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Land-Use Planning May Reduce Fire Damage in the Urban-Wildland Intermix

Carol L. Rice James B. Davis



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The risk of wildfire associated with development in the urban-wildland intermix is nationwide. To wildland fire agencies, providing fire protection for wildland residential development can be an exercise in frustration. Much of the problem is that few convincing ties have been made between community planning and wildfire. For three counties in California, the following were investigated in each: fire damage due to a recent wildfire, general plans, local planning regulations, and the real estate development process.

General observations support the idea that good fire-safe planning protects homes threatened by fire, and that loss occurs in the absence of good planning. The damage observed in all three counties appears to be related to one of four problems: inadequate consideration of protection factors; disadvantages of small fire departments in dealing with real estate developers and other units of local government; variety in residential developments and in their susceptibility to control through planning; and conflicting interests among homeowners, developers, and local governments.

The existing tools available for fire managers and planners to use in providing protection from wildland fires are environmental review, codes and regulations, the judicial process, and new legislation. Specific actions to minimize fire damage in the urban-wildland intermix are recommended: (1) convince community planners to accept fire protection factors; (2) increase the role of fire protection entities in community planning; (3) strengthen siting and building regulations; (4) educate and change attitudes of planners and the public; and (5) work toward an equitable sharing of costs and protection responsibility by developers, local governments, and fire protection agencies and departments.

Retrieval Terms: wildland-urban intermix, fire prevention, land-use planning, land development, California

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Cover—When wildfires reach a city, many homes can be lost.

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IN BRIEF . . .

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The objectives of the research discussed in this report were to (1) determine if there is a cause-and-effect relationship between fire loss in the wildland-urban fire intermix and the level of fire protection planning by local government, (2) establish what methods exist for identifying fire hazards and mitigation measures in general plans to minimize damage from wildfire; and (3) suggest how fire protection administrators can work through the planning process to enhance fire safety.

The report focuses on three case studies in which a major wildland fire destroyed structures in the recent past. After a review of the fires the report discusses the history, type and level of fire protection regulations, and proposed legislation pertaining to fire safety considerations in land-use planning. A variety of issues affecting efforts to mitigate structure losses from fire are identified, and finally, opportunities to achieve such mitigation are discussed.

The counties selected were Monterey (Morse Fire) in California's central coast, and Nevada County (Forty-Niner Fire), and Tuolumne County (Stanislaus Complex Fires), both in the west-central Sierra Nevada. The three counties are similar in topography with steep canyons supporting fuels consisting of mixed conifer forest with an understory of brush.

We cannot say—or even infer—from the case studies that good fire-safe planning will protect every home threatened by fire or that loss will be certain in the absence of good planning. However, two general observations support this idea:

- The investigator was not able to find a single house lost where there had been comprehensive fire protection planning!

- In every house lost in all three fires the investigator found a complete lack of comprehensive wildfire protection planning!

Many legislative tools were identified that if properly used and enforced might have prevented much of the fire loss.

General Plans in California generally neglect mitigation measures—the language is often “encourage” vs. “shall.” Fire protection strategies for all three counties have been to zone for low density in high fire hazard areas.

Existing regulations provide opportunities for fire departments to review plans and voice opinions, however, fire departments are often too small to promulgate regulations. Small

departments, usually supported by local taxes, find that stiff regulations are difficult to have passed by elected officials because of the influence of the real estate industry. Also, these small departments do not have the resources to check plans or to attend community planning meetings. In contrast, large fire departments have assigned plans-checkers and may have more influence.

Large real estate developments may be easier to control because more State laws pertain and more parcels can be reviewed at one time. In contrast, lot splits are harder to track, yet constitute much of the land development taking place. In some places “illegal” building occurs without building permits or inspection and may not even be on the county's tax roles.

Access is a problem in many areas—structures are inaccessible because of narrow, rough, and steep roads, and lack of turnaround opportunities. Locked gates and unsafe bridges can also be problems.

Water supply was not a problem for the Forty-Niner and Stanislaus Complex Fires because a large number of stock ponds and other water development proved adequate. Water for the Morse Fire might have been sufficient had the electric power to the pumps not been shut off—a problem that has since been rectified.

The age of a house is directly related to the difficulty of protecting it from fire. While new building ordinances are becoming stricter and may be better enforced, it is difficult to make an older house fire safe. Roofs are the easiest to retrofit, however, access, setback, water supply, and placement in respect to topography, are difficult if not impossible to correct.

Building decisions made by the homeowner are often based on promises made by the developer (or political entity) that are not fulfilled. Such promises include wider roads, better water supplies, and an urban-type fire department.

Fire departments should promulgate stiff regulations and review all proposals for all developments including subdivisions. In addition to the standard items such as roads, water supply, and density, regulations should also cover setbacks, turnarounds, and position of houses on slopes. In addition, topography and fuels should be considered in lot layout review, with new regulations that address them. Groups such as the county fire chiefs association can be used as a unifying voice: fire departments could agree on a standard or ordinance, then each department would try to get it passed in their jurisdiction, with the added justification that every other fire district is asking for the same thing.

The fire management community should comment through the environmental review process on the effect fire hazard and

needed level of protection as the consequence of land development patterns. Fire department staffs should attend and become involved in public land development hearings.

The fire community should develop a "how-to" planning guide for consultants and land development planners that addresses the fire aspects of the Government Code's safety element. This guide could be prepared in a manner similar to that detailed for earthquake and flood damage mitigation by the State Department of Mines and Geology and the State Department of Water Resources.

Much California legislation is proposed that should be helpful if it is passed. Fire managers must be aware of the legislation and be willing to support its passage and utilize it if it is enacted.

