National Park Service
Northern Great Plains Fire Ecology
Annual Report
Calendar Year 2009

A. Summary

2009 marked a diverse and productive year for the Northern Great Plains (NGP) fire ecology program. We worked in 9 of our10 National Park units. This year, a total of 136 plots of various types were measured. A total of nine prescribed fires occurred in the NGP parks, resulting in 18 plots being burned and measured immediately post-burn, ensuring plot measurements for upcoming years. The Colorado State University-based graduate research project studying the effects of thinning and chipping continued at Mount Rushmore and Wind Cave. The mechanical treatments for this study occurred in the spring and early summer and plots were measured post-treatment. This project will continue into 2010 and beyond, focusing on fuel treatment effects on stand structure and understory vegetation.

The fire ecology database, FFI, rolled out a new version in November. Several improvements suggested by NGP staff have been included in this update. We have updated all of the NGP fire effects data into the new FFI version 1.03. Dan Swanson presented results from ponderosa pine monitoring in National Park units of the Black Hills to an audience at the 4th International Fire Ecology Congress.

The fire ecology program continued a relationship with the NGP Inventory and Monitoring (I&M) network. We assisted I&M with locating their vegetation sampling plots and continued vegetation sampling protocols which will be compatible with I&M data. In 2010 we will assist I&M with their first full field season of vegetation data collection.

Headquarters West prescribed fire, Wind Cave National Park

Table 1. Fire Effects Plot Workload 2009

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 Fuels Veg. Plot (GFV)		3	3	4
Badlands	Mixed grass prairie	FMH Grass Plot			10	24
	Mixed grass prairie	GFV Plot	3	1	3	9
Devils Tower	Ponderosa forest	FMH Forest Plot			5	13
	Mixed grass prairie	FMH Grass Plot			1	3
Jewel Cave	Ponderosa forest	Forest and Fuels Plot	2		3	5
	Ponderosa forest	Forest, Fuels, and Veg. Plot (FFV)	2		3	5
Knife River	Grassland	GFV Plot	3	4	6	12
	Grassland	FMH Grass Plot		6	6	6
Mount Rushmore	Ponderosa forest	Forest and Fuels			4	11
	Ponderosa forest	CSU research		24		36
Scotts Bluff	Grassland	FMH Grass Plot			2	13
Theodore Roosevelt	Native grass	FMH Grass Plot			3	7
	Native grass prairie	GFV Plot			2	2
	Native shrubland	FMH Brush Plot			3	9
Wind Cave	Ponderosa forest	Forest and Fuels Plot	7			11
	Native grass prairie	FMH grass plot			2	9
	Ponderosa forest	FFV Plot	3	3		3
	Ponderosa forest	Chipping research		12		18
Photo Points, various parks	Grassland	Photo point		1	4	19
	Ponderosa forest	Photo point	2			8
Total	**136**		**22**	**54**	**60**	

*Total Plots column reflects the total number of plots installed to date in the project type, not necessarily the number measured in 2009.

We measured plots in 9 of 10 parks and conducted prescribed burns in 5 parks resulting in 18 immediate postfire measurements. Mechanical treatment, thinning of ponderosa pine, occurred at 3 parks with 36 monitoring plots remeasured. As a measure of the maturation of the program, we measured 17 plots at 10 years postfire in 4 different parks. We also measured 10 plots which have been treated by 3 prescribed fires. One park in our group, Agate Fossil Beds National Monument conducted its first successful prescribed fire.

Table 2. Fire Ecology Staffing 2009

Monitor	Starting Date	Ending Date	# of Pay Periods	Training and Development
Dan Swanson	1/1/09	12/31/09	26	Worked on FFT1 taskbook; writing foundations class; 6 Rx and wildfire operational periods
Andy Thorstenson	3/16/09	12/31/09	21	S-490, S-491, CPR/1st Aid; S-234 lead instructor; 25 Rx and wildfire operational periods

