National Park Service
Yellowstone National Park
Fire Ecology Annual Report
Calendar Year 2014

A. Summary

In 2014 the Yellowstone Fire Ecology staff was led by Fire Ecologist Becky Smith, Fuels Specialist Bill Mayer, and Lead Fire Effects Jess Page. The fire effects crew again consisted of Regina Bilbrey and Kate Williams, while the fuels crew consisted of returning lead Greg Oyler, and new crewmembers Jared Otto, Ryan Bell, Kevin Wallen, and Carson Pollington. This was the first year Yellowstone had a dedicated fuels crew.

2014 was a fire year for the Yellowstone record books. With a grand total of five fires and less than half an acre burned it was the quietest fire year documented in the Park since accurate fire records began in 1972. This fact hardly registered with the fire effects and fuels crews however as they were focused on keeping up with current year plot reads, fuel sampling in between rain events, maintaining the RAWS network, structure and community assessments, hazard fuel treatments, helping out with helicopter projects, search and rescues (SAR), out of park fire assignments, and attending training.

Weather Network and National Fire Danger Rating System

Figure 1: Kate and Jess completing annual spring RAWS maintenance.

Yellowstone's fire weather network consists of six remote automated weather stations (RAWS) and four manual weather stations. Most of the manual stations operate from June through mid-October, depending on weather conditions and the number of district volunteers available to collect the weather. The fire effects crew is responsible for conducting annual maintenance on the RAWS, setting up and taking down the manual stations every year, along with training the volunteers on how to accurately record weather observations and call them in to the fire dispatch center to be entered into the Weather Information Management System (WIMS) database.

The fire effects crew is also responsible for gathering weather reports, lightning maps, fire weather indices, fuel moisture data, safety information and seasonal predictions for daily fire cache meetings, fire briefings and general Park staff briefings. In order to be successful at this everyone within the fire ecology program, particularly the fire effects crew must be proficient with WIMS, Wildland Fire Management Information (WFMI), and Fire Family Plus programs.

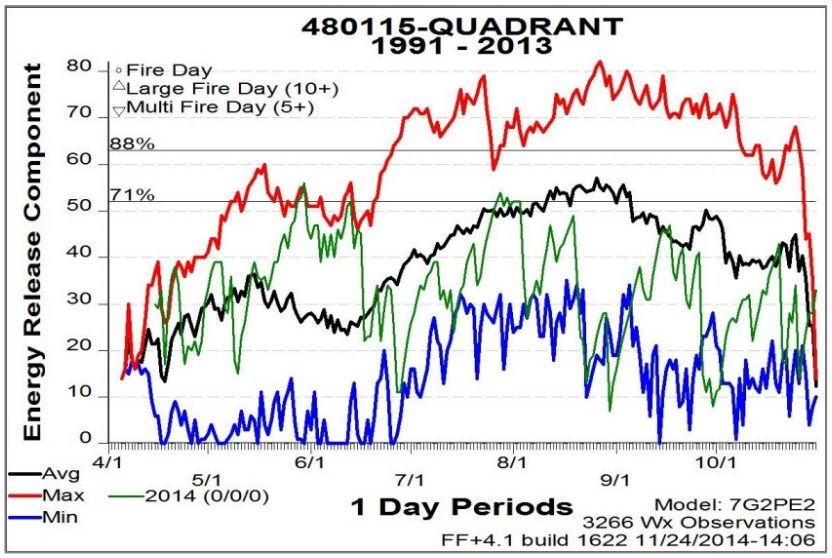


Figure 2: ERC chart showing below average conditions for much of the 2014 season, along with some record setting low ERCs.

Fire Effects Fuel Moisture Sampling

Additionally, the fire effects crew oversaw the fuel sampling program and though it seemed standing water thwarted every other attempt to sample, 28 successful visits between four sample sites were completed throughout the field season. The data were entered into both the Yellowstone fuel moisture database and the National Fuel Moisture Database (NFMD) which can be accessed by the public through the Northern Rockies Coordination Center's website. The four sampling sites are located in areas that represent the major vegetation types found in the Park. These major vegetation types include: mature lodgepole forest, regeneration lodgepole forest (i.e., 1988 burned area), Douglas-fir forest, and high elevation mixed conifer forest. In addition, each manual weather station has a 1000 hour fuel moisture log station which means there are currently nine long term 1000 hour moisture monitoring sites in use between the manual weather stations and fuel sample sites. Log data at the manual weather station sites are collected once a week by the weather volunteers in the Park and called into dispatch along with the weather, thereby helping the Park's fire ecology program greatly. The fuel moisture program becomes indispensable during the fire season by serving to inform Park managers during their decision process for a new fire start. Data from 2014, as seen below in Figure 3, show the 1000 hour fuel moistures decreased steadily until the end of July, at which point they spiked back up sharply through a very wet August. There was a short drying period in September, but unfortunately the day length wasn't sufficient enough to dry fuels to a level which would be conducive for fire behavior.

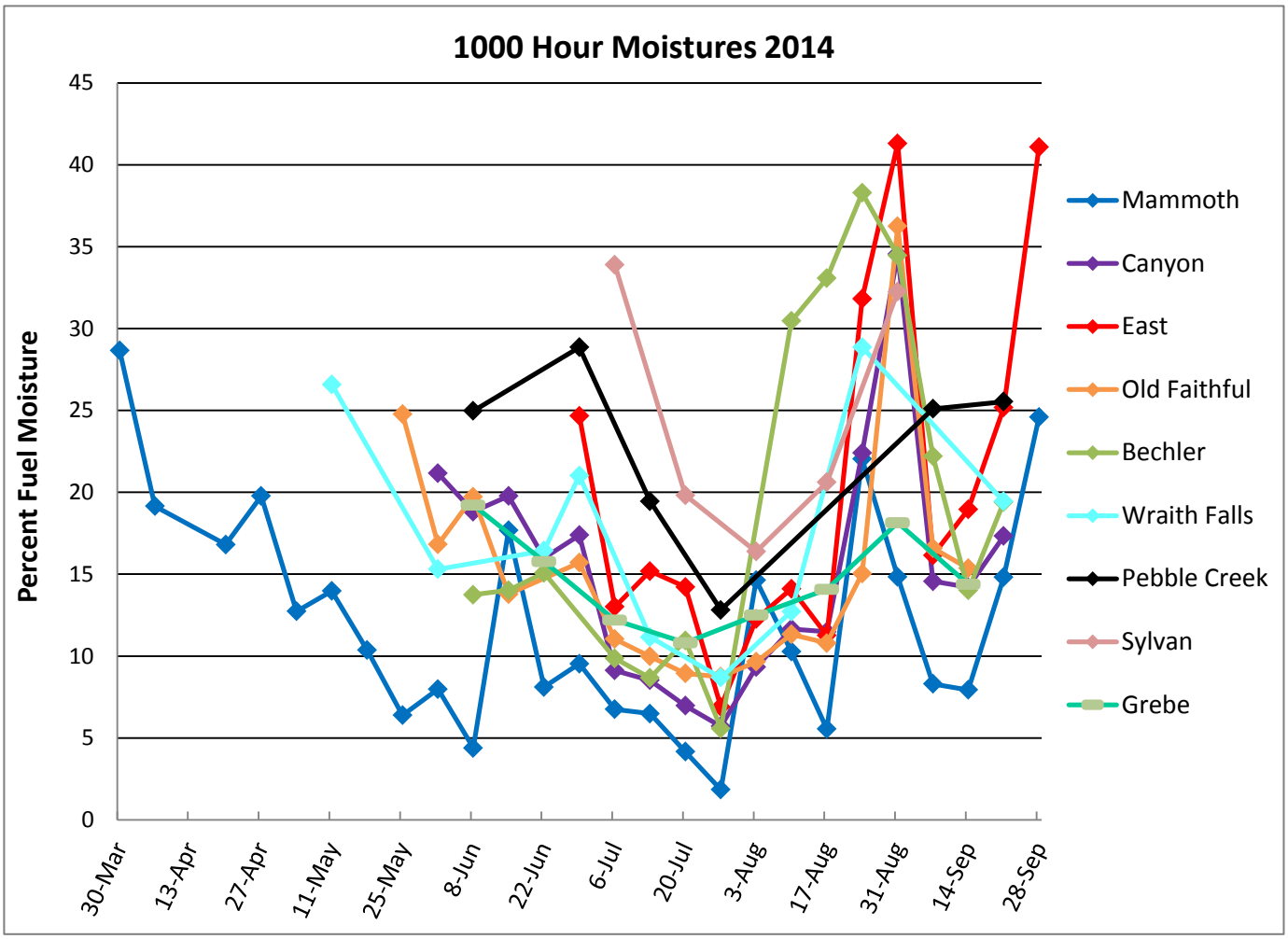


Figure 3: 1000 hour fuel moistures in 2014.

