National Park Service
Fire Ecology Annual Report
Calendar Year 2008

Summary

The Northern Great Plains fire Ecology Program reached a milestone in 2008 with 11 monitoring plots measured at 10 years post fire. Cody Wienk has been documenting the program through a 10 year program review summarizing and analyzing data by monitoring type at the burn unit, park, and region level. Dan Swanson continued working on this project after his arrival in August. This document is expected to be finished in the spring of 2009.

We continued a project working with the BLM assessing some of their lands for fire ecology related information to be used in their general management plan. That included site assessments in grassland and forest settings and forest and fuel plots in Black Hills ponderosa pine sites. We presented this information at the'88 Fires: Yellowstone and Beyond Conference in September.

We had some personnel changes in 2008 with Dan Swanson arriving as the Fire Ecologist for the park group. Dan had served as the Ozark Highlands park ecologist. Jon Freeman also arrived to take the Assistant Fire Monitor position. Jon comes from Colorado Sate University and the USFS Forest Inventory and Analysis program.

Four prescribed fires occurred during the year with two at Theodore Roosevelt and one each at Jewel Cave and Wind Cave. The smaller than normal number of prescribed fires is due to personnel changes in key positions, a Prescribed Fire Specialist at Wind Cave and Fire Management Officer for the North Dakota parks.

We continued working in a new database called FFI (FEAT/Firemon/Integrated). Our data from the previous software, FEAT, was converted into the new format this spring. All of the 2008 field data was entered into the new software and data-checked as a result of many days of committed work from Marcus Lund.

Work also continued on our spatial data and we now have complete layers for all of our fire monitoring plots in the ten parks within our group. The process of assimilating the layers for prescribed fire perimeters continues.

Table 1. Fire Effects Plot Workload 2008

2008 marked a very diverse year for the Northern Great Plains fire ecology program. We worked in 9 of 10 National Park units plus several sites managed by the US Bureau of Land Management. A graduate research project studying the effects of thinning and chipping began at Mount Rushmore and Wind Cave with 54 plots installed. Another research project studying the effects of prescribed fire on archeological resources utilized a Wind Cave fire. This year, a total of 161 plots of various types were measured.

Park	Monitoring Unit	Type of Plot (FMH, photo point, other)	Pre-burn	Imm. Post	Postburn (1-20 yrs)	Total Plots
Agate Fossil Beds	Mixed grass prairie	Grassland Fuel Veg GFV	4			4
Badlands	Mixed grass prairie	FMH grass plot			1	25
	Mixed grass prairie	NGP grass plot			5	5
	Mixed grass prairie	GFV	3			3
Devils Tower	Ponderosa Pine	FMH and NGP Forest plot			4	12
	Ponderosa forest	Forest and Fuels	3			5
Jewel Cave	Ponderosa forest	Forest and Fuels	6	6		6
Knife River	Grassland	NGP grass plot	6		2	9
Mount Rushmore	Ponderosa forest	Forest and Fuels	4		7	20
	Ponderosa forest	Chipping research	36			36
Scotts Bluff	Grassland	FMH grass plot		2	7	12
	Juniper Woodland	FMH Forest plot			2	2
Theodore Roosevelt	Native grass	FMH grass plot		3	3	14
	Native grass prairie	NGP grass plot			2	15
Wind Cave	Ponderosa forest	Forest and Fuels			4	11
	Native grass prairie	FMH grass plot			6	14
	Ponderosa forest	Chipping research	18			18
	Ponderosa forest	Archeology plot	6	6		
BLM Sites	N/A	Site assessment	10			16
	Ponderosa forest	Forest and Fuels	5			5
Total			**101**	**17**	**43**	**161**

Table 2. Fire Ecology Staffing 2008

Monitor	Starting Date	Ending Date	# of Pay Periods	Training and Development
Dan Swanson	8/4/08	12/31/08	11	’88 Fires Conference
Andy Thorstenson	2/4/08	12/31/07	24	TFLD/STEN trainee assignments, FFI online and on-the job training, ’88 Fires Conference
Jon Freeman	2/4/08	11/6/08	20	Completed FEMO taskbook, S-212, S-131, Wilderness First Responder training

