Brushfires in California Wildlands: Ecology and Resource Management
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Fuel Management, Fire Behavior and Prescribed Burning

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Abstract. Public policy decisions regarding catastrophic wildfire at the wildland-urban interface continue to emphasize an open treasury for suppression and little for prevention and public education. Structure loss is most significant in pre-1980 construction. Post fire reconstruction, with the exception of wood roofing, continues as before. Chaparral management techniques that utilize native California shrubs in conjunction with the "strategic recycling" concept provide low volume fuels while meeting state landfill requirements. The use of prescribed fire on non-federal lands in California is in jeopardy. Crushing and burning of chaparral generates higher regrowth in broadleaf chaparral, while producing lower emission factors. Pile burning creates significant soils and air pollution impacts.

Keywords: Crush and burn; cultivated biomass; public policy; regeneration; strategic recycling; vegetation management; wildland-urban interface.

Introduction

The catastrophic wildfires that consumed thousands of structures between 1990 and 1993 in Santa Barbara-Goleta, Glendale, Oakland, Malibu and Laguna clearly display the vulnerability of hillside communities in what has been termed the wildland-urban interface. Wildland fire acreage consumption, as well as structural loss, has escalated since the 1980's (Minnich 1983, Riggan et al. 1986, FEMA 1991, 1992, 1993) and the public continues to assume that increased wildfire suppression forces will provide for community safety. The recent Old Topanga Fire (2-6 November 1993) provides a valuable lesson in point.

Firefighters from state, county, city and the federal government attacked the Old Topanga Fire with a huge amount of fire fighting resources. This included, within the first hour: 6 fixed wing air tankers, 10 firefighting helicopters, 150 engine companies, 60 hand crews, 5 bull dozers and 5 water tenders. From a historical viewpoint, this high number of firefighting resources was an anomaly. Almost without exception, under severe wildfire weather conditions, more than one catastrophic wildfire incident will be burning in a region at the same time, limiting available initial action resources. In this case, there existed a large contingent of fire fighting resources, in the area which were demobilizing from fires earlier in the week, and these were available for immediate response into the Topanga/Malibu area. The total resources ultimately committed to this fire included 915 engine companies, 129 hand crews, 19 bull dozers, 11 air tankers, 14 helicopters and 37 water tenders, equaling 7,200 personnel on the fire line. Apparently, this represented the largest number of fire fighting resources committed to a single wildfire event in California's history (J. Meehan, Los Angeles County Fire Department, personal communication December 1992). Despite this, a total of 369 homes were lost in the Old Topanga Fire. For comparison, the Oakland Hills fire of 1991 consumed over 3000 structures and the Goleta/Santa Barbara (Paint) fire of 1990, over 800, while the Glendale College Fire, burning at the same time, took out 67 structures.

Causes Behind Catastrophic Wildfires

What did these catastrophic wildfire events have in common? What does the public perceive as the problem? Are we directing our public resource dollars in the right direction?

First and foremost, all of the catastrophic fire areas had been predicted a number of times, by research scientists and fire professionals. I recall discussing the Oakland-Berkeley Hills problem with Dr.Biswell back in 1981. Dr. Minnich incurred the wrath of the California Division of Forestry and Forest Service officers back in 1983 when he predicted the catastrophic wildfire events that would impact the Los Padres Forest, predating the Wheeler Fire by 3 years, and the Paint Fire by 8 years (Minnich 1983). A fire behavior/fire management condition presently exists that continues to create "firestorm" conditions throughout southern California.

Chaparral branch dieback

The broadleaf chaparral community in southern California has been afflicted with a high dead to live ratio, even in young age class shrubs. First observed in 1984 in the Santa Monica Mountains, the condition now exists throughout the broadleaf chaparral community from San Luis Obispo County through Gaviota Pass in Santa Barbara County to Baja California. The primary shrub that appeared initially afflicted was *Ceanothus megacarpus*, hence the common name "ceanothus dieback" (Riggan et al. 1986, Riggan 1991). Now more appropriately termed "branch dieback," it has been observed in manzanita (*Arctostaphylos glauca*), toyon (*Heteromeles arbutifolia*) and coastal live oak (*Quercus agrifolia*). Such dieback is thought to be caused by combination of pathogen and drought and the concern now goes beyond an increase in dead biomass, but to successful remediation and revegetation projects, statewide (Brooks 1994). Fire behavior in all of the southern California fires, with the exception of the Laguna incident, reflected this significant increase in dead biomass. The coastal scrub of Laguna displays a high dead to live ratio without the broadleaf impact. The Laguna Canyon Fire, because of this condition, was identified and predicted in the mid-1980's. (K. Turner, Orange County Fire Department, personal communication 1985).

Structures and landscaping

There has been a great deal of hand-wringing about new development in hillside communities contributing to the wildfire problem, but a close analyses of all catastrophic wild fires that have occurred since 1990 clearly reveals that the greatest risk is hillside housing and landscaping constructed or planted prior to 1980.