Monitor	Starting Date	Ending Date	# of Pay Periods	Training and Development
Jon Freeman	2/15/09	11/7/09	19	Completed FFT1, ICT5, and HECM taskbooks; worked on FALB and ENOP taskbooks, S-215, S-234, S-260, S-271, S-390; GRCA Helitack Training Academy detail; 43 Rx, wildfire, and HECM operational periods
Kate Cueno	5/26/09	8/13/09	6	Led graduate research project, worked on FFT1 taskbook; 9 Rx and wildfire operational periods
Valena Hofman	5/11/09	10/1/09	10 ½	Completed FEMO taskbook; ATV training; S-133, S-212, B-3; 18 Rx and wildfire operational periods
Marcus Lund	4/27/09	10/24/09	13	Completed FFT1 and FALA taskbooks; S-390; detail with BLHI WFM, 32 Rx and wildfire operational periods
David Kem	5/11/09	8/6/09	6 ½	S-212, CPR/1st Aid, B-3; 4 Rx and wildfire operational periods

Table 3. Management Objectives and Monitoring Results

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 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. Reduce total fuel loading by at least 30% following one prescribed burn	13% Increase 36% Increase No change 38% Decrease	Yes; N=7 Yes; N=6 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 two growing seasons after the burn.	8% Increase 8% Increase	No; N=3 No; N=3
Agate Fossil Beds N.M	Native Mixed-grass Prairie	Increase the relative cover of native grasses by at least 20% within two growing seasons after the burn. Decrease the relative cover of non-native herbs by at least 20% within two growing seasons after the burn.	5% Increase (Yr 1) 31% Decrease (Yr1)	TBD TBD

Mount Rushmore N.M.

A restoration project was conducted in the southern portion of Mount Rushmore N.M. within old-growth stands of ponderosa pine to decrease the abundant ladder fuels that have overcrowded the stands and left them more susceptible to mountain pine beetle attacks. The project involves mechanically removing most ponderosa pine trees 5 inches in diameter and smaller. The material is then stacked in piles by hand and will be burned during the winter when there is adequate snow cover. Approximately 30 acres were thinned in fall 2008 and an additional 35 acres completed June 2009. The Northern Great Plains Fire Ecology Program has established 11 monitoring plots in the restoration area to document changes to the ponderosa pine stands and to assess the success of the treatments. Figure 1 shows that there was an inverse exponential relationship between dbh and density prior to the thinning treatment which is not typical of a healthy, functioning old growth ponderosa pine stand. There was a 57% and 96% decrease in seedling and pole density respectively following the mechanical thinning treatment. Data from these plots is summarized in figure 2.

Figure 1 Ponderosa pine stand structure for eleven plots within the Old Growth unit following mechanical thinning.