Monitor	Starting Date	Ending Date	# of Pay Periods	Training and Development
Marcus Lund	4/14/08	10/25/08	14	Completed FEMO taskbook, Wilderness First Responder training
Keith Mitchell	4/14/08	6/5/08	4	Completed FEMO taskbook, accepted permanent job with Fire Use Module
Kate Cueno	5/12/08	8/14/08	7	Graduate research project
Kelly Mathis	5/12/08	10/5/08	10.5	Reinstated currency on several wildland qualifications

Table 3. Management Objectives and Monitoring Results 2008

All results shown are 80% upper or lower bounds of the mean. Fuel reduction objectives/results are mean percent reduction from preburn to immediate postburn. Stand density objectives/results are for two-year postburn relative change from pre-burn conditions. An underlined number of plots indicates that the minimum sample size has been attained for that variable.

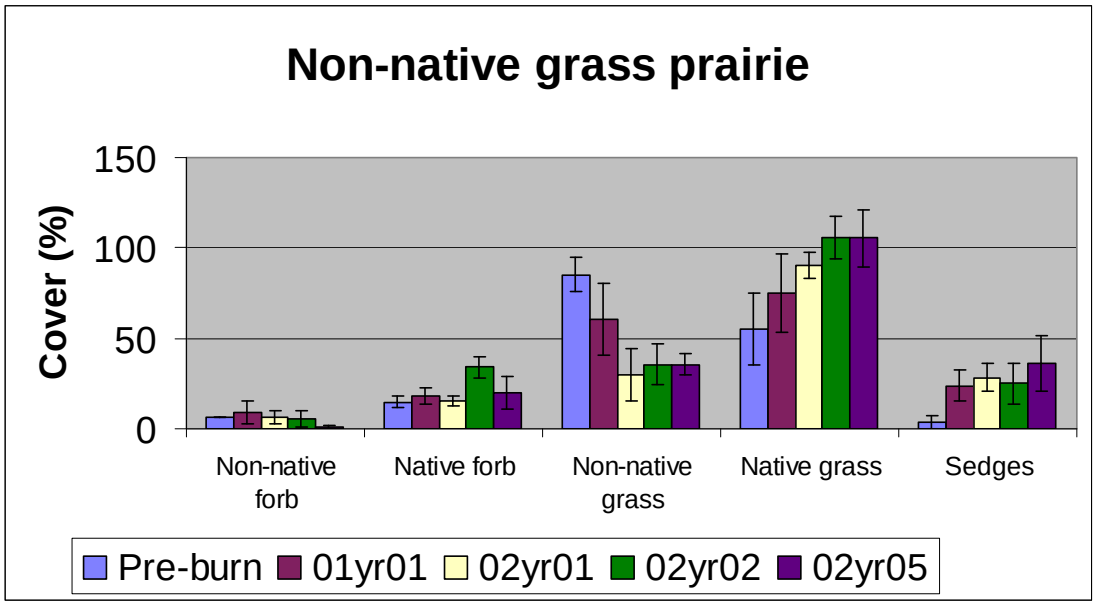
Park	Monitoring Unit	Management Objective	Monitoring Results (80% C.I.)	Objective Achieved
Wind Cave N.P.	Native Mixed-grass Prairie	Increase the relative cover of native grasses by at least 10% within two growing seasons after the burn	5% Decrease	No; N=7
		Increase the relative cover of native forbs by at least 30% within two growing seasons after the burn	No change	No; N=7
		Decrease the relative cover of non-native grasses by at least 20% within two growing seasons after the burn.	23% Decrease	Yes; N=6
	Non-native Grass Prairie	Increase the relative cover of native grasses by at least 20% within two growing seasons after the burn	59% Increase	Yes; N=5
		Increase the relative cover of native forbs by at least 20% within two growing seasons after the burn	No change	No; N=5
		Decrease the relative cover of non-native grasses by at least 30% within two growing seasons after the burn.	No change	No; N=5
	Ponderosa Pine Forest	Increase the relative cover of native herbs by at least 25% within two growing seasons after the burn	17% Decrease	No; N=5
		Decrease the relative cover of non-native herbs by at least 25% within two growing seasons after the burn	No change	No; N=5
		Reduce the density of overstory ponderosa pine (≥ 14.9 cm dbh) by at least 30% two growing seasons after the burn.	6% Decrease	No; N=9
		Reduce the density of pole-size ponderosa pine (2.5 – 14.8 cm dbh) by at least 50% two growing seasons after the burn.	No change	No; N=9
		Reduce the density of seedling ponderosa pine by at least 70% one growing season after the burn	78% Decrease	Yes; N=9
		Reduce total fuel loading by at least 30% following one prescribed burn	21% Decrease	No; N=9
Devils Tower N.M.	Non-native Grass Prairie	Increase the relative cover of native grasses by at least 10% within two growing seasons after the burn	39% Increase	Yes; N=3
		Increase the relative cover of native forbs by at least 20% within two growing seasons after the burn	74% Increase	Yes; N=3
		Decrease the relative cover of non-native grasses by at least 20% within two growing seasons after the burn.	49% Decrease	Yes; N=3
	Ponderosa Pine	Increase the relative cover of native grasses by at least 10% within two growing seasons after the burn	13% Increase	Yes; N=7
		Increase the relative cover of native forbs by at least 10% within two growing seasons after the burn	36% Increase	Yes; N=6

