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Communication

The failure of planning to address the urban interface and intermix fire-hazard problems in the San Francisco Bay Area

Joe R. McBride[A,C] *and Jerry Kent*[B]

[A]Department of Environmental Science, Policy and Management, 145 Mulford Hall, University of California, Berkeley, CA 94720, USA.
[B]East Bay Regional Park District, 2950 Peralta Oaks Ct, Oakland, CA 94605, USA.
[C]Corresponding author. Email: jrm2@berkeley.edu

Abstract. Post-fire planning following major fires in the San Francisco Bay area has identified problems of wildland fuel management and solutions to these problems; however, the failure to carry out many of the fuel management recommendations has led to increasing fire hazard for the urban interface and urban intermix zones. A proposal for a new state agency to oversee fuel management is presented.

Additional keywords: East Bay Hills, eucalyptus, 1991, Oakland fire.

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Areas of urban development in the San Francisco Bay Area are flanked by areas of wildland vegetation and agriculture. This juxtaposition results in urban interface and intermix zones where residential housing is faced with wildland vegetation and agricultural land or is commingled with open-space vegetation. Fire has been an important part of the environment of these hills since Native Americans migrated into the region about 6,000 years ago. Three fires of large proportion occurred in this urban-intermix zone in the 20th century. They burned portions of Berkeley in 1923, Oakland and Berkeley in 1991 and Santa Rosa in 2017. Property damage caused by these fires resulted from open-space areas supporting flammable vegetation, lack of fuel mitigation in the interface and intermix zones, and exceptional fire weather. Reports by various agencies after major fires offered recommendations for improving fire suppression and mitigating fuel conditions. However, various circumstances have prohibited complete enactment of those fire-hazard reduction recommendations in these reports.

The mosaic of vegetation types occurring over the San Francisco Bay Area in pre-settlement times consisted primarily of perennial grasslands, coastal scrub, chaparral, oak/bay woodlands, and riparian woodlands. Perennial grasslands dominated south facing slopes, while whereas oak/bay woodlands were common on the lower portions of north facing slopes. Coastal scrub tended to occupy the upper slopes, areas of north facing slopes, and chaparral occurred on shallow, rocky soils, often on south facing slopes. The native perennial grasslands were replaced by annual grasslands in the late 18th century because of due to the inadvertent introduction of Mediterranean annual grass seeds during the Spanish/Mexican period.

Beginning in the late 19th century and extending into the early 20th century, plantations of eucalypts (primarily *Eucalyptus globulus*), Monterey pine (*Pinus radiata*) and Monterey cypress (*Hesperocyparis macrocarpa*) were established in many parts of the Bay Area.

The potential for wildland fires to burn in urban portions of the San Francisco Bay Area was given little recognition until the 1923 Berkeley Fire. This fire burned 65 ha, destroyed 640 structures, but fortunately no one was killed. In 1991, a fire started above Oakland and consumed 615 ha of intermix land and destroyed 3276 structures and 25 people died in the fire. More recently, the Tubbs Fire, part of the complex of Wine Country fires in 2017, burned 14,895 ha, destroyed 5636 structures, and killed 24 people, while the Camp fire in Butte County burned 620 square kilometres and killed 86 people.

Several conditions contributed to the spread of these fires including (1) high velocity wind during a period of low humidity and high temperatures, (2) the existence of flammable vegetation, (3) residential neighbourhoods with many homes having wood-shingle roofs, wood siding and wood decks, (4) areas of steep topography and narrow roads, and (5) lack of multi-agency preparedness for large-scale fire suppression under extreme conditions (this included inadequate communication devices, different fittings for fire hoses, and insufficient water storage facilities for fighting fire in the case of the 1991 Oakland Fire).

Many fire reports and fire-hazard reduction plans were written in response to fires and fire danger in the San Francisco Bay Area (1923 Berkeley Fire (National Board of Fire Underwriters 1923); 1980 Berkeley–Wildcat Fire (Blue Ribbon Fire Prevention Committee 1982); Berkeley–Oakland Fire, 1991 (National Fire Protection Association 1992); Berkeley–Oakland Fire, 1991 (East Bay Hills Vegetation Management Consortium 1995); and wildfire hazard in general (LSA 2010)). The preparation of repeated plans for parts of the San Francisco Bay Area

indicate a problem of the implementation of fire-mitigation planning. Common to many of these plans are recommendations for creation of defensible space around structures, removal of ridgetop plantations of *Euclayptus globulus* and Monterey pine (known for the production of flaming embers), strategically located fuel breaks, fuel mitigation based on topography and wind direction during Diablo wind events, modification of architectural features that contribute to structural fires in the intermix zone (i.e. wood siding, shake roofs, vents allowing flaming ember to enter attics), and improvements in interagency preparedness and cooperation in fire suppression.

Problems confronting fire suppression became evident in the attempts to suppress the 1991 Oakland Fire. They included a general lack of experience of the first responders (from urban fire departments) to suppress wildland fires, inability of responding fire departments to communicate with each other to coordinate fire suppression activities, the failure of fire-hose connections used by different fire departments and CalFire to fit existing fire plugs in the areas, and the lack of water for firefighting in the hilly region of the fire. CalFire and local fire departments subsequently addressed these problems.

