

# Influences on USFS District Rangers' Decision to Authorize Wildland Fire Use

Martha A. Williamson<sup>1</sup>

**Abstract**—United States wildland fire policy and program reviews in 1995 and 2000 required reduction of hazardous fuel and recognition of fire as a natural process. Although an existing policy, Wildland Fire Use (WFU), permitted managing natural ignitions to meet resource benefits, most fuel reduction is still achieved through mechanical treatments and prescribed burning. However resource constraints suggest that successful fuel and ecosystem management hinges on expanding WFU. The decision to authorize WFU in the U.S. Forest Service rests with line officers, and the 'go/no go' decision constitutes a time-critical risk assessment. Factors influencing this decision clearly impact the viability of WFU.

This study examined influences on line officers' go/no go decision. A telephone survey was conducted of all U.S. Forest Service district rangers with WFU authority in the Northern, Intermountain, and Southwestern Regions. The census was completed during February 2005 and obtained an 85 percent response rate. Data were analyzed using classification and regression tree (CART) analysis.

Personal commitment to WFU provided the primary classifier for 91 percent of the district rangers who authorized WFU. External factors, negative public perception, resource availability, and a perceived lack of support from the Agency were the main disincentives to authorizing WFU.

## Introduction

Fuel buildup resulting from a century of fire exclusion has left millions of acres prone to higher severity wildland fires than those that historically visited the landscape. Active fire seasons in 1994 and 2000 drew attention to this unanticipated consequence of fire suppression. As a result, national fire policy has shifted towards hazardous fuel reduction and recognition of fire as an essential ecological process. In an attempt to reduce the immediate likelihood of 'catastrophic' wildfire while providing performance measures, agency direction has focused on mechanical treatments and prescribed burning.

Despite this effort to address fuel accumulation, fuels still accumulate at two to three times the current treatment rate (USDA-FS 2004). The most accessible, and therefore least expensive, treatments may already have been done (Calkin, personal communication 2005; GAO 2005), and in the current climate of budget rescissions, it seems doubtful that all the acres that need treatment to remedy 100 years of fuel buildup will receive it. Furthermore, treatments focus mostly on the 0-to-35 year return interval fire regimes, and one-time treatments will not resolve the problem of fuel accumulation. These areas will need maintenance treatments on regular intervals to truly resolve the forest structure problems resulting from fire exclusion (Black 2004).

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<sup>1</sup> Fire management specialist on the Humboldt-Toiyabe National Forest. This project was done while a masters student in the College of Forestry and Conservation at University of Montana. marthaawilliamson@yahoo.com

While mechanical treatments and piecemeal prescribed-burns do alter the forest structure responsible for the higher severity fire events, they do not remedy the underlying problem of almost systematic fire exclusion. In contrast to these two treatments, wildland fire use (WFU) provides another option to the suppression policy.

Wildland fire use is the fire management strategy that allows natural ignitions to burn in predetermined locations under scripted conditions. This strategy allows fire to assume its role as a vital ecosystem process, as encouraged by changes to national fire policy since 1995. This new direction, in conjunction with the ability of WFU to restore both structure and process, suggests that WFU should assume a more prominent role as a fuel management tool. However, in 2004 U.S. land management agencies managed a mere 2.7 percent of all lightning ignitions as WFU (NICC 2005).

## Policy Framework

The decision to allow WFU (called 'go/no go') can only come after meeting three planning requirements (NWCG 1995a). The Land/Resource Management Plan (L/RMP) provides general direction for the wildland fire management direction. In the USFS, the L/RMP corresponds to the Forest Plans that must go through a public comment period (36 CFR 219). Fire Management Plans (FMP) tier to this document. These plans identify the fire management strategies available for every burnable acre. For areas determined as eligible for wildland fire use by the FMP, managers must create guidelines that specify the burning conditions acceptable for wildland fire use (NWCG 2003).

