

Managing Fire Risk in the Forests of the U.S. Inland Northwest: A Classic “Wicked Problem” in Public Land Policy¹

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Abstract

In their classic article published in the Journal of Forestry in 1986, Gerald Allen and Ernest Gould stated that the most daunting problems associated with public forest management have a “wicked” element: “*Wicked problems share characteristics. Each can be considered as simply a symptom of some higher order problem...The definition is in the mind of the beholder and how that person chooses to explain the problem determines the scope of the search for a resolution. Furthermore, there is no single correct formulation for a wicked problem, only more or less useful ones* (p. 22).” This description seems to fit very well the difficulties associated with managing the increasing risk of wildland fire in much of the western United States. The cause of the current state of affairs is a complex mix of physical, ecological, economic and social developments which occurred during a more than one hundred year period. Proposed steps to improve the current situation involve equally complex dynamics which do not lend themselves to simple linear thinking. Using the Inland Northwest region of the U.S. as a primary example, this paper explores these complex dynamics as they relate to possible improvements and the dilemmas inherent therein. Among the elements of the problem examined include longstanding political polarization over public land management, patterns of residential development in the so called Wildland-Urban Interface, a longstanding social belief that fire is the “enemy” of the forest, uncertainties concerning tolerance for and health effects of smoke from prescribed forest burning, the economics of utilizing small diameter wood as a byproduct of forest thinning, impacts of forest treatments (or lack thereof) on wildlife habitat and the impacts of controlled and uncontrolled fire on carbon sequestration and release. We conclude that any “solutions” to the problems associated with fire risk involve complex tradeoffs that demand careful scrutiny and public deliberation.

Introduction

In the last few years, the summer newspapers have been replete with headlines about wildfires and the destruction they bring to communities and forests particularly in the American West. A common sidebar to these stories is how the management of the public forests has led to these conflagrations and how the forests might be restored to

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“health” with a combination of thinning, prescribed burning, and a streamlined environmental analysis process. The wildfire issue has returned the management of public forest lands to the national policy making agenda.

We suggest that just as the cause of the current state of affairs in these forests is a mix of physical, ecological, economic and social developments over the last one-hundred years, the solutions to managing fire risk are equally complex and come with a set of dilemmas. It is not our purpose here to propose a “solution” to the fire issue, but rather to lay out what we believe to be the most significant sources of complexity inherent in any attempt to make meaningful improvements to what we see as an archetypal wicked problem (Allen and Gould 1986). The evidence that the fire issue fits the “wicked problem” trope is abundant. Different stakeholders see the fire issue as a symptom of a higher order problem but disagree on the nature of that problem. Some see it as evidence of too much and the wrong kind of forest management and others, as a lack of adequate management. Each side can point to examples that bolster their case.

We use a *soft systems* or *soft systems methodology* (SSM) (Checkland, 1981, Daniels and Walker 2001, Wilson and Morren, 1990) to analyze this problem. This approach was conceived to deal with the less well defined problems common in complex public policy issues. These “fuzzy” problems are characterized by competing or multiple goals and purposes. The SSM approach recognizes that full agreement or a single solution may never be reached but rather achieving small improvements in the situation is a more realistic aspiration. The approach also assumes that all the requisite knowledge for making improvements may not exist in advance (at least not in any one place) but instead emphasizes incremental change public deliberation and learning as progress is made. (Daniels and Walker 2001). We use this approach to lay out in a broad way what we believe to be the major components of the fire problem using the Inland Northwest as our example and to suggest ways to think about the links between these components. In the spirit of SSM, we do not claim that our characterization of the problem is right in a once-and-for-all sense; we hope that it is useful as a heuristic device to advance thinking and to lead toward system improvements in an important problem faced by land managers and ultimately policy makers.

How did we get here?

