Prescribed Fire in Wilderness: Nature or Nurture?

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Wilderness areas are the closest approximation we have to ecosystems that exist unimpeded by management decisions. Wilderness designation protects species, habitats, ecological functions, and ecosystem services recognized as critically important. Manipulation to protect these values offers an intriguing contradiction to our longstanding notion of wilderness as a hands-off institution, and may threaten the very reason these areas exist in their current condition. Using prescribed fire in wilderness is one such example. Conflicting mandates of the Wilderness Act of 1964 illustrate the unique constraints in planning and implementation of this type of project (Parsons, Landres, and Miller 2003). This paper will investigate the complexities of stewarding fire in wilderness and highlight opportunities to learn from this type of management action. It focuses on policies and issues specific to the Forest Service and Park Service regarding ecological, sociopolitical, and organizational considerations for management ignited fire in wilderness.

Background

There are currently 757 wilderness areas, spread over 100 million acres, ranging in size from 6 to 9 million acres. The National Park Service, Forest Service, Fish and Wildlife Service, and Bureau of Land Management manage these areas. The Wilderness Act of 1964 guides managers towards conflicting objectives of natural, primeval, and untrammeled qualities (Cole 2001). Differences between agencies, ecosystems, wilderness size, and political factors make it difficult to generate consistent policy for the greater wilderness preservation system. This leads to inconsistency in how policy is translated to implementation. Compounding this problem is the more philosophical debate surrounding active management in wilderness. As congressional wilderness designation is the gold-standard in protection for our federal lands it is not surprising that there is a long-running debate over what wilderness designation really provides – stewarding resources (maintenance of ecosystems, wildlife, water; human intent) or stewarding humans to allow for self willed nature (Cole 2001). Problems such as hazardous fuels buildup, insect outbreaks, and endangered species place managers in the difficult position of choosing if, when, and how to intervene (Landres et al. 2000). The gravity of these choices has the potential to be compounded with the addition of climate change. Restoration using prescribed fire surfaces many of these issues for reasons ranging from philosophical to ecological to political (Parsons, Landres, and Miller 2003). Fire and wilderness managers need to broaden the dialogue to address issues in project planning and developing resource management plans.

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The role of fire

Fire is an essential part of most ecosystems in the western United States. Similar to wilderness, all fire is not the same. While some areas naturally have frequent low-severity fires others have high severity fires over 100 years apart. These are organized into fire regime groups based on severity and time and referred to as fire return intervals (Table 1). Human-induced changes caused by timber management, grazing, and fire suppression have altered these natural fire cycles (Noss et al. 2006). One way scientists and practitioners quantify this change and relative health and functionality of fire-adapted ecosystems is using fire regime condition classes. Fire regime condition class quantifies departure from these natural fire return intervals (Havlina et al. 2010).

For example, according to National Park Service Landfire Fire Regime Condition Class data the National Park Service has just shy of 9 million acres of wilderness in the continental United States with over 75% in condition class two or three (Table 2). While this 75% seems to be a call-to-action it is much more nuanced than that. Fire regime condition class is based on historic data that may, or may not, be representative of what we need for future targets (Hobbs et al. 2010). Furthermore, potential climate change impacts compound the issue by increasing the potential for catastrophic fire and proliferation of invasive species while challenging our ideas of what natural means (Stephenson, Millar, Cole 2010). Weighing the threat of a given wilderness area's fuels condition with the threat of human intervention is the challenge faced by wilderness and fire managers.

Evaluating impacts to wilderness character

We do have methods in place to evaluate threats to wilderness. In the late 1970's and early 1980's increased pressure from recreation led to the *Limits of Acceptable Change System*, published by George Stankey, David Cole, and others, which addressed the need to balance resource and social values (Stankey et al. 1985). In the early 1990's the Wilderness Threats Matrix identified fire exclusion as the biggest threat to wilderness character (Cole 1994). Here, wilderness character elements were defined as elements such as air, water, rocks, animals, ecosystems, and wilderness experiences. 10 years later the Carhart Institute brought together elements of minimum tool and minimum requirements analysis into the Minimum Resources Decision Guide to assess the im-

Table 1. The five standard fire regime groups and descriptions used to determine departure from historical fire return intervals and resulting fire regime condition class (Havlina et al 2010).

