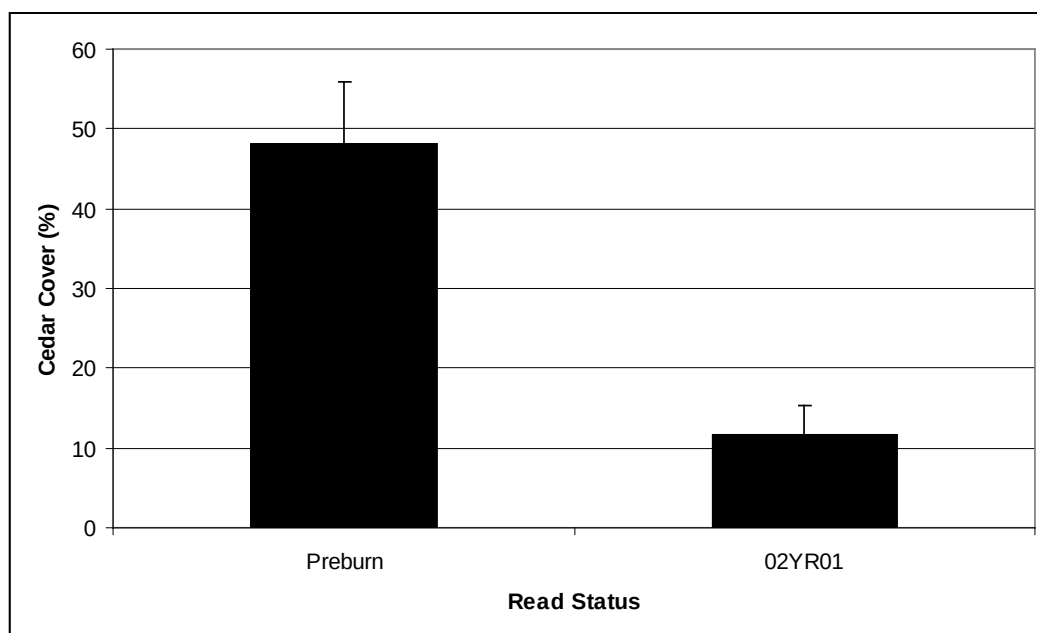


Figure 34. Cover of eastern red cedar in the *Andropogon ternarius* (barrens) monitoring type at STRI (n=8 plots). Objective for cedar reduction was 20-75%, and average reduction was a 36% decrease by one year after 2nd fire. Mechanical thinning of cedar was applied to unit, affecting some plots.

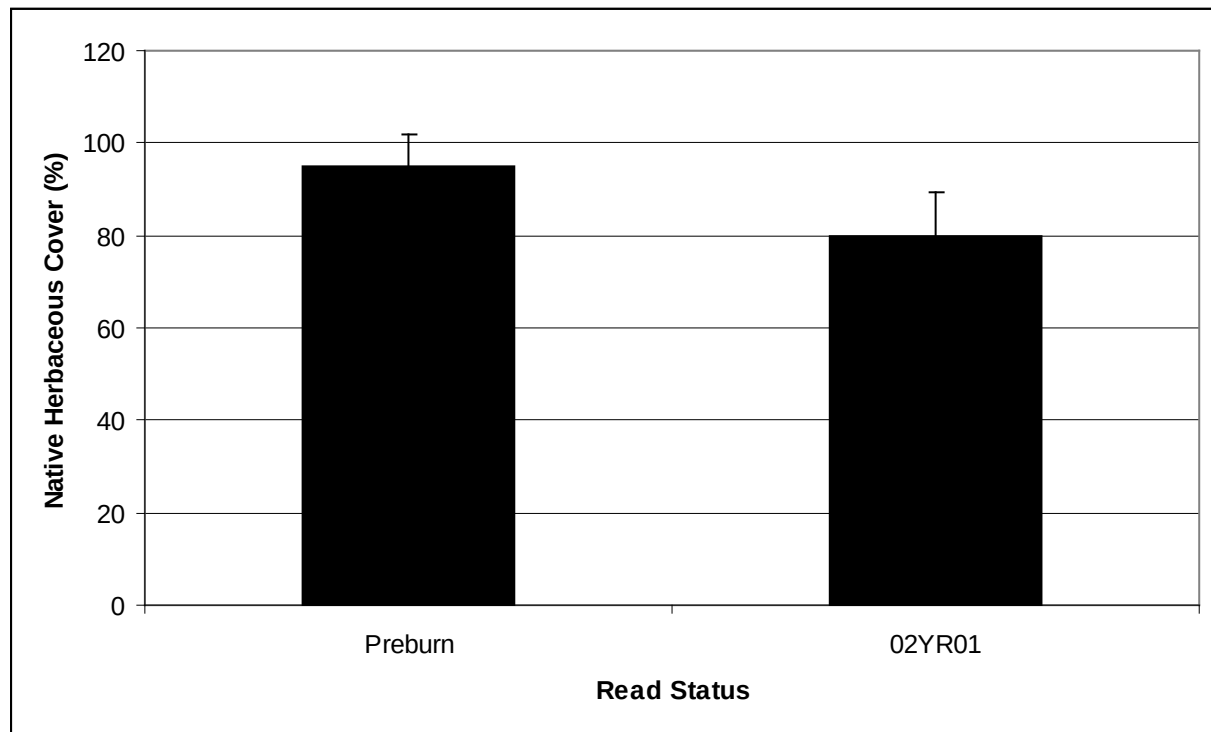


Figure 35. Cover of native herbaceous species in the *Andropogon ternarius* (barrens) monitoring type at STRI (n=8 plots). Objective for native cover increase was 20%, and a 14% decrease by one year after 2nd fire was preliminarily observed. Genera with more than a 10% decrease on one plot include *Dicanthelium*, *Sporobolus*, *Andropogon*, *Clematis*, and *Scleria*. Further examination is needed.