Fire Effects Plot Work

The fire effects crew slowly whittled away at the plot workload throughout the season. This included visiting 25 hazard fuel (HZF) plots in seven developed areas, retaking 32 photo points at five locations, and one FMH plot read. The crew is in the process of converting hazard fuel plots from the old FMECH1T99 monitoring type to the new HZF monitoring type in an effort to standardize the mixed bag of protocols and plot sizes which have been used throughout the Park's fire ecology program over the last 13 years. This entails enlarging each plot from a seven meter radius to a 11.28 meter radius circle; switching from a metric Brown's transect to an English Brown's transect; and collecting vegetation data where none were collected initially. The fire effects crew regularly borrowed personnel from the engine, fuels and helitack crews in order to accomplish monitoring objectives and would like to acknowledge how much this was appreciated.

Figure 4: Kate wades through a fireweed thicket at the Buffalo Plateau backcountry cabin fuels treatment.

Training and Fire Operations

Before field work started this year, all members of the fire ecology staff spent many weeks in training. The yearly (or almost yearly) required training included FISSA, No Fear, Defensive Driving, Credit Card, fire extinguisher, bear spray use, Blood Borne Pathogens, Hazwopper, First Aid, CPR, and RT-130. In between annual required training several fire and EMS trainings were attended, such as S-130, S-190, S-131, S-212, A-100, S-200, S-244, S-260, S-271, S-390, L-280, READ, Pre-hospital Trauma Support (EMS), and a Wilderness First Responder refresher. Permanent staff members were either lead instructors or helped teach two RT-130 classes, L-280, S-244, and S-212 at the beginning of the field season.

Figure 5: Assisting with a FWS prescribed burn in Crescent Lake NWR, Nebraska.

In the spring Becky, Jess, and Greg traveled to Nebraska to assist with a prescribed burn and to work on qualifications such as TFLD(t), ENGB(t) and ENGB. Jess was also able to travel to South Dakota in the fall as an ENGB(t) on two other prescribed burns, as well as support the Grand Canyon Fire Effects crew by filling in as the assistant lead during a month long detail in July. During her time at GRCA Jess was able to use many of her fire qualifications (ICT5, FFT1, FEMO, FALA) on several fires as well as read post fire FMH plots, learn new plot protocols, and gain a better understanding of the set up and actual use of tablets for field data collection and fire monitoring.

Throughout the field season one fire effects crewmember traveled with an interagency Type 2 IA crew to Northern California for two weeks, and with a 10 person squad to Saguaro National Park where she was able to get signed off as a HECM and also lend her skills as a FEMO(t), lookout, FFT1 and FALA, and master plot reader. The other fire effects crewmember spent two weeks with the Park's helicopter in Oregon on the Deception complex and made significant headway on her HMGB taskbook. Members of the fuels crew also took multiple out of park fire assignments, such as with the Park helicopter module to Washington, Oregon, and California, staffing an interagency Type 2 IA crew on two assignments in California and Oregon, and a 10 person squad to Saguaro National Park.

In addition the fire effects and fuels crews helped with staffing the engine, helicopter, and assisting with four Park SARs. A few of the helicopter projects were relatively involved, and the crews filled in as HECM and HMGB as needed to help sling 17,000 pounds of cement for a fish project on Greyling creek, shuttle carpenters and gear to Buffalo Plateau cabin on a weekly basis, and a trail project in the Tetons where several thousand pounds of gravel was slung to a backcountry trail. Altogether the fire effects and fuels crews worked toward or maintained currencies as HMGB, HECM, ENGB, ENOP, ICT5, FEMO, FALB, FALA, EMT, CRWB, FFT1, FFT2, FRWS, FOBS, and FIRB.

Fuels Crew

After the many weeks of required annual and fire training were completed, the new fuels crew hit the ground running with hazard tree removal in the Mammoth area and structure assessments. Mark Vaughn, a contractor working for Skip Edel, visited in early June to provide training for wildland fire risk assessments on structures in the Park. The crew trained on recording structure data using Trimble Juno GPS units and uploading data to the national server. The crew then hiked to the Fawn Pass Cabin in late June to burn slash piles created from defensible space work around the cabin in 2011. This logistically and tight time window project has been in the works for several years. The crew burned roughly 50 piles, chunked, mopped-up, and declared the piles out before hiking the 13 miles out of the backcountry.

Early summer had the fuels crew completing assessments in the Snake River District which includes Grant Village and South Entrance developed areas. They were also able to work on assessments in the Old Faithful and Norris areas for a total of approximately 500 assessments completed this year.

A minor project the crew worked on between structure assessments and fire assignments was removing a heavy concentration of dead and down fuel from a large blowdown near the Norris government housing area. The crew worked with the Yellowstone Youth Conservation Corps to buck and haul over 80 cords of firewood out of two acres of blowdown. The wood was made available for firewood permits, and the slash was piled and burned at the end of October.

Figure 6: Piles burning at Fawn Pass Cabin.

Once fall came the crew began extensive work on the defensible space fuels reduction project in the Canyon government area. The fuels crew treated approximately 45 acres creating firewood, woodchips, fencing rails, and bumper logs for multiple Park divisions. Work continued at Canyon until the end of October when snow ended all meaningful field work.

Table 1. Fire Effects Plot Workload (2014) and Total Plots Installed

Park	Monitoring Type	Plot Type	Pre-burn /Precut 2014	Imm. Post 2014	Postburn/ Postcut (1-20 yrs) 2014	Annual Total 2014	Total Plots
Yellowstone National Park	FLP01T08 (Lodgepole regeneration)	FMH forest	-	-	-	-	4
	FWFRB1T99 (Wildland Fire for Resource Benefits)	FMH forest	-	-	1	**1**	19
	FMICO1T10 (Mixed Conifer)	FMH forest	-	-	-	-	6
	HZF (Hazard Fuel Treatments)	Photo point	2	-	30	**32**	76
	HZF (Hazard Fuel Treatments)	Rapid assessment: trees, veg. and fuels	-	-	25	**25**	100
	Despain	Pre-FMH: trees, veg. and fuels	-	-	-	-	16
	Fireline Explosive	Modified Daubenmire sample					9
Little Bighorn Battlefield NM	No fire effects monitoring plots are currently installed at LIBI; a Fire Management Plan and Monitoring Plan need to be completed first.			-	-	-	0
Total			2	-	56	**58**	230

Table 2. Fire Ecology Staffing 2014

Ecologist, Fuels Specialist, Monitors and Fuels Tech	Starting Date	Ending Date	# of Pay Periods	READ Qualified (Yes or No)	Training and Development
Becky Smith	1/1/14	12/31/14	26	No	SAR monthly overhead and employee trainings; taught RT-130, sections of S-244 and L-280; participated in personal development forum; worked on TFLD taskbook and as a PSC3(t); presented poster at GYE Scientific Conference
Jess Page	3/11/13	12/14/13	19	No	S-244; co-taught RT-130; EMS endorsement; online training: FISSA, HAZWOPER, bloodborne pathogens, radio use, USERRA, veterans employment, and credit card; WFR recertification; READ class webinar; presented poster at GYE Scientific Conference
Regina Bilbrey	5/19/13	10/19/13	11	No	S-200; S-244; S-260; S-390; RT-130; online training: S-NSC Defensive Driving II, HAZWOPER, bloodborne pathogens, radio use, credit card, FISSA, and No Fear; EMS endorsement; Pre Hospital Trauma Life Support; worked on HMGB taskbook; stayed current as ICT5, FFT1, HECM, and FEMO(t)
Kate Williams	5/26/13	10/05/13	9.5	No	S-200; L-280; S-244; S-260; S-390; RT-130; online training: S-NSC Defensive Driving II, HAZWOPER, bloodborne pathogens, radio use, credit card, FISSA, No Fear; completed HECM taskbook; stayed current as ICT5, FFT1 and FEMO(t)

Bill Mayer	1/1/14	12/31/14	26	No	EMT class and certification; SAR employee trainings; structure fire training; taught S-212 and sections of S-200; READ class webinar; attended GYE Scientific Conference; stayed current as CRWB
Greg Oyler	4/21/14	10/30/2014	14	No	RX burning; S-390; structure assessment training; online training: radio use, credit card, FISSA, and No Fear; taught sections of S-212; completed HMGB taskbook
Jared Otto	5/19/14	10/16/14	11	No	S-200; L-280; completed ENGB & FALB taskbooks; structure assessment training; online training: S-NSC Defensive Driving II, HAZWOPER, bloodborne pathogens, radio use, credit card, FISSA, and No Fear
Ryan Bell	5/19/14	10/30/14	12	No	S-131; S-133; S-200; L-280; online training: S-NSC Defensive Driving II, HAZWOPER, bloodborne pathogens, radio use, credit card, FISSA, and No Fear
Kevin Wallen	5/19/14	8/23/14	7	No	S-130/190; S-212; online training: S-NSC Defensive Driving II, HAZWOPER, bloodborne pathogens, radio use, credit card, FISSA, and No Fear
Carson Pollington	6/14/14	8/23/14	5	No	S-130/190; S-212; online training: S-NSC Defensive Driving II, HAZWOPER, bloodborne pathogens, radio use, credit card, FISSA, and No Fear