Lets examine the factors that contributed to the structure loss in all of these fires. Structures built prior to 1980 represented over 98% of the loss. Why? A significant factor was the position of the dwelling on the site. No set-back from the edge of the slope, allowing for the full force of the fire to impact the dwelling. The other major factors included un-protected wood roofing, siding and decking. In addition, pre-1980 construction provided little in the way of energy conservation measures, including double pane glass in the windows, poor insulation and a generally looser or more open structure, and of course, inferior water systems. But the overriding consideration, from Oakland to Laguna was the ornamental vegetation or biomass that provided the continuity or the wick from the wildland to the structure.

Analyze any of the news media video available from these catastrophic fires and you will discover, without exception, the ornamental biomass igniting several minutes ahead of the structure. Whole areas in Oakland, Malibu and Laguna had NO wildland area adjacent to the structures, only ornamental vegetation. Ornamental or cultivated biomass, over time, tends to take on the same characteristics as wildland chaparral. Under extreme fire weather conditions, the ornamental vegetation, primarily exotic, with shallow root systems, and subsequently quicker moisture loss, reacts even more explosively than native vegetation (Franklin 1990). Vegetative build-up is a problem that must be dealt with at the community level. Individual hillside property owners have limited power over their destiny or environment.

Attitudes and perceptions

The real problem is that the public and their elected officials perceive that the fires and the losses are a result of arsonists, and the problem can be addressed through tough prison sentencing and the purchase of additional fire suppression equipment worth hundreds of millions of dollars.The result of this popular view is, as they say, literally "written on the wind". The arsonists will continue, the CL-215's and helicopters will continue to put out all of the easy fires, the fuels will continue to build-up and when the next Santa Ana's blow and the relative humidity falls below 5%, the fires next time will eclipse the major fires of the past.

Legislation enacted in the aftermath of the Oakland conflagration (1991 Bates Bill-AB 337) attempted to correct or at least quantify the problem. Unfortunately, inadequate funding, inadequate oversight and an apparent inadequate grasp of the wildland urban interface catastrophic wildfire problem continues to negate the positive intent of this law. Poorly planned construction continues in the communities of Santa Barbara/ Goleta, Oakland/Berkeley, Topanga/Malibu and Laguna.

In 10 years we will be looking at the same catastrophic wildfire scenario. To paraphrase the great Yogi Berra: "This reminds me of deja vu all over again." The only difference is that there will be less wood roofing. There will still exist un-protected wood siding, decking and vegetative build-up with poor access coupled with only marginal water system improvements. The pre-existing wildland urban interface problem is apparently considered too politically sensitive to handle, at both state and local government levels.

Disaster psychology tends to disregard nature's perturbations (Forer 1983, Loeher 1984). Recognizing the vulnerability of hillside residents after the November 1993 fires, Los Angles County Supervisor Ed Edelman suggested a "task force" composed of fire, building and architectural experts analyses and make recommendations to the county governing body regarding fire code changes, equipment requirements and catastrophic wildfire survival. The Wildfire Safety Panel appointed by the Board of Supervisors of Los Angeles County has proposed some significant and positive changes to the fire and building code, but again, these changes do little toward mitigating pre-existing conditions. Recognizing that the problem of pre-existing, pre-1980 development and vegetative growth represents future catastrophic wildfire potential, Los Angeles County Fire Chief P. Michael Freeman is proposing an innovative approach that will involve community participation toward wildland urban interface education, management and preservation. Hillside associations should consider this approach as an opportunity to provide substantive wildfire and watershed protection cooperatively, on a community basis.

We need to view the chaparral environment as a system. We need to recognize that structures have been placed haphazardly within the system and are a fact of life. Watershed management must begin at the structure and move out into the chaparral community. The present practice is to do the reverse. That is to modify the chaparral and leave the last 15 m (50 ft) around the structure covered with irrigated exotic. The irrigated shrubs are the first to decline under drought conditions, as the Santa Barbara and Oakland fires so graphically illustrated. We continue to "bulldoze" fire breaks, creating long term fire management problems. We continue to use goats to eat all of the wrong vegetation and create a flashy annual fuel fire problem in the very areas that are the most vulnerable. Aside from the fact that we have years of catastrophic wildfire loss documenting these management decisions as the wrong approach, we continue to devastate the chaparral community. We really need a chaparral fire management plan for each community that fits the surrounding chaparral ecosystem.

Fuel Management

Beginning with the structure, with appropriate slope set-back, concurrent building regulations (NON-wood roofing, one-hour protection (or more) on decking and siding, double pane windows etc), and appropriate California native vegetation in place (See Los Angeles City Fire Department list of acceptable native shrub species - CNPS approved), a structural/vegetative management plan is possible. Existing guidelines are available (Radtke 1983, Western Fire Chiefs 1991).

Native vegetation (but not *Adenostoma fasciculatum*) and (if you have no concern for our California heritage) even some low fuel volume, deep-rooted exotic, with the exception of juniper and cypress, well-pruned and free of dead material and limbed up at least five feet, will serve to break up the continuity in the first 15 m (50 ft). From 15 to 65 m (50 to 200 ft) from the structure, the technique termed "multi-cutting" or "strategic recycling" will provide for low-volume fuel loading (Franklin 1993a).