		Decrease the relative cover of non-native grasses by at least 30% within two growing seasons after the burn. Reduce total fuel loading by at least 30% following one prescribed burn	No change 38% Decrease	No; N=7 Yes; N=7
Badlands N.P.	Western wheatgrass Mixed-grass Prairie	Increase the relative cover of native grasses by at least 10% within two growing seasons after the burn Increase the relative cover of native forbs by at least 30% within two growing seasons after the burn Decrease the relative cover of non-native grasses by at least 20% within two growing seasons after the burn.	6% Decrease 4% Increase No change	No; N=20 No; N=18 No; N=19
	Non-native grass Prairie	Increase the relative cover of native grasses by at least 10% within two growing seasons after the burn Increase the relative cover of native forbs by at least 10% within two growing seasons after the burn Decrease the relative cover of non-native grasses by at least 30% within two growing seasons after the burn.	30% Increase 37% Increase No change	Yes; N=4 Yes; N=4 No; N=4
Theodore Roosevelt N.P.	Kentucky Bluegrass Non-native Prairie	Increase the relative cover of native grasses by at least 20% within two growing seasons after the burn Increase the relative cover of native forbs by at least 20% within two growing seasons after the burn Decrease the relative cover of non-native grasses by at least 30% within two growing seasons after the burn.	57% Increase No change 3% Decrease	Yes; N=3 No; N=3 No; N=3
	Crested Wheatgrass Non-native Prairie	Increase the relative cover of native grasses by at least 20% within five growing seasons after the burn Decrease the relative cover of non-native grasses by at least 20% within five growing seasons after the burn.	No change No change	No; N=3 No; N=3
	Native Mixed-grass Prairie	Increase the relative cover of native grasses by at least 20% within five growing seasons after the burn Decrease the relative cover of non-native herbs by at least 20% within five growing seasons after the burn.	8% Increase 8% Increase	No; N=3 No; N=3

