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Final Report, Joint Fire Science Program Project Number: 04-2-1-116

Project Title: Influence of prescribed and wildfire on forest structure and fire severity

Project Location: This project fell within the local need task and occurred along the Missouri River Breaks, eastern Montana

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Brad Sauer is no longer employed and was replaced by Mike Ford at the USDI Bureau of Land Management; he is now a ranch manager and **Robert Mitchell**, Soil Scientist, USDI Bureau of Land Management, Miles City Field Office, 111 Garrywopen Road, Miles City, Montana 59301.

Summary of findings at close of Project

When monitoring effects from disturbances, the preferable technique is to characterize forest overstories (crown fuels) and surface conditions (surface fuels) prior to a disturbance event, then return to the same location and characterize forest structure and other aspects, such as burn severity after the disturbance. However, the location of a future forest disturbance, such as a wildfire, is usually unknown. It also may not be economical or feasible to conduct a complete forest inventory or to establish a grid of plots that is large enough to ensure sufficient pre-disturbance data. There is no specifically located pre-disturbance data from the Missouri River Breaks in either the prescribed fire or wildfire areas. Moreover, no data were collected on specified locations after the prescribed fires. Because of this, alternative methods are needed that will provide data to address post-disturbance evaluation and/or monitoring needs. This project develops and uses an alternative method for monitoring and evaluating environments created by a series of fires, where no pre-disturbance information is available.

This project resulted in three publications:

Jain, Theresa; Juillerat, Molly; Sandquist, Jonathan; Sauer, Brad; Mitchell, Robert; McAvoy, Scott; Hanley, Justin; David, John. 2007. **Forest descriptions and photographs of forested areas along the breaks of the Missouri River in eastern Montana, USA.** Gen. Tech. Rep. RMRS-GTR-186. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 51 p.

This is published electronically (http://www.fs.fed.us/rm/pubs/rmrs_gtr186.html) and was designed for field use, sized to fit easily into a field vest.

This handbook presents photographs and information obtained from forest lands along the breaks of the Missouri River in eastern Montana. Forest characteristics summarized in tables with accompanying photographs can be used to provide quick estimates of species composition and densities within similar landscape features. These estimates may be useful to foresters, wildlife

biologists, range ecologists, and fire and fuel specialists. The book is organized by six physiographic positions: 1) waterways (ravines or gullies), 2) south aspects ≤ 25 percent slope angle, 3) south aspect > 25 percent slope angle, 4) north aspects ≤ 25 percent slope angle, 5) north aspects > 25 percent slope angle, and 6) ridges or benches. Within each physiographic position, sites containing three overstory densities are represented. Inventory data describes the forest floor, ground-level vegetation, tree density, average crown ratio, canopy base height, and other characteristics; two photographs (close and distant view) provide a visual image and accompany the quantitative descriptions.

Jain, Theresa; Juillerat, Molly; Sandquist, Jonathan; Ford, Mike; Sauer, Brad; Mitchell, Robert; McAvoy, Scott; Hanley, Justin; David, Jon. 2007. **Photographic handbook for comparing burned and unburned sites within a dry forested and grassland mosaic: a tool for communication, calibration, and monitoring post-fire effects**. Gen. Tech. Rep. RMRS-GTR-197. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 57 p.

This is published electronically (http://www.fs.fed.us/rm/pubs/rmrs_gtr197.html) and will be published for field use on October 10, 2007 and is sized to fit easily into a field vest.

This photograph handbook describes characteristics and burn severity of a dry forested and grassland mosaic that burned within the last decade. We show photographs of different burned and unburned sites to help compare fire occurrence in similar stands. The handbook provides local land managers with a quick, inexpensive, and efficient way to evaluate effects of prescribed fire, wildfire, or a combination of the two, based on current conditions of unburned sites. This handbook can be used as a communication, calibration, or monitoring tool. It also contains a CD that documents the vegetation and soil effects from prescribed, wild, and combined fire effects in our study.

Jain, Theresa; Juillerat, Molly; Sandquist, Jonathan; Ford, Mike; Sauer, Brad; Mitchell, Robert; McAvoy, Scott; Hanley, Justin; David, Jon. 2007. **Vegetation and soil effects from prescribed, wild, and combined fire events along a ponderosa pine and grassland mosaic**. Res. Pap. RMRS-RP-67CD. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 39 p.

This is published electronically (http://www.fs.fed.us/rm/pubs/rmrs_rp067.html) and will be a CD that is placed in a pocket within RMRS-GTR-197 by October 10, 2007.