This technique, developed during the Bel-Air/Stone Canyon demonstration project (Riggan et al. 1986), involves cutting or chipping all chaparral on-site, placing the cut or chipped biomass on the ground, 10-15 cm in depth, as a mulch. The cut or mulched material will burn, but only with minimal flame lengths and scorch height, almost a smoldering fire. Multi-cutting provides a "softened" or "buffered" edge effect, eliminating a hard line between managed chaparral and the wildland. The cut or chipped biomass serves a number of functions as it:

1. Virtually eliminates "ladder" fuels in the chaparral community, keeping fire on the ground and of low intensity,

2. Shields out the sun, eliminating exotic or flashy fuels that carry fire.

3. Absorbs rain drop energy and aids in stabilizing soils, even on one to one slopes.

4. Meets State of California requirement to reduce landfill impacts by 25% by 1995 and 50% by the year 2000.

5. Slows evaporation of moisture, allowing young, native, fire resistive shrubs to sprout from root crowns.

6. Cuts long term maintenance costs dramatically ($3,750/ha/yr to $160/ha/yr).

Demonstration sites exist in La Canada Flintridge in Cherry Canyon, the cities of Santa Barbara, Santa Clarita, and Newport Beach (Off Spy Glass Hill). Cal Trans has adopted this technique for freeway biomass management.

Prescribed Fire

Prescribed fire can be employed 65 m (200 ft) or further from a structure. First and foremost, the Resources Agency and the California Department of Forestry and Fire Protection must, immediately, update the program EIR for the Vegetation management Program that was approved in 1982. The state has been remiss in not complying with CEQA and the legislative mandate of SB 1704 (1981) for over 12 years. All local, state and federal agencies, the private sector, and the academic community, that are involved in wildfire, watershed management, fish and wildlife and natural resource conservation, including the land acquisition agencies, have a stake in cooperating with the Califorina Division of Forestry in up-dating the program EIR.

Even under severe budget constraints, federal land managers have met NEPA requirements. California Division of Forestry must do similarly or face court challenges to it's vegetation management program. The use of prescribed fire at the wildland urban interface requires a precise application of resources, skills and community cooperation in order to meet project objectives. Chaparral regeneration requires high intensity fire. "Cool" burns tend to degrade the chaparral community (Green 1981, Stassforth 1991, Franklin 1993). Chaparral with a high fuel moisture content will result in a cool burn. Introducing high intensity prescribed fire at the wildland urban interface or "burning under the eaves" is not always the easiest nor the safest approach to fuel management. It is important to consider that all fire, including prescribed fire creates a disturbance in the chaparral ecosystem. It is imperative that prescribed fire produce results that approximate wildfire regarding chaparral regeneration, but not inflict watershed degradation consistent with high intensity wildfire.

A technique has been developed (Riggan et al. 1986, Franklin 1993) that has proven most effective in replicating the severity of wildfire, but not creating hydrophobic soil conditions. The technique is to crush the chaparral, allow it to dry out for several weeks, and apply fire. Heavy chaparral, over 2 m (8 ft) tall, will develop flame lengths > 15 m (50 ft) and has the potential to release energy too fast, creating containment problems. Conversely, wet chaparral or chaparral on north or east aspects will barely ignite without significant wind. Crushing places the finely divided leaves that make up the chaparral canopy, on the ground, taking away the aerial array of the finely divided fuel. A pound of chaparral contains about 8,500 BTU's, equal to a cup of gasoline. On a hot, dry day, with high winds, chaparral reacts almost as explosively as gasoline when ignited. Crushed chaparral creates < 1 m flame lengths versus > 15 m for standing chaparral. Los Angeles County Fire Department uses bulldozers with the blade-up to walk over and crush the chaparral. The growsers or cleats of the dozer "walks" on the chaparral, not the ground, minimizing soil disturbance. A crushing device (gravity roller) has been developed in New Zealand that shows great promise with even less soil disturbance. The crushing technique can be used to create mosaics for wildlife concerns, and serve to keep fire from gallery or riparian zones or sensitive management areas.

The use of prescribed fire in both standing and crushed chaparral, including the coastal scrub community has produced some interesting results (Stassforth 1991). Plots monitored in Stone Canyon and Topanga State Park in the Santa Monica Mountains by Suzanne Goode and Margaret Stassforth found that crushed and burned chaparral produced significant (about a magnitude of 5) increase in Ceanothus cuneatus, C.megacarpus as opposed to regeneration of standing chaparral. While costs are higher for crushing, lower costs for burning are realized, in addition to a better product. The most damaging technique, in terms of soil degradation and seedling regeneration, was found to be pile burning.

Summary

The catastrophic fires that we have endured will continue. We presently have the ability to design fire safe communities within our chaparral environment. Even pre-existing, pre-1980 construction can be made both fire secure and environmentally compatible within the chaparral community. We need only to recognize that planning equates with survival.

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