

ALWRI PROGRAM OF WORK: FIRE

Problem Selection and Justification: (extracted from the Leopold Institute's Program Charter)

Leopold Institute Problem Area 3. There is a need for improved information to guide the stewardship of fire as a natural process in wilderness while protecting social and ecological values inside and outside wilderness.

Two fundamental goals of wilderness stewardship are to allow natural ecological processes to function without human interference and to preserve natural conditions. Natural disturbances are important ecological processes for perpetuating a wide variety of native species and the structure and function of wilderness ecosystems. To develop effective strategies for allowing natural disturbances to more freely function in wilderness, wilderness managers need to understand natural disturbance regimes, how human actions have altered these regimes, the effects of that alteration, and the consequences of management options for reversing or mitigating these effects. Development of the Leopold Institute research program in this area has identified fire as the most important natural disturbance that wilderness managers need to understand in order to protect and preserve wilderness. Research in this problem area is primarily supported by funding from the National Fire Plan, but is supplemented by other project funding (e.g., Joint Fire Science Program, Bitterroot Ecosystem Management Research Project, etc.). Development and direction of this problem will depend, at least in part, on continued availability of funding and compatibility with the needs of these funding sources.

Wilderness fire managers and planners are faced with the challenge of restoring or maintaining the natural process of fire in wilderness while protecting a wide variety of other social and ecological values inside and outside of wilderness. Additional research in the ecological and social sciences is needed to understand when, how, and where the process of fire can best be maintained or restored. Fire suppression has been, and continues to be, the dominant fire management strategy in wilderness, as it is outside wilderness. In many areas, fire suppression has contributed to increasing hazardous fuel accumulations, increasing probability of extreme wildfire occurrence, and altered ecosystem structure and function; all results that run counter to wilderness management goals. In addition, fire suppression has helped to distort human perceptions of natural systems. The orientations toward wilderness fire management that are held by the public and government agencies need to shift away from fire suppression as the dominant fire management strategy and toward a stewardship of the process of fire that includes natural (i.e., wildland fire use) and prescribed fire. To support this shift, we need to understand 1) the natural role of fire in wilderness and how this role has been altered; 2) the options available for restoring fire as a natural process and the consequences of these actions on the wilderness environment; and 3) how social and institutional factors create and maintain a particular orientation toward wilderness fire management. This research will help managers and planners devise effective strategies for restoring and managing fire in wilderness. The need for a shift away from fire suppression as a dominant strategy and

toward the use of wildland fire is increasingly being recognized outside wilderness and the knowledge gained will apply across the full spectrum of lands extending from wilderness outward to the wildland urban interface.

Element 3a. An understanding of natural fire regimes and the extent and degree to which they have been altered is required for developing effective strategies for the stewardship of fire as a natural process.

To establish realistic, sustainable, and scientifically defensible targets for management, we need a better understanding of the extent and degree to which natural fire regimes have been altered by human activities. Wilderness is the best laboratory we have for understanding the range of natural variability in fire frequency, size, severity and seasonality. Although scientists agree that the temporal and spatial variability of fires and fire effects are very important for ecosystem diversity and stability, methods have not yet emerged to effectively describe that heterogeneity. For example, descriptions of fire regimes typically only consider historical averages or mean conditions and therefore fail to capture ecologically important aspects of natural fire regimes. We need a better understanding of how characteristics of natural fire regimes vary in time and space because managers use these descriptions to develop prescriptions and targets for management and they need to be able to plan for and incorporate this variability. An understanding of the inherent variability of natural fire regimes is also important for identifying the appropriate scales for the study and management of fire. Research has shown that different environmental factors influence fire regimes at different scales and we need an understanding of these factors and their related scales of influence. To identify where and what type of intervention may be necessary to achieve management goals, we need a better understanding of how fire regimes have been altered by a variety of agents of change, including: land management, fire suppression, land use change, other disturbances, and climate change. Primary beneficiaries of this research are fire and wilderness managers who seek to restore the natural process of fire to dynamic wildland ecosystems in the face of changing climate and vegetation conditions. The information on the degree and extent of alteration is important for policy-makers and agency leaders. Knowledge gained from wilderness about reference conditions and the natural range of variability will also help set management objectives for non-wilderness environments.