We describe the efficacy of prescribed fires after two wildfires burned through and around these fires located in eastern Montana within the Missouri River Breaks. The objectives of the prescribed fires were to decrease tree density and favor increased herbaceous cover, thus decreasing the potential for crown fire. Our objective was to evaluate post-fire tree density, herbaceous cover, soil surface, and burn severity to determine if the prescribed fires fulfilled management objectives and if they affected post-wildfire outcomes. Because there is no information available on pre-fire conditions, we used a draft of the handbook *Forest Descriptions and Photographs of Forested Areas Along the Breaks of the Missouri River in Eastern Montana, USA* (RMRS-GTR-186) as our frame of reference. We compared sites burned

by prescribed fire alone, wildfire alone, and prescribed fire followed by wildfire to the unburned sites from the handbook. Although statistical analysis showed no significance in tree density, herbaceous cover, and crown scorch, we do report observed trends. Depending on the physiographic position, more trees survived in places burned by the combination of prescribed and wildfire than places burned only by the wildfire. The prescribed fires tended not to fulfill prescription objectives, particularly in tree density, until the second fire occurred. However, the wildfire tended to exceed prescription objectives because it killed too many trees. Compared to the unburned sites, all the fires tended to decrease litter and favor higher amounts of grass cover, thus fulfilling prescription objectives. Heterogeneity in vegetation characteristics such as canopy base height increased as a function of the combined fires. This CD describes detailed results and outcomes among the different fires and the unburned sites, and its accompanying photograph handbook provides examples of burned and unburned sites to use as a communication, calibration, and/or monitoring tool. Although the information is unique to a series of fires, the concepts and methods we used are applicable in other locales required to evaluate efficacy of fuel treatments.

Challenges associated with this project: Approximately one-year into the project the BLM primary investigator, Brad Sauer, resigned from the BLM. In addition, priorities changed within the BLM, resulting in diminished project support. Mike Ford is now Fire Management Specialist and Fuels/Prescribed Fire Program Manager. Given his other priorities, Mike has continued to participate and has been actively interested in the project. We noted this change in support in the 2006 JFSP progress report. We addressed this challenge by providing the basic information on how the prescribed fires may have influenced post-wildfire outcomes. This information was the primary objective and is critical toward addressing several management needs, such as refining and validating the application of prescribed fire and providing information to managers regardless of the management agency.

Table 1. Proposed products and subsequent accomplishments.

Proposed product	Accomplished/Status
Refine and validate the application of prescribed fire in ponderosa pine forests in eastern Montana.	The manuscript “ Vegetation and soil effects from prescribed, wild, and combined fire events along a ponderosa pine and grassland mosaic ” provides the key information to refine fire prescriptions.
Document the influence prescribed fire, wildfire, and wildfire combined with prescribed fire has on forest structure and fire severity relative to undisturbed sites.	We accomplished this task through the publication of the manuscript “ Photographic handbook for comparing burned and unburned sites within a dry forested and grassland mosaic: a tool for communication, calibration, and monitoring post-fire effects. ”
Evaluate the effectiveness prescribed fires have on achieving other resources objectives such as open space and grazing.	We accomplished this task and reported results in the published manuscript “ Vegetation and soil effects from prescribed, wild, and combined fire events along a ponderosa pine and grassland mosaic. ”
Evaluate the influence of two prescribed fires applied at different time after refining fire prescriptions based on results.	The two prescribed fires are not yet accomplished. In exchange for not fulfilling this objective, we added the manuscript “ Forest descriptions and photographs of forested areas along the breaks of the Missouri River in eastern Montana, USA ” as an additional product managers could use.
National workshop presentation – JFSP workshop or other national workshops	Theresa Jain will present results from this study at the Idaho State Fire Plan Working Group meeting in October 2007. In addition, Theresa will submit abstracts and present results to the next fuels workshop or other national workshop.
Publication in journals	The work was too broad and manuscripts too long to publish in journals. However, the three manuscripts published by the Rocky Mountain Research Station were peer-reviewed by managers and scientists.
Brad Sauer will organize and develop a workshop to present to people from fire, silviculturist, range, and wildlife disciplines. Theresa Jain will provide the scientific results and Brad Sauer will discuss prescribed fire applications in relation to the scientific results.	Brad Sauer organized a workshop to present results in February 2004. This workshop led to identifying and developing the format and information that was included in the published manuscripts. Mike Ford is working with Theresa Jain to determine when to present results to local managers.
Brad Sauer and Theresa Jain will be actively involved in visiting with local managers on site to discuss application of prescribed fire based on study results.	As a first step, we sent the published manuscripts to managers that work within several agencies. In addition, the photograph handbooks are a tool to evaluate future fuel treatments in areas burned by wildfire. Mike Ford and Theresa Jain are working together to insure managers obtain the information provided in this project.