Finally, the Wildland Fire Implementation Plan Stage 1 (WFIP1) must be done to further scrutinize any ignition that meets the criteria outlined in the FMP. This time-critical process, with an 8-hour deadline<sup>1</sup>, first evaluates the candidate fire's physical elements against the prescriptions established in the FMP and in the WFU guidebook. Criteria considered in this step include: threat to life, property, or public and firefighter safety that cannot be mitigated; potential effects on cultural and natural resources outside the range of desired effects; relative risk indicators and/or risk assessment results unacceptable to the appropriate agency administrator; other proximate fire activity that limits or precludes successful management of the fire; other agency administrator issues that preclude wildland fire use. Existence of any one criterion results in the decision to suppress. Foremost, public and firefighter safety take precedence over any other concern (USDA-FS 2000), and only trained and qualified personnel may implement a WFU project (USDA-FS 2000). Beyond this stipulation, only natural ignitions may be managed for resource benefits (NWCG 2005). In addition, each wildland fire may have only one objective, and suppression overrides resource benefit in case two fires merge (NWCG 2005).

The decision to authorize WFU ultimately rests with agency administrators (NWCG 2005). The need for managerial accountability has created a decision process that places all of the authority (and consequent liability) on these administrators. Specifically in the U.S. Forest Service (USFS), District

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<sup>1</sup> Until January of 2005, including the fire season preceding this study, agency administrators operated under a 2-hour time constraint.

Rangers are the administrators, or line officers, most frequently presented with the 'go/no go' decision on whether to allow WFU.

All federal land management agencies must follow national policy direction that mandates allowing fire to function in its natural role (NWCG 1995*a*). Assessing the feasibility of this policy and facilitating WFU implementation demands understanding the drivers of the so-called 'go/no go' decision.

## Drivers of the Go/No Go Decision

Several authors have touched on factors potentially affecting the decision to authorize wildland fire use. The considerations either discourage or bolster a 'go' decision.

The principal factors acting against authorizing WFU include risk, liability, lack of public support, air quality, and inadequate staffing. Most frequently, authors cited the risk of a WFU event escaping as a barrier to authorizing WFU (Arno and Brown 1991; Daniels 1991). This risk assumes greater importance when calculated with potential damage to private property, natural resources, and professional consequences (Czech 1996; Miller and Landres 2004; Arno and Fiedler 2005). Negligence could indicate liability for ensuing damages (White 1991), further raising the stakes. In the case of employee injury, decision-makers could be held liable without evidence of negligence (Stanton 1995).

Lack of public support (Daniels 1991), coupled with the documented need for public buy-in for successful fire and fuels management (Cortner and others 1990; Shindler and Toman 2003; Weible and others 2005) could also factor into the agency administrator's decision. Further, air quality concerns from both regulatory and public opinion perspectives could also (NWCG 1995*b*; Cleaves and others 2000).

Staffing concerns affect the decision to authorize WFU in two ways. The managerial endurance required to commit to managing a WFU event for an extended and indeterminate period enters into the go/no go decision (Bonney 1998; Daniels 1991; Tomascak 1991). Sufficient availability of highly qualified personnel also weighs heavily in the decision to use WFU (Cortner and others 1990; Daniels 1991; Cleaves and others 2000; Miller and Landres 2004).

While these authors predominantly suggest factors that tip the decision towards "no go," others indicate influences in favor of authorizing WFU. Anecdotal evidence of cost savings through wildland fire use suggests this as a possible motivator (Daniels 1991; Czech 1996; Bonney 1998; Calkin and others forthcoming). In addition to reducing costs, the desire to minimize firefighter exposure to the dangers of wildland fires could also influence the go/no go decision (Bonney 1998). Finally, a dedication to stewardship that dictates a commitment to restoring fire could inspire a 'go' decision (Pyne 1995; Miller and Landres 2004; Arno and Fiedler 2005).

Although the agency administrator ultimately makes the decision to authorize wildland fire use, no study has sought their input as to the relative importance, if any, of the elements found in the literature. Understanding the drivers of the 'go' decision requires identifying the factors affecting the people who must assume authority for the consequences.

This study aims to determine the factors influencing the line officers' go/no go decision.

## Methods

The question addressed in this study narrowed the potential population to those agency administrators able to authorize wildland fire use in their areas. As an agency with a mandate to manage for multiple-use, the USFS presented an ideal candidate for examining the complex decision-making behind wildland fire use. Meteorological and ethical factors indicated that USFS district rangers with wildland fire use authority on their districts in USFS Regions 1, 3, and 4 provided an appropriate population to investigate. These regions represent a swath through the Intermountain west, and include forests with WFU authority in Montana, Idaho, Nevada, Wyoming, Utah, Arizona, and New Mexico. This study did not include district rangers in USFS Regions 2 and 6 because too few rangers in these regions have WFU authority on their districts to guarantee confidentiality in their responses.