2014 Management Objectives and Monitoring Results

Hazard Fuel (HZF) Monitoring Type General Information

These permanent monitoring plots were installed in most planned hazard fuel treatment locations throughout the developed areas and backcountry of the Park starting in 2003. During the initial installment phase, vague treatment objectives were written using the previous (FMECH1T99) hazard fuel monitoring type's FMH-4, which utilizes 0.04 kg/m^3 as a critical canopy bulk density to stop crown fire initiation. Scott (2003) suggests 0.1 kg/m^3 as critical canopy bulk density with drought summer fuel moistures and a 25 mile per hour open windspeed for horizontal propagation of crown fire. A 25 mile per hour wind happens less than five percent of the time during summer months anywhere in the Park, with the exception of high mountain peaks and 0.04 kg/m^3 seems arbitrary, so it was determined each treatment unit should be evaluated separately. To do this, plot data and site specific high fire danger weather and fuel moisture conditions were entered into a spatial fire behavior model to examine each unit's ability to eliminate crown fire activity. The high fire severity weather and fuel conditions were determined through FireFamily Plus for a representative weather station near each unit, and Wildland Fire Decision Support System Basic fire behavior analyses were used to create the crown fire activity maps. At this time, the analysis has only happened for the West and South Entrance treatments, and results are shown below. The vegetation objectives were not added until recently when all plots visited were converted from the old monitoring type to the new monitoring type (HZF) to standardize plot sizes and methodology across treatment areas throughout the Park. A new FMH-4 desperately needs to be written for the HZF monitoring type.

East Entrance Hazard Fuel Treatment

The 2003 and 2007 East Entrance hazard fuel project consists of one treatment unit, located in the East Entrance housing area, totaling 15.4 acres. The first fuels reduction treatment was conducted in 2003; the second entry treatment was completed in 2007. Eleven plots were installed in 2003 prior to the first treatment, and seven of the original plots were converted from the FMECH1T99 monitoring type to the HZF monitoring type in 2014.

Results are shown as mean treatment area canopy bulk density to include overstory and pole size trees, from pre-treatment (PRE) through seven years after the second treatment (02YR07). Surface fuel results are mean solid and rotten 1000 hour size class from PRE to 02YR07. Priority weed species are relative percent cover, and native vegetation species are mean relative percent cover, using the 02YR07 data as vegetation data were not collected until 2014. An underlined number of plots indicate the minimum sample size has been attained for the objective.

Table 3. East Entrance HZF Monitoring Results

Monitoring Unit	Management Objective (Hazard Fuel Reduction)	Monitoring Results (80% confidence interval)	Objective Achieved?	Year Analysis Completed; (Range of Years Included)
East Entrance HZF	Reduce mean treatment area canopy bulk density over the entire life of the project to ≤0.04 kg/m^3, as measured from original pre-treatment conditions.	**PRE: 0.073 (±0.026) kg/m^3** **01POST: 0.025 (±0.009) kg/m^3** Difference from PRE to 01POST: -65.8% *(n = 7 plots, 1 treatment)* **02YR07: 0.027 (±0.0016) kg/m^3** Difference from PRE to 02YR07: -63% *(n=7 plots, 2 treatments)*	Yes	2014 (2003-2014)
	Reduce mean dead and down 1000 hour fuel loads to ≤10 tons/acre over the entire life of the project, as measured from original pre-treatment conditions.	**PRE: 10.9 (±3.7) t/ac** **01POST: 5.5 (±2.4) t/ac** Difference from PRE to 01POST: -49.5% *(n = 11 plots, 1 treatment)* **PRE: 7.7 (±2.8) t/ac** **02YR07: 70.4 (±77.5) t/ac** Difference from PRE to 02YR07: +819.0% *(n = 7 plots, 2 treatments)*	No	2014 (2003-2014)
	Monitor species listed on park priority weed list, through relative cover.	East 1, 02YR07: • <1% *Poa palustris* • <1% *Taraxacum officinale* • <1% *Tragopogon dubius* East 4, 02YR07: • <1% *Poa palustris* • 4.5% *Phleum pratense* East 6, 02YR07: • 0% East 7, 02YR07: • 0%	Yes	2014 (2014)

		East 9, 02YR07: • <1% *Poa pratensis* East 10, 02YR07: • 0% East 11, 02YR07: • <1% *Poa palustris* • <1% *Taraxacum officinale* • <1% *Tragopogon dubius* • <1% *Poa pratensis*		
	Monitor for native species composition change, using mean relative cover.	**02YR07: 98.9% (±0.95) native species** *(n = 7 plots, 2 treatments)*	No, as this was the first year data were collected.	2014 (2014)

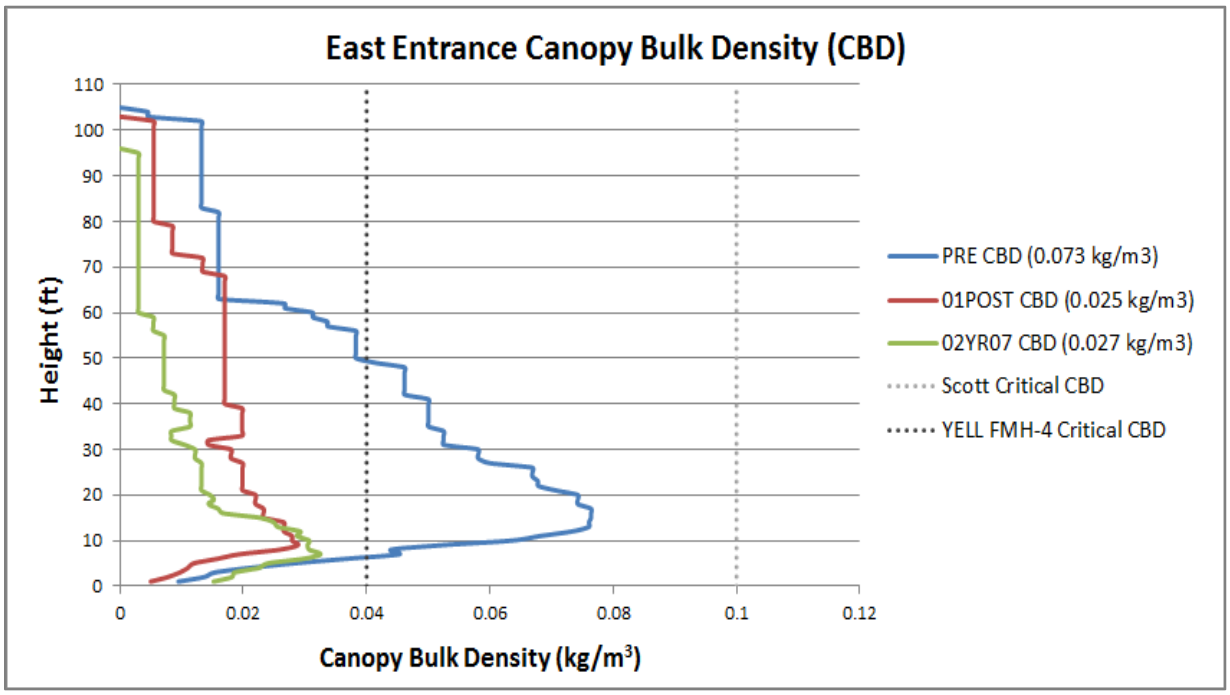


Figure 7: East Entrance canopy bulk density graph.

Based on the old FMH-4, canopy base height is not currently a specific treatment objective, but it is an important factor in crown fire initiation and was therefore analyzed. Canopy base height within the East Entrance treatment unit was 1.9 meters (±0.6 m, n = 9) pre-treatment, 2.2 meters (±1.0 m, n=10) immediately after the first treatment, and 2.2 meters (±1.8 m, n=6) five years after the second treatment. A crown fire activity analysis will be completed for the East Entrance in 2015.

