LIVING IN THE CHAPARRAL OF SOUTHERN CALIFORNIA

Proceedings of the Conference and Public Workshop Sponsored by the

National Foundation For Environmental Safety
National Park Service

AN INTEGRATED APPROACH TO PUBLIC SAFETY:

—Wildland Fire Management
—The Fire Flood Cycle
—Fire Ecology & Plant Succession
—Postfire Plant Recovery
—Flood and Erosion Control
—Landuse and Planning
—Developments & Public Concerns
—Planning & Building Safe Developments
—Developments, Public Safety, Economics
—Insurance Coverage & Cost
—Disaster Preparation & Assistance
—Disaster Psychology

The Santa Monica Mountains National Recreation Area of the National Park Service and the National Foundation for Environmental Safety are dedicated to the protection of significant natural and cultural resources related to the chaparral environment and to people living, working, and recreating safely in such areas.

$10.95

Preface

As residents of the western United States, particularly California and specifically Southern California, our lives are affected on an almost daily basis by wildfires, floods, hillside slippage, landslides, and the reality of earthquakes. Jokingly we say that there are two seasons: fire and flood. We are either living in or near fireprone hillsides or flood plains affected by the fire-flood cycle or have friends and relatives who do so. One of the regularly occurring wildfires may find us as spectators on our roofs watching the fire from far away, it may catch us worrying about our friends or relatives who may be affected by it, or it may find us frantically trying to avoid roadblocks in order to save our own homes.

To assist the public with having a better understanding of the environmental characteristics and unique problems associated with living in the disaster prone southern California chaparral habitat, the Santa Monica Mountains National Recreation Area, as part of the National Park Service's program of cooperative resource management, and the National Foundation for Environmental Safety (NFES), a nonprofit foundation dedicated to creating an integrated, interdisciplinary approach for public safety and enjoyment in difficult environments, sponsored the symposium and workshop **Living In The Chaparral Of Southern California.** It was held October 20, 1984, at the Los Angeles County Museum of Natural History with the cooperation of more than 20 public agencies and private organizations.

Using the theme of an **Integrated Approach To Public Safety,** symposium panels of public safety professionals addressed fire, vegetation and watershed management; landuse and planning; and disaster prevention, preparation, and assistance. The concurrent workshop offered individuals the opportunity to ask conference speakers and representatives of public and private agencies questions about situations affecting the home or community. Commonly addressed subjects were: how to make homes as safe as possible in case of fires, slope failures, erosion and mudslides that can be expected from the fire-flood cycle, how to use native or ornamental plants for effective landscaping, how to recognize potential hazards, and how to cooperate more effectively with neighbors and the community in protecting the neighborhood. The information presented here gives scientific yet practical management information and reflects the opinions of the speakers and not necessarily that of NFES or the National Park Service. Because of the integrated approach of the different subjects, the proceedings can be used as a handy reference guide throughout the year in conjunction with some of the more specific homeowner management guides that have been published in recent years with the assistance of members of the National Foundation.

In a disaster prone environment one is often only as safe as one's neighbors. Cooperation, not only among residents but also among public agencies and their experts, goes a long way in preparing for emergencies and in sharing the resources when disaster strikes. Experts in the many disciplines of public safety and residents can learn much from each other. With this in mind, the "HOW TO" information presented by the conference speakers gives fresh insight and is straightforward and to the point.

Public agencies, developers, and homeowners have to learn how to live with nature and not to be at war with it or to subjugate their own philosophies and often shortsighted solutions on the environment. Whether whole mesas are separating from mountain crests because of "insignificant" miscalculations on parts of public agencies in allowing cesspools and seepage pits to soak the ground throughout the year (instead of going through the expense and time consuming process of initiating a sewer system study) or whether a homeowner's forgetfulness in turning off a water hose soaks the hillside over night, the predictable results, though slower, may be the same. Slopes will move when supersaturated. In the same context, flammable materials, whether wooden roofs or brush, will burn during extreme fire weather conditions.

After slopes are denuded, inevitable mud flows will find their way through homes and backyards. We soon learn that plastic sheeting has many different uses such as serving as a temporary roof when some of our wood shingles may have burned recently due to firebrands. Plastic can also serve as emergency slope cover by sheeting water from a bare hillside. Common sense and responsible resource management must prevail in the prevention phase. We must acknowledge that sandbags, plastic, ryegrass, or if all else fails, a bulldozer as the seemingly only emergency management tools available to homeowners in time of disasters, can not substitute for adequate land management. Land management must be more long term and more comprehensive than just "quick fix" solutions.

Many persons helped in making the conference and workshop a success. In addition to the many speakers and workshop participants listed in the proceedings we want to recognize specifically our moderators: Judge Carlos Baker, Director of NFES; Margot Feuer, Commissioner, Santa Monica Mountains National Recreation Area Advisory Commission; Louis E. Hill, President of NFES; Daniel R. Kuehn, Superintendent, National Park Service, Santa Monica Mountains National Recreation Area; and also the keynote speaker Dr. Jerry Partain, Director, California Department of Forestry.

Klaus Radtke
Program Organizer
Technical Coordinator of the
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The Keynote Address

A COOPERATIVE APPROACH TO PUBLIC SAFETY[1/]

Jerry Partain[2/]

Abstract: Living in the chaparral of Southern California is somewhat like watching the steam from Mt. Saint Helens out your livingroom window, wondering when will it blow!

The combination of highly resinous plants, extreme weather conditions, rugged terrain, and urban expansion work together to create some of the most explosive fire conditions in the state of California.

Although the danger can never be removed, we can greatly improve the odds to our favor with planning. To beat the odds, there are three basic areas you must seriously plan; personal circumstances (your home), fuel modification and interagency cooperation.

The many agencies in Southern California are committed to this cooperation, but to make the odds liveable, so must you be!

Introduction

I'd like to thank Klaus Radtke for inviting me to speak to you today. You've come to this Conference and Workshop to learn a little about the land you've chosen to build your homes on. I've come today to scare you a little bit about that decision.

To avoid sounding like Chicken Little, let me qualify that statement. You live in one of the most dangerous fire settings in California. That's the part I want to scare you about. However, if you listen to what this Conference and Workshop has to offer and take care of your own backyard, so to speak, you can make great strides to mitigate the danger.

I'd like to do two things here today. First, take some time and tell you how various factors contribute to extreme fire conditions on chaparral land. The second thing I'd like to do is bring you up to date on how public agencies are working together to address the problem in the most efficient manner possible.

When we are done here, if Klaus, myself and the other participants of the Conference and Workshop are successful, *you* the residents of the chaparral will be the most important element in preventing the millions of dollars of destruction that are caused by fire every year in your area.

Living in the chaparral-covered land is somewhat like living at the base of Mt. St. Helens, wondering when it will blow again. When years go by with no major destruction, it's easy to grow complacent—to sit in your living room and forget that potential for major destruction lies right out your front door.

How many of you remember the Panorama Fire of 1980. Thousands of acres, hundreds of homes, and several lives were lost. I can guarantee you that, immediately afterwards, hundreds of homeowners set about protecting their homes from fire. Each year after that fewer and fewer poeple remembered and fewer and fewer people were prepared.

That's why "Panorama" fires are so destructive and that's why workshops like this one are so important.

Remember, you can't just do fire prevention this year and forget about it next year. Just like tuning your car or planting the garden, it's an ongoing process. As long as you're going to live in the chaparral-covered lands of California, and protect the lives of your family, you must always be prepared for fire.

Enough of my soap box. Let me take some time to tell you want causes these severe conditions. You have to remember that nature intended that the chaparral ecosystem burn on a fairly regular basis.

Factors Contributing to Wildfires

You've chosen to live in one of the most beautiful climates in the world, but of course one of the prices you pay for that climate is the fire. Over thousands of years the chaparral plant species have developed protective oils and resins which help reduce the loss of plant moisture during the long, hot, dry periods. These same protective oils and resins are very flammable. The basic structure of these plants with fine branches and a large

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[1/]Presented at the Conference and Public Workshop *Living in the Chaparral of Southern California,* October 20, 1984, Los Angeles County Musuem of Natural History, Los Angeles, California

Jerry Partain, Ph.D., Director, California Department of Forestry, Sacramento, California

surface area leads to their easy ignition. To complicate things, a high percentage of fine dead material builds up as chaparral ages. This ensures rapid fire spread in older stands of brush.

The second major factor in these circumstances is the weather. Long, hot summers and falls, low humidities and little winter rainfall all contribute to the vegetation's flammability. Then on those occasions when the Santa Ana winds blow, we have a situation which we call "instant critical fire weather."

If that's not enough to depress you, consider for a moment the topography. The steep canyons, draws and natural chimneys cause fire to spread very rapidly and fire suppression becomes an almost impossible task. Hundreds of acres can burn in just a matter of minutes.

The soil is highly susceptible to erosion and major slides are common when the plant life is destroyed.

If the fire doesn't get you, just wait until winter and the mudslides will.

And in the middle of all of this, you have people—thousands of people—building homes in all kinds of crazy places—narrow canyons, unprotected ridge tops, steep slopes—and I'll bet that many of you in this room have homes built on exactly these kinds of hot spots.

Did you know that man causes ten times as many fires as nature does?

One day another "Panorama" fire will take off. Hopefully the fire agencies will be able to save your home. But, what have *you* done to assist them? What have you done to protect yourself?

Obviously that's why you're here. To learn more about how to keep yourself and your family safe.

Protecting Your Home

So let me give you some suggestions:

First, let's consider the building site. Building sites must be large enough to allow sufficient "set back" of buildings, to prevent them from being directly in the path of flames and heat from the burning hills below. Building densities and building spacing requirements are more critical in a wildland setting than in the urban centers. Because of the flammability of the surrounding vegetation and the steepness of the terrain, the potential of fire spreading from one dwelling to those located nearby is much greater in the wildland setting. In wildland fires, it is not unusual for spot fires to develop several hundred feet from the original fire.

Second, you should consider the structure's design. Home design can make a major difference in whether or not your home can survive this kind of disaster. Buildings designed with long, low eaves and exposed decks are natural collectors of hot gases and burning embers. Large windows are often broken by the intense heat from an on-rushing wildfire. Open attic vents allow burning materials to enter the attic space with disastrous results. All eaves, decks and other overhanging structures should be enclosed. Attic vents should be screened. Large windows should be avoided or protected by shutters or other protective devices.

And don't forget building materials. The early Spanish settlers in California built relatively fire-safe homes with adobe walls and tile for roofing. A very sound idea. In short, all flammable building materials should be avoided.

Let me make a special comment about roofing materials. The extremely heavy losses on the Panorama, Anaheim and Bradbury fires were all a direct result of wooden roofing materials. There are a number of acceptable, firesafe, substitutes for hazardous roofing materials. They should be used.

Third, let's consider access. All too frequently, emergency response personnel are hampered in their efforts because of road conditions in the wildland areas. Roads and driveways must be built to accommodate the size and weight of fire apparatus. While most counties have a mountain or rural road standard, they are often not applied to private roads and driveways. Small radius cul-de-sacs, narrow roadways, extreme vertical dips and steep grades are the most common barriers to access. Just becaue the V.W. Rabbit can make it up to the house doesn't mean that a transport truck hauling a bulldozer or a long-wheelbase fire engine can.

A couple of other comments about access. Every safely designed development or home site should have at least two routes for ingress and egress. This will allow residents a route to evacuate while fire apparatus is responding into the area. It also provides escape options, should one route be blocked by fire.

Even if the roads *are* good, we still need to be able to find *your* house. Property identification or house numbers are very important. They should be large and visible. If your home is located well off the main road, the house numbers should also be displayed where the driveway meets the main street.

And finally, don't skimp on your water system. I know water systems are expensive, but don't make the mistake of spending hundreds of thousands of dollars on a home where a fire department has little or no access to water.

Fuel Modification

What I've been talking about so far is fire prevention. Now let me turn to a subject we call fuel modification. State law requires the removal of all flammable vegetation for a minimum of 30 feet around any structure. In most areas, this minum needs to be expanded to 100 to 150 feet. The extension of the minimum can be very effectively done by thinning the native vegetation, removing the majority of the plants and pruning the dead material from the remaining plants. This helps to maintain scenic values and provides soil stability.

Your local fire department and the California Department of Forestry can provide you with specific information on how to do your home hazard reduction.

We know that we can't change the area's topography or the area's weather, but we can modify the chaparral fuels. Fire environment modification is a fancy governmental phrase to explain the concept that two pounds of dry wood will make a hotter fire in the stove than three pounds of wet wood.

We modify the fuel structure with firebreaks, fuelbreaks, greenbelts and a vegetation management program. Let me explain that in a little more detail. Firebreaks are cleared to mineral soil while fuelbreaks leave the native grasses and some mature species of native chaparral. Fuelbreaks are preferred by most people because they create less erosion and are more pleasant to the eye.

Greenbelts are continuing areas of nonflammable vegetation usually located between developed areas and open brush fields. Golf courses, parks and farm land can be incorporated into greenbelt systems. Fire agencies and some large nurseries can advise you about what plants have a low-fuel volume or are 'fire retardant' and should be used to develop and maintain a greenbelt for your home and your community.

Remember, these methods require maintenance. Homeowners' associations can be an effective vehicle to ensure the maintenance of community fuelbreaks. At present, the most efficient and cost effective method available is called prescribed burning.

The Ventura Freeway Corridor Prescribed Burn is a prime example of this option. Hopefully this project will reduce the likelihood of fires crossing the freeway. The Ventura Freeway Burn was conducted by the Los Angeles County Fire Department under the authority of the California Department of Forestry's Vegetation Management Program.

The goal of the Vegetation Management Program is to safely use fire to reduce fire hazards and improve the environment through the use of prescribed burning. This program allows the state and its agents to enter into a cost-sharing agreement with local landowners, thus making them *cooperators* in achieving a common goal. Vegetation management introduces fire as a *positive force* into the chaparral ecosystem. We have had good success with this throughout the state.

Cooperative Approach

Let me return now to the part of this discussion called an "integrated approach." Nothing you do will be completely successful unless your public agencies are cooperating with you and, more importantly, with each other. Public protection in the wildlands can only be successfully provided by integrating a number of preplanning disciplines with the actions of both individuals and government working toward a common goal.

Let me explain how the area's fire protection agencies have *integrated* to provide you with better and more cost-effective service. California has a little over 100 million acres of land. Thirty-three million acres of its wildlands and forest areas are the direct responsibility of the California Department of Forestry. The remaining areas are protected by city, county, federal and volunteer fire departments.

In an effort to streamline this situation, the fire agencies have taken a number of positive steps. The first one we will address is *contracting.* As an example, the protection of the state responsibility areas within Los Angeles County has been contracted out to the Los Angeles County Fire Department. In short, L.A. County does out job for us. This has allowed both the county and the state to save money by the elimination of duplicated services. Orange, Ventura and Santa Barbara County Fire Departments are also Southern California entities doing work for CDF. We also contract with the United States Forest Service to protect the private land within the national forests.

On the other side of the coin, some local government entities have chosen to contract their fire protection responsibilities to CDF. As an example, the Riverside and San Bernardino County Fire Department are managed and staffed by the Department of Forestry. A number of cities and fire protection districts are also protected by CDF.

All contract firefighters are trained in both wildland and structural fire fighting skills and, throughout Southern California, they find ample opportunity to exercise and increase those skills.

Mutual aid, or one fire agency helping another, is as old as the fire service in America. The vanguard of the mutual aid system is California's Master Mutual Aid Agreement. Under this agreement, certain types of firefighting resources are shared with others. This system allows us to put fire services from Humboldt County on a fire in Los Angeles when needed. Local mutual aid and automatic aid agreements are now common in the Southern California fire system.

After a series of disastrous fires in 1970, the seven major fire departments in Southern California joined forces to improve our interagency operations. The project was titled FIRESCOPE. FIRESCOPE is an acronym for Firefighting Resources of Southern California Organized for Potential Emergencies. This program has made significant improvements in methods used in emergency management.

Standardized management systems, communications capabilities, mapping and an improved capability to predict fire behavior were all part of the FIRESCOPE program. Many of the FIRESCOPE products are now being put into use throughout the nation.

The most interesting element of the FIRESCOPE program is the multi-agency coordination system, which expedites the supplying of resources when multiple major emergencies occur. An Operations Coordi-

nation Center is the center of the Multi-Agency System. The OCC serves as a central location to gather information, maintain status and to deal with the allocation of resources. This center is located at the Department of Forestry's Regional Headquarters in Riverside. The center is also a regional dispatch center for CDF, the United States Forestry Service and the Office of Emergency Services.

We believe that these systems offer you, the taxpayer, the most efficient and cost-effective service available.

So there you have it. The problem, the system your public servants have developed to deal with the problem, and most importantly what *you* can do to be an effective member of the system.

That's why this is called an integrated approach. I strongly believe in what we do at CDF. I am committed to giving you people the best service possible in helping you protect your homes. I encourage you to share in that commitment.

WILDLAND FIRE MANAGEMENT[1/]

Ronald H.Wakimoto[2/]

Abstract: From 1910 to 1935 wildland fire control was basically "economic" suppression where minimum costs were achieved with fire control efforts matching the appraised forest value. In 1935 the U.S. Forest Service adopted what has been called the "10 A.M." policy which stated that fire control would be achieved by 10 A.M. of the morning following the fire's discovery. This fire exclusion policy produced older stands of more highly flammable vegetation and the resulting chaparral fires became larger and more costly each year. Finally, in 1978 the U.S. Forest Service policy changed from one of fire control to fire management. This change has brought about many changes in fire suppression methods, planning and objective setting in recent years.

Fire management is defined as, "The integrating of fire-related biological, ecological, physical and technological information into land management to meet desired objectives." Through an understanding of these factors we can begin to develop fire management strategies that might allow people to live more peacefully in the chaparral of California.

The objectives of this presentation are:

1. To present the fire management problem in Southern California chaparral covered lands.
2. To present certain advances in fire management made in recent years.
3. To challenge the professionals in fire to upgrade their current fire management.
4. To challenge the interested public into helping themselves protect their property.

Introduction

This presentation is entitled "Wildland Fire Management." For some people, the term means use of prescribed fire. In Montana, to some it means allowing fires to burn unchecked in a large wilderness area. Here in Southern California, 300-foot wide fuelbreaks are a symbol of wildfire management, as are the myriad of fire engines massed on freeways in a suppression action. For others the term "fire management" may mean zoning restrictions or building material ordinances. For some it means planning the layout of a home development site with fire protection in mind. To others, it may represent home insurance policy considerations. All these things are part of wildland fire management.

A basic definition for the term was written by Barney (1975). He defines fire management as, "The integrating of fire-related biological, ecological, physical and technological information into land management to meet desired objectives." In general, the overall, desired objective is to live in chaparral covered lands with limited social disruption due to wildfire and its suppression. Through an understanding of the factors listed in the definition, we can begin to develop fire management strategies that might allow people to live more peacefully in the chaparral of Southern California.

Biological and Ecological Information

Great advances in our understanding of the relationship of fire and chaparral have been made in recent times through research conducted by the land management agencies, colleges and universities. I will not cite the myriad of publications here. I will generalize as others on the program will present more detailed biological and ecological information.

