



**National Park Service
Fire Ecology Annual Report for NATR and Satellite Parks:
GUIS, LIRI, MACA and STRI
Calendar Year 2006**

Summary

The 2006 calendar year was a challenging, rewarding, and safe year for the NATR fire effects crew. New firsts included our participation in a mechanical prairie restoration project along the Parkway. In addition, NATR was involved in the first longleaf pine restoration burn at Horseshoe Bend National Military Park. In December, 2006 the NATR Fire Monitoring Plan was approved by NATR Resource Management and has been sent to the MWR for peer review.

During 2006, the NATR fire ecologist and effects monitors were challenged with maintaining a heavy plot workload without a lead fire effects monitor. Monitors Brad Weisshaupt and Ed Hentzelt did a fantastic job in keeping up with a demanding schedule. In April, Ed took a job with the USFS in the Bridger-Teton National Forest. In September, Brad took a job with the California Department of Forestry in Los Angeles County. Mandi Callis, the NATR fuels technician, served as the acting lead fire effects monitor. Mandi's efforts and contributions to the program in our time of need are also greatly appreciated.

Please refer to Tables 2, 4, and 5 for specific accomplishments, training, and activities.

Table 1. Fire Effects Plot Workload 2006

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	4	1	0	14
Gulf Islands	<i>Pinus palustris</i>	FMH Forest plot	0	0	0	12
Gulf Islands	<i>Sarracenia alata</i>	FMH Forest plot	0	0	0	1
Mammoth Cave	<i>Juniperus virginiana</i>	FMH Forest plot	2	0	5	8
Mammoth Cave	<i>Sorghastrum nutans</i>	FMH Grass Plot	0	2	0	3
Mammoth Cave	<i>Andropogon gerardii</i>	FMH Grass Plot	2	0	3	5
Mammoth Cave	Oak/Hickory	FMH Forest Plot	2	0	0	3
Mammoth Cave	<i>Quercus</i> species	FMH Forest plot	0	0	1	1
Mammoth Cave	<i>Quercus montana</i>	FMH Forest plot	0	0	0	1
Little River	<i>Pinus echinata</i>	FMH Forest plot	2	0	3	11
Little River	<i>Sarracenia oreophila</i>	FMH Forest plot	0	0	2	6
Little River	<i>Quercus montana</i>	FMH Forest plot	1	0	0	5
Natchez Trace	Oak/Hickory	FMH Forest plot	3	0	0	3
Natchez Trace	<i>Juniperus virginiana</i>	FMH Brush plot	4	4	0	8
Natchez Trace	<i>Pinus taeda</i>	FMH Forest plot	2	2	1	13
Horseshoe Bend	<i>Pinus palustris</i>	FMH Forest plot	0	2	0	5
Stones River	<i>Schizachyrium scoparium</i>	FMH Grass plot	4	0	7	14
Stones River	<i>Andropogon ternarius</i>	FMH Grass plot	0	9	0	9
Stones River	<i>Andropogon virginicus</i>	FMH Grass plot	0	3	0	7
Vicksburg	Exotics	Photo Plot	0	4	0	4
Total			26	23	22	132

Table 2. Fire Ecology Staffing 2006

Monitor	Starting Date	Ending Date	# of Pay Periods	Training and Development
Ed Hentzelt	1/1/06	4/14/06	9	S-244, RX-340/310
Brad Weisshaupt	1/1/06	9/30/06	21	GPS for Fire Management, FEMO taskbook initiated
Amanda Callis	7/23/06	9/30/06	6	Detailed to position from Fuels.
Lisa McInnis	1/1/06	12/31/06	26	S-244, FEMO completed, see accomplishment table

Table 3. Management Objectives and Monitoring Results 2006

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 ² immediate postburn ³	Litter/duff increase of approximately 50% by year 2 ⁴ Litter- [7% (46%) 87%] Duff- [-19% (55%) 131%]. (n=5, 1 fire) Figure 1	No- but minimum sample size not met (5/15)
	40-60% reduction of pole-sized trees ⁵ by 2 nd year after 3 rd burn	Pole density reduction=21% by Year 2 [-14 (-21) -27%] (n=5, 1 fire) Figure 2	No- but minimum sample size not met (5/13)
	20-40% increase in herbaceous cover by 2 nd year after 3 rd burn	Increase in relative cover = <1% by Year 1 [-1% (0.4%) 1.8%] (n=5, 1 Fire) 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 Year 1	Average pole density reduction =15% by Year 1 [-21 (-15) -5%] for all pole species. (n=10, 1 fire) Figure 4	No, but minimum sample size not met (10/19)
	20-40% litter and duff reduction immediate postburn (Year 2 data presented)	Litter- [-25% (-0.40%) 25%] Duff- [-75% (-48%) 21%] (n=8, 1 fire) Litter and duff combined, average reduction was 24%. Figure 5	Yes- but minimum sample size not met (7/24 with R=25)
	20-40% increase of herbaceous cover by 2 nd year after 3 rd burn.	Cover change =-1% by Year 2 [-3% (-1%), 0.5%] (n=7, 1 fire) Figure 6	No- but minimum sample size not met (10/34 with R=25)
LIRI FPIEC1DG09 Shortleaf pine forest <i>Pinus echinata</i>	25-80% reduction in pole-sized trees by 3 rd burn	Pole reduction = was 25% by Year 2 ⁶ . [8% (-25%)-40%]. (n=9, 1 fire) Figure 7	Yes, but minimum number of fires has not occurred.

¹ Minimum postburn analyses were calculated in 2004 using FMH; data will be recalculated using more recent data and Minitab software.

² Year 1 and Year 2 postburn fuels data was averaged across plot data taken 12-19 months postburn (for Year 1) and 24-33 months postburn (for Year 2; see GUIS monitoring schedule for details).

³ Year 2 data presented as no 01 Post data is available.

⁴ Area was hit by Hurricane Ivan in 9/04; data from two post-hurricane plots included here.

⁵ Pole reduction in sand pine versus hardwood species not evaluated.

Table 3. Management Objectives and Monitoring Results 2006

Monitoring Unit	Management Objective (Restoration)	Monitoring Results (80% confidence interval)	Objective Achieved? (minimum plots achieved/needed)
	25-50% increase native grass and forb cover	Average forb and grass cover percent increase was 16% from Year1-Year 3 postburn ⁷ . [10% (16%) 22%] (n=8, 1 fire) Figure 8	No, but required number of fires not met
	25-50% reduction in downed woody fuel and litter/duff by 3 rd burn	Average fuel load reduction Litter/Duff- [-24% (-21%) -17%] Woody- [-11% (23%) 59%] (n=9 plots, 1 fire) Figure 9	No, but required number of fires not met
LIRI FSAOR1G10 ⁸ Green pitcher plant forest <i>Sarracenia oreophila</i>	40-90% decrease in shrub cover by second year after 3 rd burn	Decrease in shrub cover of 10% by Year 2 [-21% (-10%) 5%]. (n=3, 2 fires) Figure 10	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	No change in <i>S. oreophila</i> cover by Year 2. (n=2, 2 fires) ⁹ Figure 11	No- but minimum sample size and required number of fires not met
	30-90% decrease in pole-sized trees by second year after 3 rd burn.	Pole reduction = 86% for two plots ⁹ by 03 Year One. [128%- (-86%)-44%] (n=2, 3 fires) Figure 12	Yes- but minimum sample size not met.
LIRI FQUMO1G10 Chestnut oak forest <i>Quercus montana</i>	20-60% reduction in pole-sized trees	Pole density reduction = [-116 (10%) 136%] by Year 2. (n=2, 1 fire) Figure 13	No- but minimum sample size not met
	25-50% increase native grass and forb cover	Increase in native forb cover =25% between Year 1 and Year 2. (n=2, 1 fires) ¹⁰ Figure 14	No- but minimum sample size not met (2/35 with R=25)
MACA FQUMO1D09 Chestnut oak forest ¹⁰ <i>Quercus montana</i>	Decrease density of shade tolerant pole trees by 30-90%.	Data from one plot exhibits 37% increase. Figure 15	No, but data from only one plot. Additional plot needed for analysis.
	Limit mortality of overstory trees to less than 20%.	Number of QUMO overstory trees decreased by 24% Year 2. (n=1, 1 fire) Figure 16	No, but data from only one plot. Additional plot needed for analysis.

⁶ Data from 2005 as no new data added in 2006.

⁷ Change between Yr 1 and Yr 3 reads is presented as no new additional preburn data was collected.

⁸ Plots within the SAOR monitoring type are not randomly distributed; plots were installed to encompass existing *Sarracenia* populations.

⁹ Two plots analyzed to look at reduction after multiple fires. More data for fewer fires exists.

¹⁰ Data from one *Quercus* species (QUSP) plot not included.

Table 3. Management Objectives and Monitoring Results 2006

Monitoring Unit	Management Objective (Restoration)	Monitoring Results (80% confidence interval)	Objective Achieved? (minimum plots achieved/needed)
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) Figure 17	No, but minimum sample size not met (5/12)
	Reduce pole-sized trees by 40-60%.	Average reduction was 56% by Year 1 [-60% (-56) -53%]. (n=4, 1 fire) Figure 18	Yes, but minimum sample size not met (5/12)
	Limit mortality to overstory species to less than 20%.	Average change was 5% increase in overstory density [1% (5%) 9%] (n=4, 1 fire) Figure 19	Yes, but minimum sample size not met (5/12)
MACA BSONU1T02 Indian grass grassland <i>Sorghastrum nutans</i>	Reduce density of shade tolerant seedlings 30% to 60% one year after second fire ¹¹ .	Average <i>Acer</i> density increase = 22%, by Year 2 -63% (22%) 107 <i>Juniperus</i> density decrease = 48% by Year 2 [-73% (48%) -23%] (n=3, 1 fire) Data from 2005. Figure 20	No- but minimum sample size and required number of fires not met (3/14)
	Reduce density of shrubs 30% to 60% one year after second fire.	Density not evaluated; shrub cover reduction = 8% by Year 2. [-17% (-8%) 1%] (n=3 plots, 1 fire). Data from 2005. Figure 21	No- but minimum sample size not met (3/14)
	Cause no net gain in percent cover of exotic plants (Japanese honeysuckle) after five years of burning	Average reduction =52% by Year 2. [22% (52%) 82%] (n=3, 1 fire) Figure 22	Yes- but minimum sample size not met (3/14).
	Increase relative cover of <i>Sorghastrum nutans</i> 15% after five years of burning	Increase of 30% by 2 years postburn [2% (30%) 57%] (n=3 plot, 1 fire) Figure 23	Yes- but minimum sample size not met (3/14)
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.	Decrease of 0.5% by 2 years postburn [-23% (-0.5) 22%] (n=2 plots, 1 fire). Figure 24	Yes- but minimum sample size not met.
	Decrease invading woody species by 30% as measured 1 year post burn.	Average decrease of 1% by 2 years postburn. [-31% (-1%) 29%] (n=2, 1 fire) Figure 25	No- but minimum sample size not met

¹¹ Density analyzed for *Acer* and *Juniperus* genera only.