We begin by asking “how did we arrive at the current state of affairs regarding the perceived risk of catastrophic wildfire in the public forests?” We need to recognize that there are two separable yet interconnected current states of affairs. One is the biophysical “here”, or the current condition of the public forests in the Inland Northwest, and the second is the sociopolitical “here”, and includes the current debate about wildfire risk, interface lands and communities, and management of public forests. Both have evolved over more than a one-hundred year period and are the result of a complex mix of physical, ecological, economic, and social developments.

Biophysical “Here”

The Inland Northwest covers eastern Washington (east of the Cascade Mountains), northern Idaho (north of the Clearwater River), and western Montana (west of the

Continental Divide). The ponderosa pine, Douglas fir and mixed conifer are the dominant forest types found in eastern Washington (Agee 1993, TriData 1997). Ponderosa pine, Douglas-fir, and lodgepole pine forest are the dominant forest types in Montana and Idaho (Adams 1995). The interaction of human and natural forces has wrought changes in forest structure and fire regimes. Native American burning, hunting, and other activities have occurred for at least 6,000 years (Barrett and Arno, 1999). Post-settlement logging, grazing, mining, farming, silviculture, and fire suppression over the last 150 years have also shaped the forests of the Inland Northwest (Arno and Allison-Bunnell 2002, Bassman and others 2003, Hessburg and Agee 2003). Now, forest structures are more homogenous and denser with multi-layered canopies; shade tolerant and fire intolerant species have increased; and there has been a corresponding decrease in fire resistant species. Ground and ladder fuel levels have increased, fire intervals have lengthened, and fire behavior and intensity are more extreme (Agee 1993, Hessburg and Agee, 2003).

Fire Severity Regimes

Hessburg and Agee (2003) characterize the historical fire regimes of the Inland Northwest forests as "...a full-spectrum of low (nonlethal), moderate (mixed), and high-severity (lethal) regimes," (p. 24). They describe each regime as follows: "Low-severity regimes displayed frequent fire return intervals, low fire intensity, small patch size, and little edge. Mixed-severity regimes exhibited less frequent fire return, a mix of fire intensities that included underburning and stand-replacement fires, intermediate patch sizes, and significant edge between patches. High-severity regimes displayed infrequent fire, generally high fire intensity, large patch sizes, and intermediate edge," (p.24). Vegetation types within these fire regimes are ponderosa pine and western larch (low severity); Douglas-fir (low to mixed severity); white and grand fir (low to mixed severity), lodgepole pine (mixed severity); western hemlock/western redcedar (high severity) and subalpine fir (high severity).

Sociopolitical here

Fire management on public forests has since passed through several stages since 1910, each with a protection, management, and research strategy (Pyne 1982). The era of fire control began after the fires of 1910. Aggressive fire suppression reduced losses yet allowed fuel to build up, especially in the low severity fire regime areas. In the 1970's fire management replaced fire control. Containment and confinement and prescribed fire received emphasis and prescribed natural fires popularly known as the "let burn" policy took hold. This policy fell out of favor with the Yellowstone fires of 1988 and the public debate over the place of fire in public forests began. This debate culminated with the National Fire Plan of 2000 that emphasizes a collaborative approach to managing wildfires and fuels, restoring fire adapted ecosystems and post-fire rehabilitation on state, federal, and private lands and initiates a new era of fire management (National Fire Plan 2000). At present, the debate over the role of fire and suppression strategy continues and has become enmeshed with the debate over the management of public forests and "forest health".

The wildfire paradigm has changed along with suppression tactics. After 1910, wildfire was "bad"; the paradigm has shifted somewhat to the view that some fires are good. But this shift has happened primarily among resource managers; much of

the public views wildfire as bad, a view exacerbated or strengthened in the Inland Northwest because of the catastrophic fires in 2000 and 2002.