In fire management one basic parameter that is frequently used to better understand a situation is the Mean Fire Interval (MFI) or the arithmetic average number of years between successive fires. A short MFI generally means limited fuel buildup because of the short time between fires and rapid fire spread with low to moderate fire intensity. Prior to fire suppression, much of the lower mixed conifer forests of the Sierra Nevada Mountains evolved with MFI ranging from 4-12 years. Chaparral studies indicate a range of MFI of 15-25 years for the bulk of the interior chaparral covered lands prior to the development of large fire suppression organizations. The greater length of time between fires allows for shrub growth, death and

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1/Presented at the Conference and Public Workshop *Living in the Chaparral of Southern California,* October 20, 1984, Los Angeles County Museum of Natural History, Los Angeles, California.

2/Ronald H. Wakimoto, Ph.D., Associate Professor of Forestry-Wildfire Management, University of Montana, Missoula, Montana.

greater fuel accumulation. In addition, a large proportion of shrub biomass is in fine twigs and small diameter stems that dry out quickly and burn readily. Fires display rapid spread and high intensity. The development of a large fire suppression organization in Southern California has increased the MFI to something around 65 years, resulting in fires with high rates of spread, huge flame lengths and extreme fire intensity.

The size and scope of environmental damage from modern day chaparral fires is in many ways due to man's effects on the natural fire regime. Suppression of all fires creates vast acreages of uniform fuel with large quantities of dead fuel with no natural barriers to fire spread. Prior to fire suppression, fires burned freely, checked by previously burned areas devoid of fuels, rocky sites, or the Pacific Ocean. The rate of fuel buildup is slow enough to require 10 to 20 years of shrub growth before fires can become intense enough to dry out live vegetation to produce an intense fire. Unless one makes the mistake of seeding large burned areas with highly flammable annual ryegrass, a non-native, the area will be relatively fire free for 1 to 2 decades. Fires that do start are more easily controlled. A mosaic of shrub stands of different ages and flammability limits fire spread and intensity. In this way, chaparral is well adapted for fire. I'll leave it to Dr. Sweeney to elaborate on this comment.

A significiant difference between historic fires and our current situation is the cause and timing of wildfire ignition. Historically, chaparral fires were ignited by lightning and native peoples. Such ignitions occurred in late spring and summer when native peoples burned lower elevation grassland or when lightning activity was greatest. Fires started by these ignitions were generally of limited intensity due to large amounts of moisture in the shurbs and herbs at that time of year. Slight changes in aspect or steepness of slope extinguished fire under these limited burning conditions. Burning was very patchy due to small scale climatic differences. Under good burning conditions fire spreads until coming in contact with a previously burned area. Unfortunately, all these fires are now easily and eagerly suppressed.

The occurrence of hot, dry Santa Ana winds peaks in the fall months, well removed from the July peak of lightning occurrence (Weide 1968). Man-caused ignitions by accident or arson during Santa Ana winds yield the huge, rapidly spreading, high intensity fires that encouraged many of you to attend this symposium. One wonders whether or not intense fires occurred with such frequency prior to effective fire suppression.

Physical and Technological Information

Chaparral vegetation occupies a landscape that is young and erosive. Soil parent materials are generally sedimentary or metamorphosed sedimentary in nature, making soils prone to large slips and slumps with or without the impact of wildfire. Subtle changes in drainage patterns or mechanical earth movement can have disastrous results. A number of speakers on this afternoon's panel will discuss such problems in detail.

Unfortunately, one of the common technological fixes for the Southern California fire problem is the design and construction of fuelbreaks and fuelbreak systems. Fuelbreaks are wide strips or blocks of land on which natural vegetation has been partially or totally removed and replaced by vegetation of lower volume and hazard (Brown and Davis 1973). Most fuelbreaks are placed on strategic ridgetops for effective use in fire control. This placement of firebreaks essentially outlines watershed boundaries. This means that once a fire started the entire watershed will be subjected to the most intense fire possible, since fire managers seek to exclude fire for as long as possible. The longer they are successful, the greater the fuel buildup, and the less effective the fuelbreak is likely to be under any weather conditions (Davis 1965). Only when fuelbreaks are combined with prescribed burning conditions does this technological fix appear logical as a fire management strategy.

Fortunately, in the area of fire behavior prediction and the use of fire to achieve land management objectives, fire management has made strides in recent years. The "BEHAVE" computer system developed at the U.S. Forest Service Intermountain Fire Sciences Lab. (Burgan and Rothermel 1984) in Missoula, Montana, allows the user to develop custom fuel models for specific sites and predict fire behavior under a multitude of weather and fuel moisture conditions. With this tool experienced burners should be able to more fully use prescribed fire to widen fuelbreaks and begin to develop a mosaic of age class of chaparral to meet fire management objectives.

Prescribed fire cannot be used to its full potential without strong effective fire suppression capability. Aerial fire retardants, long an important fire suppression tool, continue to be studied. Much effort has been placed in the area of delivery effectiveness, rapid mixing of chemicals, and low cost materials. New low cost retardants are continuously being brought forth, requiring new testing. The corrosiveness of such retardants on aircraft metals, mixing equipment, the human body, and storage tanks must be monitored continuously to assure personnel safety and low cost.

Historically, fire weather information was collected each day by fire lookouts who reported such information to a district headquarters each day for fire danger rating prediction. With the gradual phasing out of lookouts, professional fire managers were faced with less and less real world information on which to base management actions. To alleviate this situation, Remote Automated Weather Stations (RAWS) are being installed throughout the West to get accurate, timely fire weather information. These units record hourly weather information, which is periodically transmitted to a satellite which retransmits the information to a central computer in Fort Collins, Colorado. Once

there, the information can be assessed by any of the thousands of ranger district computer terminals. This technological innovation presents the fire manager with year around weather information for use in fire suppression or prescribed burning.

Fire suppression use of real time data (as the fire is burning) is invaluable for fire behavior prediction. Rates of fire spread, fire size and shape and fire intensity predictions should be used by fire managers to develop suppression strategies to be taken, equipment and manpower requirements, and location and construction specifications of fire control lines.

Another significant addition to weather data use in fire management is the development and adoption of the 1978 National Fire Danger Rating System (NFDRS) by the major fire suppression organizations. This modern tool is commonly used to analyze and compare fire weather conditions. The system combines measured fire weather conditions, specific fuel quantity and quality, probability of fire occurrence and a mathematical fire behavior model (Rothermel 1972) to generate numeric fire danger indices that describe expected fire behavior under "average worst case" conditions.

This is done by taking fire weather measurements of temperature, relative humidity, windspeed and cloud cover on open, south-facing exposures. A south exposure generally receives the highest temperature, lowest relative humidity, and strongest winds. In this way, equipment and personnel dispatched to a fire will be sufficient to suppress all but the "worst case" fires. To consistently dispatch suppression forces large enough for the "worst case" fire would be too costly, yet to dispatch for "average" conditions would mean that half the fires would escape from initial attack. For the most part, when no wildfires are burning, the system is used as an index of suppression personnel and equipment readiness and to assist in budget allocation and burning prescription development for scheduled prescribed burns.

The indices were developed to be directly related to the aspect of fire behavior being rated. The most commonly used indices are the Burning Index (BI), the Energy Release Component (ERC), the Spread Component (SC), and the Ignition Component (IC).

BI essentially rates the difficulty of containing a wildfire, related to the length of flames produced from the combination of rate of fire spread and the amount of energy released as the fuels ignite. Since BI is linearly related to the expected flame length, actual monitored fire behavior on a wildfire can be compared to the index.

The numerical value of BI is 10 times the expected average flame length produced by a fire. For example, a BI of 30 indicates an expected average flame length of three feet, which is generally considered the upper limit for attack without heavy equipment. A BI of well over 100 is seen in many Southern California chaparral areas. Fire planners, managers, and administrators can develop a set of BI guidelines for fire suppression action, personnel readiness, public news releases and fire prevention campaigns. Most importantly, these things can all be done long before a fire starts.

The Energy Release Component (ERC) is related to the estimated potential available energy released per square foot in the flaming zone of the fire. Fuels can become more available as their moisture content decreases. Small diameter fuels are also more available but contain less potential energy. The ERC is used frequently for fire management plans where long-term drought is a critical factor affecting wildfire occurrence. The moisture content of live chaparral shrubs is closely controlled by the summer drought. The ERC tends to be a more stable index, unlike BI, which can rise rapidly in response to strong winds that affect the rate of fire spread.

The Spread Component (SC) is related to the expected rate of forward spread of a fire. The value of the index is equal to the expected spread rate in feet per minute. That is an SC of 20 means an expected forward spread of 20 feet per minute. Hence, SC is an idex of the time within which a fire must be contained to prevent it from exceeding some acceptable size. This time should be related to travel time from fire stations and can dictate the position of fire suppression personnel and equipment during extreme fire weather. The rate of fireline construction by hand crews and heavy equipment must also be considered and related to SC.

The Ignition Component (IC) is an index to the ease with which fine fuels are ignited. The presence of live vegetation actually reduces the likelihood of a firebrand coming in contact with dead fine fuel. The quantity of live fine fuel, dead fine fuel, moisture, air temperature, relative humidity and cloud cover control this index. The occurrence of spotting, the spread of fire by falling firebrands carried aloft by convection or spread of fire by radiation, is clearly related to IC. More development work of this component is needed so that it can be related to wood roof ignitions and spotting distances.

Another technological advance being implemented in both wild and prescribed fires is the use of infrared imagery to detect the actively burning portions of a wildfire perimter or hot spots inside a burned area. Hand held infrared probes are used on an everyday occurrence on wild and prescribed fires. This greatly decreased the likelihood of an escape fire that was thought to be out. More recently the use of aerial infrared imagery has been used to identify housing developments with a large number of homes with wooden shake or shingle roofs. Such developments *cannot be effectively protected* under severe Southern California fire conditions. Both the homeowner and the suppression agencies should recognize the fact and work to alleviate the problem. Any wooden roof fire in the neighborhood is a threat to the entire development since the wooden shingles can cause spotting to adjacent buildings and the high intensity fire from the involved home may ignite adjacent structures regardless of their roofing material. All of you should think about this when you purchase a home.

Conclusion

The public and fire managers must work together to cope with the Southern California fire problem. Home clearance standards and hazard abatement regulations are seldom obeyed or enforced. A home insurance policy *does not protect* a home from fire. Unfortunately, people seem reluctant to pay money out of their own pockets for home protection after paying taxes to support a fire protection agency. Fire management strategies that limit where a person can live through zoning and density regulation are seldom supported.

The situation leaves the fire manager unable to reduce the risk from the fire hazard. Local governments then end up pressuring the homeowners with unpopular restrictions. Some fire managers use the situation to vegetate and simply respond to wildfires or political (useful) fires the same old way. What burns was beyond their control and due to nature and a limited budget.

As I see it, the real challenge here is to think in a new way, utilizing ever-changing modern technology in innovative ways to manage fire in Southern California. Organizations such as the National Foundation for Environmental Safety, a co-sponsor of this symposium, are born to fill a need to agitate for change in fire profession and educate the public. The politics of fire in Southern California are brutal. Someone must call a spade a spade and I commend the NFES for their effort and organization.

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WILDLAND FIRE CONTROL IN URBAN ENVIRONS: The October 23, 1978 Mandeville Fire as Case Study. [1/]

Donald F. Anthony [2/]

Abstract: When strong Santa Ana winds sweep through the southland and drastically increase temperatures and lower humidity the most feared part of the wildland fire season has arrived. Such was the case on October 23, 1978 when the Mandeville Cyn. Fire consumed over 6000 acres of highly flammable chaparral in just twelve hours and burned through Mandeville Canyon into Pacific Palisades. The spread of this fire is documented from start to finish along with the commitment of equipment and manpower.

The Los Angeles City Fire Department committed over 150 fire companies to the fire while at the same time receiving 794 other emergency calls. Almost 650 fire companies in Southern California were committed to brush fires in Los Angeles-, Riverside-, and San Bernardino Counties. Seven major brush fires burned in Los Angeles alone.

The network of firebreaks along major ridges were relatively ineffective in controlling the Mandeville Fire due to high winds which carried fire brands up to ½ mile ahead of the fire. Thirty homes were destroyed and another 20 damaged. Of these, 31 had combustible roofs.

Overview

The Los Angeles City Fire Department received the first telephone call at 0941 hours on October 23, 1978 that a brushfire had started in the Mandeville Canyon areas of the Santa Monica Mountains. Before containment, the Mandeville Fire would burn for twelve hours and consume 6,130 acres with a fifteen mile perimeter stretching from Mulholland Drive and the San Diego Freeway to Sunset Boulevard in Pacific Palisades, less than one mile from the ocean. The watershed area was covered with a mixture of fast burning mixed chaparral which contributed up to forty tons of standing fuel per acre.

A network of firebreaks maintained along the major ridge tops was ineffective due to the high winds which were carrying flying brands up to ½ mile ahead of the main fire. In November of 1961, the Bel Air fire had ravaged some of this same area, and in that fire 500 structures were burned. The remaining area had not burned since 1938. Of the 9,154 homes in the fire perimeter, fifty were damaged, thirty of which were totally destroyed. Thirty-one of the fifty homes had combustible roofs.

On October 23, 1978, there were 646 fire companies in Southern California committed to brush fires in Los Angeles, Riverside, and San Bernardino Counties. Seven major brush fires burned in Los Angeles County alone. One of those was the Kanan Fire in the western Santa Monica Mountains which burned 25,385 acres in Agoura and Malibu. Some fire resources came from as far away as San Luis Obispo County to assist with fighting these fires.

There were 157 fire companies and 60 support vehicles including helicopters, tractors, ambulances, etc., committed to the Mandeville Canyon Fire. Over 900 fire suppression personnel were deployed.

During this same 24-hour period, remaining City resources responded to an additional 794 emergency calls—314 fires and 480 EMS incidents, including thirteen greater alarm fires and one major emergency brush fire.

Weather

Three days prior to October 23, a light rain fell in the Los Angeles area. For the next three days, temperatures were moderate and the humidity was high. On the night of October 22, the weather began changing rapidly as the Santa Ana condition moved into the Southern California area. This condition was expected to exist for 24 hours, until midnight, at which time there would be a drop in wind speed and humidity would increase.

[1/] Presented at the Conference and Public Workshop *Living in the Chaparral of Southern California,* October 20, 1984, Los Angeles County Museum of Natural History, Los Angeles, California

[2/] Donald F. Anthony, Deputy Fire Chief, Fire Suppression and Rescue, Los Angeles City Fire Department, Los Angeles, California

Actual Weather Readings

Date:	10-23-78
Time	1200 hours
Temperature	86°
Relative Humidity	8%
Wind Speed	35-40 MPH
Wind Direction	NE
Index, Burning	Extreme

Burning Conditions

The FIRESCOPE Operations Coordination Center at Riverside, California, was contacted to obtain a computerized firespread model based on the existing conditions. The following predictions were received:

1200 Hours

Forward length of spread:	Ridges, 14,640 feet per hour
	Canyons, 6,000 feet per hour
Width:	2,516 feet per hour

The Fire

The fire is reviewed in one hour periods.

0941 Hours

At 9:41 am the Department received notification of a brush fire on the hillside across from 16221 Mulholland Drive and dispatched a brush assignment consisting of five engines, one truck, three helicopters, and two Battalion Commanders.

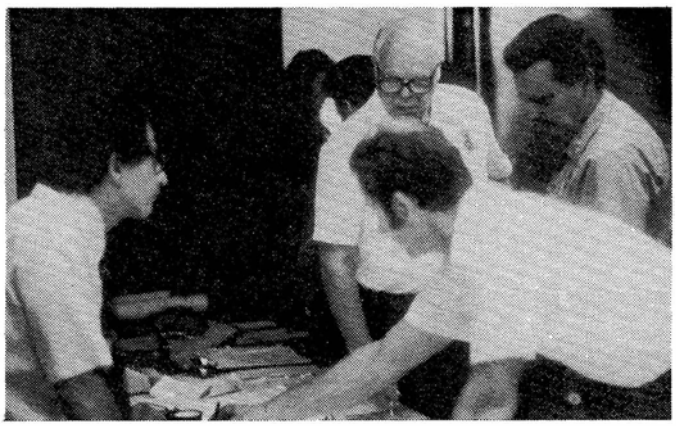

Figure 2—... City Fire Department personnel (center) at the command post is busy briefing City Councilman Marvin Braude (left) and Los Angeles County Fire Department Captain Horst Zimmermann (right) on the strong stand planned in Mandeville Canyon to protect homes and to prevent the western fire spread.

The first company arrived in three minutes and found a fire which was already four acres in size, involving grass and light brush and threatening the Miramar School. The fire was moving rapidly beyond reach at more than 200 feet per minute with northeast winds blowing from 50 to 60 MPH and moving into steep terrain.

The first arriving company began attacking the flanks * of the fire and evacuating the threatened school: a request was made for additional fire companies. As the Battalion and Division Commanders arrived, a helibase was established on Mulholland Highway for filling water dropping helicopters, a staging area was established at Sepulveda Blvd. and Mulholland, and a command post at Fire Station 109.

Additional companies were requested, and at 10:11 am the fire was declared a "Major Emergency."

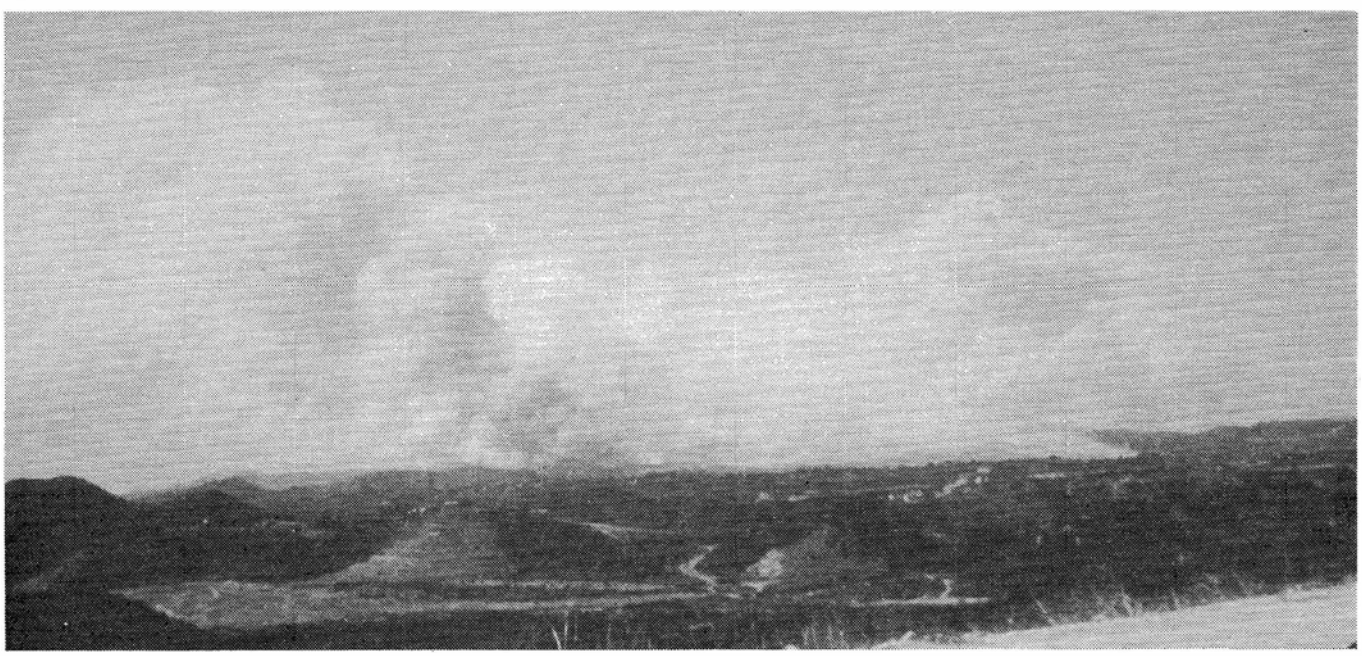

Figure 1—With the fire out of control and threatening residential areas...