Local governments should share the costs of structural protection since they approved the conditions under which development occurred. They must provide fire hazard reduction in the form of building plans checking, inspection, and participation in the planning process and these tasks should be adequately funded. Plans checking may be contracted to the building department since they must do the job anyway for other services such as water and electric power.

Model regulations, that could be used by local government, would encompass the following: (a) greater clearance on slopes by tennis courts, pools, orchards, vineyards, roads, or a combination; (b) setback, which may preclude development on small lots; (c) mitigating measures which may include residential sprinklers on independent power and water source; (d) language that states that developers cannot build unless they can ensure defensible space.

Local community planning entities should recognize that hazard is great enough to preclude development in some areas on the basis of (a) water scarcity, (b) high fire hazard rating, or (c) limited access for fire equipment.

Since much of the wildland-urban intermix fire problem is in or adjacent to National Forest land, the Forest Service should clarify its policy on structural protection including its policy to train and equip crews to fight structure fires. The agency should state in its Land-use Plans its role in planning, hazard inspection, and fire suppression in intermix areas inside and adjacent to its protection responsibility zones.

The wildfire problem in the urban-wildland intermix must be reduced within local communities, despite the need for a national strategy.

INTRODUCTION

America is heading for the hills! Over much of this nation there is a flow of people from urban settings to rural or wildland environments. This demographic phenomenon is dramatically expanding the critical boundary between wildland and more settled communities—creating the urban-wildland interface or intermix—an area of between 1 million and 1 1/2 million acres (Bradshaw 1987, Tokle 1986). Once considered a California phenomenon, the intermix now extends throughout the country. The 1400 homes burned in wildfires in 1985 testify to the fact that the associated fire protection problems are nationwide (Davis and Marker 1987, National Fire Protection Association 1987, Walt 1989).

To wildland fire agencies, providing fire protection in the urban-wildland intermix can be an exercise in frustration. While fire managers usually understand the underlying fire problems, they have for the most part, been unable to communicate their concerns to the home owning public or to their elected officials (Davis 1990). Consequently, building codes are frequently inadequate or disregarded despite dramatic losses and spectacular fires.

Fire departments may respond to requests for review of a particular land development plan, but lack information (guides) about when in the planning process to insist on effective mitigation measures, how to justify limitation on development, and the most effective means to push through a stricter fire protection ordinance (Hughes 1987a,b).

State legislators and county officials may be as confused and frustrated as fire managers. While some think that sufficient legal authority already exists to implement solutions, others see the need for new legislation, such as to demand disclosure of the fire hazard at the time of a sale of property, to provide tax incentives to those with defensible spaces, and to limit where homes can be built (Gosting 1988, Irwin 1987, 1988).

In addition, community planning is done in much the same manner throughout the nation; however, the detail in which planning is performed and number of restrictions placed do vary with location. Local planning responsibilities throughout the nation include development of master plans (or general plans), proposed zoning ordinances, review of development proposals, and issuance of building permits. Planning done in the past, and even today, usually falls short of providing adequate safety for communities from reasonable risk of wildfire. Harold R. Walt, chairman of California's State Board of Forestry summarized the state of local planning when he said:

Current general planning law recognizes the threat of wildfire only to a very limited degree, and the treatment is superficial when compared to that given to flood and earthquake threats. There is little discussion of strategic fire defense improvements, such as landing places for helicopters, or of evacuation plans for people in the event of wildfire. These types of analyses can be scary to local politicians and be viewed as very costly by developers.

Much of the problem is that few convincing ties have been made between good or bad community planning and wildfire loss (Abt and others 1987, East Bay Regional Park District 1982). A detailed reference does not yet exist to aid a local government unit (township, city, county, or homeowner association) in making decisions to limit new growth in hazardous areas, or to provide for zonings that reflect fire-safety considerations. The specific relation of local land-use planning to significant fire damage must be clarified before extensive reductions in fire-caused damage can be achieved on the urban-wildland fringe (Moore 1981).

The investigation of urban-wildland fires and relevant State and local legislation was undertaken by one of us (Rice), under a contract with the Forest Service, U.S. Department of Agriculture. To identify the role of fire protection planning in saving homes, three recent wildfires were studied in three counties in California. To determine how fire protection administrators can use planning to enhance fire safety, general plans, local planning regulations, and the development process were reviewed for the same three counties.

In preparing this paper, we surveyed the extensive literature that is accumulating regarding fire protection in the intermix (Greenlee 1990). The analysis, while oriented to California, should be viewed as "generic" in nature with similar laws, ordinances, and codes applicable to most local governmental entities nationwide.

This paper describes three case studies, identifies a variety of issues and opportunities for mitigating structure losses from fire, and recommends specific ways wildland fire managers and local planning departments can cooperate in planning for fire safety in the intermix.

CASE STUDY: THREE COUNTIES—THREE FIRES

The three case studies encompass a variety of planning entities, firefighting agencies, homeowner groups, fuel types, and patterns of development. The counties chosen were Tuolumne, Nevada, and Monterey, which represent a wide range in development history. Accordingly, they vary in the level of detail in which fire hazard was addressed, and in the stringency of fire safety regulations required. To get needed information, the investigator toured all of the fire areas, talked to homeowners and firefighters, and reviewed fire incident reports. In many cases a photo record was made of the burned structures and the immediate areas so that the fire situations could be critically analyzed.

The counties studied were somewhat similar in topography and fuels although the Morse Fire was at a much lower elevation

than the other two. All three counties are characterized by western sloping mountain topography dissected by steep canyons and broad valley bottoms. Fuels at the fire sites were also similar—coniferous forest with an understory of brush. The Forty-Niner and Morse Fires were started by illegal activities; the Stanislaus Fire Complex was started by numerous lightning strikes (*table 1*).

