Structural Wildland Intermix[1]

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Abstract: Because many major population centers are located in wildland areas, many structures have been destroyed by increasingly more costly wildland fires. The structure and jurisdiction of the fire service in California are complex, and a uniform approach to fire prevention is lacking. A description of many of the fire issues in the wildland-urban intermix is provided. The relationship between State and local governments is at the heart of many of the issues. Cooperation between State and local governments coupled with public education and enforcement of current standards and regulations should reduce the occurrence of catastrophic wildland-urban intermix fires.

Wildland fire has been a recurring component of California history. Native-Americans intentionally set fires to the same areas that have currently suffered from major fires. Researchers have determined that about 12 percent of the State of California was burned every year by various Native-American tribes.

In the early 1920's, at about the same time development began in the foothills, firefighting agencies became active in trying to prevent fires from occurring in these areas. Fuel loads became extraordinary after about 20 years with no fire. A major catastrophe (the Berkeley fire) occurred in Berkeley as early as 1923.

Major population centers are now located on formerly uninhabited wildland areas. Fuel loads are of such a magnitude that the fires have increased in frequency and severity, are destroying large numbers of structures, and are becoming extremely costly to combat. They are a major factor in what is now classified as the urban wildland interface or "intermix."

Frequency of Loss

In the past, Californians suffered a major fire loss about every 7 to 10 years. Catastrophic fires have now occurred each year from 1990 to 1993. In each of the last three after-action reports, one benchmark statement reflects the increasing severity of these fires: "this is the largest single mobilization in the history of California." The costs to suppress these fires are substantial and the trend is likely to continue. We can reasonably expect another fire of significant loss in the next 12 to 18 months.

According to the California Fire Census, more than 390 of about 1,000 separate fire departments currently claim to have an urban wildland interface problem. These communities range in size from small fire districts to metropolitan fire departments. The census contains numerous data elements that reflect both the prevention and suppression capacity of the California Fire Service. This document clearly illustrates that the jurisdiction and structure of the fire service in California is quite complex, thus contributing to the lack of a uniform approach to prevention efforts.

The spiraling losses are partially the result of the denial of the fire problem by both individual property owners and, to some degree, local government officials. The mistaken assumption that larger and larger mobilization efforts are needed to limit losses is also a factor. Although the media responds with major coverage to the scenes of these events when in progress, the follow-up coverage and resolution of specific mitigation efforts is of relatively insignificant media interest. The California urban/wildland fire problem is not perceived as a major policy consideration by local or State government when compared to other issues. When the fires are in progress, everyone is interested. As soon as the fires are over, the issue becomes secondary to daily concerns.

Written documentation from the last 10 years of these fires suggests that the specific findings from each successive fire is consistent with the findings of the previous ones. The more common factors that lead to catastrophic losses are well-defined and repeated in report after report. The mitigation efforts that are fairly effective are also well-defined. However, cohesive action that would result in comprehensive changes is lacking. For example, some mitigation efforts apply only to the burned area. In actuality, the mitigation efforts must be applied in areas that have not burned or the effort is wasted.

Fires in the recent past have resulted in a significant economic impact on the State. Fire losses are only one factor. The impact on the tax base and the costs of suppression are equally important. For example, the Oakland fire of 1989 removed over $100 million of assessed valuation from the tax rolls of that city alone (in accordance with Revenue and Taxation Code, Article 70 and Article 74). These last fires will probably result in significant reduction in the assessor's tax rolls in Orange, Los Angeles, and Ventura Counties. During the period of rebuilding, property taxes are not paid by the affected property owners. In addition, after rebuilding, the property owners are protected from incremental tax increases based on Proposition 13 provisions.

Fire suppression costs are severely impacted by the need for overtime to provide adequate personnel resources. Initially, responding engines are taken from on-duty

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companies. But, when the engine company leaves the community, it must be backfilled to maintain coverage in the community. This means bringing in personnel on an overtime basis. Because of Federal Fair Labor Standard Act requirements, overtime compensation is almost always at a time-and-one-half rate. (Responding agencies usually leave fire engines on the scene of major fires past their original 24-hour shift.) A single engine company on a fire is actually two companies at a rate of about $2,000 per day. A significant amount of the staffing costs are involved in the time it takes to demobilize an incident. Some documented cases show that strike teams can take more than 12 hours to get out of demobilization areas. We are paying the costs portal to portal.

