



**National Park Service
Fire Ecology Annual Report
Fiscal Year 2006
Yellowstone National Park**

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Fire Effects Monitoring Season Highlights

The program experienced complete seasonal turnover this year. Consequently much of our time was spent in training and getting new employees familiar with procedures and protocols, and providing necessary training. Despite this challenge, much was accomplished.

Level 1 and 2 Priorities

- **Six fire-use fires were monitored and supported.** Personnel collected and/or produced the following information: Fire perimeters, safety zones, geographic data, ArcGIS production of maps, incident planning, fire-use/fire behavior projections, and fuel moisture and weather monitoring. This year's WFU fires presented fire management with unique challenges and opportunities. Allowing fire-use events with high potential to impact the road and park operations was internally and politically significant for Yellowstone. The **Magpie Fire** had the most area (1,310 ha / 3,235 ac). The **Hellroaring Hill Fire** was ignited within 50 m of the Mammoth – Tower Junction road in northern sage-steppe and was allowed to burn for about a month before it self-extinguished at <0.25 acre. A seventh fire, the **Stinky Fire**, was managed as a suppression fire with a confinement strategy to reduce potential impacts to the Shoshone NF. It was allowed to burn to 405 ha / 1,010 acres and was managed similarly to WFU fire. Only ~400 m of fireline was constructed at the head to prevent the fire from leaving the park and entering the Shoshone NF. The Stinky Fire was also significant in allowing us to collect information on fire behavior in the LP0 (early post-fire lodgepole pine) cover type.

- **Weather station and data management.** Three permanent RAWS stations were maintained and repaired. Two micro-RAWS were deployed, maintained and repaired. Seven manual climatological weather stations and eight manual fire weather stations were managed. The new Fire Monitor staff was instructed in data collection, WIMS, NFDRS, and Fire Family Plus. These stations supported fire operation safety, NFDRS fire behavior predictions, aviation, fire weather forecasting, and research requests by internal divisions and external agencies. We collected and entered about 1,250 fire weather observations into WIMS, 714 individual 1000-

hour log station measurements, and 1,392 fuel moisture samples to support wildland fire-use, prescribed fire, and fire management intelligence. We installed and/or repaired fire weather equipment at 14 sites. Weather and fuel moisture intelligence for the entire park underpins the decision to allow fire use and safely manage it.

- Provided daily weather observations, fire danger indices, and lightning information to Fire Management staff, the Communication Center, long-term analysts, and fire behavior analysts.
- Provided comprehensive weekly fire weather and fuel condition summaries to the Chief Ranger, Sub-District Rangers, and the Fire Management Staff.
- Outside of fire season, provided monthly and seasonal climatological reports/summaries to the Chief Ranger, Sub-District Rangers, and the Fire Management Staff utilizing SNOTEL, climatological precipitation and temperature, drought monitoring, and fuel moisture monitoring.
- Provided/obtained weather forecasts and weather condition summaries for park events and activities upon request (SAR, bison capture, etc.).
- Weather station corrals were re-built at East, Old Faithful, and Canyon using help from the Yellowstone Fire-Use Module.
- We collected data to estimate the mass flow rate for two crown fire runs in LP0 at the Stinky Fire. Rates of spread were observed by fire monitors and from aerial observation, and measured using RASP data-loggers (Sigma Delta Technologies). Canopy fuels were estimated indirectly using allometric regression equations developed from destructive sampling of trees at the Norris Rx burn area. These efforts will improve crown fire modelling.