We propose to:

- Quantify and describe the variability in fire regimes at multiple spatial scales in the past and present. Outcome: identification of the appropriate scales for the study and management of natural fire regimes; sampling strategies and methods for describing and quantifying fire regimes at the spatial and temporal scales most relevant to management; identification of critical variables needed to model fire regimes at multiple scales.
- Determine how land management, fire suppression, land use change and climate have affected wildland ecosystems and their fire regimes. Outcome: evaluation of

the relative influence of climate and fire suppression on past and present fire regimes; quantification of the effect of fire suppression on ecosystem conditions.

Element 3b. Fire managers and planners need to understand the options for restoring fire and the consequences of these actions on the wilderness environment.

Options for restoring the natural role of fire in wilderness vary among wildernesses. In some wildernesses, fire is already playing its natural role and maintenance of this role is best achieved through allowing lightning caused ignitions to burn. In other cases, systems have been altered to such a degree that allowing natural fire to burn would compromise wilderness values and therefore, prescribed fire may be a preferred option prior to allowing natural fire. And in still other cases, such as small wilderness areas, allowing natural ignitions to burn may never be feasible because of the potential for escaped fires and unacceptable risks to values. Before investing limited time and resources in developing and implementing strategies to restore and maintain the natural process of fire to wilderness, managers need to understand the likelihood of meeting their objectives through management actions and the consequences of these actions. The cumulative effects of fire and fuels management activities may not be readily apparent and can depend on how surrounding lands are managed. Although the first order, immediate effects of fire on vegetation are well studied, other effects from fire are less well known. For example, fire management staff and wilderness managers need to know the extent to which fire management activities increase the likelihood of non-native plants becoming established in remote wilderness areas, and whether attempts to reduce suppression-accumulated fuels will exacerbate the spread of non-native plants. The current lack of information on the effects of fire on fish and aquatic wildlife is also a major impediment to developing and evaluating fire management strategies. This knowledge gap is particularly important as populations of several amphibian and salmonid species in the mountainous regions of the western U.S. are declining. Finally, to anticipate the long-term consequences of a particular management strategy, we need to better understand the cumulative effects of fire and fuels management activities, including the reciprocal interactions between fire regimes and patterns of vegetation and fuels across large landscapes. Through this research, we will evaluate the consequences of various options for managing and restoring fire in wilderness and adjacent lands. Beneficiaries of this research are fire managers, who need to anticipate the short- and long-term implications of their decisions, and planners, who need to develop strategies and set realistic objectives for managing fire.

We propose to:

- Investigate the long-term consequences of fire and fuels management strategies. We will use computer models to simulate the reciprocal interactions between fire and landscape pattern, project the long-term cumulative effects of fire and fire management, and assess the likelihood of meeting restoration objectives with wildland fire use. Outcome: quantification of the effect of altered fire regimes on

landscape patterns of vegetation; recommended strategies for accomplishing fire management objectives; methods for tracking the cumulative effects of suppression.

- Improve understanding of the consequences of fire and fuels management activities on the establishment and spread of non-native, invasive plants in wilderness. Measure the effects of fire and fire management activities on the influx and spread of non-native invasive plants in wilderness, taking into account variables of physiography, extant vegetation, recent fire history and severity, and proximity to source pools of invasive plants. Outcome: guidelines for minimizing the effects of fire management activities on the establishment and spread of non-native invasive plants in wilderness.
- Improve understanding of the ecological consequences of fire in upland and riparian forests on stream communities and habitat conditions at multiple scales. We will document the range of biotic and abiotic responses to fires of varying intensities and attempt to determine if prescribed burning mimics the ecological function of fire in a watershed. Outcome: evaluation of the immediate and long-term effects of fire management activities on stream ecosystems; identification of opportunities to protect threatened and endangered species; quantification of the effects of prescription burning on stream communities and habitat conditions.

