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Wildland Fire Effects on Visits and Visitors to the Bob Marshall Wilderness Complex

BY WILLIAM T. BORRIE, STEPHEN F. McCOOL,
and JOSHUA G. WHITMORE

Abstract: Wildland fire can affect wilderness visits and scientific efforts to understand visitor relationships with wilderness places. Large-scale and long-lasting fires occurred in the Bob Marshall Wilderness Complex, Montana, in 2003. A study of visitors that year to monitor long-term trends in visit and visitor characteristics was repeated in 2004 to fully understand how the 2003 fires affected trend analysis. This article considers the question of how wildland fire changes the relationship people have with wilderness, particularly related to their visits and visitor attitudes toward fire management.

A Wilderness Visitor Study— And Dilemmas over Fire

In 2003 a survey was conducted of visitors to the Bob Marshall Wilderness Complex (BMWC), an area of 1.5 million acres (600,000 ha) straddling the continental divide in Montana. It is managed under the provisions of the Wilderness Act of 1964 and comprises three units of the National Wilderness Preservation System (the Great Bear, Bob Marshall, and Scapegoat Wildernesses). The BMWC is managed by the U.S. Forest Service and has proven to be an ideal setting for a variety of social science research and planning activities (McCool 2005).



Article co-authors (left) William Borrie and Stephen McCool and (right) Joshua Whitmore.

The BMWC is a mountain ecosystem, ranging in elevation from 4,000 feet (1,200 m) to more than 9,000 feet (2,800 m). It provides habitat for grizzly bears, mountain lions, moose, Canadian bighorn sheep, mountain goats, and many other plants and animals. Many of the ecosystems in the BMWC are fire-adapted, such as low-elevation ponderosa pine forests and higher elevation western larch–lodgepole pine forests, although it has been estimated that 80% of lightning-ignited fires in the BMWC were suppressed in the 1988–1998 period (Parsons 2000).

As part of the national forest plan revision process, a trend analysis of visit and visitor data was needed. Information on the characteristics of wilderness visitors, their trips into the BMWC, and their attitudes and preferences toward the management of the Bob were previously collected in 1970 (Lucas 1980) and 1982 (Lucas 1985; McCool 1983).

Sampling of recreation visitors to the BMWC began at 12 of the most popular trailheads in late June 2003. However, during the summer a series of lightning-ignited fires occurred, a pattern also seen in Glacier National Park just to the north. Beginning at the end of July, many popular trailheads were closed to public entry to reduce safety hazards. By the end of September 2003, when all trailheads had reopened, 41

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separate fires and nearly 100,000 acres (40,485 ha) had burned in the BMWC (Lasko 2004).

The presence of fires was quite noticeable throughout western and central Montana during this period. Not only were trailheads and trails closed, but roads and campgrounds near the wilderness boundaries were also inaccessible. News of fire activity was common in the local and regional media, and a large amount of information, including photographs and maps showing the extent of the fires, was available on a variety of websites. In addition, much of the region was clouded in smoke from these and other nearby fires. It is, therefore, reasonable to assume that almost all visitors to the BMWC were aware of fires burning in the wilderness.

Whether management-ignited or natural, fire impacts all aspects of the management of wilderness. Whereas the biological effects of wildland fire are relatively well known (e.g. Agee 1996, 2000; Brown et al. 1995), there is less known about the impact of fire on recreation and other human activities. The presence of wildland fire could be expected to influence wilderness visitors in a number of ways, both direct and indirect. Not only would some areas be inaccessible, the fires would also have changed conditions and experiences at these places. Thus, visitors might change their plans as a result of access restrictions, but they might also change their expectations or evaluations of wilderness visits. Visitors may have concerns for safety and avoid traveling near currently burning fires, through recently burned areas, or to locations where fire might “trap” them or otherwise disrupt their immediate travel plans. Fire and fire-related activity can damage recreation infrastructure, and visitors may want to avoid disruption of fire management activities.

Table 1. Respondents to Bob Marshall Wilderness Complex Visitor Surveys.

# Visitors	Year of data collection	
	2003	2004
Contacted at trailheads	605	408
Refusals	7	12
Undeliverable addresses	6	3
Completed questionnaires returned	462	294
Response rate	76%	72%

Managers and scientists expressed concern that some visitors might be more affected than others by the fires. Perhaps those with more experience or more visits to the BMWC would feel less compelled to change their plans. There might also be influences from local knowledge and access to media information. Locals might have more flexibility in plans, with less commitment of time and resources to travel. Hikers might be more worried about their ability to leave the wilderness should the fires become too threatening, although horse riders might be particularly concerned about their stock and their ability to travel through burning or burned landscapes.