Level 3 and 4 Priorities

- We cooperated with NASA Goddard Space Flight Center to support their proposal “*Using NASA’s Invasive Species Forecasting System to support National Park Service decisions on fire management activities and invasive plant species control.*” Yellowstone hosted a week-long workshop to review the preliminary results and to explore data acquisition for this project. This workshop was attended by participants from NASA, Colorado State University, Yellowstone Center for Resources, Northern Rocky Mountain Exotic Plant Management Team, Yellowstone Ecological Research Center, Syracuse University, and others.
- FMH plots were installed at the Norris (3 plots, 1 control plot, and 6 other fuel transect monitoring points), and Meridian (4 plots) prescribed burn areas in the Soda Butte drainage.
- Two FMH re-reads occurred at Sylvan Pass (2003 East Fire, of interest for monitoring whitebark pine succession) and at the Chickadee Fire (2005, of interest for whitebark pine monitoring and under-burning in rhyolitic lodgepole pine).
- One Despain fire plot re-read occurred at Observation Peak. This plot was originally installed in 1988 and did not burn. It had some potential to burn in the Magpie Fire (but it didn’t). It will be useful as a control plot to monitor background succession over 18 years, also in whitebark pine.
- Two detailers assisted with monitoring: Becky Seifert (LAMR) and Carrie Minerich (GRCA). Both did an excellent job and we would invite them back in the future.
- Students from Rockhurst University helped us install one plot in our Norris prescribed burn area as part of their field methods course work.
- We issued the 6th annual NPS Fire Effects Monitoring newsletter in June. Tina Boehle did the background work to get the website off the YELL web and onto the NIFC web.
- Klukas and Miller served as local area experts at the LANDFIRE workshop in Bozeman in the spring. Miller provided vegetation and fuels data from FMH and other monitoring plots.

- We are collaborating with Zack Holden (University of Idaho) and Diane Abendroth (GRTE) in producing equations to relate dNBR to CBI and calibrate fire severity satellite imagery in the GYA.

- We are assisting the YELL Spatial Analysis Center in updating fire perimeter and severity maps for a Yellowstone atlas. The new layer will provide more detailed spatial information that was not available 18 years ago.

Other Accomplishments

- Miller attended the statistics workshop in Fort Collins in September despite a nasty sinus infection.

- Miller is active in Yellowstone's Fire Strategy Team.

- McEldery and Miller assisted burn plan preparation for the Norris prescribed fire.

- Miller assisted National Geographic in filming a documentary on the Yellowstone back-country, including pieces filmed on the fireline at the Stinky Fire and fuel moisture methods in the lab.

- Miller attended the GYA FMO meeting in October.

- Cole Irvin (Yellowstone FUM) assisted the Norris prescribed fire by correcting weather streams. Old Faithful weather data corrected 1986 – 2005. Canyon weather data corrected 1989 – 2005. Mt. Washburn weather data corrected 1995 – 2005. New wind errors from 1994 - 2005 were found and corrected. NE Entrance weather has begun to be consolidated into a NE_hypothetical database. All corrections were sent to Jeff Barnes (208-387-5286) to be entered into NIFMID. .fwx files were created with the corrected weather streams to be used in Farsite. In the .mdb files, queries were created to export the data into a text document, readable by NIFMID.

- McEldery successfully completed six modules of Technical Fire Management (TFM). Sean applied to TFM in 2005 and was accepted as a participant in TFM 21. TFM provides the opportunity to obtain an education which supports moving from technical to professional employment in wildland fire. TFM 21 began in October of 2005 and the final module concludes in April of 2007. The modules encompassed mathematics, statistics, economics, fire ecology, fuels, and management. Sean will present and defend a final project during the final module.

- McEldery completed a field review of the new S290 course curriculum for the NWCG Training Development Unit.

Table 1. Fire Effects Plot Workload 2005

Park	Monitoring Unit	Type of Plot (FMH, photo point, other – describe)	Pre-burn	Immediate Post	Postburn (1-20 yrs)	Total Plot Reads
YELL	Mechanical Hazard Fuel Reduction	Custom	0	0	0	0
YELL	CBI	CBI	0	0	0	0
YELL	WFRB-FMH	FMH	8	0	2	10
YELL	WFRB-Despain	Custom	0	0	0	0
Total						10

Table 2. Fire Ecology Staffing 2006

Monitor	Starting Date	Ending Date	# of Pay Periods	Training and Development
P. Chris Roy Fire Monitor	5/15/2006	9/15/2005	8.8	S-271, Horse Training, HECM(T), FFT1(T), Bear Safety, Montana SCZ Engine Academy
Kyle Stetler Fire Monitor	5/15/2006	8/23/2006	7.1	S-271, Horse Training, HECM(T), FFT1(T), Bear Safety, Montana SCZ Engine Academy
Sean McEldery Lead Fire Monitor	1/3/2006	11/11/2006	22	Technical Fuels Management (TFM)
Eric Miller Fire Ecologist	1/3/2005	12/31/2005	26	S-490, S-491, Landscape Level Fire and Fuel Management Workshop (Missoula), AFE Fire Ecology Congress (November, San Diego), FVS Training (November, Missoula)

Sampling Design and Field Methods

Changes in Protocols

Status of Planning Documents

Miller is working on the Fire Effects Monitoring Plan which is partially complete and needs to be updated to reflect changes in the 2004 Update to the Fire Management Plan.