Unfortunately, many of the proposals for fuel mitigation and architectural changes have not been addressed. In spite of the recommendations for fuel management put forth in more than 30 plans since 1923, no region-wide action has taken place. Individual agencies and local Fire Safe Councils have, in part, followed up on recommendations for fuel management on land they administer, but often a complete adoption of recommendations has not taken place. The failure to enact all of the recommendations of these is due to various combinations of the following reasons:

- lack of funding;
- barriers to cooperation on the part of agencies, municipalities, and property owners in fuel management;
- the failure of cities to enforce fuel-mitigation regulations;
- opposition of individuals and groups to vegetation management to reduce fire hazard; and
- loss of a sense of urgency about the problem as time passes following a destructive fire.

Fire remains a factor in the urban interface in the San Francisco Bay Area. Fuel conditions and fire weather, exacerbated by global warming and decreased precipitation, will contribute to an increasing fire danger. Addressing this danger will (1) require the establishment of state oversight for hazard-abatement authority with management, fire and natural-resource staff positions to provide stability during agency transitions, set standards to monitor local and regional fuels-management programs, and for coordinating local, regional and state mutual-aid fire-suppression efforts; (2) provide the leadership to educate the public and achieve a more viable consensus about the reality of fire hazards and need for fuel mitigation; (3) establish and enforce clear policies about the vegetation to be managed or preserved in both residential and wildland areas in very high fire severity zones in the hills; (4) seek technical improvements in linking wildland-fire science to urban-fire science; and (5) establish zoning restrictions on construction in high fire-hazard areas. These issues are addressed in the following paragraphs.

Development of a state-wide or regional authority to coordinate fuels management and fire suppression could contribute to solving the fire problem in the San Francisco Bay Area. The area is complex in terms of topography, fuels and potential fire behaviour. Agencies and cities have their own approach to the many issues that contribute to fire-hazard reduction; however, fire has the potential to spread across jurisdictional boundaries. Progress has been made in the coordination of fire suppression, but a better coordination of fuel mitigation continues to be required. A regional fire authority, like the California Coastal Commission, would have the potential to address the fuel-management problem on a regional basis. Since its inception in 1972, the California Coastal Commission was given authority over construction and development along the coast. Its objective has been to protect the scenic quality of the coast, maintain public access to the coast, and prevent construction in hazardous areas along the coast. It has state-wide responsibility for the coastal zone and authority over counties and cities with regard to coastal development. Another model for coordinating fire-hazard reduction across multiple jurisdictions is the Sierra Nevada Forest and Community Initiative Regional Coordinating Council established in 2011. Should a region-wide or state-wide authority be established to mitigate the fuel hazard, we recommend a parcel assessment to support the cost of fuel management. As can be seen from the 1923 Berkeley, 1991 Oakland, 2017 Tubbs and 2018 Camp fires, the threat of fire extends beyond the interface and intermix zone. All residents and businesses in high fire prone areas must share in the cost of fuel mitigation.

The views of various individuals and organisations opposed to fuel management that included removal of eucalypts and pine trees and the use of herbicides as measures to reduce fire hazard were not appropriately addressed early on in fuel-mitigation planning in the East Bay Hills. A more reasoned debate about fire safety and overall vegetation management must include the opposition early in the fuel-mitigation planning process. Leadership will be required in future to educate the public and achieve a more viable consensus about the reality of fire hazards and need for fuel mitigation. Good examples of the value of public education in the development of fire-hazard reduction programs are seen in the approach taken by the Prescribed Fire Councils in the south-eastern United States and on federal land in the south-west. In some cases, consensus may not be reached with some groups or individuals, and in those situations decisions must be made based on the best available science (Parsons 1993).

Many regulations currently exist to address fire hazard around structures in the San Francisco Bay Area interface and intermix zones. Enforcement of these regulations concerning fuel mitigation has often been limited by an inadequate number of enforcement personnel. Cities have yet to enforce clear residential fire-safety policy or provide leadership to reduce obvious residential fire potential. Based on completed local hazard-mitigation plans posted on agency webpages, it is apparent that land-management agencies understand their role in reducing fire hazard on their lands, but the cities in the interface zone have often failed to enforce regulations. Fire-resistant architecture standards must also be enforced to minimise fire danger to structures. The regulations adopted by the city of Hillsborough (https://www.hillsborough.net/DocumentCenter/View/2737/Exhibit-H—Hillsborough-Fire-IS—Public?bidId=, accessed

12 December 2018) on the San Francisco peninsula may serve as a viable model for such needed regulations.

Improvements in linking wildland-fire science to urban-fire science will require the development of fire models that better represent conditions in the urban intermix zone. We do not believe that fuel models for predicting flame length, fire rate of spread and fire-line intensity that have been developed for wildland fuels are applicable to the urban interface in the San Francisco Bay Area. Physics-based wildland fire models, such as those developed by the US National Institute of Standards and Technology (Mell *et al.* 2010), should be linked with urban-fire models to provide an improved method for modelling intermix fires in the San Francisco Bay Area.

This history of planning to mitigate the fire hazard in the East Bay Hills suggests we are in, what Burton (2015) referred to as, a Cassandra Zone:

> '…that time period from the voicing of the first credible warnings of foreseeable future disaster until society either awakens to the threat and proactively mitigates against it, or chooses to ignore such warnings and subsequently suffers the consequences when the foretold disaster comes to pass.' (p. 15)

Burton concludes:

> 'Whether or not that society manages to learn from its own history of disaster and use the power of state to mitigate against foretold future ones is one of the definitive criteria for determining whether such a society can be deemed to constitute a moral community.' (p. 15)

Maybe the Wine Country fires and the 2018 summer wildfires indicate that we have already passed the Cassandra Zone, but it is hoped that California and the San Francisco Bay Area will finally awaken to the growing need to mitigate interface and intermix fuels around our cities.

Conflicts of interest

The authors declare that they have no conflicts of interest.

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