Rural migration trends have gone through several dramatic swings in the last 50 years (Johnson and Fugitt 2000). A net out-migration phase that ended in the late 1980s was followed by an in-migration boom in the 1990s that continues today (McCool and Kruger 2003, Rudzitis 1999). The Inland Northwest has experienced this increase as well, and Montana's Bitterroot Valley is an oft-cited example of these migration trends. Population increased in 94 of 100 counties in the interior Columbia Basin, which includes the study area, in the years 1990-1994. The key feature bringing migrants to the Western U.S. is the presence of federal land or natural resource based amenities (McCool and Kruger 2003, Rudzitis 1999). Scenery, rivers, forests, and recreation opportunities are just as appealing as the traditional rural attractants of low crime rates, a lower cost of living, and a slower pace of life. This is especially true for retirees, who make up the largest group of in-migrants to counties with natural resource based amenities. This segment of the population is expected to grow in the coming decades as the Baby Boomers retire (McCool and Kruger 2003, Rudzitis 1999).

It is sometimes asserted that newcomers have attitudes and values that clash with the traditional commodity interests or extractive resource management emphasis of the old-timers. The existence of this attitudinal split between newcomers and old-timers is not as clear as some stereotypes would suggest however (McCool and Kruger 2003). Empirical evidence suggests that small differences in attitudes toward public land management are present but that both groups favor strategies that protect the environment (Rudzitis 1999). While preserving the amenities that brought them to these rural communities is important to newcomers, it is extra-local or national environmental groups who often appear to be the most vocal opponents to traditional extractive management activities. Decades of mistrust on all sides of the "forest management wars", increasingly restrictive legislation, and litigation have halted many management activities on public forest lands. Projects that survive in this environment are implemented after long delays, if at all, and legal or administrative gridlock is common. Those that favor active management on public forests perceive that land management agencies are not managing forests effectively. Those that oppose most or all federal timber sales are suspicious that any proposals calling for harvesting trees are a harbinger of the return to the era of federal forest management being dominated by commercial timber harvest. The result has been a downward spiral of trust on all sides.

At the local level the influx of new residents to rural communities has strained services, including volunteer structural firefighting departments. Wildland firefighting has been affected as well. Wildland firefighters have to consider homes and communities, and tactics have shifted from indirect attack to aggressive, direct attack that puts both wildland and structural firefighters in risky situations as they defend homes and communities in the wildland-urban interface (WUI) (McCool and Kruger 2003).

The majority of forestland in the Inland Northwest is managed by federal agencies (i.e., USFS and BLM). There is general agreement that wildfires threaten people, property, and forest resources, and that federal land management agencies need to act to reduce the threat of wildfire. Many of the dilemmas surrounding the proposed treatments to reduce wildfire hazard and restore public forests to something akin to historical forest conditions stem from these underlying political and value

disagreements. Other difficulties (i.e. increased fire danger in residential areas and threats to municipal water supplies) stem specifically from the unstable ecological conditions that currently exist in many forest stands. Indeed, these aforementioned disagreements make implementation of treatments to deal with fire hazard and related ecological conditions so contentious.

Treatment Options

This section addresses three broad treatment options and objectives for wildfire hazard reduction on public lands in the Inland Northwest: no treatment, prescribed fire, and mechanical removal of trees. The latter two are usually done in combination, but are described separately here. Debate over treatments does not usually focus on the scientific or technical aspects of implementing them, but on where they will be implemented (backcountry versus interface) and the motivation for doing them (restoration vs. exploitation). It should also be noted that although there is much scientific knowledge about the response of forest stands to silvicultural treatments, nothing on the scale of what is being currently considered in terms of fire hazard reduction treatments has ever been attempted in North American forests. Thus such would be by definition a learning process.

No Treatment

No treatment means no cutting of any kind- pre-commercial and commercial thinning, commercial harvest- prescribed burning, or other activity that mimics natural fires or otherwise changes existing forest conditions. A variation of no treatment is foregoing treatment only in the remote, high severity forest types where forest structures and fire regimes have not changed as dramatically (Hessburg and Agee 2003). This option does not include foregoing wildfire suppression activities.

