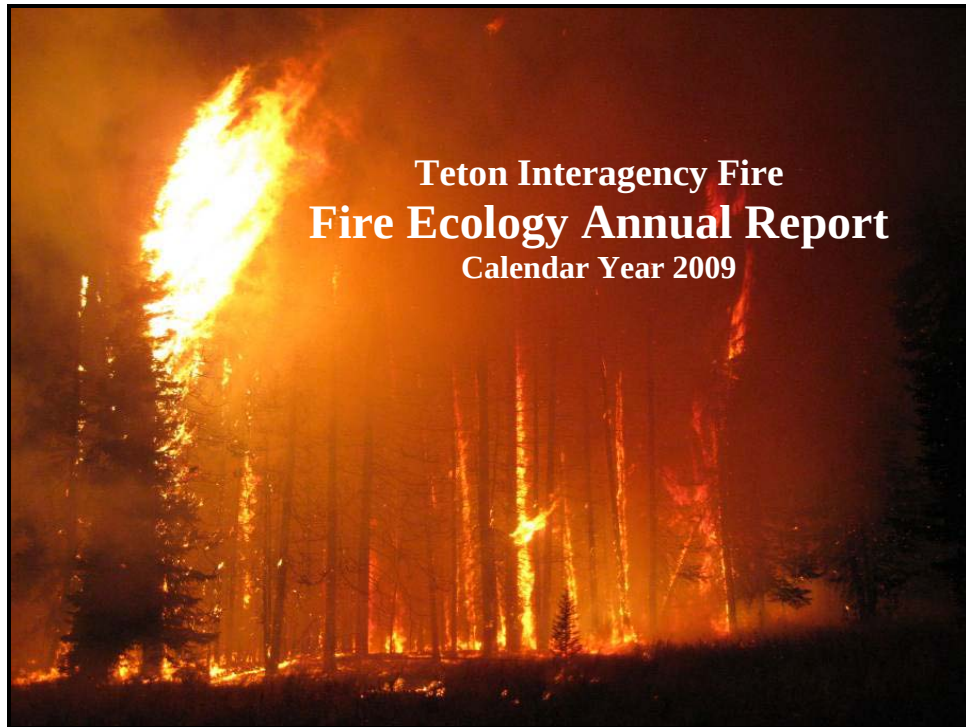




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Summary

The Teton Interagency Fire Ecology program functions to support Teton Interagency Fire by providing assessments of treatment effectiveness, science-based information and professional knowledge to facilitate adaptive fire management. The primary way that this is accomplished is through project-level monitoring and objective setting. Fire Ecology personnel coordinate extensively with FMOs, AFMOs, Fuels Specialists, and Resource Managers to plan and follow through on results for dozens of projects.

The Teton Interagency Fire Effects Crew officially includes five NPS employees, but relies heavily on the contributions of biologists from the Wyoming Game & Fish Department and US Forest Service. Additional field help from the Teton Interagency Fuels Crew, Engine 4, Engine 3, and other Fire Personnel is much appreciated!

This report represents the 2009 fire effects monitoring data collection, analysis results, and conclusions. Individual project reports are included in the Appendices. As of this past summer, all compatible fire effects monitoring data has been entered into the FFI database program (some projects still use MS Excel due to the use of non-permanent plots). In the spring of 2010, this year's data analysis will be presented in a series of coordination meetings with Fire and Resource Management staff from the two National Parks and three USFS Zones. These meetings allow for involved discussions that help identify successes and opportunities to improve future fuels treatments.

Table 1. Fire Effects Plot Workload 2009

Unit	Project	Type of Plot	Pre	Imm. Post	Post (1-20 yrs)	Total Plots
Grand Teton National Park	1999 Alder Fire WFU (397 Acres)	Photopoints			8 (Year 10)	8
	2007 Bar B–C RX Burn (20 Acres)	Photopoints Non-native species mapping and cover estimates			3 (Year 2)	3
	2009 Bearpaw Bay Wildland Fire (2939 Acres)	Douglas-fir Severity/Mortality Sampling Photopoints		30 5		35
	1998 Blacktail South RX Burn – Aspen (1198 Acres)	YR 11 FMH Forest Aspen plots Aspen Circular Plots			4 30 (Year 11)	30
	1999 Cow Lake RX Burn (1255 Acres)	YR 10 FMH Forest POTR and PSME plots			5 (Year 10)	5
	2008 Flagg Ranch Phase I Mechanical Cut and Pile (25 Acres)	Stand exams Brown's fuel transects Sightability transects		10 20 20		50

	Project	Type of Plot	Pre	Imm. Post	Post (1-20 yrs)	Total Plots
	2009 Flagg Ranch Phase III Mechanical Cut and Pile (27 Acres)	Stand exams Brown's fuel transects Sightability transects	10 20 20			50
	2008 Granite Creek RX Burn (103 Acres)	Vegetation comp and cover plots Photopoints			3 3 (Year 1)	6
	2002 Pilgrim Fire (1.5 acres)	Photopoints			5 (Year 7)	5
	Sage Strips Mowing Treatment (7.9 Acres)	Nested Frequency Plots Composition and Cover Plots Photopoints	100 26 2			128
	Shadow Mechanical Cut and Pile (25 Acres)	Stand exams Brown's fuel transects Sightability transects	10 20 20			50
	2002 Wolff Ridge RX Burn (1700 Acres)	Aspen circles, Photopoints			32 2 (Year 7)	32 2
Unit	Project	Type of Plot	Pre	Imm. Post	Post (1-20 yrs)	Total Plots
Bighorn Canyon NRA	Barry's Island RX Burn	FMH Brush Plots with line intercept transects			2 (year 1)	2
	Yellow Hill RX Burn	FMH Brush Plots with line intercept transects		1		1
	Yellowtail Slashing, Herbicide, and RX Burn				3 (Year 10)	3
Unit	Project	Type of Plot	Pre	Imm. Post	Post (1-20 yrs)	Total Plots
North Zone Bridger-Teton NF	Bryan Flat Beaver Mountain RX Burn					
	Dry Quad Slashing and RX Fire	Photopoints aspen circles	6 91			97
	Hoback Upper Palmer Creek Unit RX Burn	Photopoints Aspen Circular Plots	3 48			51

	Project	Type of Plot	Pre	Imm. Post	Post (1-20 yrs)	Total Plots
	Lower Gros Ventre RX Burn, Units G& I	Photopoints aspen circles Burn Mosaic Mapping	16 63	16 1		96
	Lower Gros Ventre RX Burn, Units J & K	Photopoints Sage circles (burned and control)	8 51			59
	Northeast Quad Mechanical Treatment and RX Fire	aspen circles	4			4
	South Burro Hill RX Burn	photopoints	3			3
Unit	Project	Type of Plot	Pre	Imm. Post	Post (1-20 yrs)	Total Plots
East Zone Bridger-Teton NF	Fremont Ridge RX Burn (1418 Acres)	FMH Brush Plots, with ground cover and shrub line intercept transects			6 (Year 10)	6
	Maki Creek Slashing and RX Burn	Slash fuels transects Photopoints Aspen circular plots Burn Mosaic mapping	12 4	12 4 1	1 30	64
	Little Flat Top Wood Draw Unit RX Burn	Willow transects Willow Photopoints Aspen circular plots			3 4 22 (Year 2)	29
	Horse Wildland Fire	Aspen circular plots Ground cover transects Photopoints			28 22 3 (Year 2)	53
	Monument II RX Burn	Shrub line intercept transects Ground cover transects Photopoints	17 15 5			37
	New Fork - Boulder, Marsh Creek RX Burn	Photopoints	4			4
	New Fork Lake Rim RX Burn	Photopoints	4			4
	Chicken Creek RX Burn	Photopoints Ground cover transects Burn Mosaic Mapping	5 20	5 1		25

	Project	Type of Plot	Pre	Imm. Post	Post (1-20 yrs)	Total Plots
	Cottonwood II Slashing and RX Burn	Ground Cover transects	27			27
Unit	Project	Type of Plot	Pre	Imm. Post	Post (1-20 yrs)	Total Plots
West Zone Bridger-Teton NF	Bradley Mountain RX Burn	Burn Mosaic Mapping Photopoints		1 14		15
	Fontenelle Willows Unit 1 RX Burn	Willow BFH Macroplot			1 (Year 6)	1
	Fontenelle Willows Unit 2 RX Burn	Willow BFH Macroplot	4			4
	Little Hornet Timber Sale and RX Burn	FMH Forest plots			2 (Year 5)	2
	Shingle Mill WFU	Photopoints			3 (Year 1)	3
Grand Total			633	141	224	988

Table 2. Projects Currently Being Tracked by the Teton Interagency Fire Effects Monitoring Program

Unit	Total Projects and Fires Being Monitored Over Time	Projects with Post Treatment Monitoring in 2009	Project with New Pre-Treatment Implementation 2007
Grand Teton NP	23	11	3
BTNF North Zone	11	7	3
BTNF East Zone	16	8	1
BTNF West Zone	9	3	0
Fossil Butte NM	1	0	0
Bighorn Canyon NRA	4	3	0
Total	64	29	7

Table 3. Fire Ecology Staffing 2009

Ecologist and Monitors	Starting Date	Ending Date	# of Pay Periods	READ Qualified (Yes or No)	Training and Development
Kristen Shive, <i>Lead Monitor</i> 	3/15/09	12/21/09	20	Yes	* USFS <i>Landscape Ecology</i> Workshop * TNC <i>Monitoring Plant Populations</i> Workshop * NPS <i>GIS</i> Workshop * Annual Fire Refresher * Operational Leadership
Kal Stromberg, <i>Crewmember</i> 	5/26/09	10/22/09	11	No	* Attended S-290 * Attended S-212 * Annual Fire Refresher
Jo Wiersma, <i>Crewmember</i> 	5/26/09	10/22/09	11	No	* Attended S-290 * Attended S-212 Refresher * Initiated FEMO taskbook * Annual Fire Refresher
Gary Yetter, <i>Crewmember</i> 	5/26/09	10/22/09	11	No	* Attended S-290 * Attended S-212 * Initiated FEMO taskbook * Initiated FFT1 taskbook * Annual Fire Refresher
Diane Abendroth, <i>Fire Ecologist</i> 	Year-round		26	Trainee	* RX510 Applied Fire Effects * Public Information Officer (FEMA) * S491 National Fire Danger Rating System * S341 GIS Specialist * Resource Advisor * S200, S300, S400, S700 * Operational Leadership * Root Cause Analysis * Annual Fire Refresher

Table 4A. Grand Teton National Park Project Management Objectives and Monitoring Results 2009

Grand Teton National Park Project	Management Objectives	Monitoring Results (significance at 80% confidence in bold)	Objective Achieved?
Alder Fire WFU	- Allow a naturally-caused fire disturbance to occur - Track the revegetation process in different burn severity levels, using permanent photopoints	Plant communities are revegetating according to natural and functional successional pathways.	Yes
Bar – B – C Prescribed Burn	- Remove 60-90% of live sage cover to be measured immediately post burn. - Increase percent cover of native grasses by at least 25% in burned shrub areas by two years post burn - Track the spread of any invasive plants into the burned area	- Sagebrush consumption was less than desired - Herbaceous percent cover was not measured - Weeds found in the burn are minimal and do not pose a control problem	No Unknown Yes
Bearpaw Bay Fire	- Monitor post-burn revegetation over time - Monitor the survival of Douglas Fir trees, in comparison to tree size and burn severity factors	Pre Monitoring Only	Yes
Blacktail South Prescribed Burn Aspen	- Detect a 60% or greater reduction of conifer seedling and pole density by two years post burn. - Increase aspen seedling density by at least 30% two years post burn - Achieve an aspen pole density greater than or equal to 2000 stems per acre ten years post burn. - Reduce dead and down fuel loading to less than or equal to 10 tons per acre one year post burn, with an alpha significance level of 25%.	- No significant difference could be detected in conifer seedling density. - Aspen seedling density increased threefold in year 2 post burn. Aspen sucker density was 3317 +/- 958 ten years post burn. No significant difference could be detected in fuel loading one year post burn.	Unknown Yes Yes No
Cow Lake Prescribed Burn	<u>Aspen:</u> - Reduce conifer invasion by > 60% 2 years post burn - Increase aspen seedling density by >30% 2 years post burn - Recruit 2000+ aspen pole trees per acre by year 10 - Maintain <10 tons/acre down woody fuel <u>Douglas-fir:</u> - Reduce fuel loading by 40-80% post burn - Reduce pole trees 10-20% year 2 post burn - Preserve 80% of large -diameter Douglas fir trees	- Apparent decrease but no significant difference in conifer density. - Apparent reduction in aspen sucker density over time, no significant difference - Insufficient data for analysis of pole sized aspen No significant difference in fuel loading - Insufficient data for analysis of fire effects on pole sized conifers 75% mortality of large diameter Douglas-fir by year 10	No No Unknown No Unknown No
Flagg Ranch Phase I Mechanical Cut and Pile	- Reduce dead and down fuel loading to 10 tons per acre - Remove all ladder fuels (limb trees, remove conifer regeneration) - Increase tree spacing distance to 10-12 feet (1500 stems per acre) between trees or groups of trees.	- Dead and Down fuel loading reduced to 14.3 tons per acre - Canopy Base Height increased to 8 ft. - Torching Index increased to 33 mph for 97th percentile weather. - Crowning index increased to 22.4 mph for 97th percentile weather	No Probably Probably

Grand Teton National Park Project	Management Objectives	Monitoring Results (significance at 80% confidence in bold)	Objective Achieved?
		Fire Type changed from passive crown fire to surface fire	
Flagg Ranch Phase III Mechanical Cut and Pile	- Reduce dead and down fuel loading to 10 tons per acre - Remove all ladder fuels (limb trees, remove conifer regeneration) - Increase tree spacing distance to 10-12 feet (1500 stems per acre) between trees or groups of trees.	- Pre Treatment fuel loading was 16.7 tons per acre - Pre treatment fire behavior : Torching index 12.6mph, crowning index 26mph, probability of torching 100%	Unknown (pre monitoring only)
Granite Creek Prescribed Burn	Maintain or reduce the presence of non-native plants.	No significant difference in the percent cover of exotic plants	Yes
Pilgrim Fire	Track the regeneration of aspen in the burned mixed conifer community	Aspen has been suppressed due to browsing. Lodgepole pine is regenerating. Understory species are recovering.	Yes
Sage Strips Mowing Treatment	- Monitor changes in the frequency of exotic plants - Monitor changes in the percent cover of all plant species	Pre Monitoring in 2009	Unknown (pre monitoring only)
Shadow Mountain Mechanical Cut and Pile	- Reduce dead and down fuel loading to 10 tons per acre - Remove all ladder fuels (limb trees, remove conifer regeneration) - Increase tree spacing distance to 10-12 feet (1500 stems per acre) between trees or groups of trees.		
Wolff Ridge Prescribed Burn	>1000 live aspen suckers per acre over 2m tall, 10 years post burn	6510 ± 1267 aspen suckers over 2m tall, 7 years post burn	Yes

Table 4B. Bighorn Canyon National Recreation Area Project Management Objectives and Monitoring Results 2009

Bighorn Canyon NRA Project	Management Objectives	Monitoring Results (significance at 80% confidence in bold)	Objective Achieved?
Yellow Hill Prescribed Burn	- Reduce the percent cover of live Utah juniper by at least 60% one year post treatment - Reduce shrub density by 30-50% one year post burn - Increase the percent cover of herbaceous plants by at least 30% two years post treatment.	- Live juniper cover was reduced by 56% - Juniper density decreased by 89% - Herbaceous plants not yet monitored	Probably Unknown
Barry's Island – Chain Canyon Prescribed Burn	- Burn in a mosaic pattern between 40-70% of the targeted acreage, to be measured immediate post burn. - Achieve 70-90% juniper mortality in dense stands across the unit immediately post burn	- The burn mosaic was not mapped - Juniper cover was reduced by 54% - Juniper density was reduced by 95%	Unknown Yes
Yellowtail Slashing, Herbicide, and Prescribed Burn	- Reduce percent cover of Russian olive and saltcedar by 50-80 percent. - Reduce percent cover of Wyoming big sagebrush by 20 to 40 percent	- Russian Olive and Saltcedar were not present in any of the FMH Plots - Wyoming Big Sagebrush was not present in any of the plots	Unknown Unknown

Bighorn Canyon NRA Project	Management Objectives	Monitoring Results (significance at 80% confidence in bold)	Objective Achieved?
	• Increase grass coverage by 20 to 40 percent • Resprout snowberry and greasewood • Minimize cottonwood mortality to 0-10 percent • Reduce non native forbs	• No significant difference in Grass Cover could be detected • Cottonwood mortality was not assessed. • Exotic forbs increased by 82%	No Unknown No

Table 4C. Bridger-Teton National Forest North Zone Project Management Objectives and Monitoring Results 2009

North Zone BTNF Project	Management Objectives	Monitoring Results (significance at 80% confidence in bold)	Objective Achieved?
Bryan Flat Beaver Mountain RX Burn	• Reduce live conifer between 20% and 60% • Reduce overstory aspen density by 70% by one year post-burn. • Blacken between 40% and 80% of the sagebrush within in the burn unit, in a mosaic pattern. • Achieve 10-30% canopy fire effects • Favor survival of large-diameter Douglas-fir trees (> 12") in burned areas to retain forest shaded conditions	• Pre monitoring only in 2009	Unknown (pre monitoring only)
Dry Quad Slashing and RX Fire	• ≥1000 live aspen suckers per acre over 10ft tall 15 years post fire	• Pre Treatment Aspen sucker density over 10ft tall: Stand A: 41/ac, Stand B: 4/ac, Stand D: 325/ac. Stand E: 102/ac	Unknown (pre monitoring only)
Hoback Upper Palmer Creek Unit RX Burn	• Reduce live conifer between 20% and 60% • Reduce overstory aspen density by 70% post-burn. • Attain > 3000 aspen suckers/acre two years post burn. • Attain > 1500 aspen suckers per acre over 6 feet tall 5 years post burn. • Attain > 1000 aspen stems/acre > 10 ft 15 years post treatment. • Maintain aspen browse levels at less than 30% on terminal leaders. • Blacken between 40% and 80% of the sagebrush. Achieve at least 40% conifer mortality in encroached meadow areas	Stand 1 (heavily conifer encroached) Pre Burn: • 723 live aspen suckers per acre • 33.3 suckers over 10 ft per acre • 19 live overstory aspen per acre • 16 live conifers per acre Stand 2 (Moderately encroached) Pre Burn: • 2311.8 live aspen suckers per acre • 73.8 suckers over 10 ft per acre • 120 live overstory aspen per acre • 19 live conifers per acre	Unknown (pre monitoring only)
Lower Gros Ventre RX Burn, Units G & I	• Treat 20-40% of forested vegetation • ≥1000 live aspen suckers per acre over 10ft tall 15 years post fire	• 61% of priority vegetation treated (includes aspen, conifer, and unforested vegetation)	YES Unknown (Pre data only)
Lower Gros Ventre RX Burn, Units J & K	• Decrease sagebrush density in treated areas by 50-70%	• Live mature sagebrush density decreased by 50%	YES

North Zone BTNF Project	Management Objectives	Monitoring Results (significance at 80% confidence in bold)	Objective Achieved?
Northeast Quad Mechanical Treatment and RX Fire	• Attain $\geq$ 50-80% mortality of aspen trees ($> 5.9"$ DBH) within one year of burn. • Attain $\geq$ 85% conifer mortality within one year of burn. • Attain > 2000 live aspen stems/acre at 6 ft height over 70% of the treatment area with a strong terminal leader within 5 years of burn. • Attain at least 1000 live aspen stems/acre over 10 ft in height within 15 years post-treatment. • In treated aspen stands, attain $\leq$ 20% bare ground cover, within 5 years post-treatment. • Maintain 50-80 square feet, basal area of live Douglas fir trees. • Maintain 10-30% of the existing smaller diameter ($<12"$ dbh) live trees per stand. • Leave no more than 13 tons/acre of dead fuel loading, including duff.	• 1175.0 +/- 152.3 aspen suckers per acre pre treatment • 14.1 +/- 6.8 live and 16.7 +/- 4.6 dead overstory aspen per acre pre treatment • 128.7 +/- 28.1 live conifers per acre pre treatment. • 35% +/- 5% browsing on aspen suckers • 98% ground cover pre treatment • 10.9 tons per acre woody fuels in Douglas-fir stands	Unknown (Pre data only)
South Burro Hill RX Burn	• Reduce sagebrush density by 50% • Increase native forb and grass cover by 25% • Increase forb and native grass cover in burned sagebrush by at least 25% by one year post burn	• Photopoints retaken in 2009	(Evaluated in previous years)

Table 4D. Bridger-Teton National Forest East Zone Project Management Objectives and Monitoring Results 2009

East Zone BTNF Project	Management Objectives	Monitoring Results (significance at 80% confidence in bold)	Objective Achieved?
Fremont Ridge Year 10	• Increase bitterbrush by 200% in year 3 • Reduce sagebrush cover 50-80% • Increase herbaceous production 100% in year 2, and 250% in year 5	• Bitterbrush density decreased to $< 30\%$ in year 5. • Sagebrush cover reduced by 100% in burned plots, 62% in all plots • Sagebrush density decreased by 100% in burned plots, 36% in all plots • No significant difference found in grass or forb cover or height.	No Yes Yes No
Maki Creek	• ≥ 1000 live aspen suckers per acre over 10ft tall 15 years post fire • Maintain or increase ground cover to $\geq 60\% \leq 2$ yrs post-burn in Mt. Big Sage habitats • Increase ground cover to $\geq 80\% \leq 5$ yrs post-burn in Mt. Big Sage habitats • Decrease density of sagebrush in mature and decadent age-classes by 40-60% 1yr post burn where canopy cover $\geq 15\%$.	• Aspen browse on suckers 14% • Ground Cover post burn in aspen was 53% Year 1 post burn • Sagebrush density decreased by 99% • Ground cover in burned sagebrush 78% Year 1 post burn	Unknown (preliminary) YES

East Zone BTNF Project	Management Objectives	Monitoring Results (significance at 80% confidence in bold)	Objective Achieved?
Chicken Creek RX Burn	• Treat 30-50% of sagebrush with 15% canopy cover or greater in a mosaic pattern over the landscape • Attain 60% ground cover in treated sagebrush/grass areas within 2 years post burn and 80% within 5 years post burn • Attain 1000 stems per acre in burned aspen areas that are 10 feet tall within 15 years.	• Immediate post burn photopoints only in 2009	Unknown (preliminary)
Cottonwood II Slashing and RX Burn	• Attain > 1000 stems per acre in burned aspen areas ≥ 2 meters tall within 15 years post burn. • Attain 60% ground cover in burned aspen areas within 2 years post burn and 80% within 5 years post burn.	• Pre treatment ground cover 96% in Sjolberg Stand, 93% in Nylander Stand	Unknown (pre monitoring only)
Horse Fire	• Attain > 1000 stems per acre in burned aspen areas ≥ 2 meters tall within 15 years post burn. • Attain 60% ground cover in burned aspen areas 2 years post burn and 80% 5 years post burn.	• 12,296 +/- 2564 stems per acre in Year 2 • 32 stems per acre over 2m tall in year 2. • 61 % Ground cover in year 2 post burn	Unknown (preliminary) YES
Little Flat Top: Wood Draw	• Attain 1000 stems per acre in burned aspen areas ≥ 10 feet tall within 15-years post burn. • Attain 60% ground cover in burned aspen areas 2-years post burn and 80% 5-years post burn. • Within burned areas, attain willow height greater than or equal to mean pre-burn height within 10-years • Attain at least 30% increase in the proportion of live to dead willow stems within 3-years post burn.	• 7333.3 +/- 1731 aspen stems per acre in Year 3 • 88 % Ground Cover in burned aspen in Year 3 • Willow height still lagging behind pre burn in Year 3, as expected. • Proportion of live willow stems is 99% in year 3	Unknown (preliminary) Yes Unknown (preliminary) Yes
Monument II	• Measure the reduction of big sagebrush (<i>Artemisia tridentata</i> var. <i>vaseyana</i> and <i>Artemisia cana</i>) height and canopy cover 1 and 5 years post burn. • Attain < 40% bare ground in burned sage/grass communities 1year post burn, and < 20% bare ground after 5 years post-burn.	• Pre burn big sagebrush cover = 26.2% (+/- 6.4) • Pre burn silver sagebrush cover = 7.2% (+/- 2.8) • Ground cover was 79% pre burn	Unknown (pre monitoring only)
New Fork - Boulder, Marsh Creek RX Burn	• Treat 30-50% of the sagebrush having >15% canopy cover. • Attain >70% mortality of sagebrush plants in treated areas. • Attain >50% encroaching conifer mortality by one year post-burn • Increase herbaceous species richness in burned sagebrush. • Attain >80% ground cover in sagebrush 5 years post-burn	• The burn mosaic was determined to have met objectives by personnel on the ground • Herbaceous vegetation effects were not monitored • Ground cover was not measured	YES YES Unknown Unknown

East Zone BTNF Project	Management Objectives	Monitoring Results (significance at 80% confidence in bold)	Objective Achieved?
New Fork Lake Rim RX Burn	• Treat 30-50% of the sagebrush having >15% canopy cover • Attain >70% mortality of sagebrush plants in treated (burned) areas. • Attain >50% encroaching conifer mortality one year post-burn • Increase herbaceous species richness in burned sagebrush communities • Attain >80% ground cover in sagebrush and aspen communities 5 years post-burn • Within all burned aspen communities, attain 10 foot tall aspen sucker density of at least 1000/ac at or before 10 years post-burn.	• The burn mosaic was determined to have met objectives in sagebrush, but not in aspen by personnel on the ground • Herbaceous vegetation plots did not burn. • Ground cover plots did not burn. • The aspen stand where sucker density	YES NO Unknown Unknown Unknown

Table 4E. Bridger-Teton National Forest West Zone Project Management Objectives and Monitoring Results 2009

West Zone BTNF Project	Management Objectives	Monitoring Results (significance at 80% confidence in bold)	Objective Achieved?
Bradley Mountain RX Burn	• Treat 30-60% of the project area, focusing on high and moderate priority areas. • Attain 10 foot tall aspen sucker density of at least 1000 stem per acres at or before 15 years post burn. • Maintain the long term distribution and extent of aspen, mountain shrubland, and big sagebrush • Achieve 40-80% conifer mortality • Restore canopy cover of shrubs to pre-burn levels within 25-40 years. • Increase shrub canopy cover and reduce conifer canopy cover	• Approximately 41% of the unit was blackened by fire. • 30% of high priority habitat was blackened • 46% of moderate priority habitat was blackened	Yes Unknown (Immediate Post Burn data only)
Fontenelle Willows RX Burn Unit 1	• Increase live willow percent cover of at least 40% at 3 years post-burn. • Attain an average willow height of greater than or equal to mean pre-burn height per plot at 10 years.	• Live Geyers willow percent cover 21%, Booth's willow live percent cover 19% in Year 6. • Average live Geyers willow height 0.98m in Year 6 (Pre burn height 2.0m). Booths willow Year 6 height 1.2m, pre burn height 1.28m	No Not yet for Geyers Willow, Yes for Booths Willow
Fontenelle Willows RX Burn Unit 2	• Increase live willow percent cover of at least 40% at 3 years post-burn. • Attain an average willow height of greater than or equal to mean pre-burn height per plot at 10 years.	• Live willow percent cover 66.5% pre burn. • Average pre burn live height 5.1 ft, dead height 3.8ft	Unknown (pre monitoring only)
Little Hornet Timber Sale and RX Burn	• Reduce the density of conifers (overstory, pole, and seedling) in the burn units adjacent to slash units. • Increase aspen sucker density in	• No conifers remain on either of the two plots • Aspen sucker density increased in Year 1 and decreased to pre burn levels in Year 5.	Yes No

West Zone BTNF Project	Management Objectives	Monitoring Results (significance at 80% confidence in bold)	Objective Achieved?
	slash units and adjacent uncut areas. Sucker heights should be at least 2m 10 years post burn. • Monitor species composition and percent cover to detect unforeseen weed invasion. • Reduce fuel loading	• Forbs dominate the post burn vegetation, with some weedy species present. • Woody fuel loading decreased by 36% to 18.2 tons per acre in Year 5.	Unknown Yes
Shingle Mill WFU	• Track the fire effects in forested areas and previously slashed areas due to the natural fire event.	• Three photopoints retaken in 2009	Yes

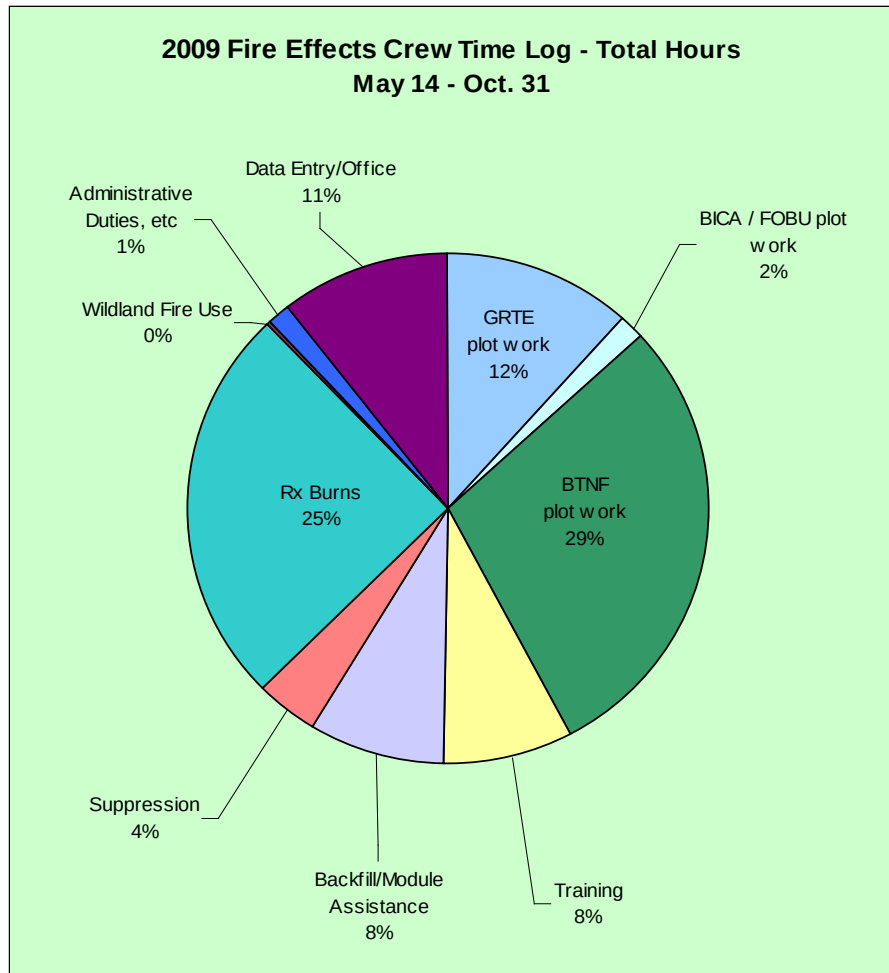
Table 5. Fire Ecologist Accomplishments and Areas of Focus

Category	Percent Time	Accomplishments and/or areas of activities
Planning		• Five Year Plan development with Fuels Specialist and Rx Fire Tech • 2 USFS ID Team assignments (Star Valley Front, Buffalo Valley Fuels) • Coordinated 2 interagency scouting field trips with resource managers to look at proposed projects and solicit comments • Several scouting trips with NPS Prescribed Fire Tech to develop future burn projects • Wrote specialist reports for the Buffalo Valley Fuels Project (USFS): Noxious Weeds, Sensitive Plants, and Non-forested vegetation
Presentations		• Monitoring Results Presentations at 3 Zone meetings in April • Fire Ecology of Wyoming Presentation – NOLS, Lander WY
NPS and Interagency Meetings/ task groups		• Jackson Hole Interagency Habitat Initiative (JIHI) • Landfire fuels map refresh modeling workshop • BTNF Vegetation/Fuels map refresh in burned areas • Assistance with Teton Interagency Fire Website • Interagency PIO working group
Fire Assignments		POIF (T) - 4 fires, including 18 days at Olympic NP – Signed off FEMO - 3 fires RXB3(T) – 1 fire FFT2 – 3 fires
Research		• Whitebark Pine Regeneration in Burned Areas project • Invasive Species Risk Assessment (Weeds in Space)
Data Collection		Assisted the lead in the field 5 days, led the crew 2 weeks
Data entry		3 days
Data analysis		30 days
Supervision/Admin		Supervised Term Fire Effects Lead
Training		READ (Resource Advisor), RX510 (Applied Fire Effects), I-200, I-300, I-400, I-700, S-341(GIS Specialist), S-492 (NFDRS), Operational Leadership, Root Cause Analysis, Public Information Officer, Aspen Browse Method training with Dr. Kiegley, Various WFDSS training sessions
Miscellaneous		Development/implementation of new FMO Network file structure

Table 6. Fire Effects Crew Accomplishments/Focus Areas

Category	Percent Time	Notes
NPS Plotwork	14%	* FMH, Aspen Circles, Stand Exams and Photo Monitoring in Grand Teton National Park * FMH in Bighorn Canyon National Recreation Area
USFS Plotwork	31%	* FMH, Aspen Circles, Photo monitoring on the Bridger-Teton National Forest * Whitebark Pine Regeneration Study, Greater Yellowstone
Prescribed Fire Assignments	14%	* Predominantly on the Bridger-Teton National Forest. * 3 crewmembers worked with the Teton Type II crew; one as FFT1(t). * 1 crewmember had a FFT1(t) assignment with an ignitions crew. * 1 crewmember had a FEMO(t) assignment under the lead monitor (FEMO). * Lead monitor assisted Engine crew.
Suppression Assignments	1%	* 1 crewmember worked with the Teton Type II crew (off Park and Forest). * Lead monitor had FFT1(t) assignment with the Teton Type II crew (off Park and Forest).
Fuels Project Work	9%	* Assisted Fuels Crew periodically throughout season. * 2 crewmembers each worked 2-week details with Fuels Crew.
Data entry	17%	* Completed data entry for all data collected in 2009. * Entered backlog of data for several large projects.
Data analysis	1%	* Basic analysis to ensure proper sample sizes.
Supervision/Admin	5%	* Lead monitor hired and supervised 3 monitors. * Time and travel paperwork, etc.
Training	8%	* USFS <i>Landscape Ecology</i> Workshop (lead monitor) * TNC <i>Monitoring Plant Populations</i> Workshop (lead monitor) * S-290 (3 crewmembers) * S-212 (2 crewmembers) * Fire Refresher (all 4 crewmembers)

Figure 1. Fire Effects Crew Breakdown of Hourly Activities for 2009



Appendix A

Grand Teton National Park

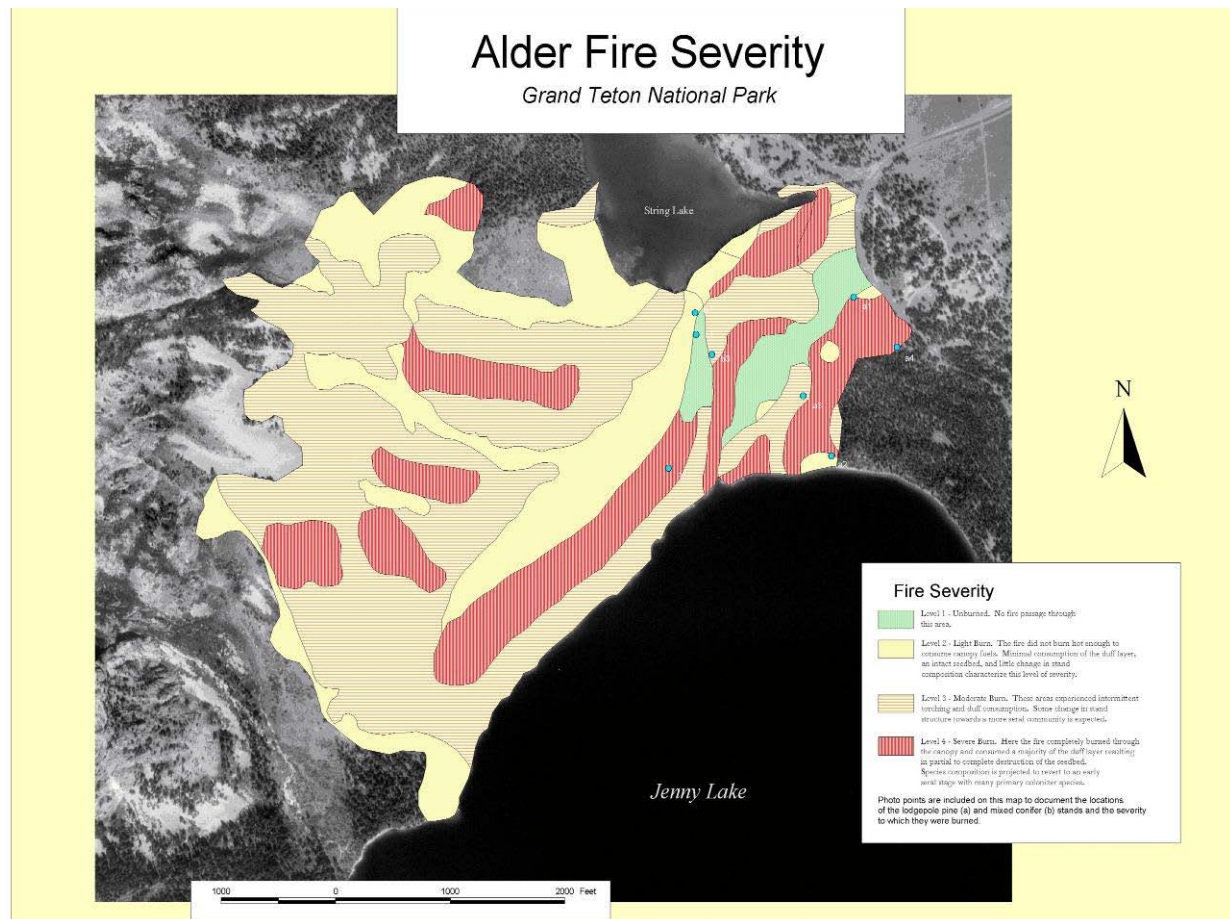
2009 Fire Effects Monitoring Report

1999 Alder Fire

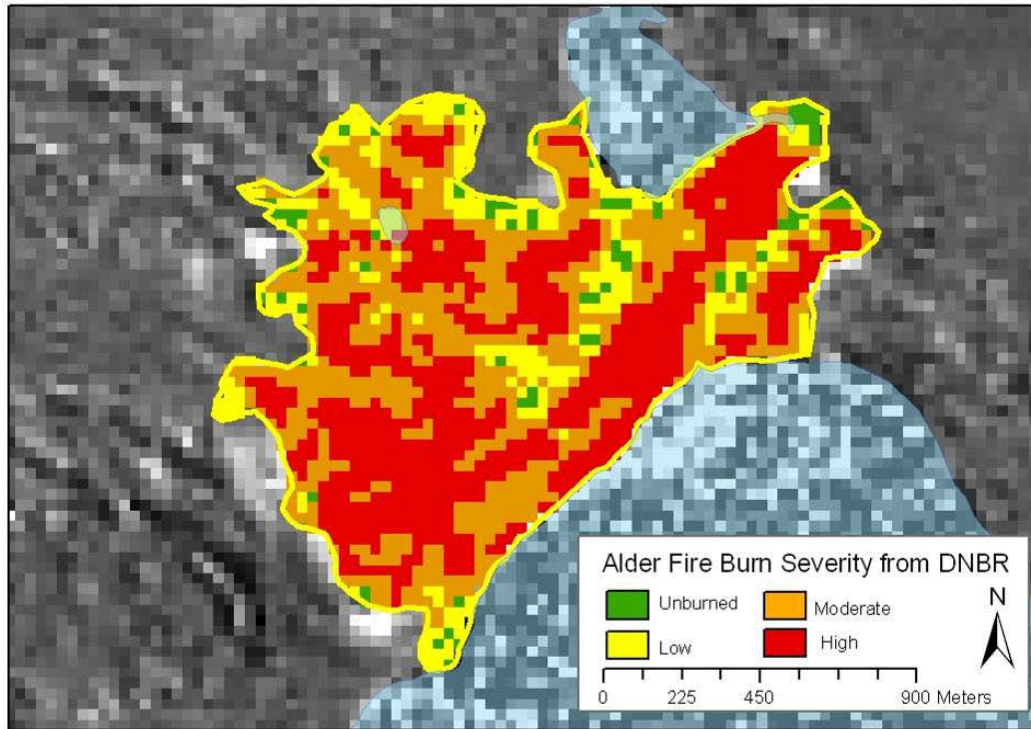
The 1999 Alder Fire was ignited by lightning and managed as a Wildland Fire Use action for Resource benefit. It burned for several weeks in the fall, and then in mid October a wind event caused it to grow rapidly and threaten the Jenny Lake Lodge area. The fire was converted to a suppression fire at that time.

Firefighters were able to use a fuel break where mechanical thinning had been completed by the Grand Teton Fuels Crew to arrest the fire's spread before it crossed the Jenny lake Loop Road at the Lodge.

Severity mapping was completed using a helicopter for the Alder Fire in 1999.



Later, a DNBR severity map was made using satellite imagery change detection at 30 meter pixel resolution.



Several permanent photopoints were established by the Fire Effects Crew immediately post fire. They have been retaken several times over the years. In 2009, Year 10 post burn pictures were once again taken by the crew. Not all of the photos show a clear representation of effects, because of poor photo quality, varied composition, and bad lighting. However the photos indicate the following:

Low Severity Areas: Many of the larger trees have survived the fire, particularly Douglas-fir. The understory appears more open.

Moderate Severity Areas: Many of the overstory that were not torched out initially in moderate severity areas were dead by Year 1, had lost their needles by Year 3, and the trees were down by Year 10. The understory had re-vegetated to tall and dense grasses by Year 3 and a mix of grasses, forbs, and snowbrush ceanothus (*Ceanothus velutinus*) by Year 10.

High Severity Areas: Any remaining trees were dead by Year 1, and most were down by year 10. Herbaceous and shrub recovery was slower than in moderately burned areas, with good cover regained by Year 4. Shrubs appear to dominate at Year 10, especially snowberry (*Symphoricarpos oreophilus*) and snowbrush ceanothus. Lodgepole pine seedlings are also evident in Year 10. Noxious thistles presented a control problem in these sites, particularly near the trail.