Morse Fire, Monterey County

A coastal community, Monterey County is mature in land development, largely agricultural with limited urban developments. As a county planner commented, "all the easy places are built." The current philosophy is to contain development and promote agricultural uses. Approximately eight plans per week are reviewed throughout the county. Planning for this county (and the fire area) is governed by the California Coastal Commission as well as State codes. Fuels are a pine overstory with brush understory, with a deep duff layer. Fire hazard is categorized as moderate (lowest possible rating) because of foggy summers and wet winters. The frequency of high fire danger is generally low throughout the year.

The Morse Fire was started May 29, 1987, by teenagers partying in a botanical reserve. Initial fire behavior was explosive. Within 2 hours after discovery, the fire had flame lengths of over 30 feet and was spotting 1/2 mile ahead of the flaming front! The fire burned for 27 hours before it was fully controlled. Ninety-nine firefighters and numerous ground and aerial firefighting resources were required to contain the fire. The losses in the Morse Fire were concentrated in the exclusive Del Monte Forest residential area. Most damage occurred in the first 3 hours and was estimated at \$37 million, with 31 homes lost and 6 more damaged.

The general plan for Monterey County was the most detailed of the three studied in treatment of fire hazards (Monterey County 1984). It included a water flow table, road standards, and specific recommendations, including one novel recommendation that advised against the county accepting title to lands on which continued fire hazard reduction would be needed. The fire protection standards were adopted in 1984, and administrative policies were adopted May 19, 1987 (11 days before the Morse Fire).

However, the specific plan for the Del Monte Forest Area was developed under requirements set forth by both the Federal Coastal Act and the California Coastal Act. The philosophy of the specific plan was quite different from that of the general plan with emphasis on esthetics and maintenance of a "natural" environment. Vegetation screening was required, fuel modification was prohibited, and as a consequence, the opportunities for involvement by the local planning and fire departments were limited.

The Del Monte Forest residential area had tightly controlled building and access requirements. The area was zoned residential and when the homes were built shortly after World War II, the prospective homeowner's lot plan was reviewed by the private owner for layout, setback, power and water access, and

Table 1—Damage resulting from Morse, Forty-Niner, and Stanislaus Complex Fires in California

Fire and dates	Damage (\$ million)	Homes lost	Acres burned
Morse (May 31-June 1, 1987)	37	31	160
Forty-Niner (September 1-7, 1988)	22	90	33,500
Stanislaus (August 30-October 15, 1987)	35	9	147,000

esthetic design considerations. Waivers were not granted for fire resistant construction that might have clashed with the perceived esthetics of the community.

The county did not have a general plan in force at the time of home construction (their first general plan was approved in 1968), no building permits were required by the county, and no input by the fire department was required. Water supply was adequate through 2- to 6-inch mains, but was dependent on a power source that was turned off during the fire (the water system power source is now independent).

The California Department of Forestry and Fire Protection (CDF) was the responsible fire agency under a contract for structural protection with the county's community services district. CDF's contract included all plans-checking and liaison with county planning entities, including a representative on the "Minor Subdivision" Committee.

Forty-Niner Fire, Nevada County

Nevada County is typical of foothill areas in the northern Sierra Nevada, with some planned community development and a long history of unplanned development. As is common throughout much of the nation's wildlands—a surge in growth has taken place during the last 10 years.

Weather is characterized by dry summers and wet winters. High fire danger is common during summer, depending upon elevation, and ends with October rainstorms.

Fuels consisted of dense, mixed-conifer forest at the higher elevation changing to chaparral and oak woodland on the lower slopes. The area in the Forty-Niner Fire was classified as high hazard in the county's general plan, but was not specifically treated in the land-use plan.

The Forty-Niner Fire was started September 11, 1988, by a transient. Fire behavior, at the peak of the fire, was typified by flame lengths of 100 to 300 feet in the timber, and spotting occurred miles ahead of the flaming front. To contain the fire (which occurred at the same time as the Yellowstone Fire and numerous other large fires throughout the West), more than 1200 firefighters were mustered, along with 142 engines, 36 bulldozers, 10 water tenders, and 10 air tankers. Water was not a problem—it was supplied from Lake Wildwood and numerous stock ponds by sufficient aerial and land-based water tending vehicles.

The losses in the Forty-Niner Fire included structures in the planned community of Lake Wildwood and an industrial park,

as well as those scattered in lot splits throughout the fire area, some of which were not even on the County Tax Assessor's rolls. The area lost 90 homes, 58 residential trailers, and numerous barns and sheds in a scattered pattern. Damage was estimated at \$22 million.

While Nevada County did not treat fire in detail in the Safety Element of its 1980 general plan, five of the nine administrative policies established addressed fire hazards (Nevada County 1980). The statement of the problem indicated an understanding, but the policies simply called on the local fire districts to adopt strict regulations. The plan states that only a few districts have adopted fire protection ordinances, and recognizes the disadvantages of the situation.

The only county ordinance relevant to fire protection is Nevada County Resolution 69-52 which provided minimum water systems within subdivisions. Water supply to most of Nevada County is unusual, passing through an irrigation ditch metered according to a "miners inch" scale. Many water supply lines consist of exposed (vs. underground) PVC pipe. However, the Conditions for Approval state that "water supply must comply with CDF regulations." Emergency water supply is, however, provided by a plethora of stock ponds. The stock ponds are not required by government entities and as land is converted from agricultural use these can be expected to be eliminated.

Lake Wildwood provided a unique study opportunity because of its planned community nature. The record of Lake Wildwood's development plans and approval process was complete, and centers around nonfire-related issues (sewage systems vs. septic tanks). The development, approved by Nevada County in 1968, was planned primarily for summer homes, although year-round residents from nearby Beale Air Force Base were also expected. As it has turned out, however, almost all residences are occupied year-round.