The USFS employee directory, available on the internet, provided names, email addresses, and phone numbers of district rangers. Unpublished data, provided by the USFS Rocky Mountain Research Station Aldo Leopold Wilderness Research Institute, identified forests with WFU approved in their forest plans.

This identification process led to a potential population of 81 district rangers with WFU authority both in and out of designated wilderness across Regions 1, 3, and 4. Twenty-nine rangers with WFU authority work in Region 1, 27 in Region 3, and 25 in Region 4. Given the small population size, this study conducted a census rather than a sample of the identified district rangers.

This study relied on a telephone questionnaire due to the associated improvements in response rate and efficiency over a mailed one (Dillman 1978; Groves and others 2004). Questionnaire construction followed widely accepted guidelines (Sudman and Bradburn 1982; Groves and others 2004).

Previously-identified, potential drivers of the go/no go decision provided guidance in developing appropriate questions to include in the survey instrument. A subset of line officers, not included in the population, verified the survey instrument's content, organization, and clarity. Question formulation followed guidelines outlined by Groves and others (2004). The questionnaire included 50 multiple-choice questions, and six open-ended ones. Respondents were invited to expand on their answers, although these discussions did not contribute to statistical analysis.

The questions included in the final questionnaire covered eight subject groups: respondent eligibility, external factors (including resource availability), past experience with fire, concern for public perception, confidence in staff, perception of internal support, perception of agency protocol, and demographics. The data reduction conducted to facilitate analysis reflected these question groups.

I conducted the telephone interviews between February 9, 2005 and March 21, 2005.

Classification and regression tree analysis (CART) offered the most appropriate analysis tool for this data set. The go/no go decision amounts to a detailed risk assessment that weighs potential costs against potential resource benefits. The Decision Criteria Checklist in the WFIP Stage 1, described previously, specifies five tiers to this process. If, at any of these levels, cost exceeds benefit then the decision tips to 'no go' and the risk assessment stops. Other factors entering into the go/no go decision that this study explored could follow a similar tiered pattern. CART provides a 'road map' to

navigate such a hierarchical decision process. The classification marks each intersection and determines whether a case progresses towards 'go' or if the risk assessment halts.

The model used a binary target variable, WFU. The binary variable resulted from collapsing the number of lightning strikes in the WFU-approved area managed as WFU in the last three seasons. A score of 0 was attributed to answers of 'none' or 'few.' 'About half,' 'most' or 'all' were attributed a score of 1. Model runs used Salford Systems CART 5.0 software (Steinberg and Colla 1997) and kept the default settings of the Gini splitting criterion, 10-fold cross-validation, minimum parent node  $N=10$ , and minimum child node  $N=1$ . The best tree was selected based on minimum probability of misclassification estimated through cross-validation. Cross-validation (test) prediction success provides the most accurate estimate of model performance (Steinberg and Colla 1997).

The model used a reduced group of factors to classify the district rangers as having authorized WFU on their unit. These factors reflect the question groups explored in the questionnaire. These independent variables include confidence in staff, external factors, experience with fire, agency support, protocol, perceived program value, staffing level and concern for public perception. For all variables, larger scores indicate higher levels of the variable in question.

## Results

Contact with 22 district rangers revealed that they did not have WFU authority on their districts and reduced the actual population to 59. The American Association of Public Opinion Research (AAPOR 2004) defines six methods of obtaining response rate, ranging from conservative to expansive. Using the most conservative computation yields a response rate of 84.75 percent. Twenty-one (of 25) district rangers from Region 1, 12 (of 16) from Region 3, and 17 (of 18) from Region 4 participated.

As a census with an 84.75 percent response rate, errors of non-observation cause minimal concern. Conducting a census eliminates concerns of sampling errors. Although not eradicated, errors associated with coverage and non-response were minimized.