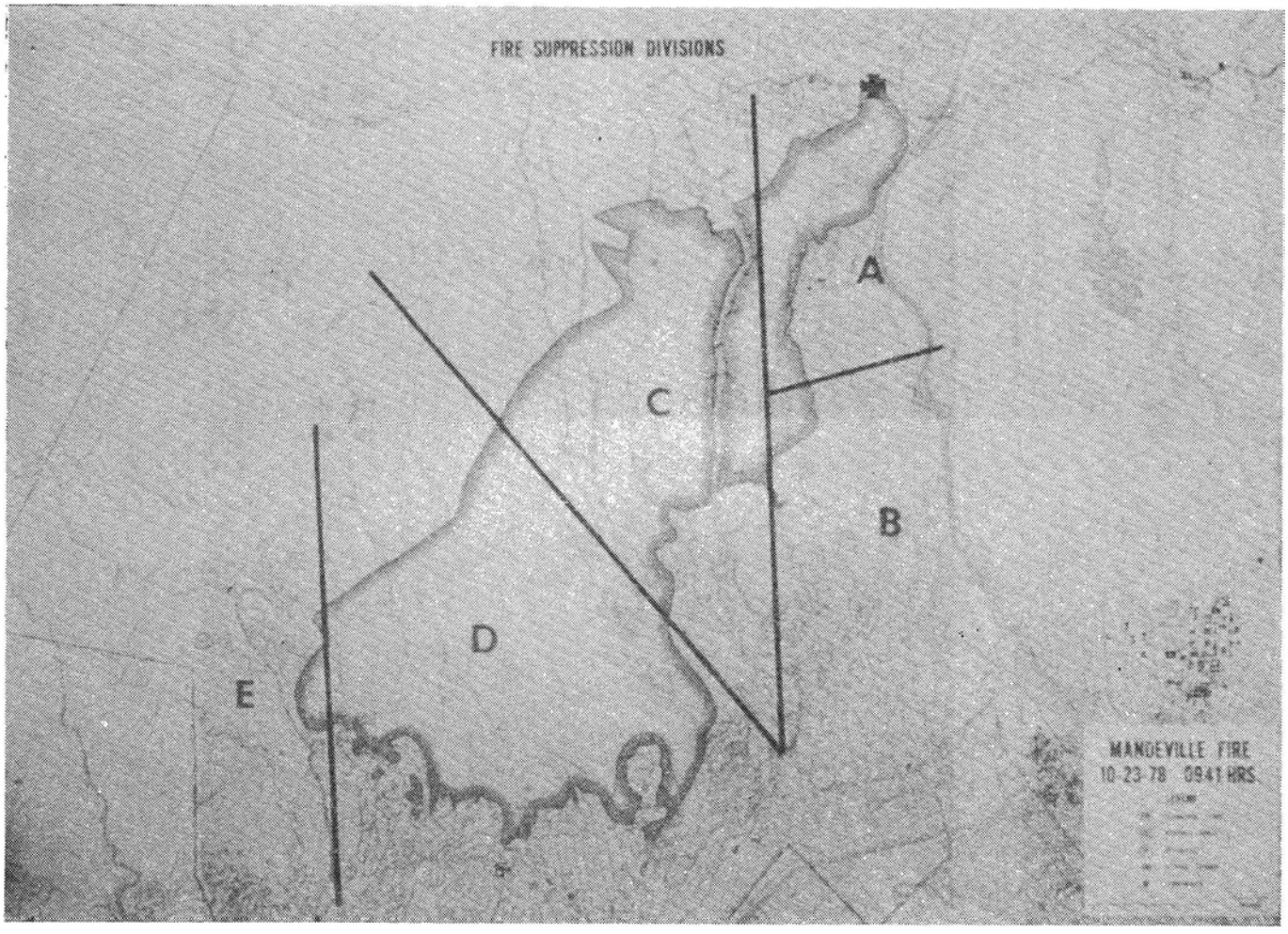

Figure 3— Fire suppression divisions engaged in fighting the Mandeville Cyn. Fire.

At 10:20 am the wind driven fire spotted across the Mission Dump Road (one mile from point of origin), over the top of companies fighting the fire, and headed south toward the Mountain Gate residential area in inaccessible terrain. The resource commitment at this time was twenty-six fire companies, three helicopters, two bulldozers, and six command officers. Additional helicopter pilots and Chief Officers were recalled.

1030 Hours

At 10:30 am additional companies and Chief Officers were requested. The Incident Commander established two Divisions, "A" on the north and west and "B" on the south and east, and began activating the Incident Command Staff at the Command Post ✱. The fire was out of control and spreading rapidly towards the East Mandeville Fire Road (west flank) and the Mountain Gate Area (east flank).

At 11 am a second staging area was established at Fire Station 37 (Veteran Avenue and Wilshire Boulevard). The fire was burning into inaccessible terrain and helicopter water drops on the head of the fire were almost futile due to the fire spotting up to one quarter of a mile ahead of the main fire. All companies from Fire Station 37 were diverted into Mandeville Canyon and the fire was divided into three divisions.

1130 Hours

At 11:30 am the Incident Commander directed the Command Post to make a strong stand in Mandeville Canyon to protect homes and to try to prevent the western spread of the fire.

A new staging area was set up at Fire Station 19 (12229 Sunset Boulevard) for companies arriving for deployment into the southern flank of the fire and Mandeville Canyon. The resource commitment at this time was seventy-one fire companies, six helicopters, four tractors, and sixteen command officers. Mutual aid was requested from Region I but none was available due to other fire activities.

At 12 noon off duty firefighters were recalled. The fire was entering the north end of Mandeville Canyon near the Hollyhock Fire Road. Division "C" continued deploying strike teams into Mandeville Canyon where dwellings, many with combustible roofs, were severely exposed to the advancing fire. Companies entering Mandeville Canyon experienced severe traffic problems from civilian vehicles.

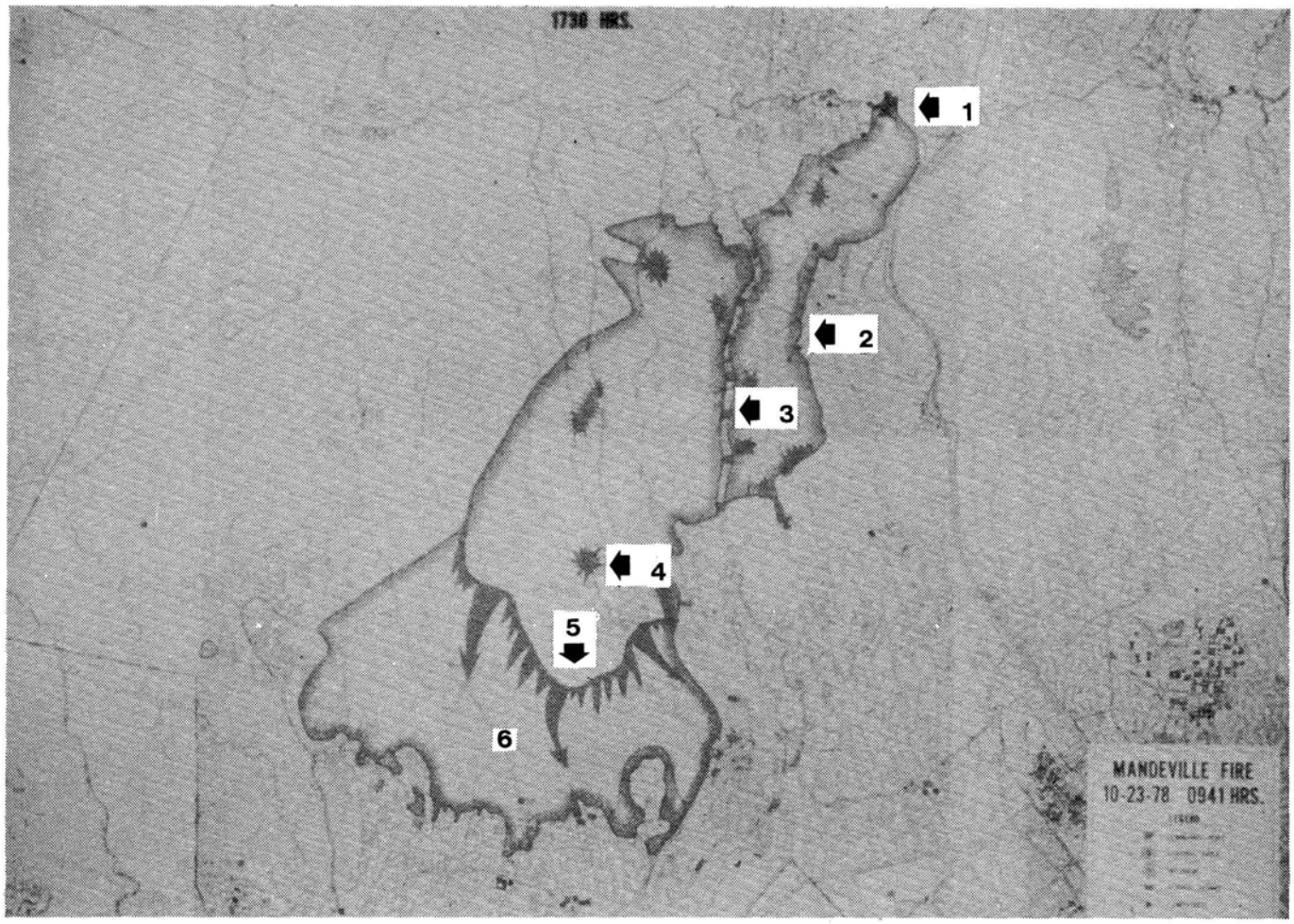

Figure 4—At 5:30 pm the fire was making a tremendous surge towards Pacific Palisades. (1) Fire start, (2) Fire boundary, (3) Mandeville Canyon, (4) Hot spots, (5) Fireline at 5:30 pm, (6) Pacific Palisades

1230 Hours

At 12:30 pm Division "A" had the fire north of the Mission Canyon Dump area under control, but the fire south of the dump was still out of control. Division "B" was deploying companies to control the southeast flank of the fire which was spotting in many areas. Division "C" faced fire on a broad front. Approaching Mandeville Canyon from the northeast, the fire at this time was approaching structures in the 3200 block.

At 1 pm strike teams and individual companies were being deployed into the following areas: Mandeville, Bundy, Kenter, and Mount St. Mary's. Division "A" was moving south on East Mandeville Fire Road. Division "B" was concentrating on the Bundy/Kenter areas. The fire, at this time, had spread over the east side of East Mandeville Fire Road and was moving towards the north ends of Bundy and Kenter Canyons. Division "C" had companies engaged in structure protection in the 3200 block of Mandeville.

The area west of Mandeville was being surveyed for future fire activities.

1330 Hours

At 1:30 pm in Division "B", the fire was moving steadily towards Kenter and Bundy Canyons where companies were deployed awaiting the fire. A fuel break was now being constructed at Hollyhock and Mandeville Fire Roads to control the north extension of the fire. Division "C" requested additional companies to augment the eight strike teams already deployed. The fire was at Mandeville and Merrimac Road and structures were exposed in the 3100 and 3400-3500 blocks. Helicopter 2 was forced to make an emergency landing due to an engine malfunction.

At 2 pm a fourth Division (Division "D") was activated for the south and west sides of the fire. Companies assigned in Division "C" were now actively involved in structure protection. The fire was burning down to the rear of structures in several areas. Attempts were made to hold the fire on the east slope of Mandeville Canyon, but at 2:30 pm the fire spotted and jumped the canyon to the west slope in the 2800 and 2900 blocks.

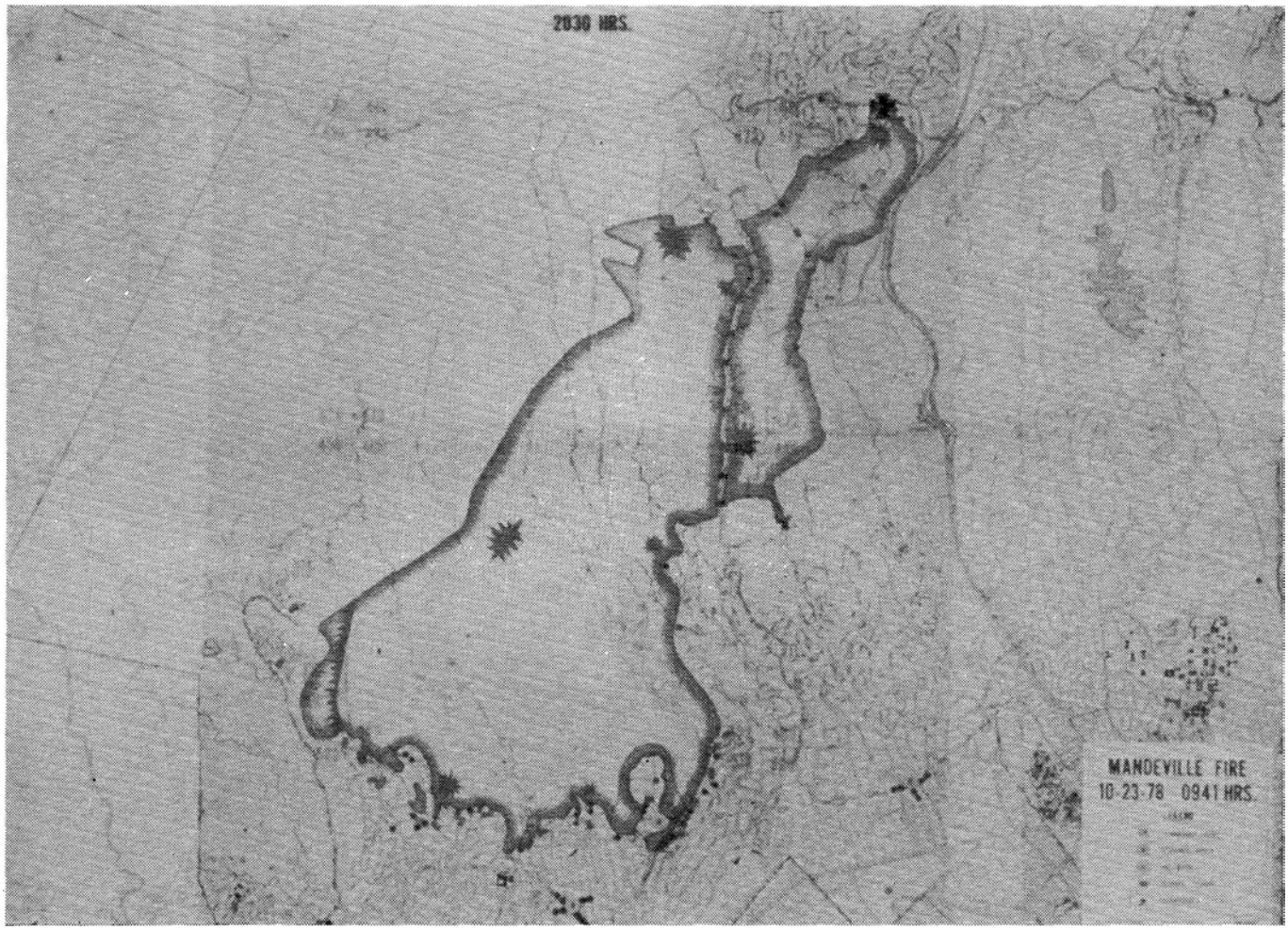

Figure 5— At 8:30 pm, as a welcome off-shore breeze hit the area, the fire was almost contained.

1430 Hours

At 2:30 pm a new fire line was planned southwest of Mandeville to protect all structures on the canyon roads north of Sunset Boulevard. All available strike teams and companies were being located and contacted for reassignment. The resource commitment at this time was eighty-five companies, five helicopters, four bulldozers, and twenty-one command officers. At 2:57 pm Helicopter 5 crashed near the helibase with the helicopter suffering major damages.

Division "C" had all strike teams in Mandeville Canyon involved in heavy firefighting activities on both sides of the canyon. The fire had advanced over the west side of the ridge and was threatening the Westridge Community. Division "C" had moved to that area to command operations and requested additional companies for structure protection.

Division "D" observed the western spread of the fire and advised the Incident Commander that he would need at least five strike teams to cover the Palisades areas.

At 3 pm the fire had jumped the Sullivan Fire Road and was now in Rustic Canyon. Division "C" was directing firefighting operations in both the Mandeville and Westridge areas. One dwelling located on the end of a private road at 3351 Mandeville Canyon was destroyed.

Division "D", now located at Fire Station 69 (15045 Sunset Boulevard), set up an additional staging area. Strike teams were directed out of the Bundy, Kenter, Tigertail, and Mt. St. Mary's areas to reassignments further west in the Rustic Canyon area.

1530 Hours

AT 3:30 pm the fire was coming out of Sullivan Canyon and was entering the northeast side of Rustic Canyon. Rustic Canyon was evacuated and the decision was made not to send resources into upper Rustic Canyon. Twelve structures burned in this area, many of these in Camp Joseph (Boy Scout Camp).

Division "D" had planned for the advance of the fire and the deployment of strike teams into the Rustic

Canyon area.

At 4 pm the head of the fire was advancing down into Rustic Canyon, was travelling south and west near the Camp Josephino area and was moving south around the Westridge area. The resource commitment was 105 companies, four helicopters, four bulldozers, and thirty command officers. Companies assigned to the northeast perimeter of the fire were continually working on flare-ups in inaccessible areas and maintaining perimeter control.

Division "B" had individual companies deployed in strategic locations ahead of the fire in the Bundy/Kenter area in anticipation of the potential southeast extension of the fire.

The fuel break had been successfully completed at Hollyhock and East Mandeville Fire Roads, and control was maintained at that point.

Division "C" had nine strike teams committed in Mandeville Canyon and one strike team in the Westridge area. The fire was moving around Westridge and exposing structures on La Condesa and Pesquera Drives.

Division "D", located at Fire Station 69, assigned five strike teams ahead of the fire to Altamura Drive, Casale Road, Chautauqua Boulevard, Marinette Road, and Sullivan Canyon.

1630 Hours

At 4:40 pm the head of the fire was continuing south and west on a wide front in very heavy brush, down Rustic Canyon and along the Westridge area. Flare-ups continued in the north perimeter but were being controlled by the companies stationed there. Division "B" released more companies as the fire moved slowly down toward Bundy and Kenter Canyons.

Division "C" began releasing companies, as they became available, to the staging area at Fire Station 19 for fuel, equipment, and reassignment to the Palisades area.

At 5 pm the fire was moving out of Rustic Canyon and into the Palisades along Cheryl Place and Bayliss Road. Division "B" was maintaining some protection in the Bundy/Kenter areas as the fire continued to burn slowly down the canyons. Three strike teams were deployed east of Rustic Canyon. The fourth strike team attempted to get up Old Ranch Road but was blocked because of spectator's vehicles. The companies arriving at the Fire Station 69 staging area were used to respond to local fire calls and fill incoming strike teams.

Resources committed to the fire at this time: 112 fire companies, four helicopters, four bulldozers, and thirty-two Chief Officers.