Element 3c. An understanding of how social and institutional factors influence the evaluation of tradeoffs by fire managers and members of the public is necessary to support the stewardship of fire as a natural process in wilderness.

Allowing lightning-caused fires to burn freely in wilderness is consistent with wilderness objectives and can impart many ecological benefits, but the potential for the fire to escape the wilderness boundary and threaten values outside of the wilderness often results in the decision to suppress. Because decisions about how to manage a wilderness fire are made within just a few hours following first report of a fire start, a full evaluation of the tradeoffs among these risks and benefits is difficult. Moreover, most existing decision-support tools focus attention on the short-term, negative consequences of fire. This concentration on the wilderness boundary, the time constraints on the decision process, and the focus on negative impacts of fire all combine to inhibit a comprehensive discussion of the trade-offs involved and ultimately reinforce an orientation towards suppression. To support wildland fire use, decision-support tools are needed to enable managers to weigh the benefits of fire against its risks, and these tools need to be used at multiple scales.

Achieving fire stewardship requires a restructuring of the decision process and a deeper understanding of the context within which decisions are made. We need to understand the individual, social, and organizational factors that support and maintain the existing orientation toward suppression and we need to determine what changes are necessary to accomplish a shift toward fire stewardship. This requires understanding the institutional

factors that create barriers to fire use, developing methods to evaluate tradeoffs among risks and benefits, and developing methods to translate this understanding into changes in organizational behavior. In addition, this requires an understanding of how public attitudes, value orientations, anticipated outcomes, community norms, and knowledge influence the development of public views and trust in the agencies and fire and fuels management activities, and how individuals make personal tradeoffs when considering alternatives to fire suppression.

This research seeks to improve our capacity to help managers restore and maintain natural fire regimes in wilderness by providing: increased understanding of the barriers to fire use and methods for dismantling them, improved quality and consistency of decisions, and improved understanding of how to gauge and engage the public in wilderness fire management. Wilderness and fire planners and managers will benefit through an improved ability to engage themselves and the public in an evaluation of the short and long-term consequences of fire management, to anticipate public and organizational response to proposed management actions, and to protect both the ecological and human values affected by fire and fuels management.

We propose to:

- Determine the institutional, political, cultural, historical, and legal factors that influence fire management decisions when opportunities for restoring and maintaining the natural role of fire in wildland ecosystems become available. We will determine and compare the factors leading to success (or lack of success) of wilderness fire programs. We will directly observe and collect data about the decision-making process for wildland fire use and suppression incidents. Outcome: identification and understanding of the primary barriers to wildland fire use.
- Increase understanding of the influence of public knowledge, value orientations, attitudes, community norms, and anticipated social and ecological outcomes on public decisions regarding fire and fuels management. We will identify and understand how specific influences such as trust in the agency, past experiences with fire, and attachment to place also affect the way the public views and responds to fire and fuels management activities. In particular, we will attempt to understand these influences in relation to public support or opposition towards wildland fire use. Outcome: improved understanding of human orientations towards wilderness fire management and how they vary; methods for monitoring public support of fire and fuels management.
- Develop and test methods for assessing tradeoffs among social and ecological values associated with fire and fuels management decisions. These methods will allow the positive outcomes of fire to be weighed against the risks from fire so that the effects of fire and fuels management on social and ecological values can be integrated into landscape planning tools. Outcome: procedures for integrating

social and ecological outcomes of fire and fuels management into landscape planning activities; improved understanding of how social and ecological value tradeoffs affect management and public decisions regarding fire and fuels; improved ability to communicate about the social and ecological outcomes and tradeoffs related to fire and fuels management.