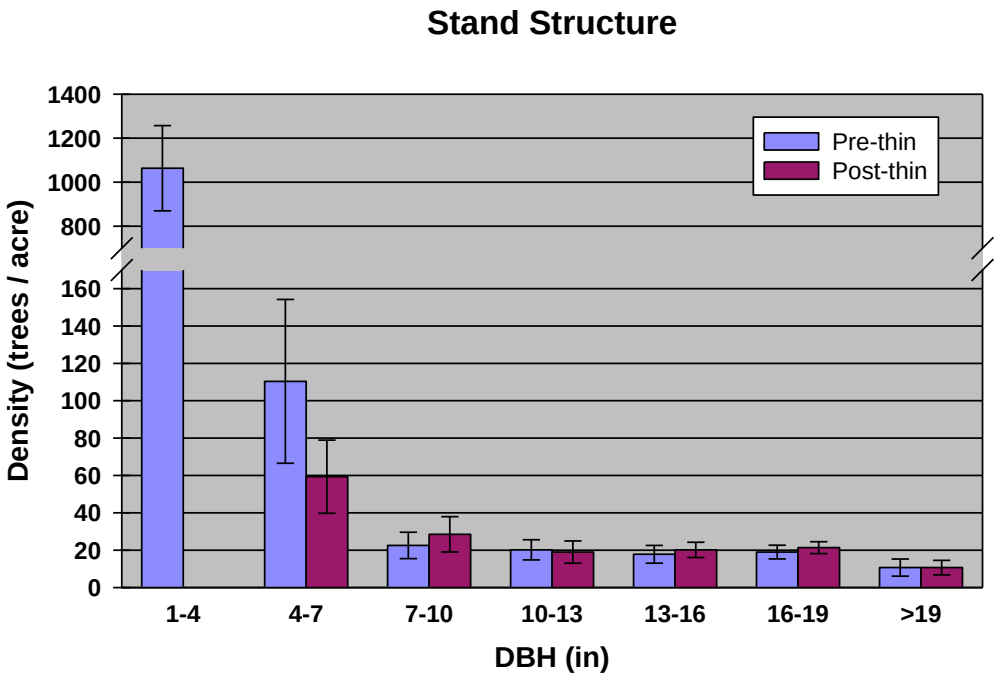
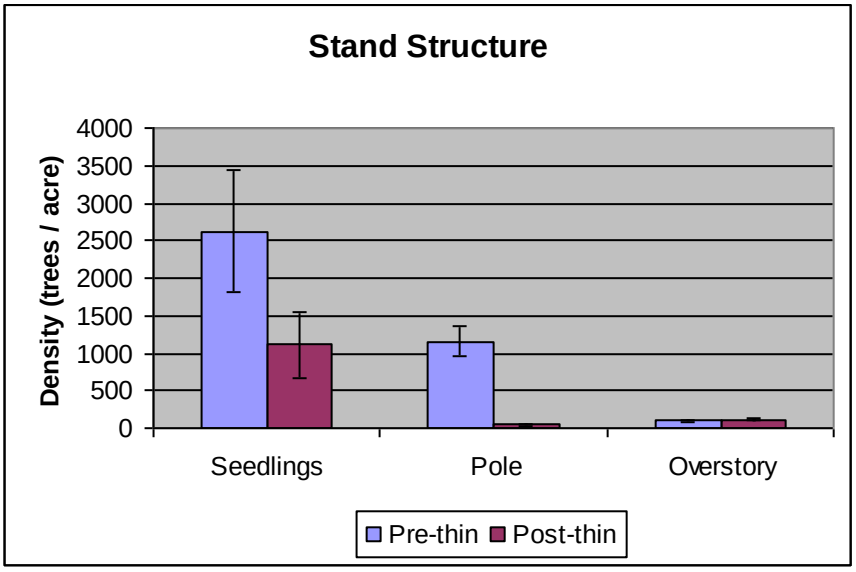


Figure 2 Seedling, pole, and overstory ponderosa pine density for eleven plots within the Old Growth unit following mechanical thinning.



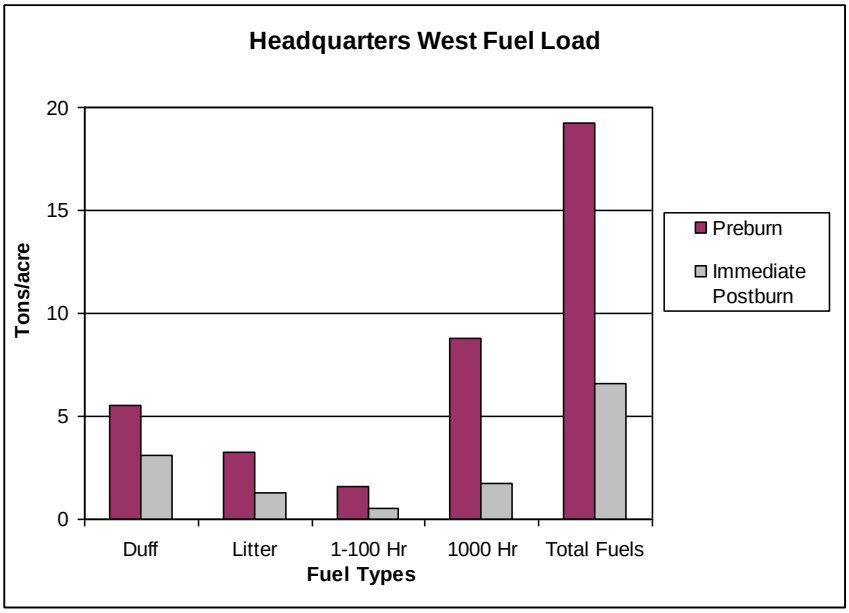
Pre-thin photo taken from monitoring plot within Old Growth unit.

