Death Rides the Forest: Perceptions of Fire, Land Use, and Ecological Restoration of Western Forests

J. BOONE KAUFFMAN*

Department of Fisheries and Wildlife, Oregon State University, Corvallis, OR 97331, U.S.A.

Abstract: *Large wild fires occurring in forests, grasslands, and chaparral in the last few years have aroused much public concern. Many have described these events as "catastrophes" that must be prevented through aggressive increases in forest thinning. Yet the real catastrophes are not the fires themselves but those land uses, in concert with fire-suppression policies that have resulted in dramatic alterations to ecosystem structure and composition. The first step in the restoration of biological diversity (forest health) of western landscapes must be to implement changes in those factors that have caused degradation or are preventing recovery. This includes changes in policies and practices that have resulted in the current state of wildland ecosystems. Restoration entails much more than simple structural modifications achieved though mechanical means. Restoration should be undertaken at landscape scales and must allow for the occurrence of dominant ecosystem processes, such as the natural fire regimes achieved through natural and/or prescribed fires at appropriate temporal and spatial scales.*

Key Words: catastrophic wildfires, forest restoration, forest thinning, fuel-hazard reduction, prescribed fire, wildfires, wildland fire

La Muerte Cabalga en el Bosque—Percepciones del Fuego, Uso del Suelo y Restauración Ecológica de Bosques Occidentales

Resumen: *En años recientes, grandes incendios en bosques, pastizales y chaparrales han causado bastante preocupación en la opinión pública. Muchos han descrito estos eventos como "catástrofes" que deben ser prevenidas mediante incrementos agresivos en la tala de bosques. Pero los incendios mismos no son las verdaderas catástrofes, sino los usos del suelo en conjunto con políticas de supresión de fuego que han resultado en alteraciones dramáticas de la estructura y composición de ecosistemas. El primer paso en la restauración de la diversidad biológica (salud del bosque) en paisajes occidentales debe ser la implementación de cambios en los factores que causaron la degradación o que están impidiendo la recuperación. Esto incluye cambios en políticas y prácticas que han resultado en el estado actual de ecosistemas en áreas silvestres. La restauración implica mucho más que simples modificaciones estructurales obtenidas mediante medios mecánicos. La restauración debe llevarse a cabo a nivel de paisaje y debe permitir que ocurrencia de procesos ecológicos dominantes (por ejemplo, regímenes de incendios naturales logrados mediante incendios naturales y/o prescritos en escalas temporales y espaciales apropiadas).*

Palabras Clave: fuego prescrito, incendios catastróficos, incendios en áreas silvestres, incendios no controlados, reducción de riesgo de combustible, restauración de bosques, tala de bosques

Introduction

Among the first posters advocating fire prevention was a striking painting of the Grim Reaper mounted on an emaciated stallion charging through a magnificent old-growth forest while setting it ablaze. The caption to this dramatic scene was "Death Rides the Forest When Man Is Careless" (Fig. 1). Since that time, the campaign against

*Current address: Institute of Pacific Islands Forestry, U.S. Forest Service, Pacific Southwest Research Station, 1151 Punchbowl Street Suite 323, Honolulu, HI 96813, U.S.A., email boonekauffman@fs.fed.us

Paper submitted December 2, 2003; revised manuscript accepted January 21, 2004.

Figure 1. An early public announcement equating forest fires with death and destruction. Popular depictions such as this ignored the integral role of fire as an ecosystem process. Much of the current rhetoric centering upon wildland fires continues to perpetuate the false view that they are "catastrophic." This perception creates a significant cultural barrier preventing the restoration of western U.S. landscapes.

fire has achieved successes far beyond the prevention of human-caused fires. Instead, generations of Americans (and people of many other cultures) have come to believe that we can suppress fires and that fire is a catastrophe in nature. *Catastrophe* is defined as a momentous tragic event ranging from extreme misfortune to utter ruin.