Group	Frequency	Severity	Severity Description
I	0–35 years	Low/Mixed	Generally low-severity fires replacing less than 25% of the dominant overstory vegetation: can include mixed-severity fires that replace up to 75% of the overstory
II	0–35 years	Replacement	High-severity fires replacing greater than 75% of the dominant overstory vegetation
III	35–200 years	Mixed/Low	Generally mixed-severity; can also include low-severity fires
IV	35–200 years	Replacement	High-severity fires
V	200+ years	Replacement/Any Severity	Generally replacement-severity; can include any severity type in this frequency range

pacts of humans on wilderness character elements; now defined as untrammeled, natural, undeveloped, and opportunities for primitive and unconfined recreation (ACNWTC 2010). The scope of this has since been broadened by Peter Landres and others through wilderness character monitoring taking the principles of the Minimum Resources Decision Guide and providing a framework to apply these tools to the greater wilderness preservation system (Landres et al. 2008). These methods are examples of how human impacts, and now intentional manipulation, have been evaluated and monitored in the past and present. Applying these methods across disciplines will require a more in-depth understanding of the priorities, constraints, and opportunities associated with managing each program. The remainder of this paper will highlight opportunities to achieve this integration with regards to prescribed fire in wilderness.

Ecological factors

The first consideration is determining the size of the wilderness and scale of the treatment. Constraints on ecological inputs and outputs resulting from actual size or effective size, due to values at risk, may preclude the use of natural fire (Landres, Morgan, and Swanson 1999; Parsons, Landres, and Miller 2003). Next it is necessary to determine how fire has historically impacted both the treatment and surrounding areas. As we are moving from an age of fire exclusion to one of fire promotion it is important to ensure there is a need to change vegetative conditions and not assume everywhere is fire deprived. For example, many of our wilderness areas are relatively untouched because they were the most difficult to access. These moist, high elevation zones can have very long fire return intervals and suppression policies over the last 80 years would have had little impact (Noss et al. 2006). Determining historical baselines, establishing effective scope of impact, and identifying current values at risk could be used to inform whether deviation from the historic baselines is required. If deviation is required due to anticipated critical habitat, high fire danger or uncertainty, it would be helpful to define desired future conditions and ensure they are useful targets (Stephenson et al. 2010). Once desired future conditions are established managers should develop prescriptions representing targets at the landscape scale that capture as much ecological variability as possible (Stephenson, Millar, and Cole 2010). As we don't know what the most appropriate abundance, assemblage, and location of species will be under rapidly changing future conditions, one proposed climate change mitigation strategy is to have as many potential habitat types represented within an ecosystem's natural range of variability (Landres, Morgan, Swanson 1999). Projects and prescriptions should reflect this goal by going beyond simply having a mosaic of habitat types but also developing targets for a variety of successional states within those habitat types. Prescriptions should also allow for as much flexibility as possible so that when working on multiple year projects, principles of adaptive management can be applied from year to year within an ongoing project. In addition to these ecological factors, planning becomes more complex as well.

Organizational factors: planning

When approaching potential projects involving wilderness it should be from the largest scale possible, assessing options and conditions beyond wilderness boundaries. Prior to looking at options of introducing fire within wilderness, all other choices should be exhausted. One way to help determine if there are no other options than to manage within wilderness is through the National Environmental Policy Act process. Interdisciplinary teams should assess projects at scales beyond wilderness boundaries with "no action" within wilderness boundaries as the preferred alternative. After it has been determined that a change in vegetative condition is necessary, the tradeoffs to wilderness character have been evaluated, and prescribed fire is shown to be the minimum tool a risk assessment should be completed to determine what type of organization is needed. Risk analysis should evaluate the increased logistical and monitoring requirements for intro-