Our sampling plan had been predicated on all trails being open to the public, but many of the trailheads scheduled for sampling were closed. This first comprehensive study of visitors in the BMWC since 1982 may not be representative enough to understand trends in visits and visitors. Since this study involved contacting visitors at trailheads, access and infrastructure closures led to a reallocation of trailhead sampling. Visitors to the BMWC have choices when selecting a trail (there are about 75 trailheads in the complex), but relatively few (a dozen or so) account for about 50% of the use.

Sampling of four-day weekday blocks and three-day weekend blocks was conducted at trailheads, with probabilities proportional to size (so that

those trailheads with higher levels of use were sampled more frequently than those with lower levels of use). This bias toward higher-use trailheads was then accounted for in the analysis by weighting data inversely proportional to size of sample, as was undertaken in earlier 1970 and 1982 studies (Lucas 1985). On-site and mail-return questionnaires were used, with all respondents to the on-site survey included in the mail-back survey.

Results and Discussion

There is confidence that the 2003 sample accurately describes the visits, visitors, and visitor attitudes for that year, but findings could not be confidently compared to previous data points. That is, the visits and visitors of 2003 may not be representative of visitors and their responses if the fires had not occurred. Although it can be acknowledged that no one particular year of sampling can ever be perfectly generalizable, we were particularly concerned that the presence of large scale fires for a lengthy period, of regional firefighting activities, and of smoke may have made 2003 a particularly unrepresentative year.

As a result, sampling in 2004 was conducted to provide data for comparison to 2003. This was an opportunity to assess the consequences of the fires on wilderness visitors and their attitudes and behaviors, as well as provide confidence in trend analysis. No major

Table 2. Bob Marshall Wilderness Complex Visitor Characteristics (no significant differences $p \leq .05$).

	Year of data collection	
	2003	2004
Age	43.7	43.5
Sex (% male)	68.7	71.1
Level of education (years)	15.3	15.6
Place of residence (% in Montana)	64.8	62.4
Previous experience (# visits to the Bob)	11.1	13.8

fire events occurred in the BMWC or surrounding areas in 2004, thus survey data in that year were not directly affected by the presence of fire, although it should be noted that various impacts of the 2003 fires continued into 2004 (e.g., blackened vegetation, opened vistas, and minor damage to infrastructure) and will continue for the foreseeable future.

Although staff and resource limitations prevented a complete replication of the 2003 sampling plan, the 13 trailheads estimated to receive the heaviest use by wilderness visitors were again sampled from the beginning of the summer, when the majority of the trails first opened, through the first significant snow event in the fall, when access roads were covered with snow and visitation dropped off sharply (see table 1).

A nonresponse bias check comparing respondents to nonrespondents to the mail-back questionnaires in both years found no significant differences

on each of six key variables (education level, amount of previous experience in the BMWC, mode of travel, length of stay, use of outfitters, and season of use).

If fire is an important influence on visitors, we would expect to find significant differences between the years in use patterns, visitor characteristics, and attitudes toward management actions. To address these potential impacts, between-year comparisons are made in three time periods, since not all of the 2003 season was heavily affected by fire: (1) prefire (June and July)—before the 2003 fires started to have an impact on visitors; (2) during fires (August and September)—when trailhead closures had begun and areas of the BMWC were closed to recreational use; and (3) postfire (October)—after fires were extinguished and trailheads had reopened

The “prefire” and “postfire” time periods were not directly affected by fire

and firefighting activity in 2003. Thus, we generally did not find significant differences when compared with the same time periods in 2004. We found no significant differences in the characteristics of the visitors between 2003 and 2004. That is, the average age, sex, place of residence, level of previous experience in the BMWC, and level of education, did not differ between the two years generally (see table 2), or between the three individual time period groups specifically.

Although the characteristics we examined of people visiting the BMWC did not vary overall between 2003 and 2004, the nature of their visits did show some significant differences. We found changes in how people visited the complex, such as a greater percentage of visitors hiked in 2003 than in 2004 (65.5% versus 54.5%). As can be seen in table 3, this difference is most noticeable for the fire-affected period, with a smaller proportion of visitors traveling on horseback during this time in 2003 than in the nonfire-affected year. Paralleling this is a reduction in the average number of stock in the travel group in the fire-affected year (average of 7.5 in 2003 versus 10.8 in 2004). Visitors were less likely to use outfitters during the fires in 2003 than during that period in 2004 (11.8% versus 31.2%).

We also observed significant changes in recreational activity participation during the wilderness visit (e.g., fishing, hunting, rafting, swimming, etc.); most noticeably a smaller percentage reported fishing in 2003 than in 2004. This was most prevalent in the “during fires” period (see table 3). The average length of stay was also found to be significantly shorter in 2003 than in 2004. In particular, during August and September trip lengths were significantly shorter in the fire year. Finally, visitors in 2003 reported seeing fewer groups

Table 3. Bob Marshall Wilderness Complex Visit Characteristics (all response pattern differences significant at $p \leq .05$).