Personnel costs also include workers' compensation costs that are inordinately high compared to other types of fires. According to 10 years of firefighter fatality data, 30 percent of all firefighter deaths are attributed to only two types of fire: grass and wildland. The death of a firefighter has a price tag to the taxpayer of about a million dollars per death in workers' compensation costs.

The Causes of Property Losses

We are losing more structures in these types of fires because of (1) the speed of the initial fire; (2) stressed environmental conditions; and (3) fire intrusion into a structure because of lack of an integrated system for fire resistance.

Speed of the initial fire merely means that many of these fires are entering into intermix zones and destroying structures before enough resources can be mobilized to make a significant difference. Although we ultimately deploy hundreds of apparatuses and thousands of firefighters, resources in these numbers are usually not available until after major damage has already occurred. The rate of heat release in areas with limited fuel modification is vastly greater than the suppression capability available to most fire scenes within the first 4 hours of the fire. The Oakland fire scenario, for example, demonstrated that the majority of losses occurred in the first 2 hours of the fire. The first 4 to 8 hours of these fires are more critical now than the next 48 hours. This phenomenon places much more priority upon initial attack capability.

Extraordinary losses can also be explained by the phenomena that many structures are lost after the first wave of fire hits. This is because resources are often removed from one neighborhood and sent to another area of the active fire front. When the fire front is moving at a faster rate than the rate at which resources are arriving, secondary fires are often left unfought in evacuated neighborhoods. The fires rekindle and destroy structures that could have been saved if fire apparatus had not been redeployed. Although we are proud of our mobilization efforts, the driving of a strike team from northern California to a fire in Laguna Beach looks good, but does not reduce actual losses.

Stressed environmental conditions mean that in high wind, high temperature, low humidity weather conditions coupled with steep topography and dense fuel conditions, no amount of conventional fire suppression can adequately protect structures that lack defensible space or structural integrity.

Structural intrusion means that structures are not inherently safe because of the presence of one feature. For example, in the recent fire experience, structures with Class A and Class B roofs were lost because of the lack of design features that prevent the fire's intrusion into windows, doors, attics and eaves. Glazing failure, exposed siding, and underpinning of wooden structures are also a problem. Yet, existing state building standards do not require universal structural integrity features for structures located on hillside sites. A situational formula demonstrates the potential for losses:

$$\frac{\text{Risk}}{\text{Mitigation}} + \frac{\text{Demand}}{\text{Response}} = \text{Potential Loss}$$

Mitigation Response

By assessing risk levels, taking appropriate mitigation efforts (prevention), and adding to them actual demands upon the system and the response of firefighter (suppression) forces, the net result is a loss ratio. High risk plus high demand equals maximum loss. Maximum mitigation plus strong response reduces potential loss. All mitigation with no response results in significant loss. No mitigation and maximum responses result in significant loss, also. As risk and demand levels go up, so should mitigation and response. Lastly, risk is not an issue unless it is calculated economically. Maximum response is not a factor unless it is timely.

The economics of the formula are that risk is primarily personal and private. Mitigation and response have always been considered a responsibility of government. The lack of accountability for mitigation by individual property owners literally means that the more they are willing to risk, the more it is going to cost the public sector to protect the risk.

The formula is dynamic. It represents the current situation throughout California. The formula also reveals that if a community does not have a mitigation plan, then deploying enough fire apparatus quickly enough to control losses is physically impossible.

The political vulnerability in this formula is that frequently incumbent leadership is criticized for conditions they did not create. At the technical level, fire officials understand the relationship of these elements but, at a political level, the issues are often obscured by other considerations. At the time of a specific emergency, the formula is totally disregarded except to evaluate the adequacy of the response and to try to blame the lack of resources.