Park Name	FRCC 1	FRCC 2	FRCC 3
Ansel Adams Wilderness	27	439	46
Badlands Wilderness	71	22,235	6,120
Bandelier Wilderness	296	9,648	14,606
Beaver Basin Wilderness	155	4,003	6,528
Black Canyon of the Gunnison Wilderness	3,250	11,440	468
Black Canyon Wilderness	30	16,525	0
Bridge Canyon Wilderness	6,395	0	0
Buffalo National River Wilderness	2,691	1,284	27,364
Carlsbad Caverns Wilderness	12,943	15,312	3,212
Chiricahua National Monument Wilderness	4,178	1,995	5,943
Congaree National Park Wilderness	0	14,647	83
Craters of the Moon National Wilderness Area	116	2,534	368
Cumberland Island Wilderness	1,939	387	6,235
Death Valley Wilderness	361,375	1,998,587	103,620
Eldorado Wilderness	455	24,510	0
Gaylord Nelson Wilderness	2,702	3,832	25,361
Great Sand Dunes Wilderness	414	2,997	8,810
Guadalupe Mountains Wilderness	12,413	21,721	9,733
Gulf Islands Wilderness	1	2,431	598
Indian Peaks Wilderness	1,037	197	138
Ireteba Peaks Wilderness	7	9,519	0
Isle Royale Wilderness	80,703	32,470	14,179
Jimbilnan Wilderness	2	17,572	0
John Krebs Wilderness (draft boundary)	11,788	20,363	6,315
Joshua Tree Wilderness (draft boundary)	5,303	313,551	202,856
Lassen Volcanic Wilderness	750	69,115	4,787
Lava Beds Wilderness	153	13,022	7,907
Marjory Stoneman Douglas Wilderness	508,205	145,456	216,981
Mesa Verde Wilderness	26	6,597	1,402
Mojave Wilderness	63,863	611,704	9,639
Mount Rainier Wilderness	39,023	117,375	25,334
Muddy Mountains Wilderness	22	3,173	0
Nellis Wash Wilderness	1,543	10,063	0
Olympic Wilderness	237,652	407,202	172,183
Organ Pipe Cactus Wilderness	282,664	22,454	84
Otis Pike Fire Island High Dune Wilderness	6	1,052	189
Petrified Forest National Wilderness Area	1,916	22,548	11,917
Phillip Burton Wilderness	1,301	22,632	124

Table 2. The number of acres each park has in condition class 1, 2, and 3. It only includes acres with vegetation that supports combustion. Numbers are coarse estimates and are not to be used for project planning purposes without local verification.

Pinnacles Wilderness	1,782	10,153	3,971
Pinto Valley Wilderness	954	34,621	0
Rocky Mountain National Park Wilderness	95,345	61,172	18,213
Saguaro Wilderness	26,242	13,665	31,691
Sangre de Cristo Wilderness	14,071	17,177	6,888
Sequoia-Kings Canyon Wilderness	92,490	390,040	57,604
Sequoia-Kings Canyon Wilderness (draft boundary)	18,545	9,641	16,663
Shenandoah Wilderness	1,888	11,985	68,142
Spirit Mountain Wilderness	22,763	3,499	4
Stephen Mather Wilderness	224,824	291,683	79,210
Theodore Roosevelt Wilderness	19,809	3,971	2,060
Upper Buffalo Wilderness	243	0	2,153
Yosemite Wilderness	113,565	403,043	87,984
Zion Wilderness (draft boundary)	21,078	64,778	15,392
Totals by Category	2,299,014	5,316,020	1,283,105
Total NPS Wilderness Acres	11,084,094		
FRCC 1	21%		
FRCC 2	48%		
FRCC 3	12%		

Table 2 (continued).

ducing fire in wilderness. The analysis should evaluate potential tactical safety issues posed by primitive tool limitations or the use of Minimum Impact Suppression Techniques in the event of an escape; especially if contingency plans based on catching the fire with primitive tools. These combined risk factors could increase the complexity beyond what is typical for this type of project outside of wilderness.

In order to effectively plan a prescribed fire in wilderness success needs to be defined for decision makers and people implementing the project on the ground. This definition may be extremely variable and could be measured by aesthetics, vegetative characteristics, resulting management such as allowing a natural fire to burn, or even positive post-fire effects after allowing a natural fire to burn post-treatment. Impacts to future management decisions could be as important to wilderness character as specific vegetative conditions. Restoration goals that achieve target vegetative conditions and require minimal repeated treatment are most desirable (Noss et al. 2006). For example, success could mean that in the future natural fires will be allowed to burn in this area unchecked. In contrast, success could be defined as a situation where objectives are achieved temporarily with inevitable future maintenance required, leading to such outcomes as finite or continual subsequent treatments such as rehabilitation, additional prescribed fire, or invasive species removal. The difference between these restoration goals is extremely important in wilderness; the former example enhances wilderness character elements where the latter lends justification for continual impacts. In addition to planning, these scenarios involve some important considerations with implementation.