Of nine non-respondents, four corresponded to either vacant positions or positions that had been filled since the 2004 fire season. The remaining five non-respondents face contexts (terrain, weather, fuel, and political) similar to their neighbors who participated. This similarity in geographical and political situations suggests that their responses would resemble their neighbors' and would therefore not alter the study's results.

A combination of residual instrument errors and respondent errors may have contributed the most significant source of error in the data collected. Several of the questions either reflected areas of Agency direction or inquired after professional motivations. Despite confidentiality guarantees, the respondents could have opted to 'toe the Agency line' and not provide completely candid answers.

## Analysis

Model 1 from the CART analysis used eight variables to classify the dependent variable. This classification resulted in a tree with five decision nodes and six terminal nodes (Figure 1). Program value, concern for public perception,

staff trust, external factors, and agency support successfully identified 63.6% of respondents who authorized wildland fire use. Table 1, below, summarizes Model 1 performance.

Figure 1, on the following page, depicts Model 1. Each intersection, or node, provides a make-or-break rule for whether or not the respondent will continue down the tree. Respondents whose answers meet the splitting rule move down the path to the left. The tree shunts respondents who fail the splitting rule to the right.

The first intersection, at program value ( $\text{PROGVAL} \leq 3.8$ ), diverts 11 respondents and classifies them as not authorizing WFU (terminal node 1). This indicates that program value is the most important factor, and progression to the next decision rules hinges on the score for this variable.

Respondents who make it through the intersection at program value move to the next one, at concern for public perception ( $\text{PUBPERC} \leq -0.2$ ). Here, though counter-intuitive, respondents who reported less concern for public support are classified as not authorizing WFU (terminal node 6). Survey participants who reported higher concern for public support (lower negative score) continue to the next intersection, which occurs at staff trust.

This more intuitive split ( $\text{STFTRST} \leq 2.4$ ) indicates that staff trust plays the next most important role in determining whether or not respondents have authorized WFU. Respondents who reported a level of confidence in their staff below 2.4 are classified as not authorizing WFU (terminal node 2) and do not continue down the tree.

The next criterion involves external factors. Respondents who scored at the upper end of external considerations ( $\text{EXT} > 6.5$ ) do not authorize WFU (terminal node 5). Those who meet the splitting rule of  $\text{EXT} \leq 6.5$  move on to the final intersection, at agency support.

This final tier separates those respondents who perceive that the Agency facilitates the decision to use WFU. Again counter-intuitively, respondents who scored above the threshold value of 2.5 did not authorize WFU (terminal node 4). Conversely, respondents who met the decision rule  $\text{AGSPRT} \leq 2.5$  did authorize WFU (terminal node 3).

Ninety-one percent (20 of 22) of respondents who authorized WFU follow the tree all the way through to the final intersection at agency support.

**Table 1**—Model 1 test prediction success.

	Actual Class	Total Cases	Percent Correct	Predicted Class	
				0 N=19	1 N=27
Test	0	28	67.9	19	9
data	1	22	63.6	8	14