Jurisdictional Conflict

The body of knowledge regarding mitigation requirements that have been proven to work, and fire suppression deployment methods are fairly well-defined. The response component is well-structured through the California Office of Emergency Services (OES) Master Mutual Aid System, but it lacks a uniform comprehensive approach to the application of site mitigation methods. This would involve the use of adequate standards, an active code enforcement program, inspection, and penalties for violations. There is no equivalent to OES-type coordination system in the regulatory process, especially as it relates to defensible space and structural integrity.

Consistency is absent because the laws, regulations, and standards to remedy the exposure problems are scattered among Federal, State and local jurisdictions. After-action fire records identify the same lack of regulatory controls on specific fires, i.e., roof coverings, defensible space, vegetation management, access and infrastructure problems, and water supply.

The Building Codes and Fire Codes

The California Building Code (CBC) Title 24 was adopted from a model code, with amendments made by the State. The CBC must be enforced by all local governments after the State adopts the most recent edition of the Building Code; local government has 6 months to prepare findings of fact that allow them to make Title 24's minimum requirements more strict based on local conditions. A major portion of municipalities have adopted local amendments to the Building Code. Yet, very few of these amendments deal with the urban-wildland interface. The Building Code itself does not distinguish the requirements for structural features based on location in the interface. The basic requirements are keyed to the type occupancy, not to the exposure to a specific hazard.

Have We Learned the Lessons?

The lesson that we should have learned from a past fire is that fire behavior is not exclusive to that fire. The common thread among past fires is that local action to remedy the situation did not occur before the fire, and, moreover, many local communities have failed to exercise reasonable mitigation strategies in the aftermath of the fire. This has already occurred in Oakland. In effect, they are rebuilding the same fire condition for the future. Further, the fact that the average period of ownership of a California dwelling is only 5 years results in a turnover that creates an information gap between generations of homeowners in impacted areas.

Two mutually contradictory examples can be highlighted: positive and negative. The first is the success of the California Department of Forestry and Fire Protection (CDF) in creating reasonable site safety conditions by enforcing the Public Resource Code (PRC) Sections 4290 and 4291. PRC 4290 is the basis for the Fire Safe California program. PRC 4291 is an excellent approach to the business of mitigation. PRC 4290 cannot be enforced by local governments unless they are contracted with or under State Responsibility Area (SRA). PRC 4291 can be enforced by local governments, but routinely is not.

Second, State and Federal agencies constantly debate the issue of fire clearances and vegetation management. Even in CDF's primary jurisdictions, vegetation management and prescribed burning are difficult to enforce because of local resistance and disputes with environmental agencies. The "kangaroo rat" discussion in Riverside County is one example of this debate. The problem is that frequently State and Federal environmental agencies will not say "no" to vegetation management activities. They just say "maybe" for so long that eventually no action is taken.

In addition, land-use patterns in portions of the state have resulted in allowing development in high fuel loads areas and enforcement efforts have become limited or non-existent. Classic examples of this can be found in Marin County, the Tahoe Basin, and all across the Sierra Nevada.

The issue of fuels and fuel modification is probably the most critical question to be resolved in creating defensible space. The conflict between the need to retain ground cover for wildlife habitat contradicts the need to control fuel levels to protect human habitat. This affects our risk management efforts to a large degree.

Why Have We Not Solved the Problem?

The current situation creates a complex problem without a simple solution: a significant portion of our state has a "growing" fire problem that is under the jurisdiction of both State and local government. Local governments are often reluctant to deal with the issues and State government is often restricted in its efforts because of conflicting special interest from environmental groups.

The problems of adopting specific solutions are further complicated by the political volatility and economic considerations inherent in mitigation efforts. All fire protection mitigation efforts cost money. An increase in roof classification increases a homeowner's costs. Interestingly, adding new fire protection levels actually penalizes a property owner by raising the assessed valuation of the property by the value of the improvements. The Revenue and Taxation Code exempts certain enhancements in fire protection improvements (Revenue and Taxation Code, Section 74):

> § 74. Exclusions from definitions of "newly constructed" or "new construction" of certain fire protection devices and improvements
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> (a) For purposes of subdivision (a) of Section 2 of Article XIII A of the Constitution, "newly constructed" does not include the construction or installation of any fire sprinkler system, other fire extinguishing system, fire detection system, or fire-related egress improvement which is constructed or installed on or after November 7, 1984.