1730 Hours

At 5:30 pm the fire had made a tremendous surge towards the Palisades. The Incident Commander in a helicopter reported that a two-mile fire front was moving towards the Palisades area and that all available companies were to be dispatched into the area. The fire crested near Temescal Canyon and approached the reservoir at the end of Chautauqua.

Another strike team was released from Mandeville Canyon. The fire continued to flare-up threatening the southeast flank toward Bundy and Kenter Canyons. The strike team in the Westridge area was protecting structures. The fire was moving rapidly towards the strike teams deployed on Casale Road and Alta Mura Drive where strike team leaders requested additional companies.

Two strike teams were enroute to the Palisades from Fire Station 19 as another one was preparing for response from that staging area. Division "D" requested all available companies into the Palisades area where one strike team was presently deployed.

At 6 pm conditions in Division "D" had become critical. The need for additional resources was stressed. Division "D" planned to deploy companies ahead of the fire at exposed structures in the Palisades, but movement of companies was not keeping up with the extensive, fast moving fire front.

An additional strike team was deployed on Bienvenida Avenue as two more were enroute to the area from Fire Station 19. Two more strike teams were released from Mandeville Canyon to Fire Station 69 to refuel and regroup for assignments. Five strike teams still remained in Mandeville Canyon. Some of them were in the process of picking up hose lines while others controlled residual fires.

Because of the fire movement southward and the potential extension to the west, plans were developed for moving the Command Post from Fire Station 109 to Fire Station 23 and moving the helibase on Mulholland to the polo field at Will Rogers Park.

The resource commitment to the incident was 125 companies, three helicopters, four bulldozers, and forty command officers.

1830 Hours

At 6:30 pm strike teams were deployed to Bienvenida Avenue, El Medio Avenue, and Lachman Lane. Structures were burning in these locations as well as the Conference Grounds, where one company was attempting to protect the area. Structures were also burning in Rustic Canyon. Fire storm conditions developed and hit the homes with the accompanying fury of flames, burning embers, and driving winds.

Resources were working on El Medio where three roofs were well involved. Roofs were burning on Palisades Avenue and Anoka Drive. More help was requested. The fire was nearing the structures in the Chautauqua area as companies were in position for the attack.

Numerous roof fires were reported on Bienvenida and Lachman Lane, but damages were minimal as strike teams, residents and volunteers controlled the

fires. The intensity of the fire was hitting Casale Road and Alta Mura Road. Companies were moving from place to place to provide protection along this fire front.

Additional companies were released from Mandeville Canyon to report to Fire Station 69 for assignment. The strike team in the Westridge area was released for reassignment. Flare-ups on the north perimeter continued throughout the later stages of the fire causing a potential threat in that area and to the homes to the north.

By 7 pm the fire extended from Mandeville to the Palisades and resources were spread very thin over the extensive area. The command post was now in operation at Fire Station 23, and three helicopters were being supported by the Helibase located in the Will Rogers polo fields. The fire front hit hard from Rustic Canyon to Lachman Lane and continued its westward movement, posing a potential threat to the Palisades Highland area.

Flames were reported to be 60 to 100 feet high as the fire involved the north end of Alta Mura Road. Roof fires started on San Onofre Drive. The fire was also threatening homes on Amalfi Drive.

The combustible roofs of St. Mathews School and Church, remote from the immediate fire front, were burning. Three companies responded and found three separate structure fires burning simultaneously and all well involved. Structures were being protected, as best as possible, on Lachman Lane, El Medio Avenue, the Conference Grounds, Monument Street, and Chautauqua Boulevard as an additional strike team arrived to assist on Chautauqua where some roofs and fences were burning.

1930 Hours

At 7:30 pm the fire front was burning around structures from Charmel Lane to Alta Mura Drive and in some areas had spotted well ahead of the fire front into the residential district. On the western flank, the fire had jumped the Split Rock Fire Road at Charmel Lane. Concern over the westward extension of the fire was increasing. Two additional strike teams were now deployed on Lachman Lane and Jacon Way to assist the strike team in that area.

A strike team had responded to Rimmer Avenue, Temescal Canyon Road and El Medio Avenue and deployed companies to extinguish burning homes and to protect exposures. Additional homes were reported to be burning on Las Lomas Avenue and Las Pulgas Road. Additional strike teams were urgently requested to both areas. Houses were burning on Monument Street as companies were deployed at various locations to protect structures.

The fire was moving down Rustic Canyon between Evans Road and Amalfi Drive. Homes were being protected as the fire moved on. Additional companies were needed on Evans Road to protect endangered structures. At Alta Mura Road and San Onofre Drive, numerous roof fires were being caused by winds and flying brands. Two strike teams were enroute to the Palisades Area, and two strike teams were also released from Mandeville Canyon.

At 8 pm another Division was established (Division "E") to encompass the area from Sunset Boulevard to the north end of the Palisades Highlands along Palisades Drive. The objective was to contain the fire on the east side of Santa Ynez Canyon and prevent the spread north above the highlands and to protect structures within the area. Two additionals strike teams were deployed into the Palisades Highlands.

Two strike teams were deployed to the burning homes on Las Pulgas Road and Las Lomas Avenue. Several homes were involved and destroyed prior to their arrival. Las Candas Road also had homes involved on arrival. Companies on Oracle Place, Marinette Road, and Goucher Street were still involved in structural fire fighting.

Some dwellings on Charmel Lane were exposed to the fire as companies in the strike team were forced to draft water from a small reservoir due to very low hydrant pressure. Evans Road and Will Rogers Park were threatened as the fire continued through Rustic Canyon. One strike team was deployed in the park, and two strike teams and additional companies were deployed along both sides of Evans Road as the fire hit. Another stike team was released from Mandeville as a minimal force was maintained in that areas for protection. The resource commitment at this time was 143 companies, three helicopters, four bulldozers, and forty-five command officers.

2030 Hours

By 8:30 pm the fire continued to burn toward the Palisades Highlands, but at a reduced rate, as the winds diminished considerably. The fire in the lower end of Rustic Canyon was being controlled and many exposed structures saved. Spot fires occurring at the southeast corner of the polo grounds were handled by helicopter drops and engine companies. Most companies were now engaged in extensive mop-up operations and controlling flare-ups as the critical fire threat had passed.

At 9 pm the fire had reached the eastern ridge of Santa Ynez Canyon. All structure fires were controlled, and companies started to gather their equipment and take a breather. As a welcomed off-shore breeze hit the area, the fire quieted down into random hot spots and flare-ups through the balance of the night.

Total commitment to the fire: 157 Fire Companies, sixty support apparatus, and forty-nine command officers..

*** FIRE TERMINOLOGY—Strike Team: 5 engine companies commanded by a Battalion Chief; Flank: Side of fire; Head: Front of Fire; Division: Major geographic area commanded by an Assistant Chief; Incident Commander: Fire Department in command of overall incident.**

The Recurrence of Fire and Flood Problems on Chaparral Covered Land The Stages and Their Recognition[1/]

Paul J. Zinke[2/]

Abstract: Historical experience of the recurrence of fire and flood on chaparral covered watershed lands in Southern California is described. The process is a cycle with various stages beginning with fire burning the protective watershed cover followed by: the period of minimum protective cover leading to soil erosion and flooding, the regrowth of protective cover with increasing biomass-fuel and associated fire hazard, to the inevitable ignition and conflagration completing the cycle. The various stages and a guide to fire or flood hazard recognition are presented. The cyclical nature of the sequence dictates that management for fire control and reduction must include forest and range management in the stages related to biomass-fuel control as well as the fire control efforts needed at the time of conflagration. A balanced program is needed in suburban areas of Southern California to minimize hazards to life and homes and to achieve reasonable control over this cycle.

Introduction

Many residents of Southern California face the problem of recurring hazards of fires, floods and debris deposition from wildland watersheds, and associated events such as the mass sliding of hillslopes, and extended drought.

These events have occurred in California for historical time, and all are well recorded in the history of our landscape. Whether we read newspapers of the last century, or the present decade, we find similar headlines outlining the catastrophes of forest, brush, and grassland fires, and of floods accentuated in their effect because of fire denuded watersheds. However, as California's population has increased, there have been increasing losses in life and property. The increased deadliness and costliness of these recurring events requires more attention to all stages of the fire-flood cycle.

What is the process of these recurring hazards? Can the homeowner identify the susceptibility of his or her property to such hazards? Is there anything which can be done to mitigate such hazards? Where can information be found concerning these recurring events?

Many of these questions will be answered in this and other papers from this conference. This paper will discuss the nature of these recurring hazards, and present a way for the homeowner or prospective buyer to recognize the current stage of the hazard on the surrounding land.

Recurring Fires and Floods

In any past decade one can find headlines in the newspapers proclaiming the emergency created by wildfires and the possibility of uncontrolled runoff of flood waters, mud, and detritus.

For example, in 1962, Los Angeles County Supervisor Ernest E. Debs issued a proclamation declaring the county a disaster area due to damages sustained from flooding. He noted in this proclamation that Los Angeles County "is presently a high-risk flood area due to recent catastrophic fires" (*L.A. Times* Feb. 16, 1962 pp. 30). Record amounts of precipitation of more than 24 inches had falled in two weeks in the western Santa Monica Mountains. The coincidence of fire denuded watersheds and heavy rainfall intensities was repeating typical Fire-Flood sequences which lead to disasters in Los Angeles and adjacent counties.

These emergencies have been recognized since the earliest times in California. In May, 1793, Governor Arillaga issued a proclamation prohibiting any type of burning of brush or grass, and detailed the taking of appropriate measures to stop fires (Clar, 1959).

The recurring hazards we face are those of fire

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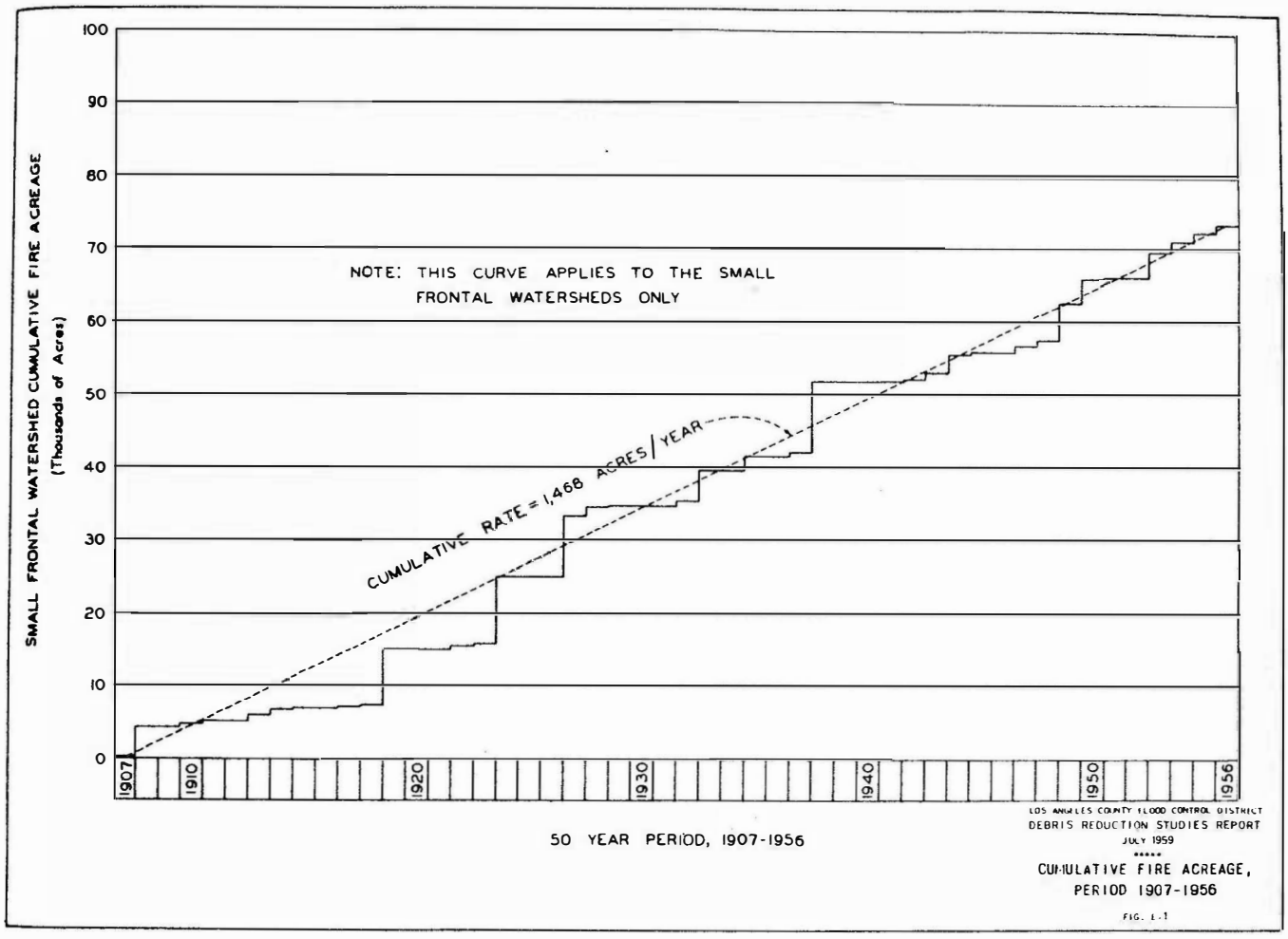

Figure 1—Average Annual Rate of Burn

hazard in chaparral and brush and associated dense vegetation; and the flood hazard due to intense rains on burned over watersheds. Every home and business in our hills and mountains and their fringe areas is susceptible in some degree to loss or damage related to these events.

What is the process which leads to this combination of recurring hazards?

The Fire-Flood Sequence

The experience of centuries of California history has taught us the details of the Fire-Flood sequence. The steps in this sequence are as follows:

1. The burning of inflammable watershed brush, forest, or grass cover.
2. The erosion of the unprotected soil during rainfalls of high intensity.
3. The high flood peak flows of the streams and the large amounts of debris transported by them when the watersheds are made bare by fire.
4. The gradual regrowth of the chaparral cover and its protective influences in reducing erosion and flood.
5. The buildup of flammability due to growth of biomass-fuels (trees, brush, and grass) and the inevitable ignition of the biomass-fuel when climatic conditions are most conducive to spread.

What are the details of this sequence and what have we learned through centuries of living with it?

1. Fire

The Fire-Flood sequence begins with the burning of the highly flammable protective cover of chaparral or brush on our mountain watershed. As mentioned before, this flammability was recognized by the earliest Spanish Governors and gave rise to proclamations prohibiting the use of fire during hazardous seasons. Recently many homeowners in fireprone hill areas have had experience with such fires.

Despite emphasis on fire control activities, the average annual rate of burn of watershed lands in the suburban areas of Los Angeles County has maintained a relative steady rate. Illustrative of this are the data presented in *Figure 1*.

The cumulative area of burned frontal watershed lands in the Angeles foothill areas of Los Angeles County is shown from 1907 through 1956. A period of fires of small size is followed by catastrophic fires of large size. When only fire control is practiced without the necessary biomass-fuel forest management, the

result will be larger conflagrations coming at less frequent intervals determined by ignition and conditions that are more extreme.

The most serious problem is in the growth and accumulation of biomass-fuels in areas adjacent to homes. The recent Baldwin Hills Fire in Los Angeles City (July 2, 1985) serves as a good case study of such a situation, in which a large bed of biomass-fuel (mustard, chaparral broom, landscape vegetation) developed below a line of houses. Following the inevitable ignition of the biomass fuel bed under adverse climatic conditions a long block of homes (another dense form of fuel) ignited. Fire fighting equipment could not be brought up the street quick enough to control the fire spread along wood shake and wood shingle homes and not close enough to be effective because of the heat produced. The homes became part of the fuel bed, and with nearly simultaneous ignition of the first rows of homes located in the path of the fire front in the biomass-fuel, the radiative heat of the burning fuel masses was too great to allow ready access of ground based equipment. This radiative heat load is a factor in combustion of large quantities of biomass fuel as well.

Extensive biomass-fuel beds have megaton quantities of combustible material which will burn within minutes during a conflagration. An overmature cover of chaparral may have as much as 48 tons of standing brushy biomass-fuel, and another 40 tons of deadwood, twigs and leaflitter on the ground (Zinke, 1982). Every acre that burns clean with nearly 100 tons of biomass-fuel turns into a conflagration when it is extended to hundreds and thousands of acres.

Complete fire protection must incorporate a *Forest and Range Management* phase which reduces the catastrophic potential of this stage of the fire-flood sequence.

The homeowner can also do much at this stage to reduce the hazard potential immediately around the house by removing fuels and keeping roofs free of flammable materials. The overall reduction of hazard in a neighborhood necessitates a community *Forest and Range Fuel Management* Program.

The event which ignites biomass-fuel may occur at any time with the probability depending upon the type of ignition. The types of ignition range widely from powerlines falling during windstorms, automobile collisions, house fires escaping into the brush, children playing with matches, arson, cigarettes, and many miscellaneous possibilities, each with varying probabilities of occurrence. The longer the period between fires, the more biomass-fuel acumulates. Weather conditions with low humidity and high winds increase the potential of the resulting conflagration.

After the inevitable ignition has occurred during extreme fire weather conditions with extensive biomass-fuel accumulations, fire fighting activities are at a disadvantage. A critical element in reducing the hazard of such conflagrations is in the *Forestry and Range Management Phase* of biomass-fuelbed reduction. This is necessary locally around each home, and regionally over entire watersheds. The homeowner plays a vital role in recognizing the fuel hazard of the vegetation surrounding the home and reducing the amount of this biomass-fuel.

2. Soil Erosion

The shallow, light textured soils and steep slopes of most of our mountain watersheds result in an extremely high soil erosion hazard when the protective cover of brush has been removed by fire. This erosion hazard remains until bare ground is covered by protective vegetation.

While the ground is barren, erosion will occur even without rain (Anderson, Coleman, Zinke 1959). Immediately after fire dry ravel of soils from the steeper slopes occurs. This moves soil down slopes and into stream channels. Cones of loose detritus deposited in stream channels become subject to erosion by flood water.

3. Flood

When high intensity rainfall occurs on the barren slopes of high erosion potential soils, much of the water flows as surface runoff on the soil surface. Poorly wettable soil conditions frequently follow the fire and accentuate this initial rapid runoff. Additional soil is transported from the slopes to stream channels, and these channels are filled with running water which cuts into the loose debris cones created by the dry creep of materials. As early as 1885 accounts of such erosion following removal of the protective brush cover due to fire were reported in the *Los Angeles Herald* by Abbot Kinney (1886). This extreme erosion potential creates a hazard of debris flows and deposition of mud and detritus on homesites and lots following fires on adjacent land. The greater the present urban development on the lands below, the more damaging these processes become.

Similar, removal of watershed cover along Soledad Canyon by fire in 1884 caused the washout of the Southern Pacific Railroad in the canyon due to the floods of debris and water originating from the burned area (Kinney, 1900). A sequence of events in 1978 brought about a similar occurrence, washing out the railroad again, and also portions of the highway along the river in Soledad Canyon.

In areas of Pasadena and Altadena which were citrus orchard land in 1886, Mr. Craig of the Hermitage Ranch found that when the brush cover on the watershed of the stream on his ranch was burned over, deposits of sand and boulders up to 16 feet in depth followed in the subsequent flood. This sequence was so serious to the Citrus Industry, that Abbot Kinney in a talk to the second Citrus Fair in Pasadena said that the success of the Citrus Industry was "closely connected

with the preservation of our forests and brushland on our mountains" (*Los Angeles Herald*, March 18, 1886, p. 6).