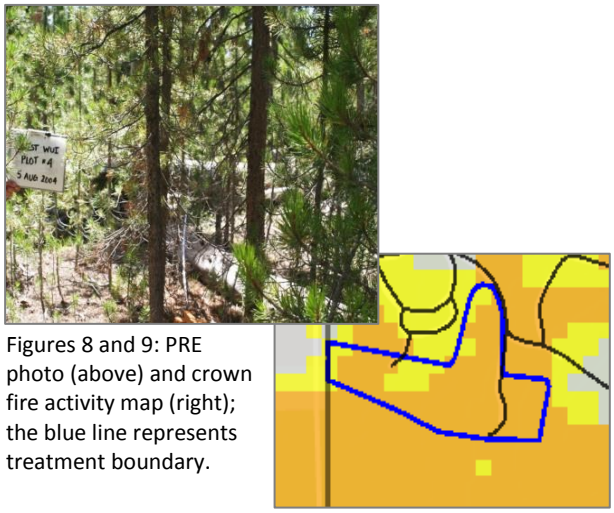
West Entrance Hazard Fuel Treatment

The 2004 and 2009 West Entrance hazard fuel project consists of one treatment unit, located in the West Entrance government area, totaling 13.3 acres. The first fuel reduction treatment was conducted in 2004; the second entry treatment was completed in 2009. Four plots were installed in 2004 prior to the first entry, and the plots were then converted from the FMECH1T99 monitoring type to the HZF monitoring type in 2014.

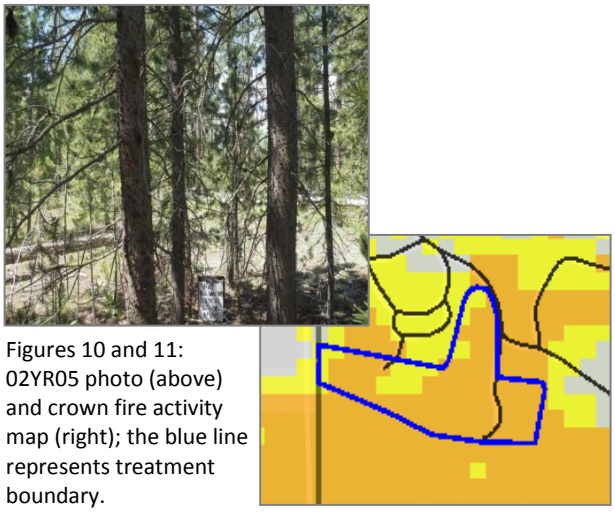
Results are shown as mean treatment area canopy bulk density to include overstory and pole size trees, from pre-treatment (PRE) through five years after the second treatment (02YR05). Surface fuel results are mean solid and rotten 1000 hour size class from PRE to 02YR05. Priority weed species are relative percent cover, and native vegetation species are mean relative percent cover, using the 02YR05 data as vegetation data were not collected until 2014. An underlined number of plots indicate the minimum sample size has been attained for the objective.

Table 4. West Entrance HZF Monitoring Results

Monitoring Unit	Management Objective (Hazard Fuel Reduction)	Monitoring Results (80% confidence interval)	Objective Achieved?	Year Analysis Completed; (Range of Years Included)
West Entrance HZF	Reduce mean treatment area canopy bulk density over the entire life of the project to ≤0.04 kg/m^3, as measured from original pre-treatment conditions.	**PRE: 0.045 (±0.014) kg/m^3** **02YR05: 0.069 (±0.012) kg/m^3** Difference from PRE to 02YR05: +53.3% *(n = 4 plots, 2 treatments)*	No	2014 (2004-2014)
	Reduce mean dead and down 1000 hour fuel loads to ≤10 tons/acre over the entire life of the project, as measured from original pre-treatment conditions.	**PRE: 42.5 (±30.1) t/ac** **02YR05: 5.8 (±7.0) t/ac** Difference from PRE to 02YR05: -86.5% *(n = 4 plots, 2 treatments)*	Yes	2014 (2004-2014)
	Monitor species listed on park priority weed list, through relative cover.	West 1, 02YR05: • 4.4% Unknown *Hieracium* spp. West 2, 02YR05: • 4.4% *Poa pratensis* • 5.9% Unknown *Phleum* spp. West 3, 02YR05: • 0% West 4, 02YR05 • 0%	Yes	2014 (2014)
	Monitor for native species composition change, using mean relative cover.	**02YR05: 96.3% (±4.02) native species** *(n = 4 plots, 2 treatments)*	No, as this was the first year data were collected.	2014 (2014)



Figures 8 and 9: PRE photo (above) and crown fire activity map (right); the blue line represents treatment boundary.



Figures 10 and 11: 02YR05 photo (above) and crown fire activity map (right); the blue line represents treatment boundary.

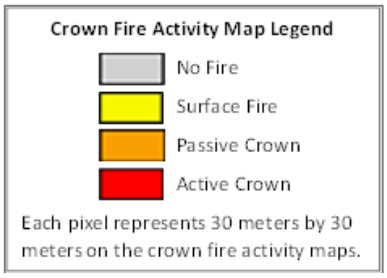


Figure 12: Crown fire activity map legend.

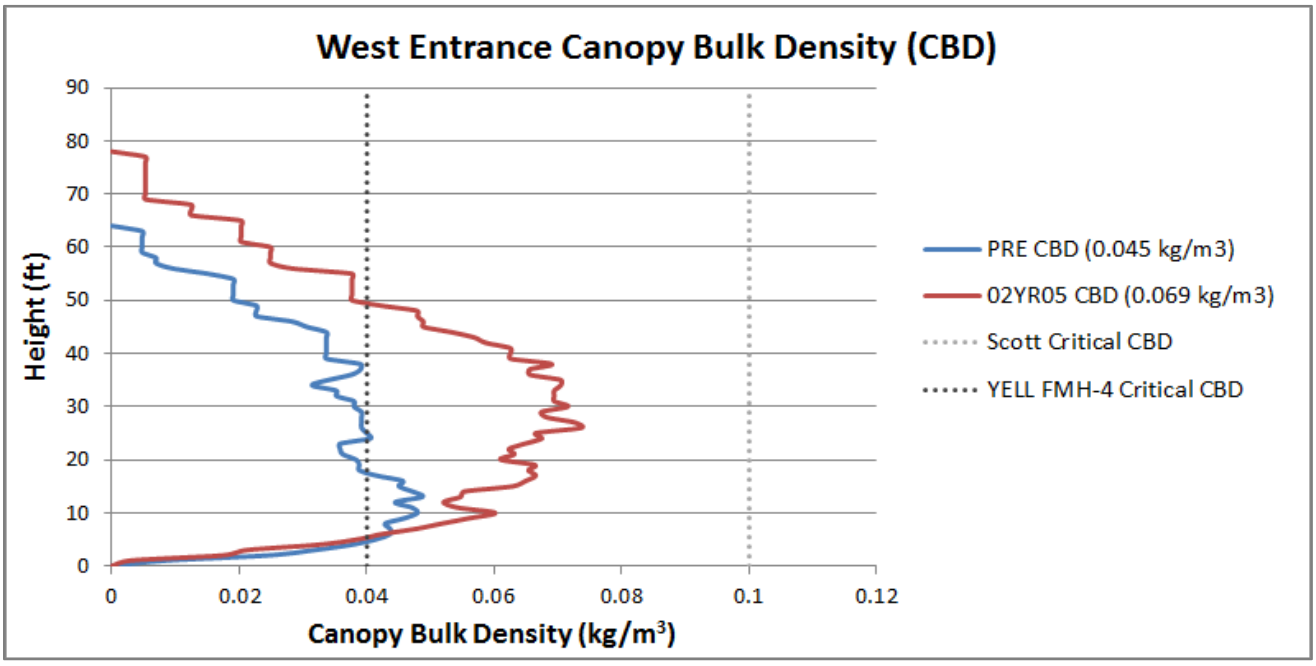


Figure 13: West Entrance canopy bulk density graph.

Canopy bulk density within the West Entrance treatment actually increased after the second entry, most likely due to growth of seedling and pole sized trees. Canopy base height increased from 1.5 meters (±0.7 m, n=4) pre-treatment, to 2.4 meters five years after the second treatment. This analysis suggests a third entry treatment is needed to stop crown fire initiation.

South Entrance Hazard Fuel Treatment

The 2004 and 2013 South Entrance hazard fuel project consists of one treatment unit, located in the South Entrance housing area, totaling 5.8 acres. The first fuel reduction treatment was conducted in 2004; the second entry treatment was completed in 2013 due to the Snake Fire threatening the area. Three plots were installed in 2004 prior to the first entry, and two of the original plots were converted from the FMECH1T99 monitoring type to the HZF monitoring type in 2014 to standardize plot sizes and methodology across treatment areas throughout the Park.

Results are shown as mean treatment area canopy bulk density to include overstory and pole size trees, from pre-treatment (PRE) through one year after the second treatment (02YR01). Surface fuel results are mean solid and rotten 1000 hour size class from PRE to 02YR01. Priority weed species are relative percent cover, and native vegetation species are mean relative percent cover. An underlined number of plots indicate the minimum sample size has been attained for the objective.