Table 3. Management Objectives and Monitoring Results 2006

Monitoring Unit	Management Objective (Restoration)	Monitoring Results (80% confidence interval)	Objective Achieved? (minimum plots achieved/needed)
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. [-36 (46) -54] (n=7, 1 fire). Figure 26	Yes
	Reduce conifer poles (2.5-15.0 cm dbh) >25% one year post burn	Density reduction = 8% by Year 1. [-14% (-8%) -2%] Figure 27	No
	Cause no net gain in percent cover of exotic plants (e.g. kudzu, Chinese privet, Japanese honeysuckle, etc.) after 5 years of burning	No available data- 7 plots with no preburn data, and 5 plots that have not burned	Not Determined
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%] Figure 28	Yes, but minimum sample size not met (4/14). ¹²
	20-40% reduction in cover of exotic vegetation by 4 th burn	Density of exotic species reduced by 50% after 4 th burn. Data from 2005.	Yes, but minimum sample size not met (4/14).
STRI GSCSC1G02 Little Bluestem Grassland <i>Schizachyrium scoparium</i>	Reduce exotic species cover by 20-70% after 5 burns.	Exotic cover increase of 4% on average. [-9% (4%) 50%] (n=6 plots, 1 fire) Figure 29	No, but additional fire requirement not met.
	Increase native grass and forb cover by 20-50%	Average increase in native herbaceous cover was 4%. [-10% (4%) 18%] (n=6 plots, 1 fire) Figure 30	No, but additional fire requirement not met.

¹² Additional plots will not likely be installed in this monitoring type, as monitoring is occurring using other methods in conjunction with local botanists.

Table 4. Fire ecologist accomplishments and area of focus

Category	Percent Time	Accomplishments/Focus Areas
General Planning	15%	• Crew task planning • Monitoring schedule planning • Prescribed burn planning at NATR, MACA and HOBE/objective development • Burn plan review for GUIS, HOBE, NATR, LIRI
Monitoring Plans	5%	• Draft of NATR FMP forwarded to regional ecologist; 95%; awaiting peer review. Lit review for other park's mon plans begun.
Presentations	5%	• Prescribed burn success stories submitted to InsideNPS: 2 for NATR • Presented poster of NATR data at Fire Congress Conference • Co-presented poster of HOBE work at National FMO Conference • Fire effects data reports to each park • Interdivisional meeting at MACA to discuss objectives of fire
NPS Meetings/ Task Groups	10%	• Fire Ecology Steering Committee Annual Meeting • Adaptive Management Task Group, Objectives and Monitoring Design Task Group, Ch 11 Rewrite Task group • Assisted EVER with FEAT data conversion
Interagency Work	5%	• Participated as JFSP Panel Review board member • Interagency prescribed burns with FWS and USFS. • FPA training- Shepherdstown WV • Attended LANDFIRE rollout meeting (Memphis, TN)
Fire Assignments and Fuels Projects	<5%	• FEMO on 6 prescribed fires • COTR on 1 WUI mechanical fuel reduction project • Prairie restoration and fuel reduction work at NATR • Contracted botany work at NATR
Research	<5%	• Literature reviews • Investigated potential JFSP project with MSU faculty
Monitoring Field Work	30%	• 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 • Attended Sametime meetings
Data Analysis	5%	• Data analysis primarily for annual report
Training & Professional Development	5%	• PT (approximately 3 hrs per week) • ACA training • S-244 • Firefighter and chainsaw refresher
Miscellaneous	<5%	• GIS work- tutorials, consulting outside resources for help, etc. • Responses to emails asking for input or data
Supervision		• Acquired first SCA for NATR fire program • Recruiting and filling of 2 monitors ongoing

Table 5. Fire effects crew accomplishments and area of focus.

This section deals with roles and functions of the fire effects crew. Identify accomplishments and/or focus areas along with a rough estimate of the amount of time spent in these areas (see table format and example below).

Category	Percent Time	Notes
FMH plots	40	Estimated amount of time spent collecting plot data; includes any preparation time, unknown resolution, etc.
Mechanical Treatment plots	0	Estimated amount of time spent collecting plot data; includes any preparation time.
CBI plots	0	Estimated amount of time spent collecting plot data; includes any preparation time.
Other plot work	5	Non-FMH plot work at prairie restoration site and blackbelt prairie.
Fire Assignments and Fuels Projects	10	Prescribed fires in SER, assists with NATR projects.
Data Entry	20	Estimated amount of time spent entering data from paper to PC
Data Management and Conversion	10	Time spent figuring issues with conversion, how FEAT works, species list problems, unknown species naming, etc.
Data Analysis	0	
Supervision/Admin	8	Travel, payroll, credit card reconciliation, etc.
Training & Professional Development	5	PT, Safety meetings, operational skill refreshers, GIS work, Access tutorials.
Miscellaneous	2	Random unforeseen requests from various people, SCA training, etc.

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.

APPENDIX 1

Little River Canyon National Preserve

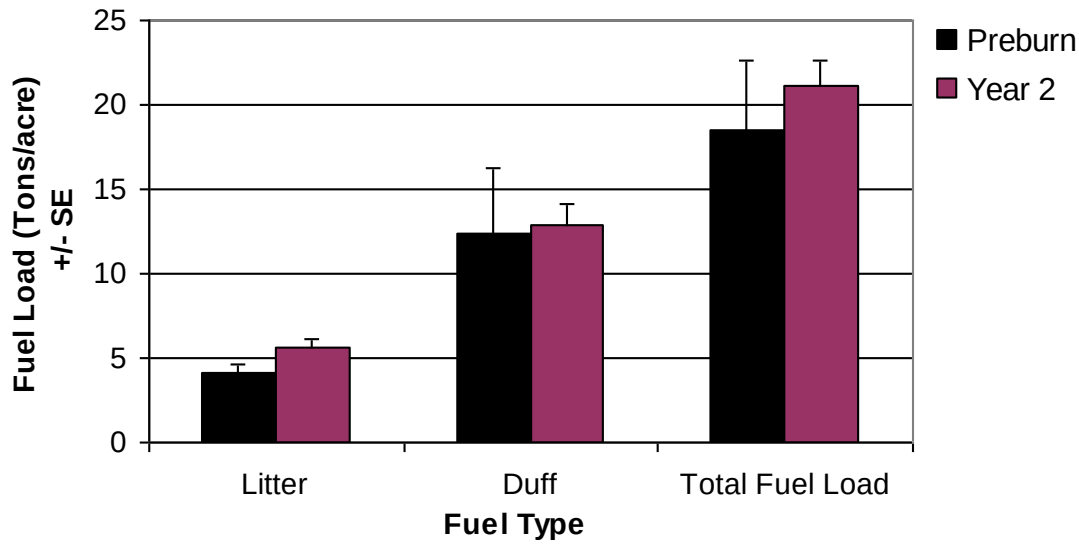


Figure 1. Average litter and duff loading for 5 *Pinus clausa* plots at GUIS ($\pm$ SE). Year 2 data was taken from 24-33 months postburn. Objective for litter and duff reduction is 20%; observed change was an increase of 20% by Year 2. Data presented same as 2005 as no new plots burned. Immediate postburn fuel data not available.

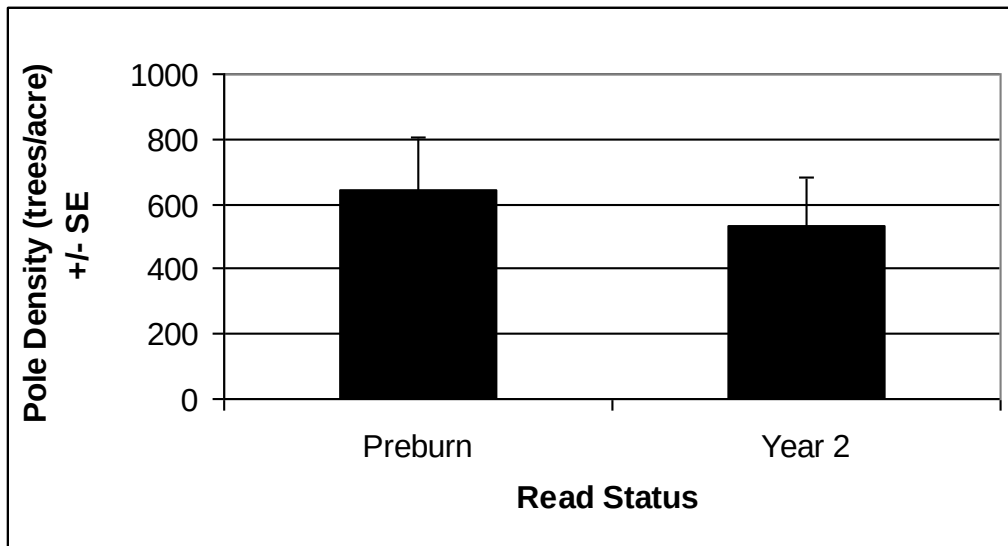


Figure 2. Average density of pole-sized trees in the *Pinus clausa* monitoring type at GUIS (n=5 plots). Year 2 data was taken 24-33 months postburn. Objective for pole reduction is 40%; actual reduction was approximately 21% by Year 2.