This concept could be considered for expansion to other fire protection features because they help control costs of State and local government.

Access and infrastructure are both expensive to create and to maintain. As a result, local government often lacks the will to impose more stringent infrastructure requirements upon specific developers. The public perception of this problem is not helpful either. The general public considers most mitigation efforts unnecessary and an abuse of their quest for privacy. For those individual property owners who reject recommendations for improving fire defensibility, there are few penalties.

The perception that insurance exists to repay people for lost property is based on the notion that compensation is available for all property losses. The California Fair Plan, which was created to serve homeowners in high-risk situations, is intended to ensure coverage is available. For the first time in the recent past, even the Fair Plan has asked for supplemental funds from the contributing companies because of the severe losses.

Unfortunately, insurance does not address the problem that these catastrophic fires result in hundreds of millions of dollars of public expenditures that are a direct burden to the taxpayer at both the State or Federal level.

The financial liability to both State and Federal government has grown because of the increased frequency of catastrophic fires. Local government does not see this as a liability because, after a state of emergency is declared, everyone gets reimbursed for their extraordinary costs. Some communities have even indicated these fires are financial windfalls. The reimbursement is sometimes in excess of actual expenditures, so there is no reason to complain or remedy the situation. The deep pockets that continue to accrue liability are the State and the Federal governments. If the trend towards more frequent and wider spread losses continues, the costs to government will continue to escalate. Therefore, fire is of statewide concern.

Risk Management

Risk can be categorized at three separate levels: site risks, neighborhood risks, and community risks. Site risk is a factor of evaluating building sites and structural integrity, specifically slope and aspect orientation and fuel loading relationships. The tool available to accomplish this evaluation is a "Wildland Risk Calculation." Neighborhood risk is a factor of density, structural conditions, topographical layout, and vegetation management, evaluated by using a "Field Evaluation Form." And finally, the community risk level is a factor of infrastructure, community emergency planning, and the level of policy commitment to mitigation gauged by using the form of OES Disaster Plans.

Mitigation Efforts

The most effective stage for mitigation against urban wildland fires for all these levels is during the development stage. Yet, the issue of urban wildland fire is conspicuously absent from planning concerns in most communities. A review of the Office of Public Resources (OPR) report on strategic growth indicates that discussions of the California Environmental Quality Act (CEQA) requirements do not address the issue of the urban wildland interface at all.

The second point of mitigation is at the site construction phase. However, unless the community has adopted a code or ordinance similar to PRC 4291, there are no requirements for site analysis. One of the biggest problems is the lack of training of fire and building department inspectors. This results in a wide variety of interpretations of even the simplest of requirements such as clearance distances, glazing requirements, and attic or eave protection.

Another influence in the mitigation effort is at the property owner and community-based action group level. The deficiency here is the lack of effective educational efforts to obtain and maintain public support. The CDF and Los Angeles City Fire Department have two of the most successful efforts, but they are not typical. In some cases, these activities have actually been rejected by community-based groups who use Codes, Covenants and Restrictions (CCR's) to promote "ambience" at the expense of safety.

Existing Regulations

We already have a great deal of statutes and regulations. Roofing requirements can be divided into two distinctly different levels: Assembly Bill 337 (Bates 1992), requiring Class B roofing and defensible space in Very High Fire Risk Severity Zones (VHFRSZ); and Assembly Bill 2131 (O'Connell 1992) requiring Class C roofing in all other parts of the state. Both of these bills were signed into law last year. Because of post-enactment implementation dates, neither has been implemented and thus has not produced tangible results. The key point is that the exposure to urban/wildland fire situations is a statewide problem. But it is not a uniform problem. Attempts at statewide mandates to deal with the problem almost always face strong resistance from those agencies and property owners who will not benefit from the new requirements.