Devils Tower N.M

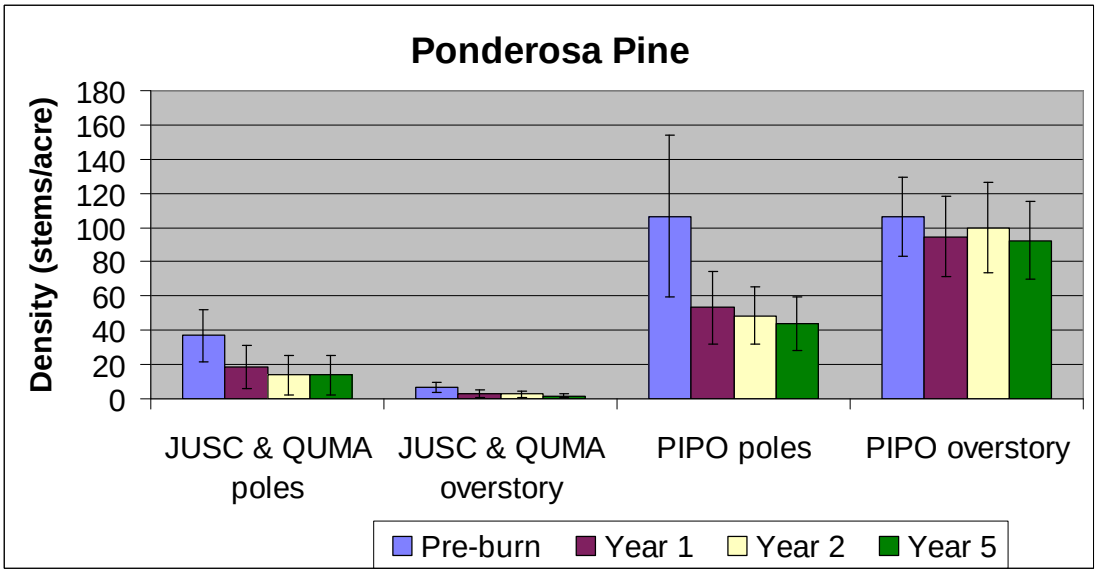
Three plots have been installed in Kentucky bluegrass dominated grasslands. All of these plots have burned twice and were visited 5 years post-burn. There is an 80% certainty that native grasses and sedges significantly increased by at least 39% in relative cover following two growing seasons and two burns. Native forbs significantly increased by at least 74% two growing seasons after the second burn treatment. Non-native grasses significantly decreased by at least 49%. Therefore, all three of these monitoring objectives were met for this monitoring type. Data from these plots are summarized below in figure 1.

Figure 1 Percent vegetative cover by lifeform for three plots within the Kentucky bluegrass monitoring type following two prescribed burns.



Seven FMH tree plots have been installed within the ponderosa pine monitoring type and have burned once in a prescribed fire. There is an 80% certainty that at least a 20% reduction in ponderosa pine pole density occurred two years after the prescribed burn with overstory density slightly decreasing. Data from these plots is summarized in figure 2.

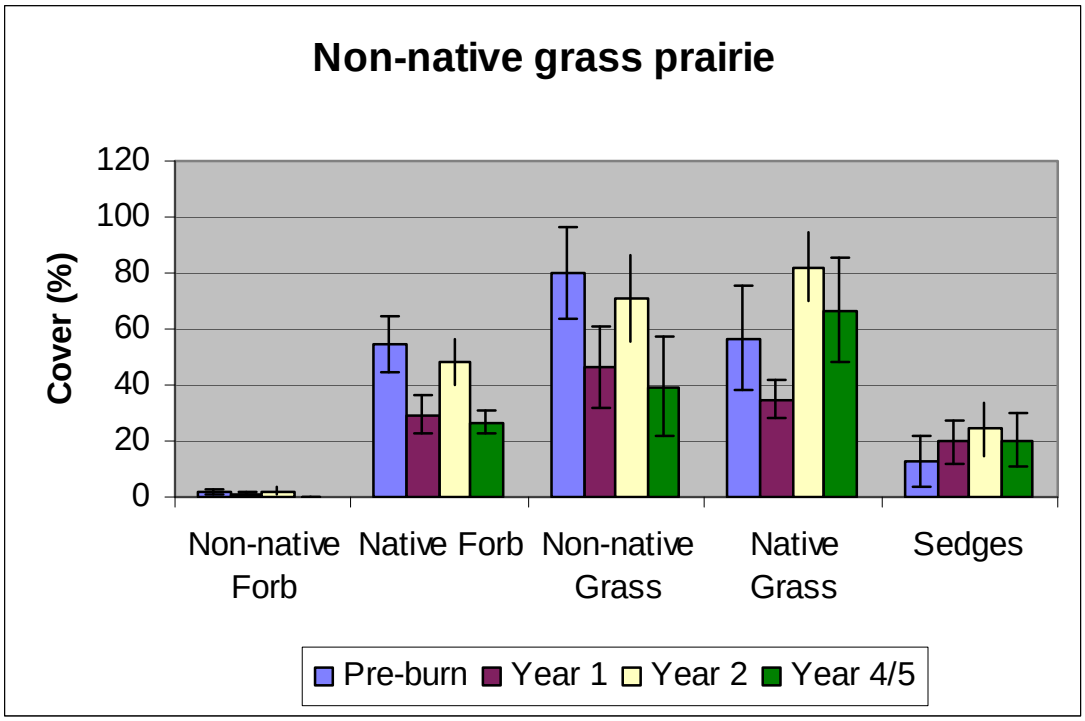
Figure 2 Overstory and pole density of ponderosa pine, rocky mountain juniper, and bur oak for seven plots within the ponderosa pine monitoring type following one prescribed burn treatment.