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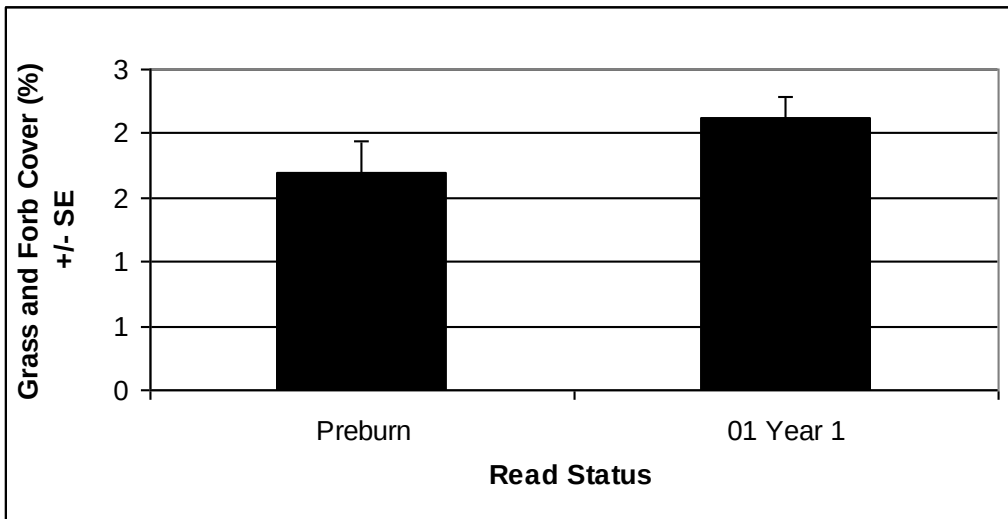


Figure 3. Mean percent cover $\pm$ SE of grass and forb species for the *Pinus clausa* monitoring type at GUIs. Objective for herbaceous cover increase is 20%; observed increase for forbs, grasses and grass-like species was approximately 0.5%.

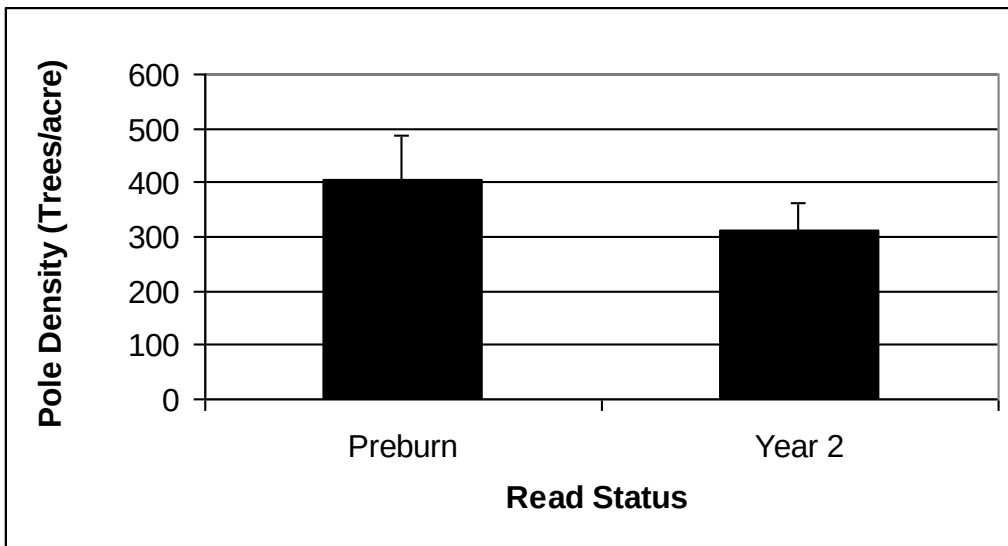


Figure 4. Average density of pole-sized trees per acre for 10 *Pinus palustris* plots at GUIs ($\pm$ SE). Year 2 data was taken 2 years postburn. Objective for pole reduction is 50%; actual reduction was approximately 15% by Year 2.

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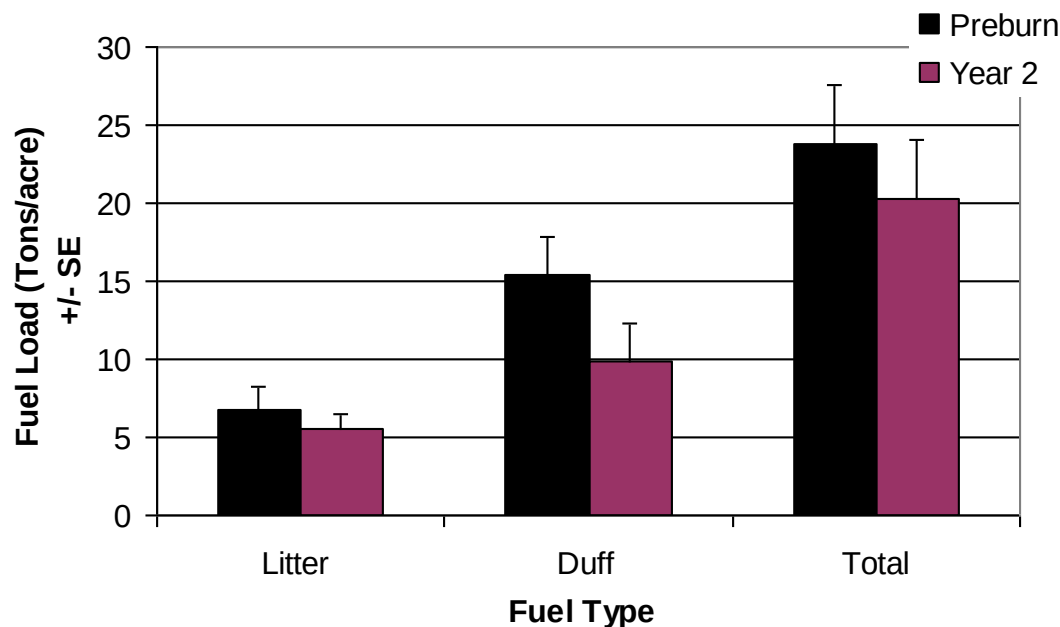


Figure 5. Average litter and duff load for the *Pinus palustris* monitoring type at GUIS (n=8 plots). Year 2 data was taken from 19-24 months postburn. Objective for litter and duff reduction is 20-40%; actual reduction for litter and duff combined was approximately 24% by Year 2.

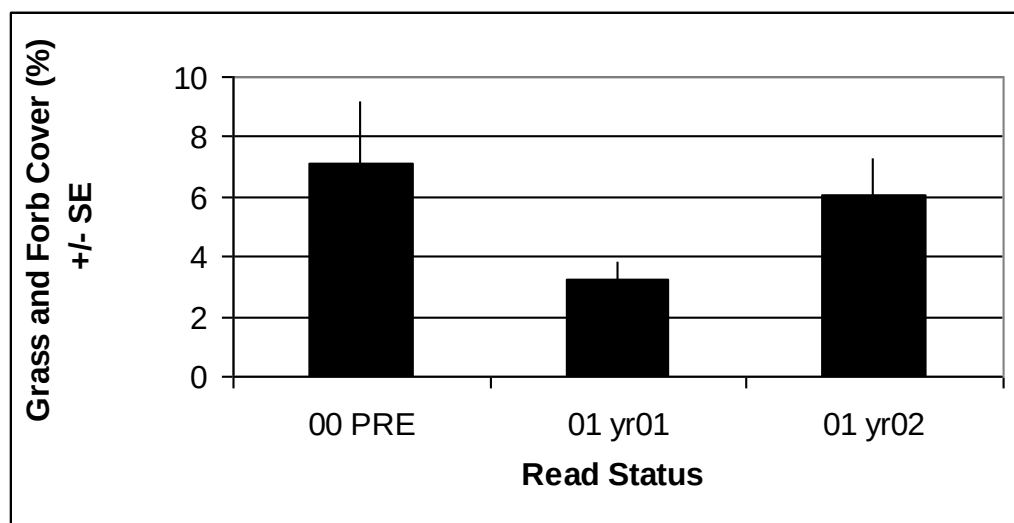


Figure 6. Mean percent cover of grasses, grass-like species, and forbs 10 for the *Pinus palustris* monitoring type at GUIS. Year 1 data was taken from 12-18 months postburn, and Year 2 data was taken at 24-33 months postburn. Objective for herbaceous cover increase is 20%; observed change was a 1% decrease.

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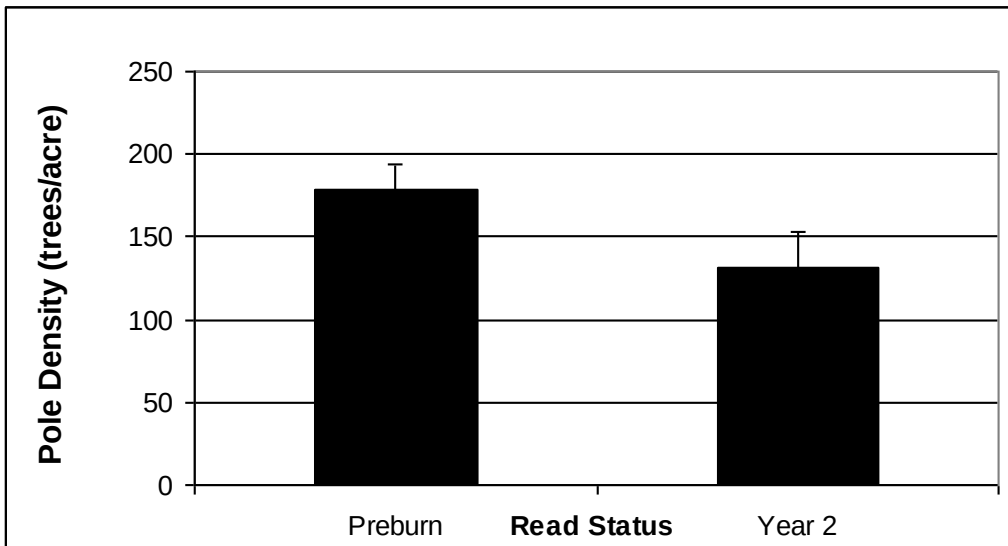


Figure 7. Average density of pole-sized trees per acre for the *Pinus echinata* monitoring type at LIRI ($\pm$ SE, n=9 plots). Objective for pole reduction is 30-90%; actual reduction was approximately 25% by Year 2.