However, significant gaps in the Bates bill involve the areas mapped by CDF as VHFRSZ—these can be rejected by a non-rebuttal response from the local governing body. This does not result in any consequence if they suffer a subsequent fire in that area. If CDF applies the Class B requirement in an area with a common boundary to a city identified as VHFRSZ, and the city does not adopt it for themselves, we have an exposure problem. If CDF has the authority to require Class B in their area, and a local community rejects it for other reasons, what has been accomplished?

The Public Resource Code provisions used by the CDF are probably the best overall mitigation approaches in the code system. However, to be used by local government, PRC 4291 requires it to be adopted by each one independently. Model ordinances achieve this, such as the City of La Verne and Napa's "Hillside Overlay Zone," but historically very

few have such ordinances. Three other documents in existence could be used as a basis for adopting local ordinances. They are the National Fire Protection Association (NFPA) 299, the Western Fire Chiefs' Urban Wildland Interface text, and the CDF's Fire Safe Guides for Residential Development.

What Needs to be Regulated?

Roof covering is frequently considered as the ultimate villain in these types of fires, but this is entirely too simplistic and is one of the reasons we are not making progress on resolving the problem. Roofs are an issue, but there are many other factors that must be considered in the regulatory scheme, such as:

- Structural integrity—the ability of the structure to withstand intrusion by fire.
- Defensible space—the use of fuel and vegetative management techniques to reduce fire exposure to a vulnerable structure.
- Infrastructure reliability—the ability for fire suppression forces to have access to structures and for the water supply to remain in service for the duration of the fire attack.

None of these issues is independently addressed in the current model code, and they are absent from planning requirements in CEQA. (The Uniform Fire Code currently has a proposed amendment to create a set of requirements for model code, which will probably be adopted in about a year.)

Current Action

The political environment regarding imposing new regulations is not favorable in spite of the fact that almost everyone agrees that we have a serious problem. Although most local governments readily agree on the consequences of these fires, many disagree about the preferred solution. To propose more mandated duties on local government is volatile; yet, at the same time, these same officials are looking for leadership in the area. They are under a great deal of pressure to define activities that get results, and they also recognize the need to reevaluate priorities.

The CDF has followed through in its commitment to map the VHFRSZs. The California State Fire Marshall (CSFM) is in the process of preparing a model ordinance for adoption of the VHFRSZ by local government. Both efforts are on schedule, but are unlikely to make any significant difference in this problem for a period of 7 to 10 years. The reason is fairly simple; they apply only to a limited area of growth. They are not retroactive, and they are dependent upon political action by local government.

The major obstacles to significantly reduce the current potential for large-loss fires include: (1) lack of knowledge by local officials as to how to take action; (2) confusion and ambiguity about the imposition of structure requirements in building codes based on local conditions; and (3) funding reduction in the fire prevention capacity of many agencies.

Distribution of Existing Information

Knowledge of the appropriate mitigation efforts is not evenly distributed. In fact, the methods and techniques for controlling the problem are not taught in any of the recognized fire science curricula at community colleges or universities. We do have a fire suppression course on wildland operations, but no fire prevention course is focused on this area. A tremendous amount of information is available, but it has not been widely used by local government. The distribution matrix of proposed state regulations, and the mailing lists to provide updates on this topic do not currently serve to keep communities well informed of appropriate authority, or how to implement more comprehensive regulations.

Summary

The problems will not be significantly reduced unless we motivate local government into action, supported by a coordinated state response to the issue of vegetation management and a comprehensive training and education program. Because these types of fires will be difficult to eliminate, all forms of government must be proactive to limit losses. The issues will focus on costs for solutions and the ability to avoid conflict with local government.

And finally, the public needs to understand that this is a serious social issue that can be addressed only by cooperation between State and local government and that a combination of education, partnering processes, technology transfer and improved enforcement of current standards and regulations will ultimately impact the potential to reverse the trend towards more catastrophic fires.

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Appendix

California Department of Forestry and Fire Protection (CDF).
California Environmental Quality Act (CEQA).
California Office of Emergency Services (OES).
California State Fire Marshall (CSFM).
National Fire Protection Association (NFPA).
Office of Public Resources (OPR).
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