Low Severity Example B2, 326°



Immediate Post Burn 1999



Year 1 Post 2000



Year 2 Post 2001



Year 10 Post 2009

Moderate Severity Example – A3 42degr or 222



Immediate Post Burn 1999



Year 2 Post 2001



Year 4 Post 2003 1999



Year 10 Post 2009

High Severity Example B4 305



Immediate Post Burn 1999



Year 2 Post 2001



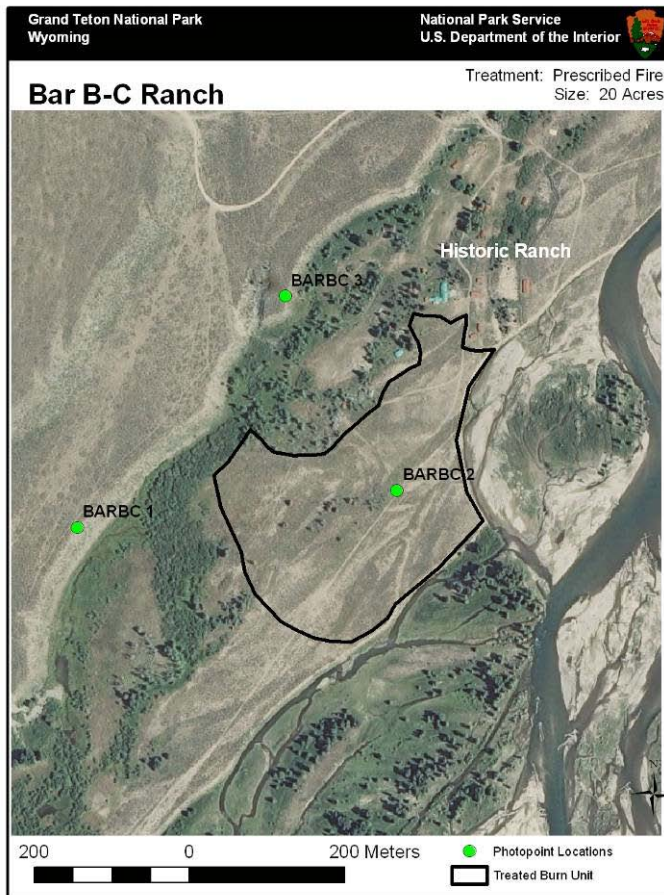
Year 4 Post 2003



Year 10 Post 2009

Bar B-C Ranch Prescribed Burn – Two Years Post Burn

The 20-acre Bar BC prescribed burn was designed as a hazard fuels reduction for the protection of the historic Bar BC Dude Ranch. The ranch dates to 1912 and is a cultural resource under the preservation and protection of Grand Teton NP. The area is surrounded by sagebrush.



Immediate Post Burn, looking Northwest



Immediate Post Burn, looking Southeast

The purpose of the Bar B_C burn was to convert fuels from shrub to grass in order to create a more defensible space in the event of a wildland fire. Burn objectives, as outlined in the burn plan, included:

1. *Remove 60-90% of live sage cover to be measured immediately post burn.*
2. *Increase percent cover of native grasses by at least 25% in burned shrub areas by two years post burn.*
3. *Track the spread of any invasive plants into the burn area*

Because the unit is very small (approximately 20 acres) photopoints and ocular estimates rather than vegetation plots were used to evaluate fire effects. Three permanent photopoints were installed. Two are located on the bench above the Bar B-C ranch, with broad views of the unit

below. The third photopoint is located on the sagebrush flats south-southwest of the ranch with a view of the Bar B-C historic structures and the sagebrush directly upwind.

The burn was ignited on September 14, 2007. Low wind speeds and non-continuous fuels (sagebrush) created somewhat unfavorable burning conditions. Fuel consumption was good in the initial firing area of the unit, where sagebrush was relatively dense (top, R portion of unit in the aerial photo below). Also, see photos below. As the burn progressed through the unit, however, sparse fuels and continuously low wind speeds created inconsistent and infrequent consumption. The highest sustained wind speed recorded for the day was 6 mph. Although some sagebrush was certainly removed, burn mosaic objectives were not met and the burn was terminated that afternoon.

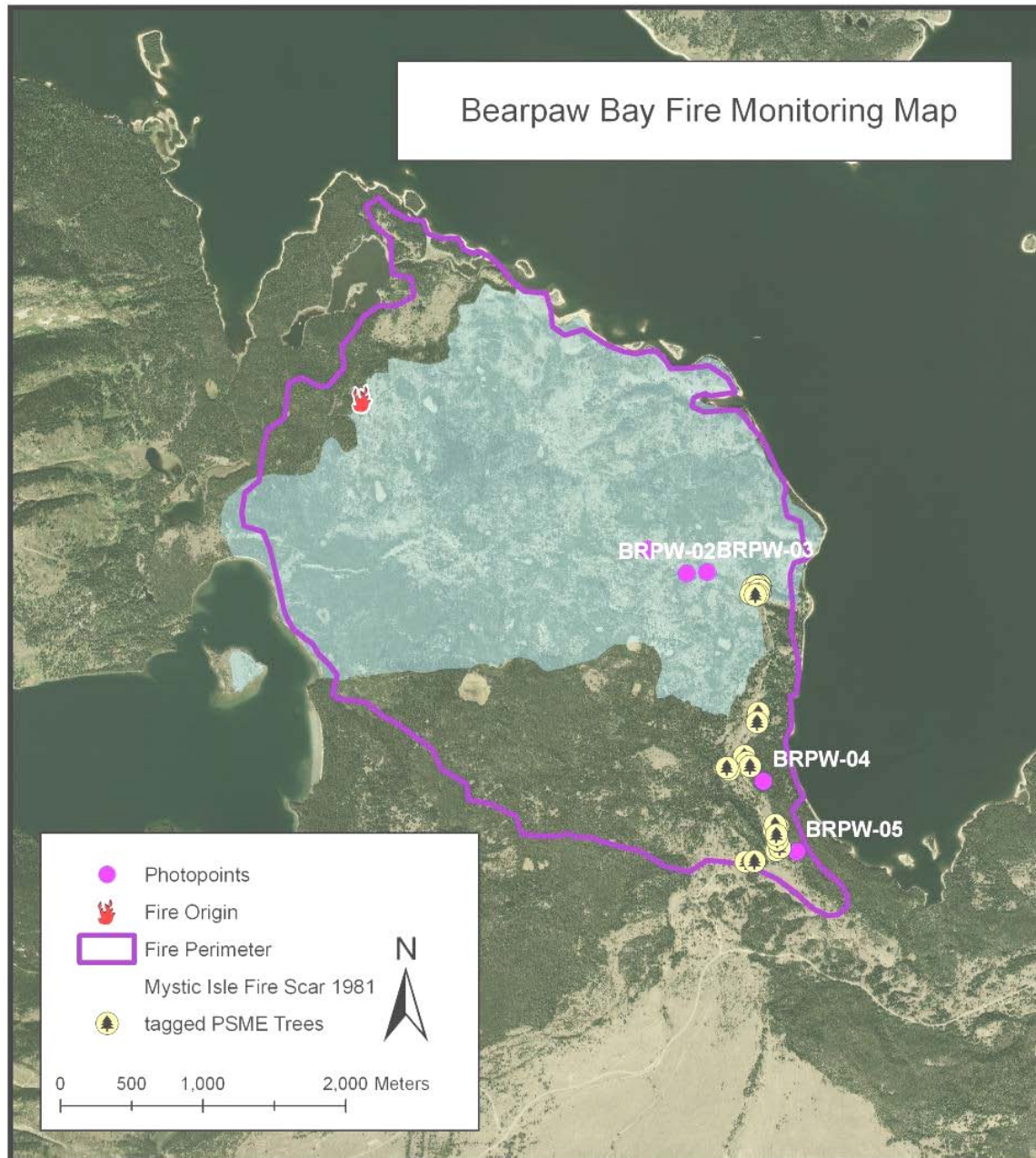
A non-native plant survey was also conducted by the fire effects crew pre burn and in Year 2 Post:

EXOTIC SPECIES	ESTIMATED % COVER	
	Pre-Burn, 2006	YR02, 2009
Smooth brome <i>Bromus inermis</i>	5-10%	15-20%
Kentucky bluegrass <i>Poa pratensis</i>	5-10%	10-15%
Bulbous bluegrass <i>Poa bulbosa</i>	5-10% in eastern portion of burn unit	5-10%
Musk thistle <i>Carduus nutans</i>	Northern portion of unit by structures	1-5%
Sheep sorrel <i>Rumex acetosella</i>	not noted	1-2%
Western salsify <i>Tragopogon dubius</i>	not noted	trace
Pennycress <i>Thlaspi arvens</i>	not noted	trace
Intermediate wildrye <i>Thinopyrum intermedium</i>	not noted	trace
Common dandelion <i>Taraxacum officinale</i>	not noted	trace

The table above shows an increase in both the estimated percent cover and species observed after the burn. Of these species, Musk thistle is the most problematic. The other species are either naturalized to the area or relatively easy to control. Coordination is ongoing with Grand Teton National Park's Invasive Species Program to address these weeds.

Bearpaw Bay Fire

The 2939-acre Bearpaw Bay fire was started by lightning in early September 2009. It was allowed to burn naturally in the area of the 1981 Mystic Isle fire until a cold front passage with low RH and strong winds necessitated some suppression along the Spalding Bay Road. The Mystic Isle fire area had regrown to young lodgepole pine poles and open meadow. When the fire moved out of the Mystic perimeter, it burned into mature Douglas-fir forest in a range of severities. This provided an opportunity to study fire effects on these trees.



Immediate Post Burn fire effects monitoring consisted of permanent photopoint installation and Douglas-fir tree sampling.

Permanent Photopoints:

Five photopoints were established and marked with rebar within the fire in the following areas. Four photographs were taken at each site.

Point

BRPW-01
BRPW-02
BRPW-03
BRPW-04
BRPW-05

Location

Low severity PICO regeneration in 1981 Mystic Fire
Moderate severity PICO regeneration in 1981 Mystic Fire
High severity PICOI regeneration in 1981 Mystic Fire
High severity in mature PSME Mix
Low severity in mature PSME Mix



BRPW-01, Low Severity in 1981 Mystic Fire
lodgepole pine



BRPW-03, High Severity in 1981 Mystic Fire
lodgepole pine



BRPW-04, High Severity in mature Douglas-fir / mixed
conifer



BRPW-05, Low Severity in mature Douglas-fir / mixed conifer

Douglas-fir Severity / Mortality Comparison Sampling

Mature Douglas-fir trees, with a DBH of over 15cm are thought to be resistant to girdling by fire, due to the development of thick, insulating bark. Younger trees tend to be more easily killed. Needle scorch in Douglas-fir is believed to be a factor in Douglas-fir beetle infestation and later mortality.

A total of thirty burned live Douglas-fir trees were sampled and permanently marked to compare patterns of burn severity and tree mortality over time in the Bearpaw Fire. These trees include a range of crown scorch, char height, crown base height, and DBH. The trees will be revisited in three years to evaluate subsequent mortality. This data will help in designing ideal burning conditions for future prescribed burns in this forest type.

Example Data Collected:



Tree 81
DBH: 49.4 cm
Char Height: 3m
Crown Scorch: 55%
Bole Circumference Charred: 60%



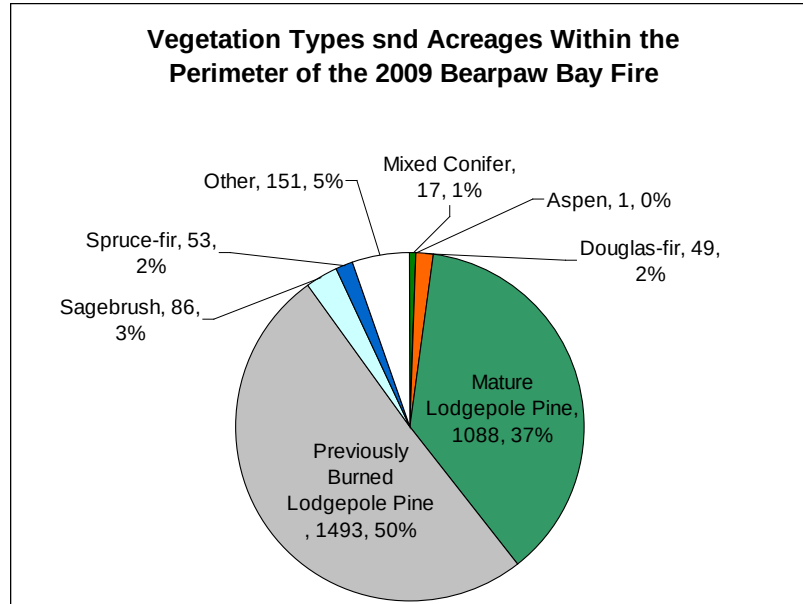
Tree 195
DBH: 50.5 cm
Char Height: 6m
Crown Scorch: 35%
Bole Circumference Charred: 35%



Tree 108
DBH: 16.3cm
Char Height: .25m
Crown Scorch: 5%
Bole Circumference Charred: 80%

Burn Severity Mapping

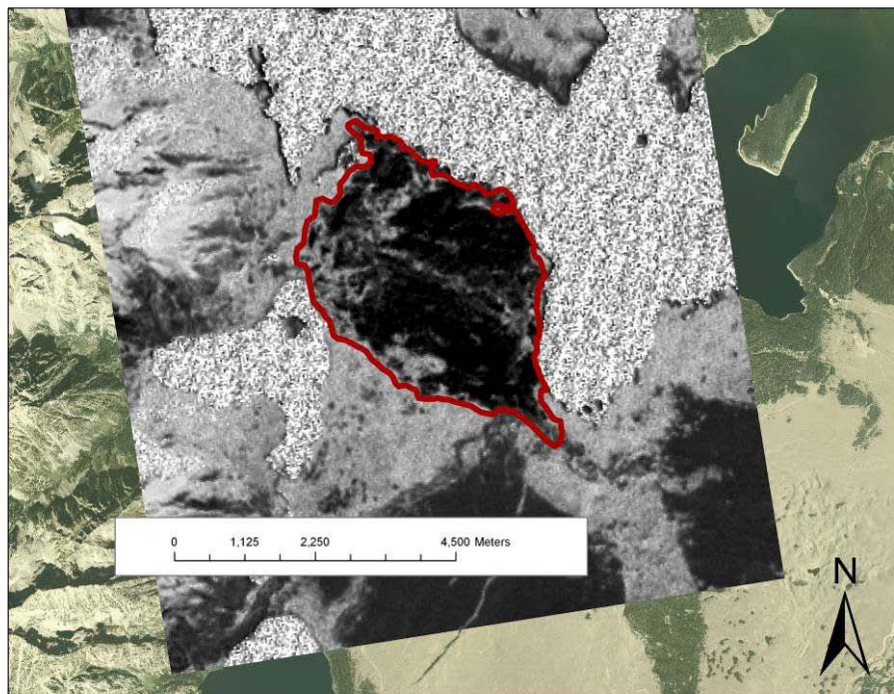
On November third, a series of oblique air photographs was taken by wildlife biologists from GTNP. These pictures showed the extent and severity of the fire, and allowed for some perimeter mapping.



As the photograph below shows, much of the 1981 Mystic Isle fire reburned (95%).



Landsat satellite imagery was also obtained from the USGS to produce a post-burn map using the Normalized Burn Ratio. This provides an initial assessment of burn severity, but is not as accurate as the extended change detection that compares a pre-burn image to a one year post burn image from the same point of the growing season, showing the initial vegetative recovery. In the map below, pixels with a darker shade of gray have reduced near infrared reflectance and increased mid infrared reflectance, indicative of a more severe burn.

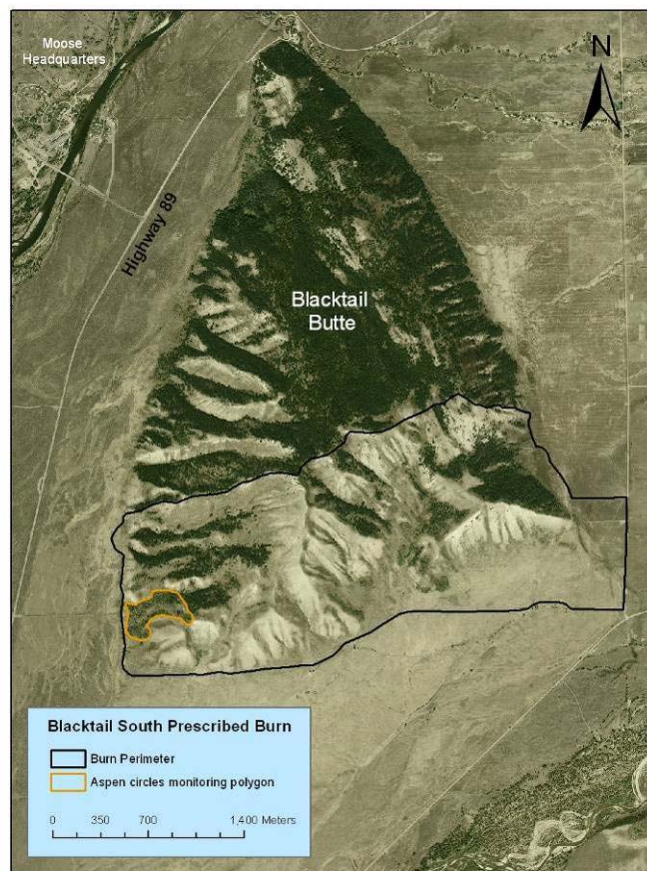


In 2010, a more accurate burn mosaic map will be made using serial photography and/or satellite imagery.

Blacktail South Prescribed Burn Aspen - Year 10

One of the earliest prescribed burns conducted in forested vegetation by Grand Teton National Park was the fall 1998 Blacktail South project. The 1198-acre burn also accompanied the first official Fire Effect monitoring plots to be installed here, which were done as part of an RX80 class.

Three monitoring types were included in the burn unit, described as Aspen-Mixed Conifer (four FMH plots), Sagebrush Steppe (one plot), and Douglas-fir Mixed Conifer (six plots).



Monitoring objectives were articulated for each monitoring type. Unfortunately, none of the Douglas-fir plots burned. It is safe to say that the objectives were not met, because fire did not carry into that plant community. While a desirable burn mosaic was achieved in sagebrush, the single FMH plot did not provide sufficient data to evaluate success in that vegetation type. Therefore, what follows is the Year 10 post burn analysis of the aspen vegetation type only.

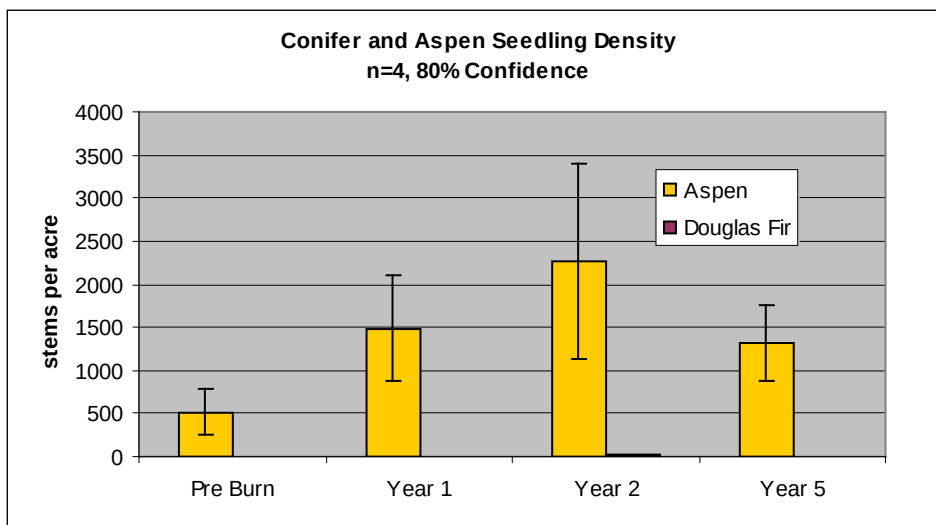
The original FMH monitoring objectives for aspen were as follows:

- Detect a 60% or greater reduction of conifer seedling and pole density by two years post burn.
- Increase aspen seedling density by at least 30% two years post burn

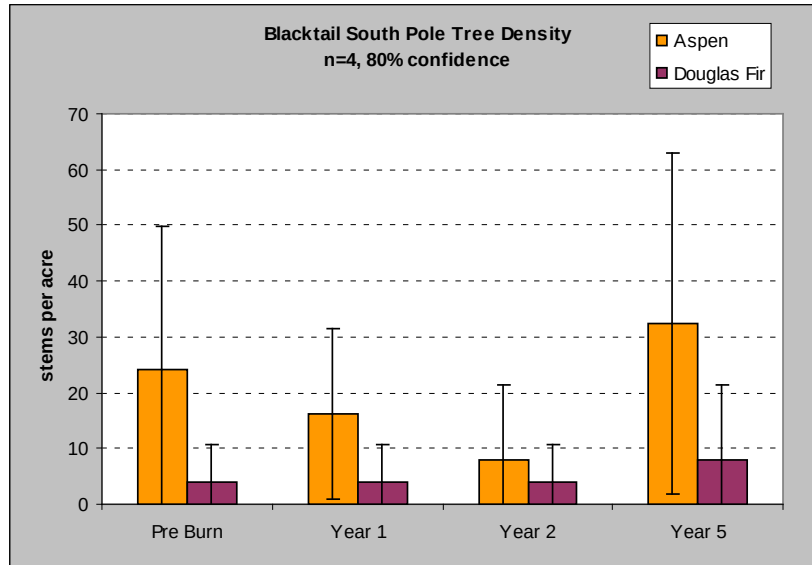
- Achieve an aspen pole density greater than or equal to 2000 stems per acre ten years post burn.
- Reduce dead and down fuel loading to less than or equal to 10 tons per acre one year post burn, with an alpha significance level of 25%.

The results from four FMH forest plots in the aspen vegetation did not provide compelling evidence that these objectives were met in the first five years post burn.

Conifer seedlings were sampled in a 10x25 meter quadrat at each of the four plots pre burn, and Year 1, 2, and 5 post burn. Unfortunately seedlings were so scarce and variable in the Blacktail aspen plots, that the data is not useful to determine whether there has been a change (see Douglas-fir in the graph, below).

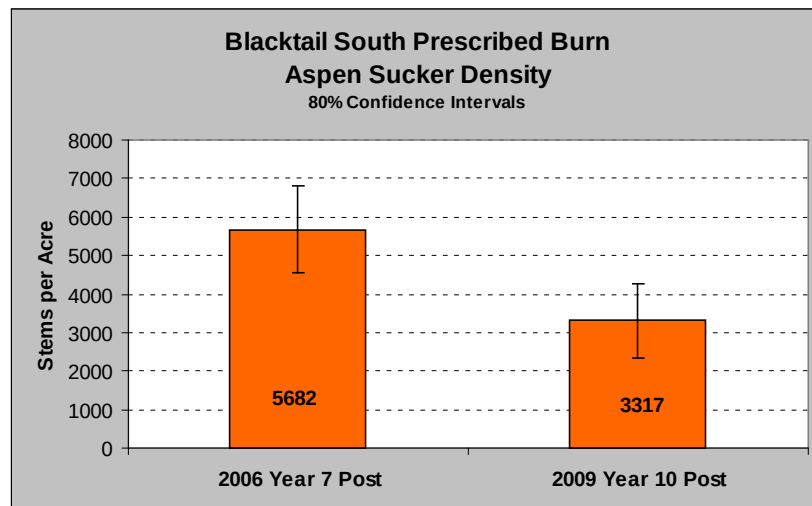


Aspen seedling density increased significantly after the burn, from an estimated 518 stems per acre to 1,485. By year 2, the average was 2,258 +/- 1,136. By year 5, the average stems per acre had decreased again, but not to a statistically significant degree, based on the sample data. At that time, there was concern that elk and moose were overbrowsing the aspen regeneration, putting future stand health at risk.



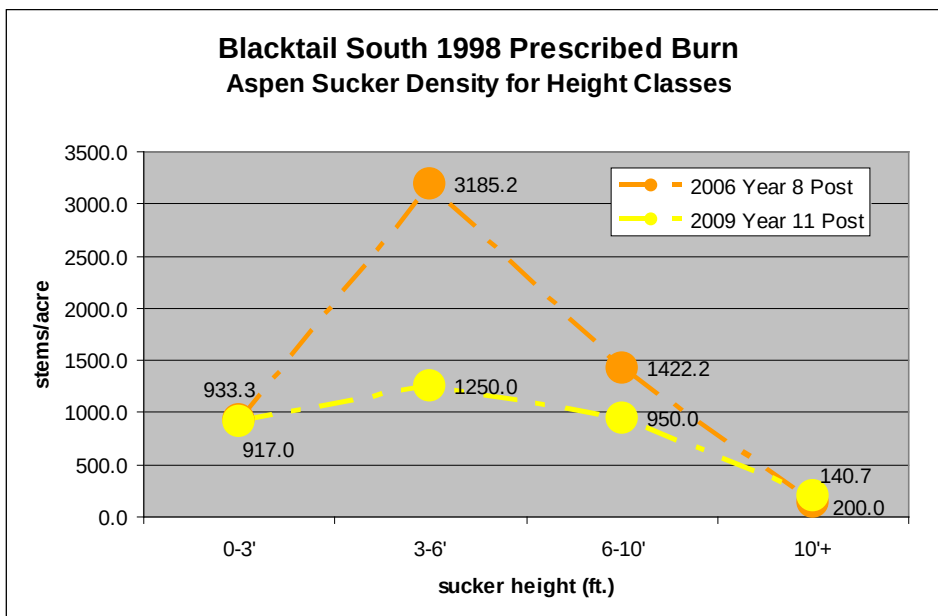
Pole-sized conifer and aspen density data also suffered from inadequate sample sizes in the monitoring plots. No conclusions about whether or not the objectives were met are possible.

In 2006, with the help of volunteers from the GTNP Youth Conservation Program, a more robust sample of aspen regeneration was made using the non-permanent circular plot method. Live aspen suckers were sampled by height class in fixed radius circular plots to obtain density estimates for a designated stand. Many more stems per acre were estimated than the 4 FMH plots reported in year 5 post burn.



In Northwest Wyoming, a monitoring objective that has been generally accepted for aspen suckering in burned areas is to measure a minimum of 1000 live stems per acre over 10 feet (2m) in height, ten years post burn. The aspen sucker recruitment meets the density target at present. However, as the chart below shows, desired sucker heights have not been

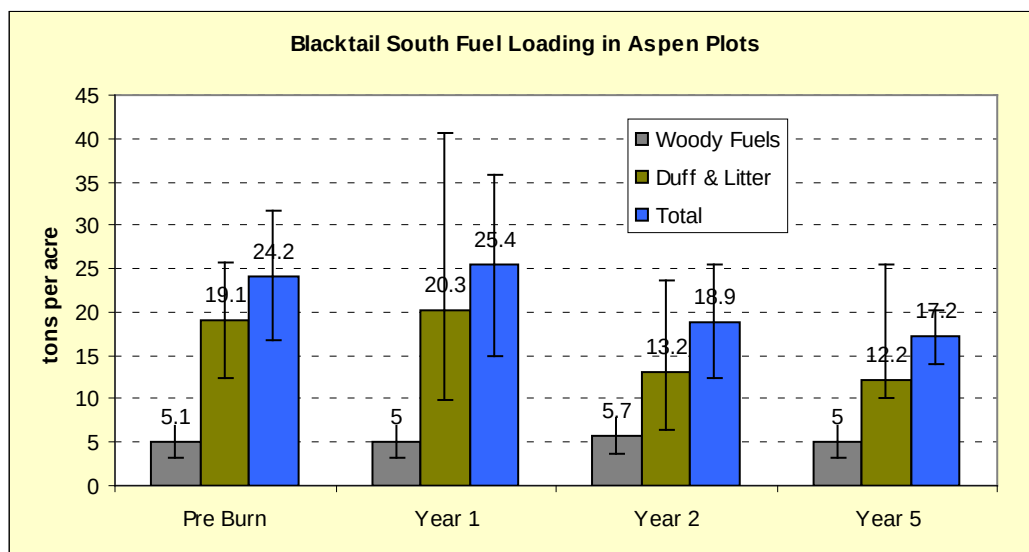
attained. The height objective is an indication of whether the stand has been overbrowsed by ungulates.



In 2009, only an average of 140 stems per acre exceeded 10 feet in height. Most of the suckers were between 3 and 6 feet tall. The fact that some suckers are reaching the desired height may indicate that browsing pressure may not ultimately prevent the stand from regenerating, but more time may be needed.

Fuel Loading

No significant difference in fuel loading could be detected from the four plots following the burn. Fire did not carry consistently through the aspen area, and severity was fairly low.



Cow Lake Prescribed Burn – Year 10 Post Burn

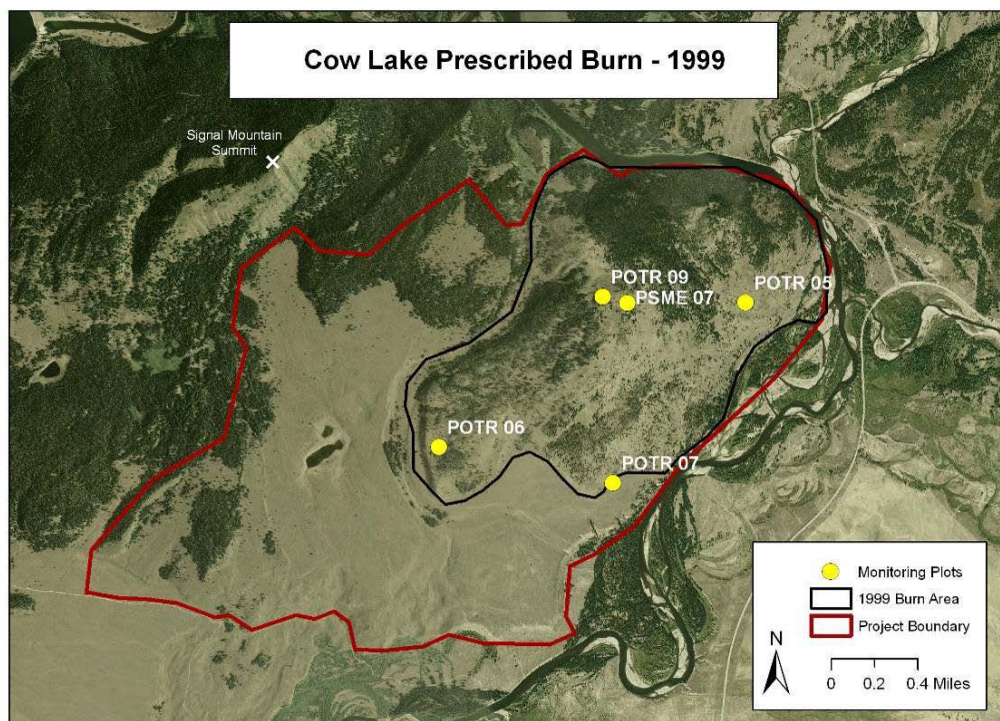
The Cow Lake prescribed burn was implemented in the fall of 1999. The area is located to the east of Signal Mountain, and south and west of the Snake River in Grand Teton National Park. The burn unit consists of sagebrush, aspen, lodgepole pine, and Douglas fir. The project boundary includes 3125 acres, but only approximately 1255 were treated. A first entry in the spring of 1999 demonstrated that the sagebrush portion was not capable of carrying fire to meet objectives during a prescribed burn. For the fall burn operation, blacklining was accomplished with drip torches, and interior burning used a helitorch. A few days after ignition, the Alder Fire (WFU) blew up, leading to a resource drawdown that necessitated cooling off the Cow Lake burn with some bucket drops.

The objectives for the aspen portion of Cow Lake were as follows:

1. Reduce conifer invasion by at least 60% within two years post burn.
2. Increase aspen seedling density by at least 30% two years post burn.
3. Recruit pole size aspen density of at least 2000 stems per acre ten years post burn.
4. Maintain dead and down fuel loading at ten tons per acre or less.

For Douglas-fir, the objectives were:

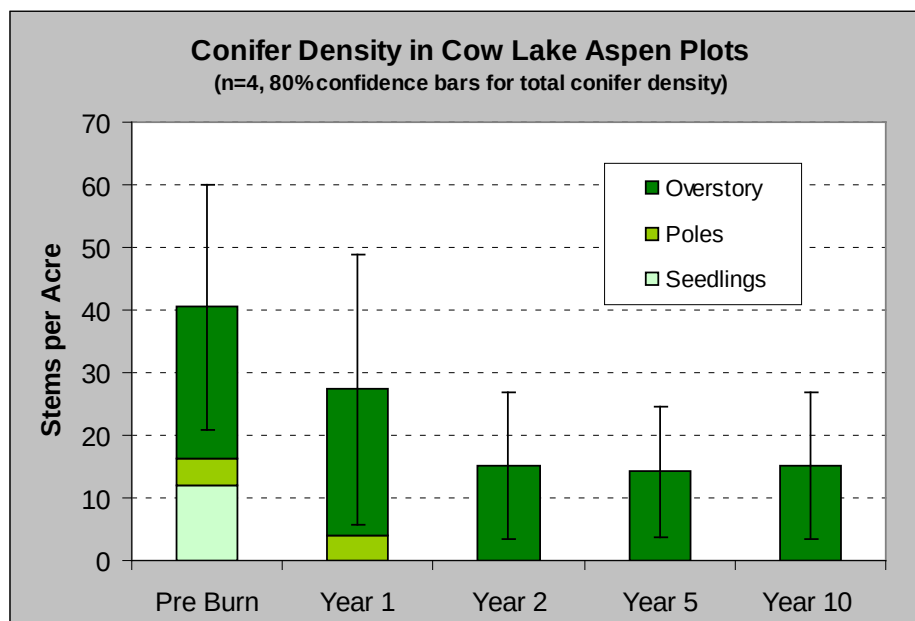
1. Reduce total fuel load by 40-80% 1 year post burn.
2. Reduce pole tree density by 10 - 20% within two years post burn.
3. Limit the reduction/mortality of 50+cm dbh overstory trees to <20% within two years post burn.



Five FMH Aspen Forest Plots and one FMH Forest Douglas-fir plot were installed pre burn in the summer of 1999. These were re-read immediately post burn, and in years 1, 2, 5, and 10 post burn. The following report compares the monitoring data with the stated objectives, above:

Conifer Reduction in Aspen:

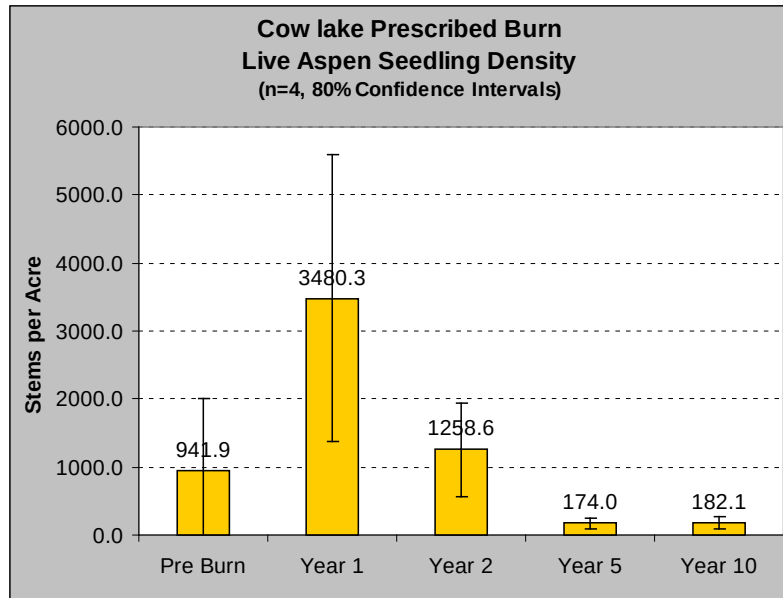
The four aspen plots appear to show a declining trend in the number of live conifer trees. The pole and seedling size classes completely dropped out of the sample areas two years post burn. This may have resulted from mortality and/or graduation into the overstory tree class (>15cm DBH). The overall conifer density was fairly low to begin with (40.5 $\pm$ 19.5 stems per acre). Error bars on the following graph indicate that there is no statistically significant change in the conifer density.



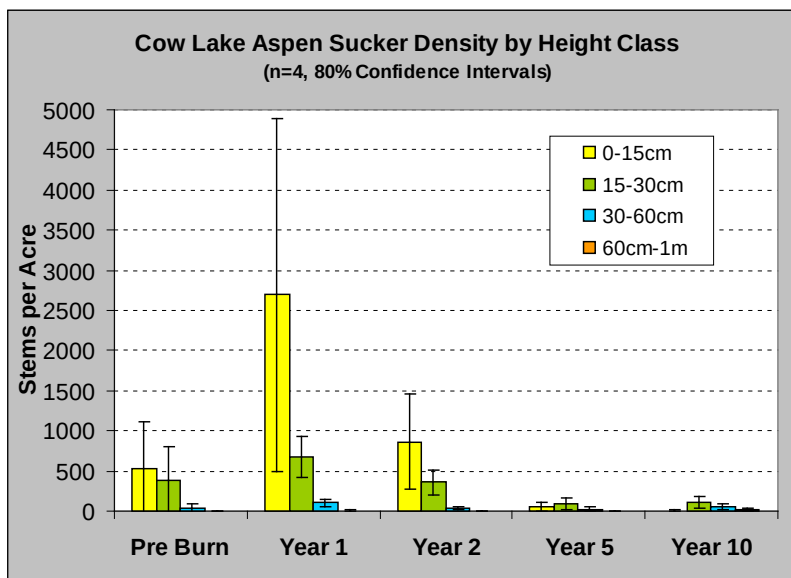
Aspen Regeneration:

Aspen seedling and pole density are used to indicate the success of post-burn resprouting. Objectives called for a 30% increase in seedlings by year 2, and a minimum of 2000 stems per acre in the pole size class by year 10.

Seedling density data from four plots gave an estimate of 3840 $\pm$ 2104 stems per acre one year post burn. This is not statistically different from the pre burn density, but it indicates a flush of suckers emerged. In years two and beyond, however, the mean density dropped off dramatically, indicating that project objectives were not met. Pole density data is not available, because none of the plots included that size class of aspen during any of the sampling events.



The height classes of aspen suckers in the plots show that no suckers exceeded the height of 1 meter, even ten years post burn.



Aspen Fuel Loading:

The objectives for prescribed fire in aspen forest called for maintaining dead and down woody debris loading at 10 tons per acre or less. Pre burn, the fuel loading at Cow Lake was within this range. Most of the loading was in the 1000 hour time lag fuel size class (logs on the ground larger than 3 inches in diameter). No statistical difference was measured one year post burn.

Conifer Pole Density in Douglas-fir Forest:

Douglas-fir trees less than 8 inches DBH have thin bark, and are more vulnerable to surface fire. Young subalpine fir and lodgepole pine have thin bark as well. Therefore, fire naturally tends to thin the regeneration in Douglas-fir communities, leading to open stands of larger trees.

Treatment objectives for Douglas-fir at Cow Lake called for killing between 10 and 20% of the conifer poles by year 2 post burn.

Only one FMH Douglas-fir forest plot was located in the Cow Lake burn. Within this plot, a 25x10 meter subplot was used to track the density of pole sized trees. Unfortunately no poles were documented to exist in this subplot during any of the field sampling visits, so it is not possible to measure any changes.

Mortality of Large-Diameter Douglas-fir Trees:

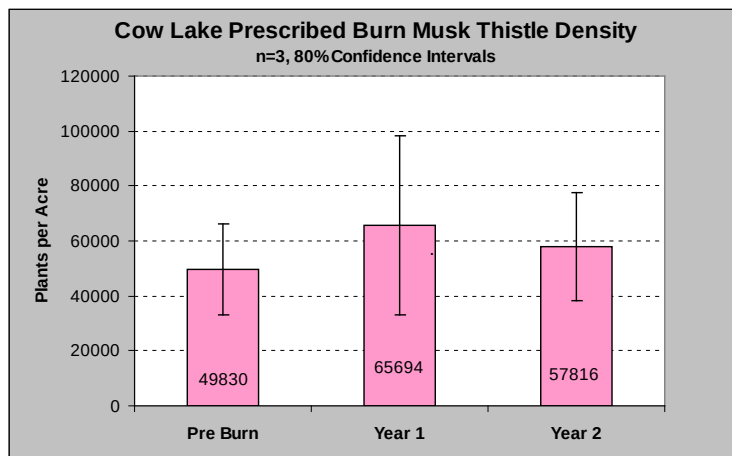
Similar to the goal of reducing conifer poles, the Cow Lake Prescribed Burn was designed to limit the mortality of thick-barked, large-diameter Douglas-fir overstory trees to less than 20%. These trees are often capable of withstanding surface fire, even if it chars the bole, and scorches a portion of the foliage. In the four Cow Lake FMH aspen plots and one Douglas-fir plot, all Douglas-fir trees over 20cm (8 in) DBH were tracked over time to determine their survival. Burn severity data was recorded immediately post burn for each tree.

Tree Tag Number	Plot	DBH, in	Survival	Year recorded dead	Scorch height, ft	scorch percent	char height, ft
280	POTR-9	8.03	Yes (unburned)	---	---	---	---
55	PSME-7	12.20	No	Year 10	4.27	3	0.33
54	PSME-7	12.99	No	Year 10	0.00	0	0.33
56	PSME-7	13.58	No	Year 10	16.40	10	0.66
50	PSME-7	14.96	Yes	---	8.20	5	6.56
711	POTR-9	15.28	No	Year 5	6.56	2	1.64
47	PSME-7	29.33	No	Year 10	0.00	0	0.98
48	PSME-7	37.01	No	Year 5	22.97	3	14.76

Six of the eight tracked trees (75%) were dead by year 10 post burn. None of them died before year 1 or 2. The two most severely burned trees were dead by year 5. Since 1999, the Grand Teton National Park area has experienced an epidemic of Douglas fir beetle, which may have contributed to this rate of mortality.

Noxious Weeds:

The Cow Lake burn area contains one of the largest infestations of the noxious weeds musk thistle (*Carduus nutans*). This was true prior to the burn. In order to evaluate fire effects on these weeds, the Grand Teton Vegetation Crew installed three plots with three thistle density transects each in the burn unit in the summer of 1999. They were revisited in 2000 and 2001. No significant change was detected in the density of musk thistle based on the data obtained.