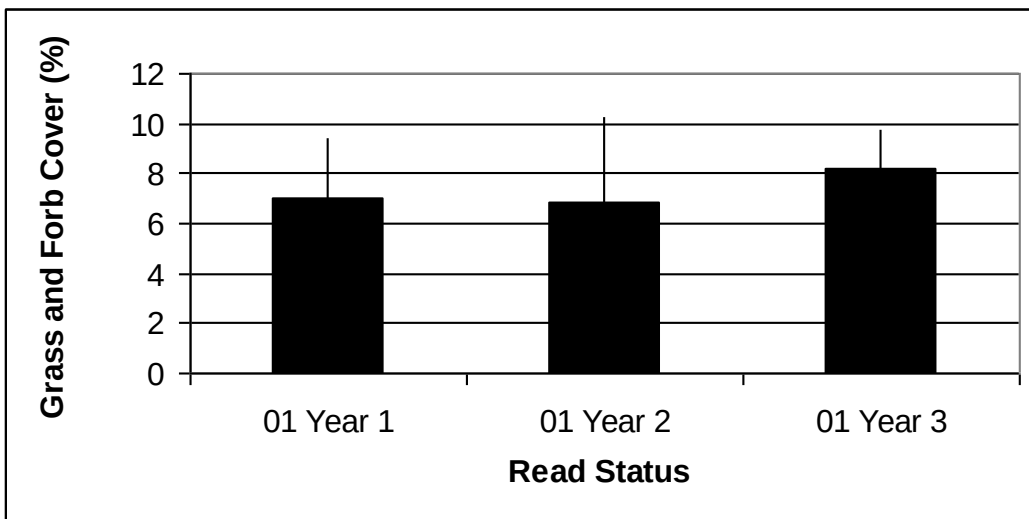


Figure 8. Percent cover of forbs and grasses for the *Pinus echinata* monitoring type at LIRI ($\pm$ SE, n=8). Year 1 and 3 data were recorded at 12-19 and 36 months postburn, respectively. Observed change was a 16% increase, while the objective was a 25% increase.

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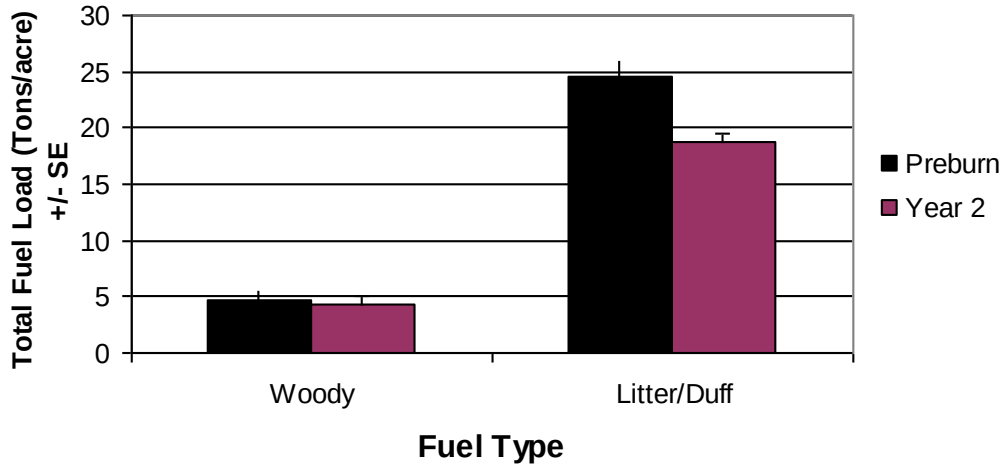


Figure 9. Average fuel load for the *Pinus echinata* monitoring type at LIRI (n=9 plots). Data was taken from 24-33 months postburn. Objective for fuel reduction was 25-50%, and actual observed reduction was 21% for litter and duff.

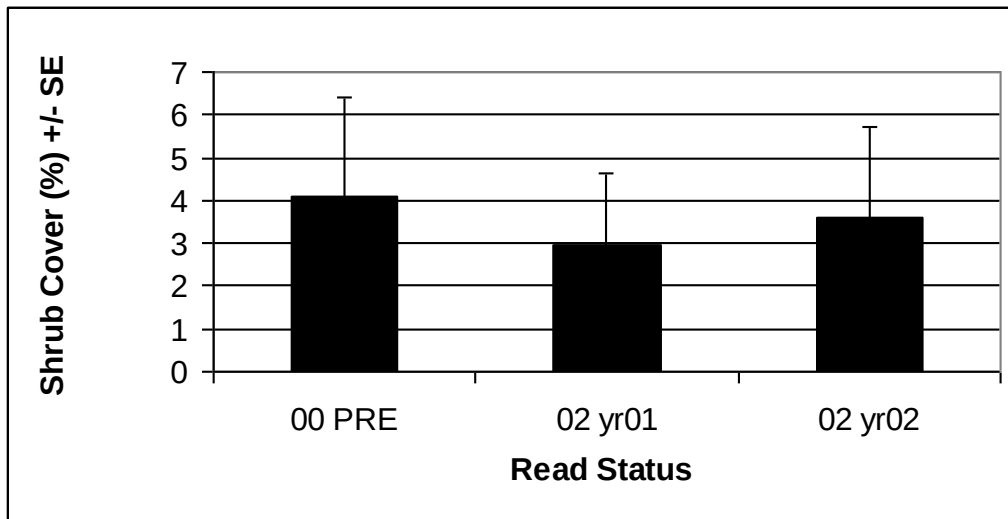


Figure 10. Average shrub cover for 3 *Sarracenia oreophila* plots at LIRI. Data shown compares shrub cover collected at one and two years after the second fire. Objective for shrub reduction is 30%; actual change was a decrease of 10% by Year 2.

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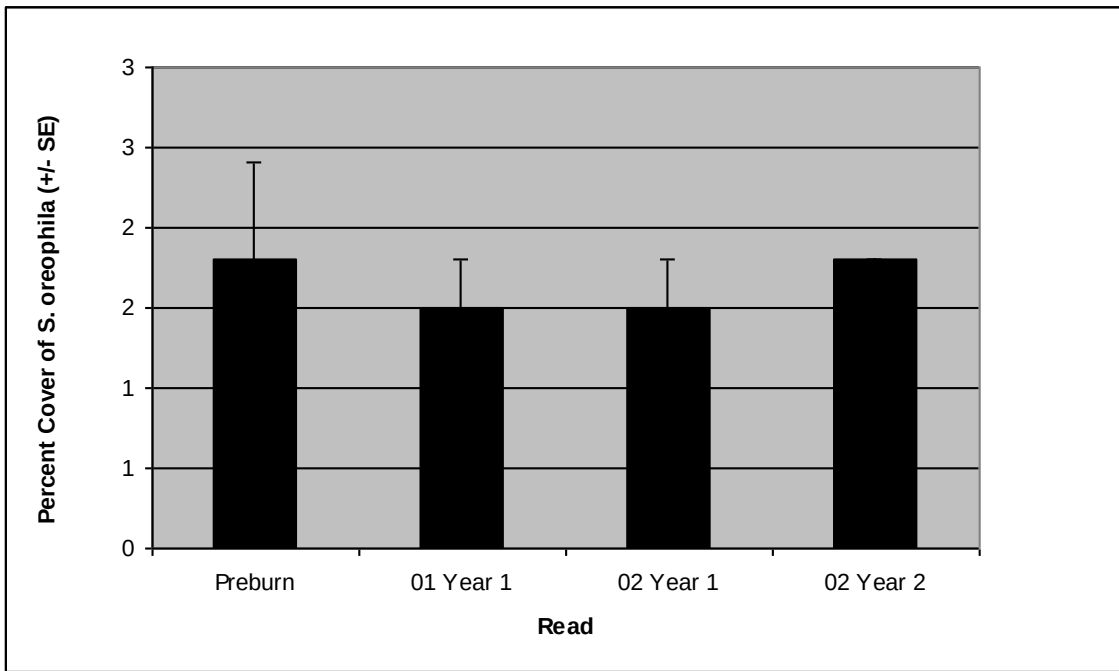


Figure 11. Average cover of *Sarracenia oreophila* on 2 plots at LIRI ($\pm$ average standard error). Data shown compares cover collected after one and two fires. Objective for cover increase is 20%; actual change 0% by Year 2 after the second fire.