Prescribed Fire

Prescribed fire is the use of anthropogenic or lightning ignited fire to achieve land management objectives, generally in low severity fire regimes. In the context of this paper, prescribed fire is used for hazardous fuels reduction in forests, especially those around WUI communities, and to restore fire adapted ecosystems. Given current forest conditions, this option alone cannot achieve hazardous fuels reduction and forest restoration goals without mechanical treatment beforehand. Current fuel loads in the low severity fire regime forest types are too high to implement this option safely without pre-treatment. Prescribed stand replacement fires would accomplish fire hazard reduction goals in mixed and high severity fire regimes, but they are risky and the public and land managers aren't likely to accept that risk (Arno 2000, Clark and Sampson 1995).

Mechanical removal of trees

One of the oft-advocated approaches to dealing with the relatively high, "unnatural" stocking levels present on portions of the forests of the western United States is an aggressive thinning program. This treatment option calls for the mechanical removal of selected trees to reduce fuel levels, control insects and disease, and restore fire

adapted forests. This approach includes: low thinning; commercial harvest and commercial thinning, and ecologically based prescriptions.

Low thinning would remove all trees in a stand below a certain size threshold (diameter limit), to reduce density (i.e., TPA, BA) and ladder fuels. *Commercial harvest and thinning* would remove commercially valuable timber from public forests for hazardous fuel reduction in both the backcountry and WUI. *Ecologically based prescriptions* would retain and remove trees of various sizes and species within a stand to achieve a more sustainable forest condition. This approach would apply to backcountry as well as WUI areas, can substantially reduce fire hazard, and is generally low cost (Fiedler and others 2001 and 2002).

The Dilemmas of the Treatment Options

The treatment options are easily defined than implemented. Forest managers must confront difficult scientific and technical questions as well as social and political ones if the implementation of treatments is likely to be seen as broadly acceptable or successful. Perhaps the thorniest question is that of time scale. Although the treatments have potential to mitigate the wildfire or “forest health” problem, current estimates suggest it will take 50-100 years to treat fire prone forests and move forest ecosystems to a more sustainable condition (Pass 2004). This time scale is almost incomprehensible to a political system and a public notorious for its impatience for problems to be solved. This tangle of issues complicates the discourse over wildfire management on public lands and has the potential to hamper or prevent implementation (Figure 1). One-hundred-fifty years of fire suppression, logging, grazing, and human population growth and the resulting changes to forest ecosystems cannot be undone or reversed in a decade. Taken together the interaction of the technical and socio-political issues and the different time scales inherent in each constitute the wickedness of the “fire problem”.

Prescribed burning dilemmas

One dilemma associated with broadcast burning is that of public tolerance for smoke and the attendant poor air quality and health impacts generated by such burning (Pyne, 2001, Sandberg and Dost, 1990, Schindler and Reed, 1996; Schindler and Toman, 2003; Winter and others 2002). Although expert opinion suggests that broadcast burning produces less smoke than the uncontrolled wildfires such burns may prevent (Hessburg and Agee 2003, Huff and others 1995), such analysis does not guarantee public acceptance.

Another dilemma associated with prescribed burning is the fear of escaped fire (Schindler and Reed 1996, Schindler and Toman, 2003). There is a high risk of public sanction for those who allow prescribed fire to escape as indicated by the public reaction to the Cerro Grande fire of 2000 (Pyne 2001). Therefore the timing of such burns is critical and problematic. Because prescribed fires are often conducted when weather conditions (low wind, high humidity, cool temperatures) are suited for better fire and smoke control, actual fuel combustion may be retarded. Consequently, fuel reduction and restoration goals may not be achieved by conducting burns when it is reasonably safe to burn. An associated issue is the legal liability associated with escaped fires (Carroll and others 2004).