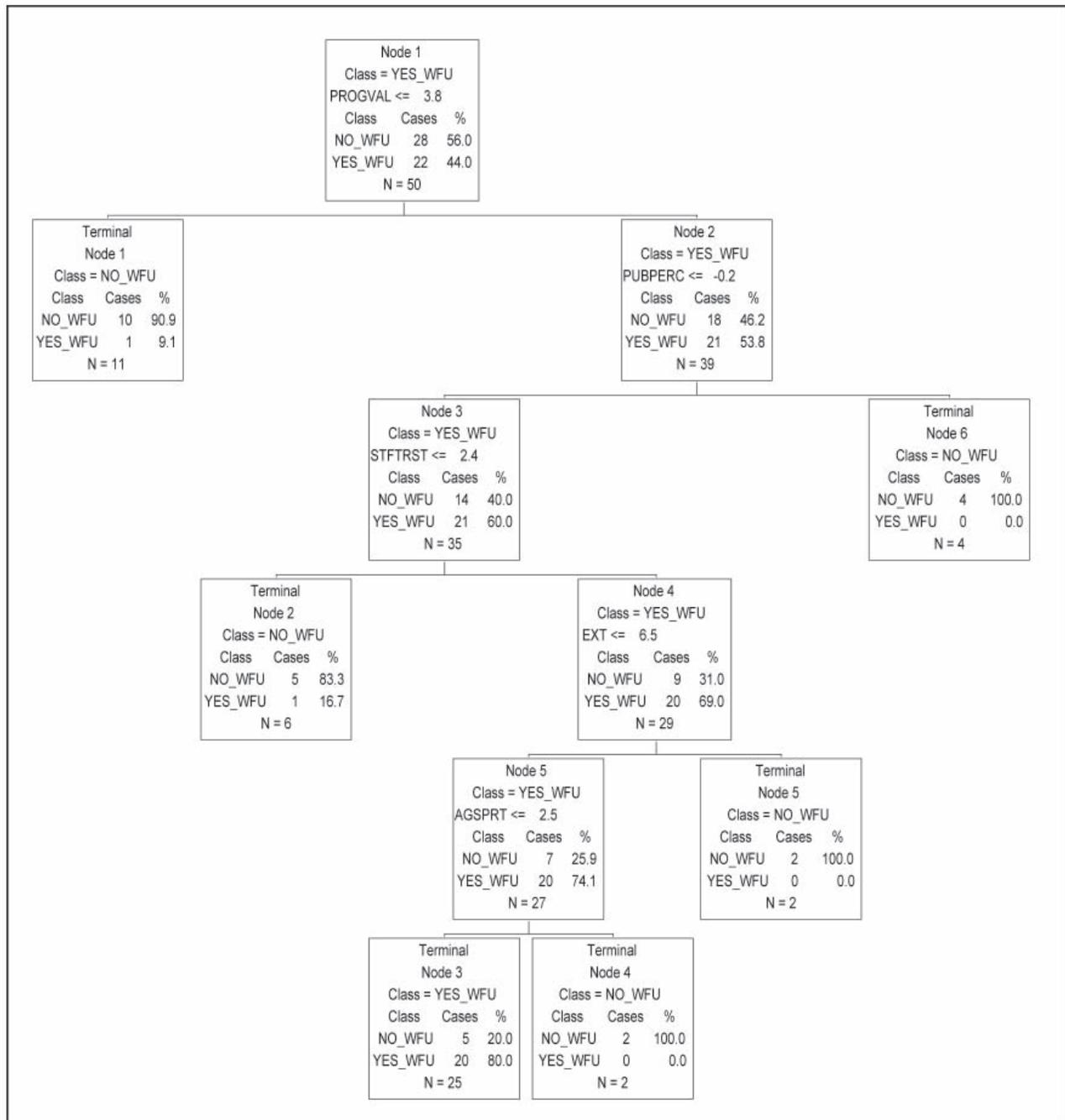


Figure 1—CART Model 1.

## Discussion

Interpretation of CART-analysis results indicates that the go/no go decision rests on personal commitment to returning fire to the landscape. This overarching theme helps explain the somewhat counter-intuitive modeling results. The decision structure presented by Model 1 highlights potential deterrents to WFU, and responses to individual survey questions expand on them.

### ***“You are acting outside the scope of your employment if you do not do what is best for the land”***

The CART model suggests that the value placed on the WFU program provides the most important determinant of whether a respondent authorized wildland fire use.

From Model 1 emerges a group of decision-makers that stands behind returning fire to the landscape, and is strongly motivated by ‘doing the right thing’ for the land. Beyond this belief, these district rangers have confidence in their staff, but worry about public perception and do not feel supported by their employer. As one respondent said, “the nexus of temporal, spatial, and political factors doesn’t always align” and yet individuals driven by their desire to do right by the land will proceed with WFU.

The results of Model 1 suggest that “the laudable, noble goal of ecosystem restoration” motivates a cohort of district rangers, convinced that WFU will accomplish this goal. According to the CART model, this cohort will predictably see potential benefits to the resource outweighing potential risks, and decide to ‘go.’ The model suggests the idealistic nature of those who reliably authorize WFU, but also highlights the obstacles that prevent district rangers from authorizing WFU across the board.

### ***“There is more value to the resources at risk than value to allowing fire back on the landscape”***

Responses to the open-ended questions in this study flesh out the backbone suggested by the CART model and draw attention to the risks that make implementing a stewardship ethic a costly gamble. External factors, public perception, resource availability, and agency support all surfaced as top considerations that inhibited the ‘go’ decision.