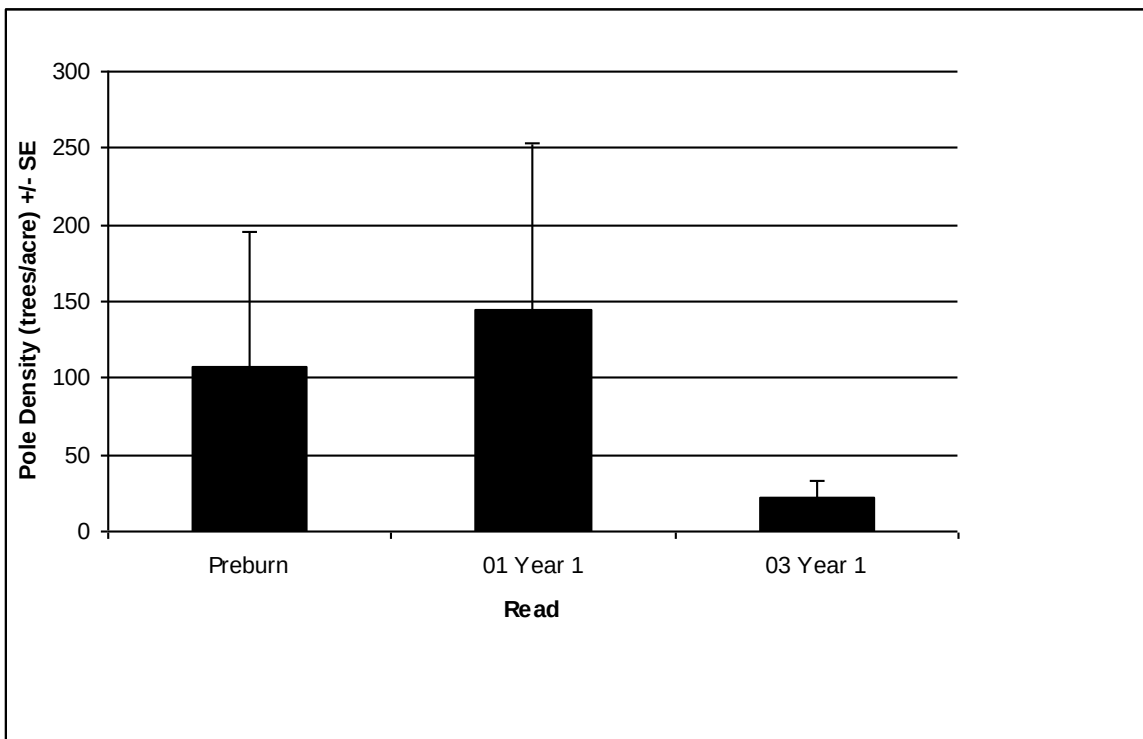


Figure 12. Average density of pole-sized trees per acre for 2 *Sarracenia oreophila* plots at LIRI from 1 year postburn after first fire and after 3rd fire). Objective for pole reduction is 20%; actual reduction was approximately 86% by Year 3).

Little River Canyon National Preserve

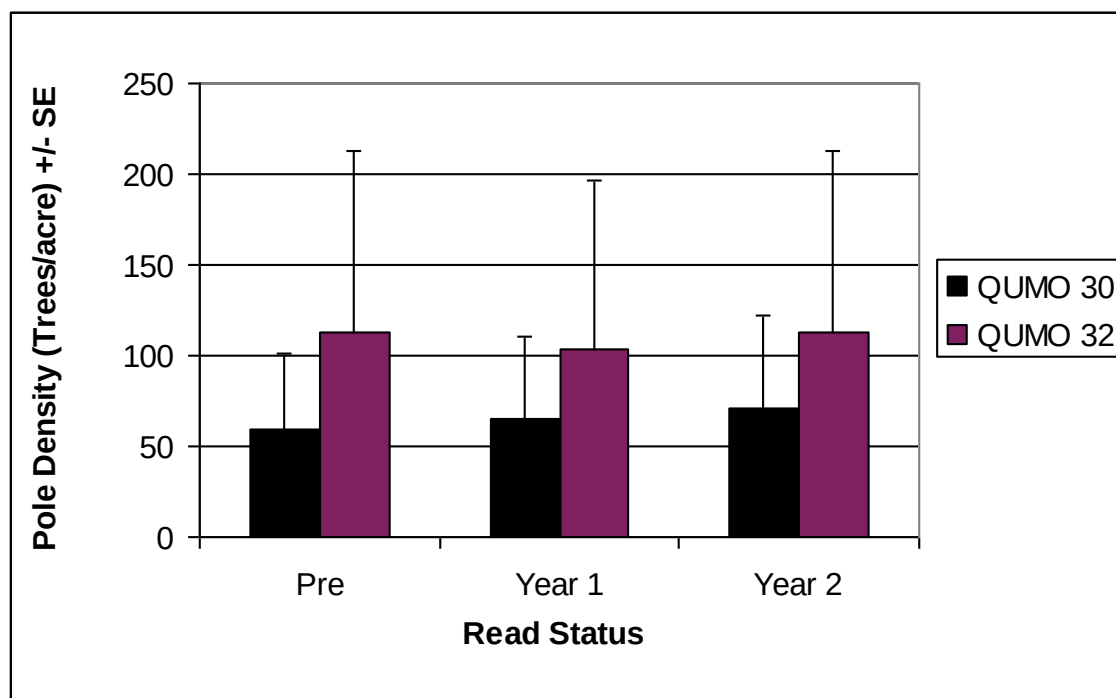


Figure 13. Average density of pole-sized trees per acre for 2 *Quercus montana* plots at LIRI. Year 2 data was taken 26 months postburn. Objective for pole reduction is 20%; mean density increased by 10%. Density examined per plot revealed a relatively constant trend.

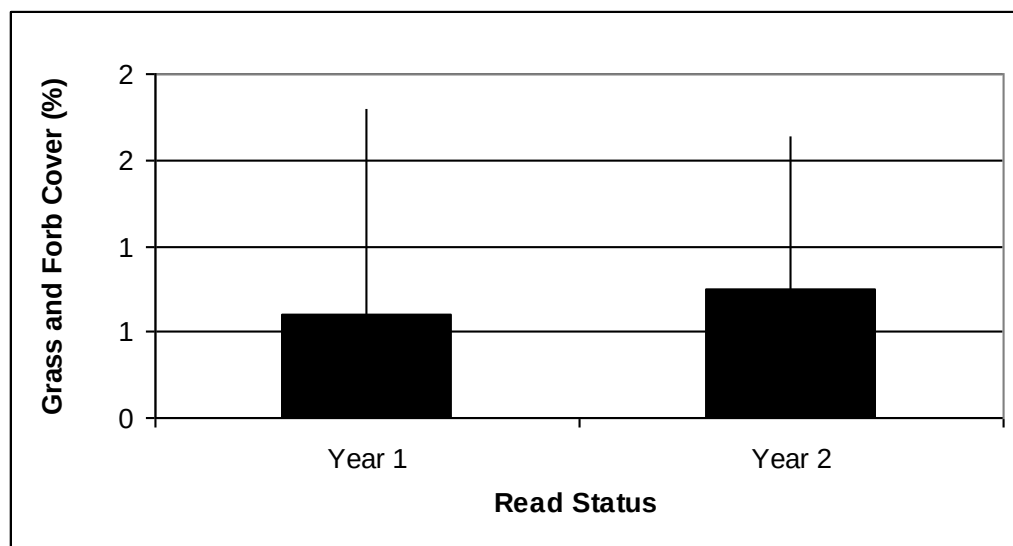


Figure 14. Mean percent cover $\pm$ SE of native grasses and forbs on 2 *Quercus montana* plots at LIRI ($\pm$ SE). Data was taken 16 and 26 months postburn. Objective for herbaceous cover increase is 25% from preburn levels; observed change for grass and forbs was 25%. No preburn data is available.

Mammoth Cave National Park

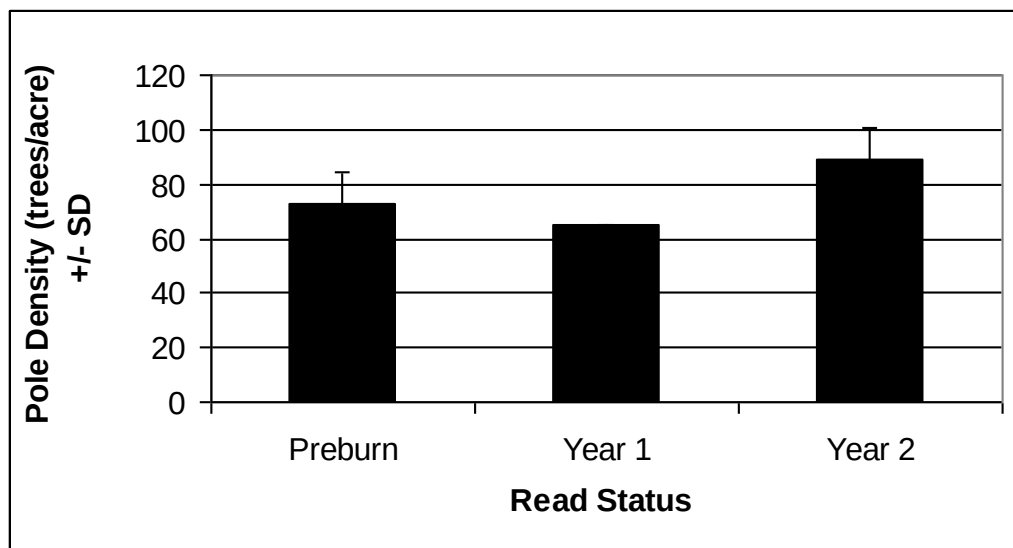


Figure 15. Average density of pole trees per acre for 1 *Quercus montana* plot at MACA. Objective for pole reduction is 20% or less; actual change was an approximate 37% increase by Year 2.

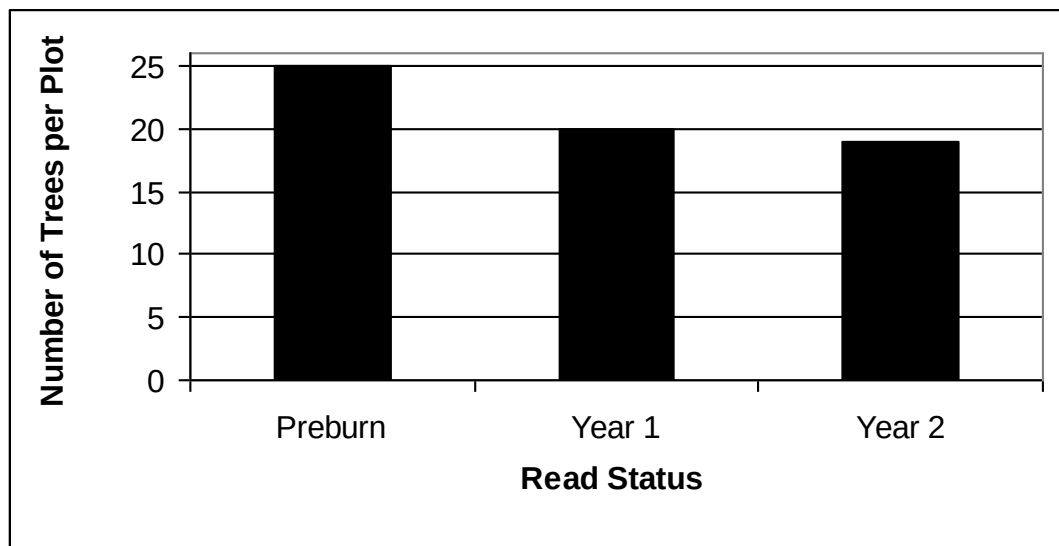


Figure 16. Number of overstory *Quercus montana* trees for 1 *Quercus montana* plot at MACA. Objective for overstory mortality is 20% or less; actual reduction was approximately 24% by Year 2.