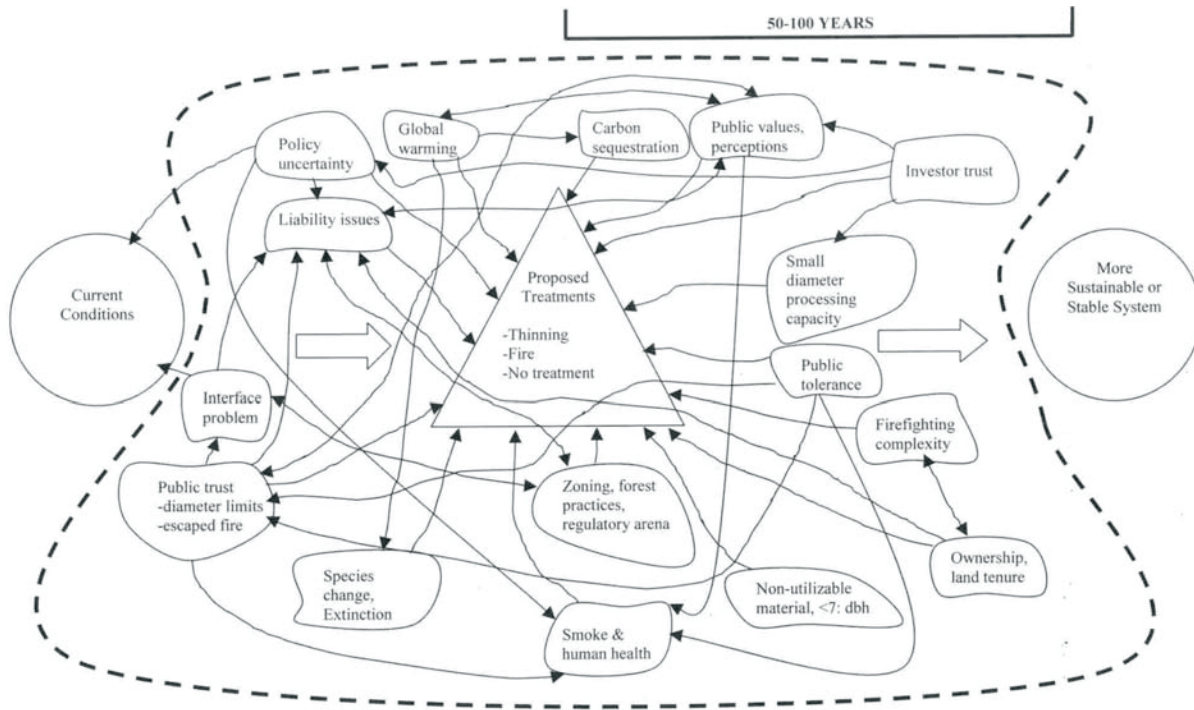


Figure 1--Soft systems model of treatment dilemmas

Global warming and carbon sequestration are intertwined dilemmas associated with burning and thinning; they make balancing the carbon budget and reducing fuel loading and fire hazard a challenge. Both treatments have the potential to affect carbon sequestration but in quite opposite ways. Carbon sequestration in ecosystems and utilization of woody growth as lumber products enhance carbon sequestration, yet prescribed burning for ecosystem restoration and fuel reduction will release more carbon (in the form of carbon dioxide) into the atmosphere, potentially aggravating climate warming trends (Rapp 2004).

Climate change models indicate that western summers will become hotter and wetter, leading to an increase in woody growth i.e. fuel. This increase in woody growth and fuel due to climate change is linked to increase fire risk as well as changes in other disturbance regimes as well as vegetation changes. For example, in the interior west, the acreage of ponderosa pine forests is expected to increase and the range of Douglas fir may expand. These vegetation changes also have implications for wildlife species as their habitats shrink or expand with the vegetation changes. (Rapp 2004).

Thinning Dilemmas

While many advocate thinning as a partial answer to the “fire problem” in the region, implementing this tool across the varied landscapes of the Inland Northwest United States is neither simple nor straightforward. Major issues include: 1) how many acres

need treatment or should be treated from biological and social perspectives; 2) how frequently will the treated acres have to be retreated through time; 3) how should we prioritize the treatment of acres across the landscape and 4) how many acres of those selected for possible treatment may actually be treated given current markets, harvesting technology and access constraints?