A study by the Los Angeles County Flood Control District (Ferrell 1959) bore out these observations by showing that burning the chaparral cover on watersheds in the Los Angeles County area will increase sediment yields by 20 times that from the unburned brush covered watershed. Each square mile of burned watershed land may produce from 100,000 to 200,000 cubic yards of sediment per square mile to be deposited upon lands below when a heavy storm occurs. Costs of such debris removal are extremely high in developed areas.

This phase of the Fire-Flood sequence is also a matter of probabilities. The possibility that an intense flood may occur depends upon the occurrence of a storm that may normally happen only every 10, 25, or 50 years. However, if a fifty year storm occurs on a watershed recently denuded by fire, then it is highly probable that the complete fire-flood sequence will occur.

4. Regrowth of Protective and Flammable Chaparral

The Fire-Flood sequence enters the next stage with the gradual reduction of the large amounts of flood water and detritus from heavy storms as the burned chaparral regains a protective cover over the watershed. This was noted as early as 1883 by Mr. Canfield, a Superintendent of the Mission Water Company near Santa Barbara (Kinney, 1886). He wrote that following a fire in 1883, which had destroyed a portion of the chaparral cover on Mission Creek, the result was a reservoir choked with sand and boulders, but the chaparral eventually had started a new life, and in unmolested condition reclothed the watershed slopes.

The Los Angeles County Flood Control District study carried out by Ferrell (1959) indicated that usually a 100% recovery of the chaparral could be depended upon eight or ten years after fire; with a fifty percent recovery of the protective function in two to three years.

Table 1

Stage	Duration years	Fire Hazard	Flood-Erosion Hazard
I. Postfire ashbed. Bare soil.	0-1	very low	extreme
II. Herbaceous vegetation, resprouting chaparral.	1-3	low-moderate	high-moderate
III. Short-lived woody perennial phase. Closing of canopy by hard chaparral species.	3-7	moderate	moderate
IV. Young, closed canopy, of hard chaparral. Little dead wood.	7-15	moderate	low
V. Old closed chaparral cover; much dead wood and detritus.	15-ignition	high-extreme	low

The Stages of the Fire-Flood Cycle on wildland watersheds covered with hard chaparral vegetation and affecting suburban Southern California.

There are watershed *Forest and Range Management* activities that can minimize the excessive erosion and sediment of such an event, and these need to be incorporated in the programs of appropriate agencies. The goals of the management activities are needed to maintain maximum protective cover consistent with minimum fuel hazard. These objectives pose an obvious dilemma since the more protective cover the greater the biomass-fuel quantitites. The professional forest and rangeland watershed manager needs to make correct decisions for critical measures needed to assist the public in maintaining a balance between hazard and protection.

5. Recurrence of the Flammability of Chaparral Cover

The regrowth of the chaparral cover brings back the regime of clear streams with a minimum of sediments but also increases the fire hazard as chaparral ages. Now, with our longtime history of settlementsince the mid 1700's we have a well documented history of recurring fire in these chaparral watershed covers. Barrett (1935) reported recurring fires in the Santa Monica Mountains in September 1885; June 1887, October 1887, and September and October 1891. Many of these fires destroyed homes and resulted in deaths. Ferrell (1959) documented that from 1907 to 1956 in an

area of 24,848 acres in the Santa Monica Mountains, 14,475 acres had burned over; an average of 290 acres per year. An average recurrence interval of fire on any particular area was from 25-27 years. These studies have been verified for the Santa Monica Mountains by Radtke, Arndt and Wakimoto (1981) who showed that the acreage burned follows a predictable cycle and that large scale fires are also predictable. The homeowner has the specific obligation of complying with state and local ordinances regarding the removal of flammable and hazardous materials in preparation of each year's fire season. This should be done in a way which does not accelerate the erosion and flood cycle through the excessive removal of the protective vegetation cover on steep and erosive slopes. Guidelines for accomplishing this have been published by *Forest and Range Management* agencies (Radtke, 1984).

Recognizing Current Hazard

How can the homeowner assess the current stage of the fire-flood sequence and the hazards of either fire or flood and erosion?

The periodic cycle of fire - flood - biomass-fuel regrowth is like a wheel of fortune. Relative high or low hazards for fire and flood damage to the home change with the condition of the vegetative cover on nearby lands in a repetitive cycle. The homeowner can evalute the stage of the vegetative cover that is present on local areas as an index to the relative hazard.*Table 1* shows the stages, their duration, and the relative fire or flood-erosion hazard associated with them.

At any stage, ignition of biomass-fuels will return the land back to Stage I, repeating the cycle. This is the usual cycle with sprouting woody chaparral present. Grassland without brush will go through a shortened cycle involving only stages I and II with the flood-erosion hazard not as extreme because of the quick reestablishment of a protective soil cover with native or naturalized grasses. The soft chaparral/coastal sage vegetation will also go through a shortened cycle with a high fire hazard already returning within 5-10 years after a previous burn.

The homeowner can often ascertain the nature of the hazard from a backyard view. Hazards will have a seasonal nature such that the flood hazard applies to the rainy season, and the fire hazard to the latter part of the dry season. *Table 1* is a general hazard assessment guide for the wildland areas adjacent to one's property. Conditions may differ directly around the home and site specific management adjustments have to be made to address the specific hazards found here.

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Fire Ecology and Plant Succession[1/]

James R. Sweeney[2/]

Abstract: Descriptions and characteristics of fire type vegetation, plant adaptations, reproductive strategies, and the role of fire in maintaining these vegetation types is discussed. Major emphasis is placed on the chaparral of Southern California with particular attention given some of the major fires in the Santa Monica Mountains. Fire frequency, post burn vegetation patterns, rates of fuel recovery, and sequence of past fire changes in plants are considered. The importance of native plant cover the first season following fires in relation to erosion and soil stability is emphasized. The speaker will attempt to show how an understanding of Fire Ecology can reduce the risks of living at the urban-rural interface in chaparral.

Fire Ecology and Plant Succession

For those living near, or in the chaparral environment a knowledge of and familiarity with the characteristics of fire type vegetation may prove helpful in managing ones environs towards reducing the fire hazard and improving living conditions and keeping the fire hazards to a minimum.

Fire Type Vegetations

In the regions of the world that have Mediterranean climates with cool moist winters and dry hot summers there have evolved very distinct vegetation types that are extremely well adapted to survive frequent fires. Fire has been a factor for many thousands of years and acted as a selective agent on the various plants found in each of these regions. Even though the kinds of plants are vastly different in the different regions, the long periods of selection by fire has produced vegetations that are remarkably similar in appearance although often totally different floristically. Also, there have evolved a number of common characteristics that help to insure survival following fires. The most familiar ones are: sprouting from the above ground stems, sprouting from underground stems, roots, bulbs, corms, lignotubers, etc. and viable seeds remaining in the soil following fires.

The survival mechanisms all sound simple and straightforward, however the plants have very definite requirements that must be met before they will reproduce. For example the sprouting behavior will not occur unless the above ground living parts of the plants are removed or damaged. This can happen in many ways and fire is one of the principal causal agents that stimulates reproduction of perennial forms in fire type vegetations by removing the overstory. At the same time fire removes much of the accumulated organic debris that contains inhibitors to germination and establishment of seedlings. One of the most complex problems is the relationship between fire and seed germination and establishment of seedlings. Annuals and non-sprouting perennials are totally dependent on seeds for reproduction and survival in these fire type vegetations.

The chaparral of California is similar to other fire type regions of the world with one important exception. In the chaparral of California, with the exception of the so called mountain chaparral, there is a well defined herbaceous annual fire type flora. This well defined flora is unique, and, so far, has been encountered only in the chaparral regions of California. It is absent in the maquis of the Mediterranean, the mallee of Australia, the mattoral of Chile and the fynbos of south and southwest Africa. Much of the information presented here is based on observations and data from fire areas in the Santa Monica Mountains.

Adaptations to Fire Environments

Sprouting

The ability to sprout from above ground stems is well developed in a number of species. Tree species that often occur adjacent to or within chaparral recover

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rapidly in one to three years as a result of this ability. The big-cone spruce forests which were burned in the 1975 Mill and Village fires in the Big Tujunga and Mt. Baldy area of the Angeles National Forest have recovered well. *(Figure 1)* The coast live oaks also showed rapid recovery following numerous fires in the Santa Monica and San Gabriel Mountains. This sprouting ability, which is usually absent in most pines, is well developed in Canary Island Pine which has been used for roadside plantings. Some closed cone pines, notably knobcone pine, have been able to co-exist with chaparral because the cones are persistent on the tree and open with fire *(Figure 2).*

Many of the shrub species have the ability to sprout following fires *(Figure 3).* The burnt stems remaining above ground are usually killed and the rapid shrub recovery is the result of sprouts from underground stems or roots, some of which develop large platforms at the base called lignotubers. *(Figure 4)* These shrub species also reproduce in abundance from seeds stored in the soil prior to burning. These reproductive strategies are well developed in chamise, and some of the manzanitas as well as many other chaparral species.

Several species of Ceanothus such as chaparral whitethorn (Ceanothus leucodermis) and greenbark Ceanothus (C. spinosus) are known to sprout after fire. Many other perennials are able to survive because of their underground reproductive bodies such as corms, bulbs, tubers and fibrous root systems which are protected by the great insulating ability of soils. Surface temperatures can reach more than 600 degrees celsius yet 2 to 3 centimeters below the surface often will not exceed 100 degrees. Following the removal of the chaparral canopy by fire, these underground parts sprout vigorously and provide a mechanism to slow erosion and help reduce earth movement.

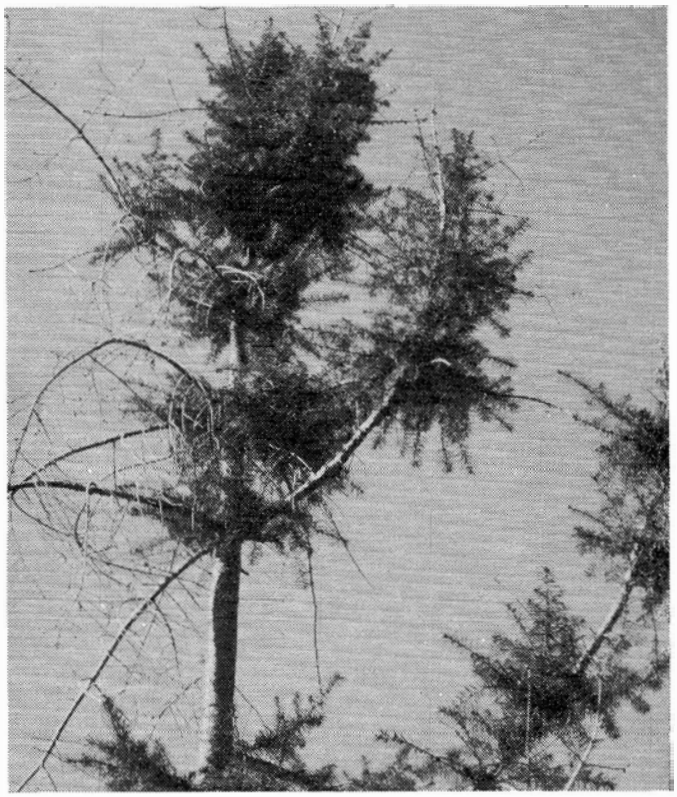

Figure 1—Sprouting in big-cone spruce.

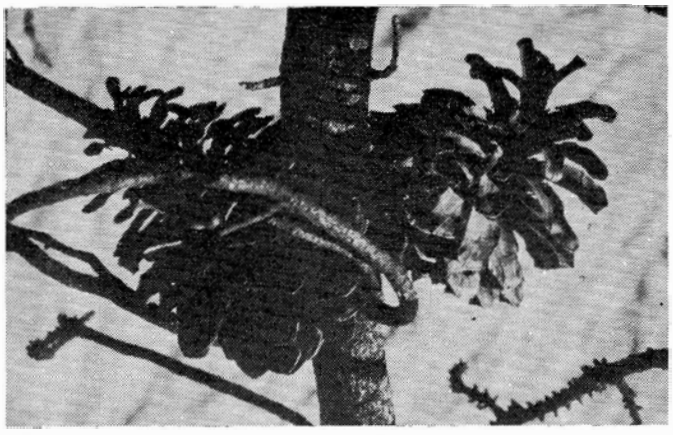

Figure 2—Pine cones opened by the heat of fire.

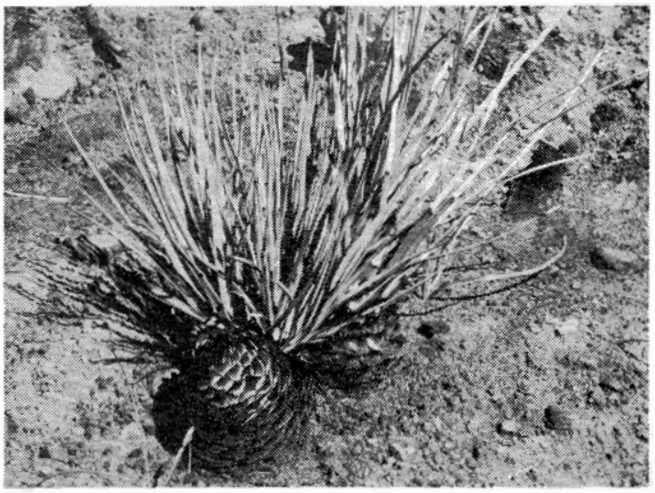

Figure 3—Sprouting in yucca.

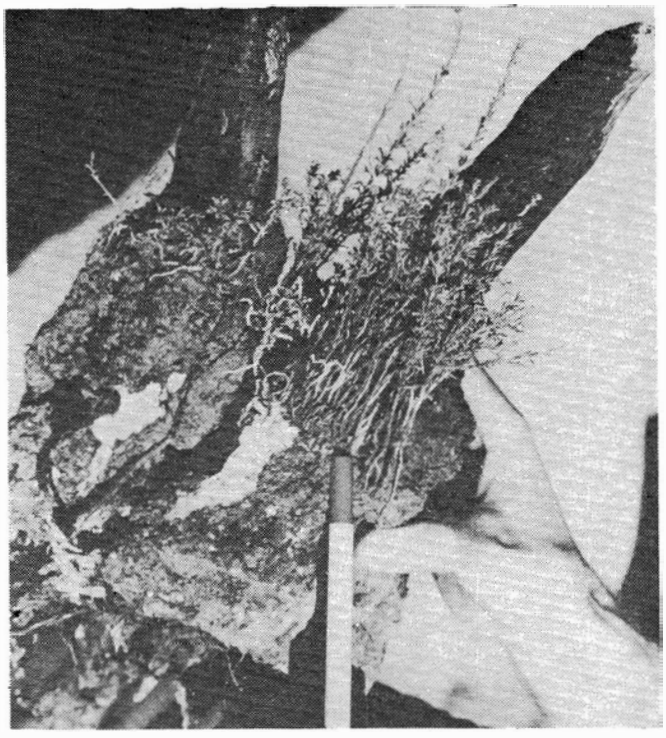

Figure 4—Chamise resprouting from lignotubers.

Seed and Germination Characteristics

As a result of the stringent selective pressures encountered in fire environments, those plants that have persisted in the chaparral have developed various dormancy mechanisms that prevent germination of the seeds under mature stands and provide a seed bank for reproduction and establishment under the many environmental conditions encountered after a fire. The fire acts as an environmental factor which provides the proper conditions for germination and seedling establishment and, along with sprouting ability, sets the pattern for the revegetation of burned chaparral areas. It is the reproduction from seeds that maintains the genetic and species diversity in these areas.

Seed germination behavior of the plants making up the chaparral cover is varied, and in many cases, unknown or at best poorly understood. This is true for most if not all of the chaparral areas of California. There are several types of dormancy exhibited by seeds of these species. The most common is mechanical restriction in which case the seed coats need to be cracked or broken so that moisture and oxygen is made available to the embryo to initiate growth. Some seeds have built-in chemical inhibitors in the seeds that must be inactivated before germination will take place. Others may have seeds with both these characteristics. Still others may not have built-in restrictions to germination but fail to germinate because of chemical inhibitors produced by some of the plants in the overstory such as sages (Salvia), manzanitas or chamise. Some others require certain light intensities for germination as well as for flowering. Other plants such as one of the so called Loco Weeds (Astragalus *congdoni)* and chamise produce two kinds of seeds, those that germinate readily and those that germinate after exposure to high temperatures. My experiments with ash and activated charcoal on germination were negative, however, others have used charred pieces of chamise and produced positive results with seeds from whispering bells (Emmenanthe penduliflora), a common and widespread annual found in most chaparral areas of California.

There seems to be no common denominator for the reproductive strategies of the various species which persist in the chaparral. Working out these strategies for each species is necessary before we will have a clear understanding of the chaparral ecosystem. Suffice to say that frequent and recurring fires provide the stimuli and environmental conditions that maintain the rich diversity in this ecosystem.

Plant Growth and Fuel Characteristics

The shrub species that dominate mature stands of chaparral have small leathery leaves with high concentrations of volatile oils and an ever increasing amount of fine dead fuels. The branching is much divided into small segments which burn readily and

Figure 5—Sprouting of woody plants and germination of light sensitive seeds the first season after a fire.