This perception of wildland fire is quite different from that shared by ecologists, conservation biologists, and fire managers, who for decades have recognized fire as an essential ecological process in western forests, rangelands, and wetlands. This perception was reflected in the 1995 Federal Wildland Fire Management Policy (Zimmerman & Bunnell 1998), which stated as its guiding principle that the natural role of fire will be incorporated into land management. Incorporating fire into land management necessitates the use of both prescribed fire (purposeful ignition) and wildland fire (fires ignited by lightning and allowed to burn under predefined conditions) that benefit resources. I present an ecological perspective on how and why the fire regimes of some western forests have changed in the last century, the causes of that change, potential approaches to forest restoration, and proposed actions that will likely be ineffective if not harmful to forest health and diversity.

Identifying the Real Catastrophes

The loss of one's home to a forest fire or a fatality arising from a wildland fire are human catastrophes. But is it appropriate to consider wildfires ecological catastrophes in western landscapes of the United States? On these landscapes, the real ecological catastrophes or tragedies are not the fires themselves but the land-management practices that led to the creation of conditions facilitating negative consequences for resources or ecosystem composition following fires. This situation cannot be attributed solely to fire exclusion. The factors responsible for the structure of forests today are historical and current land uses, particularly logging, roads, and livestock grazing, in concert with policies of total fire suppression. These land uses have profoundly changed the structure and composition of the low- to mid-elevation forests and rangelands of the western United States. It is these changes in structure that have contributed to the shift from low-intensity surface fires to severe stand-replacing fires.

The idea that wildland fires are catastrophes, combined with a disregard of the actions that have contributed to changes in fire behavior, seem to be driving land-management policies. The Healthy Forest Initiative, released during the height of the 2002 fire season, and the Healthy Forest Restoration Act, signed into law in 2003, have as their objectives improvement of the regulatory process to ensure more timely decisions, greater efficiency, and better results in reducing the risk of catastrophic wildfire by restoring forest health. Although the wording of this legislation is positive, the devil will be in the details of implementation. The law is based on an assumption that forest thinning and other logging activities can solve many forest health problems, that an economic value can be found for small-diameter trees, and that regulatory processes need to be streamlined to increase the efficiency of forest restoration.

Few scientists disagree that altering the frequency, size, and intensity of such an important disturbance process as wildland fire will ultimately result in dramatic disruptions in the composition, structure, and function of western forests and rangelands. There are two policy directions within the federal government's Wildland and Prescribed

Management Policy Guide that address the important role of wildland fire on landscapes (Zimmerman & Bunnell 1998). The first is described as follows: "fires as a critical natural process will be integrated into land resource management plans and activities on a landscape scale, across agency boundaries, and will be based upon the best available science." The second relevant policy direction is described thus: "wildland fire will be used to protect, maintain, and enhance resources and, as nearly as possible, be allowed to function in its natural ecological role." The management of naturally ignited wildland fires to accomplish specific prestated resource-management objectives in predefined geographic areas outlined in fire-management plans is referred to as "wildland fire use" (Zimmerman & Bunnell 1998).

Restoring Forests

It is estimated that about 10 times more landscape was burned, 8 times more biomass was consumed, and 7 times more emissions were produced annually in the preindustrial coterminous United States than at present (Leenhouts 1998). Clearly, it is not feasible to restore fire to presettlement conditions throughout the West. But the restoration of ecological processes (fire) will be important in those areas where native forest ecosystems are the desired land cover. Changes in policies relating to land use, prescribed and wildland fire, and smoke management will be needed if we are to maintain or restore fire as an ecological process in the remaining native landscapes altered only by fire exclusion (e.g., wilderness areas and other vast areas of public lands). From 1995 to 1997, only 0.2% of U.S. Forest Service wilderness areas and 0.1% of National Park Service wilderness areas were allowed to burn as a result of natural fires (wildland fire use) (Parsons 2000). With few exceptions, fires are not allowed to burn naturally in any significant manner in the western United States. From 1998 to 2002, an average of only 296 out of more than 85,000 fires per year (about 3 out of every 1000) were managed under the policy of wildland fire use (data from the National Interagency Coordinating Center [www.cidi.org/wildfire; accessed June, 2003]). From 1998 to 2002, in the Pacific Northwest (Oregon and Washington) an average of 13 wildland fires were allowed to burn each year totaling an average of only 56 ha/yr (a range of 0.4 to 181 ha/yr). In contrast, Agee (1993) estimated that a presettlement mean of 184,737 ha burned each year in Oregon and Washington. This means we allow an area to burn naturally whose size is about 0.03% of historical averages in the Pacific Northwest. Out of over 13 million ha of public land in Oregon, only 2 fires, burning a total of 0.4 ha, were allowed to burn as a wildland fire in 2002. These numbers show that significant barriers remain to restoring the role of fire as an ecological process in resource management.