	Sampling period and year			
	August & September 2003	August & September 2004	Whole Season 2003	Whole Season 2004
Mode of travel (% hiking)	64.7	35.3	65.5	54.5
(% on horseback)	35.3	59.1	34.5	45.5
Percentage using an outfitter	11.8	31.2	14.0	21.9
Participated in fishing (%)	30.8	51.9	41.9	52.7
Average length of stay (# nights)	2.4	3.8	2.2	3.3
Number of groups encountered	3.8	5.2	4.2	5.5

**Table 4. Bob Marshall Wilderness Complex Visitor Attitudes
(% who found management action desirable)
(all response pattern differences significant at $p \leq .05$).**

Desirability of ...	Year of data collection	
	2003	2004
cemented rock fireplaces with metal grates	20.3%	13.8%
small, loose rock fireplaces (fire rings)	58.1%	44.8%
prohibiting wood fires where dead wood is scarce	54.4%	44.6%
eliminating grazing by visitors' horses (require carrying horse feed)	38.4%	33.9%
natural forest fire started by lightning	49.3%	68.4%

in the wilderness on their trip than visitors in 2004 reported seeing.

Respondents were also queried about their attitudes toward a large variety of social and physical conditions in the wilderness, as well as potential management actions (46 items total). There were few differences between the attitudes of 2003 visitors and those in 2004, with some notable exceptions. Table 4 shows the five attitudes that did differ between 2003 and 2004. The provision of fireplaces (cement or loose-rock fire rings), prohibiting wood fires, and eliminating grazing were considered desirable by more respondents in the fire year. And, very importantly, natural forest fires were considered desirable by a smaller proportion of visitors in 2003 than in 2004. In combination, these differences (and lack of other differences) indicate the likelihood that attitudes toward fire and fuels management were significantly altered by the fires in August and September of 2003.

Conclusion

In summary, the research opportunity presented by the BMWFC fires in 2003 has yielded some important insights about the impacts of wildland fire on visitors and on science. Sampling is based on a set of assumptions, one of those being that the conditions under which sampling occurs are representative. Whereas there is no such thing as an average year in the northern Rocky

Mountains, there are surely limits to generalizability. In 2003 we saw those limits exceeded. Had the study not been replicated in 2004, for example, a serious underestimate of outfitted use could have resulted in poor decisions about outfitter allotments.

Fortunately, there was an opportunity to replicate data collection in a year far less impacted by fires. Comparing data provided by visitors in each of the two years indicated no significant differences in the visitor characteristics we measured and in most of their attitudes. However, it does appear that the fires affected some visit characteristics. Visitors adapted to the presence of fires by staying fewer nights in the wilderness, were more likely to hike than to travel by stock, and were less likely to fish and/or use outfitters than visitors in 2004. A consequence of these changes was that visitors encountered fewer other visitors during their stay. Attitudes toward fuels and fire differed between 2003 and 2004, with those studied in the fire year expressing more support for fire control measures (see figure 1).

The impacts of numerous and widespread fire events in the

BMWFC are likely to be long-term and profound (large-scale fires occurred in 1988 and 2001 as well). As wilderness agencies move toward more than fire suppression for their wildland fire and fuels management, we could expect more fluctuation in the accessibility of specific areas within wilderness. Given the fire regime of many wildernesses in the northern Rockies—large, infrequent, but stand replacement regimes—the visual effects of these fires will be present for many years. In addition, we have identified some short-term impacts that have required response by researchers and managers alike. As fire becomes more a part of the wilderness landscape we need to be aware of its impact on visitors and the implications for social science data collection. **IJW**

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Figure 1—Natural forest fires were considered desirable by a smaller proportion of visitors in the fire year than in 2004. Aldo Leopold Research Institute photo.

Results of our study identify many factors that make it difficult for managers to allow fires to burn freely in national forest wilderness.

managing natural ignitions as WFU is likely even more challenging on nonwilderness lands. The Federal Wildland Fire Management Policy directive to restore natural fire regimes applies not just to national forest wilderness, but to all lands administered by the federal government (FWFMP 2001). Restoring fire will require cooperation among various levels within an individual agency, along with various federal, state, and local governments, and local and national communities (DellaSala et al. 2003).

Learning to live with fire is a social issue (Dombeck et al. 2004). Wilderness can be a proving ground for demonstrating the benefits of restoring fire across the landscape. Suppression, however, is likely to remain the cultural norm unless barriers to managing natural ignitions as WFU can be overcome. This research suggests that viable options for mitigating these

barriers do exist, and we recommend systematic and periodic assessments of the factors influencing WFU implementation as part of program evaluation. A better understanding of the factors that influence managers is a meaningful complement to accountability measures of the number of fires allowed to burn freely and acres subjected to WFU. **IJW**

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