CDF was the responsible fire protection agency once the fire threatened State responsibility areas. However, other than for water development, CDF was not responsible for checking plans nor promulgating regulations in the area of the Forty-Niner Fire. A variety of small volunteer fire protection districts encompassed the fire area and were responsible for "signing off" on the adequacy of fire hazard mitigation on the structures.

Stanislaus Fire Complex, Tuolumne County

Tuolumne County is located in the foothills of the central Sierra Nevada in California's "Mother Lode Country." The county's population of 42,000, in comparatively few planned communities, is intermixed with forest and grazing land. While the area has one of the highest growth rates in the State, development of planned communities is proceeding slowly. The USDA Forest Service District Ranger in the area of the Stanislaus Fire typically reviews two or three development plans each year.

Fire hazard is categorized as high by CDF. The weather pattern is typified by dry summers and wet winters. High fire danger is common during the summer, depending upon elevation, and ends with October rains. Forest fuels in the fire area consisted of second growth mixed-conifer forest and brush patches, which frequently are remnants of past burns.

Lightning started numerous fires on August 30 and 31, 1987. Fire behavior was explosive on some fires with flame lengths of hundreds of feet and spotting miles ahead of the flaming front. About 5,000 firefighters were required to contain the fires, many of which eventually burned together. During the height of the fires, 6,000 to 7,000 people—14 percent of the county's population—were evacuated from their homes.

Nine homes were burned in a scattered pattern throughout the fire area. Seven of these homes were built before 1970 when the county took over the planning and building permitting process from the State. There were no losses in planned major subdivisions in the Stanislaus Fire Complex.

Damage was estimated at \$35 million, primarily to forest resources. More damage was done to natural resources than to homes because of the emphasis on structural protection by both CDF and USDA Forest Service fire crews—a reflection of current State and Federal policy.

Tuolumne County required no permits for homes built before 1970 and, in fact, has no record of these homes other than for tax purposes. Thus no building documents were required for seven of the nine destroyed homes. For the two homes built after 1970, building permits were issued after compliance and review by the building department. The records for these two buildings do not indicate any participation of the fire departments at the time of development. Currently, treatment of fire in Tuolumne County's general plan is based largely on a Master Fire Plan, which was drafted at the same time as the general plan, but was never approved (Tuolumne County 1982).

A comprehensive revision of the Master Fire Plan is being revised but still is not complete enough to be reviewed. The county will base hazard assessment on CDF's evaluation (instead of their own assessment system) and expanded mitigating measures from solely increased water flow to include other measures, such as contribution to fuelbreaks, fuel reduction areas, and strategic access improvement. The mechanism for stating new requirements was by referencing such documents, such as CDF's Firesafe Guide and hazard assessments (California Department of Forestry Fire Protection and USDA Forest Service 1980). No standards concerning fire safety are specified, but decisions on what is acceptable depend on site-specific circumstances.

Plans are reviewed by the CDF, which is under contract to the county for fire protection on private lands. However, local USDA Forest Service Ranger District personnel review plans for subdivisions in the Forest Service protection jurisdiction.

LESSONS LEARNED

The authors cannot say—or even infer—from the case studies that good fire-safe planning will protect every home threatened by fire or that loss will be certain in the absence of good planning (fig. 1). However, two general observations support this idea:

1. *The investigator was not able to find a single house lost where there had been comprehensive fire protection planning!*
2. *In every house lost in all three fires the investigator found a complete lack of comprehensive wildfire protection planning!*

In fairness to the counties involved, most of the homes lost were constructed before current planning regulations were in effect. Perhaps ironic, is that where intensive planning was conducted under the “Coastal Act” in Monterey County the fire situation was worsened by the emphasis on esthetic values such as screening, setbacks, and maintenance of native vegetation without regard for the wildfire problem.

All structures that were burned or damaged in all three counties must be rebuilt in accordance with current restrictions and with the current review process, which affects building materials, water power supply, and possibly road surface. Rebuilding, however, does not affect access and water flows. Requirements for design and even for siting and setback of the homes are difficult to add or change. In the Forty-Niner Fire area, the investigator observed a house being rebuilt to the exact same specifications as before—complete with cantilever decks overlooking the forest that burned. Thus the importance of insisting on fire-safe development in the first place is paramount, since even rebuilding does not cure the woes of past mistakes. The Firesafe Guides clearly state, “Situations hazardous to life and property are generally beyond practical correction. In such cases, all concerned must acknowledge and be willing to accept the resultant level of risk and inevitable damages from wildfire.”

The damage observed in all three counties appears to be related to one of the following problems:

- Inadequate consideration of protection factors
- Disadvantages of small fire departments in dealing with developers and other units of local government
- Variety in residential developments and in their susceptibility to control through planning



Figure 1—This house withstood a wildfire. Burned area is shown in the right background. The house had adequate vegetation clearance, a wide driveway with room for a fire engine turnaround, a fire-resistant roof and siding, and a swimming pool that could serve as a source of water for fire equipment.

- Conflicting interests among homeowners, developers, and local governments

Explanations of these problems follow.

Fire Protection Factors

The language in general plans was weak regarding fire loss mitigation. Measures to be taken were stated in advisory terms (using “should”) rather than as requirements (“shall”). Even in Monterey County, the most tightly controlled, there are 10 “shoulds” and 28 “shalls” in the policies addressing fire safety. Historical strategies have been to zone for low density in high fire hazard areas, the concept of defensible space is treated only by road standards, and setback of structures is not addressed for fire hazard but for esthetics—such as a minimum driveway distance of 100 feet is required in a Local Coastal Plan for the Del Monte Forest.

Fire equipment access is a problem in all counties. Structures may be inaccessible because of narrow road width, surface, and grade, and lack of turnarounds (fig. 2).