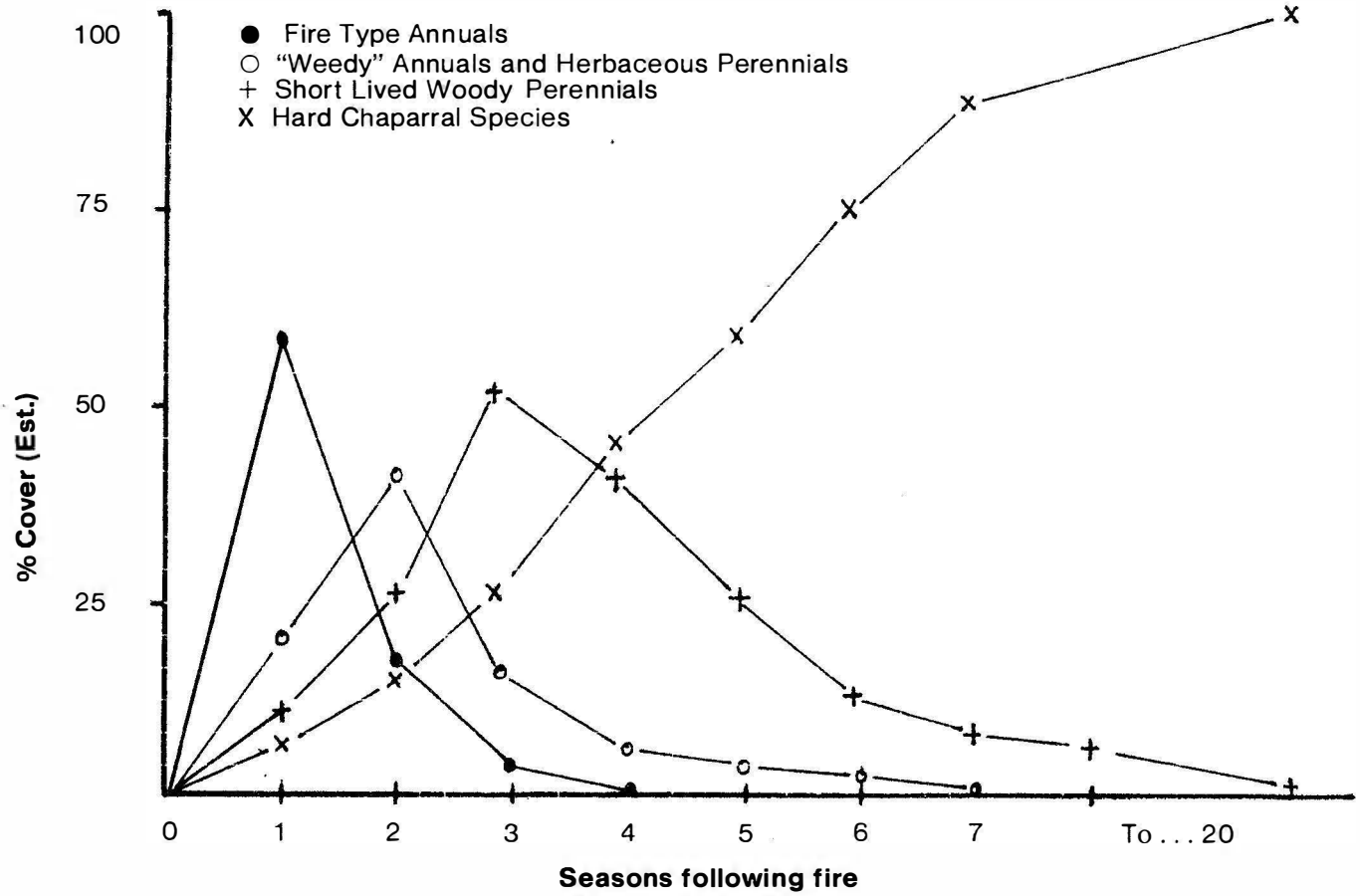

Figure 6—Changes in plant cover following fires.

with great intensity. Fires move rapidly through this dense, and more or less, continuous fuel source. The fire removes most of the overstory and only charred main stems remain above ground. The action of the fire brings about the environmental changes that activate the built-in reproductive mechanisms mentioned earlier and starts the recovery of the burned sites.

Fire removes the chemical inhibitors produced by the plants. The high temperatures stimulate seed germination in many species. These same temperatures open the cones of the closed cone pines so that the seeds can reach the ground for a proper seed bed and establish new seedlings. Also, fire can partially burn and break the seed coats resulting in germination in those species having seedcoat dormancy. Removal of the overstory initiates the sprouting of the perennial forms. In addition, light intensities increase following the removal of the overstory which promotes light sensitive seeds and flowering *(Figure 5).*

The species diversity in old stands of chaparral is generally low and dominated by shrub species. A few individuals usually manage to exist on the edges or in a few open spots within the brush cover. Species diversity reaches its highest level the first growing season following a fire as a result of sprouting and the germination and growth of the stored seeds in the understory prior to the fire. Many of these germinating seeds provide the unique herbaceous annual flora that is found only in the California chaparral. However, the populations of the perennial species are also rejuvenated by seed germination and establishment of new seedlings.

Changes in Plant Cover

The patterns of recovery following fire are most often referred to as plant succession. Studies on several of the major fires in the Santa Monica and San Gabriel mountains shows this so called succession to be more in the nature of changes in dominance than a true replacement of species *(Figure 6).* Most species are represented in any given area whether it be seeds in the soil or the occasional plant besides a trail or other disturbed areas in or near a mature stand of chaparral.

The 1970 Wright Fire which started at the Ventura Freeway in Agoura and burned south to the Pacific Ocean as well as earlier fires can be used to illustrate these changes over a 15-30 year period. The first year after the fire many areas of the burn were covered with a spectacular display of wildflowers, few of which had been seen in the area prior to the fire. *(Figure 7)* Although most chaparral species were present the first year after the fire the plant cover was dominated by the

Figure 7—Wildflowers in full bloom the first season after a fire.

herbaceous flora. Many of the herbaceous elements declined or disappeared after the first season. By the end of the third year most of the herbaceous flora had vanished and was only represented by a few plants scattered about in open areas *(Figure 8)*. There were many short-lived shrubs and sub shrubs that dominated the cover from the third through the seventh year *(Figure 9)*. After seven years the cover was dominated by the same groups of species that were present in mature chaparal stands prior to burning. The changes that occur in the numbers of individuals in the different species are usually the result of changes in dominance of species rather than a change in species composition through time as in true succession. *(Figure 10)*

These changes in species dominance and patterns of vegetation cover on the burned areas were repeated over and over on several areas. In addition to the Wright Fire of 1970, similar patterns are being observed on the Trippet Ranch Fire (1973), Topanga Fire (1977), Kanan-Dume and Mandeville Canyon Fires (1978) and the Dayton Canyon Fire (1982).

Species distribution within chaparral areas are not random, but occur in scattered populations on particular slope exposures and also vary according to differences in soils and elevations.

Special Situations

Species Habitats

The habitats of some species may be very specific and unless one knows the localities, it is easy to assume that they are very rare or even endangered. One species, Dicentra ochraleuca, the tall, cream colored "Bleeding Heart," is found on north and east slopes in some of the chaparral localities in the Santa Monica and Santa Ynez mountains. While this species is listed with other Dicentras as a perennial, its behaviour is that of a biennial. The seeds germinate the first season, the plants flower the second season and are dead by the third year. The yellow flowered Dicentra chrysantha which was not encountered in the Santa Monicas, but was common on the 1975 Mill burn is a true perennial and survived for several years. Unless one knows when and where to look, Dicentra ochraleuca is rarely found. The same is true for the fire poppy, Papaver californicum, which is a delicate small annual which is in abundance only the first year following fire. Many of the fire type annuals become rare or disappear the second year after a burn. It is this kind of reproductive behavior that gives us the beautiful displays of wildflowers the first and sometimes second spring after wildfires in the chaparral.

Prescribed Burning

Most fires occur during the hot dry season and burn with considerable intensity. Thousands of years of selection by fire has produced these fascinating groups of species with their special adaptations for survival and perpetuation in areas where fires are frequent and a well established environmental factor. Man has not evolved along these same lines and is able to survive in the same environments only by avoidance and other strategies such as fuel reduction, clearing around homes and special plantings of low fuel type plants. Such methods are being covered by other papers in this symposium.

Fuel reduction can be accomplished by prescribed burning. However, it is risky to burn during the hot, dry season when wildfires usually occur. This problem has led to the practice of burning during the cool, moist season when soil moisture is high. If the moisture content of seeds is 25 to 35 percent of dry weight the temperature tolerance of the seeds drops to levels below the high soil temperatures and much of the seed source for new plants is destroyed. Therefore, wherever and whenever possible, the burning program should conform to the same ecological conditions that gave rise to this unique and diverse vegetation type, chaparral.

Figure 8—Most herbaceous flora had vanished at the end of the third season after a fire.

Figure 9—Six years after a fire short-lived shrubs and sub-shrubs are giving way to woody chaparral.

Figure 10—10-20 years after a fire woody chaparral again totally dominates the site and is ready to repeat the burning cycle.

FIRST POSTFIRE SEASON PLANT ESTABLISHMENT[1/]

Klaus Radtke[2/]

Abstract: Reestablishment of the chaparral cover the first and even the second season after a fire is most critical from both the ecological and management viewpoint. If a cover is established quickly, the potential damage from the fire-flood cycle will be greatly reduced. The expected heavy erosion on fire denuded bare soils will be minimized and the nutrients released by the fire in the form of ash will not be lost to runoff. Also, if a predictable cover reestablishes itself in time for the winter rains, there may not be any need for the widescale aerial seeding of exotic species such as annual ryegrass *(Lolium multiflorum)* in the hope of reducing immediate postfire soil erosion to protect downstream values.

Site specific quantitative data are presented regarding the effects of fire frequencies and/or years since last burn on postfire vegetative cover and floristic changes which should assist in the management of the postfire fire-flood cyles. The data documents that the chaparral ecosystem has a dependable pool of both seeding and sprouting species that reestablish themselves under various fire and postfire conditions. However, the climatic regime is such that neither the native flora nor the seeded ryegrass can reestablish itself quickly enough to provide an effective cover for the heavy winter rains which at times immediately follow a fire.

Introduction

The previous paper on "Fire Ecology and Plant Succession" pointed out that the herbaceous fire-type annuals and short-lived perennials are the dominant plants the first and second season after a fire. Their function is sometimes compared to that of a sponge which quickly absorbs as many of the nutrients released by fire in the form of ash before the winter rains, or even heavy winds, remove much of the postburn ash, often down to mineral soil.

Zinke (1977) summarized mineral cycling in fire-type ecosystems by stating that the positive effects of the large scale nutrient release by fire may continue until the next burn provided the soil has the storage capacity for these elements and there is no excessive loss due to leaching and/or erosion immediately after a fire. The nutrient flush will be followed by a corresponding increase in vegetation and leaf litter storage of these elements. If postfire rains are optimum for an effective cover of herbaceous plants, nutrients will be stored; if heavy rains strike in short intervals, the stage is set for maximum erosion and high nutrient losses. On harsh southern exposures where chamise is present and the soils are generally thin and infertile the site may degenerate even further. A mature stand of chamise can deplete the soil of nitrogen by as much as 250 lbs/acre/year so that most of the nutrients on such a site are tied up in the standing prefire plant material. Fortunately, the heavy nutrient depletion is offset by nitrogen fixing annuals and short lived perennials such as Lupen (*Lupinus* spp.), deerweed *(Lotus* spp.) and woody chaparral species such as mountain lilac *(Ceanothus* spp.) and scrub oak *(Quercus dumosa)* all of which can supply much nitrogen to a site.

Environmental Factors Influencing Plant Reestablishment

Soil moisure is perhaps the most critical factor in quickly reestablishing a dependable postfire plant cover. Distinctive changes in dominant plant life forms are well documented along latitudinal aridity changes. Locally, many environmental factors may also change the soil moisture balance and plant community structure. These abrupt changes over short distances are apparent in slope aspect, slope runoff, drainage patterns, soil texture and soil depth, soil wettability and soil organic material. These changes have been related to strategies of water use by plants.

Postfire soil moisture regimes differ from prefire moisture regimes because soil moisture generally does not drop below the wilting point (point to support plant life) for the first 18 inches of soil depth (Bauer 1936) because the deep rooted overstory has been burned off

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[2/]Klaus Radtke, Ph.D, President, GEO SAFETY, Inc. Pacific Palisades, Calif.

and does not utilize moisture from the deeper soil layers. However, surface moisture is rapidly depleted by the herbaceous postfire flora. If limiting factors such as moisture and light are reduced or eliminated as is the case during the first season after fire, slope aspect, due to insulation by the sun, becomes the most important factor in initial germination and plant reestablishment with seedling emergence being much more rapid on a south slope than on a north slope. If an adequate postfire rainfall pattern of well spaced rainfall supports germination and growth of herbaceous plants, first year cover may be greater on a south than north slope. If, on the other hand, rainfall comes widely interspersed or comes in the form of just a few heavy storms, the thin soils may dry out rapidly, germinating seedlings may die, and the more equitable moisture regime found on a north slope may be responsible for greater cover the season after a fire.

The frequency of fire (or years since the last burn) also greatly influences postfire recovery. Decreased fire frequency may greatly increase fire intensities because of the accumulation of dead fuels and the resulting hot fires which evenly burn many of the seeds at the soil surface. A long fire interval also causes a decline in species diversity, particularly in short-lived shrubs, grasses, and herbaceous plants not only because of their short seed viability when compared to many woody shrubs but also because regeneration of the seed pool of fire type annuals and short lived perennials is fire (or disturbance) dependent whereas mature woody plants produce enough seeds for regeneration almost on a yearly basis. Because of the lack of verifiable fire history and fire mapping spanning at least 50-100 years, these general observations had not been previously quantified. I did this for the Kanan-Dume Fire and proceeded from there. Tarbes (1980) dated the age of the chaparral in relation to the fire frequency maps prepared for this study and found consistent agreement between the fire frequency maps and the biological age of the chaparral.

After the fire history was established, the first year postfire cover in chaparral areas such as the Santa Monica's could be quantified in terms of slope aspect, soil depth, and fire frequency. This study investigated the postfire plant recovery on 640 ¼ m plots located through the Kanan-Dume burn of October 23, 1978 (Radtke, 1981). The study was designed to investigate vegetative cover, floristic changes as well as the degree of these changes and their possible management implications. Replicate test plots were located on north and south slopes as well as side slope to account for differences in the moisture regimes between slope aspects and soil depth from the top to the bottom of slopes.

Fire Frequency and Plant Cover

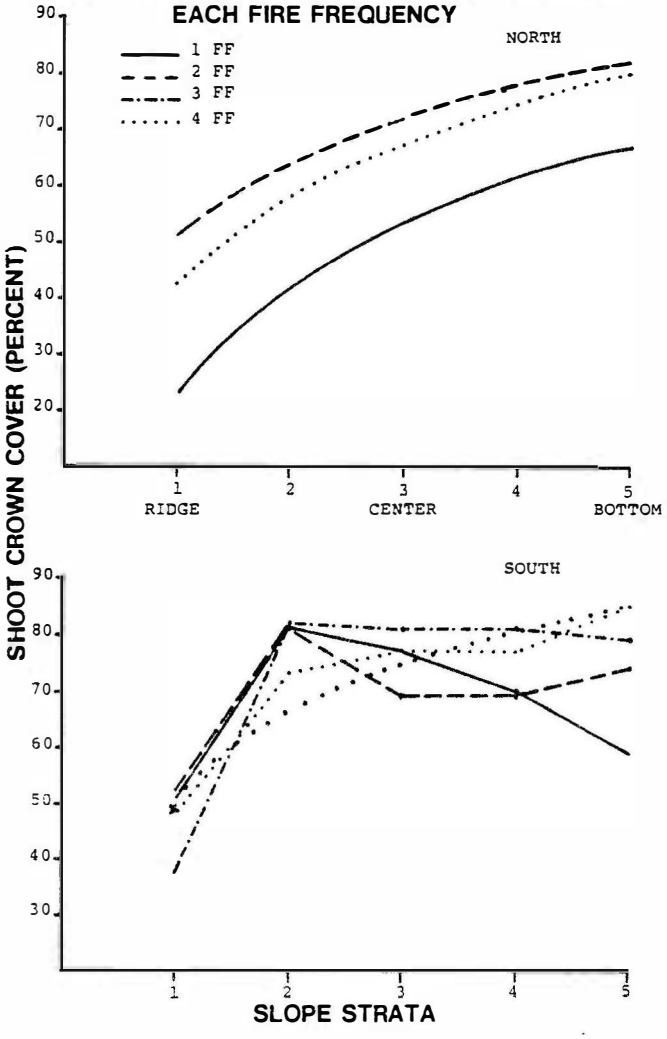
Most of the area of the 25, 285 acre Kanan-Dume burn had burned from 1-4 times since 1903 (1919). These fire frequencies translated into fire free intervals of about 75 (59), 53, 32, and 27 years respectively.

Results of intensive sampling showed that at the end of the first spring after the fire the hot intensity fire area (read fire frequency 1 or no fire for about 75 years) had a significant lower plant cover (59%) than fire frequencies 2, 3 and 4 (68%). When the data was separated by slope aspect no significant differences were found on south slopes where the cover averaged 70%. However, on north exposures the low cover of 50% on fire frequency 1 slopes was significantly lower than the cover on the other slopes which averaged between 65 and 70%.

Next, strata or sampling lines placed sideslope were investigated with line 1 being the ridge top (normally very thin soils), line 3 the center of the slope (deeper soils) and line 5 the top of the slope (where most of the soil accumulates). It was again found that during spring fire frequency 1 had a significant lower crown cover of at least 10% in all strata except the ridge top and the center of the slope. Cover from top to bottom of slopes averaged 40, 54, 70, 64 and 64 percent for fire frequency 1.

Next, for more intensive management purposes, strata were separated by north and south slopes. Again, the south slopes did not show any significant differ-

FIG. 1 AVERAGE SHOOT CROWN COVER: SPRING EACH FIRE FREQUENCY



ences in cover among the fire frequencies but the north slopes did. Here the cover for fire frequency 1 increased from 30% at the ridgetop to 64% midslope and 69% at the bottom of slopes whereas the cover for the other fire frequencies averaged about 20% higher *(Figure 1).* However, on south slopes there was a significant difference in crown cover among the strata with a low cover of 47% found on ridge tops after which the cover increased sharply to 80% in stratum 2 before declining slightly towards the bottom of the slope. The patterns on the north slopes were different with a steady increase in cover from top to bottom of the slopes. The differences shown were also significant in fall.

Next, average shoot crown cover was compared to soil depth as shown in *Figure 2.* Cover for all fire frequencies was separated into north and south slopes for both spring and fall. Soil depth is shown as the right y-axis and average shoot crown cover as the left y-axis. A very good correlation is shown between increase in soil depth, percent cover and slope strata (ridge top to base of slope) both in spring and fall for the north slope. The south slope shows the increase in soil depth from top to the bottom of the slope at a reduced scale due to the more shallow soil depth found on south slopes. This levelling off in soil depth is also found in levelling off in cover. Because of the high correlations between shoot crown cover and soil depth within individual fire frequencies (except the south slope on fire frequency 1) curve fitting for shoot crown cover was done by slope aspect and soil depth for the individual fire frequencies *(Figure 3).* This separates the trends indicated in *Figures 1 and 2.*

FIG. 2 AVERAGE SHOOT CROWN COVER AND SOIL DEPTH: ALL FIRE FREQUENCIES COMBINED

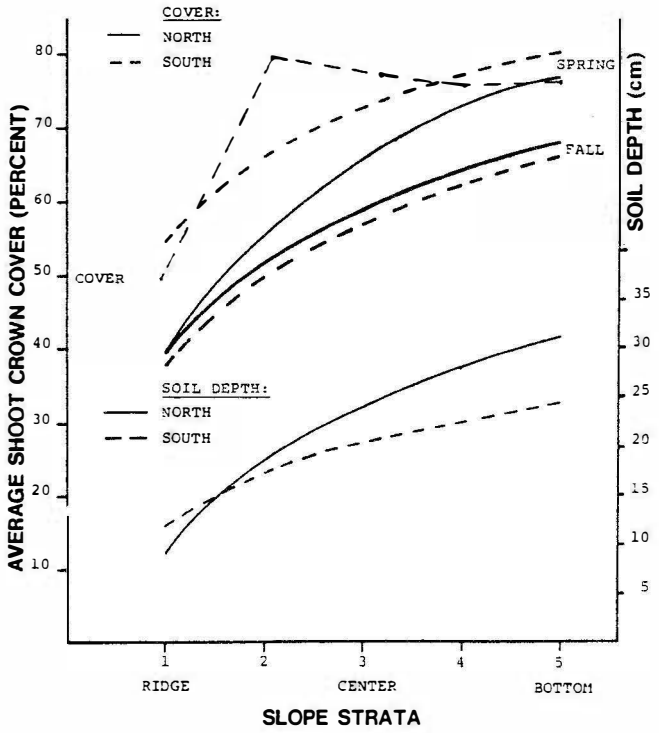
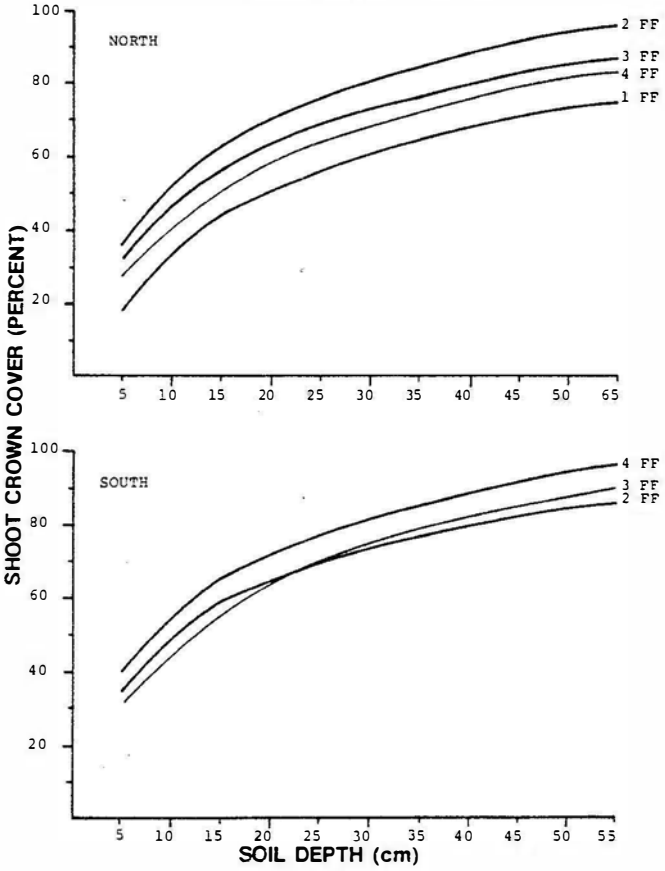


FIG. 3 AVERAGE SHOOT CROWN COVER VS. SOIL DEPTH: EACH FIRE FREQUENCY



Plant Cover Analyzed by Species

While this study also analyzed the total number of species as well as the number of individuals per species, a more important analysis for management purposes is the breakdown of cover by individual species according to the postfire successional trends described by Sweeney and also emphasized by Zinke.