### ***External Factors: “WFU is Risky Business”***

Environmental factors came up as the main consideration influencing the go/no go decision, and a key to managing non-suppression fires to meet objectives. Specifically, fire danger indices were mentioned seven times in the context of managing a non-suppression fire and 21 times as the top consideration in the go/no go decision. Location and time of year surfaced 17 and 16 times, respectively, as the most important factors influencing the go/no go decision. Beyond these repeated concerns, weather, ignitions, smoke, and threatened and endangered species habitat all came up as considerations that weighed in the go/no go decision. These factors reflect concern for “risk of the unknown” that 8 respondents mentioned as a disincentive to use WFU.

Deciding to authorize a WFU event can engage a district’s management capacity for an extended period. The time commitment involved depends on unpredictable events such as weather and lightning ignitions. In the midst of this uncertainty, air quality and endangered species regulations, in addition to

private property considerations impose definite restrictions on management activity. Even for those supportive of fire restoration, the daunting requirements to ensure in this uncertain environment often prove prohibitive.

### ***Public Perception: “Dick Cheney is not too hip on smoke”***

Public support and public perception surfaced six times as a requirement for managing non-suppression fires to meet objectives and seven times as a disincentive to using WFU. Respondents evoked concerns for the political fallout of the external considerations described previously. Smoke, perceived or real threats to threatened and endangered species habitat, and resource damage perceived as unacceptable by the public or by others within the agency, all came up as specific areas of public concern. These concerns stem to some extent from a partially misinformed public that still views all wildland fires as a threat.

### ***Resource Availability: “We need trained people with the right qualifications”***

Resource availability surfaced 20 times as the top factor entering into the go/no go decision, 14 times as what was needed to manage a non-suppression fire to meet objectives, and in 18 of 43 unprompted discussions that arose during the interviews. Respondents mentioned that the level of qualifications required for fire use managers constrained WFU authorization. In addition, several respondents indicated that they lacked skilled personnel in sufficient numbers to manage WFU.

Respondents also indicated that candidate lightning ignitions frequently occurred when other fire activity was high. In these situations, the line officers did not have the staff on hand to manage the ignitions as WFU. Potential staff shortages cause concern given the indeterminate duration of WFU events.

Respondents mentioned the need for aerial resources in addition to personnel. Two respondents specifically indicated that the availability of helicopters had allowed them to manage WFU events to meet their objectives. In both cases, water-bucket drops by the helicopters cooled down flanks that would have otherwise hit management action-points and triggered a shift to suppression.

### ***Agency support: “Signing ‘go’ is a lonely feeling”***

The need for agency support surfaced as a requirement for managing non-suppression fires to meet objectives. Respondents also cited a perceived lack of agency support as a disincentive to authorizing WFU. This perceived lack of agency support takes two forms. First, respondents expressed a doubt that the agency would stand behind their decision if a WFU event went awry. Second, respondents indicated that the current focus on meeting hazardous fuel reduction targets impeded their use of WFU.

Potential career impacts surfaced seven times as a disincentive, and 14 times in unprompted discussions. Three respondents mentioned specific concerns about the potential for criminal charges as a result of recent after-action reviews of suppression fires that led to fatalities. Weighing resource benefits against potential damage to the decision-maker's family makes 'no go' more attractive.

Pressure to meet targets and lack of credit for WFU came up as disincentives to using WFU and surfaced in 14 unprompted discussions. These respondents indicated that they could not credit acres restored through WFU

towards fuels targets. At the same time, they suggested that prescribed burn targets conflicted with using WFU. Further, two respondents reported that they would suppress lightning fires within areas prepared for prescribed burns because the WFU fire would not count towards the prescribed fire targets.

## Conclusion

The position of line officer in the U.S. Forest Service draws people with a strong commitment to working for the good of the land. As with many public sector careers, there are few benefits other than satisfying a personal land stewardship ethic—a characteristic that holds true in the context of using lightning ignitions to restore fire to the landscape. This study suggests that authorization of WFU by district rangers primarily stems from their personal commitment to restoring fire for the good of the land, despite multiple disincentives. If national policy mandates restoring fire as a natural process, then implementation should not rely uniquely on those willing to take risks for their personal ethic.

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