Mammoth Cave National Park

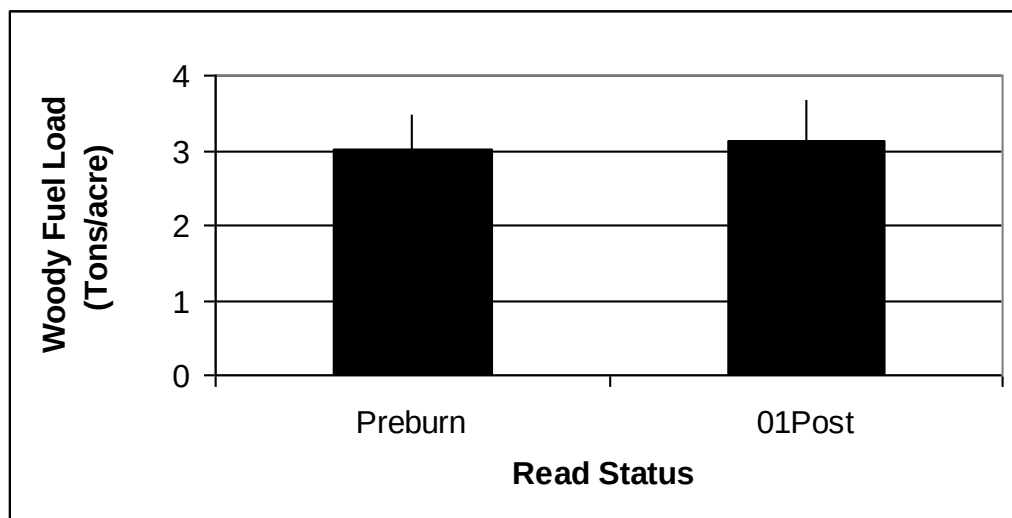


Figure 17. Woody fuel load in the *Juniperus virginiana* glade monitoring type at MACA (n=5, $\pm$ SE). Objective for fuel load reduction was 25%, and observed change was a 3% increase immediately postburn.

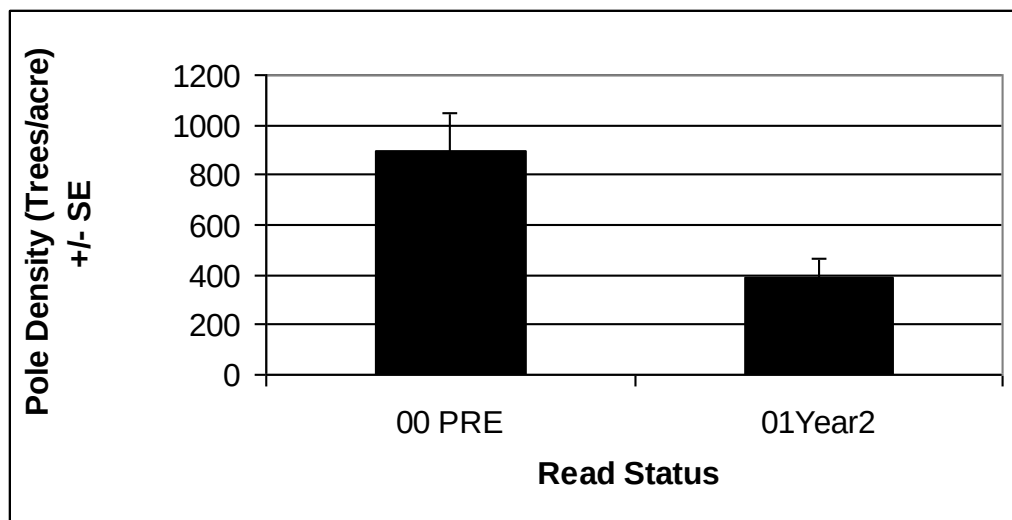


Figure 18. Pole density the *Juniperus virginiana* monitoring type at MACA (n=4 plots). Objective for pole reduction was 25-50%, and observed reduction was 56% by Year 2.

Mammoth Cave National Park

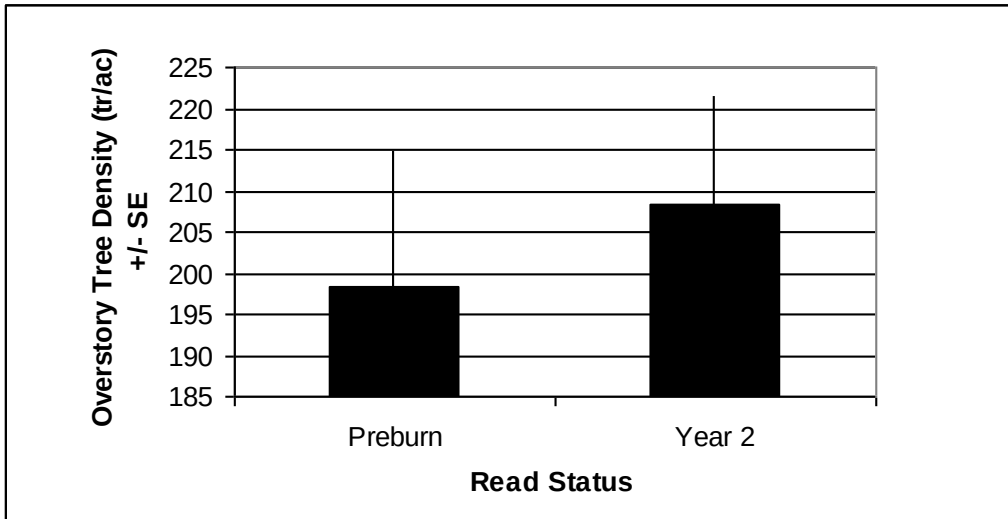


Figure 19. Overstory density in the *Juniperus virginiana* glade monitoring type at MACA (n=5, $\pm$ SE). Objective was a 20% limit on overstory mortality and observed change was a 5% increase by Year 2.

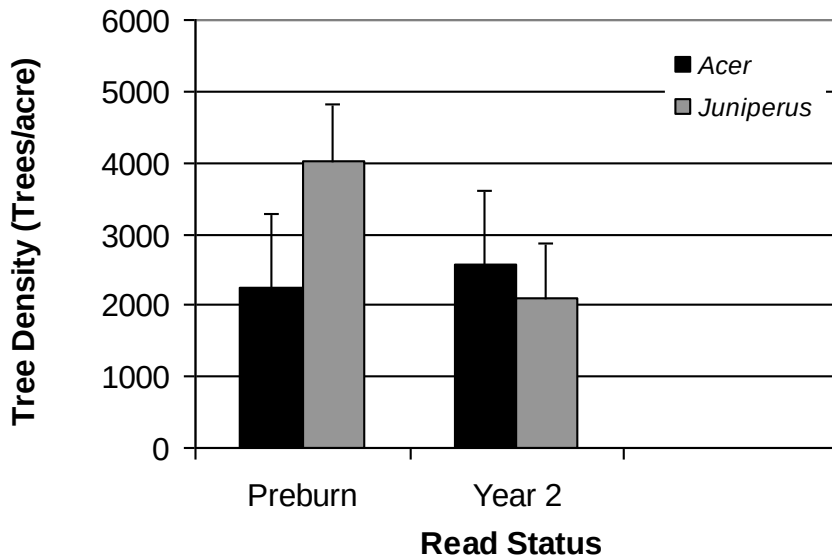


Figure 20 . Average density of *Acer* and *Juniperus* tree species on 3 *Sorghastrum nutans* transects at MACA ($\pm$ average standard error). Data shown compares densities collected two years after one fire. Objective for seedling reduction is 30%; actual change was a 48% decrease for *Juniperus*, and a 22% increase for *Acer* species. Data from 2005.

Mammoth Cave National Park

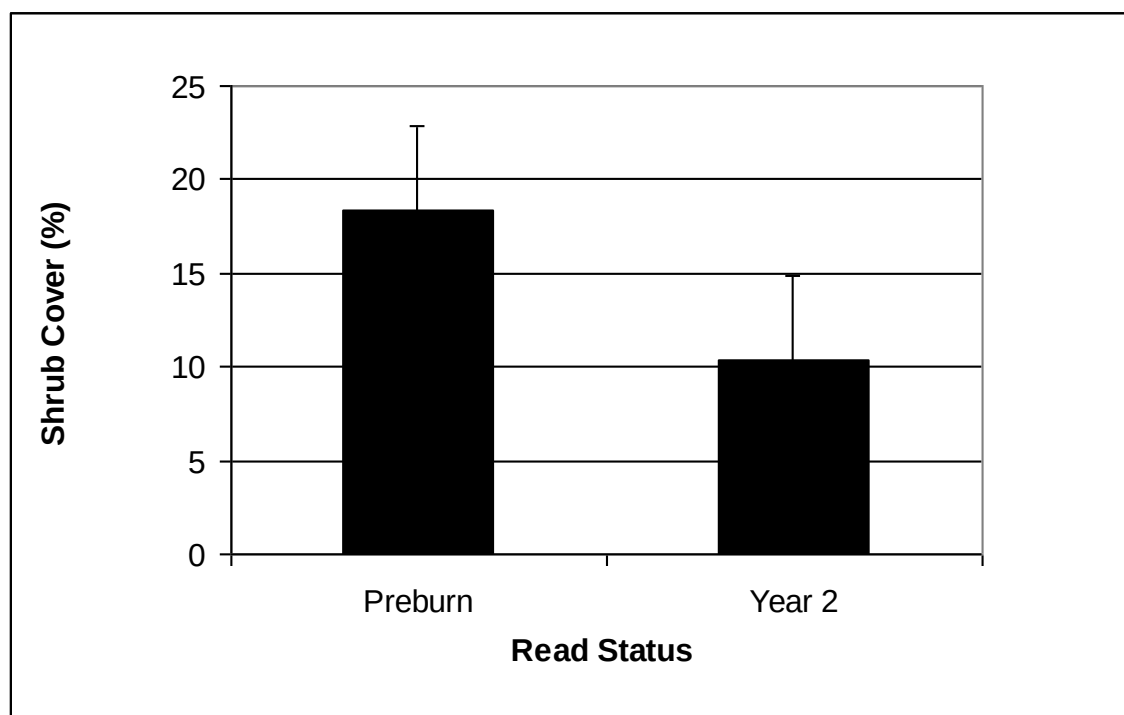


Figure 21. Percent cover of shrub species in the *Sorghastrum nutans* monitoring type at MACA ($\pm$ average standard error, $n=3$ plots). Data shown compares shrub cover collected preburn and at two years postburn. Objective is 30% reduction in shrub species cover; average reduction was 8% by Year 2. Data from 2005.