Post-thin photo taken from the same monitoring plot and location.

Wind Cave N.P.

On September 3rd and 4th, 2009, Fire Management staff at Wind Cave National Park completed a 631-acre prescribed fire adjacent to the park's Visitor Center. The area burned in a high severity wildfire in 1991 resulting in significant amounts of dead and down fuel on the forest floor. The Headquarters West project succeeded in reducing the total fuel load by 66% and 1000 hr fuels by 81% (Figure 3). It also reduced the threat of another high severity wildfire near the park headquarters.

Figure 3 Fuel loading by size class for three plots following the Headquarters West prescribed burn on September 3rd and 4th, 2009.

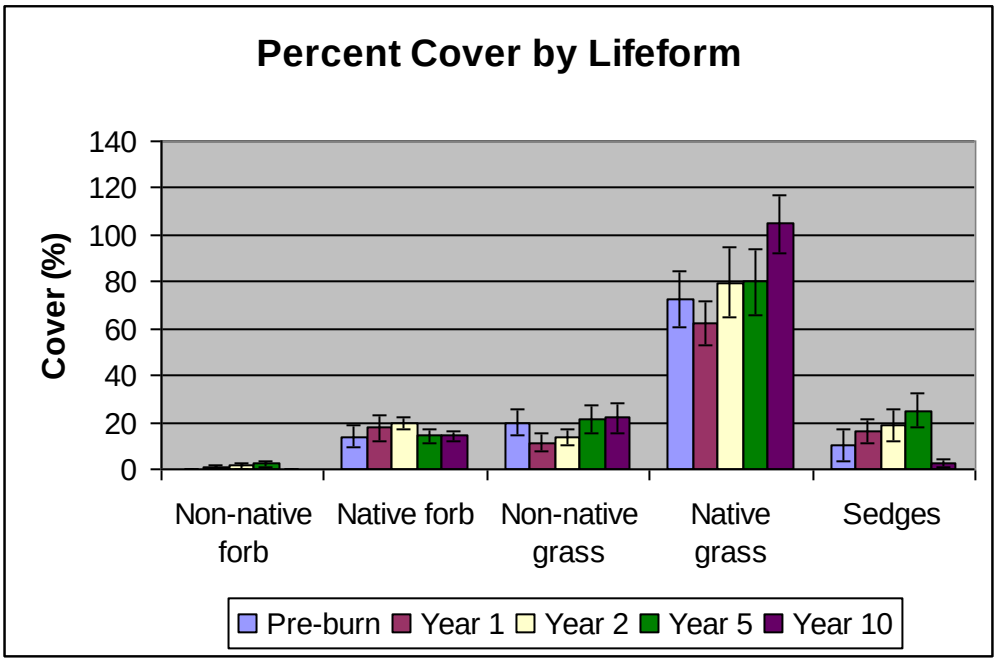


Monitoring of the area prior to the fire found more than 3,500 ponderosa pine seedlings per acre. Surveys immediately following the fire suggest that the fire successfully reduced the high density of seedlings. At the same time, few of the larger, overstory trees were killed by this fire. Initial estimates showed less than 30% mortality in this size class. Overall, the prescribed burn resulted in a mosaic of low to moderate burn severity. This combination of effects will create a balance of age classes in the forest and maintain an open, park-like stand. This was a complex interagency burn that was successfully implemented in the late summer when fires historically occurred in the Black Hills.

Devils Tower N.M.

Five monitoring plots were installed within this ponderosa pine monitoring type in three burn units and were burned in 1998 and 1999. Herbaceous cover objectives included reducing non-native grass cover by 30-50%, increasing native grass cover by 10 to 25%, and increasing native forb cover by 10 to 25%. Following one prescribed burn native grass cover increased approximately 44% by year 10 (Figure 4). Non-native grass cover declined about 45% at year 1 but by year 5 reached pre-burn cover levels. Native forb cover was essentially unchanged throughout the ten year monitoring period.