Water supply was not necessarily a problem in all fires (the Forty-Niner Fire had adequate water for firefighting due to a vast number of water tenders as well as properly positioned reservoirs). Power generation for pumping water was a problem in the Morse Fire. Water supply, in general, was inadequate in the

Stanislaus Complex.

Local fuel condition is not usually incorporated into planning decisions except as it enters into the Hazard Analysis Rating developed by the CDF. The CDF rating is weighted toward weather instead of fuel condition, and is aimed at rating large-scale wildland conflagrations rather than preventing damage in the urban-wildland intermix.

Planning Department staffs are often neither knowledgeable nor aware of new fire safety regulations and standards, or of the importance of setback, access, fire-resistant building materials, and other fire-related measures (fig. 3).

Small Fire Departments

Small political entities, such as volunteer fire departments, have a difficult time getting stiff regulations passed by elected officials. These small districts often do not have the resources to check plans, or to attend planning meetings.

County governments are often represented by elected officials with alliances within the building industry. Heads of fire departments frequently are appointed and serve “at the pleasure of the Board,” which makes passage of building restrictions for fire safety difficult. This issue is not easily solved by the fire departments, but lies with the voting public.



Figure 2—Fire engines designed for urban use are often too wide for urban-wildland intermix roads, too heavy for bridges, and too long to turn around in small yards or driveways.



Figure 3—Shake roof being constructed on a house that narrowly missed being destroyed in the Forty-Niner Fire a few days before. Burned vegetation appears in the foreground.

Variety in Residential Developments

Tax roll avoiders are surprisingly common and, of course, unregulated. Larger developments are easier to control because plans for them must go through several levels of review and more residences can be reviewed at one time. In contrast, lot splits are harder to track. Inequity exists with lot splits because often only the fourth builder of a four-way lot split is required to upgrade to minor subdivision standards for water, access for increased traffic, and exposure to wildfire risk. On the other hand, in Monterey County, the first to build on a lot split is required to install the required level of infrastructure, assuming the lot eventually will be fully developed.

As ordinances have become stricter, a direct relationship has developed between the age of a structure and its relative resistance to fire. Retrofitting fire resistant features to an older house, however, is difficult. Roofs are easiest (though still difficult) to retrofit because they eventually need replacement. Problems with access, setbacks, water flow, and placement on the lot in relation to topography are difficult, if not impossible, to correct (Howard and others 1973).

Often development does not pay its own way. The owners of lots that have been sold, but not built on, may have paid taxes at residential rates for years on their undeveloped property. How-

ever, the tax money collected, that would have been earmarked for their portion of the infrastructure—streets, schools, sewage, power—is frequently spent to service areas where actual construction has taken place. This type of spending is becoming a serious problem in many intermix areas and is leading to financial difficulties in local governments—and possibly to bankruptcy for some.

Conflicting Interests

Many decisions by homeowners building in the intermix are based on promises made by local government and developers but not fulfilled. Residents are sometimes told of improvements planned, such as wider roads and increased water storage, yet these improvements do not happen for a variety of reasons (such as the expenditure of tax money previously mentioned). Homeowners might have taken greater precautions themselves if they knew that water storage was to remain substandard, or that road access would not be improved.

Developers and local planners may make assumptions that hamper fire-safe planning. Developers frequently paint an optimistic scenario, rather than worst case assessment. For example, developments are often planned to consist of seasonal homes (with lesser demand on services) but turn quickly into

year-round residences. Lake Wildwood, damaged in the Forty-Niner Fire, is an example (*fig. 4*).

Counties are reluctant to admit past shortcomings in procedures. The investigator heard the statement "We've done this all along" uttered many times while conducting this study. Those wishing to promote change must package their suggestion in a manner that does not confront or highlight past mistakes.

Fires do not occur with certainty. The concepts of "risk" or "probabilities of damage" are poorly defined, making limits on development difficult for decision-makers to justify or support. Additionally, lack of information makes tradeoffs in a variety of mitigating measures subjective. On the other hand, problems ranging from pot holes in the streets to major crime are a certainty, must be dealt with every day, and compete with wildfire protection for both attention and financial resources.

Last—but far from least—residents and planners alike seem to believe that a fire will not occur (at least not in the foreseeable future), in "my" neighborhood, and should that unlikely and unhappy event occur, the fire departments can save anything (*fig. 5*). These delusions are present at all levels of government and are perhaps the greatest single obstacle to effective fire-safe planning.

PLANNING TOOLS AVAILABLE FOR FIRE PROTECTION

The general planning tools described in this section were indicated by specific observations from the case studies. In gathering information on these tools, the investigator interviewed local planning officials and studied historical and current planning records.

The existing tools available for fire managers and planners to use in providing for protection from wildland fires are environmental review, codes and regulations, and the judicial process. Also, legislation proposed in California at the time of this writing would allow consideration of fire safety in county general plans.



Figure 4—Urban-wildland intermix development taking place in Lake Wildwood in Nevada County, California, near where many homes were lost in the Forty-Niner Fire.



California Department of Forestry and Fire Protection

Figure 5—Fire departments frequently lose lives and equipment trying to protect wildland homes.

Environmental Review

The environmental review is a method by which citizens, consultants, and governmental staff can provide input into the regulatory and development process. While impacts of wildfire hazards can be identified in the environmental review, the seriousness of the impact need not preclude project completion. The only statutory requirement is to consider the environmental ramification of a project in sufficient detail. The following sections focus on the general planning and specific planning process and touch on other aspects of planning for development.

While development plans are specific, and more restrictions are placed on developments in California than many other States, the environmental review and approval process for these plans are less stringent than elsewhere in the nation. In California, the State itself certifies the adequacy of its own environmental review. In most other States, Certification Offices offer independent review.