Organizational factors: implementation

If ecological targets and extensive planning point towards prescribed fire the next step is to develop a burn plan. Factors such as determining if, when and where mechanized equipment will be allowed, and when and where it can be used needs to be spelled out in advance with appropriate minimum tool analyses, permits, and exemptions in hand. This will influence ignition and holding plans. When possible, ignition plans and firing patterns should attempt to mimic natural burn patterns, ignition sources, and timing. If many lightning strikes at once are common for the area, the ignition pattern should reflect that. If fire generally moved in from grass and brush lowlands from some distance away, those fire effects should be captured. There are likely multiple types of fires that impact the landscape and ignition plans should try to achieve one or more of these. If not, justification should be provided for the alternative. Ignition plans that mimic natural ignitions should have complementary holding plans similar to management action points on a long-term fire being managed for resource benefit. Changes in fuel types, natural barriers, and opportunistic holding points should be identified in advance to slow or stop fire spread if necessary. Furthermore, monitoring and documentation should extend beyond the obvious ecological impacts of the burn itself and also look at things such as: length of intrusion, effects of personal camps and equipment, duration of area closure, and noise pollution. Lastly, documentation should be approached with the idea that the information is being provided for the entire wilderness system and fire program as a whole so we can better incorporate our successes and failures across geographical and agency boundaries.

Sociopolitical factors

If it is reasonable that natural fire can achieve the desired resource objectives, management ignited fire is not an option. However, neither the National Park Service nor the Forest Service can use natural fire if it is not written into their respective land, fire, and sometimes wilderness management plans (FSM 2324.22, NPS-DO-41). Prescribed fire in wilderness for vegetative objectives is acceptable in the National Park Service, however this is not the case in the Forest Service, where planning would be limited to protection objectives (Parsons, Landres, and Miller 2003). Agency policy or what is, or is not, written into resource management plans may guide decision space from the outset. Furthermore, softer holding lines, primitive tools, and potentially larger scales liken prescribed fire in wilderness more to fire for resource benefit than traditional prescribed fire. Line officers, resources specialists, and the community need to be ready for impacts such as aesthetics and degraded air quality for extended periods of time. Increased awareness and understanding gained from an active fire history can facilitate the use of fire as a management tool, however historical impacts leading to a negative experience, can have the opposite effect making the current use of fire socially or politically unacceptable (Landres, Morgan, and Swanson 1999). Defining success to the public and the agencies will be crucial for future project acceptance (Parsons, Landres, and Miller 2003). Furthermore, agencies need wilderness plans in place to outline desired future conditions in terms of wilderness character, incorporate resource advisors experienced with fire, and ensure consistency with agency plans and priorities. These plans provide a valuable way to communicate new ideas of success and desired future conditions to other resource specialists and the public.

Conclusion

In the late 1970s, Cole, Stankey, and the scientists at the Forest Service's Wilderness Management Research unit in Missoula stated their foremost concern with existing wilderness management plans was the absence of specific, achievable, management objectives for wilderness conditions (Cole and Stankey 1997). At that time, descriptions for desired conditions were very general and therefore it was difficult to articulate problems, develop management strategies, and define success. Since then, there have been great improvements in defining what and how to monitor wilderness character however defining desired future conditions and success following active management is still an issue.

By identifying the values we care about most, and those most threatened, at broad scales and incorporating adaptive management and resilience principles into our projects and resource management plans we will have the ability to both mitigate and adapt to uncertain future conditions. Consistent monitoring and documentation of these actions will increase the support for this type of project and thus the ability and speed at which we can change. Defining success in new ways will begin the mental transition beyond ecological boundaries incorporating wilderness character values and future uncertainty. Beyond preserving wilderness values, these considerations will also aid in clarifying the role of wilderness in climate change mitigation and adaptation strategies both as a refuge and as a comparison for more actively managed landscapes. Acting with restraint and only using fire as a treatment when necessary, while using wilderness as a control, will provide us the broadest range of ecological and social values so that we have ecosystems resilient to future change.

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