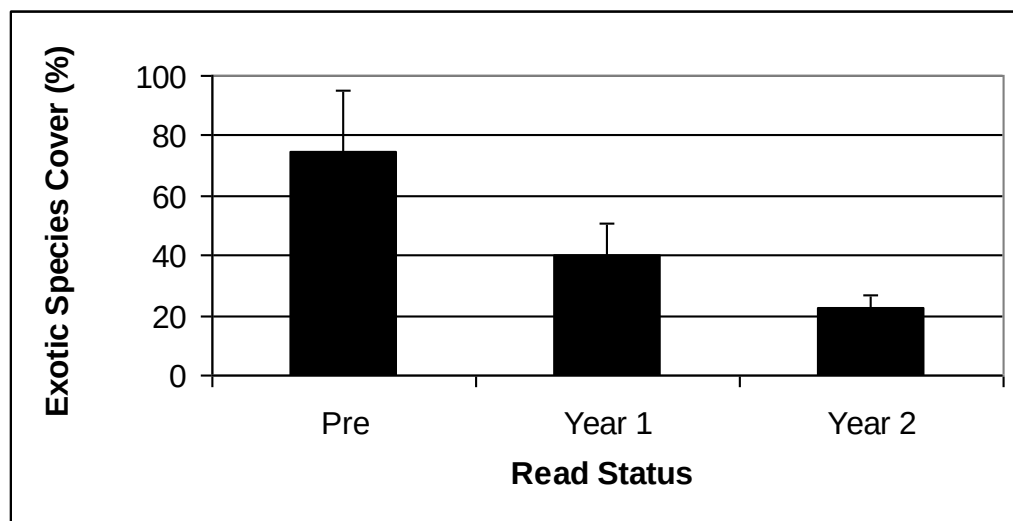


Figure 22. Percent cover of exotic species (herbaceous and woody) in the *Sorghastrum nutans* monitoring type at MACA ($\pm$ average standard error, $n=3$ plots). Objective is to cause no net gain in cover of exotic species; average exotic cover reduction was 52% by Year 2.

Mammoth Cave National Park

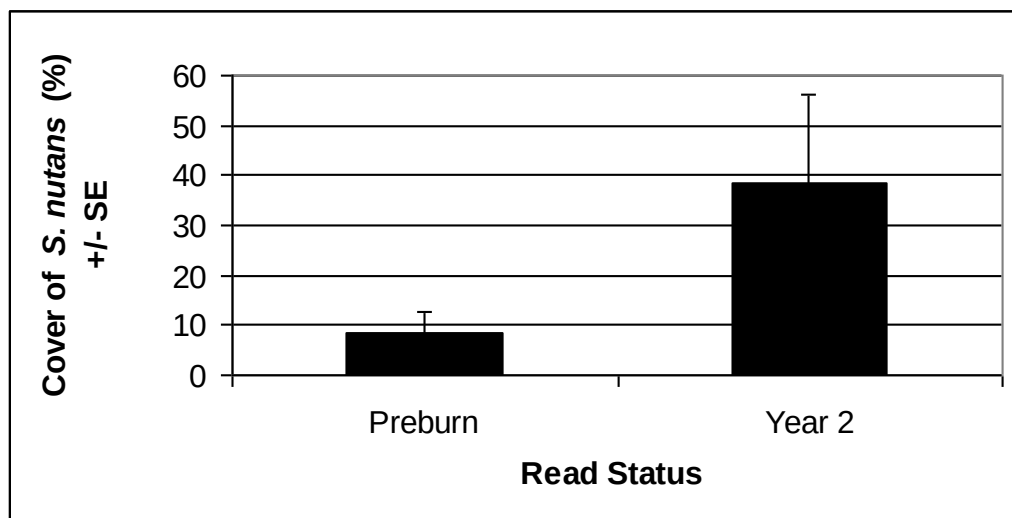


Figure 23. Percent cover of *Sorghastrum nutans* ($\pm$ SE, n=3 plots) at MACA. Average increase in percent cover was 30% by Year 2, and minimum objective increase was 15% after 5 years of burning.

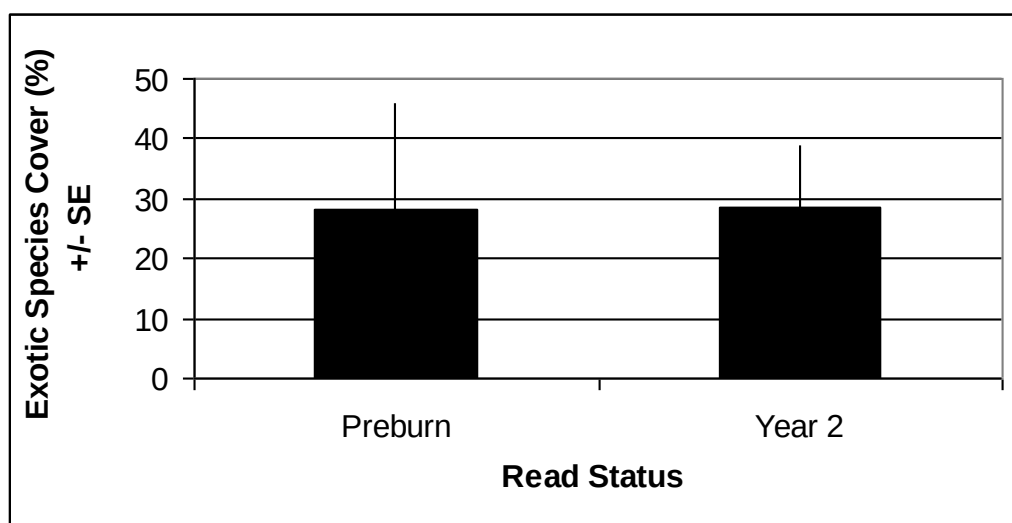


Figure 24. Average exotic species cover for the *Andropogon gerardii* monitoring type at MACA (n=2 plots). Objective is no net gain in exotic cover, and observed average change was a 0.5% decrease.

Mammoth Cave National Park

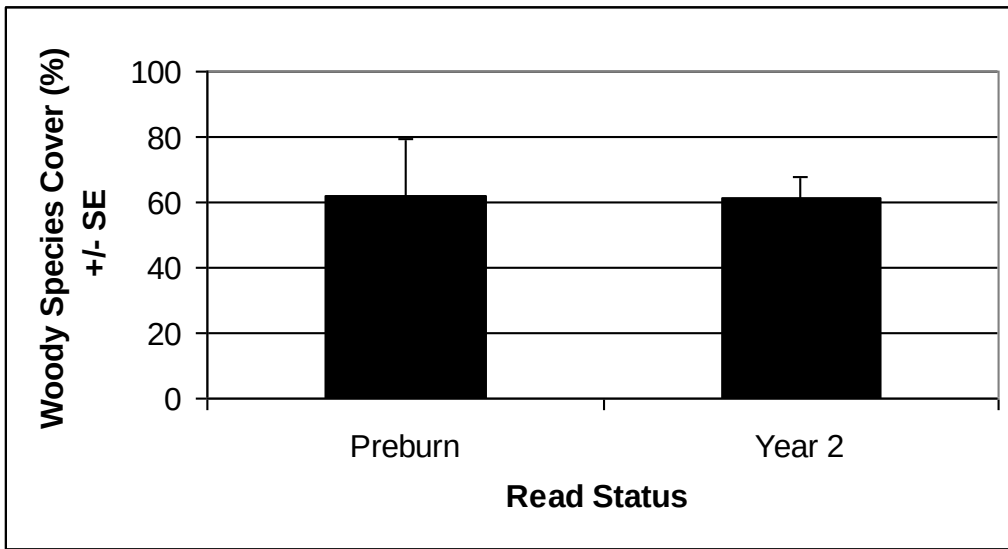


Figure 25. Average woody species cover for the *Andropogon gerardii* monitoring type at MACA (n=2 plots). Woody species included tree, shrub/subshrub, and vine species (native and exotic). Objective is a 30% decrease, and observed average change was a 1% decrease.