Table 5. South Entrance HZF Monitoring Results

Monitoring Unit	Management Objective (Hazard Fuel Reduction)	Monitoring Results (80% confidence interval)	Objective Achieved?	Year Analysis Completed; (Range of Years Included)
South Entrance HZF	Reduce mean treatment area canopy bulk density over the entire life of the project to ≤0.04 kg/m^3, as measured from original pre-treatment conditions.	**PRE: 0.094 (±0.042) kg/m^3** **01POST: 0.066 (±0.080) kg/m^3** Difference from PRE to 01POST: -29.8% *(n = 2 plots, 1 treatment)* **02YR01: 0.057 (±0.086) kg/m^3** Difference from PRE to 02YR01: -39.4% *(n=2 plots, 2 treatments)*	No	2014 (2004-2014)
	Reduce mean dead and down 1000 hour fuel loads to ≤10 tons/acre over the entire life of the project, as measured from original pre-treatment conditions.	**PRE: 13.6 (±9.3) t/ac** **01POST: 1.8 (±2.6) t/ac** Difference from PRE to 01POST: -87.0% *(n = 3 plots, 1 treatment)* **PRE: 11.4 (±23.2) t/ac** **02YR01: 1.9 (±5.7) t/ac** Difference from PRE to 02YR01: -83.7% *(n = 2 plots, 2 treatments)*	Yes	2014 (2004-2014)
	Monitor species listed on park priority weed list, through relative cover.	South 1, 02YR01: • <1% *Poa pratensis* South 3, 02YR01: • <1% *Rumex acetosella* • 2.7% *Poa pratensis*	Yes	2014 (2014)
	Monitor for native species composition change, using mean relative cover.	**02YR01: 98.2% (±4.08) native species** *(n = 2 plots, 2 treatments)*	No, as this was the first year data were collected.	2014 (2014)

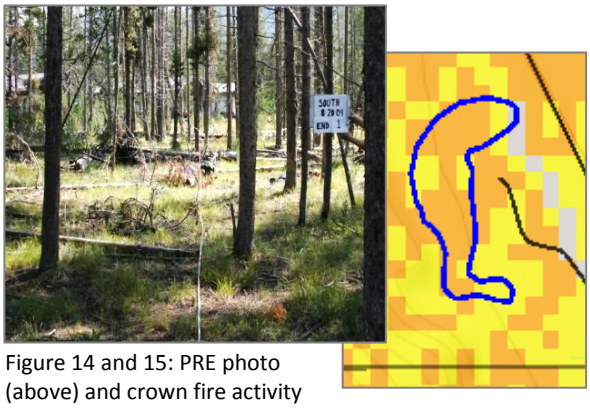


Figure 14 and 15: PRE photo (above) and crown fire activity map (right); the blue line represents treatment boundary.

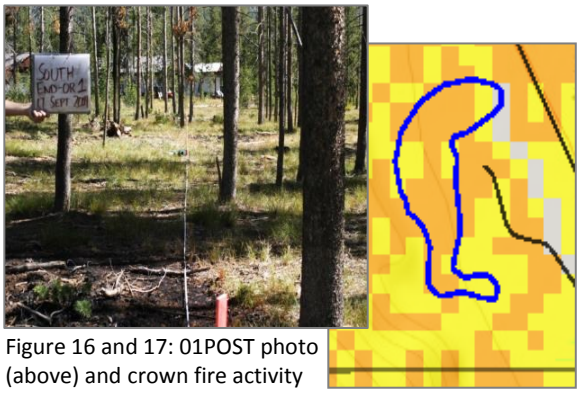


Figure 16 and 17: 01POST photo (above) and crown fire activity map (right); the blue line represents treatment boundary.

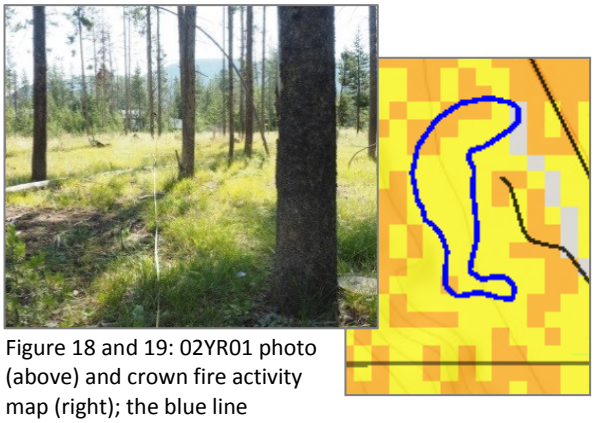


Figure 18 and 19: 02YR01 photo (above) and crown fire activity map (right); the blue line represents treatment boundary.

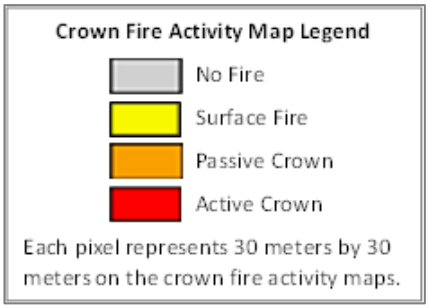


Figure 20: Crown fire activity map legend.

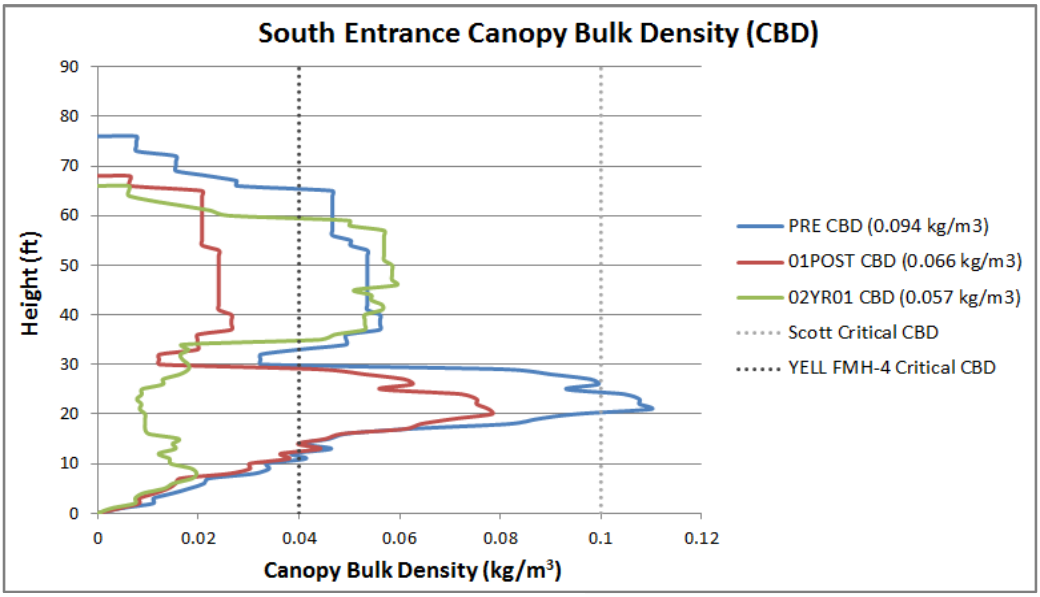


Figure 21: South Entrance canopy bulk density graph.

Canopy bulk density within the South Entrance treatment decreased after the first and second entries, especially in the 10 to 30 feet tall range. Canopy base height was 4.5 meters (±2.3 m, n = 3) pre-treatment, 4.4 meters (±2.5 m, n=3) immediately after the first treatment, and 5.5 meters (±11.4, n=2) one year after the second treatment. Although the objective to reduce canopy bulk density to 0.04 kg/m^3 has not been met, this analysis suggests the second entry treatment is currently sufficient to stop crown fire initiation throughout most of the treatment unit at the South Entrance.

Lake Hazard Fuel Treatment

The 2003 and 2009 Lake hazard fuel project consists of one treatment unit, located in the Lake government housing area, totaling 33.1 acres. The first fuel reduction treatment was conducted in 2003; the second entry treatment was completed in 2009 due to the Arnica Fire threatening the area. Seven plots were installed in 2003 prior to the first entry, and four of the original plots were converted from the FMECH1T99 monitoring type to the HZF monitoring type in 2014.

Results are shown as mean treatment area canopy bulk density to include overstory and pole size trees, from pre-treatment (PRE) through five years after the second treatment (02YR05). Surface fuel results are mean solid and rotten 1000 hour size class from PRE to 02YR05. Priority weed species are relative percent cover, and native vegetation species are mean relative percent cover, using the 02YR05 data as vegetation data were not collected until 2014. An underlined number of plots indicate the minimum sample size has been attained for the objective.