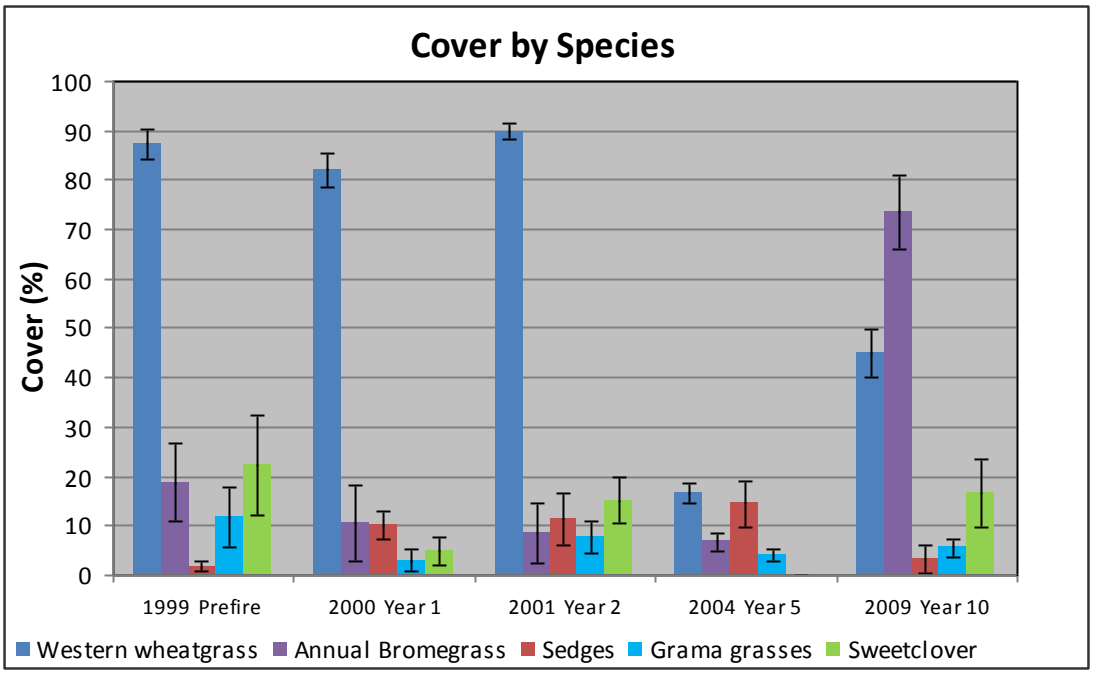
Figure 4 Percent vegetative cover by lifeform for five plots within the ponderosa pine monitoring type following one prescribed burn.



Badlands N.P.

Eight western wheatgrass mixed-grass prairie plots were installed within this monitoring type from two burn units and data includes through ten years post-burn. Western wheatgrass significantly reduced in cover during the drought years (2002-2007) following the burn in 1999. Pre-burn through two years post-burn showed its cover relatively constant at over 80% but then it dropped dramatically to less than 20% in 2004. With an above average precipitation year in 2008 and above normal spring moisture in 2009, western wheatgrass more than doubled its cover to over 40%. Annual brome grass showed a less pronounced decrease in cover during the drought from approximately 19% in 1999 to about 7% in 2004, but rebounded well above pre-burn levels to 73% at year 10. The annual brome grass appears more tolerant of drought than western wheatgrass and better at taking advantage of moister years. Sedges significantly increased in cover following the fire and were not affected by the drought. Data from these plots is summarized in figure 5. This figure depicts how precipitation is a much stronger driver in some herbaceous species cover than fire in Northern Great Plains prairie communities.

Figure 5 Percent vegetative cover by species for five plots within the western wheatgrass mixed-grass prairie monitoring type following one prescribed burn.