Wind Cave N.P.

Five Kentucky bluegrass plots were installed within this monitoring type and data includes through five years post-burn. Following two growing seasons after the burn, relative cover of native grasses and sedges significantly increased by at least 59% with an 80% certainty. There was no significant change in non-native grasses or native forbs two growing seasons following the prescribed fire. Data from these plots is summarized in figure 3.

Figure 3 Percent vegetative cover by lifeform for five plots within the Kentucky bluegrass monitoring type following one prescribed burn.



Nine ponderosa pine monitoring plots were installed in five burn units and had one prescribed fire treatment. Ponderosa pine overstory density significantly decreased by 6% two growing seasons after the burn with pole density significantly decreasing by 14% after one growing season. Pole density is trending upward from year 1 to year 2 due to previously classified seedlings migrating into the pole class. Seedling density significantly decreased by at least 78% one growing season after the prescribed burn. Data from these plots is summarized in figures 4 and 5.

Figure 4 Overstory and pole density of ponderosa pine for nine plots within the ponderosa pine monitoring type following one prescribed burn treatment.

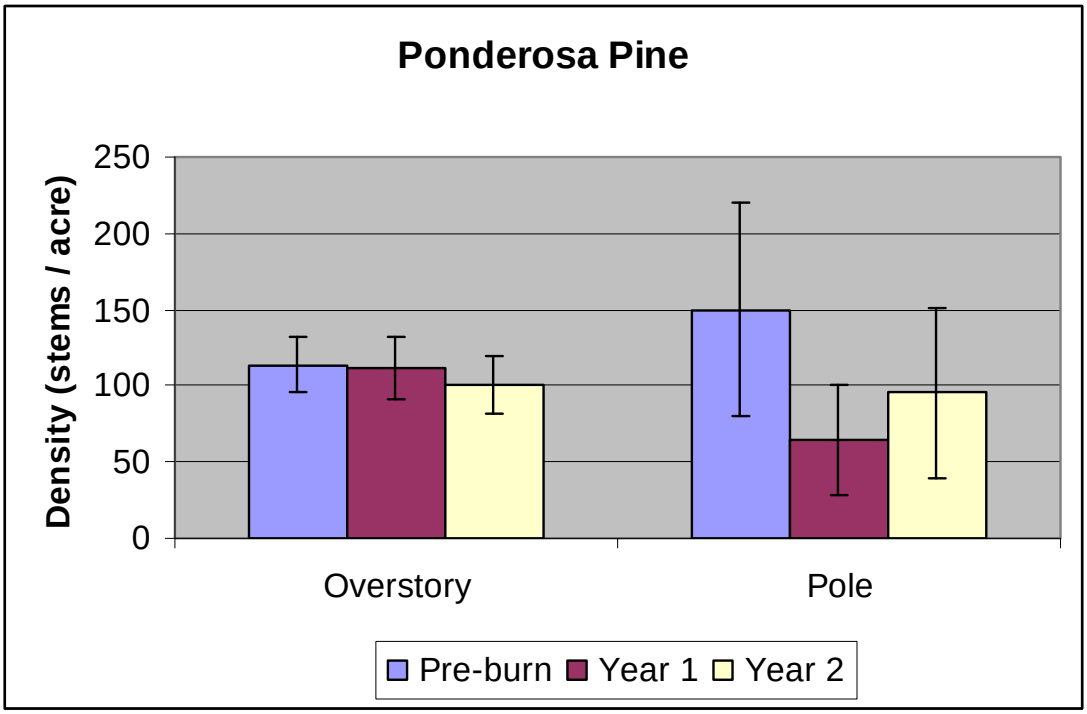
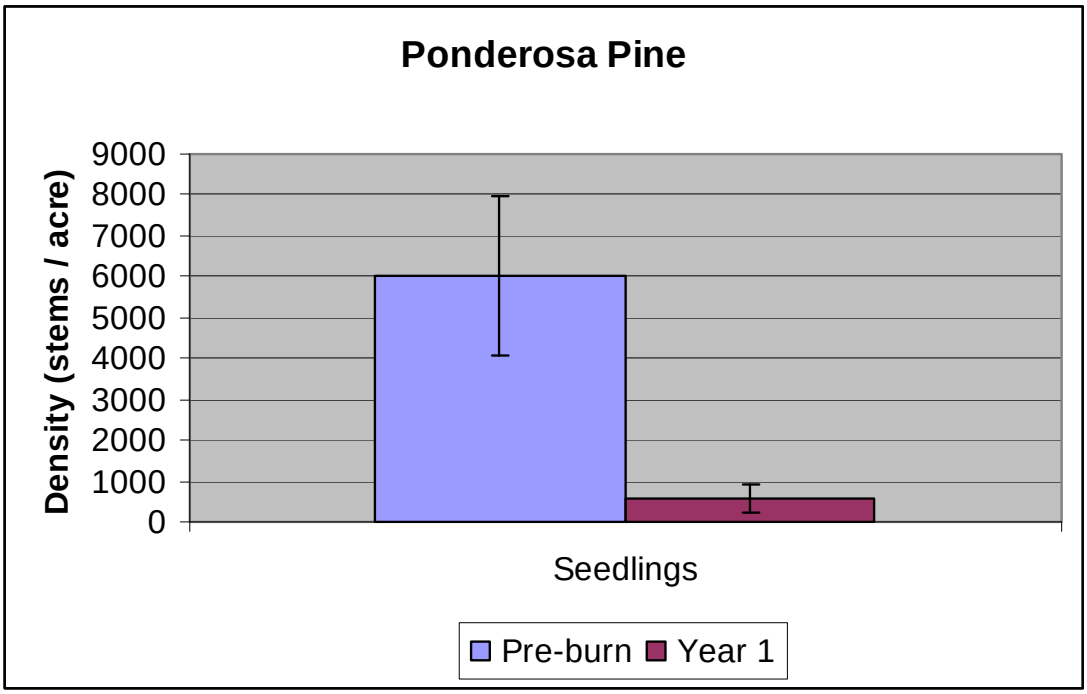