Table 6. Lake HZF Monitoring Results

Monitoring Unit	Management Objective (Hazard Fuel Reduction)	Monitoring Results (80% confidence interval)	Objective Achieved?	Year Analysis Completed; (Range of Years Included)
Lake HZF	Reduce mean treatment area canopy bulk density over the entire life of the project to ≤0.04 kg/m^3, as measured from original pre-treatment conditions.	**PRE: 0.048 (±0.028) kg/m^3** **01POST: 0.028 (±0.026) kg/m^3** Difference from PRE to 01POST: -41.7% *(n = 4 plots, 1 treatment)* **02YR05: 0.042 (±0.027) kg/m^3** Difference from PRE to 02YR05: -12.5% *(n=4 plots, 2 treatments)*	No	2014 (2003-2014)
	Reduce mean dead and down 1000 hour fuel loads to ≤10 tons/acre over the entire life of the project, as measured from original pre-treatment conditions.	**PRE: 24.4 (±12.6) t/ac** **01POST: 12.3 (±7.2) t/ac** Difference from PRE to 01POST: -49.7% *(n = 5 plots, 1 treatment)* **PRE: 26.6 (±16.7) t/ac** **02YR05: 24.5 (±18.0) t/ac** Difference from PRE to 02YR05: -8.1% *(n = 4 plots, 2 treatments)*	No	2014 (2003-2014)
	Monitor species listed on park priority weed list, through relative cover.	Lake 1, 02YR05: • 5.8% *Trifolium repens* Lake 3, 02YR05: • 0% Lake 6, 02YR05: • 5.1% *Taraxacum officinale*; • 1.7% *Trifolium repens* Lake 7, 02YR05: • <1% *Taraxacum officinale*	Yes	2014 (2014)
	Monitor for native species composition change, using mean relative cover.	**02YR05: 94.4% (±5.87) native species** *(n = 4 plots, 2 treatments)*	No, as this was the first year data were collected.	2014 (2014)

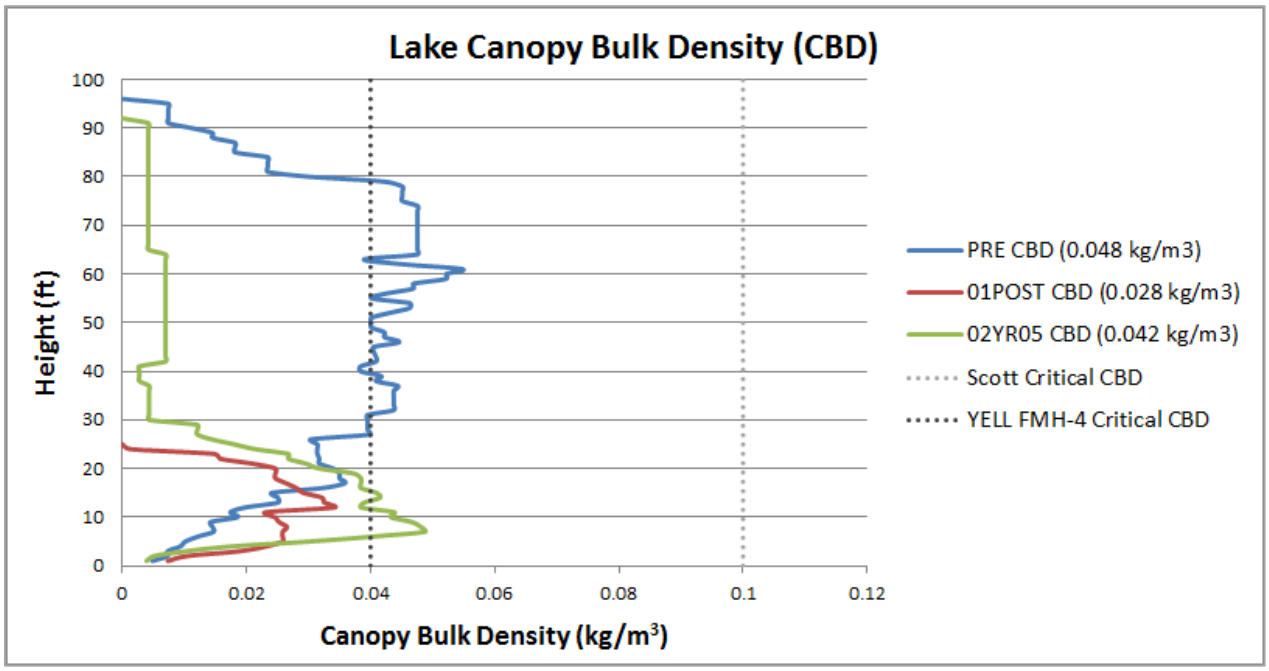


Figure 22: Lake canopy bulk density graph.

Canopy base height within the Lake treatment unit was 6.5 meters (±4.3 m, n=5) pre-treatment, 1.0 meters (±0.6 m, n=3) immediately after the first treatment, and 1.3 meters (±0.1 m, n=4) five years after the second treatment. This downward movement of canopy base height is most likely due to the overstory canopy being opened up after the first entry treatment, therefore allowing the smaller size class trees to rapidly grow. A crown fire activity analysis will be completed for Lake in 2015.

Northeast Entrance Hazard Fuel Treatment

The 2003 and 2009 Northeast Entrance hazard fuel project consists of one treatment unit, located in the Northeast Entrance housing area, totaling 13.2 acres. The first fuel reduction treatment was conducted in 2003; the second entry treatment was completed in 2009. Four plots were installed in 2003 prior to the first treatment, six plots were installed immediately after the first treatment, and six of the original plots were converted from the FMECH1T99 monitoring type to the HZF monitoring type in 2014.

Results are shown as mean treatment area canopy bulk density to include overstory and pole size trees, from pre-treatment (PRE) through five years after the second treatment (02YR05). Surface fuel results are mean solid and rotten 1000 hour size class from PRE to 02YR05. Priority weed species are relative percent cover, and native vegetation species are mean relative percent cover, using the 02YR05 data as vegetation data were not collected until 2014. An underlined number of plots indicate the minimum sample size has been attained for the objective.

Table 7. Northeast Entrance HZF Monitoring Results

Monitoring Unit	Management Objective (Hazard Fuel Reduction)	Monitoring Results (80% confidence interval)	Objective Achieved?	Year Analysis Completed; (Range of Years Included)
Northeast Entrance HZF	Reduce mean treatment area canopy bulk density over the entire life of the project to ≤0.04 kg/m^3, as measured from original pre-thin conditions.	**PRE: 0.107 (±0.039) kg/m^3** **01POST: 0.076 (±0.110) kg/m^3** Difference from PRE to 01POST: -29.0% *(n = 3 plots, 1 treatment)* **02YR05: 0.041 (±0.041) kg/m^3** Difference from PRE to 02YR05: -61.7% *(n=3 plots, 2 treatments)*	No	2014 (2003-2014)
	Reduce mean dead and down 1000 hour fuel loads to ≤10 tons/acre over the entire life of the project, as measured from original pre-treatment conditions.	**PRE: 13.6 (±7.0) t/ac** **01POST: 12.9 (±4.1) t/ac** Difference from PRE to 01POST: -5.6% *(n = 3 plots, 1 treatment)* **02YR05: 37.9 (±24.6) t/ac** Difference from PRE to 02YR05: +177.8% *(n = 3 plots, 2 treatments)*	No	2014 (2003-2014)
	Monitor species listed on park priority weed list, through relative cover.	Northeast 1, 02YR05: • 0% Northeast 3, 02YR05: • <1% *Taraxacum officinale*; • 1.8% *Phleum pratense* Northeast 4, 02YR05: • 4.1% *Taraxacum officinale*; • 3.75% *Cirsium arvense*; • 4.5% *Trifolium repens*; • 4.1% *Phleum pratense*	Yes, but high occurrence of priority weed species in most plots	2014 (2014)

		Northeast 7, 02YR05: • 5.0% *Taraxacum officinale*; • 8.8% *Trifolium repens*; • 8.6% *Phleum pratense* Northeast 9, 02YR05: • 12.4% *Taraxacum officinale*; • 7.0% *Trifolium repens*; • 1.6% *Phleum pratense* Northeast 10, 02YR05: • 8.9% *Taraxacum officinale*; • 3.8% *Trifolium repens*; • 1.9% *Phleum pratense*		
	Monitor for native species composition change, using mean relative cover.	**02YR05: 87.1% (±5.74) native species** *(n = 6 plots, 1 treatment)*	No, as this was the first year data were collected.	2014 (2014)