As photos from Plot 5 show, Musk thistle was abundant prior to the burn and in the years afterward. By Year 10, the photo shows less thistle, however this could be due to different phenology.



Pre Burn 1998



Immediate Post Burn 1999



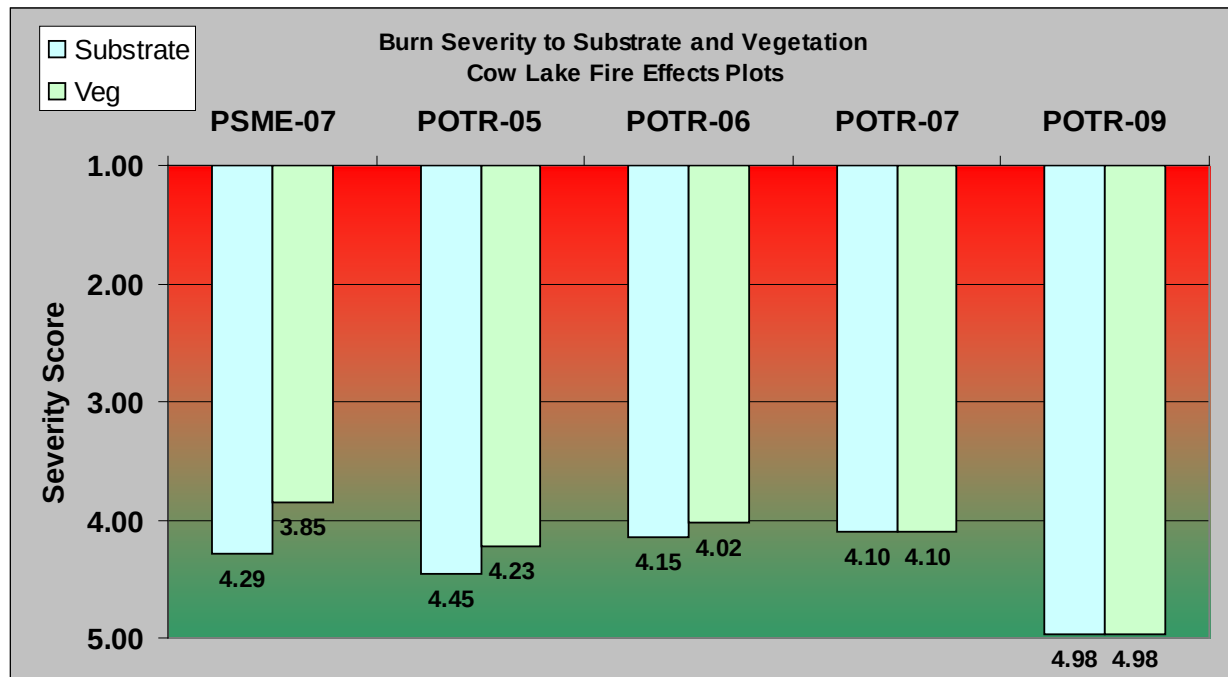
Year 2 Post - 2001



Year 10 Post - 2009

Discussion:

Fire Effects data shows that many objectives were not met at the Cow Lake Prescribed Burn. Each of the five plots experienced fire, with severity scores indicating scorching to substrate and vegetation.



Severity Score Key: 1= Heavily Burned, 2=Moderately Burned, 3=Lightly Burned, 4=Scorched, 5=Unburned

The reduction in aspen seedlings in years 2 through 10 is a disturbing event, which places the future health of the aspen forest in doubt. It is likely, based on field observation, that elk browsing is responsible for the failure of seedlings to survive. It is also possible that drought during 2000-2003 also played a role. The aspen stands may also have been somewhat weakened in vigor prior to the burn, as a result of conifer and sagebrush encroachment, and/or elk use.

The Cow Lake burn unit is located across the Snake River from the 2002 Wolff Ridge Prescribed burn, which has shown very different aspen responses. The vegetation types are similar, but at Wolff Ridge, wintering wolves may be helping to reduce elk browsing pressure. Wolff Ridge has much less musk thistle, although the area is infested. Finally, the Wolff Ridge treatment has not experienced post-burn drought to the degree that was seen at Cow Lake. It is clear from field visits that the poor recovery and survival of aspen seedlings indicated by the data is real.



Pre Burn 1998



Immediate Post Burn 1999



Year 2 Post - 2001

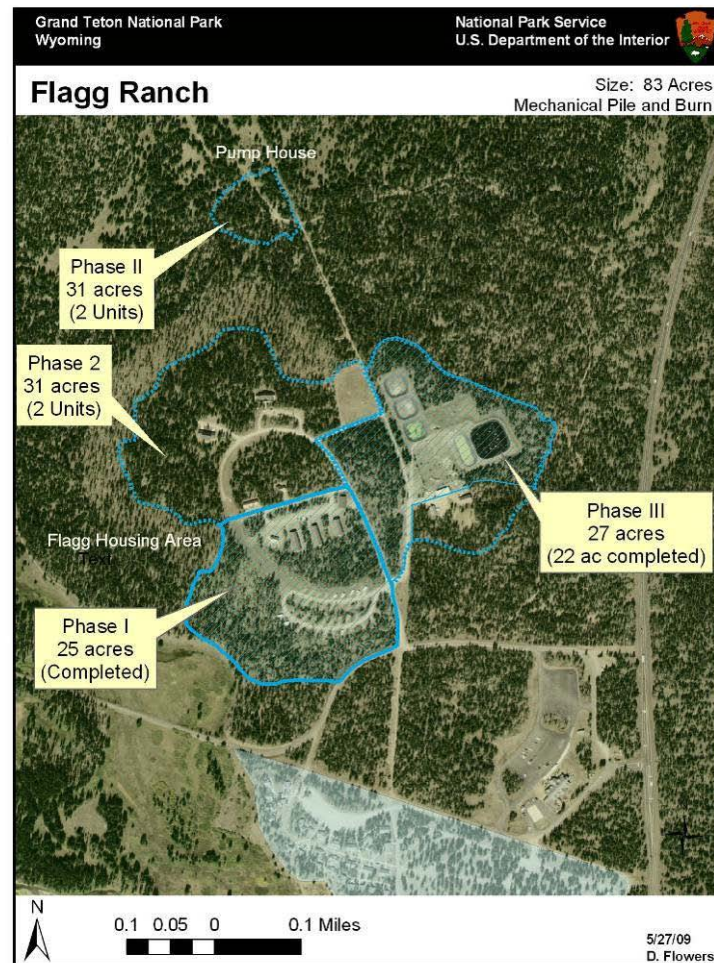


Year 10 Post - 2009

The FMH forest plot methodology used at Cow Lake did not provide an adequate sample size to detect whether or not several of the objectives were met. The population of pole-sized trees was so low that no data could be recorded in most of the subplots. Overstory trees were sparse and clumped in their distribution, which also led to insufficient samples.

Flagg Ranch Phase I Mechanical Thinning

The 25-acre Flagg Ranch mechanical fuels thinning project was implemented in the summer of 2006 or 2007. Prior to the treatment, the Fire Effects Crew and the Teton Interagency Fuels Crew collected stand exam data and sightability monitoring in order to evaluate how the treatment will affect fuel loading and fire behavior.



The goals of this mechanical thinning project are to reduce fuels around the wildland interface at the Flagg Ranch village in the John D. Rockefeller Parkway (JODR). Fuel reduction is intended to create defensible space and improve firefighter and public safety, by increasing fire containment opportunities during wildland fire events. Objectives for the mechanical treatment are as follows

- Reduce dead and down fuel loading to 10 tons per acre
- Remove all ladder fuels (limb trees, remove conifer regeneration)
- Increase tree spacing distance to 10-12 feet (1500 stems per acre) between trees or groups of trees.

Treatment methods included limbing and felling trees with chain saws, and subsequently burning the slash in piles.

The Forest Vegetation Simulator (FVS) Fire and Fuels Extension (FFE) program is used with stand exam data to compare pre- and post-treatment fuels, predicted fire behavior, and effects. Sightability transects will give an additional indication of change in ladder fuels.

The fuel loading summary for Flagg Ranch Phase I pre and post treatment is summarized below:

	Pre Treatment	Post Treatment
Fuel Model	FM10 99%, FM12 1%	FM10 55%, FM8 45%
Litter Tons/ac	3.83	5.09
Duff Tons/ac	15.3	10.41
1, 10, & 100 Hour Fuels Tons/ac	2.04	3.20
1000 hour Fuels Tons/ac	22.56	11.12
Total Woody Fuels Tons/ac	24.60	14.32
Canopy base Height, ft	6	8
Canopy Bulk Density kg/m3	0.050	0.105

This unit did have particularly heavy amounts of downed woody fuel loading pre-burn, and it is located very close to developed areas and employee housing. The stand is very young and dense, which affects the predicted fire behavior because younger lodgepole pine trees act as ladder fuels.

The predicted fire behavior is summarized for moderate and severe fire weather below. The torching and crowning indices refer to the wind speed required to initiate torching or crowning.

	Pre Treatment		Post Treatment	
	Moderate 75th %	Severe 97th %	Moderate 75th %	Severe 97th %
Surface Flame Length, ft	3.2	5.8	2.8	3.7
Fire Type	Surface Fire	Passive Crown Fire	Surface Fire	Surface Fire
Probability of Torching	88%	100%	56%	90%
Torching Index, mph		7.9		33
Crowning Index, mph		38.4		22.4
Potential mortality, % of BA	78%	99%	73%	85%
Potential Smoke tons per acre <2.5	0.30	0.34	0.19	0.21

A photopoint in the Flagg Ranch Phase I stand shows the characteristics of the young lodgepole pine forest. Note that there is a 2m x .5m red and white sightability board in each photo (located 50ft from the camera location):

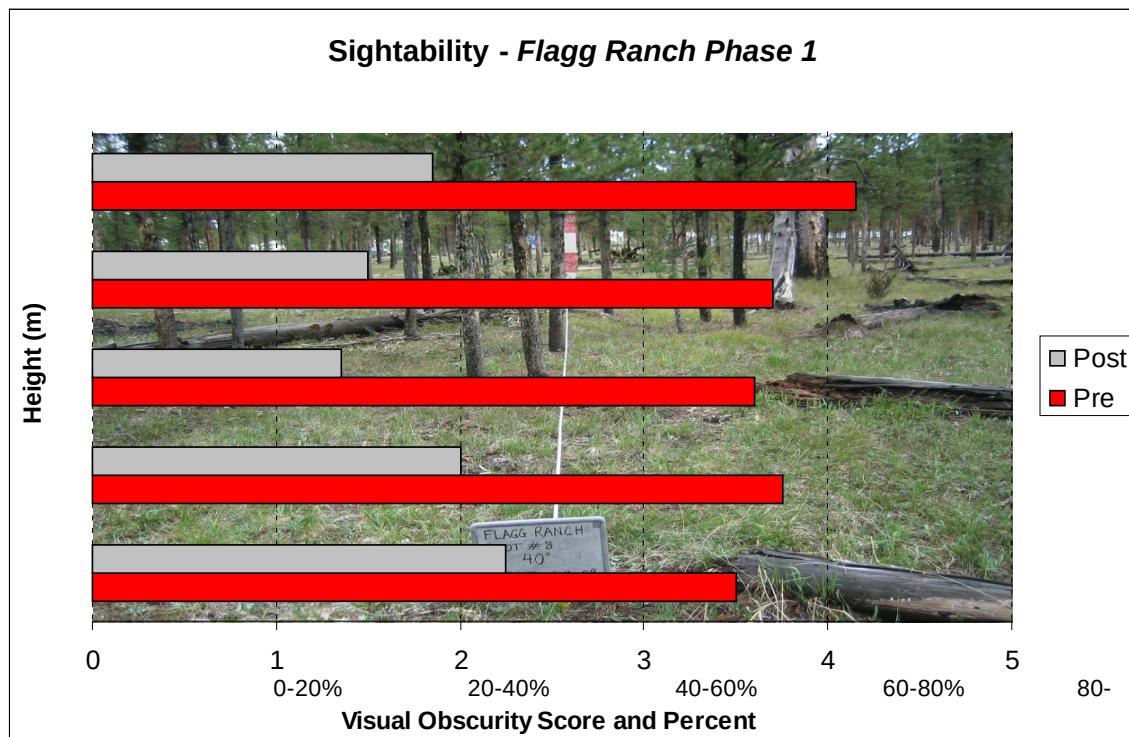


Pre-treatment



Post Treatment

Sightability transect data is shown here for the pre-treatment monitoring event. Visual obscurity is analogous to the amount of ladder fuels in the stand.



Flagg Ranch Phase III Mechanical Thinning

The 27-acre Flagg Ranch mechanical fuels thinning project will be implemented in the summer of 2009 or 2010. Prior to the treatment, the Fire Effects Crew collected stand exam data and sightability monitoring in order to evaluate how the treatment will affect fuel loading and fire behavior.

The goals of this mechanical thinning project are to reduce fuels around the wildland interface at the Flagg Ranch village in the John D. Rockefeller Parkway (JODR). Fuel reduction is intended to create defensible space and improve firefighter and public safety, by increasing fire containment opportunities during wildland fire events. Objectives for the mechanical treatment are as follows

- Reduce dead and down fuel loading to 10 tons per acre
- Remove all ladder fuels (limb trees, remove conifer regeneration)
- Increase tree spacing distance to 10-12 feet (1500 stems per acre) between trees or groups of trees.

Treatment methods will include limbing and felling trees with chain saws, and subsequently burning the slash in piles. The Forest Vegetation Simulator (FVS) Fire and Fuels Extension (FFE) program is used with stand exam data to compare pre- and post-treatment fuels, predicted fire behavior, and effects. Sightability transects will give an additional indication of change in ladder fuels.

The fuel loading summary for Flagg Ranch Phase III pre treatment is summarized in the table, below:

Fuel Model	FM10 60%, FM8 40%
Litter Tons/ac	5.13
Duff Tons/ac	8.78
1, 10, & 100 Hour Fuels Tons/ac	2.09
1000 hour Fuels Tons/ac	14.59
Total Woody Fuels Tons/ac	16.68
Canopy base Height, ft	4
Canopy Bulk Density kg/m3	0.086

This unit did not have particularly heavy downed woody fuel loading pre-burn, however it is located very close to developed areas and employee housing. The stand is very young and dense, which affects the predicted fire behavior (summarized below for moderate and severe fire weather):

	Moderate 75th %	Severe 97th %
Surface Flame Length, ft	2.2	3.9
Fire Type	Surface Fire	Passive Fire
Probability of Torching	74%	100%
Torching Index, mph		12.5

Crowning Index, mph		26
Potential mortality, % of BA	72%	96%
Potential Smoke tons per acre <2.5	0.19	0.23

The torching and crowning indices refer to the wind speed required to initiate torching or crowning.

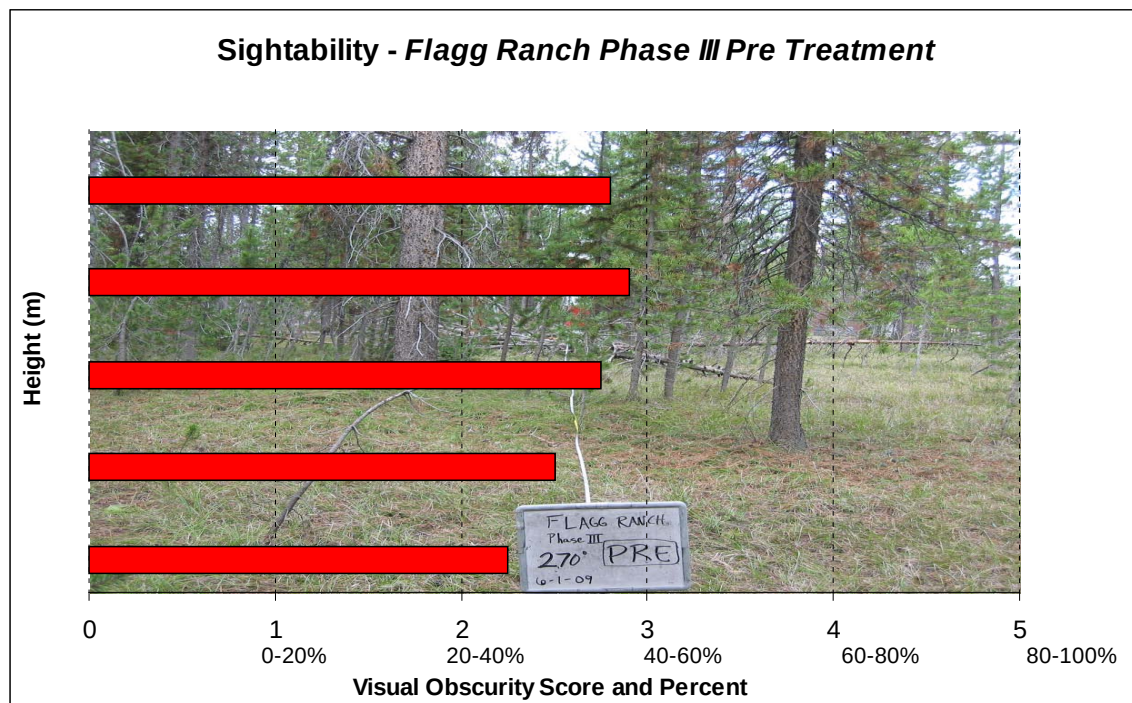
A photopoint in the Flagg Ranch Phase II stand shows the characteristics of the young lodgepole pine forest. Note that there is a 2m x .5m red and white sightability board in each photo (located 50ft from the camera location):



Pre-treatment photopoint

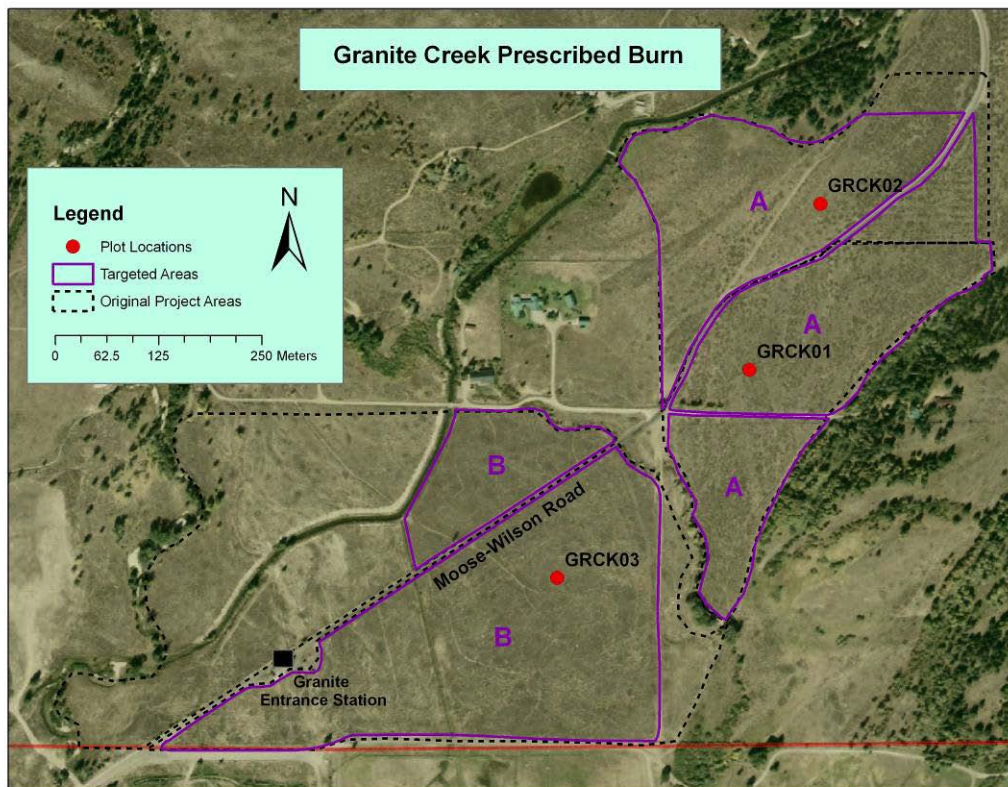


Sightability transect data is shown here for the pre-treatment monitoring event. Visual obscuration is analogous to the amount of ladder fuels in the stand.



Granite Creek Prescribed Burn

The Granite Creek prescribed fire project was implemented in the spring of 2008. It is located in sagebrush vegetation near private land and housing developments in the area of the Grand Teton National Park Southwest Entrance Gate.



The burn area was divided into two units, A and B. Unit A consists of a mixture of sagebrush (*Artemisia tridentata* ssp. *vaseyana*) and bitterbrush (*Purshia tridentata*). The soils are coarse, and the understory consists of many species of forbs and sparse grasses. Unit B has a dense sagebrush community with abundant rhizomatous grasses such as smooth brome (*Bromus inermis*). There is much less bare ground exposed in Unit B. The intent of the burn was to reduce shrub fuels along the roadside and adjacent to private homes within the park. Specific monitoring objectives were as follows:

- Reduce the stems per acre of mature sagebrush by 60% in dense areas (Unit B)
- Maintain or reduce the presence of non-native plants.

Sagebrush (and bitterbrush in Unit A) density was measured and compared pre and post burn in each unit using nonpermanent circular plots in 2008. Photopoints were taken in each unit to document additional fire effects. Species composition and cover plots were conducted pre burn at the three photopoint locations in 2009.

Unit B experienced much more complete and extensive burning than Unit A did.

Photopoints were located on both sides of the road in Unit A. One photopoint was located in Unit B. At each location, a digital picture was taken facing each cardinal direction. 2009 was a very favorable growing season, and the burned area in Unit B responded with lush and tall grass production in 2009.

Photopoint GRCK01 shows the very patchy burn mosaic typical of unit A:



Immediate post burn June 2008

One year post burn, June 2009

Photopoint GRCK03 in Unit B shows the much more extensive burn mosaic, with large areas of sagebrush mortality. Note the vigorous grass regrowth in 2009:



Pre burn June 2006

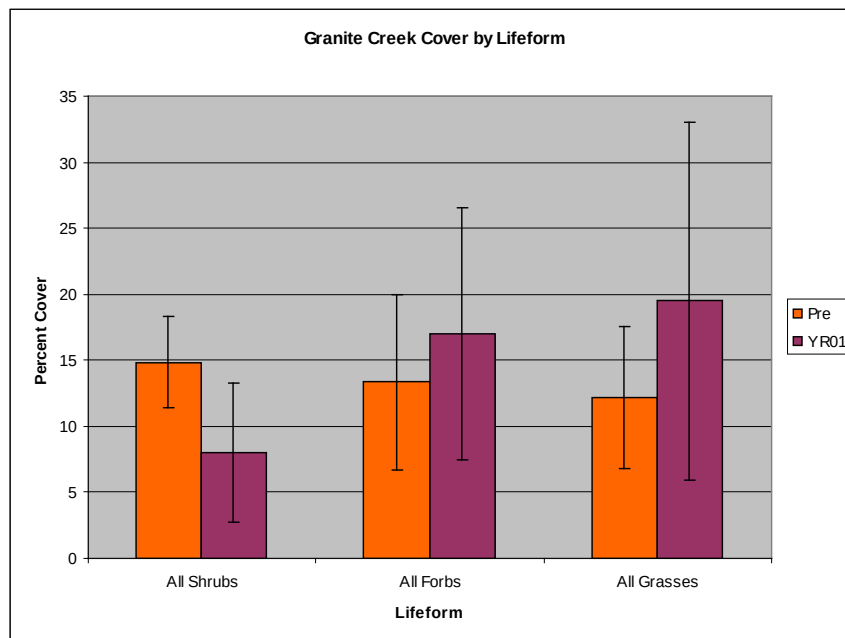
Post burn June 2008



One year post burn, June 2009

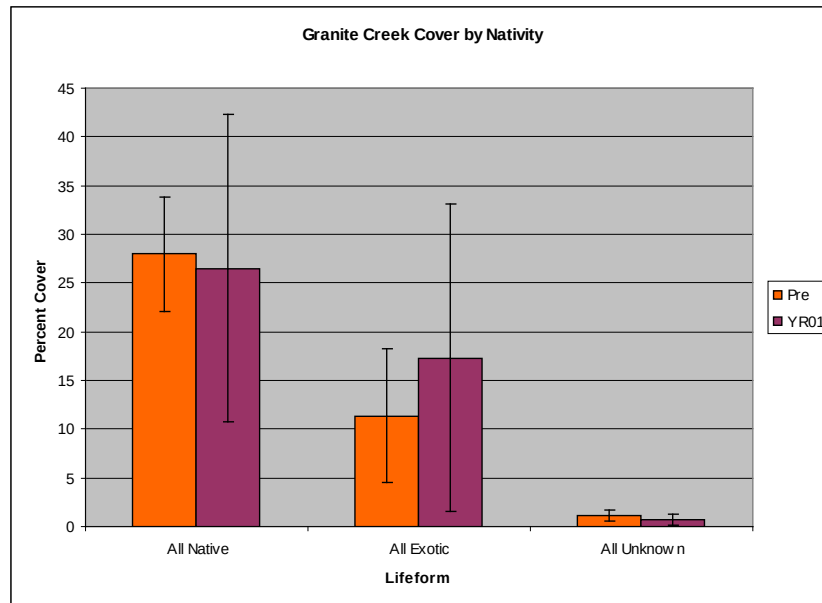
The Granite Creek prescribed burn treatment was most effective in Unit B, where shrub density was high and continuous, and afternoon weather was more favorable to fire spread. Shrub density reduction objectives were met over nearly 70% of this area. Unit A was also treated to reduce shrub fuels; however the burn mosaic was very patchy.

In 2009, species composition and cover plots were reread at the photopoint locations in both treatment units at Granite Creek. The graphs below summarize all three plots, two of which were in the low severity Unit A area. No significant difference in percent cover of any of the life forms could be demonstrated.



Exotic species at the three plots included the following forbs: Yellow alyssum (*Alyssum alyssoides*), hoary alyssum (*Berteroa incana*), musk thistle (*Carduus nutans*), Dandelion (*Taraxicum officinale*), western salsify (*Tragopogon dubius*), and alsike clover (*Trifolium hybridum*). Exotic grasses included crested wheatgrass (*Agropyron cristatum*), smooth brome

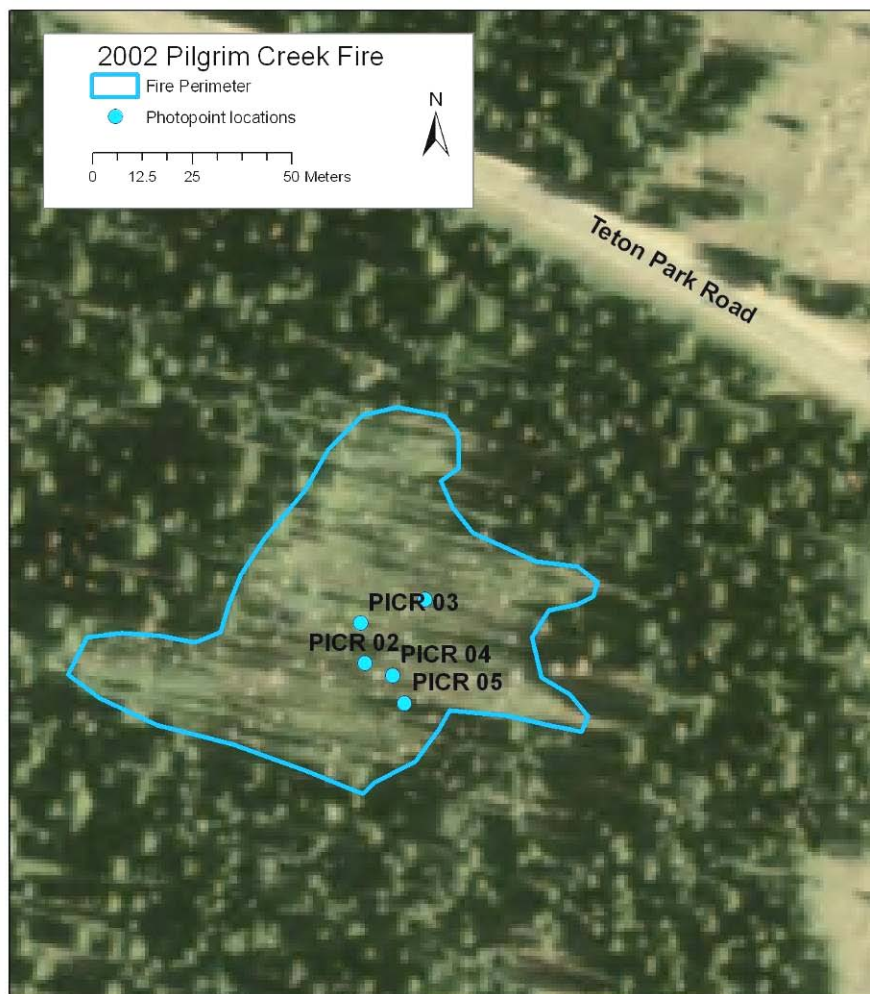
(*Bromus inermis*), Bluegrass (*Poa compressa* and *P. pratensis*). Of these species, musk thistle is considered a noxious weed. No significant difference in percent cover of exotic species was found at the three plots. The monitoring design is not well suited to detect subtle changes in this variable, however, because cover is estimated in classes, and there are no control plots to separate the effects of seasonal precipitation differences.



Pilgrim Fire 2002

The 1.5 - acre Pilgrim Creek Fire was started by lightning in August, 2002. It was suppressed because it was located adjacent to a major travel corridor between Grand Teton and Yellowstone National Parks during a period of high fire danger. The Fire Effects crew was asked to establish permanent photopoints in the fire to track regrowth patterns in the mixed aspen and conifer vegetation. The crew returned to retake the photographs in 2004 (Year 2 post burn) and again in 2009 (Year 7 post burn).

The map below shows the small fire area juxtaposed on a 2006 aerial photograph.



Based on the photographs, it appears that the burn severity was moderate to high. The trees were torched, and substrate was charred throughout. In the year 2 post burn photos, pioneer species such as fireweed (*Chamerion angustifolia*) and Canada thistle (*Carduus nutans*) were present, indicating that soil heating was sufficient to kill many of the understory plants, opening up the site for colonization by windblown seeds. By year 7, elk sedge (*Carex geyeri*) and pinegrass (*Calamagrostis rubescens*) had begun to dominate, with some thistles remaining. New

lodgepole pine seedlings were present, at average heights of approximately 2 ft. Aspen suckers were also in evidence, but it appeared that they had been browsed by wild ungulates every year, and were not growing taller than approximately 1.5 ft.



Immediate post burn: Moderate severity in mixed conifer forest with scattered aspen



Two years post burn: Trees are dead and the understory is filling in with pioneer species



Seven years post burn: Grasses and lodgepole pine seedling with some thistles and browsed aspen suckers.

Sage Strips Mowing Treatment

The sage strips project is a roadside fuels reduction treatment intended to improve control options in the case of a wind driven sagebrush fire. The sides of two east-west trending roads were mowed to widen the existing fuel break to a total of 80 feet.

The airport road treatment included a total of approximately 3.8 acres of mowing, along both sides of the paved access to the Jackson Hole Airport. Four mower widths were treated, with two on each side of the road. A buffer was left in the sparse vegetation between the pavement and these mow lines, in order to avoid disturbing invasive species that had established there, particularly cheatgrass and Japanese brome (*Bromus tectorum* and *B. japonicum*).



Pre Treatment: Looking west, north side of road

Post Treatment

The Circe E-W Ranch road, several miles to the north, was also mowed. This dirt road has much less traffic and weed propagule pressure.

Monitoring objectives for the sage strips project are as follows:

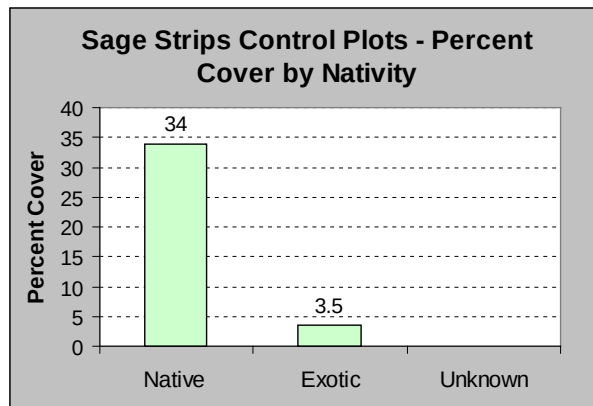
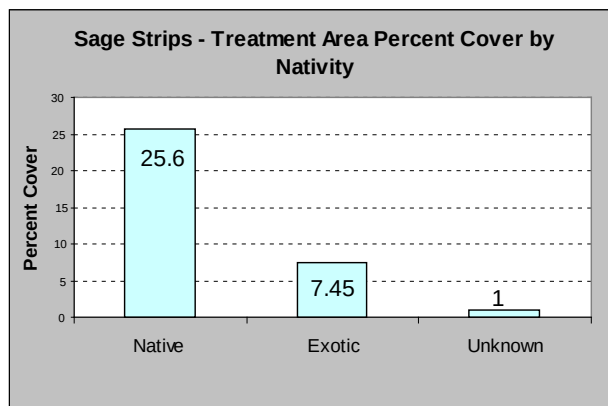
1. Monitor changes in the frequency of exotic plants
2. Monitor changes in the percent cover of all plant species

Pre-treatment vegetation sampling consisted of 26 cover plots (including 6 controls) and two nested frequency transects along the entire length of the Airport Road. The control plots are located along the road approximately 20 meters from the pavement, while the remaining plots are closer, within the targeted mow lines. Because of this distance, the control plots are most likely less impacted by roadside disturbance and invasive plants. In the treatment area, shrub cover was 11.0 +/- 4.7%. The control plots had 16.0 +/- 8.4% shrub cover.

Exotic plant species found at the pre-treatment Airport Road composition and cover plots are included in the following table. The control plots featured much fewer species, but there were only 6 plots, as compared to 20 treatment plots.

Treatment Area (Pre Mowing) n=20	Percent Cover	Control Area (Pre Mowing) n=6	Percent Cover
<u>Graminoids:</u> Crested wheatgrass (<i>Agropyron cristatum</i>) Smooth Brome (<i>Bromus inermis</i>) Japanese brome (<i>Bromus japonicus</i>) Cheatgrass (<i>Bromus tectorum</i>) Intermediate wheatgrass (<i>Elymus hispidus</i>) Bulbous bluegrass (<i>Poa bulbosa</i>) Canada bluegrass (<i>Poa compressa</i>)	0.2% 0.1% 0.4% 2.7% 0.1% 0.1% 1.4%	<u>Graminoids:</u> Canada bluegrass (<i>Poa compressa</i>)	1.6%
<u>Forbs:</u> Pale madwort (<i>Alyssum alyssoides</i>) Tansymustard (<i>Descaurania Sophia</i>) Prickly lettuce (<i>Lactuca serriola</i>) Dandelion (<i>Taraxicum officinale</i>) Pennycress (<i>Thlaspi arvense</i>) Salsify (<i>Tragopogon dubius</i>)	1.7% 0.1% 0.3% 0.3% 0.2% 0.2%	<u>Forbs:</u> Pale madwort (<i>Alyssum alyssoides</i>) Dandelion (<i>Taraxicum officinale</i>) Salsify (<i>Tragopogon dubius</i>)	0.8% 1.1% 0.1%

The percent cover of native and exotic species by life form for the treatment and control plots is shown in the following graphs. Based on the plots, it appears that the control area had a smaller proportion of exotic plants prior to the mowing treatment.



Shadow Mountain Mechanical Thinning

The 22-acre Shadow Mountain mechanical fuels thinning project was implemented in the summer of 2009. Prior to the treatment, the Fire Effects Crew and the Teton Interagency Fuels Crew collected stand exam data and sightability monitoring in order to evaluate how the treatment will affect fuel loading and fire behavior. Treatment methods included limbing and felling trees with chain saws, and subsequently burning the slash in piles (planned for 2010).

The goals of this mechanical thinning project are to reduce fuels around the wildland interface at Shadow Mountain in Grand Teton National Park. Fuel reduction is intended to create defensible space and improve firefighter and public safety, by increasing fire containment opportunities during wildland fire events. Objectives for the mechanical treatment are as follows

- Reduce dead and down fuel loading to 10 tons per acre
- Remove all ladder fuels (limb trees, remove conifer regeneration)
- Increase tree spacing distance to 10-12 feet (1500 stems per acre) between trees or groups of trees.

The Forest Vegetation Simulator (FVS) Fire and Fuels Extension (FFE) program is used with stand exam data to compare pre- and post-treatment fuels, predicted fire behavior, and effects. Sightability transects will give an additional indication of change in ladder fuels. The fuel loading summary for Shadow Mountain pre treatment is summarized in the table, below:

Shadow Mountain Pre-Treatment Fuel Loading	
Fuel Model	FM10 82%, FM12 18%
Litter Tons/ac	10.32
Duff Tons/ac	0.95
1, 10, & 100 Hour Fuels Tons/ac	3.74
1000 hour Fuels Tons/ac	17.4
Total Woody Fuels Tons/ac	21.14
Canopy base Height, ft	37
Canopy Bulk Density kg/m³	0.005

The stand is very young and dense, which affects the Predicted fire behavior is summarized below for moderate and severe fire weather:

Shadow Mountain Pre Treatment Predicted Fire Behavior		
	Moderate 75 th %	Severe 97 th %
Surface Flame Length, ft	2.9	4.6
Fire Type	Surface Fire	Surface Fire
Probability of Torching	19%	96%
Torching Index, mph		126.7
Crowning Index, mph		188.2
Potential mortality, % of BA	56%	66%
Potential Smoke tons per acre <2.5	0.30	0.21

The torching and crowning indices refer to the wind speed required to initiate torching or crowning.

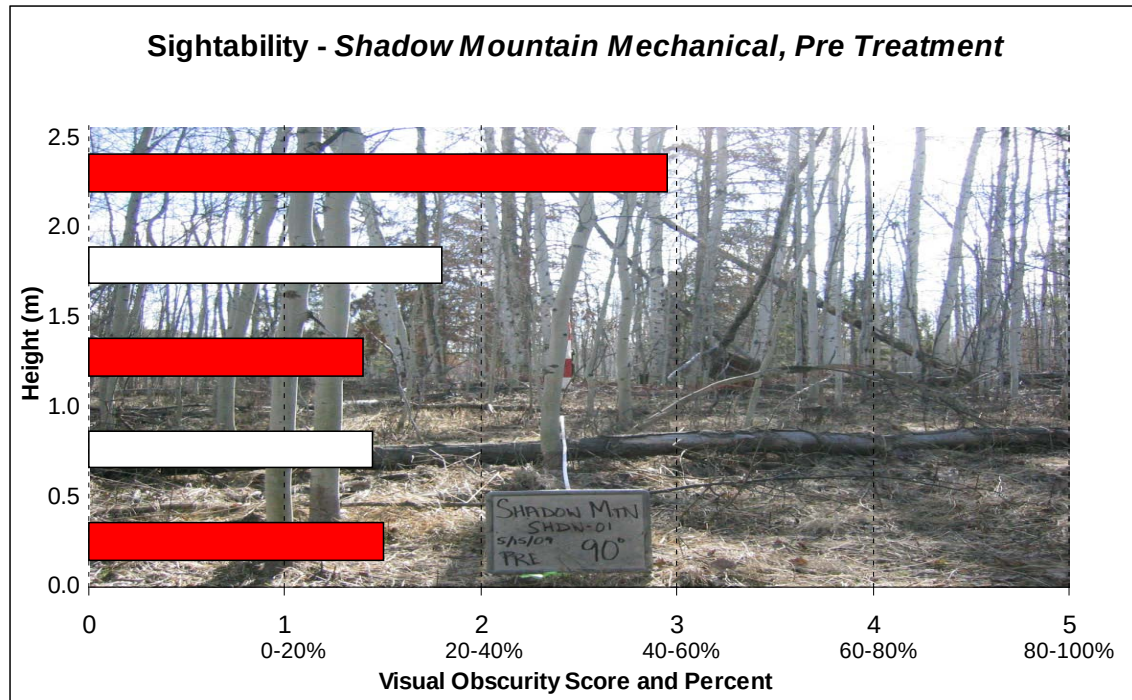
A photopoint in the Shadow Mountain stand shows the characteristics of the aspen stand. Note that there is a 2m x .5m red and white sightability board in each photo (located 50ft from the camera location):



Pre-treatment photopoint SHDW01 looking East

SHDW01 looking North

Sightability transect data is shown here for the pre-treatment monitoring event. Visual obscurity is analogous to the amount of ladder fuels in the stand.



Wolff Ridge Prescribed Burn Aspen Sucker Monitoring

The Wolff Ridge prescribed burn was implemented in the fall of 2002, in sagebrush, aspen, and lodgepole pine vegetation. Several FMH forest-style plots were used to monitor programmatic objectives; however additional statistically significant data was needed to track aspen response under conditions of heavy ungulate browsing pressure. In the winter of 2003-2004, an electric fence was installed to exclude ungulates from a portion of the burned aspen. The Fire Effects Crew and colleagues from the Wyoming Game & Fish Brucellosis Feedground Habitat Program used randomly-located circular density plots to compare live sucker density, height, and browse status within the fence and in an adjacent control area. The fence was not successful in excluding ungulates, and it was difficult to maintain its efficacy in deep snow, which resulted in its removal in 2005. Aspen monitoring has continued every year since then, with the formerly-fenced and control areas now lumped together.

The objective addressed by this monitoring is as follows, “Attain 1000 live aspen suckers (<15cm dbh) per acre in burned aspen areas ≥ 10 feet tall within 10 years post burn.”

In the summer of 2009, aspen regeneration was once again monitored at Wolff Ridge. Live suckers were sampled in 100th acre circular plots. In addition, two permanent photo points were retaken, one that was once inside the electric fence, and one that was in the control area. As was found in previous years, some areas of the burn have taller aspen suckers and apparently less browsing than others. It is likely that this difference is related to growing site quality and snow deposition as well as wildlife utilization.



Aspen growth at Wolff Ridge, year 7 post burn

Ridge location outside of former fence, Year 7

Live aspen density and browse were measured in random locations within burned aspen clones only. The 2009 estimate for density of aspen suckers with 80% confidence is 6510 ± 1267 stems per acre. Of these stems, 21% were browsed. Many of the stems have reached a height inaccessible to elk.