Monitoring Results

Completed Reports

E.A. Miller, R.J. Seifert, E.R. Moss, S.C. McEldery, & S.J. Jackson. 2006. Estimating Error Associated with Litter Depth Measurements. Yellowstone National Park Fire Effects Monitoring Research Note #20

Miller E.A. 2006. Equations for predicting canopy fuel load for early post-fire lodgepole pines. Yellowstone National Park Fire Effects Monitoring Program Research Note #16.

Miller, E.A., T.J. Klukas, S.C. McEldery, R.J. Seifert, S.J. Jackson, & E.R. Moss. 2006. An Application of Wildland Fire Effects Monitoring to Prescribed Fire. Poster presentation at the IMR FMO Conference in Albuquerque and the National FMO Conferences in Phoenix.

E.A. Miller, S.C. Mceldery, R.A. Renkin, and T.J. Klukas. 2006. A case study of crown fire behavior in immature lodgepole pine, Yellowstone National Park. Poster presentation at the National FMO Conferences in Phoenix.

In Progress:

McEldery, S.C. 2006. Soda Butte Fuels Treatment Project Study Plan. Technical Fuels Management Proposal. 13 pp.

Research Projects/Collaboration

Benson, N., Morisette, J., and B. Welch, "Using NASA's Invasive Species Forecasting System to support National Park Service decisions on fire management activities and invasive plant species control." Response to NASA Cooperative Agreement Notice: NN-H-04-Z-YO-010-C A Partnership between NPS and NASA Goddard Space Flight Center proposing an "Integrated System Solutions (of Earth science for applications of national priority)." We are providing fire effects monitoring data on exotic species as inputs to spatially predictive models of exotic locations and spread potential.

We are continuing to sample large fires for the Composite Burn Index (CBI) to improve mapping of fire severity at the landscape scale using the Normalized Burn Ratio. We had no qualifying fires in 2005 that required sampling in 2006. Enough field data exists at this point to predict NBR from CBI but this relationship remains to be statistically developed. Updated fire severity GIS layers will support LANDFIRE, FRCC, research in the YCR division, and fire atlases.

We are assisting Zack Holden (University of Idaho) and Diane Abendroth (GRTE/Colorado State University) in each of their efforts to calibrate and apply the CBI-dNBR relationship to the Greater Yellowstone Ecosystem GIS layers. GRTE and YELL have pooled their CBI data to improve the sample size. Miller met with them at the Fire Conference in San Diego in November.

We provided the LANDFIRE project with fire effects monitoring data to support their spatial fuel modelling and ground-truthing efforts.

Adaptive Management

The Superintendent requested information on why Yellowstone does not utilize prescribed fire like other parks. This led to a discussion of the perception of fire behavior of lodgepole pine forests as a stand-replacement fire system. Empirical descriptions of a lodgepole underburn are lacking. We plan to use fire effects monitoring plot data as part of an internal white paper on fire behavior and effects in lodgepole pine underburns. Co-incidentally we were able to install a plot this year in front of a wildland fire-use fire that mostly burned as an underburn, reaching ~90 acres over ~2 months (Chickadee Fire). Tree mortality probability and other fire effects will be related to char and scorch height and other measures of fire intensity. Preliminary observations suggest that tree mortality may take more than 1 year to stabilize.

One of the propositions for allowing the Stinky Fire to burn in confinement rather than full suppression strategy was to learn more about fire behavior in the LP0 cover type. Miller is preparing a paper on crown fire behavior in LP0. Results will directly impact planning efforts at many WUI areas involving the LP0 cover type as well as improve general crown fire modelling.

Fire effects monitoring efforts in LP0 areas at the 2000 Boundary Fire, 2002 Phlox Fire, 2003 East Fire assisted burn plan preparation for the Norris Rx project. A poster was presented at the IMR FMO meeting in Albuquerque and the National FMO conference in Phoenix. A burn window did not appear for the Norris project in 2006.