Large, upright herbaceous "fire-type" annuals found on south slopes such as pincushion *(Chaenactis artemisifolia)* and wild canterbury bell *(Phacelia grandiflora),* provide a large cover even when they are found in small numbers. The short-lived postfire perennial species morning glory *(Calystegia cyclostegia)* is found almost exclusively on harsh and disturbed sites, such as most southern exposures and some harsh northern exposures characterized by chamise or disturbance (high fire frequency).

Morning glory consistently provided a large portion of the postfire cover alone or in conjunction with the second postfire persistent but short-lived perennial deerweed *(Lotus scoparius).* By the end of the first growing season both species may provide in excess of 50% cover on southern exposures. Coastal northern exposures, except for the herbaceous perennial vine wild cucumber *(Marah macrocarpa),* the annual miner's lettuce *(Montia perfoliata)* and the postfire herbaceous

annual bleeding heart *(Eucrypta chrysanthemifolia),* do not have species which can provide consistent first season postfire cover on north slopes. Furthermore, the three species mentioned above are only found consistently on more mesic north slopes and vacate the harsher sites to, tenacious bindweed and persistent deerweed. A different picture, however, emerged in ceanothus chaparral communities where greater species diversity in both the number of species and individuals provided a consistently high cover on the lower portions of the slope.

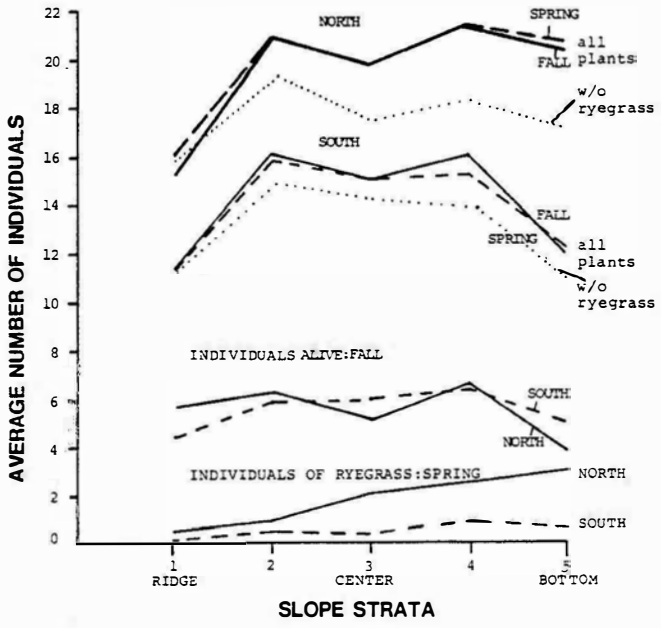
By fall, no differences were found in north and south slope cover because the south cover was reduced by about 20% due to the mortality and decadence of the annual flora as well as the reduction in cover of the short-lived perennials due to drought stress. Postfire fall reduction in cover would be much greater if the woody resprouting perennials would not act as a buffer. As the postfire succession continues, the woody resprouting perennials shift the cover in favor of the less harsher northern exposures so that chaparral succession becomes the gradual ascendence of long-lived species present in the prefire stand as described by Hanes (1971). However, only truly harsh exposures such as are indicated by the presence of Spanish dagger *(Yucca whiplei)* show a persistent lower cover than northern exposures during the second season after fire. Short-lived south slope prostrate perennials, such as bindweed, quickly recover their turgidity with the onset of the winter rains and, along with deerweed, continue to provide a major portion of the cover for several years. First year changes in shoot crown cover between the end of spring and the beginning of fall are summarized as follows: woody based perennials showed a 20% decrease in shoot crown cover, annuals a 30% decrease and herbaceous perennials a 40% decrease. Woody perennials showed a 50% increase.

Crown Cover of Introduced Species

Since ryegrass *(Lolium multiflorum)* was seeded almost indiscriminately throughout the fire area, the effects of ryegrass on plant cover were well documented. *Figure 4* shows the total number of individuals present per sampling unit and then separates the numbers into ryegrass and other species.

In analyzing the data according to field conditions it was found that ryegrass was only well established on harsher north slopes where chamise *(Adenostoma fasciculatum)* dominated. Other north slopes showed less than 1% ryegrass cover except for strata 4 and 5. On harsh north slopes the south slope postfire dominants, except for whispering bells *(Emmenanthe penduliflora),* did not add significant cover and ryegrass could become established wherever adequate moisture was present for its germination and growth. On more fertile north slopes (such as Ceanothus chaparral sites) an abundant native plant cover reestablished itself quickly so that ryegrass cover was primarily compensatory. However, on plots where ryegrass provided most of the cover, such as on moist, fertile sites with deeper soils, herbaceous seedlings as well as seedlings of the woody flora were greatly suppressed. Here, during the second season after fire, new ryegrass seedlings expanded into the areas vacated by the annual flora and further competed with woody chaparral seedlings. In other postfire studies it was also noted that ryegrass can provide a significant cover towards the end of the rainy season on intensively burned north slopes that face a depauperate herbaceous flora. Ryegrass will then compete strongly with the seedling reestablishment of the depressed woody flora.

FIG. 4
AVERAGE NUMBER OF INDIVIDUALS PER SAMPLING UNIT: ALL FIRE FREQUENCIES



On south slopes more than 1% average ryegrass cover on any stratum was encountered on only 3 of 8 sites. More than 5% average ryegrass cover was only encountered on one mixed ceanothus chaparral site. Its cover was mostly compensatory. For example, on one site where ryegrass accounted for 19% cover, resprouting laurel sumac *(Rhus laurina)* accounted for 93% cover.

Postfire Plant Cover, Climate, and Erosion

Crown cover of native herbaceous annuals, biannuals, and aerially seeded ryegrass during the critical postburn months was investigated in relationship to rainfall for the Wright Fire. This fire burned 28,000 acres of watershed cover in the Santa Monica Mountains on September 25, 1970 (Radtke, 1971, 1975). The results of this study showed that under optimum conditions shoot crown cover of fire-type herbaceous

annuals and biannuals, after initial germination on December 1, can be expected to increase to about 10-20% within 8 weeks (February 15), to 40% by March 15 and then almost double a month later. Seeded annual ryegrass, primarily because of the quicker germination and initial growth of the grasses, was three to four weeks ahead of the native annuals in similar cover. Within 14 weeks after the first rains responsible for germination, or by about March 15, ryegrass averaged less than 10% average cover on shallow soils and about 20% cover on deeper, more fertile soils on midslope or northern exposures. Here it increased to over 30% by the end of the growing season. About 90% of the season's rain had fallen by December 31 but generally warm weather during January and February supported this "optimum" top growth.

The success or failure of first season postfire establishment of a plant cover depends on germination and growth in relation to rainfall (storms) and temperature. Personal communication with Research Hydrologist Dr. Raymond Rice (U.S. Forest Service Pacific Southwest Forest and Range Experiment Station) while carrying out the above studies also brought to light his longstanding efforts in studying the effectiveness of ryegrass seeding on the San Dimas Experimental Forest. In modeling mean temperature for the area along with expected rainfall, germination and growth, he showed why ryegrass (and for that reason most native herbaceous cover) does not become established in the winter months. By the time the first 2 inch rainstorm had moved through the area (rule-of-thumb for initial germination of grass seedlings)and the grass seedlings had a 50% chance of germinating, the mean temperature curve had dropped below 50 degree F. This is considered the lower boundary for any appreciable plant growth. Therefore, the growth curve became nearly horizontal for the months of December through February.

Rice also had voiced his concern that the seeding of ryegrass may be detrimental to the longterm stability of the chaparral ecosystem. He noted that during his studies in the 1960's the successful postfire establishment of ryegrass at the end of the season led to a substantial reduction in total plant cover of the native vegetation within seven years after a burn and after the ryegrass had died.

Many studies have shown that landslides are an important eroding mechanism in mountainous watersheds. The available data suggests that the successful seeding of ryegrass (successful cover at the end of the first season which increases towards the end of the second season before diminishing thereafter) will increase landslide erosion because it will retard the recovery of chaparral. Rice noted that during the first nine years following fire and brush conversion on the San Dimas Experimental Forest, grass covered areas produced 360 cubic yards per acre more landslide erosion than comparable areas where the brush was recovering naturally (Rice and Foggin, 1971). Studies have consistently shown that the survival of brush seedlings is negatively correlated with ryegrass density (Schultz, Launchbaugh and Biswell , 1955).

Rice also pointed to postfire erosional studies which showed that channel scour or removal of the debris accumulated in the streambeds accounts for as much as 74% of the postfire debris production. Rill and gully erosion, (the surface erosion which a timely and effective first season postfire vegetative cover could affect) accounts for only 25% of first season debris production. If one assumes that ryegrass is effective the second through the fifth season (ryegrass cover is normally substantially reduced from the third season on as it requires heat, moisture, fertile soils and disturbance to germinate) it could only effect 10% of the long term erosion on mountain watersheds. Fortunately, by this time, native vegetation is well on its way to recovery.

Conclusion

Effectively managing the fire-flood cycle and reducing the high erosion rates that can be expected after fires is of primary concern to public agencies as well as mountain residents. The only immediate tool presently available to public agencies to reduce the damaging effects of expected flood and debris flow is the aerial seeding of grasses such as annual ryegrass. An investigation of temperature, rainfall, germination and growth relationships showed that neither the seeded ryegrass nor the native herbaceous vegetation can reestablish itself quickly during the winter months. On areas of low fire frequencies (high fire intensities) the native plant cover can be expected to be even lower because of the reduction of the soil seed pool by the intense fire.

The fire-flood cycle is also so damaging because even a partially effective postfire cover on hillsides could only affect about 25% of the expected downstream debris flows or could only affect the erosion expected from hillsides and not the debris already resting in the streambed. It is therefore imperative that effective zoning ordinances preclude the building of homes in areas where they can be affected by the fire-flood cycle, or, if already built, that the homeowner, along with Flood Control Agencies, protect the development with flood control basins and other mechanical devices.

The homeowner, living at the top or base of hillsides must provide an immediate cover to a bare, fire denuded watershed as the 25% of the watershed erosion he can effectively manage may amount to 100% of all the erosion and resulting damage the property may receive during the winter rains. Effective postfire management may include the immediate seeding of grains such as annual grasses while the temperatures are still warm and provide sufficient moisture for germination and growth. However, after the winter rains have passed, the ryegrass has to be hand weeded to assure that no long term slope instability results and the slope may have to be replanted.

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FLOOD AND EROSION CONTROL[1/]

David M. Potter[2/]

Abstract: A hazardous flood potential exists where development is located below chaparral covered mountains. Of major concern is the fire/flood sequence since erosion on burned watersheds can increase up to 20 times more than normal. Disasters have occurred where the debris flow phenomenon was not sufficiently recognized.

To prevent or reduce damages, a variety of protective measures are available. These range from major debris control structures to homeowner installed emergency measures. Hazards to future development are minimized through close review of proposed subdivisions and, where appropriate, flood plain management.

For those who enjoy living in the rural mountainous areas, various approaches can reduce the flood risks.

Introduction

Continuous development in the Los Angeles area has filled the valleys below steep, chaparral-covered mountains. In many areas housing extends into the canyons and onto the hillsides. Storm runoff can pose a serious hazard to development and for those living in and below the mountains, it is compounded by the "fire/flood sequence."

While a dense vegetative cover protects a watershed from major erosion, mature chaparral is highly susceptible to burning. After a fire, storm runoff increases and erosion can be up to 20 times greater than on a heavily vegetated watershed. For several years, while plants are regrowing, the community is exposed to an increased flood hazard from debris flows. These are floods which are heavily laden with eroded soil and rock.

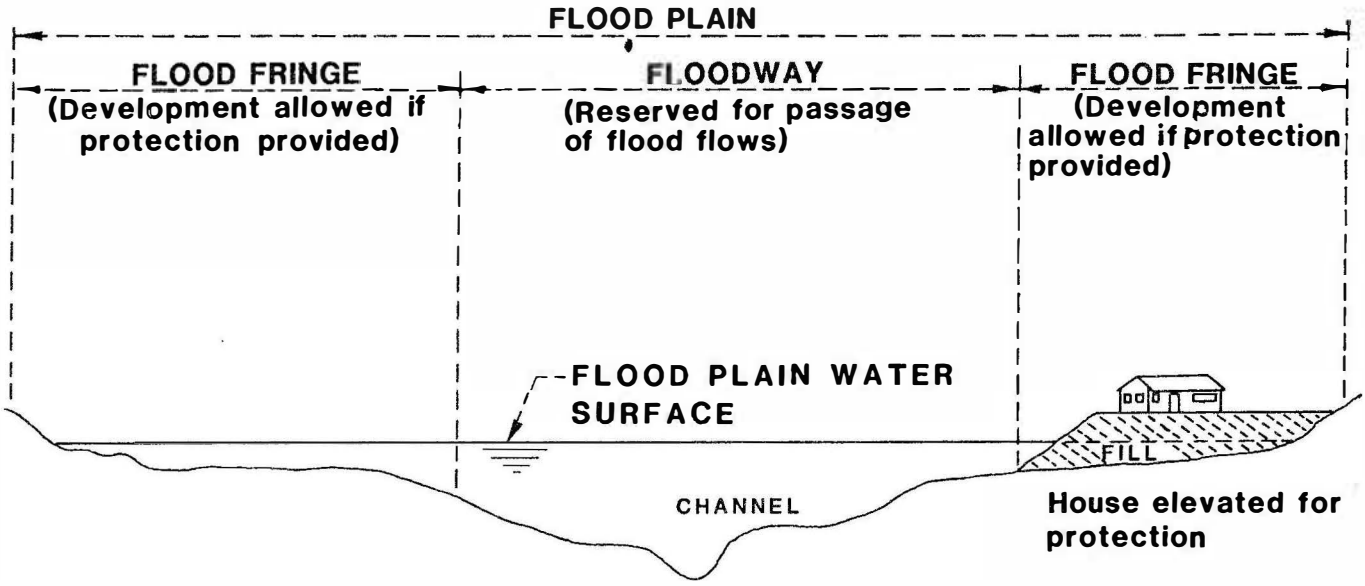

Figure 1—Typical Floodplain

A number of flood disasters have involved debris conveyed from recently burned watersheds, hence the term "fire/flood sequence." A more notable one was the Montrose flood in January 1934 when heavy rain fell

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[2/]David M. Potter, Civil Engineer, Hydraulic Division, Los Angeles County Flood Control District (As of January 1, 1985 the Flood Control District is part of the County Department of Public Works.)

Figure 2—Emergency Erosion Control Facility

on watersheds which had burned less than two months earlier. Runoff carried boulders twice the size of automobiles out of canyons. Thirty-four people were killed and 483 homes were destroyed and made uninhabitable. Damages were estimated at $5,000,000.

Hazard Reduction

To deal with such problems, the flood control system operated by the Flood Control District now has 120 debris basins. The debris basins slow the runoff of sediment deposits. Then the clearer runoff continues safely into the downstream channels and storm drains. The design capacity for each debris basin is determined by using debris production curves developed to predict debris production during major storms on watersheds with vegetation partially recovered from a fire. The basins have worked well, some becoming filled or nearly filled.

Some areas still have unmet drainage needs, including protection against debris flows. Unfortunately, the District has insufficient funds to alleviate these problems as fast as it would like to. To avoid repeating the headaches left by some past land use decisions, the District reviews proposed developments in unincorporated areas. This assures that flood and debris hazards are mitigated.

Along a number of water courses flood plain ordinances now control new development. Without this control, development is randomly sited, sometimes blocking the flow of water. Under the ordinance, a floodway free of structures is retained to allow an unobstructed path for runoff *(see Figure 1)*. Structures are allowed in the flood fringe if they are floodproofed. Commonly, this involves elevating the floor above the calculated high water surface.

After brush fires, the District evaluates potential hazards. Sometimes the threat to a community warrants construction by the District of an emergency erosion control facility. *Figure 2* shows one type of emergency facility. Often such structures are not feasible, so individual homeowners must protect their own property.