The average density for aspen suckers over 2 meters in height in 2009 was 2100 ± 621 per acre. This has exceeded the objective of 1000 per acre ten years post burn, after only 7 years.

Appendix B

Bighorn Canyon National Recreation Area 2009 Fire Effects Monitoring Report

Barry's Island-Chain Canyon Prescribed Burn

The Barry's Island and Chain Canyon unit is approximately 450 acres of Utah juniper-dominated desert. The area is important for bighorn sheep, and the burn is intended to improve habitat for this species. A portion of the unit was burned in spring of 2008.



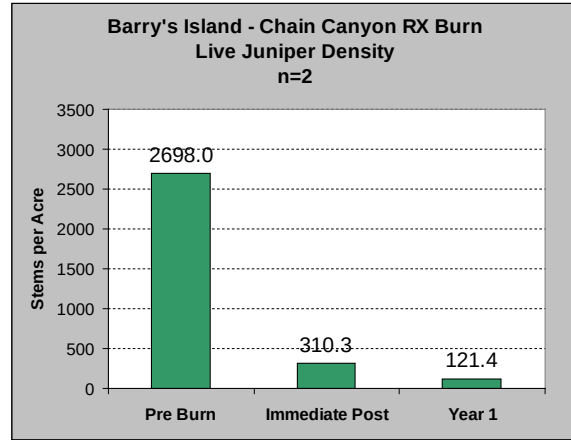
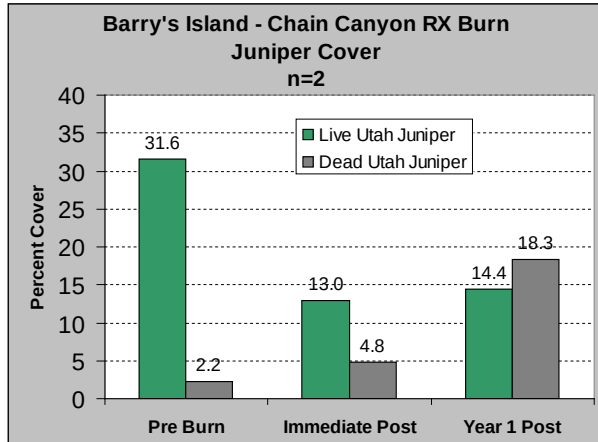
Specific monitoring objectives are as follows:

- 1) Burn in a mosaic pattern between 40-70% of the targeted acreage, to be measured immediate post burn.
- 2) Achieve 70-90% juniper mortality in dense stands across the unit immediately post burn

Five FMH-style fire effects brush plots were installed in the unit pre burn in 2007, and were modified to include an extra 30 meter transect for shrub density and line intercept. Only two of these plots were part of the 2008 burn entry. According to immediate post burn sampling, the burn severity for substrate and vegetation was at the "lightly scorched" level.

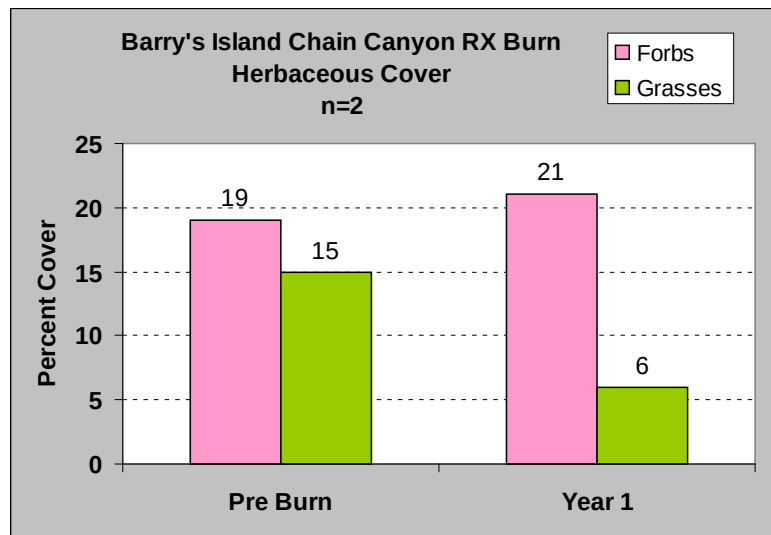
Juniper Cover and Density

With only two plots, statistical analysis was not possible, however the average utah juniper cover and density decreased considerably, and met project objectives.



Herbaceous Cover

A comparison of grass and forb cover pre and post burn shows that forbs had a similar presence, while grasses were decreased in year 1. It is to be expected that recovery of these species would be delayed. Future plot visits may indicate whether bighorn sheep forage has been benefited, however without control plots this is difficult.



Species Composition:

The plant species lists from the two burned plots indicated the presence of cheatgrass (*Bromus tectorum*) at plot BICC04 pre burn. Dandelion (*Taraxicum officinale*) and salsify (*Tragopogon dubius*) were present at that plot 1 year post burn. Otherwise the composition consisted of native plants only.

Yellow Hill Prescribed Burn

The Yellow Hill prescribed burn project is located where the Wyoming-Montana State Line intersects Highway 37 in Bighorn Canyon National Recreation Area. The vegetation is Utah juniper (*Juniperus Utahensis*) and mountain mahogany (*Cercocarpus ledifolius*) shrubland. The project is being completed in stages, because it is difficult to carry fire in the sparse understory under prescribed conditions. The purpose of the burn is to improve habitat for bighorn sheep. Monitoring objectives include the following:

1. Reduce the percent cover of live Utah juniper by at least 60% one year post treatment
2. Reduce shrub density by 30-50% one year post burn
3. Increase the percent cover of herbaceous plants by at least 30% two years post treatment.

In 2005, four FMH-style brush plots were installed in the unit prior to slashing.

A portion of the burn was completed in the spring of 2009. Of the four plots, only one burned so far.

Plot photos show the change in juniper cover after the burn at this plot:



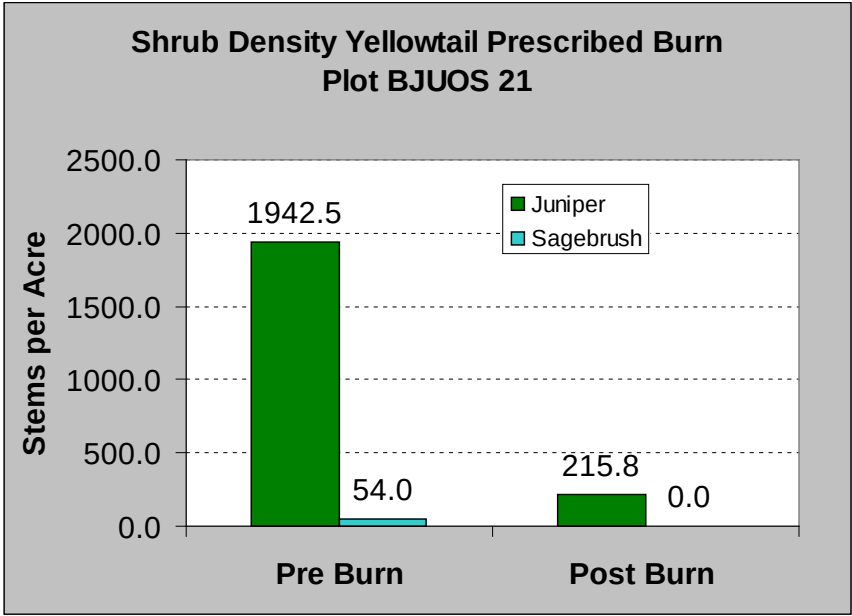
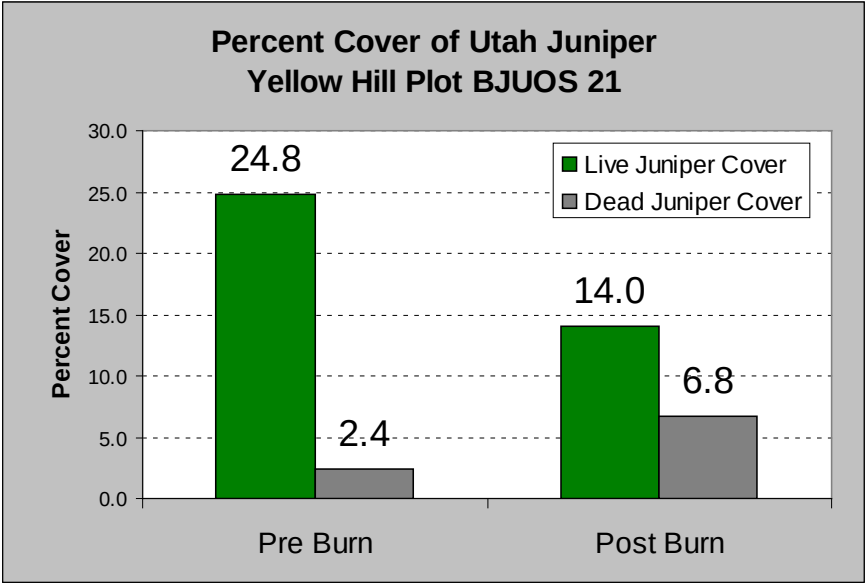
Pre treatment, 2005



Post burn, 2009

The average severity for the substrate and vegetation at this plot were 2.6 and 2.7, respectively. These scores represent a “lightly to moderately burned” condition.

The cover of live Utah Juniper decreased by 56%, and dead cover increased by 183%. Juniper density decreased substantially by 89%. Data has not yet been collected to evaluate herbaceous plant cover changes.



Yellowtail Slashing, Herbicide Treatment, and Prescribed Burn

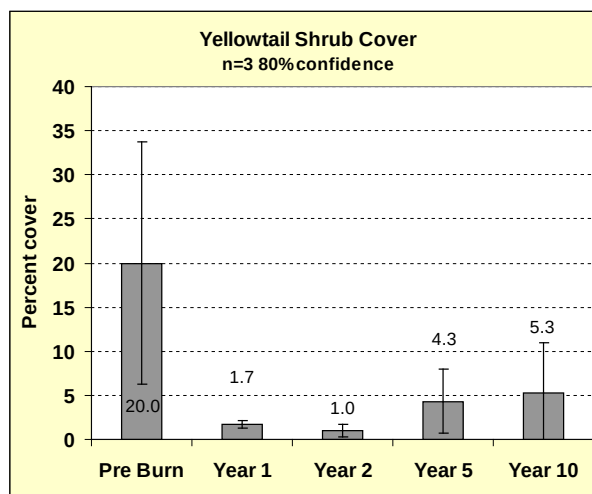
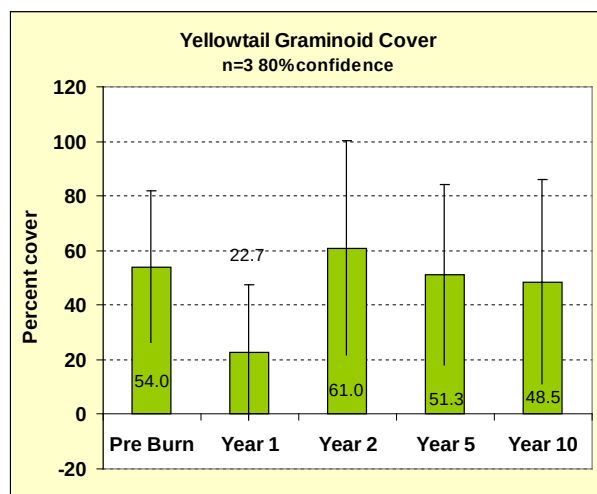
In the spring of 1999, Bighorn Canyon NRA began the Yellowtail Habitat treatment project to restore a ____ acre area within the lands managed cooperatively with Wyoming Game & Fish Department as the Yellowtail Wildlife Habitat Management Area.

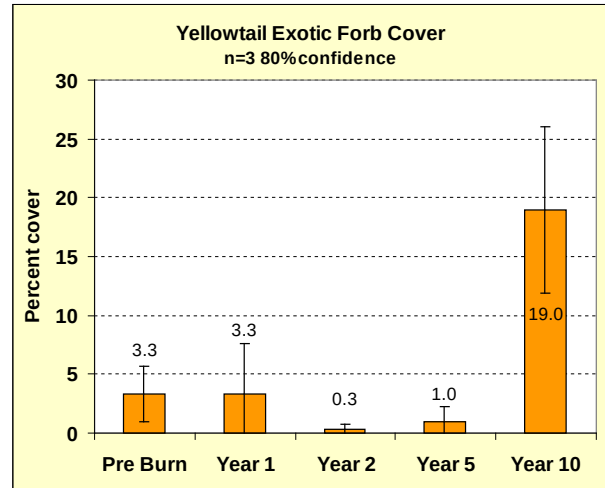
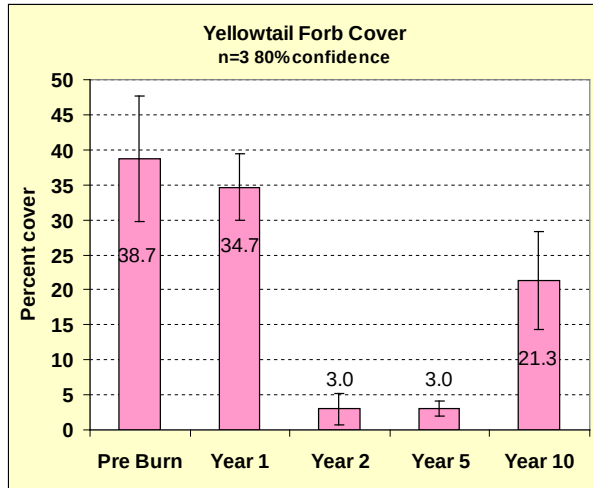
The objectives of the treatment were as follows:

- Reduce percent cover of Russian olive and saltcedar by 50-80 percent.
- Reduce percent cover of Wyoming big sagebrush by 20 to 40 percent
- Increase grass coverage by 20 to 40 percent
- Resprout snowberry and greasewood
- Minimize cottonwood mortality to 0-10 percent
- Reduce non native forbs

Four FMH brush plots were installed in the burn unit, within greasewood (*Sarcobatus vermiculatus*) - saltgrass (*Distichlis spicata*) vegetation. The plots were re-read in Year 1,2,5, and 10 post burn. One plot was lost due to rebar disturbance. These plots were able to evaluate two of the objectives, grass cover and exotic forb cover. Data is also provided on the cover of forbs and shrubs.

No significant difference could be detected in the cover of grasses at the Yellowtail plots. It appears that cover decreased post burn and then recovered to near pre treatment levels. Shrub cover was significantly decreased, however these particular shrub species (greasewood and snowberry (*Symphoricarpos oreophilus*)) were not addressed in the project objectives. Total forb cover was quite variable over the course of the past 10 years, possibly owing to herbicide treatments that were ongoing. Exotic forb cover was relatively unchanged until Year 10, when *Kochia* (*Bassia scoparia*) increased greatly.





Photopoints from the Yellowtail plots show spatial and temporal variability in the distribution of species, which is consistent with the plot data.



Pre Burn 2000 (early spring photo)



Year 1 post



Year 5 Post



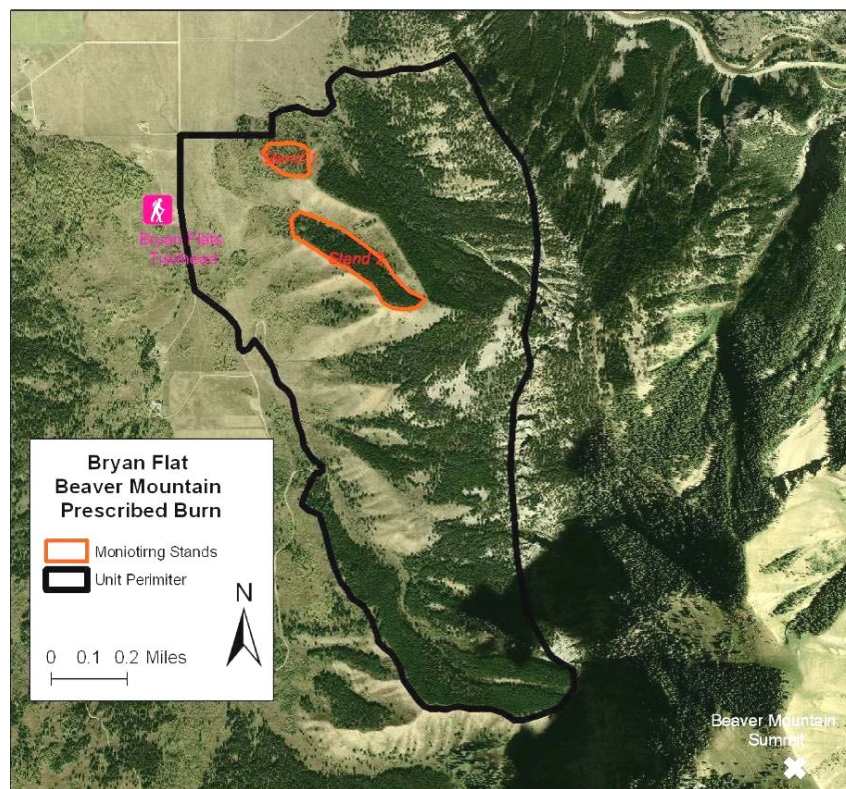
Year 10 post

Appendix C

Bridger-Teton National Forest North Zone 2009 Fire Effects Monitoring Report

Beaver Mountain Prescribed Burn

The Beaver Mountain Prescribed burn is part of the overall Bryan Flats Fuels Reduction Project, located south of Jackson Wyoming near the University of Michigan Geology Field Camp (Camp Davis), and a cluster of private homes that have recently been built up in the wildland urban interface alongside USFS land in the Jackson Ranger District. The Beaver Mountain unit has also been identified in the past as important wildlife habitat that would benefit from treatment with fire.



Monitoring objectives for the burn are as follows:

- Reduce live conifer between 20% and 60% in designated aspen stand #1, (see map) to promote aspen health and vigor.
- Reduce overstory aspen density (stems > 5.9" DBH) by 70% by one year post-burn.
- Blacken between 40% and 80% of the sagebrush within in the burn unit, in a mosaic pattern.
- Achieve 10-30% canopy fire effects in representative stand #2 (see map).
- Favor survival of large-diameter Douglas-fir trees (> 12") in burned areas to retain forest shaded conditions

In 2009, the fire effects crew installed five permanent photopoints in identified priority locations in the burn unit (see map, above). These photographs will help to track fire effects and changes in the fuel conditions.



BFBM-01 - Aspen in Stand 1



BFBM-02 – Overview of Stand 2 (mixed conifer and aspen)



BFBM-03 – Mixed conifer in Stand 2



BFBM-04 – Larger-diameter Douglas-fir in Stand 2



BFBM-05 – Overview of sagebrush area looking south



Looking northwest

Dry Quad Slashing and Prescribed Burn

The Dry Quad project area is located along the boundary between the Bridger-Teton National Forest and Grand Teton National Park near Spread Creek. It is a north-facing hillside with aspen and mixed conifer vegetation. The area is also transitional and migration habitat for elk. The intent of the project is to reduce the conifer component and regenerate aspen.

A total of five different treatments are planned for the Dry Quad project area (see map).

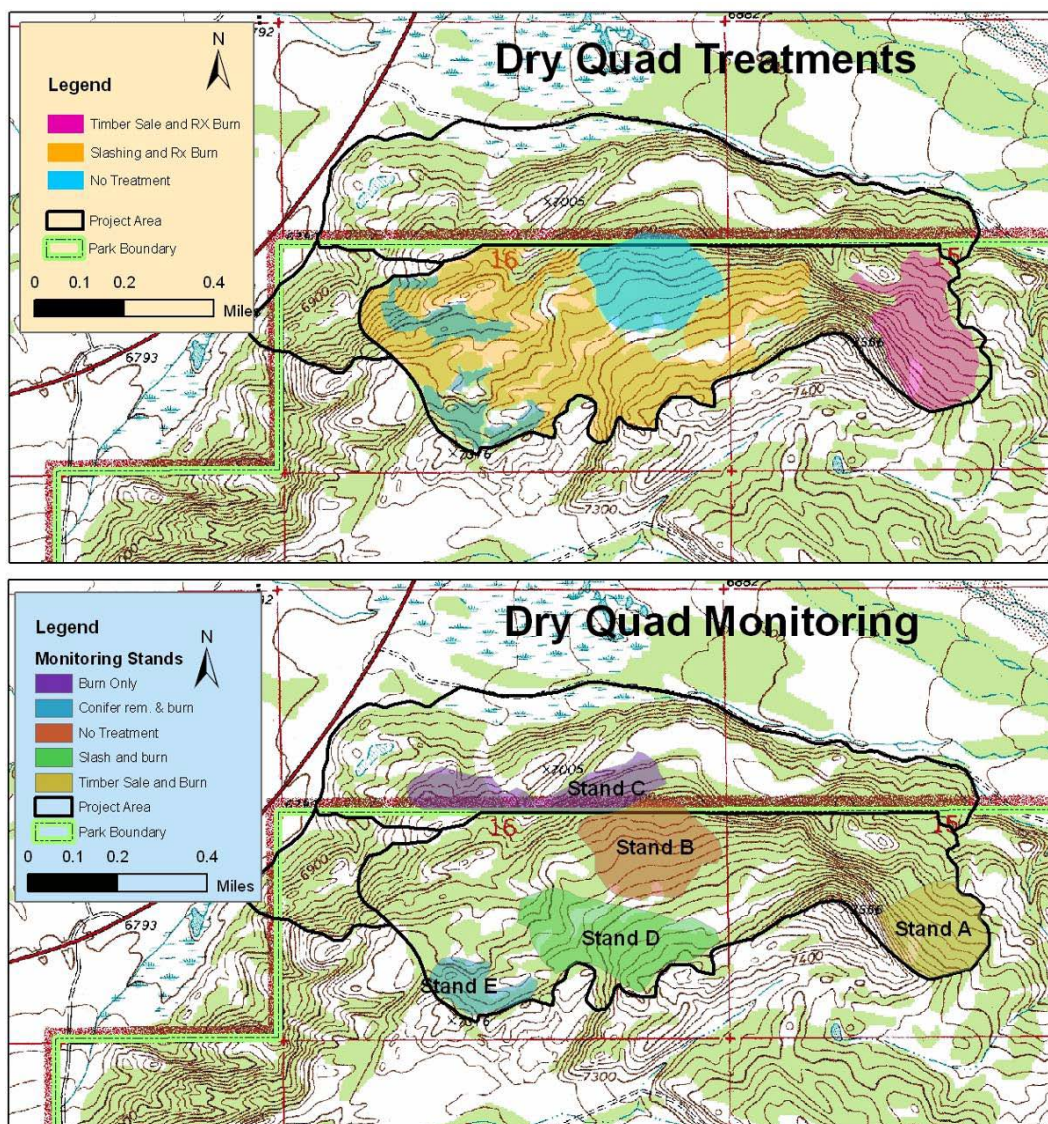
Timber sale and prescribed burn – monitored in Stand A

No treatment – monitored in Stand B

Prescribed burn only – Stand C

Conifer removal, slashing, and prescribed burn – monitored in Stand E

Slashing and prescribed burn – monitored in Stand D



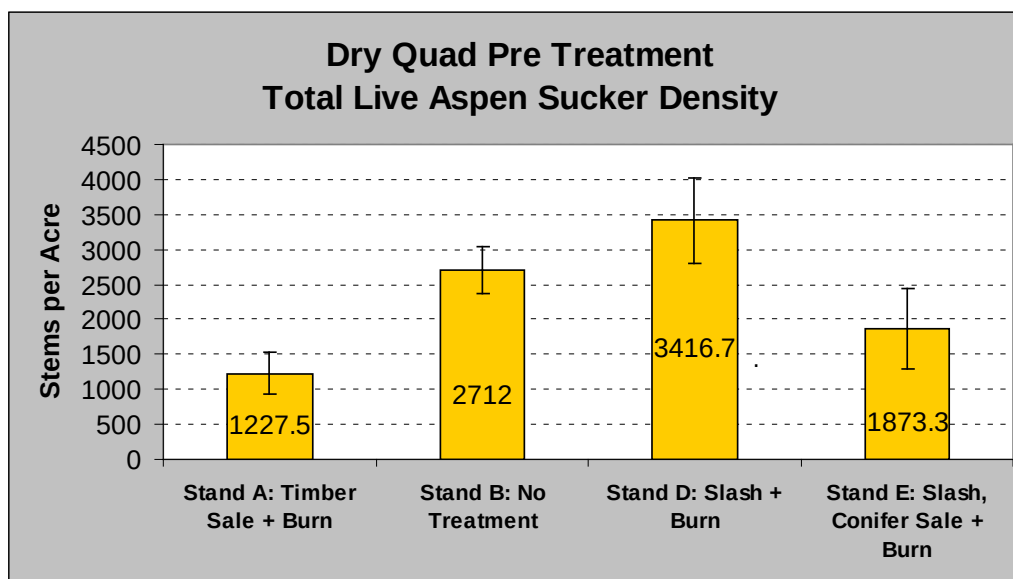
Objectives include the following

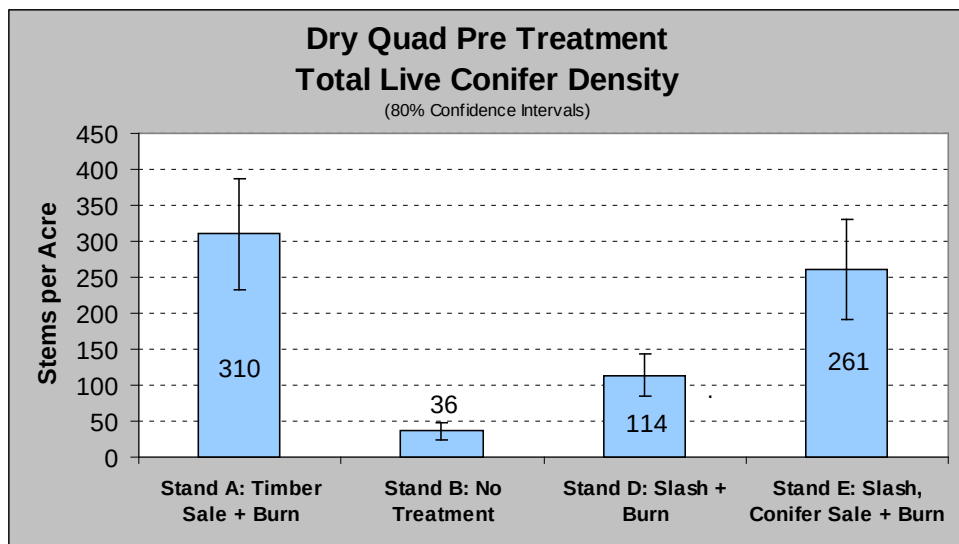
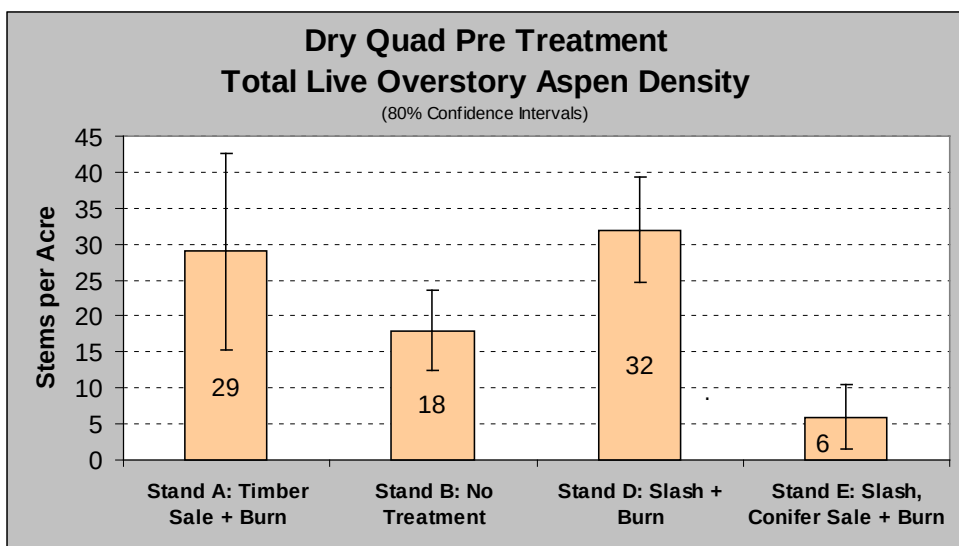
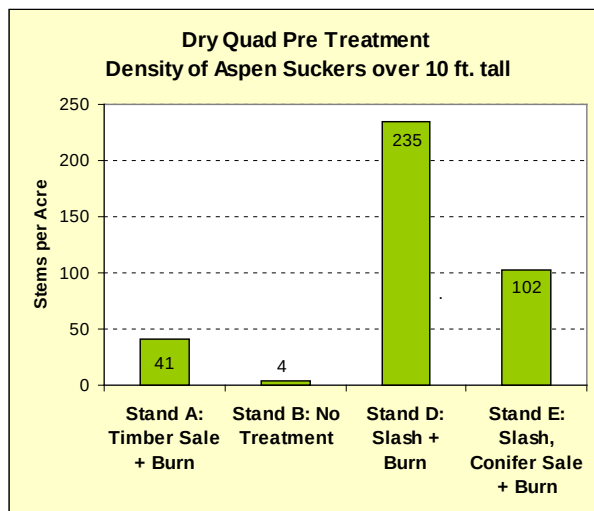
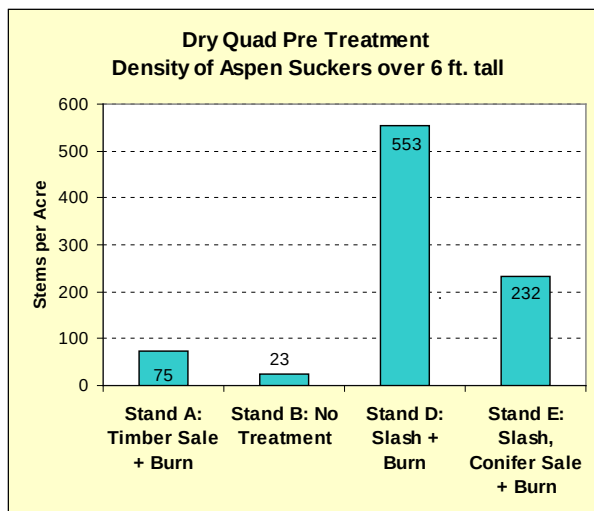
- Attain ≥ 50 -80% mortality of aspen trees ($> 5.9''$ DBH) and 85% conifer mortality (all size classes) within one year of burn in all treated stands (A, B, E, D)
- Attain at least 2000 aspen suckers/acre over 6 ft in height 3 years post burn (All stands).
- Attain at least 1000 aspen suckers/acre over 10 ft in height 15 years post burn (All stands).
- Attain $\leq 20\%$ bare ground cover, within 3 years post-treatment (All stands).
- Create a down woody fuel bed with an average depth between 12 36 inches in mechanically treated stands post treatment (pre burn) (A, E, D).
- Map the extent of fire effects on the burn unit
- Attain a vegetation and substrate severity level of at least 2.0 (moderately burned) in treated areas (A, B, E, D).

In 2008 and 2009, pre-implementation monitoring data was collected for several of the 5 treatments at Dry Quad. This data consisted of aspen and conifer overstory tree density by live status and live sucker density using nonpermanent circular plots distributed randomly in the designated stands. The remainder of the pre treatment data will be collected in 2010.

Total live aspen sucker density in the treatments is shown below. Stand B was excluded from treatment due to the existing healthy regenerating aspen condition; however Stand D is equally populated by aspen suckers. Stand D also shows much higher density of tall aspen suckers than does stand B.

Stand B appears to have the highest density of live overstory aspen, and lowest density of conifers (all size classes including seedlings). Stand D also has fairly low conifer density.





Photopoints show the stand characteristics pre burn:



Stand A: Timber Sale and Burn



Stand B: No Treatment



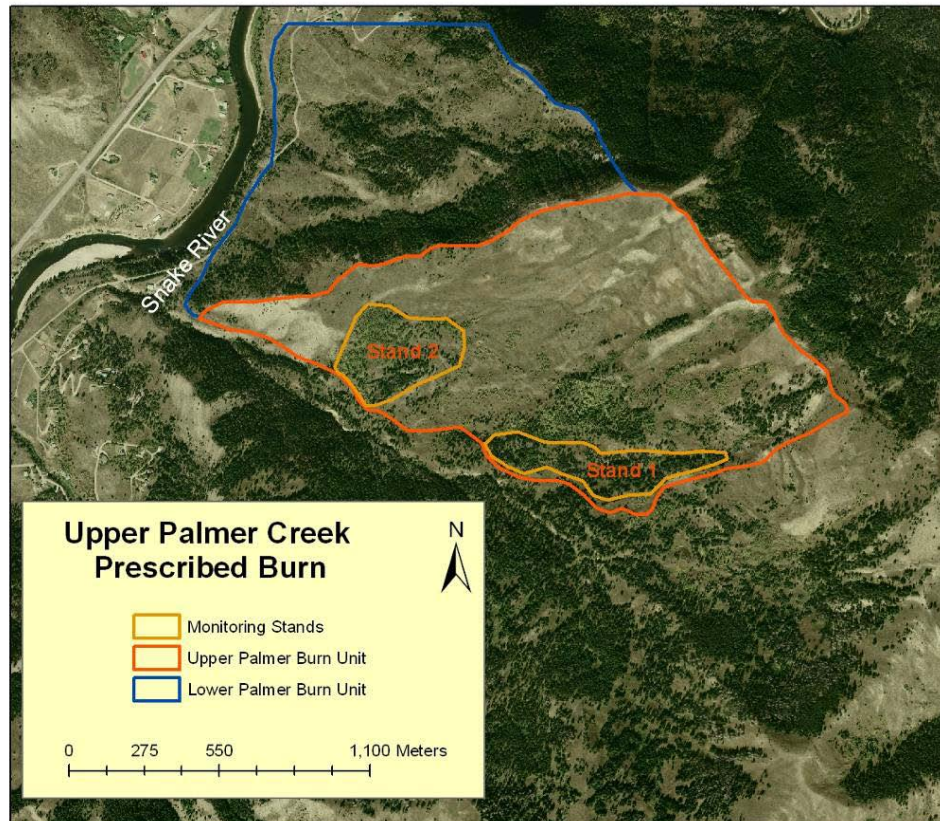
Stand D: Slashing and Burn



Stand E: Slashing, Conifer Sale, and Burn

Hoback Upper Palmer Creek Prescribed Burn

The Upper Palmer Creek prescribed burn project area is located at Hoback Junction, near a small community in the wildland urban interface south of Jackson, Wyoming. The vegetation consists mainly of sagebrush, with several forested draws where aspen and Douglas-fir are succeeding to mixed conifer. The prescribed burn is intended to reduce fuel loading and continuity in the vicinity of private homes. The area is also yearlong habitat for big game.



Fire effects monitoring objectives for Upper Palmer Creek are given as follows:

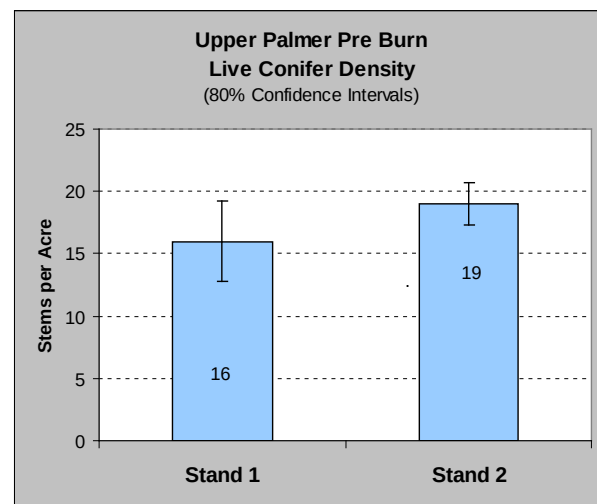
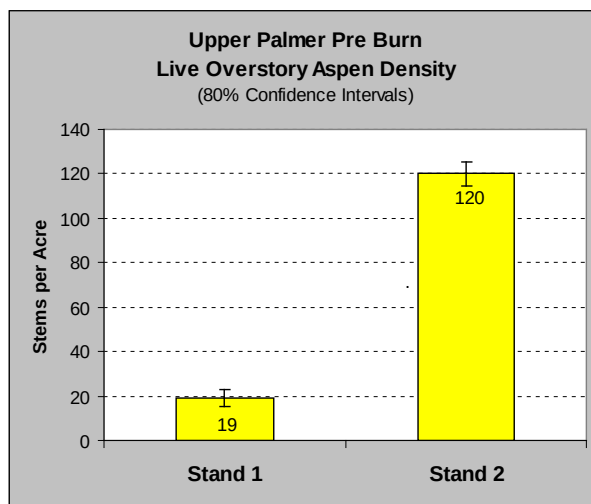
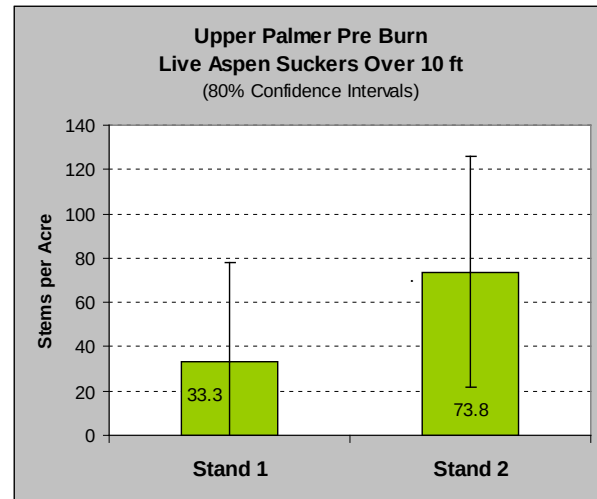
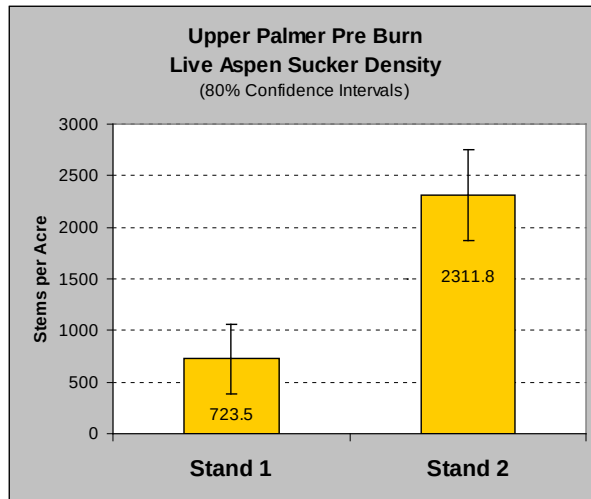
Sagebrush Objectives:

- Blacken between 40% and 80% of the sagebrush in the burn unit, in a mosaic pattern.
- Achieve at least 40% conifer mortality in encroached sagebrush areas.

Aspen Objectives:

- Reduce live conifer between 20% and 60% in designated aspen stands #1 and #2 (see map) to promote aspen health and vigor.
- Reduce overstory aspen density (stems > 5.9" DBH) by 70% post-burn.
- Attain more than 3000 aspen suckers/acre in the designated aspen stands two years post burn.
- Attain more than 1500 aspen suckers per acre over 6 feet tall 5 years post burn.
- Attain at least 1000 aspen stems/acre at 10 ft or taller within 15 years post treatment.
- Maintain aspen browse levels at less than 30% on terminal leaders.

In 2009, the fire effects crew installed 4 photopoints and measured the density of aspen suckers, overstory aspen, and conifer trees in monitoring stands 1 and 2. The following charts show the results. Stand 1 is dominated by conifers, and may have limited potential for aspen to regenerate to objective levels post burn. In 2010, a third stand will be added.



Photopoints:



Stand 1 Pre Burn



Stand 2 Pre burn

Lower Gros Ventre Prescribed Burn Units G,H, and I

Lower Gros Ventre units G, H, and I were burned in the fall of 2009 as the second phase of the Lower Gros Ventre burn project. These units include the watersheds of the two forks of Horsetail Creek. The objectives for this phase are similar to the J and K burn, however the wildlife habitat goals are somewhat different. Instead of removing conifers in bighorn sheep habitat and reducing sagebrush density, the main focus of this phase is to regenerate aspen in stands where conifers have encroached.

Monitoring Objectives:

Burn Mosaic:

- Stand replacement fire with canopy mortality in forested fuels within 20-40% of treated areas, creating a mosaic fuel arrangement and younger age classes. 2. Promote structural diversity of aspen within treatment units: retain 30% of mapped mature old stands, with a post-treatment conversion of up to 70% to early succession stands.
- In mountain big sagebrush stands, allow up to 100% mortality in burned areas. Treat only 40% of sagebrush that will carry fire. Avoid most Basin Big Sagebrush.

Aspen Disturbance:

- Reduce live conifer presence in aspen stands to promote aspen health and vigor on the landscape: >60% conifer mortality in treated aspen, >60% aspen mortality > 6"DBH.

Aspen Regeneration and Browse

- Attain at least 1000 aspen stems per acre at 10 ft or taller within 15 years post burn in treated aspen stands. Maintain aspen browse levels at less than 30% on terminal leaders.

Maintaining Limber Pine

- Avoid killing limber pine trees > 16"DBH.