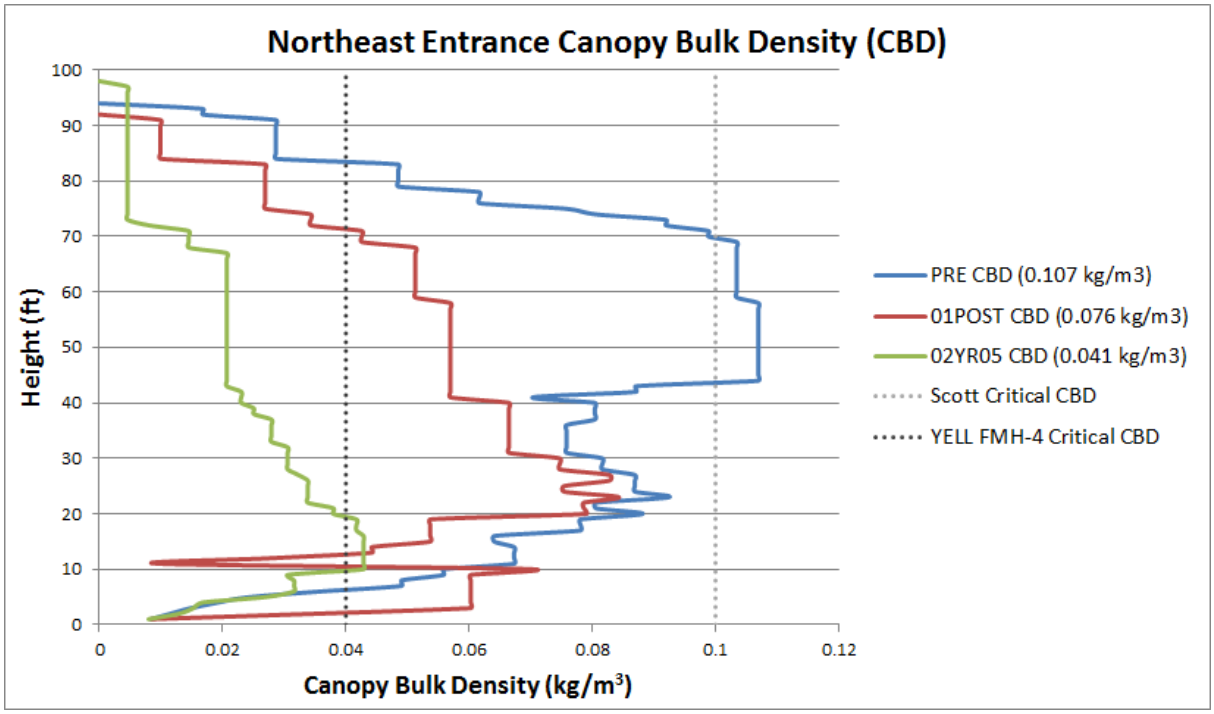


Figure 23: Northeast Entrance canopy bulk density graph.

Canopy base height within the Northeast Entrance treatment unit was 4.6 meters (±1.0 m, n = 3) pre-treatment, 5.8 meters (±2.3 m, n=3) immediately after the first treatment, and 3.6 meters (±2.0 m, n=5) five years after the second treatment. A crown fire activity analysis will be completed for the Northeast Entrance in 2015.

Buffalo Plateau Hazard Fuel Treatment

The 2003 Buffalo Plateau hazard fuel project consists of one treatment unit, located around the Buffalo Plateau backcountry cabin, totaling 5.1 acres. Two plots were installed in 2003 prior to the first entry; both plots were then converted from the FMECH1T99 monitoring type to the HZF monitoring type in 2014.

Results are shown as mean treatment area canopy bulk density to include overstory and pole size trees, from pre-treatment (PRE) through 11 years after the first treatment (01YR11). Surface fuel results are mean solid and rotten 1000 hour size class from PRE to 01YR11. Priority weed species are relative percent cover, and native vegetation species are mean relative percent cover, using the 01YR11 data as vegetation data were not collected until 2014. An underlined number of plots indicate the minimum sample size has been attained for the objective.

Table 8. Buffalo Plateau HZF Monitoring Results

Monitoring Unit	Management Objective (Hazard Fuel Reduction)	Monitoring Results (80% confidence interval)	Objective Achieved?	Year Analysis Completed; (Range of Years Included)
Buffalo Plateau HZF	Reduce mean treatment area canopy bulk density over the entire life of the project to ≤0.04 kg/m^3, as measured from original pre-treatment conditions.	**PRE: 0.154 (±0.368) kg/m^3** **01YR11: 0.007 (±0.017) kg/m^3** Difference from PRE to 01YR11: -95.5% *(n = 2 plots, 1 treatment)*	Yes	2014 (2003-2014)
	Reduce mean dead and down 1000 hour fuel loads to ≤10 tons/acre over the entire life of the project, as measured from original pre-treatment conditions.	**PRE: 6.8 (±20.9) t/ac** **01YR11: 9.1 (±7.2) t/ac** Difference from PRE to 01YR11: +33.1% *(n = 2 plots, 1 treatment)*	Yes	2014 (2003-2014)
	Monitor species listed on park priority weed list, through relative cover.	Buffalo Plateau 1, 01YR11: • <1% each of *Poa pratensis, Trifolium repens,* and *Taraxacum officinale* Buffalo Plateau 2, 01YR11: • 0%	Yes	2014 (2014)
	Monitor for native species composition change, using mean relative cover.	**01YR11: 99.1% (±2.71) native species** *(n = 2 plots, 1 treatment)*	No as this was the first year data were collected.	2014 (2014)

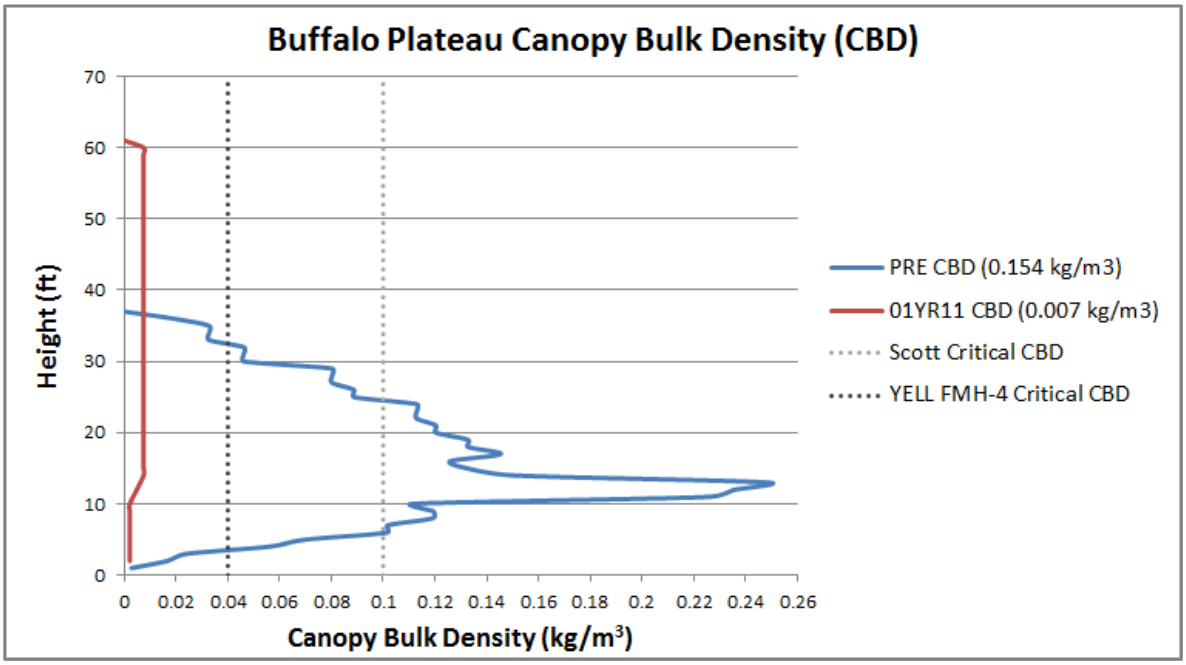


Figure 24: Buffalo Plateau canopy bulk density graph.

Canopy base height within the Buffalo Plateau treatment unit was 1.7 meters (±2.0 m, n=2) pre-treatment, and was measured at 2.3 meters (±5.4 m, n=2) 10 years after the first treatment. Eleven years after the initial treatment only one tree per plot existed, which explains the flat line on Figure 24 above.