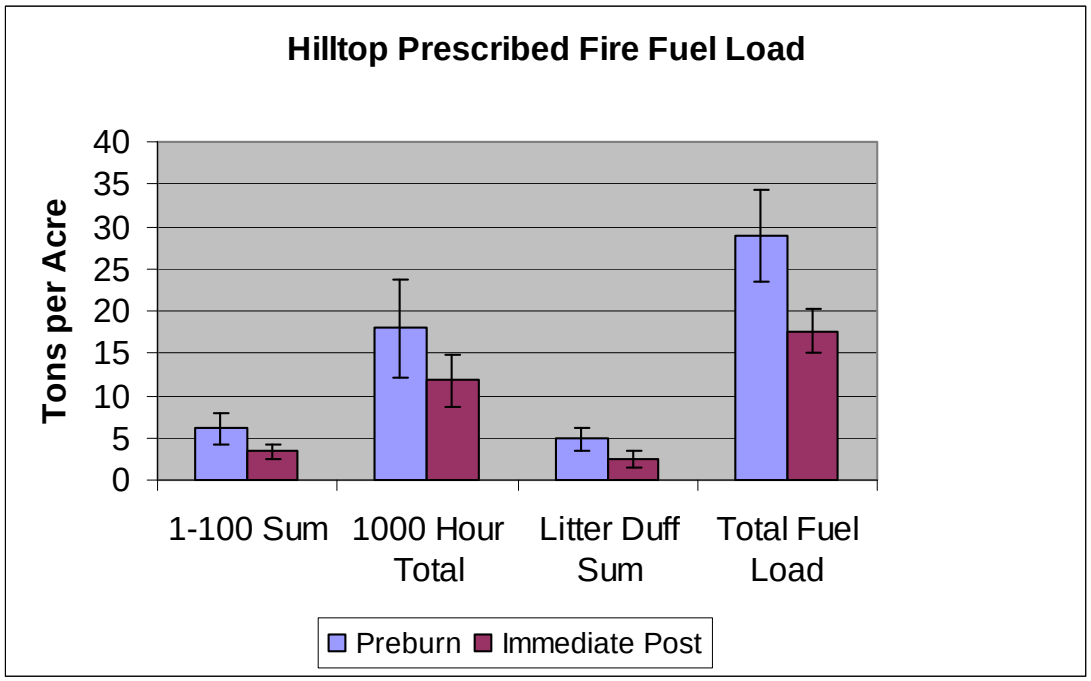
Figure 5 Ponderosa pine seedling density for nine plots within the ponderosa pine monitoring type following one prescribed burn treatment.



Jewel Cave N.P.

The Hilltop prescribed fire was completed on October 30th, 2008 and consisted of 313 acres adjacent to Hell Canyon. Much of this area had burned as a crown fire in the Jasper fire in 2000, leaving a significant load of dead and down 1000-hour fuels. An objective for this burn was a 70-90 % reduction in total fuel loading. 1000 hr fuel loading decreased 35% after the prescribed burn and total fuel loading by 39% (See figure 6 below). Even though total fuel loading wasn't reduced enough to meet the objective, the Hilltop prescribed fire represented a first step in lowering the fuel loading at the monument.

Figure 6 Pre and post fuel loading by size class for six fuel plots within the Hilltop prescribed burn unit.



Fire ecologist accomplishments and areas of focus

Accomplishments include time worked as the Ozark Highlands park ecologist (1/1/08 – 8/3/08) and Northern Great Plains park ecologist (8/4/08 – present). While Dan was working as the ecologist for the Ozark Highlands network parks, he collaborated with the fire education specialist and I&M Heartland Ecologist on a natural resource report on the Ozark National Scenic Riverways. This report documented the effects of prescribed burning on each of the park's monitoring types. After Dan's arrival to the Black Hills in mid August he began working on a ten year program review that Cody Wienk had initiated more than a year earlier. Analysis was done by monitoring type at the burn unit level and park. This thorough analysis has helped our program determine whether monitoring objectives need to be modified and/or eliminated. Drought appears to be a much stronger driver in vegetation structure/composition than does fire in our native mixed grass and non-native prairie ecosystems. Many of our vegetative cover monitoring objectives were not met probably due to the severe drought that affected the area

from 2001-2007. We have seen herbaceous cover decline during periods that coincide with drought, irrespective of whether prescribed burns have occurred the previous years. Meetings with the Northern Great Plains Inventory & Monitoring program continued this fall and winter to determine whether we could combine our work effort to the benefit of both programs. In 2009 the I&M program will install 310 intensive plots throughout their network. The following year the fire effects program will help I&M read monitoring plots for the North Dakota parks to assess changes at the park level, and I&M will help the fire ecology program install/read a greater number of forest and fuels plots in the Black Hills parks. The two programs plan on using the same sampling designs with randomly, spatially distributed plot locations so that vegetation changes across the landscape can be assessed in relation to fire and precipitation patterns. The fire ecology program in the past has not had any control plots due to time constraints and this has inhibited our ability to ascertain the driver of changes in the herbaceous layer.