Much of the Healthy Forest Restoration Act is based on the assumption that there are alternatives to fire in affecting forest structure, ecosystem processes, and hence forest health. Is there a scientific basis for suggesting that forest thinning and other logging practices can "restore" forests? Although cutting can give the appearance of an open forest structure, unique ecological processes associated with fire are not realized. A basic tenet of ecological restoration is that the creation of form without function does not constitute ecological restoration (Kauffman et al. 1997). No mechanical means of fuel reduction—grazing, timber harvest, thinning, or biomass utilization—can duplicate the unique ecological effects of wildland fire, such as soil heating, nutrient cycling, and alteration of community composition and structure (Leehouts 1998). Fires (wildland fires or prescribed burns) do not reduce fuels in the same manner as thinning. Fire consumes vegetation and surface fuels (litter and duff), whereas thinning affects only standing vegetation. This is significant because surface fuels can be the most abundant fuel in fire-suppressed ponderosa pine (*Pinus ponderosa* Dougl. ex Laws.) and mixed-conifer stands (Shea 1993).

Thinning will not alter ground and surface fuels (except through compaction and physical disturbance). Increases in the mass of duff layers (organic horizons) are among the most dramatic shifts in forest fuel loads associated with fire exclusion. In simulating wildfires in mixed-conifer forests under severe weather conditions, Stephens (1998) reported that prescribed burning either alone or in conjunction with mechanical treatments was effective in decreasing extreme fire behavior. Treatments without prescribed fire (including fuel breaks) did not effectively reduce fire behavior under extreme conditions. The only known substitute for natural fires and their infinite number of effects on ecosystems is prescribed fire. If social and political barriers persist in maintaining policies that, in all practicality, are those of total suppression, then prescribed fire will be necessary to maintain or restore native ecosystems.

Thinning or other mechanical treatments alone will not restore forest ecosystems. The manipulation of forest overstory via selective tree (or shrub) removal can be an important initial step in the restoration of forest stands affected by decades of fire exclusion and land use. However, it is not a panacea. Fuels begin to reaccumulate the day after the treatments end. Without proper follow-up, the treatments will lose their effectiveness in a relatively short period of time. The restoration of ecosystem composition and function will require fires to occur with the relative severity and in the spatial and temporal patterns that would occur under current environmental conditions (i.e., restoration of fire regimes). Forest restoration can be achieved only when the dominant disturbance processes (wildland fires) are allowed to occur or are mimicked via prescribed fire. Pile burns, in which large wood is piled and burned on site, is an inadequate substitute

for prescribed fire because of the severe damage to soils beneath burn piles (e.g., loss of soil structure, nutrients, and soil organic matter; Shea 1993) and the continued absence of fire as a process over most of the landscape.

The construction of homes and subdivisions in highly flammable landscapes is another land use affecting fire policy. Much of the recent discussion on the need for fuel reduction has focused on the area known as the wildland-urban interface (WUI). Should the focus on fuels reduction center in areas near the WUI in the hope that this will result in fewer homes lost? Cohen (2000) and his colleagues report that it is the home and its immediate surroundings (30–60 m) that principally determine the potential for home ignition during fires. They suggest that the problem is more one of home ignitability and is largely independent of wildland fire-management issues. If the house cannot ignite, it will not burn. Cohen and colleagues found that even high-intensity crown fires will not directly ignite homes at distances beyond approximately 60 m (200 feet) (Cohen 2000). Therefore, wildland fuel characteristics beyond the home and its surroundings have little if any significance for WUI home losses. Cohen's research suggests that major changes to the home and its immediate surroundings are the most effective means of saving private property from fires burning in the WUI.