Sagebrush Density

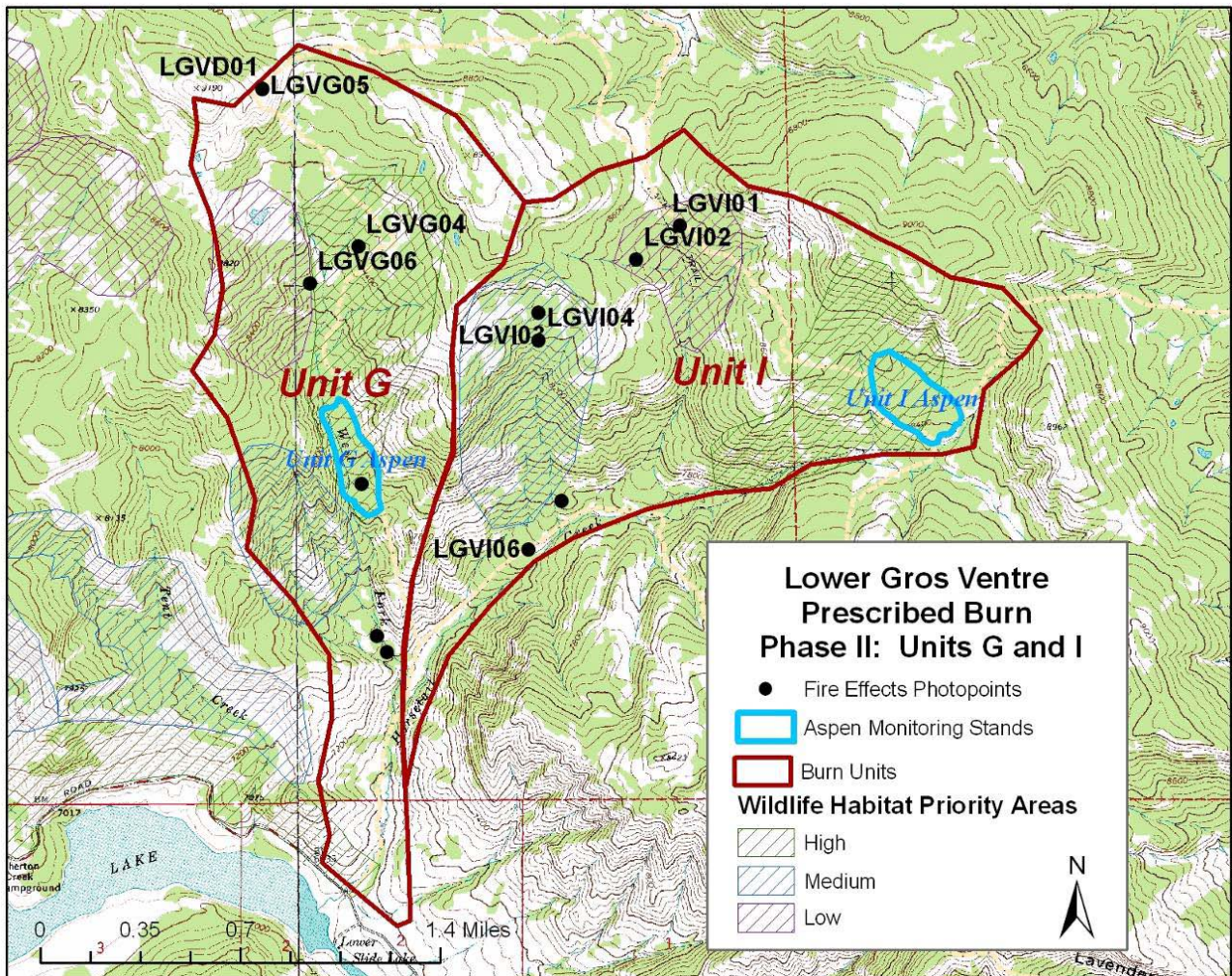
- Allow 70-100% mortality in treated mountain big sagebrush stands.

Forage Production

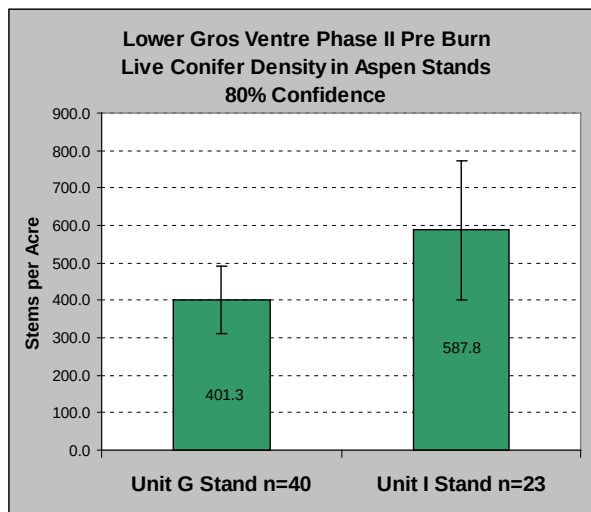
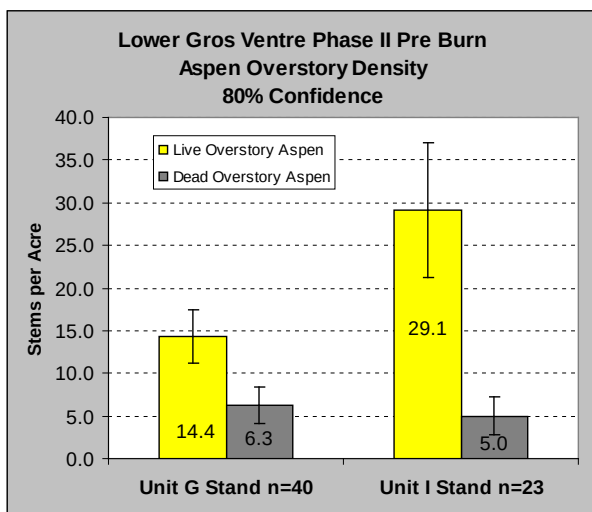
- Increase forage production and nutritional quality of native forbs and grasses.

Habitat priority areas within the G and I Units were identified by the Jackson Interagency Habitat Initiative group. These areas were specifically targeted by firing operations.

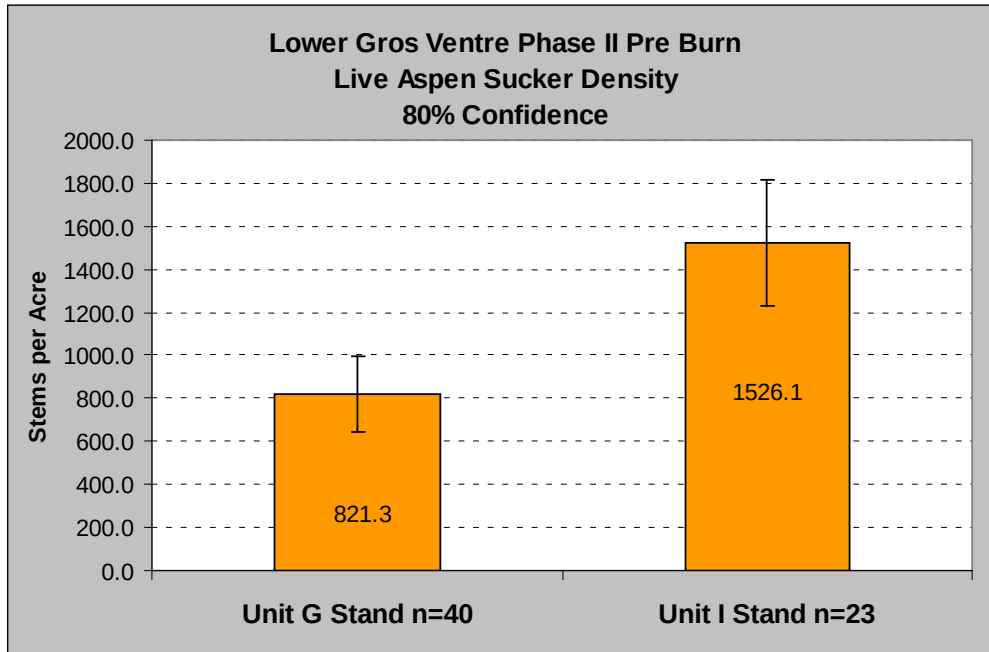
Two aspen stands were selected for fire effects monitoring and pre-burn non-permanent circular density plots were installed in each. Multiple permanent photopoints were installed in each fork of Horsetail Creek



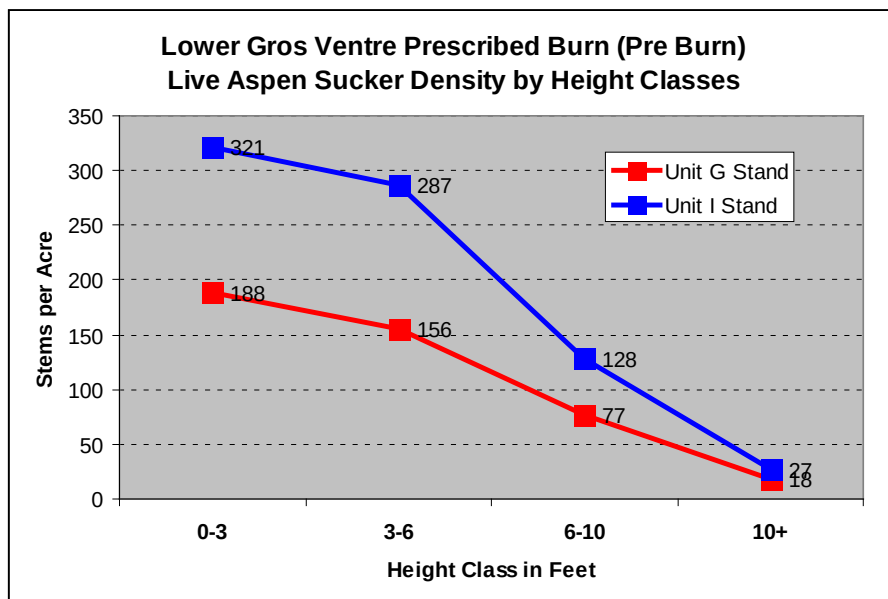
Pre burn overstory aspen and conifer density for the two stands is shown in the figures below. Conifers far outnumber aspen stems.



Aspen sucker density is moderate in the Unit I stand and fairly low in the Unit G Stand. The percent browse on the aspen suckers is only 13.1% (+/- 4.0) in G and 9.9% (+/- 4.2) in I. This is fairly low and should not represent a threat to suckers attaining full height.

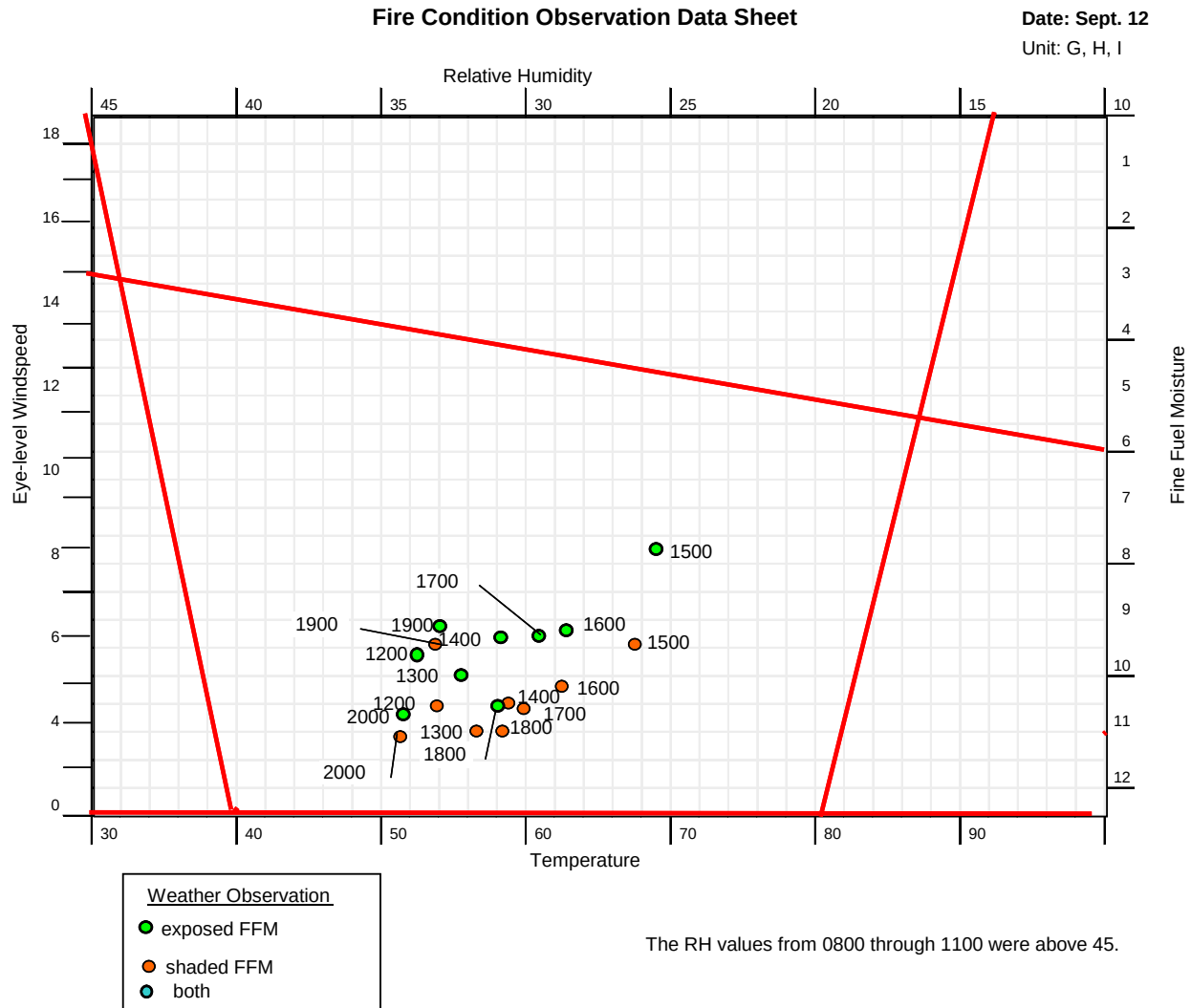


Sucker density by height class is shown below. It appears that while density is low, at least some aspen suckers are able to reach heights over 10 feet, which are thought to be above the reach of ungulates.



Burning Conditions:

The Lower Gros Ventre Prescribed burn lasted for more than two weeks. Fire weather and behavior observations were compared to the prescription window for each of the days, on Fire Conditions Charts. During blacklining, typical observations were in the middle to low end of the prescription window (see example from September 12, below).

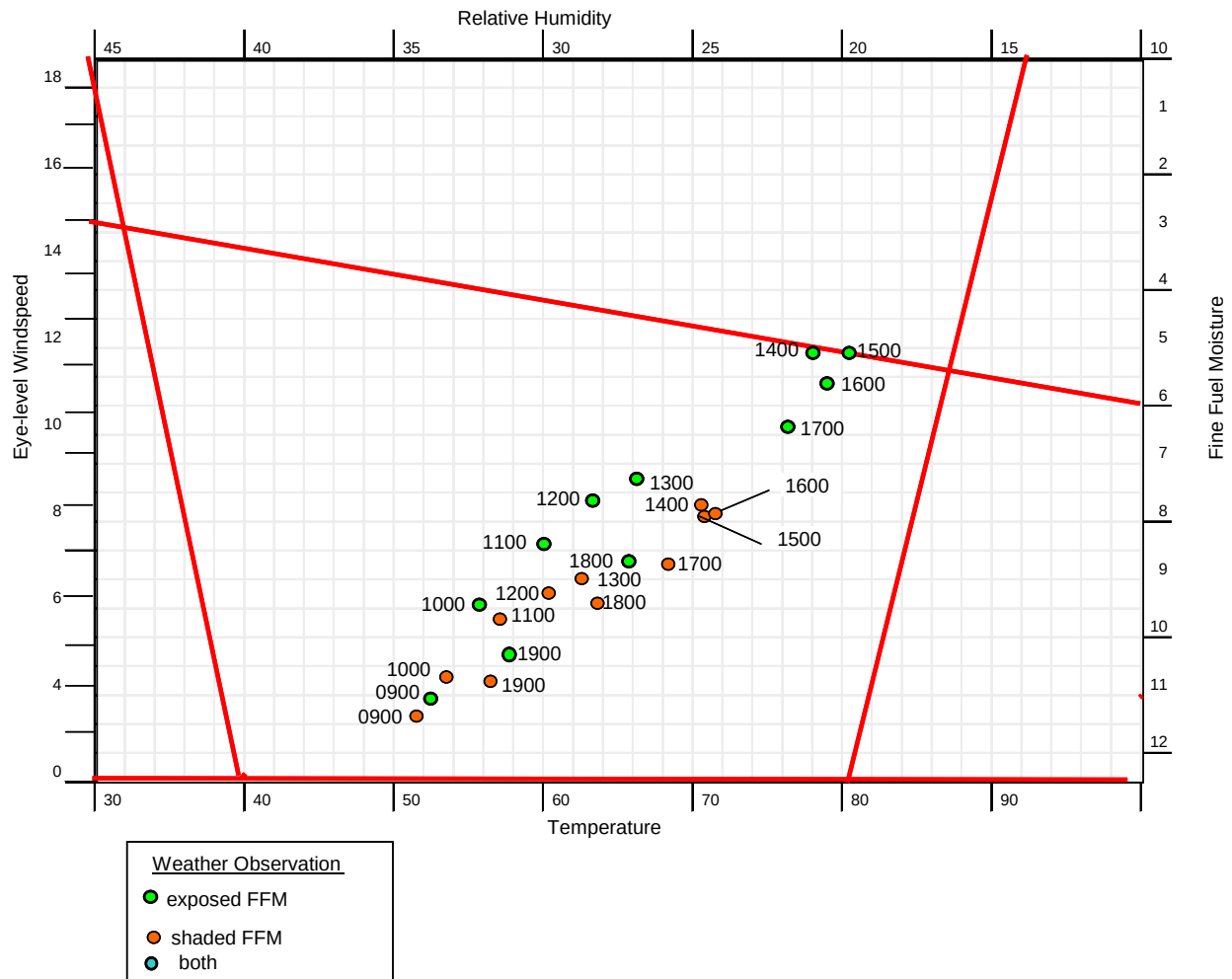


Later in the month, a warm and dry weather pattern moved in, and burning conditions improved. Desired fire effects and behavior occurred at the hot end of the prescription window. Stand replacing fire in conifer stands was achieved in priority areas. See the example Fire Condition Chart from September 27:

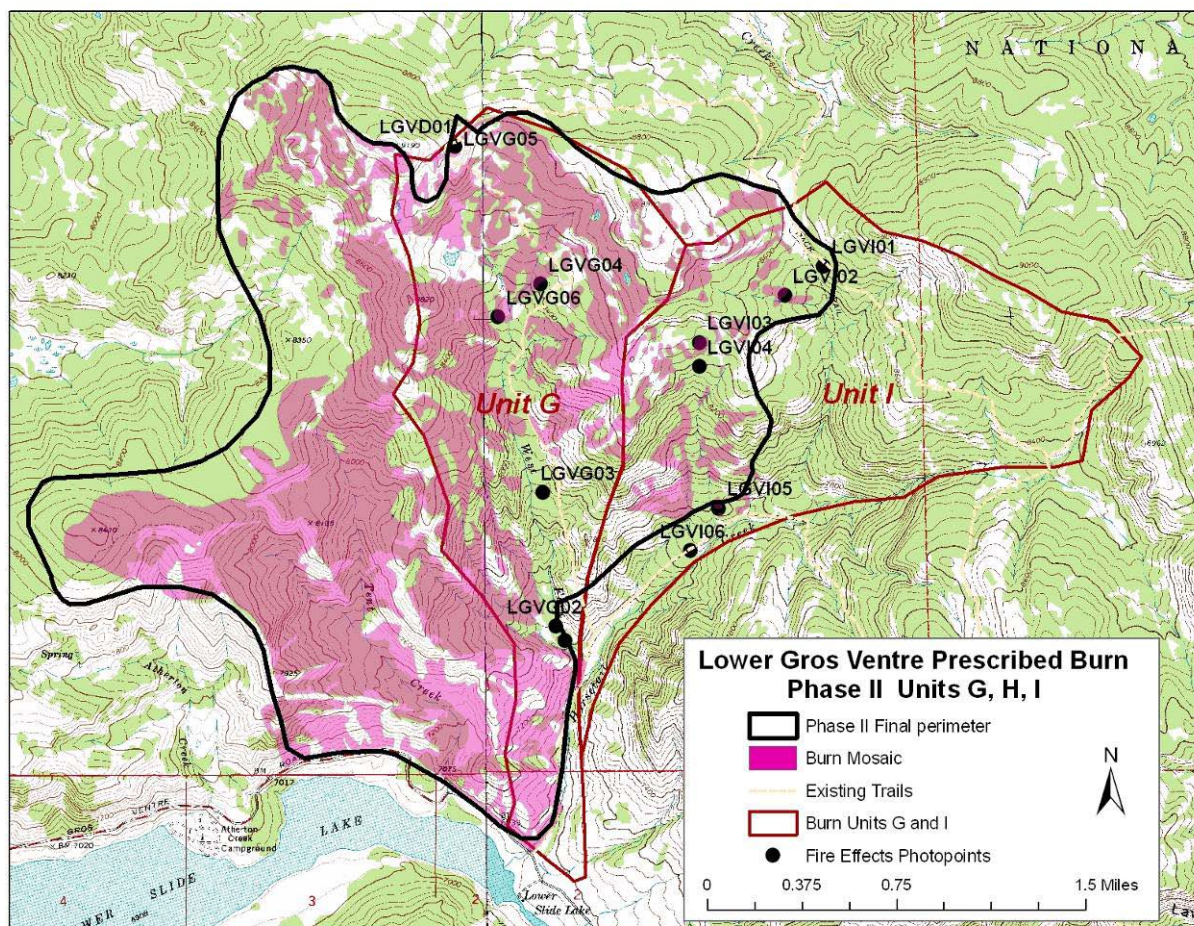
Fire Condition Observation Data Sheet

Date: Sept 27

Unit: G, H, I



In order to assess the burn mosaic with respect to the vegetation objectives and habitat priorities, a post burn fire effects map was produced. Source data for the map included digital photographs taken from overflights and interviews with burn personnel.



Due to the excellent burning conditions, the target area was expanded to include portions of the Tent Creek drainage, planned for implementation in Phase III. A majority of Unit I could not be treated, however, due to risk of unwanted fire spread to the West. The burn mosaic map was compared to the target priority habitat polygons in a GIS, with the following results:

	Acres	Percent Treated
Size of 2009 burn perimeter	3143	53%
Total acres within burn mosaic (Acres treated)	1657	
Area within 2009 priority burn area polygons (wildlife habitat)	2737	61%

Unfortunately, neither of the aspen stands where pre burn monitoring occurred was burned in the fall prescribed burn. Several of the permanent photopoints did experience fire, with severity ranging from low to moderate-high. Photopoints that did not burn were removed.

Low Severity



Pre Burn



Immediate Post Burn (some snow showing)

Moderate-High Severity



Pre Burn



Immediate Post Burn



Pre Burn



Immediate Post Burn

Lower Gros Ventre Prescribed Burn Units J & K

The Lower Gros Ventre burn project is split into several units, labeled A through K. In the fall of 2008, the westernmost units J and K were completed. This 5908-acre area consists mainly of sagebrush and mixed conifer vegetation, with some aspen forest. It is particularly important habitat for big game species throughout the year, especially for bighorn sheep. Several organizations including the Foundation for North American Wild Sheep and the Wyoming Governor's Wildlife Task Force helped to fund the prescribed burn.

Treatment and monitoring objectives included conifer mortality, aspen regeneration and browse, maintenance of limber pine, reduction of sagebrush density, and improvement of bighorn sheep and elk forage production and nutritional quality. An aspen stand was designated for regeneration monitoring (to be revisited in 2010). Two sagebrush stands (one burned and one control) were monitored pre and one year post burn. Several other permanent photopoints were established to track landscape changes.



*Looking into the aspen monitoring stand (LGVK02)
Immediate Post Burn*



One Year Post Burn

Photopoint LGVK03 shows a very patchy burn mosaic in a sagebrush stand that was monitored in 2009:

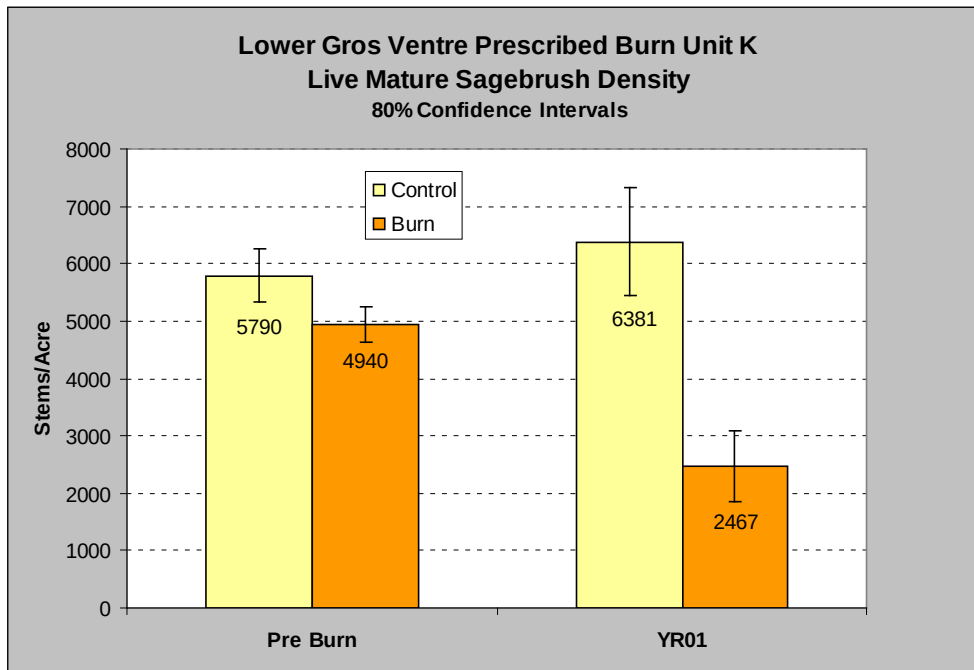


Sagebrush burned stand (LGVK03) Immediate Post Burn



One Year Post Burn

Sagebrush density monitoring was conducted using nonpermanent circular plots in the treated and control stands. The burned stand shows a significant density reduction in live mature plants, with an average 50% percent reduction.



Photopoint LGVK07 shows fire effects to a limber pine community. Objectives called for removal of smaller-diameter limber pine trees, while retaining larger trees ($\geq 16''$ dbh) in areas that would not normally carry fire due to sparse fuels:



LGVK07 Immediate Post Burn

Year one post burn

Northeast Quad Mechanical Treatment and Prescribed Burn

The Northeast Quad project area was identified by the Jackson Interagency Habitat Initiative group because it is important wildlife habitat with potential for aspen enhancement. It is located southwest of the Buffalo Ranger District office, along the Flagstaff Road.

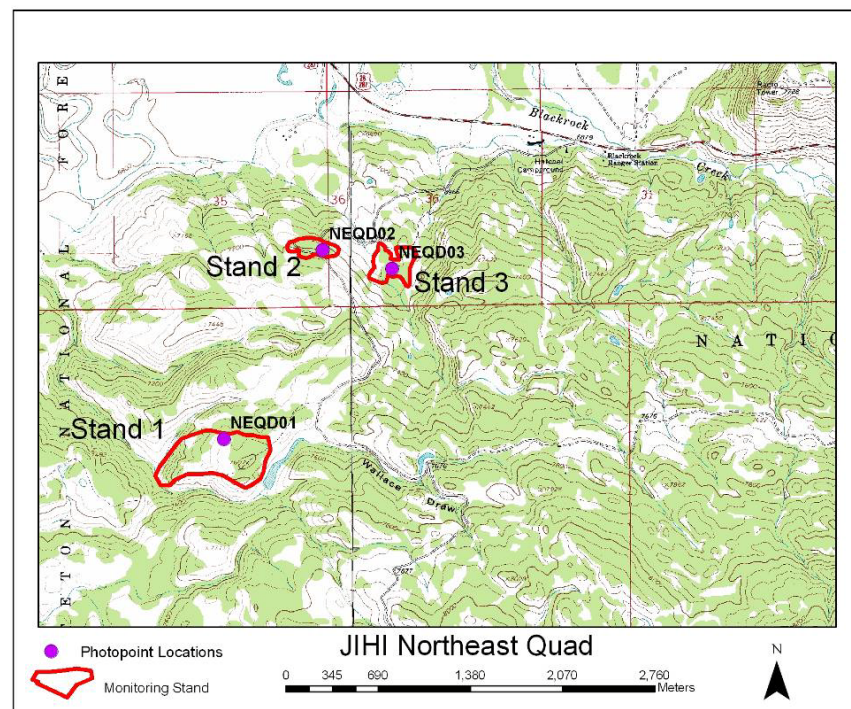
Plans call for a combination of timber sale and mechanical slashing followed up by prescribed fire in a number of units. The monitoring objectives for aspen are as follows:

- Attain ≥ 50 -80% mortality of aspen trees (> 5.9 " DBH) within one year of burn.
- Attain $\geq 85\%$ conifer mortality within one year of burn.
- Attain > 2000 live aspen stems/acre at 6 ft height over 70% of the treatment area with a strong terminal leader within 5 years of burn.
- Attain at least 1000 live aspen stems/acre over 10 ft in height within 15 years post-treatment.
- In treated aspen stands, attain $\leq 20\%$ bare ground cover, within 5 years post-treatment.

Additional objectives for Douglas-fir include:

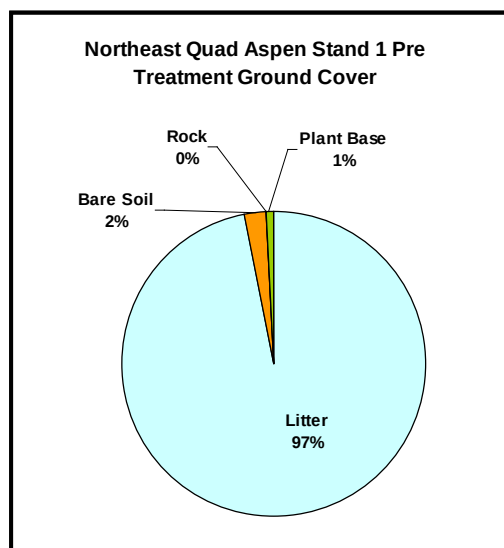
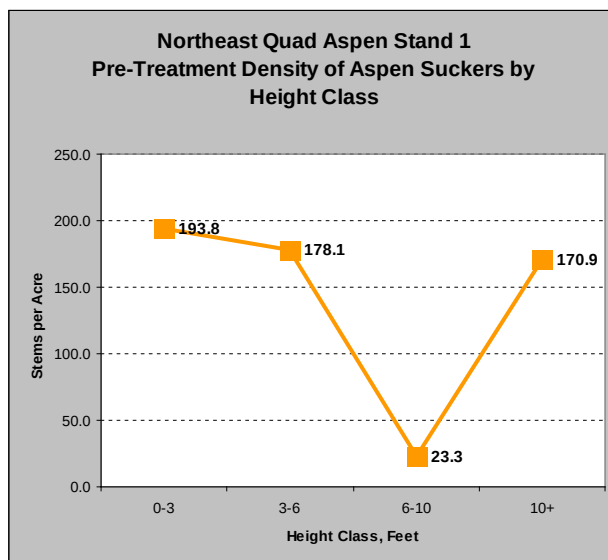
- Maintain 50-80 square feet, basal area of live Douglas fir trees.
- Maintain 10-30% of the existing smaller diameter (<12 " dbh) live trees per stand.
- Leave no more than 13 tons/acre of dead fuel loading, including duff.

One aspen stand and two Douglas-fir stands were chosen for monitoring:



In the Aspen Stand (Stand 1), aspen circular plots were used to monitor pre-burn aspen sucker density, overstory aspen trees, and conifers. The density of aspen suckers is moderate, but overstory aspen are quite sparse. Browsing on suckers was estimated to be 34.8% (+/- 5.4%), which is fairly high. Some suckers and poles have escaped browsing and attained heights over 10 feet, however. Ground cover data was also collected.

Northeast Quad Aspen Stand 1		
	Pre Treatment Stems per Acre	+/- (80% Confidence)
Aspen Suckers	1175.0	152.3
Live Overstory Aspen	14.1	6.8
Dead Overstory Aspen	16.7	4.6
Live Conifers	128.7	28.1



A permanent photopoint was also installed in the aspen stand:



Two Douglas-fir stands were selected for monitoring using Common Stand Exams, Brown's Transects, and Sightability Transects. This data was used to model stand and fuels characteristics using the Forest Vegetation Simulator (FVS). Ten stand exams from the two Douglas fir stands were combined for this analysis:

Pre Treatment Fuels Summary:

Fuel Model	FM8 86%, FM10 14%
Litter Tons/ac	1.52
Duff Tons/ac	10
1, 10, & 100 Hour Fuels Tons/ac	3.5
1000 hour Fuels Tons/ac	7.4
Total Woody Fuels Tons/ac	10.9
Canopy base Height, ft	3
Canopy Bulk Density kg/m3	0.111

Weather Conditions Used:

Severe 97th Percentile Weather

Temp	87°
Wind Speed	15.8
1 hour fuel moisture	3.1
10 hour fuel moisture	4
100 hour fuel moisture	7.8
1000 hour fuel moisture	10.7
Duff moisture	Default=15
Live woody	75.9
Live herbaceous	49.2

High 90th Percentile Weather

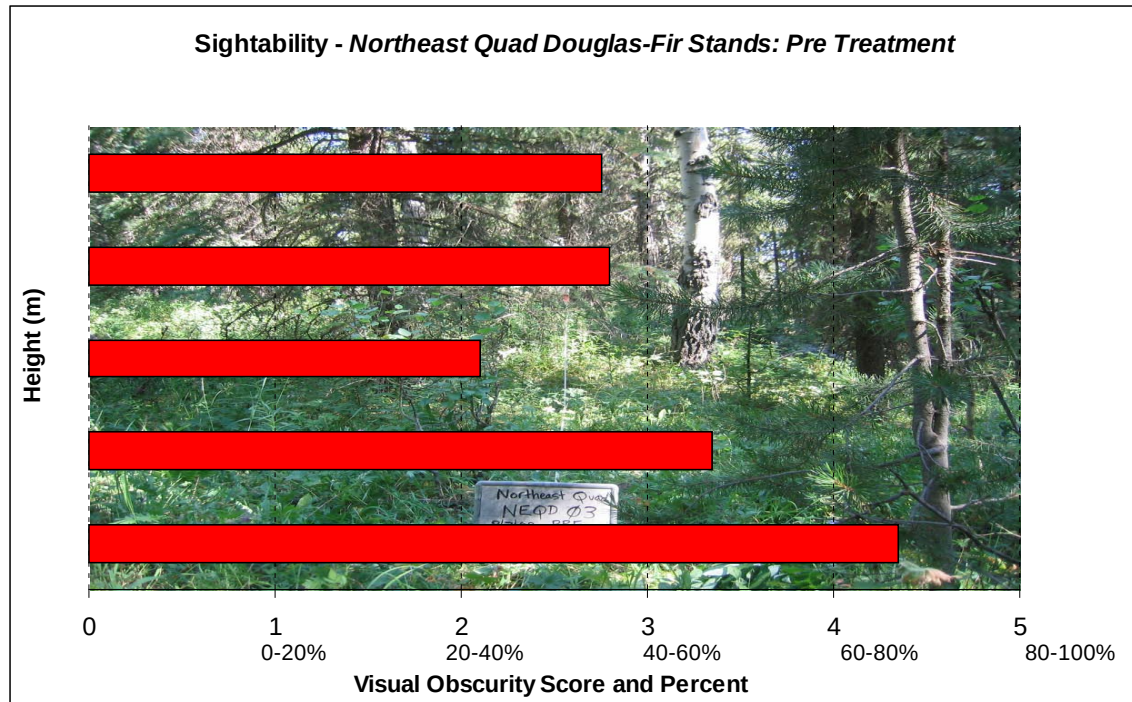
Temp	82°
Wind Speed	11.4
1 hour fuel moisture	2.9
10 hour fuel moisture	4.1
100 hour fuel moisture	9
1000 hour fuel moisture	16.4
Duff moisture	Default=15
Live woody	80.4
Live herbaceous	55.4

Moderate 75th Percent Weather

Temp	79°
Wind Speed	8.2
1 hour fuel moisture	5
10 hour fuel moisture	6.8
100 hour fuel moisture	13.7
1000 hour fuel moisture	20.7
Duff moisture	Default=15
Live woody	122.5
Live herbaceous	98.7

Pre-Treatment Fire Behavior Summary According to Weather Indices:

	Moderate 75 th %	High 90 th %	Severe 97 th %
Surface Flame Length, ft	1.1		1.8
Fire Type	Surface Fire		Surface Fire
Probability of Torching	100%		100%
Torching Index, mph	52.1		48.7
Crowning Index, mph	21.6		21.6
Potential mortality, % of BA	45%		46%
Potential Smoke tons per acre <2.5	0.17		0.18



Permanent photopoints were also taken in the two Douglas-fir stands:



Stand 2: Note sightability board in background

Stand 3

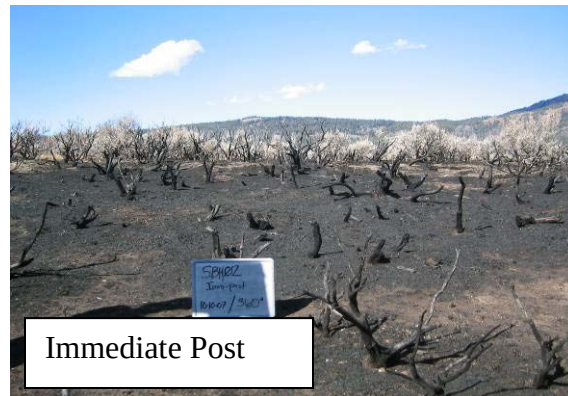
South Burro Hill Prescribed Burn

The South Burro Hill prescribed burn was conducted in September of 2007. The unit is located on a south-facing slope, over-looking the Buffalo Fork River valley and is comprised primarily of sagebrush with small aspen stands. The purpose of the project was fuel reduction in the vicinity of developed areas.

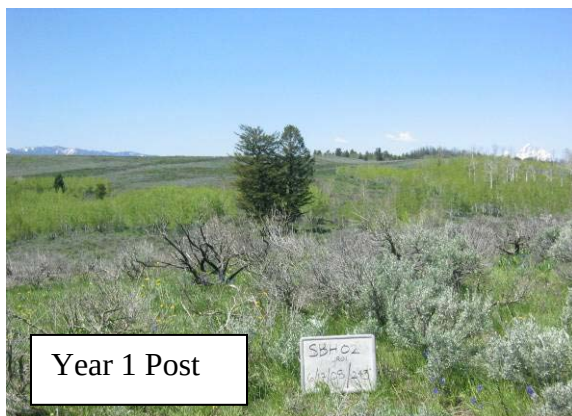
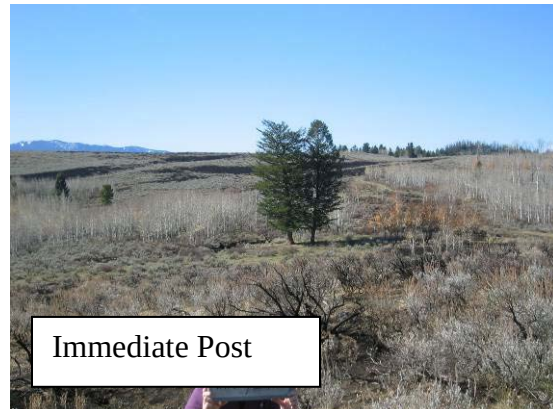
The fire effects monitoring objectives were stated as follows:

- Obtain an immediate post burn severity rating of 3 or less, immediately post burn, across the sagebrush in the burn unit.
- Within sagebrush vegetation in project area reduce total live sagebrush density by a minimum of 50% immediately post burn.
- Increase forb and native grass cover in burned sagebrush by at least 25% by one year post burn
- These objectives were monitored in previous years, however the Year 2 post burn photopoints were retaken in 2009:

SBH01



SBH02



Appendix D

Bridger-Teton National Forest East Zone 2009 Fire Effects Monitoring Report

Chicken Creek Prescribed Burn

The Chicken Creek prescribed burn was implemented in the fall of 2009. It was a 1285 acre project with sagebrush, aspen, conifer, and willow vegetation. Much of the aspen was encroached by conifers (mainly limber pine). Many of the aspen stands also showed reduced vigor compared to the sizes of boles on the ground remaining from decades earlier.

The objectives of the Chicken Creek burn were as follows:

- Treat 30-50% of sagebrush with 15% canopy cover or greater in a mosaic pattern over the landscape
- Attain 60% ground cover in treated sagebrush/grass areas within 2 years post burn and 80% within 5 years post burn
- Attain 1000 stems per acre in burned aspen areas that are 10 feet tall within 15 years.

Burn Mosaic:

Using photographs taken from an airplane, it was possible to make a partial map of the burn mosaic at Chicken Creek. Unfortunately, snow shortly after the burn prevented a final mapping flight, however. In order to obtain a final map, photographs from aerial detection flights or helicopter missions in the area will be needed early in the 2010 season.

Photopoints:

Permanent photopoint retakes show the fire effects on sagebrush and aspen vegetation:



Pre Burn view in sagebrush

Immediate post burn



Immediate post burn in aspen

Ground cover and aspen regeneration will be measured in the next few years.