Dan also spent a significant amount of time dealing with and resolving issues relating to the FEAT to FFI conversion. Many of the issues related to data that was collected in non-FMH protocols but were resolved after working with the FFI programmer. Reorganization of the plot naming convention was also implemented this fall to accommodate the various plot designs and protocols.

In September Dan went to Rocky Mountain N.P. to assist with the Estes Park prescribed burn which ended up being their largest in history. He also participated on the Campground and Hilltop prescribed burns at Wind Cave and Jewel Cave this fall as the fire effects monitor.

Table 4. Fire Ecologist Accomplishments/Focus Areas

Category	**Percent Time**	**Accomplishments and/or areas of activities**
Planning	10%	Determining fire effects plot / CBI location and establishment in monitoring types at OZAR, BUFF, PERI, and HOSP. Determining fire effects travel costs to area parks. Training of field crew in FFI and CBI protocols
Presentations	5%	Park staff, public meetings, and training
NPS Meetings/ task groups	10%	Park meetings, I&M meetings, GMP meetings, OZAR safety committee meetings
Interagency work	1%	
Fire Assignments	4%	FEMO on 4 RX fires (4 operational periods), FFT2 on 2 RX fires (4 operational periods), FFT2 on 1 WF(1 operational periods
Research	3%	Assisted Fire Education specialist with glade monitoring project
Data entry	1%	Estimated amount of time spent entering data from paper to PC
Data Conversion	12%	FEAT to FFI conversion issues
Data management & analysis	32%	Northern Great Plains area parks fire effects data analysis
Supervision/Admin	15%	Hiring, supervision, travel, payroll, etc
Training	2%	FFI Workshop, Botany training, fire refresher
Miscellaneous	5%	NGP fire management web site, Writing burn reports, collaborated in writing a natural resource report on the Ozark National Scenic Riverways

Fire effects crew accomplishments and areas of focus

Table 5. Fire Effects Crew Accomplishments/Focus Areas

Category	Percent Time	Notes
FMH plots	15%	Includes immediate postburn measurements
Other plot work	35%	NGP plots that integrate Fire and Inventory and Monitoring protocols, Ponderosa pine Forest and Fuels plots, and graduate research thinning plots .
Fire Assignments	7%	Wildfire assignments
Prescribed Fire & Fuels	5%	Prescribed fires in the park group in calendar year 2007
Data entry	15%	All plot data into FFI version 1.02.10
Data conversion	5%	Estimated amount of time to convert FEAT data to FFI; includes verification of protocols, error checking, etc.
Data analysis	5%	
Supervision/Admin	7%	Travel, payroll, hiring three GS-5 seasonals and GS-6 perm asst. lead
Training	4%	Includes fire and ecology related training
Miscellaneous	2%	Seasonal detailing onto engine crew

Additional Items from 2008

This summer a graduate research project was implemented at Mount Rushmore National Memorial and Wind Cave National Park to study the understory response due to thinning and chipping ponderosa pine forests. Thirty-six plots were installed at MORU and 18 in WICA this summer to gather data on pre-treatment conditions. It is currently unknown whether broadcast chips enhance or disrupt tree regeneration, promote or reduce exotic species, or restore suppressed understory plant communities in the Black Hills. Treatments include: 1) broadcasting chips from mechanically thinned fuels, 2) removing mechanically thinned fuels, and 2) control, no treatment. This winter treatment areas will be thinned/chipped and next summer year one data will be collected.

1. Identify types of fire effects monitoring databases or spreadsheets being used (e.g., FFI, Access, Excel).
   • FFI, 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.
   • A presentation covering the last ten years of fire effects data collection was given to the Northern Great Plains Technical Committee in early December. The presentation lasted over an hour and analysis was shown documenting whether fire effects monitoring objectives were being met for each monitoring type at the park level.
   • I gave a presentation to the Buffalo NR fire management officer, prescribed fire specialist, and natural resource staff in June on how effective the Ozark Highlands fire effects program is meeting their objectives at Pea Ridge N.M.P., Hot Springs N.P., and Buffalo N.R. I also presented new methods and protocols in project level monitoring that would be used in proposed burn units.