B. Program Information

Table 10. Planning - 2014

Park	Does Park have written DFCs? (yes or no)	Date Park-level Monitoring Plan completed (or revised)	Total # of Project- or Community-level Monitoring Plans (not just 2014)	Assisted with how many BAER plans in 2014?
Yellowstone National Park	no	Late 2015	4	0
Little Bighorn Battlefield National Monument	unknown	After Fire Management Plan is completed	0	0

Table 11. Monitoring - 2014

Park	% 2014 Data Entered	% 2014 Data Quality Checked	# Prescribed Fires Monitored*	# Non-fire Fuels Treatments Monitored*	# Wildfires Monitored*	# BAER Treatments Monitored*
Yellowstone National Park	100	100	0	7	0	0
Little Bighorn Battlefield National Monument	n/a	n/a	0	0	0	0

***** Number of treatment units with treatment effects monitoring conducted. Include pre-burn and post-burn monitoring but not burn-day monitoring.

Table 12. Communicating Results - 2014

Park	# of Project Monitoring Reports completed in 2014	# of annual meeting(s) with Park staff	# of formal presentations of results	Do you use Minitab?
Yellowstone National Park	2	2	1	Infrequently
Little Bighorn Battlefield National Monument	0	0	0	

Table 13. Research - 2014

Park	Are research needs identified in FMP or Monitoring Plan? (yes or no)	# of Proposals Submitted in 2014	# of Proposals Funded in 2014	# of Research Projects Supported in 2014*	Additional Comments
Yellowstone National Park	Yes	0	0	3	
Little Bighorn Battlefield National Monument	Not yet	0	0	0	

*Number of funded research projects, new or ongoing, supported by the fire ecology program including logistical info or support, staffing, etc.

C. Fire ecologist accomplishments and areas of focus

Table 14. Fire Ecologist 2014 Accomplishments/Focus Areas

Category	Percent Time	Accomplishments and/or areas of activities
Planning	35%	• Initiated and completed WUI geodatabase to include all fuel treatments completed in the Park from 2001 through those proposed in 2015 • Assisted with a SOW for Northeast fuel project and spearheaded all compliance for fuels projects • Completed annual FWS T & E report for 2013 fire season; fire ecologist annual report, YELL RVP annual report, and regional annual report • Lead of Fire and Fuels Interdisciplinary Team (IDT) • Wrote and edited FMP • Developed budget requests and managed crew funding • Edited numerous fire publications for YELL and LIBI
Presentations	8%	• One presentation on YELL Fire Ecology to CO college group • One presentation on YELL Fire program to Yellowstone Conservation Corps and Explore Yellowstone • Counseled Gardiner High School student interested in a job in wildland fire • Researched, prepared and presented a poster on YELL WUI project analyses at the 12th Biennial GYE Scientific Conference
NPS Meetings/ task groups	5%	• Facilitated one meeting and one field trip with Fire and Fuels IDT to discuss FMP and upcoming fuel project • Attended daily (during fire season) and weekly (non-fire season) fire cache briefings • Attended IMR fire ecology and fuels conference calls • Participated in monthly SAR overhead team meetings and trainings
Interagency work	0%	
Wildfire/SAR assignments	8%	• Assisted with major Park SAR as PSC3(t) • Coordinated with park GIS to complete maps of the park fires

Rx fire projects	3%	• Traveled to Nebraska and assisted FWS on rx burn as ENOP(t) and TFLD(t)
Non-fire fuels projects	2%	• Assisted with Norris and Canyon fuels treatment for a few days as time allowed
Research	<1%	• Provided consultation on graduate project, joined external researchers in the field one day, and wrote JFSP funding support letter for researchers
Data collection	8%	• Filled in for Lead Fire Effects Monitor while she was on GRCA detail for the month of July • Assisted with fuel moisture sample collection as needed
Data entry	0%	
Data analysis	15%	• Completed data analysis of fuel treatments for IDT purposes, annual report, and for conference poster
Supervision/Admin	6%	• Completed and certified time on bi-weekly basis, signed travel, supervised and performed all other small supervisory tasks which fill the days
Training	6%	• Participated and lead monthly employee SAR trainings • Organized and co-taught two annual fireline refreshers (RT-130) in the park • Taught units of S-244 and L-280 • Attended ergonomic training, and participated in a personal development forum
Out of park travel	0%	
Miscellaneous	4%	• PT, assisting with RAWS maintenance, acting as Duty Officer, assisting with helicopter projects

D. Fire effects and fuels crew accomplishments and areas of focus

Table 16. Fire Effects Crew 2014 Accomplishments/Focus Areas

Category	Percent Time	Notes
FMH plots	4%	• Sylvan WFRB in YELL and Lead assisted GRCA with FMH plots
WUI plots	15%	• Hazard fuel WUI plots were sampled at East, Northeast, West, South, Buffalo Plateau, Norris and Lake
CBI plots	0%	
Other plot work	0%	
Wildfire/SAR assignments	15%	• Various members of the crew performed as ICT5, HECM, ENGB(t), HMGB, HMGB(t) FEMO, FEMO(t), FALA, FFT1 and FFT2 in and out of Yellowstone • One crewmember traveled with the Park helicopter to Oregon to the Deception complex. • Another crewmember traveled with a Type 2 crew to California and with a 10 person handcrew to Saguaro National Park • Lead spent 30 days at the Grand Canyon on a detail as the assistant lead fire effects monitor • Park SARS: Black Canyon, Falls, Latty, Osprey)
Prescribed fire projects	1%	• Lead participated in prescribed burns at Wind and Jewel Cave National Parks in South Dakota and Crescent Lake National Wildlife Refuge in Nebraska
Non-fire fuels projects	10%	• Fuel sampled four locations biweekly • Canyon mechanical thinning project
Travel out-of-park for plot work	0%	Lead traveled to Grand Canyon to assist with plot work but none of the time was coded during regular base hours
Data entry	4%	• Data entry for FMH and WUI plots
Data analysis	<1%	• Lead completed FF+ and 1000 hr fuel moisture analysis for pocket cards
Supervision/Admin	4%	• Lead hired and supervised two seasonals • Project admin, credit card, travel, and payroll paperwork • Employee evaluations

Training	11%	• On-line credit card training, FISSA, USERRA, whistleblower in the workplace, blood borne pathogens, Hazwopper, NSC Defensive Driving II class, radio training, A-100 aviation training, No Fear Act, Fire extinguisher, Bear Spray deployment • L-280, S-200, S-244, S-260, S-390, RT-130 • EMS endorsement, Pre Hospital Trauma Life Support, WFR recertification, CPR/First Aid
Weather	6%	• Weather station set up • RAWS annual rehab, trouble shooting, sensor ordering • NFDRS updates • WIMS configuration • ERC charts
Miscellaneous	30%	• Gathering info for morning meetings • Presentations to outside groups • Teaching classes • Assisting other divisions with work (helitack, engine) • Leave taken, holidays worked or not, meetings, PT time, and janitorial duties • Office work not in other categories (Plant ID, filing photos, other misc computer time)

Table 17. Fuels Crew 2014 Accomplishments/Focus Areas

Category	Percent Time	Accomplishments and/or areas of activities
Structure Assessments	14%	• Structure Assessment training • Finished Grant Village Area and Norris structure assessments • Started Old Faithful structure assessments • Cleaned-up Mammoth and South Entrance structure assessments • Completed a few backcountry cabins
Prescribed Fire	5%	• RX Burning with USFWS in NE • Pile burning at Fawn Pass, Norris, and Lake
Non-fire fuels projects	40%	• Norris blowdown fuel reduction • Canyon government Area Fuels Reduction implementation
In-Park wildfire/SAR assignments	1%	• Assist with ground search for Latty SAR
Out of park wildfire assignments	25%	• Type 2 Crew to CA for preposition • Squad to SAGU for wildfire • Type 2 Crew to OR for 36 Pit fire • HECM to OR for fire support • HEMG with park helicopter in OR/WA
Hazard tree projects	1%	• Cut five hazard trees at Norris Campground, backcountry cabins, and along roadsides
Supervision/Admin	5%	• Hired five person fuels crew • Completed time & travel
Training	4%	• Fuels Specialist attended EMT class and Structure fire classes and taught S-212 • The crew attended annual fire refresher, guard school, S-131, S-133, S-200, L-280
Miscellaneous	7%	• Fuels Specialist was member of Employee Safety Committee and Mammoth Community center NPS Representative • Crew complete fleet maintenance, and regular PTs

E. 2015 Direction

2015 will bring more clean up, organization and moving forward for the Yellowstone Fire Ecology program. A Park wide monitoring plan will be written and hopefully approved, FMH-4s will be updated, and data will continue to be cleaned up, organized, and analyzed. The fuels crew will have one year under their belts and with at least a few returning seasonals will continue to complete structure assessments and clean up existing fuel treatment units which we started in previous years.

F. Literature Cited

Scott, Joe H. 2003. Canopy Fuel Treatment Standards for the Wildland-Urban Interface. In: Omi, Philip N.; Joyce, Linda A., ed.; Fire, fuel treatments, and ecological restoration: Conference proceedings; 2002 April 16-18; Fort Collins, CO. RMRS-P-29: 29-37.