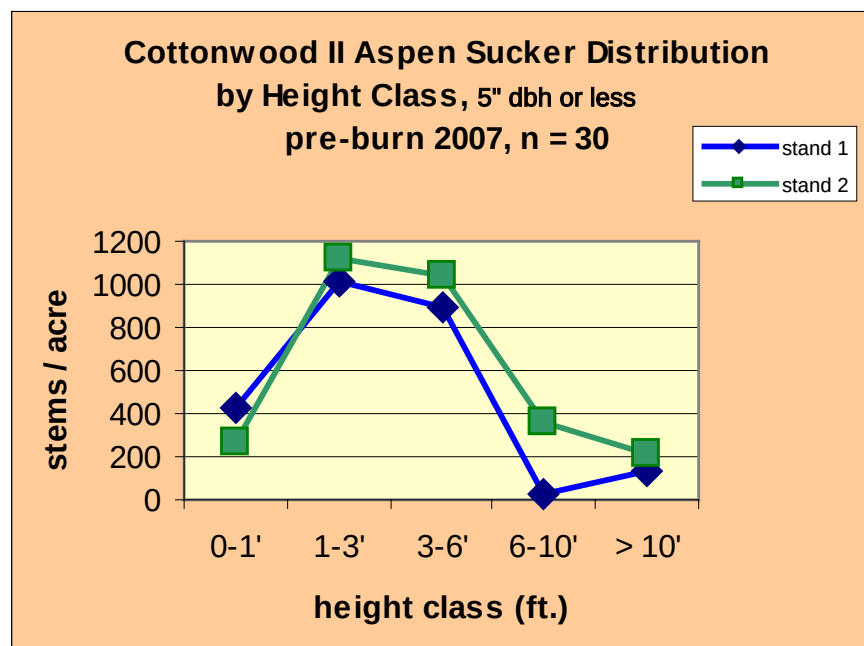
Cottonwood II Slashing and Prescribed Burn

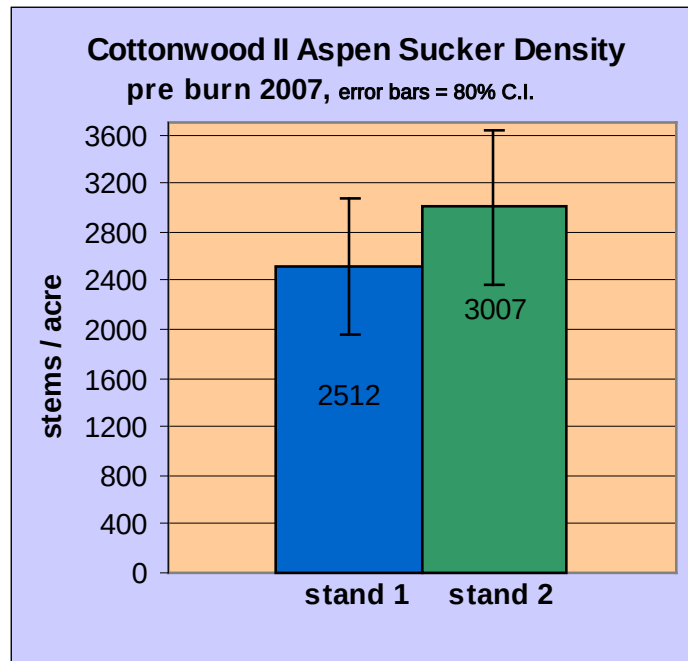
Cottonwood II is a mechanical thinning and prescribed burn project, similar to the Maki aspen enhancement project. Both feature similar objectives and utilize similar implementation tools to expand the treatment across additional acres on the landscape.

Monitoring objectives include aspen and ground cover targets that will ultimately show the reduction of conifer encroachment and a return a young aspen forest:

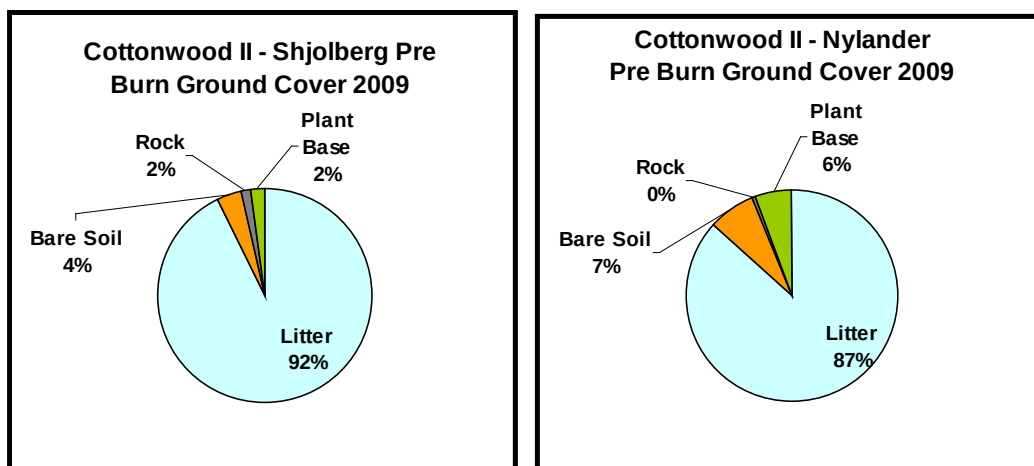
- Attain > 1000 stems per acre in burned aspen areas ≥ 2 meters tall within 15 years post burn.
- Attain 60% ground cover in burned aspen areas within 2 years post burn and 80% within 5 years post burn.

Two stands within the Cottonwood II burn unit were targeted for treatment and monitoring: stand one, in the Sjholberg drainage and stand two, in the Nylander drainage. Aspen sucker density data was collected in 2007. Stands one and two have pre-burn aspen sucker density ranges of 1955 – 3069 and 2377 – 3637 stems per acre, respectively. The values are reported as 80% confidence intervals. Both stands also have the majority of aspen suckers distributed in the height classes between 0-6 feet tall. Only a small number of aspen suckers per acre are over 10 feet in height. Browse utilization of total aspen suckers is 17% in stand one and 13% in stand two.



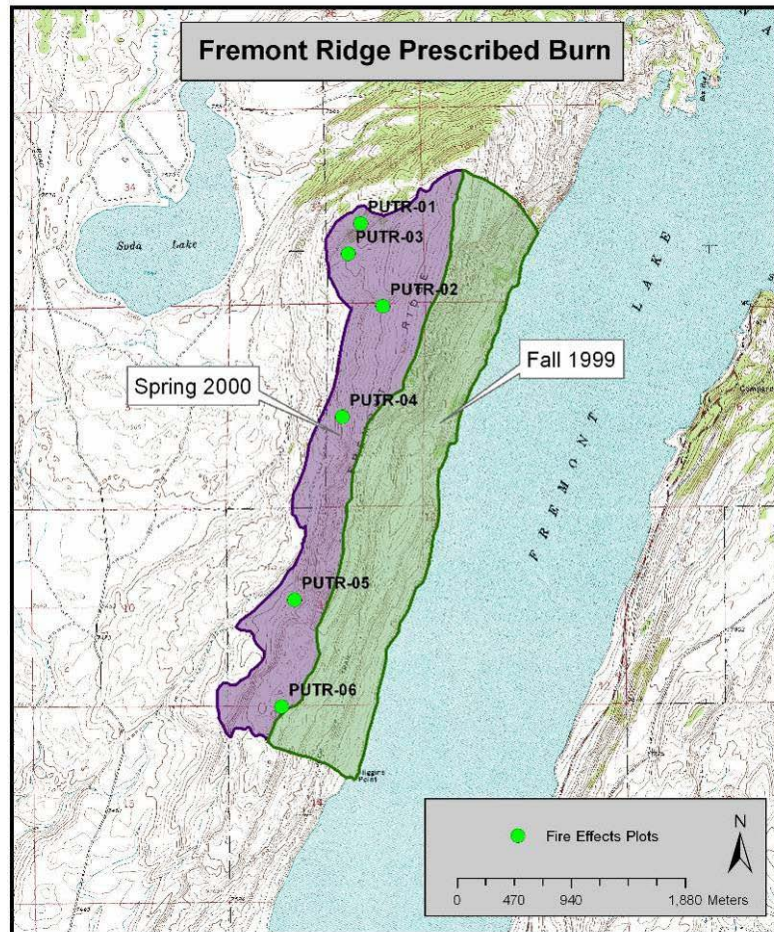


Ground cover pre treatment is summarized in the figure, below.



Fremont Ridge Prescribed Burn – Year 10

The Fremont Ridge prescribed burn is one of the oldest projects monitored by the Interagency Fire Effects Crew. The 1418-acre area was burned using two entries in the fall of 1999 and the spring of 2000.



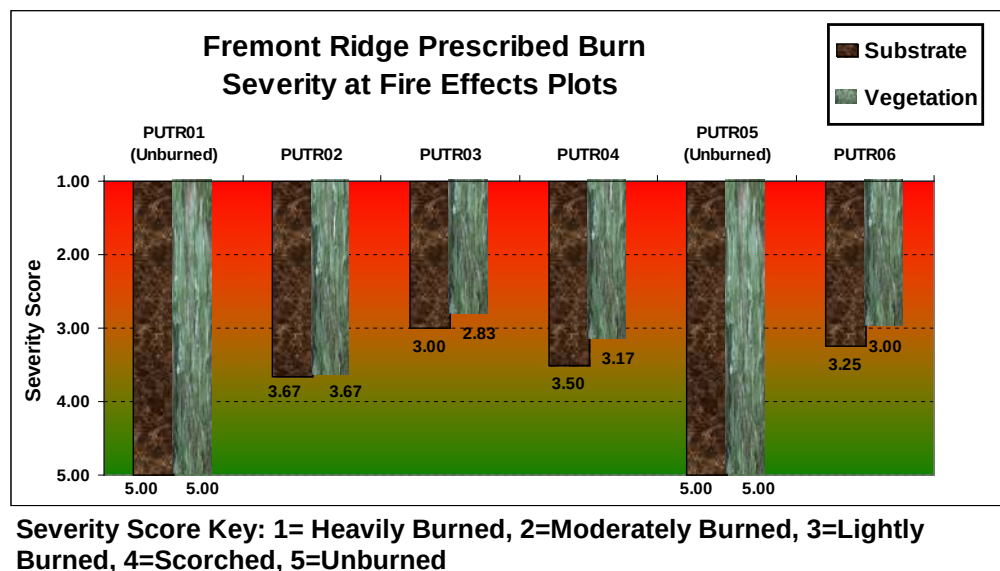
The vegetation on Fremont Ridge is dominated by a sagebrush-bitterbrush mix (*Artemisia tridentata* var. *pauciflora* and *Purshia tridentata*) with an understory of bluebunch wheatgrass (*Pseudoroegneria spicata*), Idaho fescue (*Festuca idahoensis*) and needlegrasses (*Hesperostipa commata* and *Achnatherum* spp). Forbs include low growing species such as wild buckwheat (*Eriogonum umbellatum*) and Hood's phlox (*Phlox hoodii*), as well as balsamroot (*balsamorhiza sagittata*) and stoneseed (*Lithospermum ruderales*). The area is important winter range for elk. The objectives for the burn, written in 1999, are as follows:

- Detect at least a 200% increase in bitterbrush density three years post burn.
- Detect a 50-80% reduction of sagebrush cover post burn.
- Increase grass and forb production by 100% two years post burn and 250% 5 years post burn.

Six FMH-style brush plots were installed in random locations on the west portion of the burn unit (fall ignition area). Each of these plots included two permanent photopoints, a shrub belt, a line-intercept shrub transect, and a point-intercept cover transect. Burn severity data was also collected immediately post burn. In 2009, the fire effects crew collected data representing ten years post burn.

Burn severity:

Four of the six randomly-located fire effects plots were burned. The severity levels to substrate and vegetation averaged at the level of “lightly burned.” In sagebrush vegetation, this represents moderate to good consumption of shrub branches and trunks.

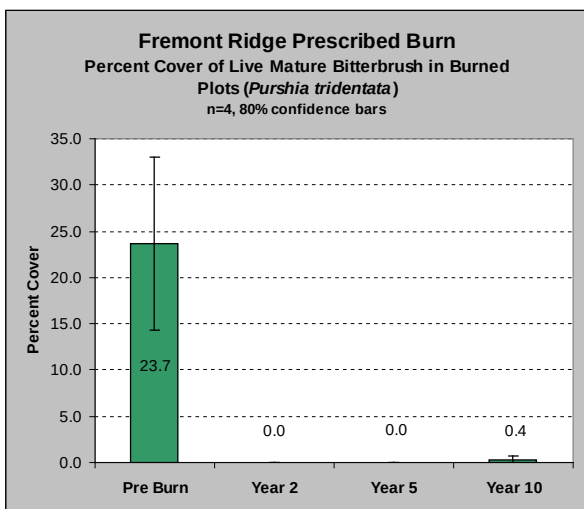
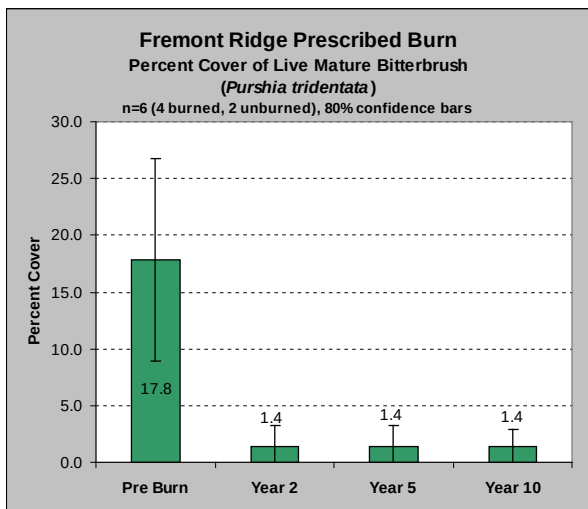


Bitterbrush Cover and Density:

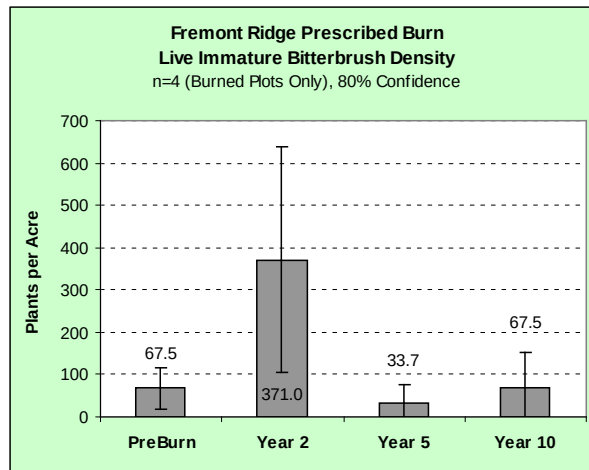
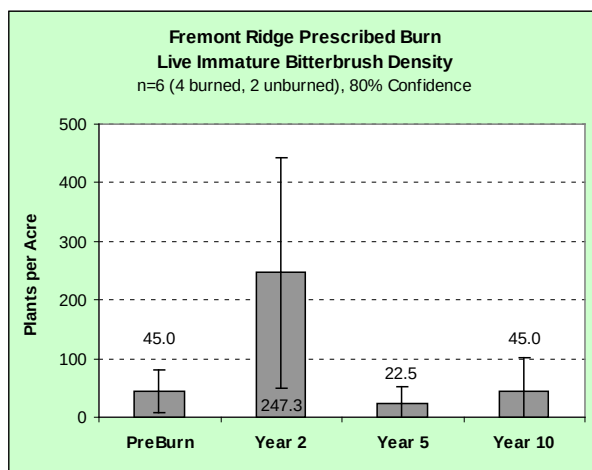
The objective developed in 1999 for bitterbrush density called for a 200% increase, only three years post burn. While no data was collected in Year 3, the Year 1 and Year 5 density is far below the desired level, with only approximately 8% of the pre burn cover remaining according to the six plots (two of which did not burn). Among the 4 burned plots, no live bitterbrush remained in Year 2 or year 5. By Year 10, bitterbrush is just starting to return to the plot transects.

Given the fire ecology of bitterbrush, it is unrealistic to expect a full recovery of percent cover in such a short time, let alone a twofold increase. Bitterbrush will resprout following fire, but subsequent survival is somewhat dependent on environmental factors such as drought. Other burned areas monitored by the Fire Effects Crew show only approximately 30% of pre-burn cover at 10 years post burn. Re-establishment through seeding is also a slow process.

The following cover data was derived from line intercept transects:

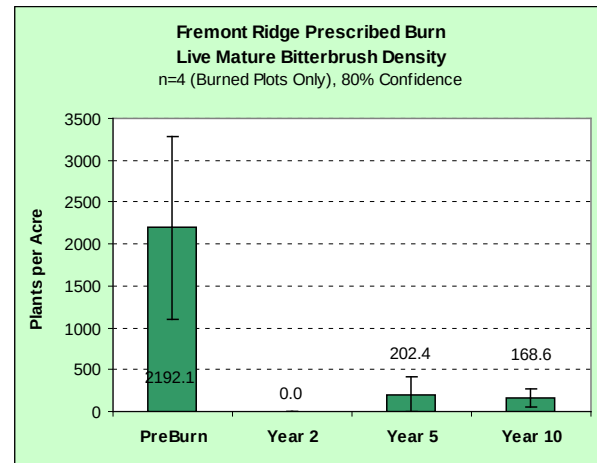
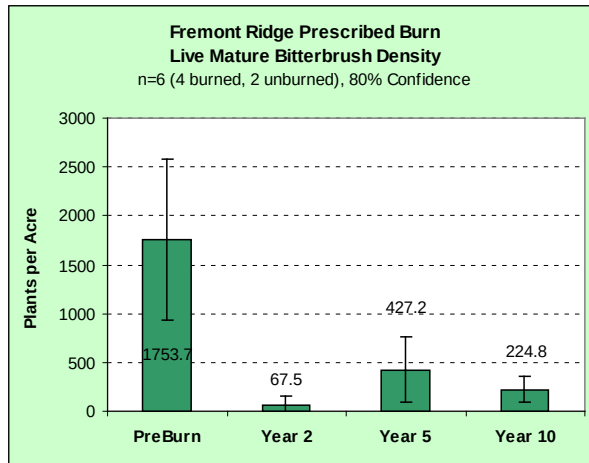


Bitterbrush density was also monitored at the six plots at Fremont Ridge. Six belt transects (1m x 30m) were used to count seedlings, resprouting plants, and mature plants. Seedlings and resprouts that are less than 15cm in height are categorized as “immature.” The results are graphed separately below for all six plots and the four burned plots.



In Year 2 post burn, a flush of immature plants was evident in some of the plots (error bars are large because all plots did not contain bitterbrush). In Years 5 and 10, the density decreased, possibly due to either 1) plants growing taller than 15 cm; or 2) plants dying. Statistically, there is not a significant difference in seedling density (at the 80% confidence level) except between Years 2 and 5.

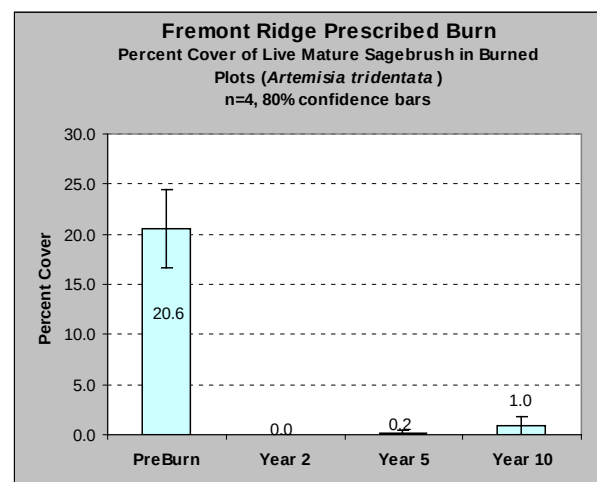
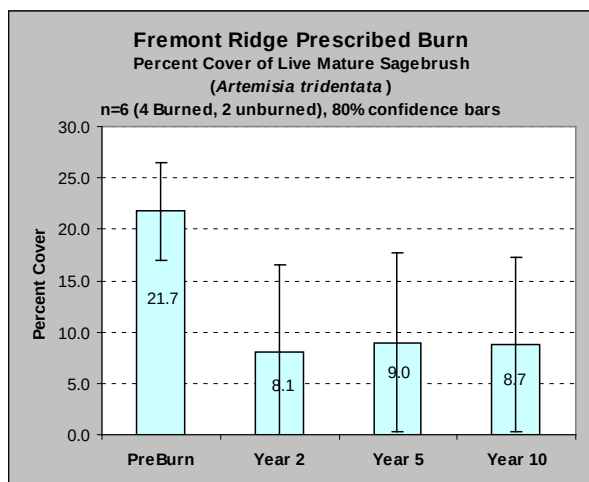
Mature bitterbrush density from the six plots and four burned plots is shown below.



Mature bitterbrush density was significantly reduced in Year 2 to an average of 5% of preburn density, and completely eliminated in the four burned plots. In Year 5 and Year 10, mature plants began to gradually return to the sites, but to a level only 6% of preburn levels (for burned plots in Year 10).

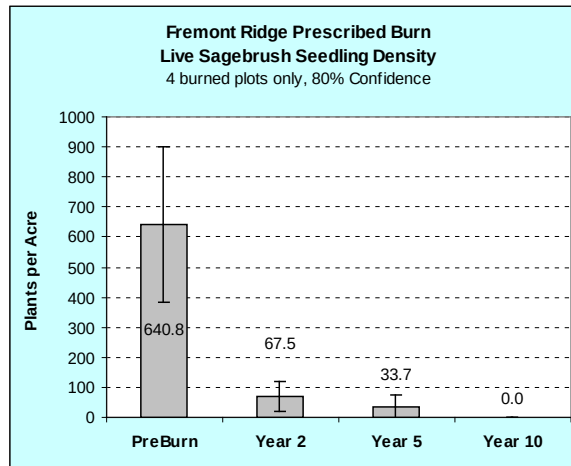
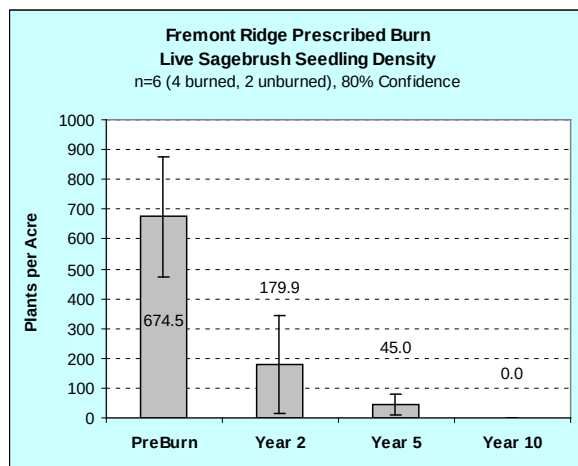
Sagebrush Cover and Density:

Project objectives for sagebrush called for a reduction of between 50% and 80% of the preburn cover. This objective was for the entire burn unit. According to the six plots (four burned and two unburned) the overall reduction in percent cover averaged 62%. This had statistical significance at 80% confidence. The portions of the unit that burned had very high mortality of sagebrush (according to the burned plots) and are only beginning to show the return of mature plants (1% cover).

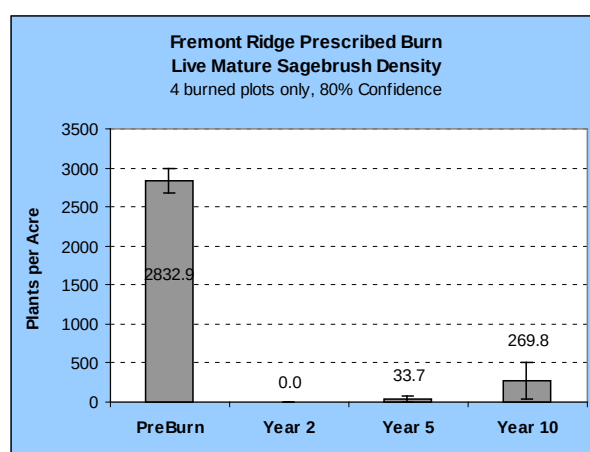
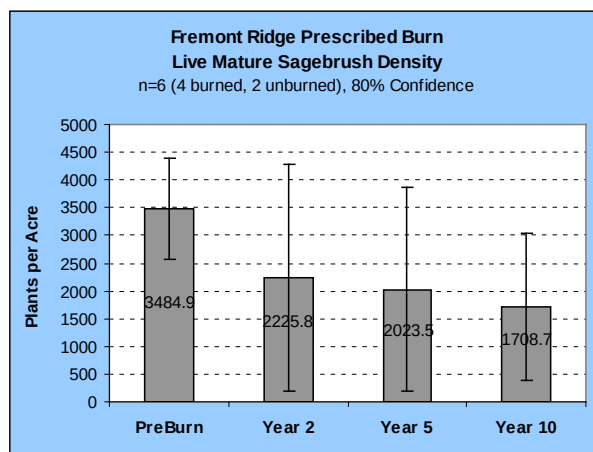


Sagebrush density belts show the change in stems per acre of both seedlings and mature plants. Seedlings are defined as individuals less than 15cm tall. Despite the age of the pre burn shrub community, seedlings were most numerous pre burn. Since the treatment, they have dropped out

of the picture in both burned and unburned plots, possibly due to climatic factors or competition from grasses and forbs.

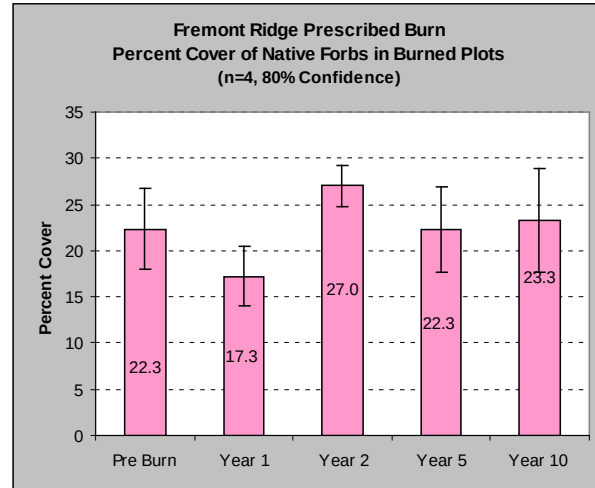
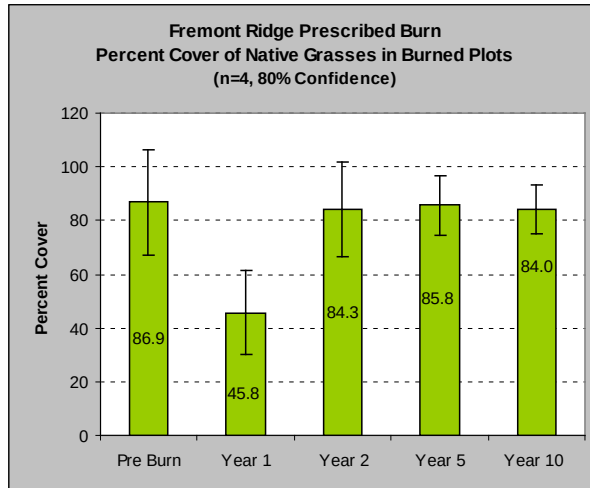


Mature sagebrush density was reduced by an average of 36% over all six plots. All of the mature sagebrush was killed in the burned plots. By year 10 post burn, mature plants were beginning to appear once again in the belt samples, but only approximately 10% of the pre burn density has recovered.



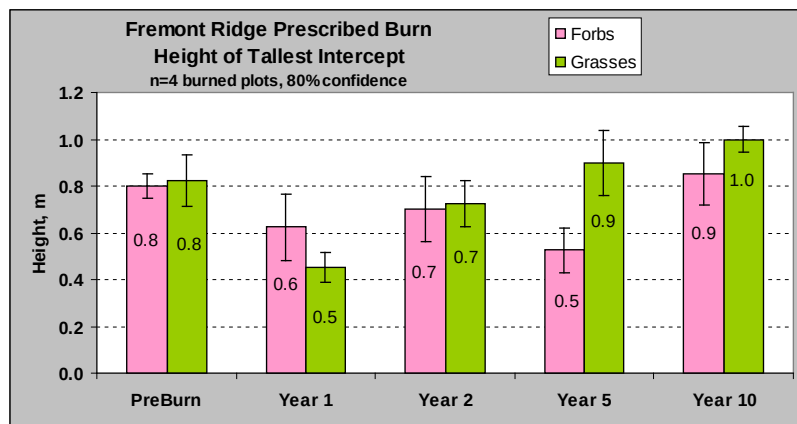
Grass and Forb Cover:

Wildlife habitat objectives for Fremont Ridge called for increases in grass and forb production that would enhance forage quantity and quality for wintering elk. Actual production was not measured, however. Instead, percent cover and height of first intercept was used to represent the change in the herbaceous component. Point intercept transects were used to gather data about the percent cover of each species. With only four burned transects, the data was lumped into life form in order to derive more meaningful interpretations.

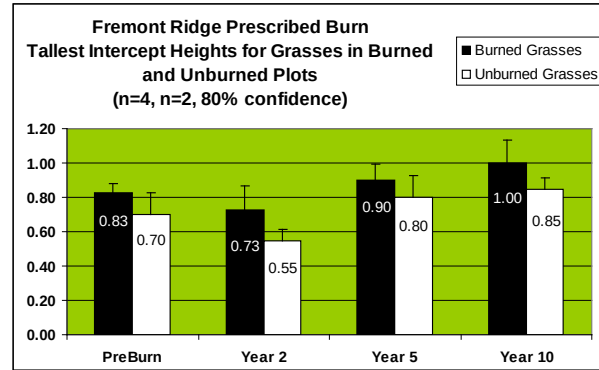
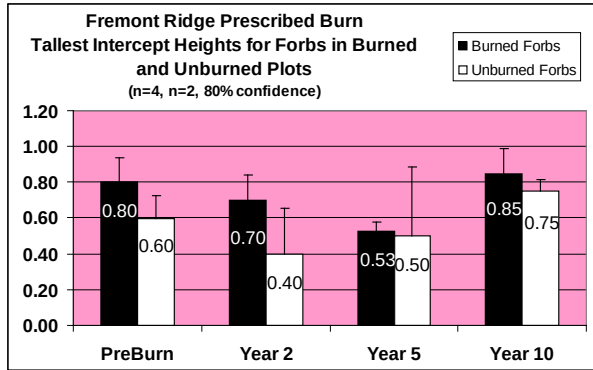


During the first growing season after the burn, grass and forb cover was reduced. This is usual. After a full year of recovery, however, there was no significant change from pre-burn levels. The cover of both forbs and grasses has remained relatively consistent since.

Production may also be inferred from plant height. For the four burned plots, the height of the tallest intercept for each of the 100 transect points was used to determine if a measurable increase had occurred. According to the data, however, no statistical difference can be inferred.



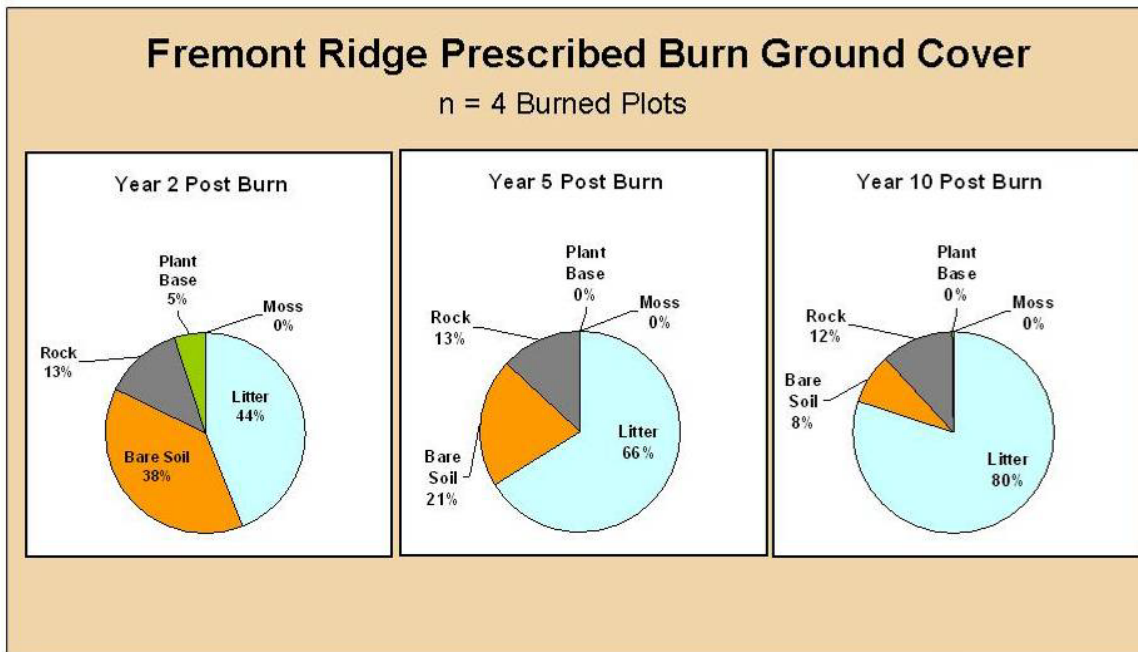
It is quite likely that annual precipitation has a large influence on herbaceous production. The following graphs compares the heights of forbs and grasses in burned vs. unburned plots. While the means are greater for the burned plots (even for preburn sampling), there is no statistically significant difference to be inferred.



Ground Cover:

In order to assess the recovery of litter on the burned ground surface, ground cover data was collected in addition to plant species on the point intercept transects. This allowed 100 data points to be classified as bare soil, plant base, litter, or rock at each of the six transects.

Ground cover is important for protecting the soil from erosion and invasive species. Usually it takes a few years for litter to accumulate naturally, but sometimes livestock or wildlife use can delay this recovery.



From the graph above, showing only the burned plots, it is clear that the percent cover of litter has increased since the burn, so that there is less than 10% bare ground.

Conclusions:

From data obtained at six FMH brush plots (four of which burned), it appears that some of the project objectives were met, while others were not. There was certainly not a 200% increase in

bitterbrush density three years post burn. This objective, however, is not realistic or supported by the literature. If bitterbrush recovery is a primary objective in future projects, a different monitoring approach could be chosen that would obtain a larger and more reliable sample size.

Sagebrush reduction objectives are difficult to evaluate statistically for the overall project with only six plots. In the four burned plots, sagebrush was reduced by 100%, but a burn mosaic map would be needed to better evaluate the percent reduction over the entire burn unit. Also, no plots were installed in the eastern half of the unit that was burned in the fall of 1999. It appears from visiting the unit, however, that the sagebrush objective was probably achieved.

Fire effects plot data for herbaceous cover and height did not indicate a significant difference at Fremont Ridge after the burn, let alone the 100%-250% increases desired. Plot photos show a much more productive looking appearance, however. Without actual paired control vs. treated clipped production sampling, this objective is difficult to evaluate.



Plot 3 - Pre Burn



Plot 3 – 10 Years Post Burn

Horse Creek Fire Aspen

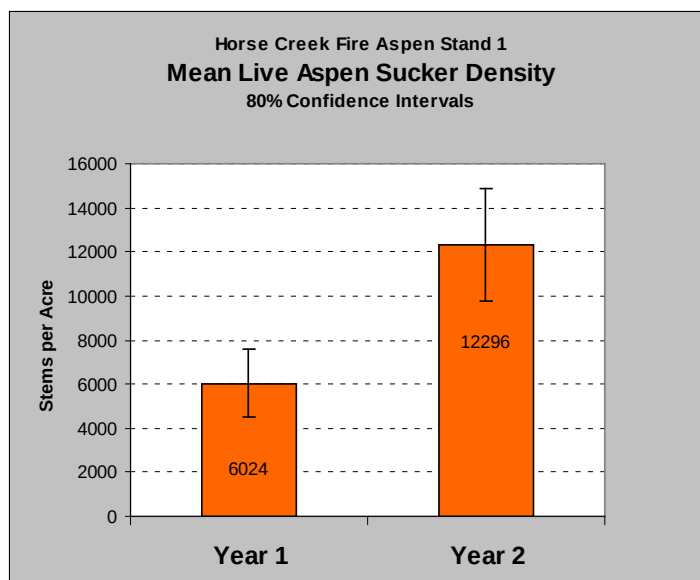
The 9600 acre Horse Creek Fire occurred during the summer of 2007. It was located on the Piney Front foothills of the Wyoming Range, in the Big Piney Ranger District. The fire was human caused and managed for suppression.

Mixed aspen and conifer forest was burned, and widespread aspen regeneration occurred, mainly in previous aspen forest, but also in burned conifer areas. The East Zone fire management organization and Wyoming Game & Fish Department biologists became interested in monitoring the reforestation by aspen in the burned area. With the local elk population above the herd size objective, and potential cattle grazing, it is possible that browsing pressure could threaten the aspen recovery.

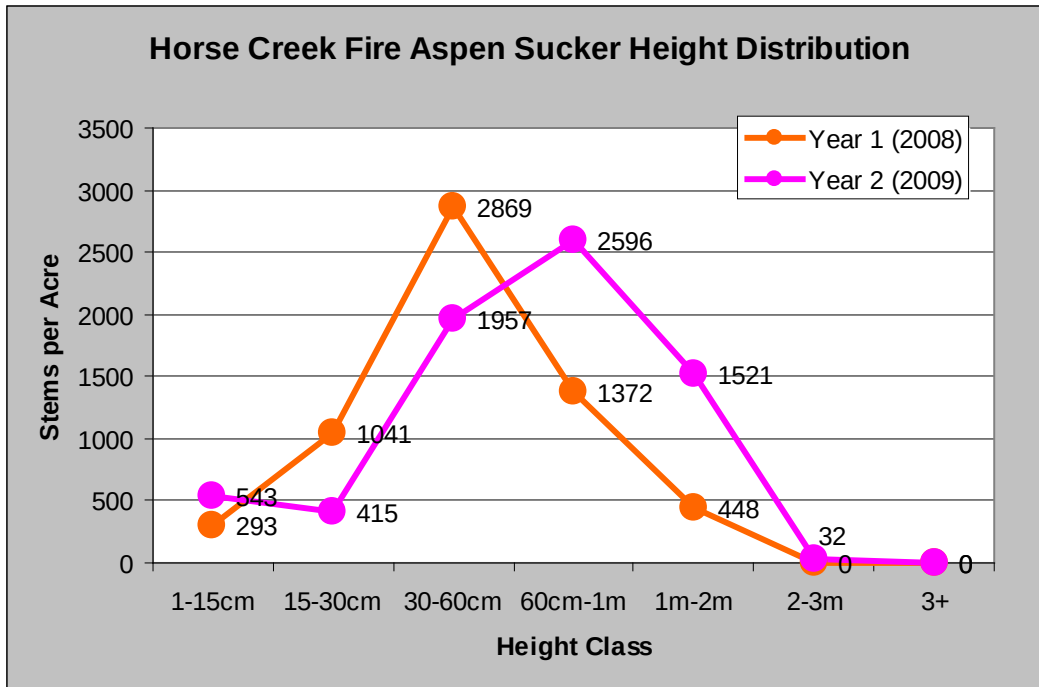
In 2009, the Fire Effects Crew and WGFD biologists revisited the aspen monitoring stand to retake photopoints, estimate sucker density nad height, and add ground cover monitoring to the data collection. Objectives were stated as follows:

1. Attain 1000 stems per acre in burned aspen areas ≥ 2 meters tall within 15 years post burn.
2. Attain 60% ground cover in burned aspen areas within 2 years post burn and 80% within 5 years post burn.

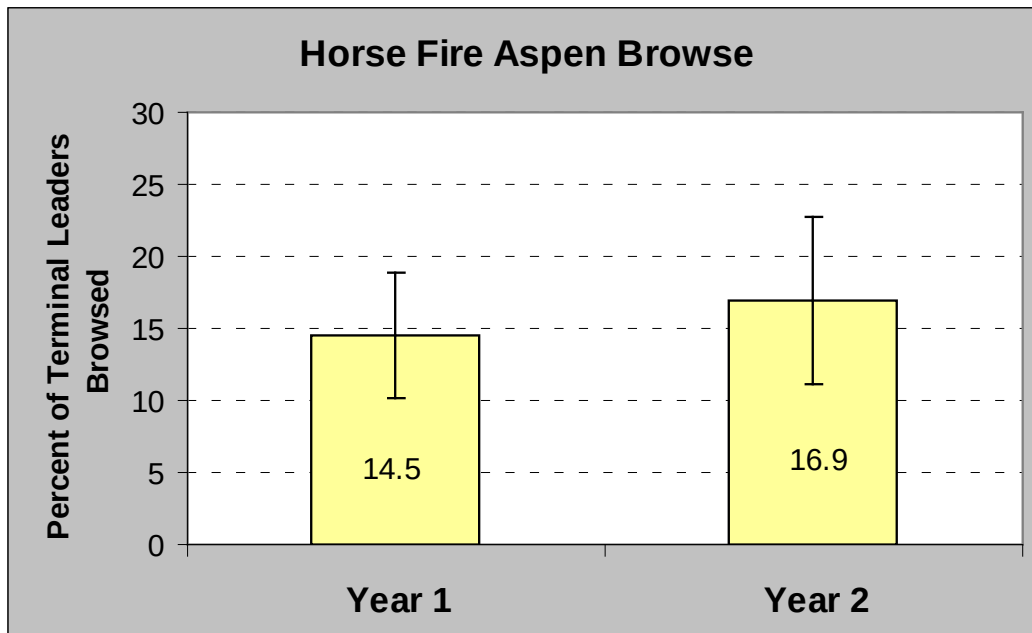
Non-permanent aspen circular plots were used to determine live aspen sucker density. Because aspen and conifer patches occur together in the stand, plot locations that did not have aspen presence were rejected. Specifically, at least one live or dead overstory aspen or one live aspen sucker had to be present in the plot for it to be counted.



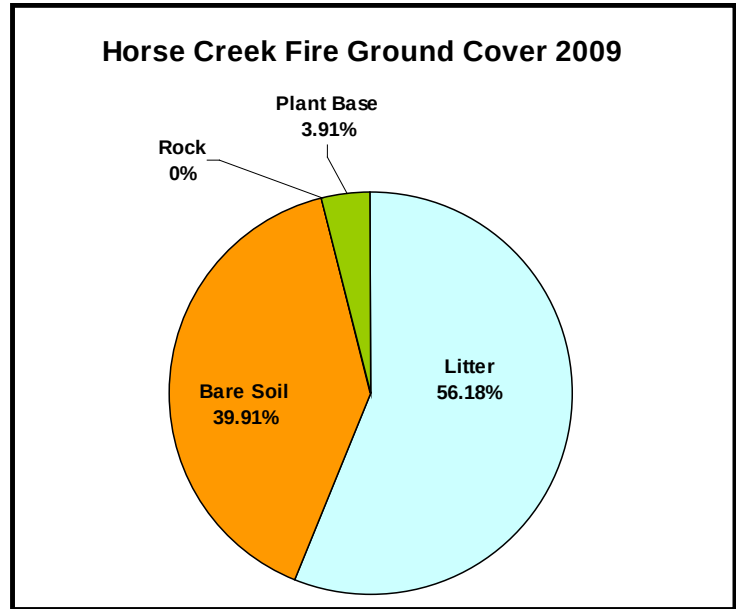
Aspen suckers per acre have nearly doubled in the second growing season post burn. Height distributions of suckers have begun to increase as well. The mode height class is now between 60cm and 1 meter tall. Some individuals have exceeded 2 meters in height already.



Aspen browse on terminal leaders has been low to moderate, as the chart below shows.



Ground cover measurements taken from 22 randomly located transects within the aspen monitoring stand show that there is almost 40% bare ground in Year 2 post burn. This contrasts with the 10-20% usually found in aspen stands treated by prescribed fire in the first few years post treatment. Ground cover will continue to be tracked until it reaches 80%



Photopoints from Year 1 and Year 2 post burn show how the aspen stand has regenerated.