These operational issues are further confounded by the need to reduce fire risk to homes in fire-prone rural areas, as well the desire to preserve selected historically important and/or culturally significant areas. The intermingling of federal, state, and private lands also calls into question the efficacy of such efforts when adjacent lands are left untreated.

Further, land managers need to consider the effect of thinning on a wide array of vegetation management, wildlife habitat, biodiversity, and threatened or endangered species issues. For example, it is not clear how thinning would be applied in even-aged stands; thinning from below would prevent the development of uneven-aged stand structures, a common and ecologically desirable condition in the dry, low-elevation forest types. It is not clear if thinning would be effective in mixed and high severity fire regimes (i.e. the lodgepole pine forests of Montana) where fires are weather, not fuel driven (Arno and Allison-Bunnell 2002, Hessburg and Agee 2003).

Another significant dilemma related to thinning treatments is one of public trust and support for a broad scale thinning program. The federal government is promoting aggressive thinning programs under the recently passed Healthy Forests Restoration Act (HFRA), and one has to question how long the public will wait for these treatments to significantly reduce the fire hazard. Large areas of forestland threatened by wildfire may not be treated at all if thinning is applied only in the WUI. As noted previously, it could take as many as 50 to 100 years before thinning treatments begin to significantly reduce the risk of catastrophic wildfire. Others have found that some types of thinning do not substantially reduce fire hazard (Fiedler and others 2001 and 2002).

Thinning is expensive to implement, even more so if no commercially valuable material is harvested (Fiedler and others 2001, 2002). It is this non-commercial material that is implicated in the fire hazard problem. How should this material be handled after thinning? Most forestry professionals recommend burning, which comes with a set of dilemmas previously discussed. In many parts of the West there are limited markets for small diameter timber (7-9" dbh), which limits the ability of land managers to remove this material economically on many sites. Capacity and utilization studies show that less than 10% of the wood processed in the study area is from trees less than 10" dbh. Regional processing capacity is underutilized at present, but diameter and species preferences would limit full utilization (Keegan and others 2004). To further complicate this, recent research demonstrates that investments in new sawmills designed to utilize such material are not economical (Stewart and others, 2003a, b) and that the forest products industry will not invest in new mill capacity without some assurance of a long-term supply (10 to 20 years) (Keegan and others 2004). Conversely, given the historical problems with long-term supply contracts, the creation of new contracts appears unlikely or problematic at best from a public policy perspective.

Removal of commercially valuable timber would pay the way out of the woods for the non-valuable material and would make sales more appealing. However, this option is usually mentioned as a treatment for backcountry or roadless areas and

would undoubtedly meet with marked resistance from environmental groups. Removal of only the commercially valuable trees would not benefit stands with non-merchantable timber, leaving large areas of the WUI untreated. Logging slash could increase fire hazard if not handled properly.

A related dilemma associated with forest thinning is explicitly political, in part due to HFRA, which emphasizes thinning. This Act was proposed by the Bush administration, which is strongly mistrusted by the national environmental movement. This movement characterizes HFRA as “logging by another name”, grouping HFRA with other Administration environmental proposals as being *anti*-environmental. On the other hand HFRA is generally supported by the forest products industry and its supporters whose rhetoric views the proposal as a return to “common sense” forest management. Thus HFRA may prove to be one more chapter in the polarization over public forest management.