Wildland fuel-reduction projects are likely inefficient, costly, and largely ineffective in reducing home losses at the WUI (Cohen 2000). They are inefficient because wildland fuels reduction for several hundred meters or more around a home is greater than necessary for decreasing ignitions arising directly from the fire's flames. Furthermore, wildland fuel projects will likely be ineffective because they will not sufficiently decrease firebrand ignitions. To be effective given no modification of home ignition characteristics, fuels-reduction projects would have to significantly reduce firebrand production, requiring expensive and dramatic fuel reductions for several kilometers around each home. Through simulation modeling, Stephens (1998) also predicted that fuel breaks would be ineffective in decreasing fire behavior under severe fire-weather conditions. This does not mean that forest restoration within the WUI is without merit. There are many important ecological and aesthetic reasons to restore forests close to human populations.

The Future

It would be misleading to suggest that we will be able to prevent severe wildfires from occurring in the future, even with the most active of fuel-management approaches. In addition, a continuing policy of suppressing practically all wildfires, though well intentioned, will result in a continuing trajectory of forest decline due to disruption of the dominant disturbance process on the western landscape. The forests of many national parks and wilderness areas have fire regimes with a long return interval, stand-replacing fires. These forests currently display few or subtle changes at stand scales, with decreases in younger stands at watershed scales. In the decades to come, however, we do not know how they will respond to fire exclusion. A landscape-level approach that increases the land area burned by natural (lightning-caused) fires and/or prescribed fires (purposeful ignitions) will be essential to restoring and/or conserving native forest and rangeland ecosystems. This will require a stronger commitment by homeowners to assume the ultimate responsibility for WUI home protection from fire that would increase the flexibility of land-management agencies to restore ecological processes necessary to maintaining healthy forests.

If death rides the forest today (Fig. 1), it will not be carrying fire on a white stallion; it will likely be powered by fossil fuels driving land uses that have resulted in dramatic shifts in the structure and composition of the western landscape. The catastrophes in the American West are not the large wildfires that have burned millions of hectares in the last few years, but 150 years of land uses that have altered natural ecosystem processes, destroyed ecosystem structure, and failed to protect biological diversity. If it is recognized that fire exclusion has contributed to declines in forest health, then why continue with suppression and land-management policies that perpetuate this problem? The "forest health catastrophe" in the American West will only be worsened by continued responses that ignore and perpetuate the causes of degradation while exacerbating threats to biodiversity, ecosystem processes, and human safety.

Acknowledgments

I wish to thank J. Rhodes, T. Sexton, C. Heider, D. DellaSala, J. Williams, M. Dombeck, D. Sarr, and J. Hall for thoughtful reviews of the manuscript. Preparation of the manuscript was made possible through grants from the Joint Fire Sciences Program.

Literature Cited

Agee, J. K. 1993. Fire ecology of Pacific Northwest forests. Island Press, Washington, D.C.

Cohen, J. D. 2000. Preventing disaster: home ignitability in the wildland-urban interface. Journal of Forestry **98:**15–21.

Kauffman, J. B., R. L. Beschta, N. Otting, and D. Lytjen. 1997. An ecological perspective of riparian and stream restoration in the western United States. Fisheries **22:**12–24.

Leenhouts, B. 1998. Assessment of biomass burning in the conterminous United States. Conservation Ecology **2:(1)** http://www.consecol.org.vol2/iss1/art1.

Parsons, D. J. 2000. The challenge of restoring natural fire to wilderness. Pages 276–282 in D. N. Cole, S. F. McCool, W. T. Borrie, and

J. O'Loughlin, compilers. Wilderness science in a time of change conference.5. Wilderness ecosystems, threats and management. Proceedings RMRS-P-VOL-5. U.S. Department of Agriculture Forest Service Rocky Mountain Research Station, Ogden, Utah.

Shea, R. W. 1993. Effects of prescribed fire and silvicultural activities on fuel mass and nitrogen redistribution in *Pinus ponderosa* ecosystems of central Oregon. M.S. thesis. Oregon State University. Corvallis.

Stephens, S. L. 1998. Evaluation of the effects of silvicultural and fuels treatments on potential fire bahaviour in Sierra Nevada mixed-conifer forests. Forest Ecology and Management **105:**21–35.

Zimmerman, G. T., and D. L. Bunnell. 1998. Wildland and prescribed fire management policy: implementation procedures preference guide. National Park Service, U.S. Forest Service, Bureau of Indian Affairs, U.S. Fish and Wildlife Service, Bureau of Land Management, and National Interagency Fire Center, Boise, Idaho.