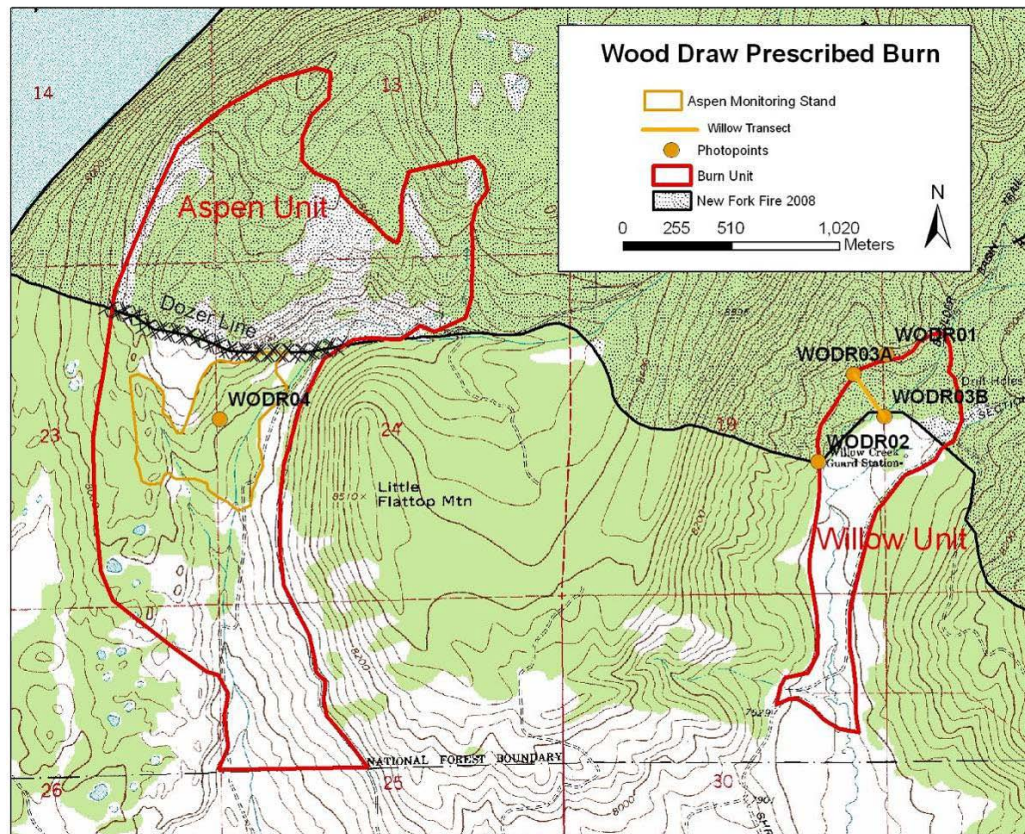


One year post burn

Two years post burn

Little Flat Top Wood Draw Prescribed Burn

The Wood Draw portions of the Little Flat Top prescribed burn project area were burned in the spring of 2007. Included were a 742 acre area of aspen forest and a 147 acre willow community along Willow Creek in the foothills of the Wind Rivers.



Aspen Unit:

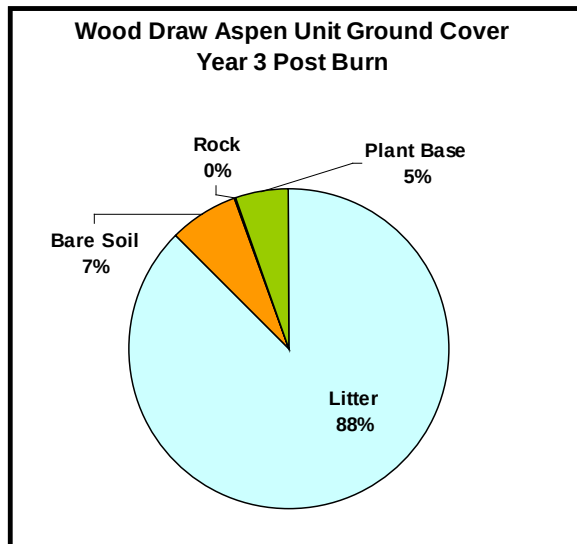
Objectives for the aspen portion of the burn area were as follows:

- 1) *Attain 1000 stems per acre in burned aspen areas $\geq$ 10 feet tall within 15-years post burn.*
- 2) *Attain 60% ground cover in burned aspen areas within 2-years post burn and 80% within 5-years post burn.*

In 2008 the 15,089-acre New Fork wildland fire prevented Year 2 post burn aspen and ground cover monitoring at Wood Draw. In 2009, this data was collected by the Fire Effects Crew and Wyoming Game & Fish biologists in the designated stand (see map, above).

In year 3 post burn, aspen sucker density was 7333.3 stems per acre $\pm$ 1731. 11.6% ($\pm$ 2.8) of the leaders were browsed.

Ground cover has already met the Year 5 post-burn objectives according to the Year 3 data.



Wood Draw Aspen Stand – Year 3 Post Burn

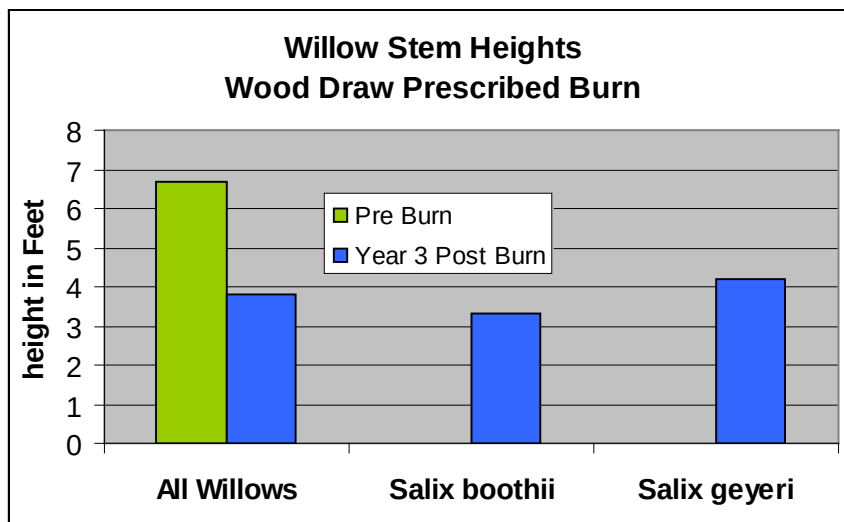


Willow Unit:

Willow objectives included:

- 3) *Within burned areas, attain willow height greater than or equal to mean pre-burn willow height within 10-years post burn.*
- 4) *Attain at least 30% increase in the proportion of live to dead willow stems within 3-years post burn.*

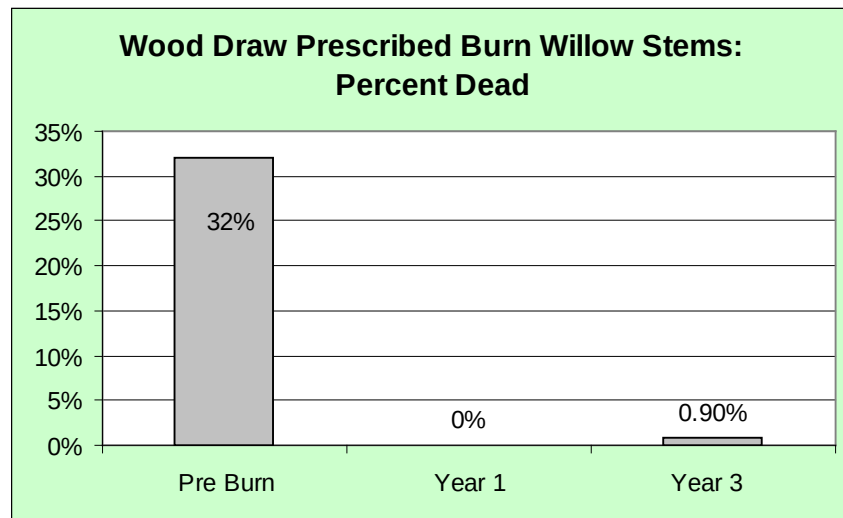
The willow height transect was measured with a maximum of 11 feet. All stems taller than that were recorded as 11. Therefore, the mean heights given here are not true averages. According to this data, willows have not yet attained pre-burn height.



It does not appear that browsing by ungulates is likely to hamper the growth of willow stems, because browse levels were fairly low. Willow browse utilization in Year 3 is summarized below:

	Percent of stems browsed
Overall	23.4%
<i>Salix boothii</i>	28.3%
<i>Salix geyeri</i>	20.1%

Live-to-dead ratios of willow stems have changed considerably since the burn:



Wood Draw Willows Immediately Post Burn



Year 3 Post Burn

Maki Creek Slashing and Prescribed Burn

By: *Eric Maichak – Big Piney Brucellosis-Feedground-Habitat Biologist, Wyoming Game & Fish Department*
 Jill Miller – Pinedale Terrestrial Habitat Biologist, Wyoming Game & Fish Department

The primary goal of the Maki Creek Aspen Enhancement project was to rejuvenate conifer-encroached aspen stands and decadent mountain big sagebrush communities, and its completion is the result of nearly 20 years of planning, coordination, and teamwork among WGFD, USFS, the associated livestock permittee and adjacent landowners/ranch managers, as well as funding provided by USFS (\$300,000), WWNRT (\$60,000), and WGFD (\$25,000). Additionally, in-kind funding (salary, mileage, fuel) from USFS and WGFD likely exceeds \$50,000. With final slashing of conifers within 200 acres of aspen in autumn 2008, a robust fuel base was prepared for remaining prescribed burning of aspen on the project area. Following WGFD seasonal elk calving restrictions that ended 30 June, USFS crews completed final burns in early-mid July 2009 via helitorch and driptorch during moist fuel conditions resulting from copious late spring snow and early summer rain. A total of about 1,450 acres of aspen and mountain big sagebrush were ultimately burned, primarily from the central to northern portion of the project area (Figure 1). Aspen stands in the southern portion of the project area originally identified for slash/burn treatments were omitted because 1) the Categorical Exclusion – 10 permit was revoked, which then allowed 2) lynx stipulations (*i.e.*, $\geq 48\%$ horizontal cover) to mandate NEPA for remaining untreated areas, with the final decision that 3) funding and effort to fulfill lynx NEPA requirements exceeded benefits of identifying and treating few of the remaining 75 acres of aspen. Additionally, 275 acres of sagebrush in the southern portion of the project area (originally identified for burning) was not burned as it was deemed that an overabundance (rather than desired mosaic) of sagebrush burned on the northern portion in 2008.

WGFD and GTNP personnel assessed the impacts of treatments on aspen density, height composition, and current-year terminal leader browsing by implementing 30 to 60, 1/100 acre circular plots in two treated stands (MACB1: burned late September 2008; MACB2: burned early July 2009) and one untreated stand (CONTROL) from mid-July to mid-August, 2006 (pre-treatment) and 2009 (≤ 1 yr post-burn, Figure 1). These stands were on upland sites with no apparent sub-irrigation from seeps/springs, had northeast to east-facing aspects with slopes of 15° or less, and were extremely conifer-encroached with few parent aspen trees present within individual stands (*i.e.*, possible worst-case scenario with respect to potential aspen regeneration following treatment). To determine impacts to basal ground cover in aspen stands, personnel used 10, 5-m line-point transects (one point every 0.25 m), each starting along a random azimuth from the center of every third aspen circle on MACB1 and CONTROL (2009 only).

Because the original monitoring sites for sagebrush (MSB, MSC) were within the southern portion of the project area and not treated, new monitoring sites (treatment, MSBN; control, MSCN, Figure 1) were identified on the northern end of the area in mountain big sagebrush habitat that typified the sagebrush component of the treated project area. On each site, a BFH-style macroplot was established, and personnel used 5, 25-m line-point transects (and conjoined 1-m wide belt transects), randomly distributed along the permanent 25-m baseline. Parameters collected in mid-July included species composition (richness), shrub density and height/size composition, and basal ground cover. On each site, herbaceous production estimates were collected in late September 2009 by use of 25, 0.42m x 0.42m modified Daubenmire quadrats

distributed equally among 5, 22.5-m transects (1 quadrat every 5m) randomly distributed along the permanent 25-m baseline.

We found that density of aspen was <1000 stems/ac pre-treatment on all sites but then increased on MACB1 and particularly MACB2 less than one year following burn treatments (Figure 2). The proportion of terminal leaders browsed was 24.5% on MACB1 (approximately 1 mile from the Jewett elk winter feedground) in 2006, but did not exceed 20% on other stands monitored in 2006. The proportion of terminal leaders browsed declined substantially in 2009 on MACB1 and MACB2 but remained around 14% on the CONTROL (Figure 3). Similar to other conifer-encroached aspen stands throughout the east-central slope of the Wyoming Range, we found that most aspen comprised the 1 to 3-ft height category pre-treatment (Figure 4A), but then comprised the 0 to 1-ft category less than one year post-burn (Figure 4B). We also found that MACB1 had an overall basal ground cover (litter and plants) of 53.5% while the CONTROL stand was much higher at 100% (primarily litter).

In mountain big sagebrush, we found that both burn (MSBN) and control (MSCN) plots had 10 species of grasses. Nelson's needlegrass and bottlebrush squirrel-tail dominated the burned site, while Idaho fescue, Nelson's and Letterman's needlegrasses, and unidentified sedges dominated the control site. Burn and control plots had 18 and 17 species of forbs present, respectively. Silvery lupine and buckwheat dominated the burned site, while buckwheat, *Astragalus diversifolius*, and long-leaf phlox dominated the control site. The burned site had a live sagebrush density of 243 stems/hectare (all classified as 'mature'), while the control site was higher at 45,369 live stems/hectare. Most (74.6%) of the sagebrush encountered on the control site were seedlings, while 19% were mature. Basal cover of bare ground was 21.4% and 4.2% on burn and control sites, respectively. However, cover of plants was 4.8% and 2.6% on burn and control sites, respectively. Production of grasses and forbs was 551.2 kg/ha and 618.1 kg/ha, respectively, on the burned site. The control site had lower grass (386.6 kg/ha) and forb (212.5 kg/ha) production estimates.

Results suggest that slashing/scattering of conifers and subsequent prescribed burning within aspen stands of the east-central slope of the Wyoming Range 're-sets' vegetation succession and is an appropriate management tool to ultimately promote persistence of aspen on upland landscapes of the Intermountain West. Although burning of one aspen stand in summer 2009 (fuels cut and piled, rather than broadcast, in summer 2005) produced heat insufficient to kill parent aspen and promote suckering, the site appears to have excellent shrub and tall-forb regeneration resulting solely from conifer removal. Remaining aspen stands with broadcast slashed conifers burned well, were contained relatively easily, and produced moderate (MACB1) to substantial (MACB2) aspen regeneration (and herbaceous growth) less than 1-year post-burn. Disparities in aspen stem densities between MACB1 and MACB2 may be due to timing of burns (MACB1, autumn; MACB2, spring) and respective soil moisture levels, however, MACB1 appeared (pre-treatment) to have far fewer parent aspen trees within the stand than MACB2. Regardless, both stands will likely meet management objectives (i.e., 1,000 stems/acre $\geq$ 10', 10-15 years post-treatment) and should return to pre-treatment or CONTROL stand conditions within 75-100 years. Declines in current year browse levels from both MACB1 and 2, respective to pre-treatment observations, were unexpected and may be a result of elevated personnel activity (disturbance) associated with additional treatment operations and/or substantial increases

in quantity/quality of aspen and herbaceous production in the nearby 8,500 acre Horse Creek Wildfire of June 2007. Continued election of 'non-use' by the permittee in this allotment (North Cottonwood) should prevent additional browse use and expedite aspen, shrub, and herbaceous regeneration. Basal ground cover from MACB1 appears similar to other aspen treatments along the Wyoming Range front (Maki Ind., WYFARP, BLM) and will likely return to levels similar to pre-treatment and Control stand observations within 5 years.

Observations from treated and untreated mountain big sagebrush sites appear similar to the relatively adjacent (easterly) Brodie Draw prescribed burn. Substantial decreases of live sagebrush density and basal ground cover, as well as increase of herbaceous production on the burned site were expected. The relatively high abundance of seedling sagebrush on the control site was similar to this finding on several other lower elevation sites (BLM) in 2009, and suggests that above average precipitation during the growing seasons of 2008 and 2009 stimulated sagebrush seedling germination and recruitment. As this mountain big sagebrush habitat lies within a fairly liberal precipitation zone, burned areas could return to pre-treatment conditions within 25-40 years. Future monitoring of previously sampled aspen and sagebrush stands within the Maki Aspen Enhancement project area is scheduled for 2011, 2013, and 2018.

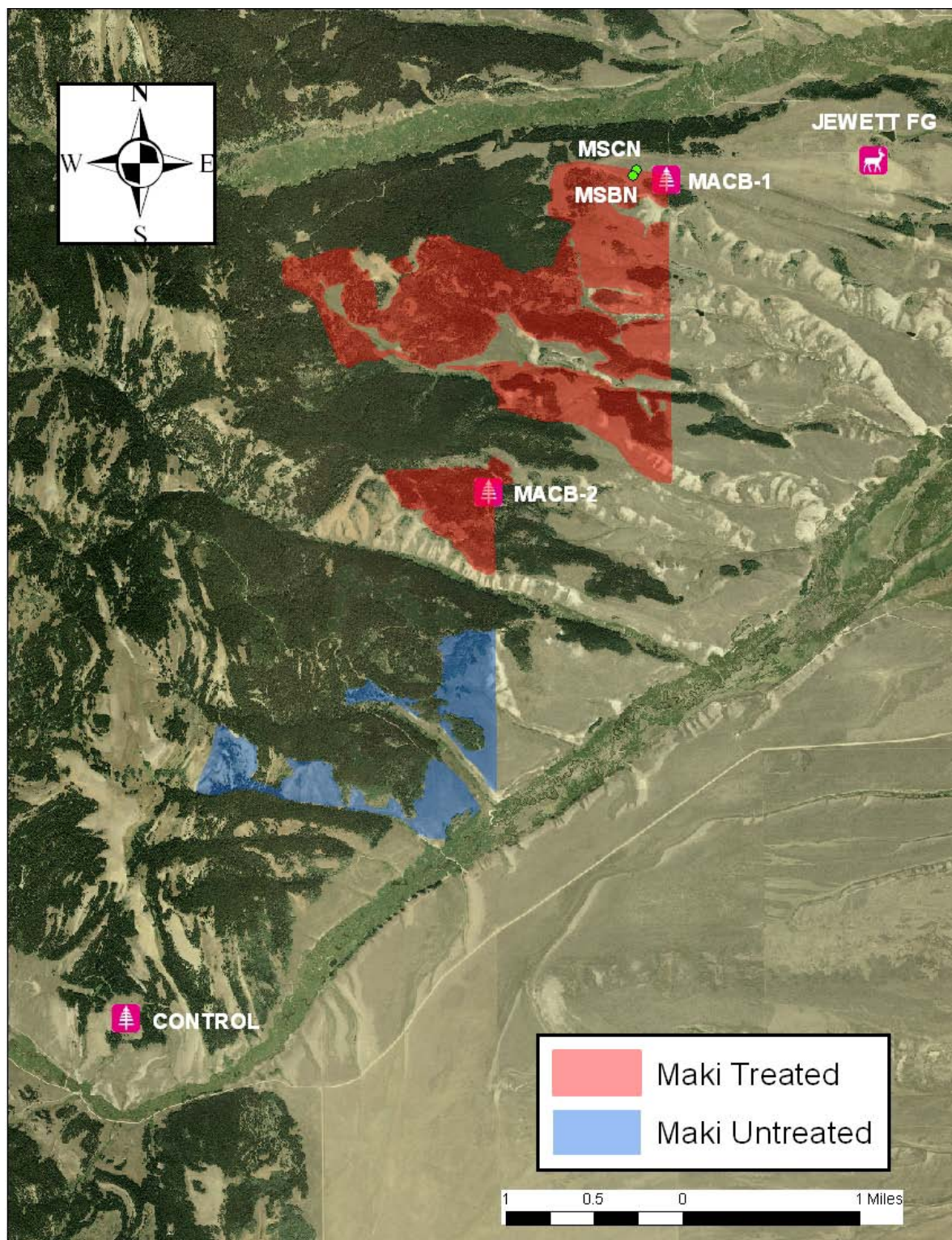


Figure 1. Maki Aspen Enhancement project area, including final aspen and mountain big sagebrush habitats treated and untreated, conifer habitats commercially harvested, aspen monitoring sites (tree symbol), sagebrush monitoring sites (green circles), and adjacent Jewett elk winter feedground (elk symbol), east-central slope Wyoming Range, western WY.

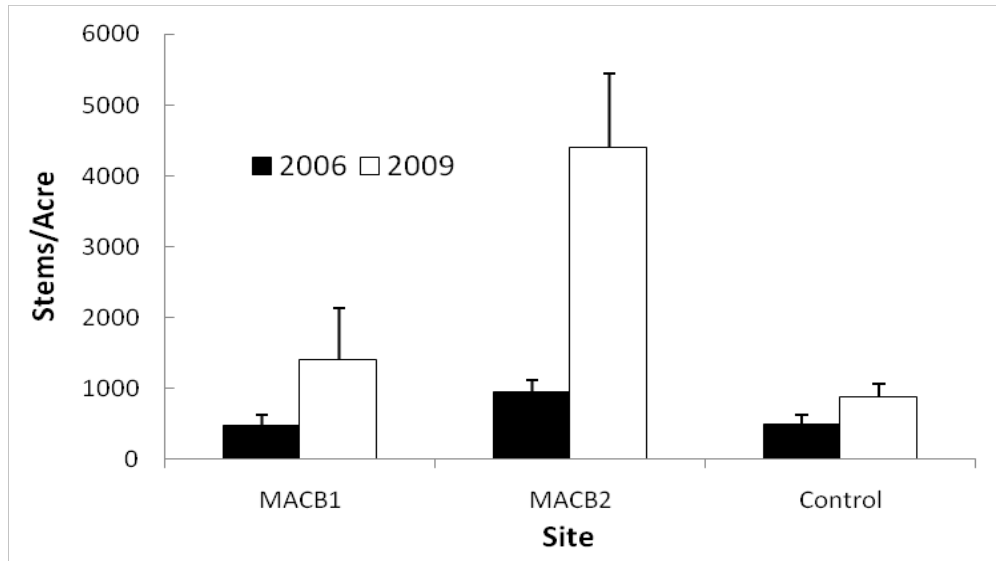


Figure 2. Total aspen stem density ($\pm$ SE) from aspen stands within Maki Aspen Enhancement project area, pre-treatment (2006) and $\leq$ 1 yr post-treatment (2009), east-central slope Wyoming Range, western WY.

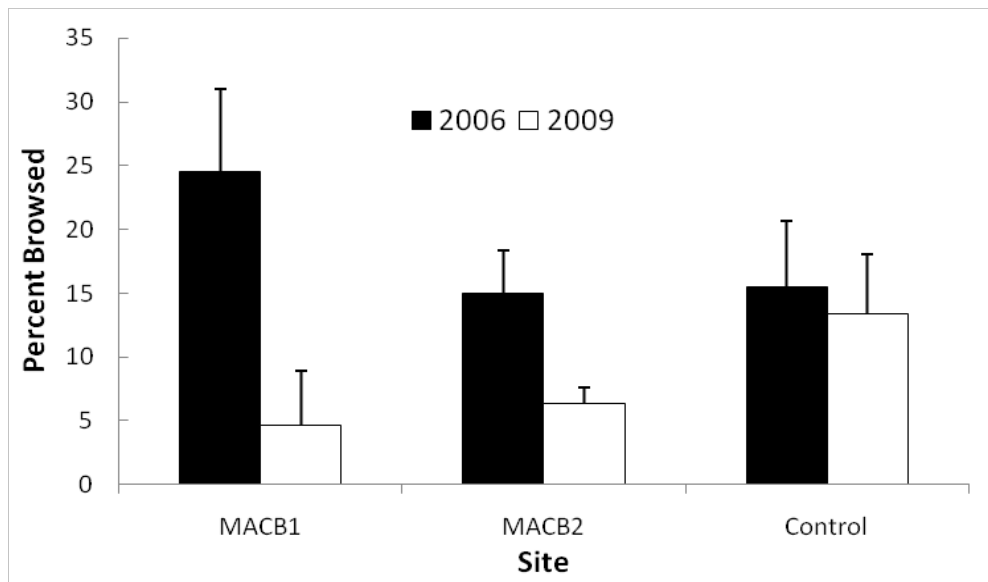


Figure 3. Proportion of aspen terminal leaders browsed within current year ($\pm$ SE) from aspen stands within Maki Aspen Enhancement project area, pre-treatment (2006) and $\leq$ 1 yr post-treatment (2009), east-central slope Wyoming Range, western WY.

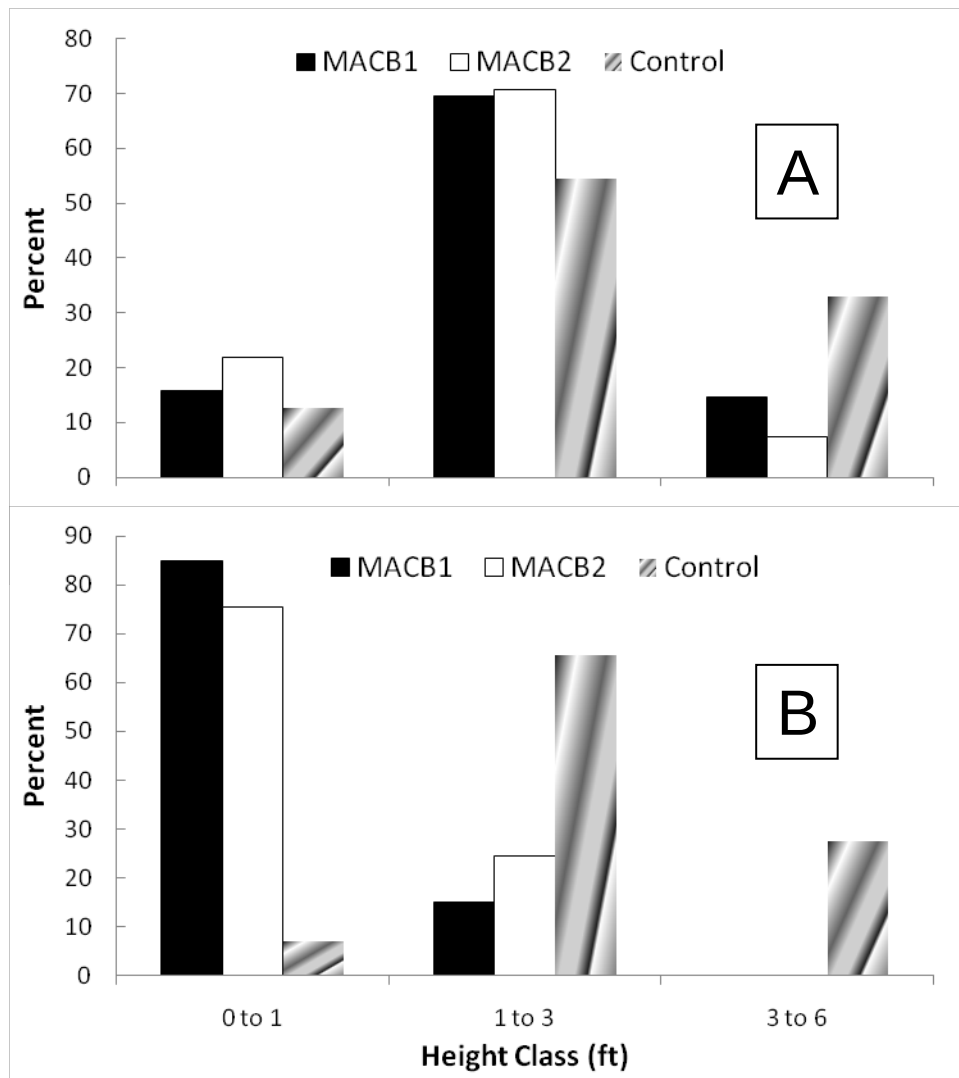
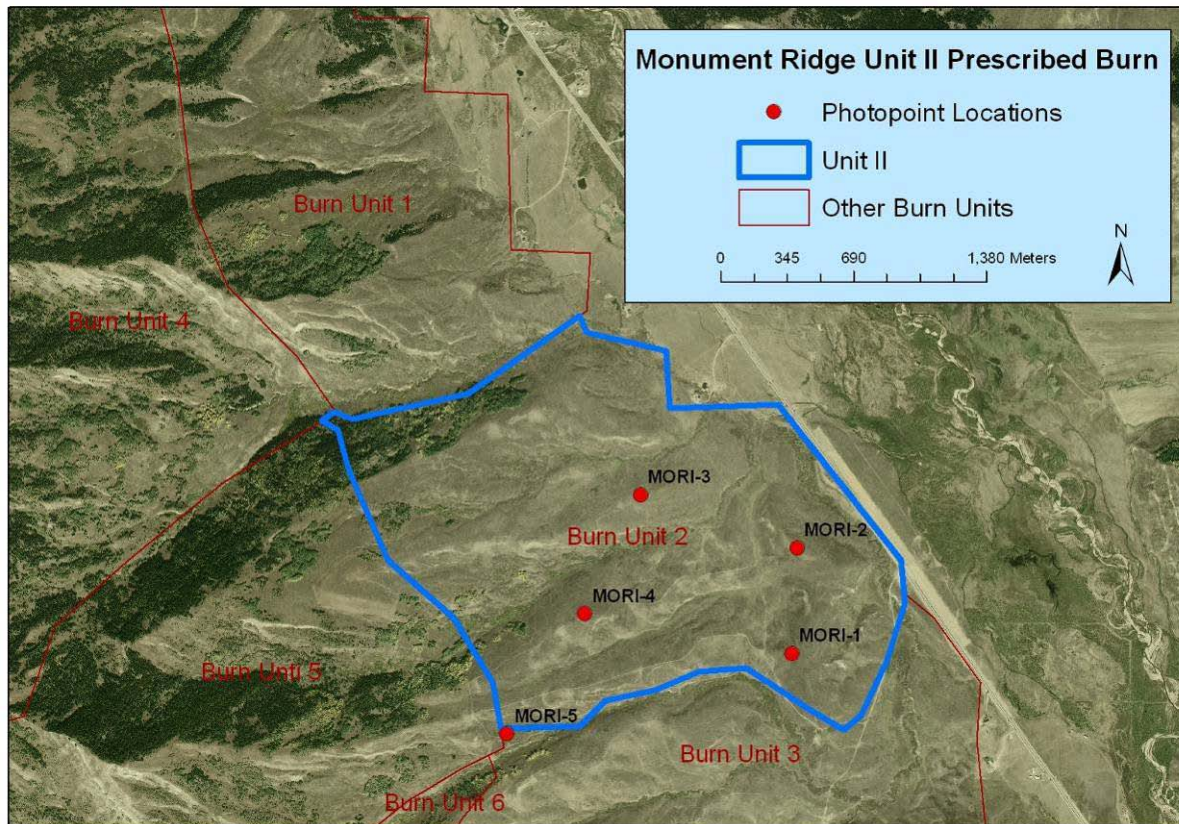


Figure 4. Proportion of aspen suckers comprising height class categories pre-treatment (2006, A) and ≤ 1 yr post-treatment (2009, B) from aspen stands within Maki Aspen Enhancement project area, east-central slope Wyoming Range, western WY.

Monument Ridge Unit II

The second unit in the Monument Ridge prescribed burn project is slated for ignition in 2010. It is a 985 acre area of mainly sagebrush-grassland.

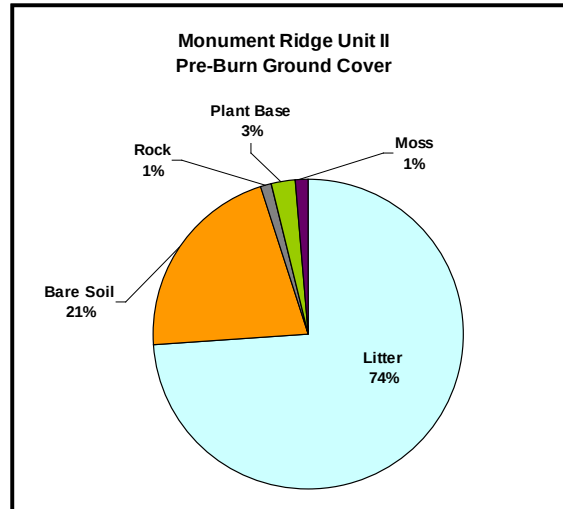
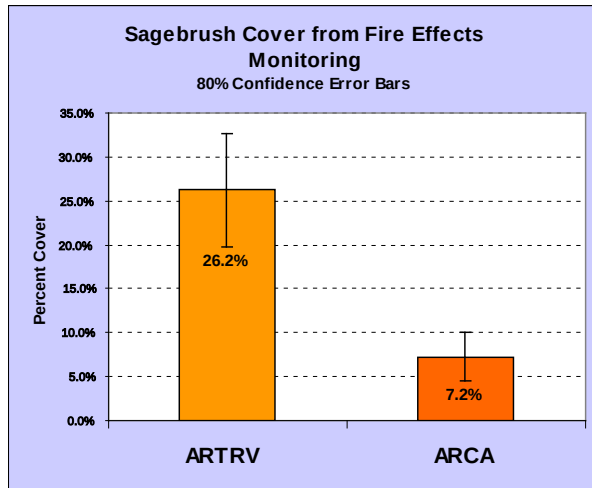


Monitoring objectives for Unit II were altered slightly from the Unit I objectives in order to focus on shrub percent cover rather than density (with multi-stemmed species, it is difficult to obtain a consistent density estimate):

- Burn 30-60% of the sagebrush communities in a mosaic pattern within the project area.
- Measure the reduction of big sagebrush (*Artemisia tridentata* var. *vaseyana* and *Artemisia cana*) height and canopy cover 1 and 5 years post burn in treated areas.
- Attain less than 40% bare ground in burned sage/grass communities one year post burn, and less than 20% bare ground after the fifth growing season post-burn.

Pre-burn sagebrush cover was measured using 30 randomly-located, non-permanent line intercept transects. Ground cover was measured at point-intercept transects co-located with 15 of the shrub transects. Five permanent photopoints were also installed.

Both Wyoming big sagebrush (*Artemisia tridentata* var *Vaseyana* or ARTRV) and silver sagebrush (*Artemisia cana* or ARCA) are found in the burn unit.



Ground cover measurements pre burn indicated only 79% ground cover. This is close to the Year 5 post burn ground objective.



Looking Southeast at Monument Unit II, Pre Burn



Looking North

New Fork-Boulder Lake Rim Prescribed Burn

The Lake Rim Unit of the New Fork-Boulder Prescribed burn was treated in the spring of 2004. The unit includes a ridge along the north shore of New Fork Lake, with aspen, conifer, and sagebrush vegetation.

The overall New Fork-Boulder project was designed in collaboration with the Wyoming Game & Fish Department to benefit wildlife habitat using the disturbance effects of fire. Specific New Fork-Boulder objectives include the following:

- Treat 30-50% of the sagebrush having >15% canopy cover in a mosaic pattern within the project area.
- Attain >70% mortality of sagebrush plants in treated (burned) areas.
- Attain >50% encroaching conifer mortality by one year post-burn
- Increase herbaceous species richness in burned sagebrush communities to greater than 20 herbaceous species by three years post burn.
- Attain >80% ground cover in sagebrush communities and aspen communities within 5 years post-burn
- Within all burned aspen communities, attain 10 foot tall aspen sucker density of at least 1000/ac at or before 10 years post-burn.

At the Lake Rim unit, aspen sucker density was measured pre burn using randomly-located, non-permanent circular plots. Unfortunately, the aspen in this area did not burn. A sagebrush macroplot installed by the Wyoming Game & Fish Department also not experience fire. Therefore, only permanent photopoints remain to document fire effects. In 2009, these photos were retaken (5 year post burn).

In this burned area, sagebrush has been replaced by forbs, grasses, and snowberry.



Pre burn, prior to spring green-up

Immediate post burn



Year 5 post burn

Note the aspen mortality and regeneration in the lower left corner of this photo:



Pre burn, prior to spring green-up



Immediate post burn



Year 5 post burn

New Fork-Boulder Marsh Creek Prescribed Burn

The Marsh Creek Unit of the New Fork-Boulder Prescribed burn was treated in the spring of 2004. The unit consists of Wyoming big sagebrush vegetation with small pockets of aspen.

The overall New Fork-Boulder project was designed in collaboration with the Wyoming Game & Fish Department to benefit wildlife habitat using the disturbance effects of fire. Specific New Fork-Boulder objectives include the following:

- Treat 30-50% of the sagebrush having >15% canopy cover in a mosaic pattern within the project area.
- Attain >70% mortality of sagebrush plants in treated (burned) areas.
- Attain >50% encroaching conifer mortality by one year post-burn
- Increase herbaceous species richness in burned sagebrush communities to greater than 20 herbaceous species by three years post burn.
- Attain >80% ground cover in sagebrush communities and aspen communities within 5 years post-burn
- Within all burned aspen communities, attain 10 foot tall aspen sucker density of at least 1000/ac at or before 10 years post-burn.

At the Marsh Creek unit, only permanent photopoints were used to monitor fire effects. In 2009, these photos were retaken to document 5 year post burn conditions:

Photopoint MACR-02 shows an overview of the eastern side of the unit:



Pre burn

Immediate Post Burn



Year 5 Post Burn

This photo shows fire effects to an aspen stand (upper left corner)



Pre burn (pre leaf-out conditions)



Immediate post burn



Year 5 post burn

Appendix E

Bridger-Teton National Forest West Zone 2009 Fire Effects Monitoring Report

Bradley Mountain Prescribed Burn

The Bradley Mountain prescribed burn was implemented in two stages in the spring and fall of 2009. The project area is 3271 acres on the south facing slopes of a long ridge that separates the Snake River Canyon from the mouth of the Greys River, near Alpine, Wyoming. The vegetation consists of mountain shrubs, aspen, and mixed conifer.

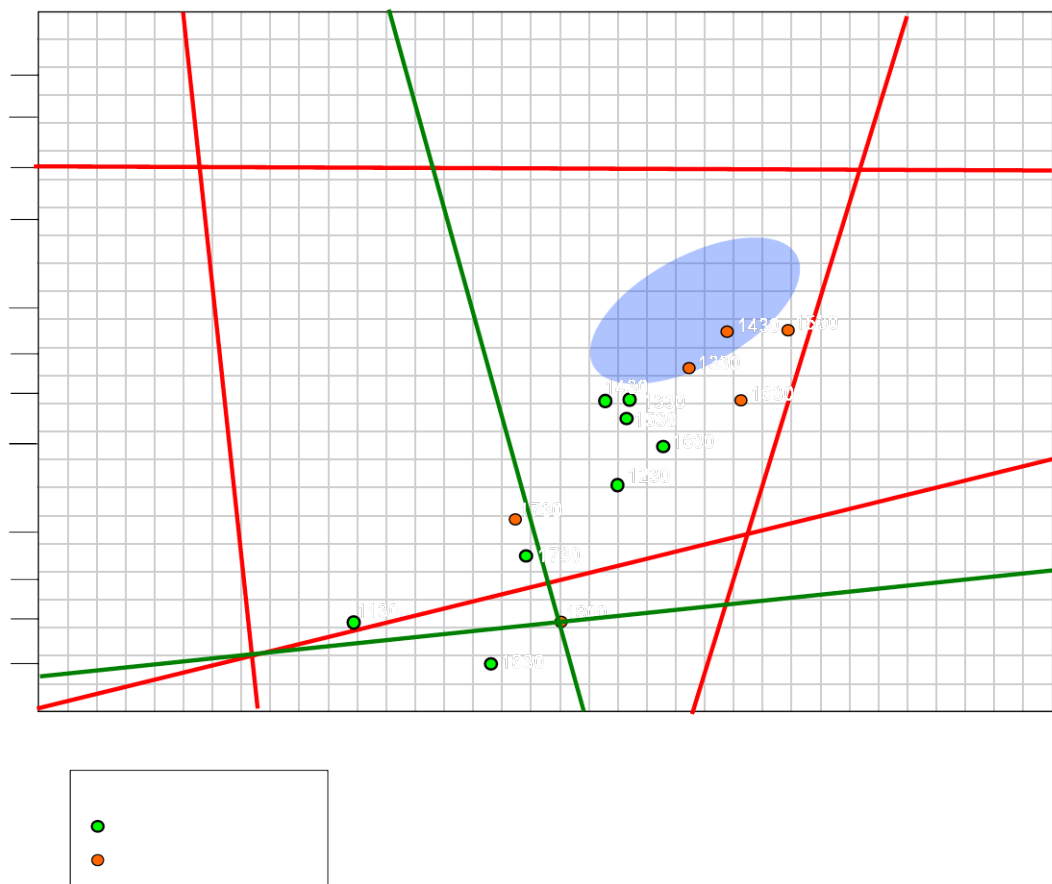
The fire effects objectives are as follows:

1. Treat 30-60% of the project area, with a focus on the highest and moderate priority areas east of the Alpine viewshed, while also treating lower priority areas to the extent feasible.
2. Attain 10 foot tall aspen sucker density of at least 1000 stem per acres at or before 15 years post burn.
3. Maintain, at a minimum, the existing distribution and extent of aspen, mountain shrubland, and big sagebrush vegetation types, recognizing that they will remain in early succession for several years.
4. Achieve 40-80% mortality of encroaching conifers.
5. Restore canopy cover of shrubs to pre-burn levels within 25-40 years, at a minimum, and increase shrub canopy cover to the extent that conifer canopy cover is reduced.

Due to the steep and remote terrain and vegetation characteristics, mapping and photopoints will be used to track the fire effects of the burn with respect to these objectives. Depending on the degree to which aspen was burned, aspen sucker density plots may be implemented in Year 2 post burn in selected stands.