Codes and Regulations

Analysis of the planning process requires understanding of the framework or context for general planning. Parts of the planning framework are the legal authority and constraints

placed on planning and regulating entities by means of general plans, specific plans, the Subdivision Map Act, and codes.

General Plans

A vehicle for progress toward both comprehensive analysis of fire hazards and appropriate action on a local level is the general plan, where—by law—hazards must be identified and mitigation measures proposed. The general plan has substantial clout in that all zoning and development, as well as specific plans, must be consistent with it. Several sections in the general plan, including the Safety Element required by the California State Government Code, could easily incorporate identification of wildfire hazards and the details of appropriate mitigation measures.

The general plan is a long-term (up to 20 years) comprehensive guide which addresses all aspects of future growth in varying levels of detail. A general plan is legally binding on local jurisdictions: new development must be in keeping with the plan's policies, standards, and locational criteria (California Government Code 1989, Section 65359). Policies, standards, and principles must also ensure that goals and objectives are met.

Planning and the results of planning decisions have daily effects on every member of the community. General plans ideally serve as the basis for all local land-use decisions made by elected bodies. General plans set forth the philosophy of how,

where, and when the county should grow. To make those decisions, most counties assemble exhaustive data and then try to reflect that data in general goals, more limited policies, and specific objectives.

In California, for example, the Planning and Zoning Law (Code 1989, Sections 65000-66003) (State of California, 1989) addresses the planning requirements for the State. The general plans are required for both cities and counties only as of 1971. Chapter 3 of the Planning and Zoning Law covers local planning and defines the authority, scope, methodology to be used, and required elements within the general plan.

Fire departments are authorized to comment on the general plan through Section 65352, which states that the general plan "will be referred to any special district affected by proposed action," although fire departments are not specifically named.

Several of the seven required elements incorporate fire safety concerns: Conservation, Safety, Open Space, and Housing Elements.

Conservation Element—The Conservation Element mentions that it may also cover prevention of pollution and erosion, and protection of watersheds.

Safety Element—The Safety Element includes a requirement to address wildland and urban fires "for the protection of the community from unreasonable risks."

Open Space Element—In the California Government Code (1989) section 65302(e), the "local option space plan" is the open space element of a county or city general plan as adopted by county board or city council. This element notes that open spaces may be so designated for "public health and safety, including . . . areas which require special management or regulation because of hazardous . . . conditions such as earthquake fault zones, unstable soils areas, flood plains, watersheds, areas presenting high fire risks, . . . and areas required for the protection and enhancement of air quality."

Further, the discussion of the Open Space Element in the Planning and Zoning Law declares as a policy that discouraging premature and unnecessary conversion of Open Space to urban use is of public interest because it will discourage noncontinuous development patterns which unnecessarily increase costs of community services to community residents. Each county and city is required to adopt an Open Space Plan. California Government Code (1989) 65567 states "no building permits may be issued, no subdivision maps approved, and no open-space zoning ordinance adopted unless the construction, subdivision or ordinance is consistent with the Open Space Plan."

Housing Element—In the Housing Element statement, the legislation declares that each government must consider the economic, environmental, and financial factors that enter into community goals in the general plan. The Housing Element must analyze potential constraints on maintenance, improvement, or development of housing, including building codes and their enforcement, plus local processing and permit procedures.

Perhaps the relative lack of emphasis placed on fire safety is reflected in the code. Noise pollution is treated in much more detail than fire safety. As further indication of the low priority accorded to fire safety, the index lists two fire safety standards: one that addresses "zoning of health facilities" and the other,

"land reservations for fire stations." For comparison, flood plain standards are cross-referenced to Open Space Land, general plans, and the Office of Planning and Research.

Specific Plans

Specific plans are required in areas of focused development or interest, such as coastal areas. The California Coastal Act of 1976 requires that coastal counties prepare a plan (Local Coastal Plan) for the portion under the jurisdiction of the Coastal Commission. In Monterey County, the fire area was included in such a specific plan, serving a dual purpose as the required Local Coastal Plan as well. The use of specific plans varies widely. Almost all of Monterey County is covered by one of many local specific plans. In contrast, Tuolumne County has only one small portion of the county covered by a specific plan.

Specific plans, while they must be consistent with general plans, need not include the same elements, and specifically need not mention fire safety. They must, however, describe the distribution of access, water, and other essential facilities needed to support the land-uses described in the plan. Additionally, they must describe the standards and criteria by which development of the specific plan area will proceed, plus the regulations and programs to carry these out. Thus fire safety concerns are only indirectly required in specific plans (Groves 1988).

Subdivision Map Act

The California Subdivision Map Act (California Government Code 66410-66499.58) declares that for any development that creates over five parcels from one (major subdivision), a tentative map must be submitted for review. When compliance with review comments is complete, an application for a building permit can be submitted. For lot splits that create four or less parcels from one (minor subdivision), a map must be submitted only with the application for a building permit. This law greatly influences the pattern of development, as developers set up many more lot splits than minor subdivisions, to avoid the extra review process. When several successive splits of four occur, the result is a development pattern that is more driven by law and review processes than by natural boundaries, efficient infrastructure (such as access or water supply routes), or even by appealing building sites. This pattern also greatly hinders the ability of fire departments to review plans. Both major and minor subdivision location and approval procedures must be consistent with the general plan and conform to the State's Environmental Quality Act guidelines.

Codes

Several existing codes in California, if adopted in the general and specific plans, carry the force of law. By adopting a code, a government can specify a variety of performance standards—roofing, methods of construction, or minimum water supply, for example.

Uniform Fire Code—The Uniform Fire Code developed by the Western Fire Chiefs Association (WFC) and The International Conference of Building Officials covers mostly structural fire protection and is referenced in many general plans and specific plans. The Uniform Fire Code addresses construction

types, water flow rates and hydrant spacing, and layers these requirements with land-use (commercial and residential, for instance). Recognizing the current Uniform Fire Code does not adequately address the fire problem in the urban intermix, the Board of Directors of the Western Fire Chiefs' Association has authorized development of a code covering the urban-wildland intermix.