No Treatment Dilemmas

The no treatment approach to management of wildfire threat on public land is arguably the default option when political or legal controversies prevent any specific treatment or prescription from being implemented (Arno and Allison-Bunnell 2002). The dilemmas this option generates are the same as those associated with the current wildfire threat: smoke, resource (e.g., water, timber, wildlife habitat, etc.) damage, invasive weeds, and impairment of ecosystem functions. More fires outside the historic range of variability are likely to occur, particularly in the low severity fire regimes if those forests are not treated. The result may be higher life and property losses, increased liability costs, and more capital and physical resources devoted to firefighting at the expense of other programs. As the wildland-urban interface expands, firefighting complexity will increase. Although no forest restoration or hazardous fuel reduction activities occur under this option, ecological and anthropogenic process that contribute to increased wildfire threat (e.g., forest succession and densification, fire suppression) will continue to operate. Consequently, threats associated with wildfire do not diminish and are likely to increase as more acres burn and other acres become increasingly likely to burn.

General Dilemmas

The issues and dilemmas associated with treatments for the fire problem in the region can be collapsed into three major categories. The first of these is trust. As we have indicated, there is a generally low level of public trust for government and public land management agencies in the region and indeed the country. It seems safe to assert that of all the myriad land management issues which generate trust issues, none has more potential for generating mistrust than those associated with fire. The second general category is that of tolerance for any given treatment when it is actually carried out on the ground. People tend to develop attachments to the way a given landscape looks even if its current condition is not historical or natural. Nearly any treatment changes the appearance and “feel” of the landscape, thus nearly any treatment is likely to be objectionable to someone (Arno and Allison-Bunnell 2002). The third general category is that of policy uncertainty. Policy uncertainty related to public lands in the region has become so endemic that it “breeds” on itself. In such an atmosphere, no actors can be guaranteed that good faith actions on their part will be

met with a desired response on the part of others. This is true no matter which side of the ideological divide one resides on.

Conclusion

There is near universal agreement that significant portions of the public forests in the Inland Northwest are outside the historic range of variability and that one consequence of this condition is an increased likelihood of catastrophic wildfire. And there is also near universal agreement, particularly among those who live near such forests, that such an increased likelihood is unacceptable given the consequences of such events. Given that the current situation is widely seen as unacceptable, it follows that changes in forest conditions are needed. However, the nature of such changes and the means to achieve them are subject to a variety of biophysical and socio-political dilemmas that confound implementation of the proposed treatments. As we have noted, Gould and Allen (1986) point out that such wicked problems tend to be viewed as symptoms of higher order problems and that different observers often disagree on the nature of such higher order problems. Current debate over the fire problem certainly illustrates this tendency. We suggest it is probably not productive to expend more energy in the philosophical debate over which higher order problem the fire dilemma reflects or to think in terms of once and for all or quick fix solutions to the “fire problem”. Rather, it is perhaps more useful to think in terms of system improvements. Clearly the “fire problem” will be with us for a long time and it is perhaps a useful first step for forest managers to accept this biophysical reality and to prepare the public for the long haul. It will take at least a human generation before we really know if we have made significant landscape wide progress in addressing the “fire problem”. Even then, real progress in terms of cause and effect relationships may be difficult to gauge given the impact from uncontrollable and nearly uncontrollable events such as moisture and drought cycles and climate change on fire frequency and intensity. It also seems useful to face up to the socio-political reality that any such improvements must necessarily be attempted, at least for now, in an environment of relatively low trust and significant scientific and political disagreement and uncertainty. All of this coupled with the fact that the “fire problem” stretches across jurisdictional boundaries, land ownership/tenure categories and a myriad of stakeholder groups, suggests an adaptive, deliberative people-centered approach as advocated by Gould and Allen (1986) rather than a “one size fits all” technocratic one. While it is indisputably important to take account of the broad scale landscape dynamics described by Hessburg and Agee (2003) and other landscape ecologists in their analysis of the “fire problem”, we argue that any system improvements will necessarily take place on an incremental basis. Given the nature of such improvements and the lag time between treatments and ecological response, there is unlikely ever to be one emotionally satisfying moment when we can proclaim the problem is “solved”. Instead the best that we can hope for is gradual change and the requisite social and ecological learning which can accompany such change.

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