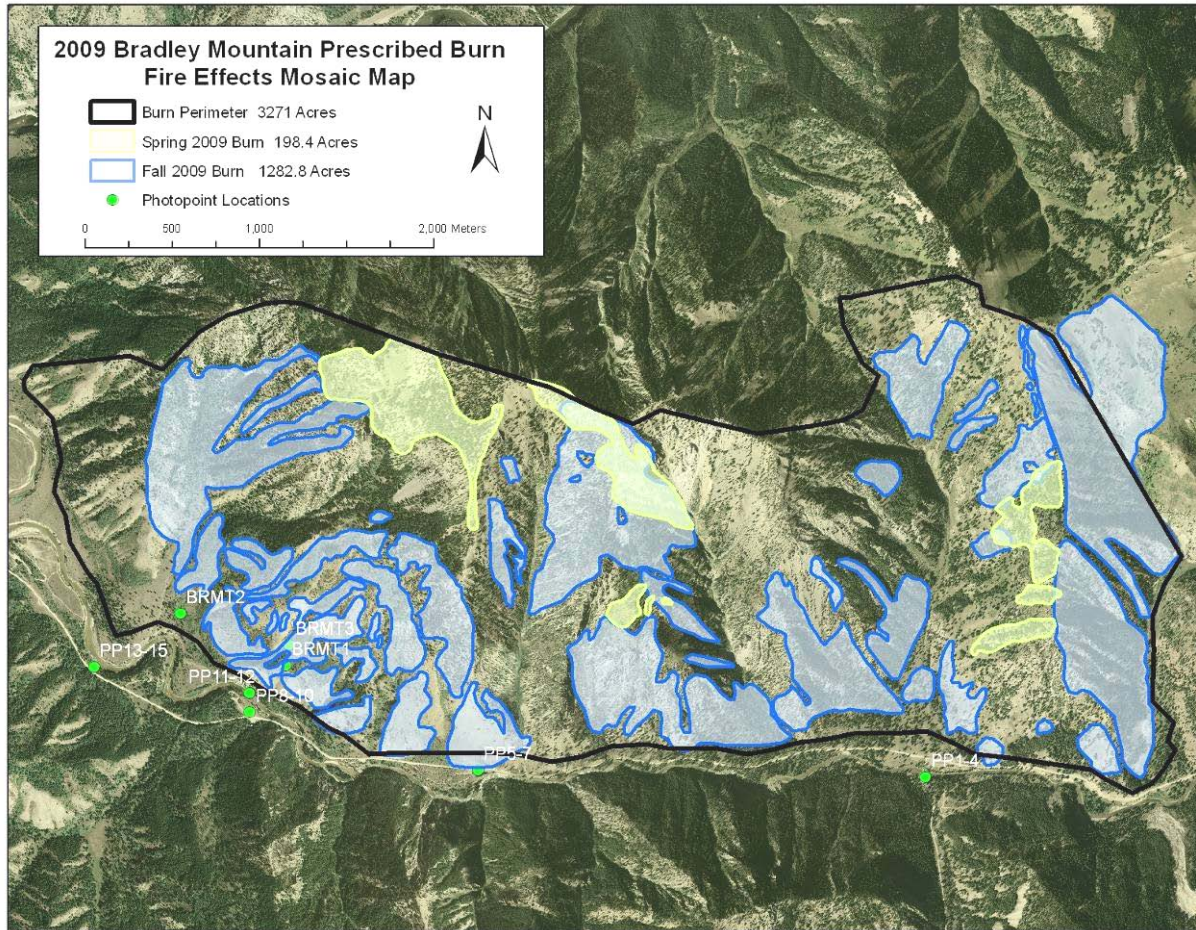
Pre burn data for Bradley Mountain was collected in 2006 in the form of 20 photopoints. Three were taken within the unit in aspen and sagebrush vegetation, and the remaining 17 show a landscape view, highlighting fall colors of aspen and mountain maple. All photopoints were retaken after the fall 2009 burn.

The Bradley Mountain Prescribed Burn took place September 23-25, 2009. The following Fire Conditions Chart compares the hourly fire weather observations recorded by the assigned FEMO (Fire Effects Monitor) to the prescription elements in the burn plan. No data is available for the third day of burning at this time.

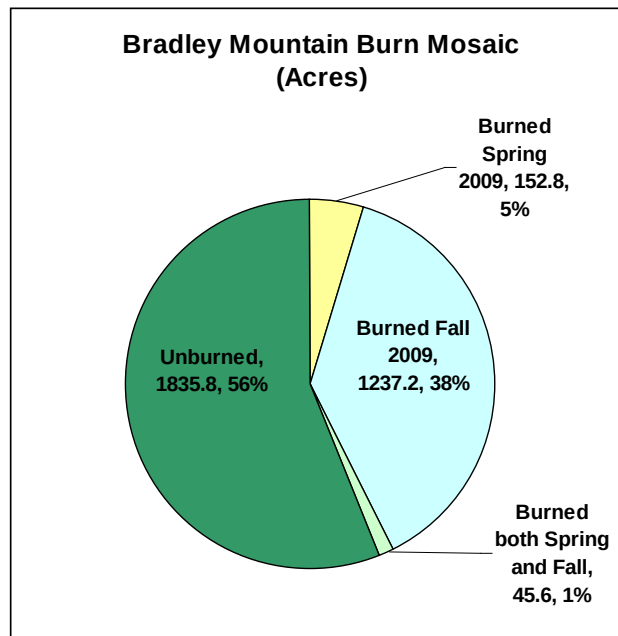


For the two days that data is available, conditions were ideal for a short period each afternoon, between approximately 1330 and 1630. On the third day, much drier and windier conditions were present.

A burn mosaic map was made for Bradley Mountain based on aerial photographs and recollections from operations personnel. This map, in conjunction with vegetation mapping data, will be used to evaluate several of the burn objectives.



According to the map analysis, 43.8% of the project area was treated with fire. The overall burn mosaic breakdown is shown in the chart, below:



Further GIS analysis of the burn mosaic map is summarized in the table, below.

Type	Total Acres in Bradley Project	Acres Burned in 2009	Percent of Total Burned
Mountain Shrub Vegetation*	181.4 ac	75.2 ac	41%
Aspen Vegetation*	680.7 ac	359.3 ac	53%
Conifer Vegetation*	1817.4 ac	713.8 ac	39%
High Priority Habitat**	634.8 ac	193.0 ac	30%
Moderate Priority Habitat**	1487.6 ac	683.5 ac	46%
* Vegetation management classes according to the BTNF 2007 Vegetation Map ** Priority habitat types identified for treatment and mapped by BTNF and WGFD			

Examples of photopoints taken pre and post burn show the fire effects within the burn unit:



Sagebrush photopoint, pre burn



Immediate post burn



Aspen photopoint, pre burn



Immediate post burn



Aspen/Conifer photopoint, pre burn



Immediate post burn

Landscape Photopoints indicate the appearance of the area from the Grey's River road"



Pre burn



Immediate post burn



Pre burn



Immediate post burn



Pre burn



Immediate post burn



Pre burn



Immediate post burn

Fontenelle Willows Prescribed Burn Unit 1

Unit 1 of the Fontenelle Willows Prescribed Burn project was implemented in the spring of 2003. The unit burned intensely and most of the acreage was blackened. The willow community was tall and dense, even though it had been burned in the late 1980's. Geyer's willow (*Salix geyeri*) and Booth's willow (*Salix boothii*) are the dominant species, with an understory of bluegrass, dandelion, and sedges.



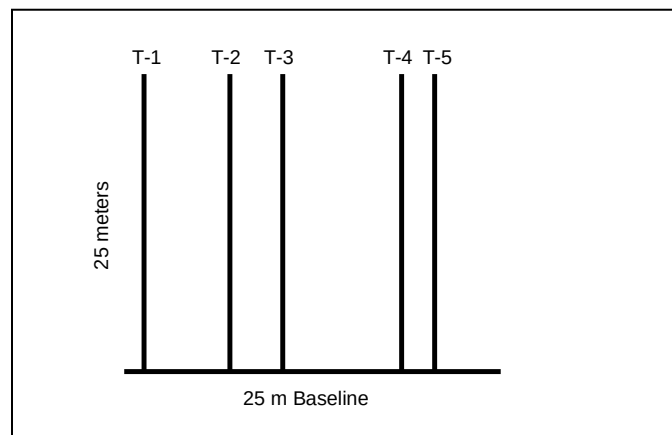
Flame lengths in excess of 15 ft during the burn

Immediate post burn fire effects

Objectives for the burn included the following:

1. Restore riparian willow communities by attaining an increase in live willow percent cover of at least 40% at 3 years post-burn.
2. Restore riparian willow communities by attaining willow height of greater than or equal to mean pre-burn height per plot at 10 years.

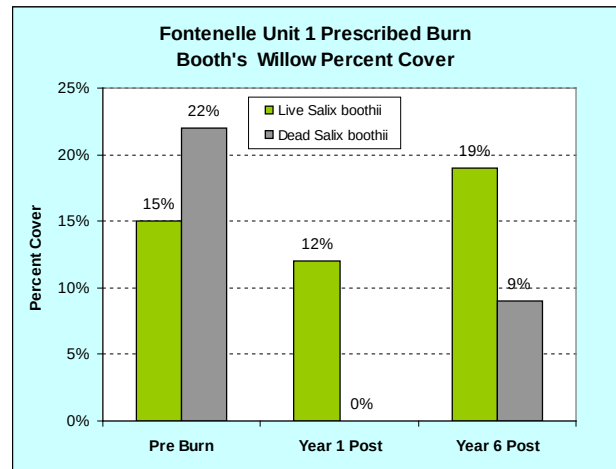
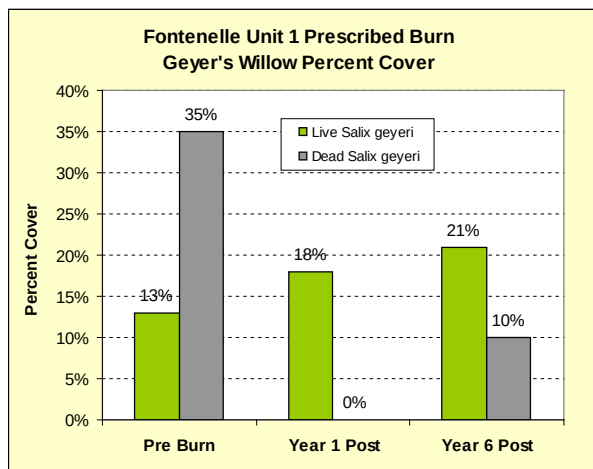
One Fire Effects Macroplot was located in the unit, consisting of five 25 meter transects which run perpendicular to a 25 meter baseline at randomized intervals.



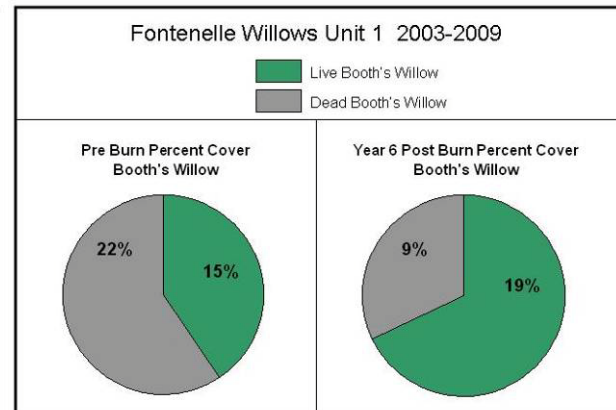
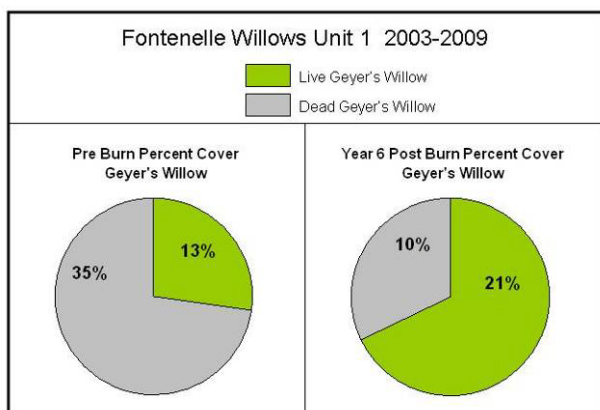
These plots measure the percent cover and height of live and dead willows. Line point intercepts were recorded on the five transects, using a 3 meter pole, for live and dead branches by species, with heights recorded for the uppermost intercept in each category. In 2009, the plot was revisited to provide results for the sixth year post burn.

Willow Percent Cover

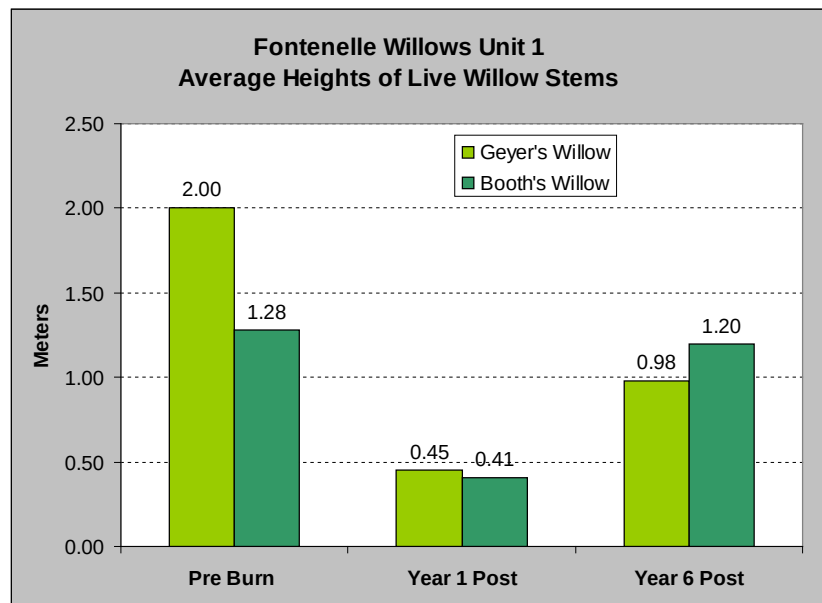
The percent cover of live and dead willow stems was recorded for the two species separately. For Geyer's willow, live cover increased by 61%. Booth's willow increased by 26%. For both species, there were approximately twice as many live stems as dead in Year 6.



The charts below show the relative proportions. The total percent cover of live willows did not meet the stated objective of 40%.



Willow Heights



Average willow stem heights were recorded on the plot transects for both species. While maximum heights of the plants were in some cases greater than 3 meters in Year 6, the averages include all intercepted stems. According to the data, pre-burn heights have been reached for Booth's willow, and it seems reasonable that this could occur for Geyer's willow by Year 10. Photopoints show that willows are clearly not impacted by excessive browsing.





Fontenelle Willows Prescribed Burn Unit 2

Unit 2 of the Fontenelle Willows Prescribed Burn project is planned for implementation in 2010. The Fire Effects Crew visited the site in the summer of 2009 to re-collect plot data from two older plots (from 2003) and add two new ones.

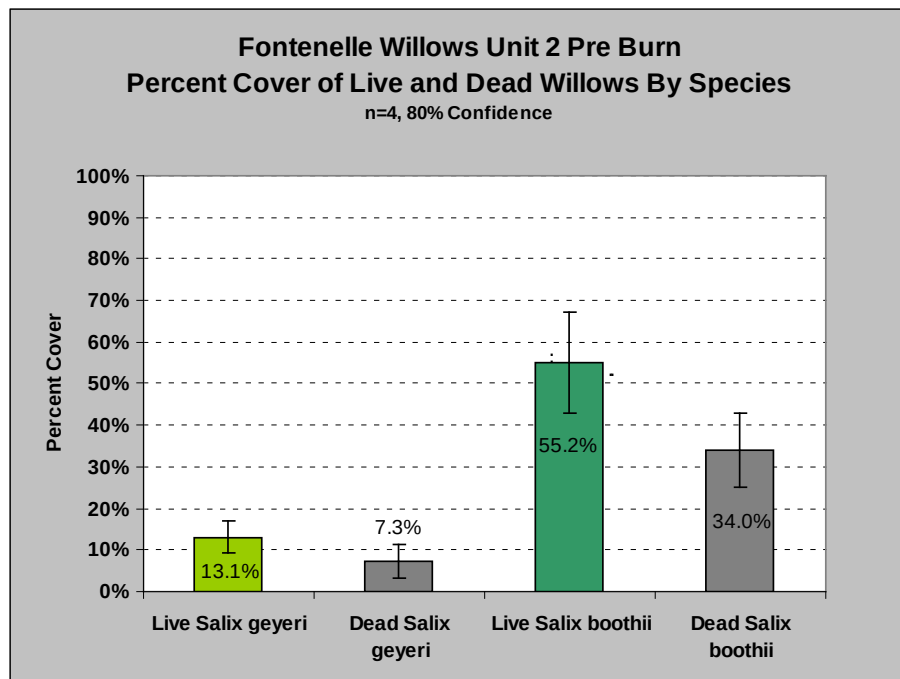
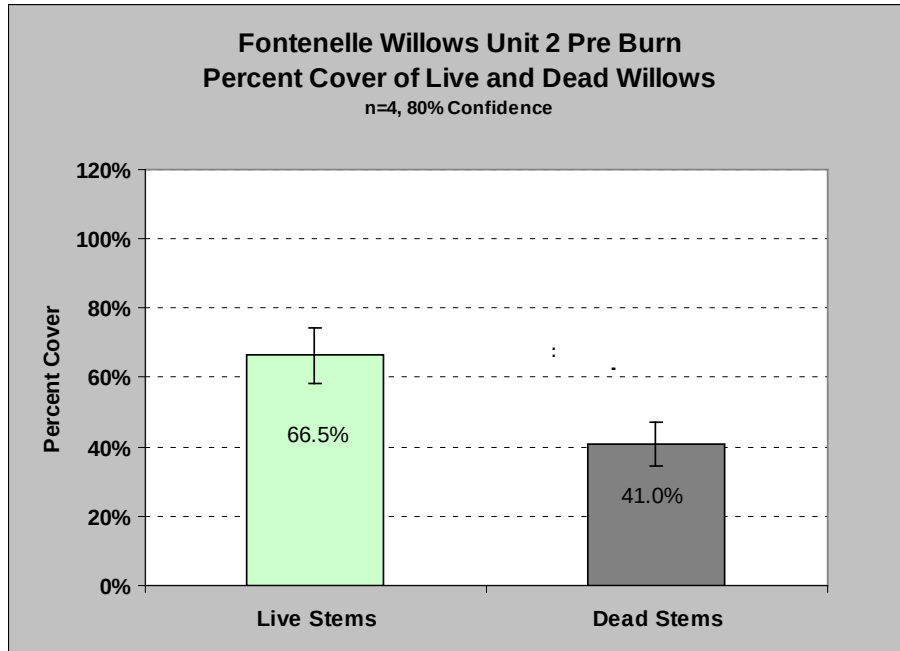
Objectives for the burn included the following:

3. Increase live willow percent cover to at least 40% at 3 years post-burn.
4. Attain willow height of greater than or equal to mean pre-burn height per plot at 10 years post burn.

The methods used to track these objectives consist of four macroplots with a randomly-located baselines with three perpendicular point intercept transects each. These transects measure the percent cover and height of live and dead willows.

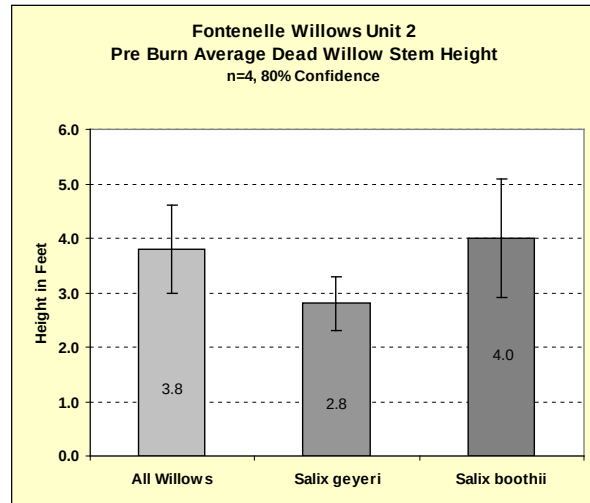
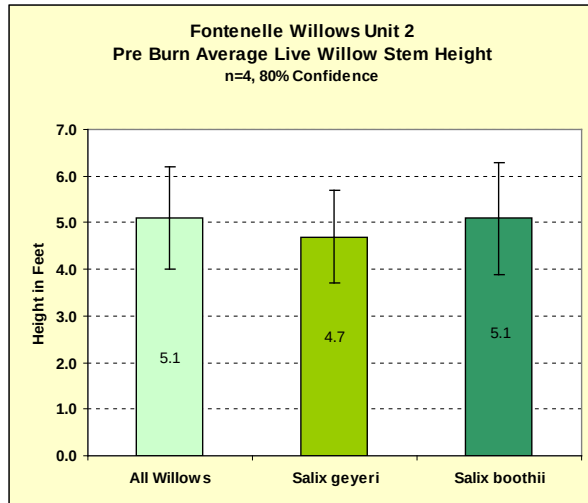
Pre Burn Willow Percent Cover

The percent cover of live and dead willow stems was recorded for all willow stems and the two dominant willow species (Geyer's willow and Booth's willow) separately.



Pre Burn Willow Height

The average heights of willow stems that fell along the transect points are shown in the graphs below. The height for live stems is somewhat greater than for dead stems. This data does not reflect the height of the stand or the fuel bed depth; however it will provide an index to compare against post-burn recovery.

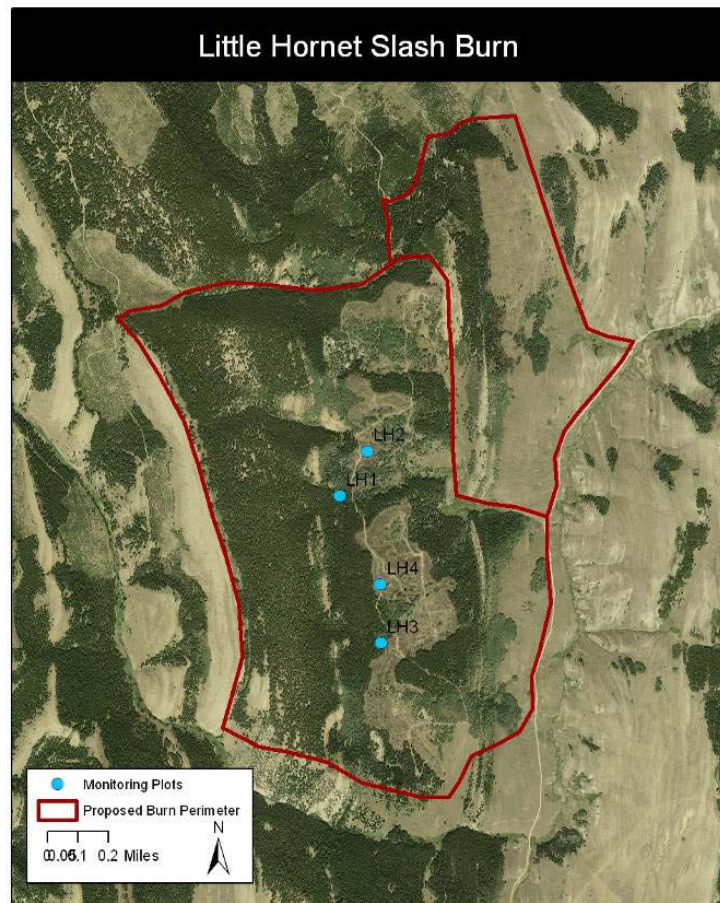


Photopoints show the characteristics of the willow vegetation pre-burn:



Little Hornet Prescribed Burn

The Little Hornet project was implemented in the fall of 2004. Four fire effects plots were installed in 2003, two in slash units and two in adjacent mixed aspen and conifer forest vegetation. The two slash plots (LH2 and LH4) burned. These were revisited in 2005 and 2009 (Year 5 Post Burn).



The objectives of the Little Hornet burn were as follows. Quantifiable targets were not determined for all items.

1. Reduce the density of conifers (overstory, pole, and seedling) in the burn units adjacent to slash units.
2. Increase aspen sucker density in slash units and adjacent uncut areas. Sucker heights should be at least 2 meters in height 10 years post burn.
3. Monitor species composition and percent cover and ground cover post burn to detect unforeseen fire effects such as weed invasion.
4. Reduce fuel loading

Fire Effects were measured at the two treated plots. Repeat photographs were also taken, which show the severity of the slash burn and vegetative recovery in the five years since.

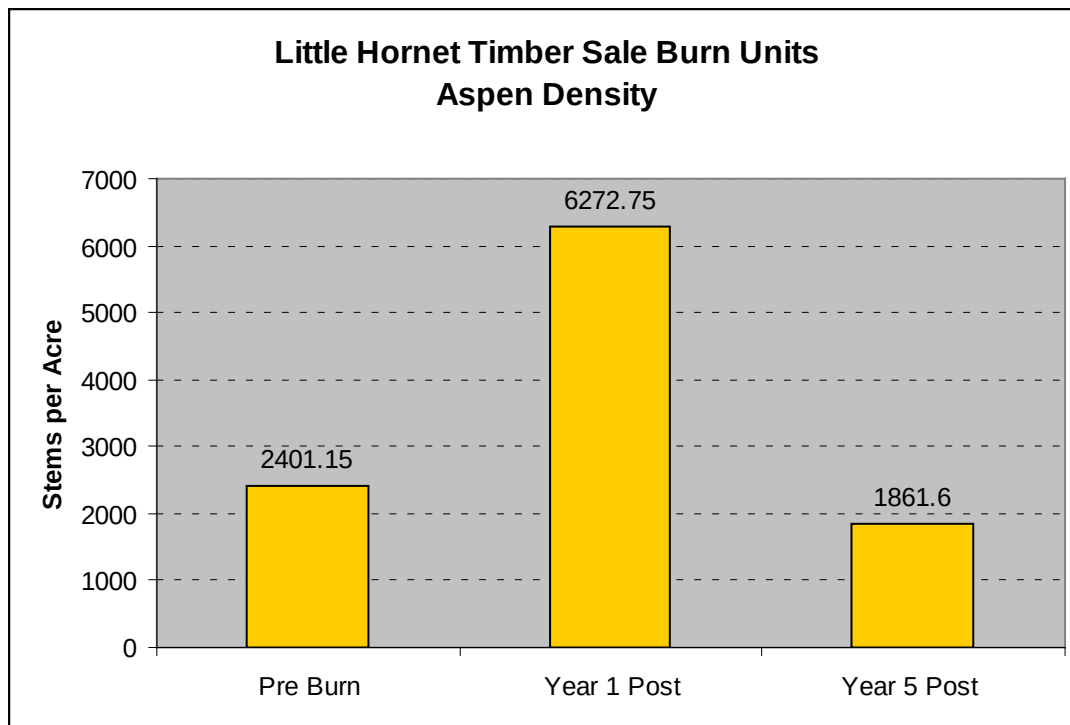
Conifer Density

Conifer seedlings, poles, and overstory trees were monitored pre burn, Year 1 post burn, and Year 5 post burn. In Year 5, no conifers were found in either of the plots.

Aspen Sucker Density

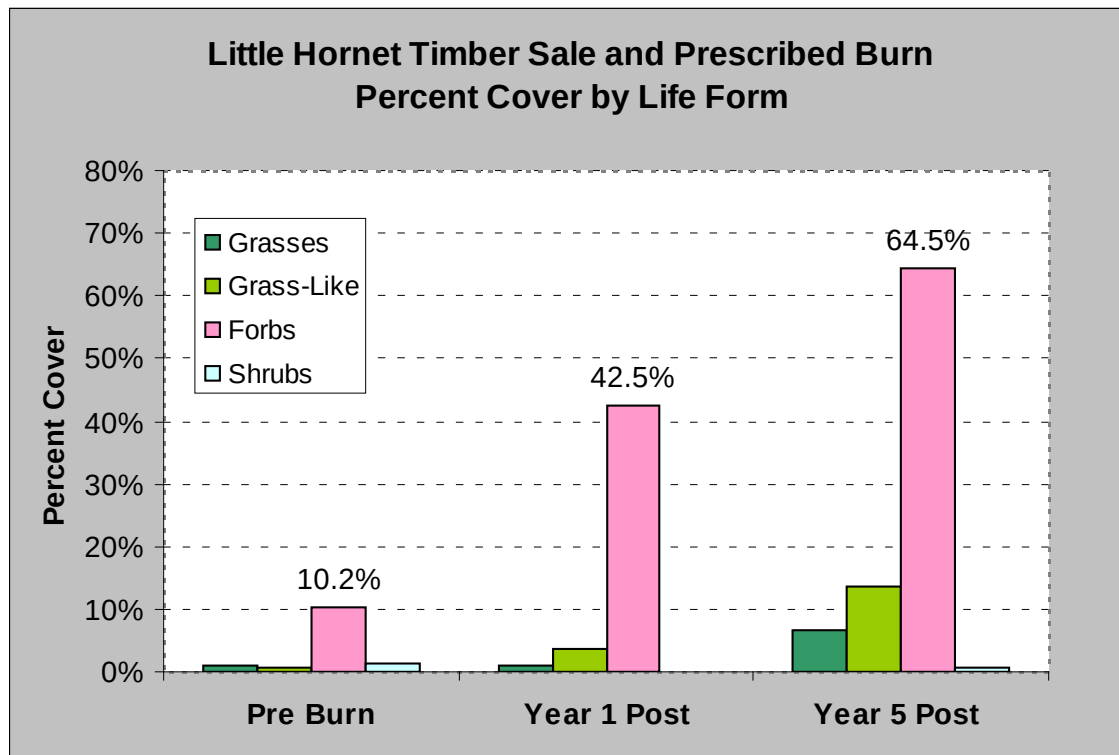
Aspen sucker density belts were used on the plots to estimate the number of stems per acre pre and post burn.

In Year 5 post burn, aspen sucker density was greatly reduced, to near pre-burn levels. Plot photographs suggest that this may be due in part to competition from other plants and browsing pressure.



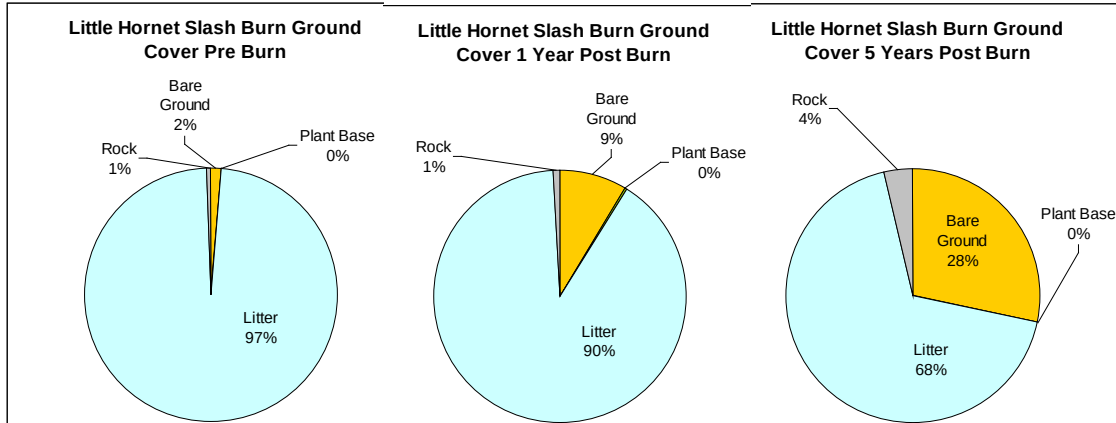
Vegetation Composition and Cover

Plant cover was measured using point intercept on two 50 meter transects, one at LH2 and one at LH4. When aggregated by life form, it is clear that forbs dominate the burned area. Species richness was quite high. Some weedy species were present, including the noxious musk thistle (*Carduus nutans*) and Canada thistle (*Cirsium arvense*).



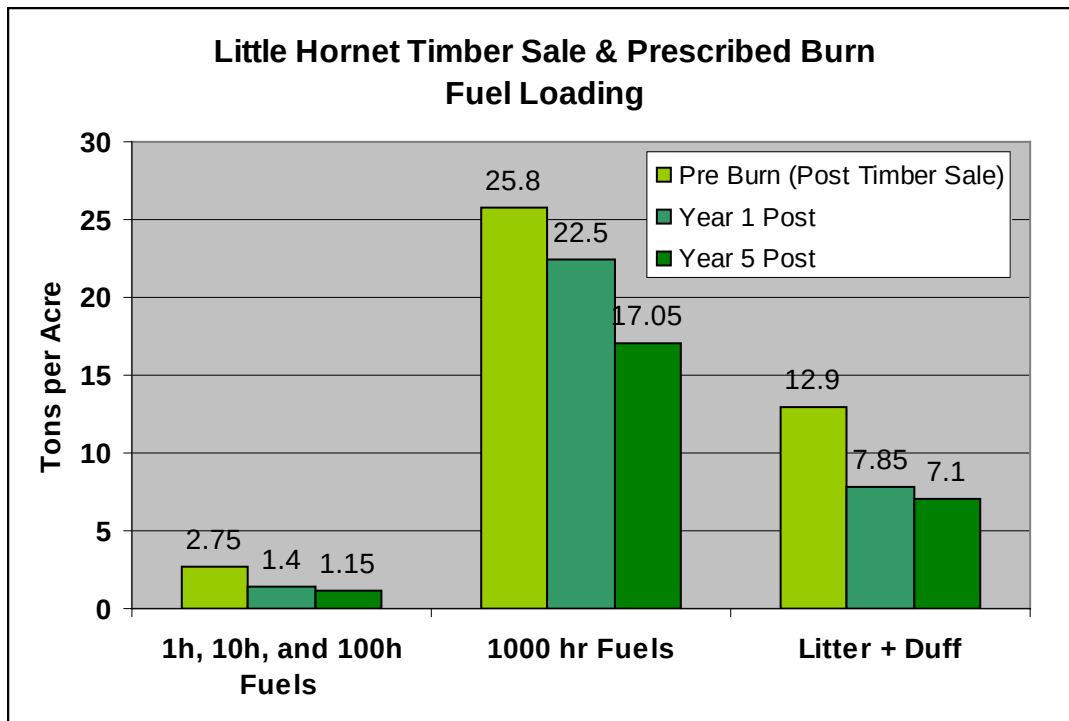
Ground Cover

Point intercept transects were used to gather data on the percent cover of substrate components at Little Hornet. This data gives a rough estimate of ground cover. It appears that there is still a considerable amount of bare ground remaining in the treated units five years post burn. This may be a result of forb cover, which produces little persistent litter.

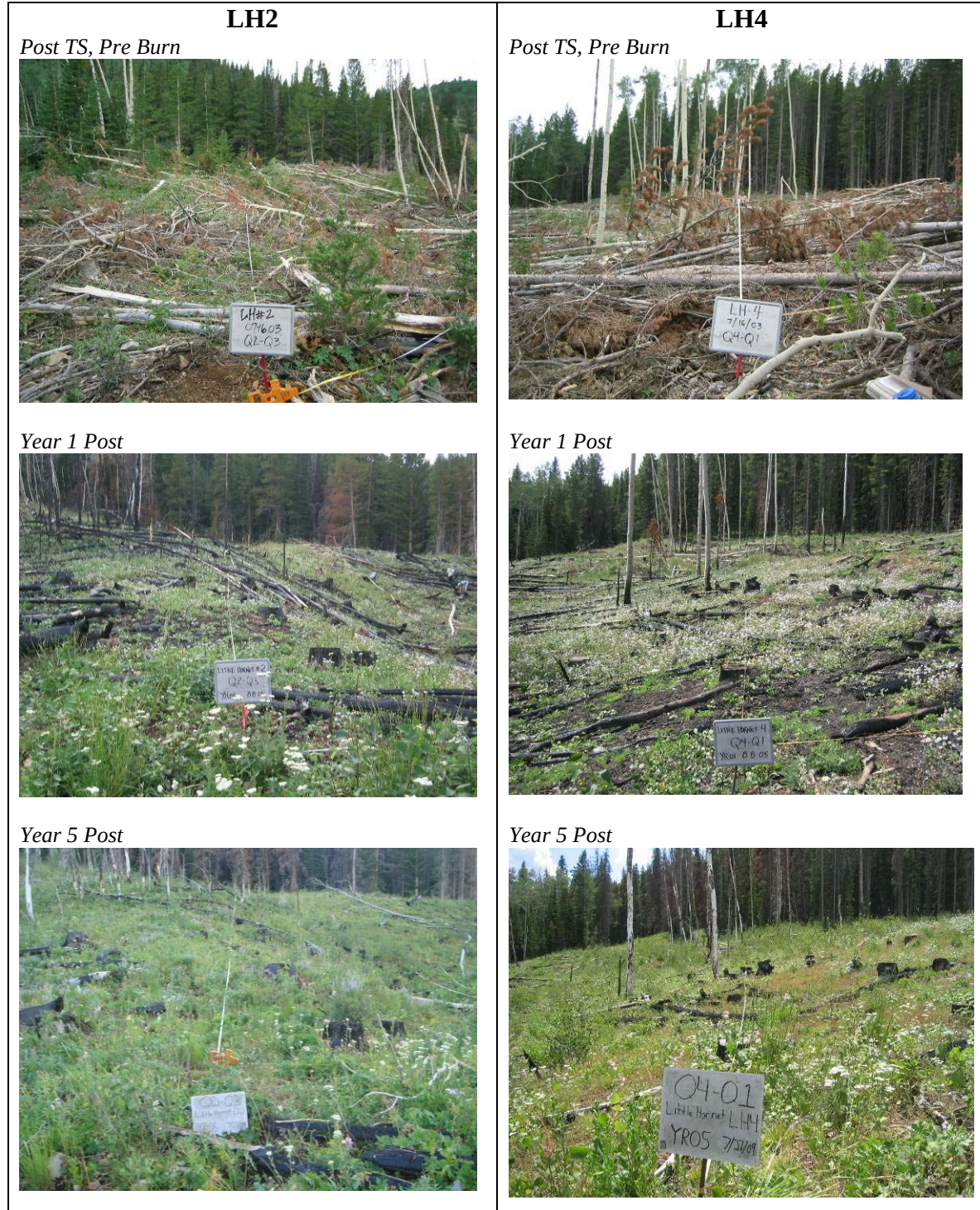


Fuel Loading in Slash Units

Four Brown's transects were measured at each plot and re-measured one year post burn. The total fuel loading pre burn (post timber removal and slashing) was 41.5 tons per acre. In Year 1 after the burn it was 31.8 tons per acre. Five years after the burn the total loading was 25.3 tons per acre, a 39% reduction from pre burn.

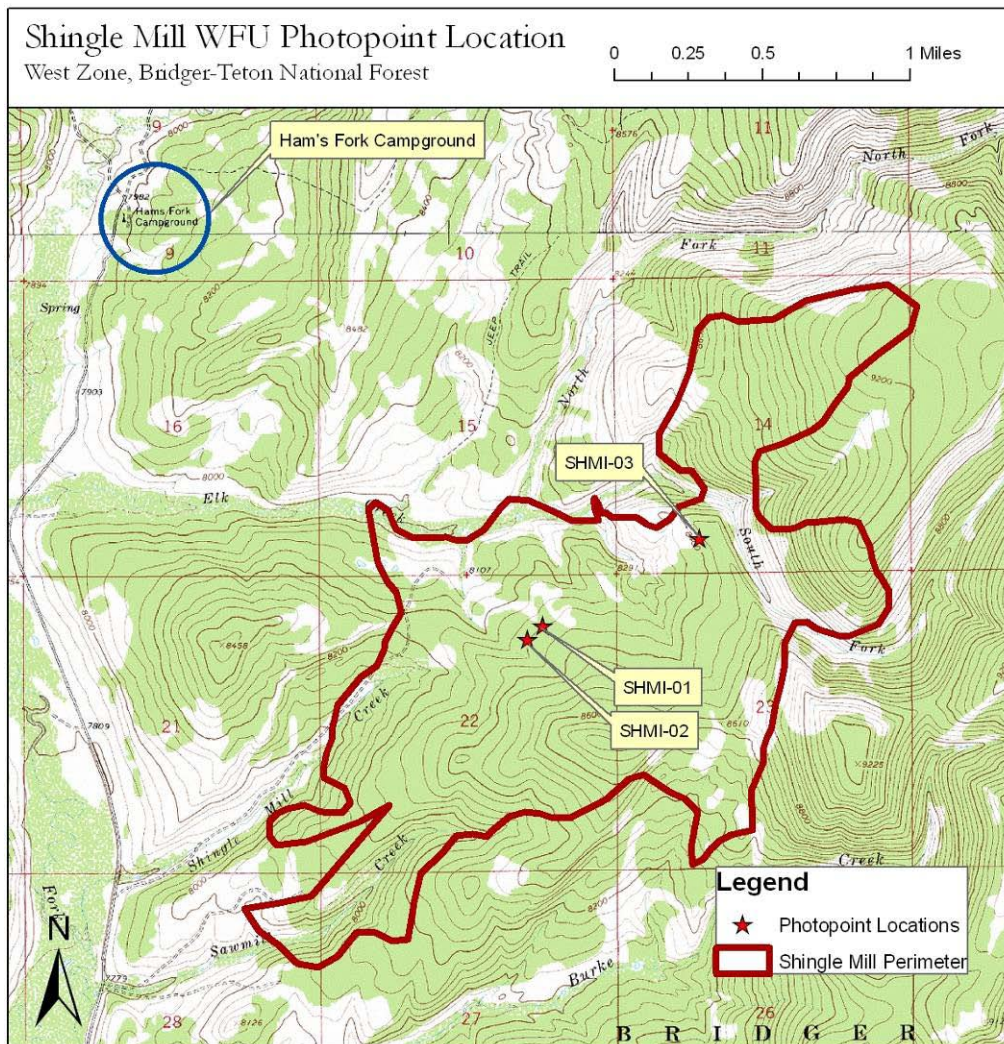


Plot photopoints show the fuel loading and revegetation of the two plots:



Shingle Mill Wildland Fire Use

The 2008 Shingle Mill Fire was started by lightning during the summer of 2008. It is located in the Ham's Fork drainage near the confluence of Elk Creek. The fire was managed for resource benefit.



The monitoring objective for the Shingle Mill fire is to conduct repeated site visits to track the fire effects in forested areas and previously slashed areas due to the natural fire event. In order to accomplish this, a series of permanent photopoints was installed ahead of the fire and then retaken immediately post fire. In 2009, these photographs were taken again by the Fire Effects Crew.

Photopoints:

High Severity



Low Severity



Moderate Severity



A change detection analysis of the Landsat-derived Normalized Burn Ratio was also used to produce a burn severity map with 30 meter pixel resolution.