B. Fire ecologist accomplishments and areas of focus

Dan continued working with the Northern Great Plains Inventory & Monitoring Program reviewing and editing their vegetation monitoring protocols as well as helping with the installation of plot origins at Mount Rushmore N.M., Jewel Cave N.M., Badlands N.P., and Wind Cave N.P. The I&M program is still targeting the implementation of their first field season in 2010. The Northern Great Plains (NGP) fire effects monitoring program will collaborate with the I&M monitoring program in reading plots for the North Dakota parks as well as reading monitoring plots within the Black Hills parks in SD and WY. In January, Dan worked with the lead monitor of the Ozark Highlands fire ecology program to analyze, summarize, and write their annual report due to the vacant Ozark Highlands fire ecologist position. Worked with the MWR fire ecologist in the writing and editing of park vegetation and fuel documents for an archeological research project that was conducted at Pea Ridge NMP and Buffalo NR.

Throughout the year Dan provided input to the FFI programmers on making improvements for the just released FFI version 1.03. During the fall a significant amount of time was spent updating NGP's prescribed and wildland fire occurrence spatial data for a LANDFIRE refresh project. He contacted all ten park's fire coordinators, resource managers, or park GIS specialists to retrieve this data and worked with the MWR GIS staff on compiling the spatial layers for the project.

Throughout the year monitoring results and prescribed burn reports were uploaded to the NGP fire web site.

Starting this past May, I became the park ecologist representative on the Fire Ecology Steering Committee and participate in their monthly phone conference calls.

Field assessments on future prescribed burn units were made this fall at Wind Cave N.P. to develop burn and monitoring objectives and this information was directly communicated with the burn boss.

Table 4. Fire Ecologist Accomplishments/Focus Areas

Category	Percent Time	Accomplishments and/or areas of activities
Planning	10%	Determining fire effects travel costs to area parks, training of field crew in FFI
Presentations	8%	Scientific meetings, park staff, public, etc.
NPS Meetings/ task groups	10%	Park, I&M, & FESC meetings
Interagency work	5%	LANDFIRE Refresh project assimilating RX and WF fire occurrence data
Fire Assignments	3%	FEMO on 1 RX fire (1 operational period), FFT2 on 3 RX fires (3 operational periods), FFT1(T) on 2 WF(2 operational periods)
Research	0%	JFSP, other
Data Collection	10%	Estimated amount of time spent in the field collecting data
Data entry	0%	Estimated amount of time spent entering data from paper to PC
Data management & analysis	32%	Northern Great Plains area parks fire effects data analysis
Supervision/Admin	15%	Hiring, supervision, travel, payroll, etc.
Training	4%	Botany training, writing foundations class, Climate Change Workshop
Miscellaneous	3%	NGP fire management web site, Writing burn reports

C. Fire effects crew accomplishments and areas of focus

The fire effects crew completed a variety of plots, assisted with a Joint fire Science research project, and moved in to a new vehicle. 2009 had limited opportunities for wildland fire assignments but crewmembers all developed their skills in prescribed fires in the spring, summer, and fall. The lack of wildland fire had benefits for data entry and data checking as the 2009 field data was entered and checked in record time which allowed time to check the 2007 data as well. The staff improved the database through the process of cleaning and checking the data and smoothing some issues with the FFI software. This included adding disturbance history for the plot network, checking all datasheet header information for accuracy and uniformity, removing unused protocols from monitoring events, and converting the database into the most current version of FFI.

Table 5. Fire Effects Crew Accomplishments/Focus Areas

Category	Percent Time	Notes
Fire Effects Plots	32%	Includes CSU research plots and immediate post-burn plots
Fire Assignments	8%	Wildfire assignments, including local I.A. and details with the Black Hills Wildland Fire Module
Prescribed Fire & Burn Unit Prep	9%	Prescribed fires in the NGP park group, calendar year 2009
Data entry	9%	100% of plot data entered into FFI version 1.02.10, Converted and updated to FFI Version 1.03
FFI data conversion problem solving, data checking	8%	Checking data converted from FEAT to FFI, correcting FFI conversion errors and data entry errors

Data analysis	2%	Analyzing data for inclusion in reports, presentations, etc
Supervision/Admin	16%	Travel and payroll processing, seasonal hiring, field season preparation, equipment upkeep and repair
Training	10%	Includes fire and ecology related training
Miscellaneous	6%	Physical training, fuel sampling, herbarium updates, NGP fire history project