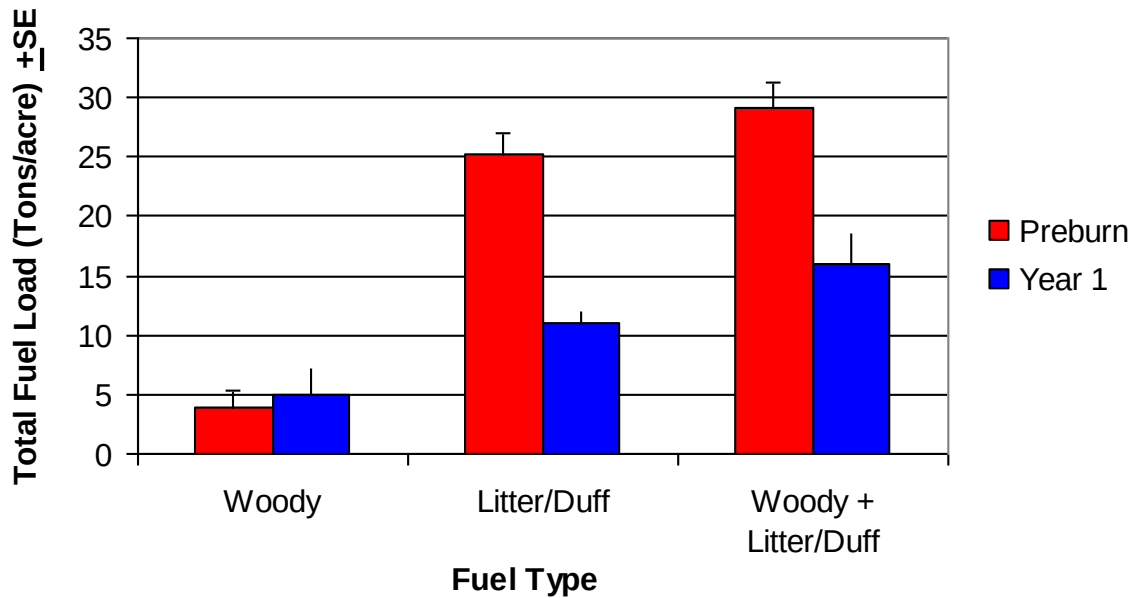


Figure 26. Average fuel load for the *Pinus taeda* monitoring type at NATR (n=7 plots). Postburn data was taken 12-15 months after the fire. Objective for fuel load reduction was 20-40%, and observed change was a 46% in total fuel load by Year 1.

Natchez Trace Parkway

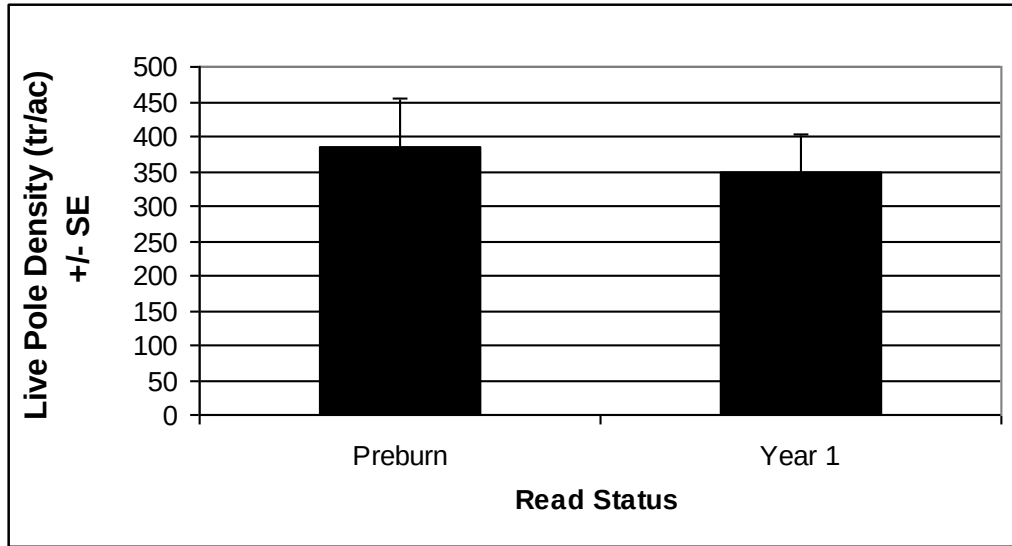


Figure 27. Average pole density for the *Pinus taeda* monitoring type at NATR (n=7 plots). Postburn data was taken 12-15 months after the fire. Objective for density reduction was 20-40%, and observed change was 8% by Year

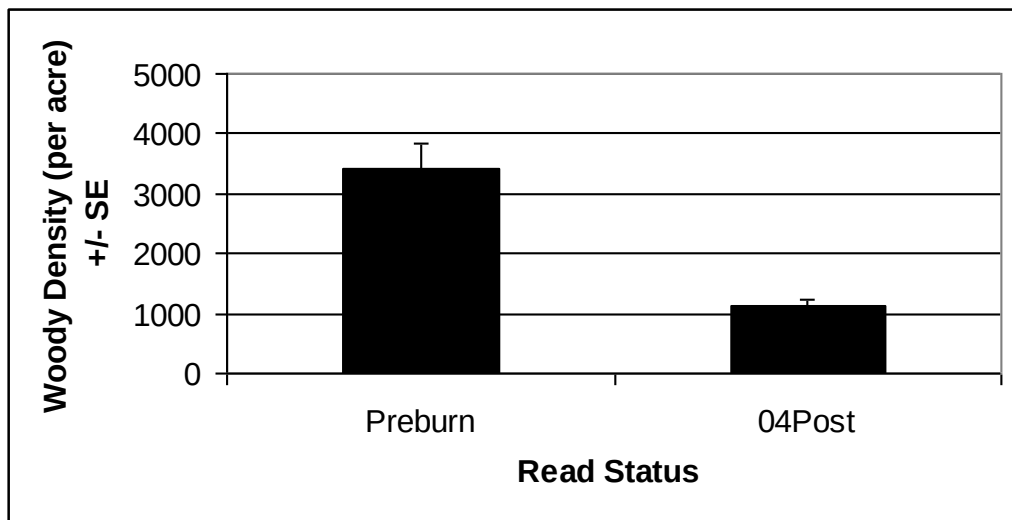


Figure 28. Average shrub density for 4 *Juniperus virginiana* plots at NATR ($\pm$ SE). Postburn data within 2 weeks after the fourth fire. Objective for shrub density reduction was 25%, and observed reduction was 67% after the 4th fire.

Stones River National Battlefield

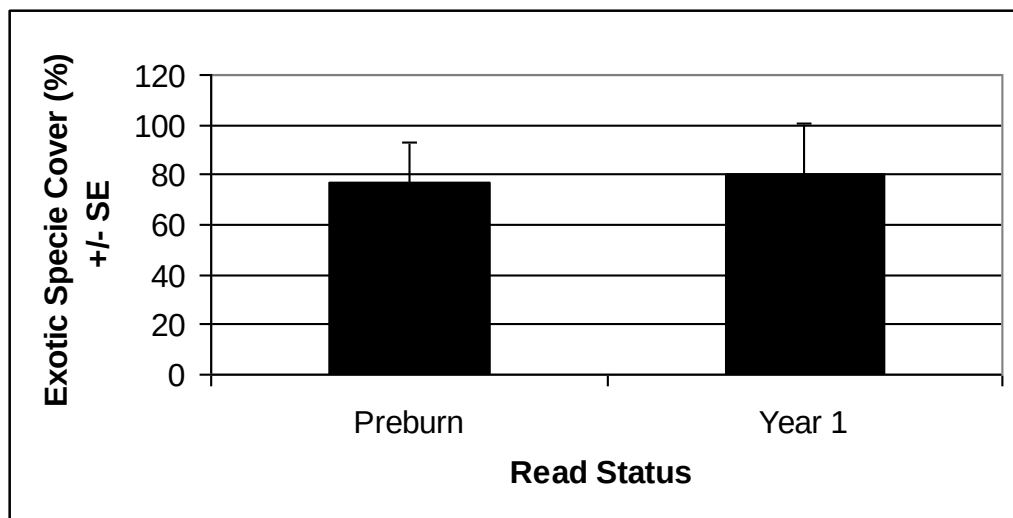


Figure 29. Cover of exotic species for the *Schizachyrium scoparium* monitoring type at STRI (n=6 plots). Objective for exotic species cover reduction was 20%, and average change was a 4% increase.

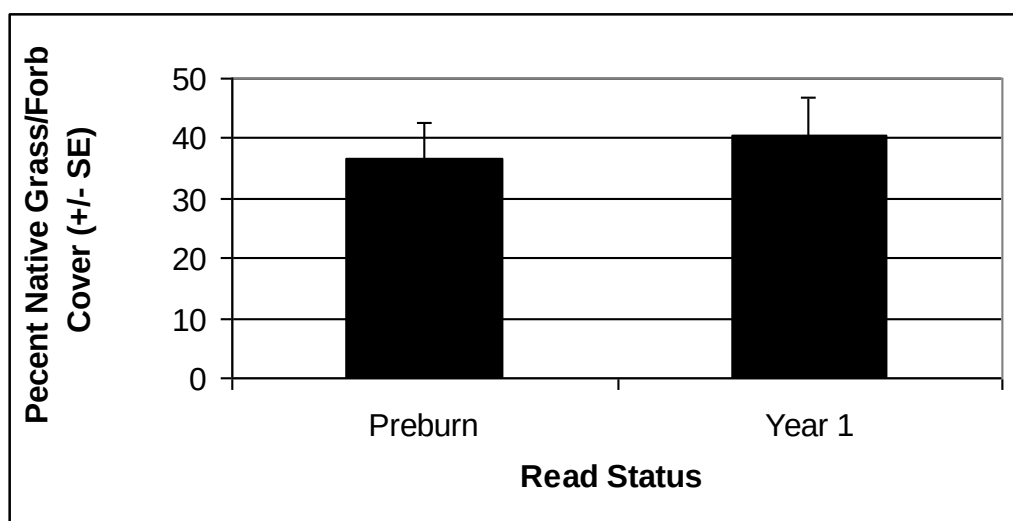


Figure 30. Cover of native herbaceous species for the *Schizachyrium scoparium* monitoring type at STRI (n=6 plots). Objective for native species cover increase was 20%, and average increase was 4%. Data includes cover from *Brassica*, *Carex*, *Dicanthelium*, *Eragrostis*, *Helianthemum*, *Oxalis*, *Rubus*, *Setaria*, *Aster*, and *Vitis* genera.