Standard for Fire Protection—The National Fire Protection Association (NFPA) recently established Standard 1141-1989, the Standard for Fire Protection in Planning Building Groups. It addresses minimum turnarounds, length of roads, bridge strengths, water supply, building construction, and the like (National Fire Protection Association 1989). The requirements set forth under California Public Resources Code (PRC) 4290 will greatly advance fire safety in those areas of State protection responsibility simply because it is mandatory rather than discretionary. For those areas under county protection jurisdiction (instead of State responsibility), these regulations will serve as a model by which to fashion local ordinances. The 4290 regulations incorporate fire protection measures such as emergency access, street and structure identification, private water supply, and vegetation modification. These final standards will be put into effect January 1, 1991.

Fire Safety Guides

What is not part of the legislative background is the Fire Safety Guides (Calif. Dep. For. and Fire Prot., USDA Forest Serv. 1980), since these do not have the force of law behind them. These excellent publications offer local government planners basic information in fire safety standards so that land-use policies and zoning criteria can be developed to reduce potential wildfire damage. The introduction states that these guides should be used as an aid when counties and cities are preparing or revising their general plans. The guidelines encompass hazard classification, recommended fire safety standards, water supply, power and roofing, building construction standards, building spacing and densities, and vegetation clearances. The Fire Safety Guides only use the word "should" and only suggest that fire departments review specific circumstances. The Fire Safety Guides are referenced in general plans for specific standards (Tuolumne County, for example), but do not carry the force of law.

Legal Authority Through the Judicial Process

As seen in the California Government Code, legal authority is provided to fire departments to restrict development, but it is not strongly worded, and provides no justification for restriction. Greater legal authority was established through the judicial system for fire departments to take a conservative stance on development. In court, the stance that "harm prevention is much stronger than that of public benefit" (of development, via tax revenue and business growth). For example, the court case *Twain Harte Homeowners vs. County of Tuolumne* established fire safety as one layer of criteria for land-use decisions (Califor-

nia Reporter 188, 1982). Additionally, citizens have a broad standing to sue.

One avenue for suit is for consistency within a plan and between all levels of plans. For example, a specific plan must be consistent with a general plan, and the safety element must be consistent with goals set forth in the general plan. Consistency in theme and levels of detail are also required. One example of inconsistency is in Tuolumne County, where the general plan states that a timber-based economy is preferred over a construction and tourism-based economy. However, broad limits to land conversion are not proposed, and no justification for limits is provided to decisionmakers.

Proposed Legislation

In fall 1990, two bills were introduced in the California State Legislature that would enable fire managers to consider fire safety in general plans:

- SB 186 would require counties to submit a copy of the Safety Element of the county general plan to the State Board of Forestry, and would name local fire protection agencies as recipients of draft general plans. Further, this bill would require counties to submit findings in writing to reject recommendations of the fire protection agencies or Board of Forestry.

- SB 965 would require that evacuation routes, peak load water supply requirements, and minimum road widths and clearances around structures be identified in the Safety element of general plans, and would tie fire hazards to geologic hazards.

Two other bills do not specifically relate to the general planning process because the development is already in place, but they merit attention as model regulations:

- AB 1812 requires an owner of property in an area of State protection responsibility to disclose (1) whether the property is in a hazardous area regarding fire; (2) that clearance is required; and (3) that the State is not responsible for structural protection unless contracted to do so.

- AB 1813 requires Class A roofs in those areas classified as very high hazard.

RECOMMENDATIONS

On the basis of the lessons learned from the three case studies and the planning tools that are generally available, we recommend specific actions that planners, fire managers, and developers can take to minimize fire damage in the urban-wildland intermix.

1. Fire managers must try to convince local government planners to accept fire protection factors.

- Local planning entities must recognize that extreme fire hazard may preclude development in some areas on the basis of

water scarcity, environmental conditions (steep slopes, fuels, weather), and inaccessibility. To minimize political opposition, local planning departments must designate such areas before developments are proposed (Radtke 1983).

- Local planning entities must consider fuel conditions in their land-use and development decisions. Planning documents should state that the developer cannot build unless he or she can ensure and maintain a defensible space.

2. Local government planners must increase the role of fire protection entities in planning:

- Fire departments should be adequately staffed to attend meetings and public hearings, restructuring job requirements if necessary. Several small departments can pool resources to cover meetings and ensure that concerns about fire safety are voiced.

- Fire departments must promulgate stiff regulations and review all proposals for development (not just subdivisions). In addition to the standard consideration of roads, water supply, and density, such regulations should also cover setbacks, turn-arounds, and position of the lot and house on the slope. In addition, topography and fuels should be considered in lot layout review, with new regulations that address them.

- Fire departments must use informal groups such as the county-wide Western Fire Chiefs' Association (as in Monterey County) as a unifying voice. Fire departments must agree on a standard or ordinance, then each try to get it passed in each jurisdiction, having the added justification that every other fire district is asking for the same thing. This way the same ordinance becomes the regulation for a large area and confusion over policy differences is avoided.

- Fire protection entities must be vocal and active participants in the environmental review process, providing comment on the fire hazards and levels of protection resulting from the overall patterns of development. Included in this review should be the analysis of incremental and cumulative impacts of development.

- Fire departments must quantify needs such as for water supply, personnel requirements, additional demands on time, and equipment, etc., to identify the environmental threshold for development as it relates to fire hazards.

- Fire departments must zone strategic areas for suppression after classifying and justifying specific locations. This would include restricting development of certain ridgelines and zoning fuelbreaks in other areas. This may be done through a Cooperative Fire Protection Agreement or Coordinated Resource Management Program whereby a variety of agencies are involved in the location, development, and implementation of a site-specific local community prevention and protection plan.

- Fire managers must develop a "how-to" booklet with model ordinances and model language for planning consultants, fire departments, and planners that would address the fire aspect of planning documents. One of the reasons floods and earthquakes are treated in detail in California is that the State Department of Mines and Geology prepared instructions concerning how to prepare those parts of the planning documents.

3. Local government planners must strengthen siting and building regulations:

- Model regulations adopted by local governments must encompass: (a) greater clearance on slopes—by appropriate uses as pools, tennis courts, orchards, vineyards, roads, or combinations of these; (b) greater setback from property boundaries, to ensure clearance can be accomplished, which may preclude development on small lots; and (c) stronger mitigating measures, which may include residential sprinklers on independent power sources, or a foam system.

- The many requirements that have been established for different, nonfire-related goals should be pursued by homeowners, developers, architects, and builders. For example, thermal pane windows, which are effective for reducing fire damage, are required out of concern for energy efficiency. And, in contrast, conscientious homeowners may plant drought-resistant vegetation that is highly flammable because landscape architects and nursery personnel were not informed of their danger.

- Local planners should adopt minimum requirements for building, based possibly on an existing code such as NFPA's 1141, WFLA's Uniform Fire Code (although the current code addresses mainly structural protection) CDF's PRC 4290 regulations, Fire Safety Guides, or a combination of these. Much of the proposed legislation promises to be helpful if passed; these can, in turn, serve as models for legislation to be proposed in other areas of the nation.

4. Educate and change attitudes of planners and the public.

- The fire management community must inform planners and homeowners of such things as these: (a) the potentially high probability of structure loss should a fire occur; (b) that the fire department (particularly a forestry department) may not be a year-round department; (c) the average response times may be much longer than urban standards; and (d) that responsibility and liability for protection ultimately rests with property owners, not the fire department. Fire departments should inform residents that they may not be able to save every house (Groves 1988).

- Fire managers must explain that the fire ecology of a building site in the intermix is still controlled by natural forces to a great extent. For example, a program in Incline Village, Nevada—an area of ponderosa pine—is explaining that the attitude, "We haven't had a fire in 80 years, so why worry," should be changed to, "We haven't had a fire in 80 years, so we're especially worried."

- Homeowners and other citizens should become more vocal in the legal requirements and aspects of the local planning process. For example, no building permits and subdivisions are to be approved unless the construction, subdivision, or ordinance is consistent with the county's Open Space Plan. Yet comparison of proposals with the Open Space Element for consistency is rare. Citizens need to know avenues for political pressure, and if that fails, avenues for judicial recourse.

5. The State Legislature must work toward an equitable sharing of costs and protection responsibility by developers, local governments, and fire protection agencies and departments.

- Fire damage prevention in the form of plan review, inspection, and participation by the fire department in the planning

process must be funded to a greater extent. Plans review may be contracted by smaller protection districts to the county building department, or fire departments can jointly fund staff positions to promote consistency.

- All developers in a lot split should pay their respective portions of increased services required for emergency access and water. The requirement that the first lot in must provide enough water and access for the eventual development of all lots has merit.

- Local governments should share the costs of structural protection since they approved the conditions by which development occurred in undefendable places. Of the total fire suppression cost spent by wildland protection agencies in the Stanislaus Fire Complex, \$656,000 was spent on structural fire protection (Irwin 1987).

- The USDA Forest Service should state in its Land-use Plans the role of the Federal Government for planning and protection in intermix areas. Development affects the types of activities that take place in the area, and reassigns priorities to those activities.

SUMMARY AND CONCLUSIONS

Many planning opportunities for improving fire safety in the urban-wildland intermix exist within current laws. Consistent, dedicated, concerted, and vocal effort is most effective in identifying issues and promulgating regulations. Distribution and passage of model legislation, ordinances, and language for planning documents will help local fire departments assure adequate levels of protection.

Because retrofitting is the most difficult problem, the importance of insisting on fire-safe development in the first place is paramount.

Fire departments would do well to equate fire with flooding, since many similarities exist: (1) intensity and frequency are inversely proportional, (2) some areas are more prone than others, and (3) only some technology can help—and only to an extent.

The planning process—and more so, development review process—is a matter of negotiation, and stakes are high for all parties. Fire departments (especially volunteer fire departments) are often conservative in requirements because they are used to dealing with meager budgets. Development is worth a lot of money; and high costs for fire protection as well as exorbitant damages are real. An appropriate philosophy concerning fire protection measures in the urban-wildland intermix may be “You can pay now, or pay later.”

Fire departments must become sophisticated in methods for regulation. Many opportunities for mitigating measures are available during development review. Such avenues include the

use of these: Conditions for Approval; Codes, Covenants and Restrictions; and developer agreements.

Fire departments must ask for off-site improvements, as well as for on-site improvements, as long as a link to fire safety can be shown. Developers are certainly sophisticated in this respect as it is their job to maximize profit and provide a buyable product. Ensuring that mitigating measures occur by providing tradeoffs and allowances is the key to building safely.

Combining efforts is the key to progress. Goals include these:

1. Obtaining funds to support review of plans by fire departments

2. Quantifying the hazard and probability of loss due to various factors, to justify regulations and mitigation measures; and

3. Establishing and maintaining political clout for local volunteer fire protection districts to promulgate regulations.

Fire departments have learned the value of working together in an emergency. Mutual aid agreements and joint dispatch units are good examples of the cooperation possible. Now building departments, fire services, and planning agencies must work together in the planning process.

Although a national strategy and effective national leadership will be important in reducing the wildfire problem in the urban-wildland intermix, the real battles and real progress will be made within local communities.

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