As a public service, the District offers engineering advice on emergency protection and has developed a pamphlet, the "Homeowner's Guide for Debris and Erosion Control." It shows a variety of relatively simple measures to protect property *(see Figures 3 and 4)*. When more permanent protection requiring engineer-

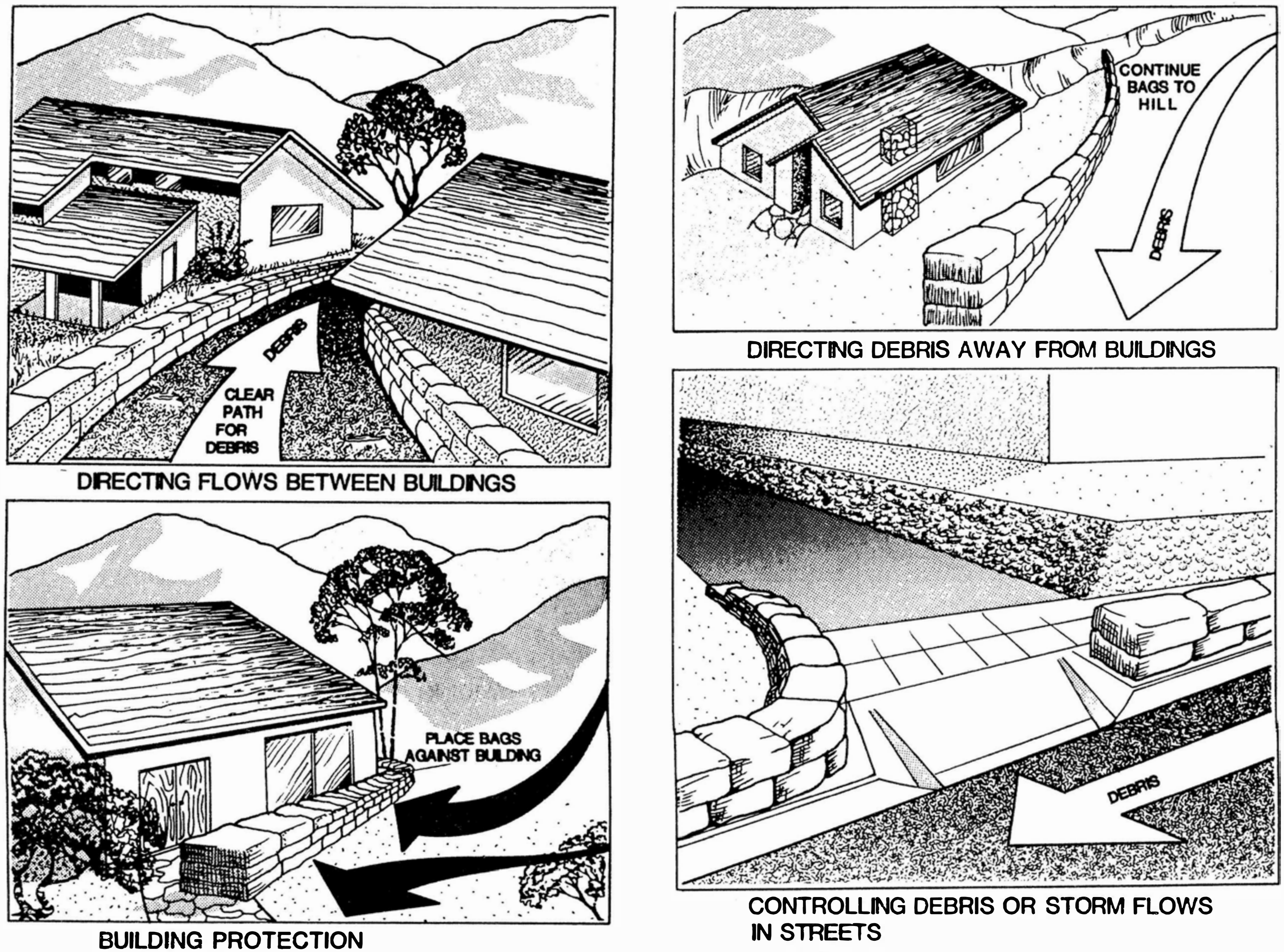

Figure 3—Excerpts from the "Homeowner's Guide for Debris and Erosion Control"

ing design is desired, homeowners are advised to hire a consulting engineer.

Since protection for one home may direct mud flows onto another, neighbors must coordinate their efforts. This is particularly important when flows must pass between homes *(see Figure 4)*. Following a fire, storms can produce 200 to 375 cubic yards of sediment per acre. Therefore, owners should give attention even to small watersheds. In all instances an important general rule is to divert, rather than block, debris flows. Also, burlap bags have a three to six month life span while the increased debris hazard can exist for several years. Temporary sandbag walls should be restored, as needed, before succeeding storm seasons.

While temporary measures can prevent damage from minor storms, protection against a major storm is not always practicable. In these cases, evacuation is advised whenever weather forecasts predict heavy rainfall.

Another important consideration for homeowners is flood insurance. While this does not prevent damage, it can help relieve the financial burden of a disaster.

Conclusion

Many people enjoy living in chaparral-covered mountainous areas. Because of the fire-flood threat, these people must accept some risk. However, often the homeowner can reduce these risks through preparedness against predictable hazards.

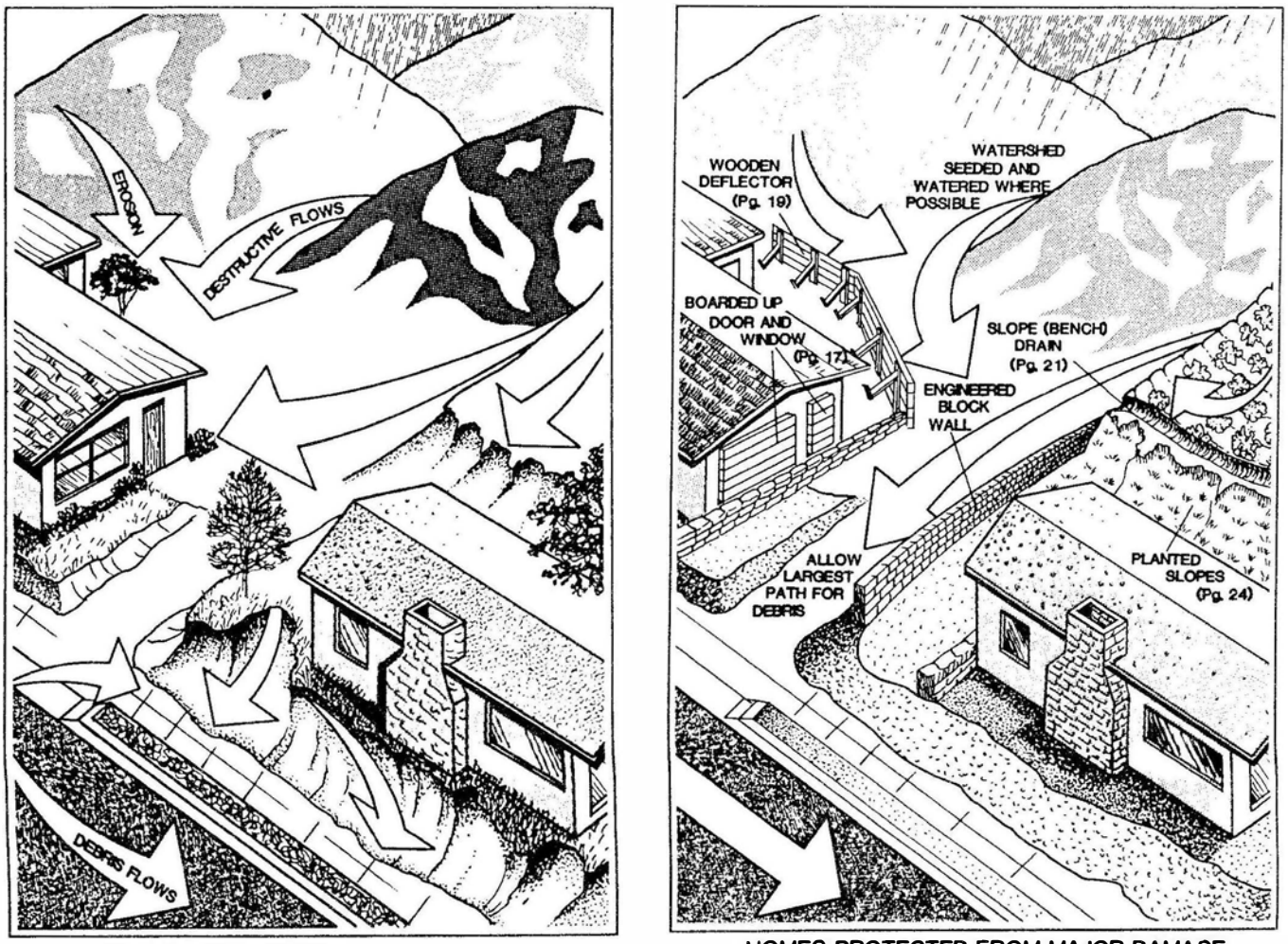

Figure 4—Excerpts from the "Homeowner's Guide for Debris and Erosion Control"

THE PUBLIC PLANNING PROCESS[1/]

Sherman W. Griselle[2/]

Abstract: California statutes mandate that ". . . each county and city shall adopt a comprehensive long-term general plan for physical development. . ." with nine required elements, including a seismic element and a safety element. These two elements must be consistent with all other elements, and the land use element must reflect safety policies, proposals and programs.

The purpose of safety and seismic elements are to identify hazards and propose measures to reduce loss of life, injuries, damage to property, economic dislocation and social disruption. Subjects, such as earthquakes, wildfires, landslides, soil erosion, flooding and other hazards must be fully covered in these general plan elements.

The Problem: Developmental Pressures

Growth pressures in Southern California are pushing development into hazardous chaparral. Much of the easily developed land in our urban areas has reached build-out and urban sprawl is spreading into the extremely sensitive chaparral. But development in the chaparral carries a high risk to life and property as the fire-flood-erosion cycle is a fact of nature in these wildlands. Proper planning is needed to achieve an acceptable level of risk in the urban-wildland interface.

The Solution: A General Plan For Proper Planning

The general plan, required of all California cities and counties, provides the means by which proper planning can be accomplished. Cities and counties must adopt a general plan as an official document indicating how they propose to develop over the next 15 to 20 years. Because the general plan must be "comprehensive" and "long-term" it is necessary that cities and counties give careful consideration to future planning for chaparral areas.

State law defines the general plan as a "statement of development policies" consisting of "a diagram or diagrams and text setting forth objectives, principles, standards, and plan proposals." California statutes mandate that seven elements, including a safety element, must be included in the general plan. The safety element is not the only element of a general plan that can be used in planning for the chaparral. Some of the six other elements also provide policies and plan proposals supportive of the safety element.

California statutes state that the general plan and all of its elements and parts must "comprise an integrated, internally consistent and compatible statement of policies." Consequently these seven elements must be consistent with each other. For example, the density standards set forth in the land use and safety element must be identical. If the safety element calls for a density of one dwelling unit per twenty acres in chaparral areas then the land use element must reiterate that density, and the mapping of chaparral boundaries must be identical in both elements.

1. Safety Element

Major policies and plan proposals dealing with the chaparral must be included in the safety element of the general plan. California statutes require the safety element in the local general plan to cover a broad spectrum of safety issues. This coverage specifically mandates planning "for the protection of the community from . . . wildland and urban fires." The safety element must also address "evacuation routes, peak-load water supply requirements, and minimum road widths and clearances around structures." This means chaparral areas mut be mapped, policies determined, and plan proposals recommended which provide for safety in the chaparral. Many cities and counties adopted their safety elements years ago and in the past may not have been aware of the hazardous characteristics of chaparral and the need for specialized planning for such areas in their communities. It is necessary that outdated safety elements be amended to include currently available chaparral safety and planning techniques.

[1/] Presented at the Conference and Public Workshop *Living in the Chaparral of Southern California,* October 20, 1984, Los Angeles County Museum of Natural History, Los Angeles, California

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2. Land Use Element

The land use element designates the general distribution, location and extent of the uses of land for housing, business, industry, open space, education, public buildings and grounds, and other categories of public and private uses of land. Consequently, planning proposals contained in the land use element dealing with the chaparral will have a direct influence on the safety element as these proposals contain the location, population density and intensity, and types of land uses permitted in the chaparral.

3. Circulation Element

This element identifies the ground location and extent of existing and proposed roads and highways, railroads and transit routes, terminals and other public utilities and facilities. The building of roadway and utility systems, other than as required for safety purposes should be discouraged in the chaparral as such infrastructure induces land development. The circulation element must reflect the recommendations of the safety element when dealing with sensitive chaparral areas.

4. Housing Element

The attainment of decent housing and a suitable living environment for every California family is a goal of the housing element. The housing element must contain quantified objectives and a five-year schedule of actions using land use and development controls in order to provide for the housing needs of all economic segments of the community. The element must inventory land and identify sites suitable for residential development while considering environmental factors and community goals set forth in the general plan. This means avoiding hazardous chaparral and other environmentally sensitive areas, such as flood prone areas and hillsides subject to landslides.

5. Conservation Element

The conservation element provides for the conservation, development, and use of natural resources, including water, forests, soils, rivers, lakes, fisheries, wildlife, and other natural resources. It should be coordinated with safety element proposals regarding the chaparral as both elements are concerned with regulating the use of land in sensitive areas; providing for the prevention, control, and correction of soil erosion, and recommending ways to protect watersheds and to reclaim land. The inclusion of chaparral planning in the conservation element gives added protection to these wildland areas.

6. Open-Space Element

The open-space element details measures for the preservation of open space and natural resources, for the managed production of resources, for outdoor recreation, and for public health and safety. The element designates land and water resources which are essentially unimproved and devoted to an open-space use. One of the goals of this element is the preservation of natural resources, such as habitat for fish and wildlife species. Other goals are to preserve watershed lands, and to provide for public safety, including special management of hazardous areas presenting high fire risks. Another purpose of an open-space element is to discourage premature and unnecessary conversion of open space to urban uses. From this brief description it is obvious that the open-space element can be very supportive of the safety element in chaparral planning and protection.

7. Noise Element

A noise element identifies noise issues in the community. Noise contours are identified as a guide for establishing a pattern of land uses that minimizes the exposure of community residents to excessive noise. The noise element must include implementation measures that address noise problems.

The Public Planning Process

In preparing a general plan with a safety element it is necessary to follow the public planning process. The process covers a number of steps beginning with citizen participation and concluding with implementation.

Citizen Participation

Citizen participation is a required part of preparation of a general plan and safety element and state law specifies that in preparing and carrying out a general plan, "the planning agency shall consult and advise with. . . civic, educational, professional and other organizations, and citizens generally." Because citizen participation is so crucial to the plan's success in chaparral areas it is imperative that citizens be involved throughout the planning process. Once the general plan and its safety element are adopted the local jurisdiction should maintain public participation as valuable assistance in monitoring and evaluating progress in implementing the plan. The safety element must be instructional and self-explanatory. As an educational document it must be useful to a wide spectrum of interests—homeowners, realtors, builders, lenders, environmentalists, and elected and appointed public officials. It promotes understanding and cooperation between conflicting interests. The element serves as a formal statement of adopted public policies, plan

proposals and recommended implementation programs for the chaparral.

Data Collection and Analysis

To competently prepare a safety element it is necessary to collect scientific and general information concerning chaparral areas within the community. The research often begins with a land capability/suitability study to determine the ability of wildlands to sustain development without degradation and the appropriateness of land development. Data is needed on the fire-flood cycle, microclimates, location of fire and fuel breaks, vegetation and fuel loads, soils and erosion, topography, encroachment of urban development, roadways, water supply and pressure, and other factors. Extensive mapping of this information is required. Follow-up analysis of these data serves as a bridge of logic from raw data to policy.

Policy Formulation

Inclusion of policy in a general plan, and in the plan's safety element, provides explicit future direction in dealing with chaparral planning issues. Policy, expressed in "objective, principles, and standards" leads directly to plan proposals. Policy also establishes rules for future decisions and provides recommendations for implementing the plan. Policy becomes the basis for zoning and subdivision regulations and for capital improvement programs. Chaparral policy in the safety element must be clear and unambiguous. For example, if the element contains a policy which states, "A Chaparral Overlay District with special zoning regulations shall be applied to all chaparral hazard areas identified in the safety element," it would be necessary to map applicable districts in the safety element. It would also be necessary for the element to contain specific standards to be applied to any development permitted within the recommended Chaparral Overlay District.

Plan Preparation and Adoption

Plan preparation flows naturally from the policy planning phase. The policy phase decides major objectives for the community and sets forth principles and standards to follow in order to achieve the proposed objectives. The plan preparation phase tests agreed upon policy by suggesting alternative general plan scenarios. For example, alternative land use patterns, infrastructure proposals, an open space, hillside and farmland resources can be studied in varying configurations, and alternative plans for chaparral areas can be studied. Each alternative should be evaluated for its short- and long- term effects on the community. The consensus which emerges from community review is usually a synthesis of alternatives into a final version general plan with all of its elements. The proposed plan is then processed through public hearings and other adoption procedures required by state statute.

Implementation

In the administration of the general plan the city or county planning agency is required to "investigate and make recommendations to the legislative body regarding reasonable and practical means for implementing the general plan, or element of the general plan, so that it will serve as an effective guide for orderly growth and development, preservation and conservation of open space land and natural resources, and the efficient expenditure of public funds." Planning implementation programs for chaparral areas must follow logically from the recommendations found in the local general plan and its safety element. An implementation program for the chaparral should include a coordinated set of subdivision and zoning ordinances and a capital improvements program designed to carry out chaparral planning policies and plan proposals. Successful effectuation of sound chaparral planning is sometimes difficult to achieve as special interests exert pressure on elected officials to amend or bend regulations in order to allow development in the chaparral. All project approvals must be in conformance with the policies and plan proposals of the safety element and with requirements of implementing ordinances. State statutes mandate that subdivision, zoning, and capital improvement projects be consistent with the general plan and all of its elements.

Subdivision Ordinance

The local subdivision ordinance, in conjunction with the State Map Act, gives cities and counties broad authority to regulate subdivision. Firm control over the subdivision of land in the chaparral can discourage urban sprawl, create minimal and economical service systems, protect environmentally sensitive areas, preserve open space, and reduce risks to life and property in hazardous areas. Subdivision ordinances authorize cities and counties to regulate the design and improvement of subdivisions, including the physical layout of streets and lots, construction and dedication of public improvements and easements, and other measures necessary to ensure implementation of the general plan and its safety element. As a part of the approval process for a subdivision cities and counties are required to make findings that a proposed subdivision is consistent with the general plan; that the site is suitable to the type and density of the subdivision proposed; and that the subdivision will not cause environmental damage or health and safety problems.

Zoning Ordinance

A city or county may adopt a zoning ordinance

which regulates the use of land for open space, recreation, enjoyment of scenic beauty and use of natural resources. The ordinance may also regulate the location of residences, business, industry, and agricultural land. This means the zoning ordinance is ideally suited for implementation of the safety element and for controlling development in hazardous areas.

The chaparral policies and plan proposals of the safety element must be reflected in regulations contained in the young ordinance. For example, if the safety element proposed to use transfer of development rights as a method to reduce density in chaparral areas then the zoning ordinance must contain the detailed regulations with which to administer the development rights transfer system.

Capital Improvement Program

A capital improvement program provides for planned and phased construction of public facilities. However, public infrastructure investment in chaparral areas should be avoided as most chaparral areas are better retained in an open space or conservation land use classification. In hazardous chaparral areas the costs of development to the public are often greater than benefits. Sound financial studies are needed in the chaparral planning process to determine if costs of improvements for roads, sewers, water, drainage and other public facilities and services will be offset by development benefits. An effective capital improvements program and process determines the feasibility of providing public facilities in chaparral areas and must be based on the policies and plan proposals of the safety element.

WORKING WITH DEVELOPERS AND AGENCIES[1/]

Rubell Helgeson[2/]

Abstract: Nobody has a greater stake in the future development of a community than the people who live there. But residents, as such, face enormous handicaps in effectively controlling or altering the plans proposed by developers and permitted by government agencies.

To work effectively through public agencies in determining the future of their communities, residents must:

1. Organize, prioritize, strategize, and raise money.
2. Learn the issues, the procedures and the language, i.e., become experts in the planning process.
3. Overcome neighborhood parochialisms and develop a general community consensus.
4. Work on a broad canvas with an eye to the long perspective.
5. Develop alliances.
6. Be fair, be consistent, be prepared. Document everything.
7. Accept compromise with grace when appropriate.
8. Never give up.

We have heard a lot about my community this morning. Judging from the slides of the multitudinous disasters there, Pacific Palisades must provide a textbook example of how to do things wrong.

Pacific Palisades is about 25 square miles of mountain and mesa alongside four linear miles of the Pacific Ocean. Almost the entire northern border is an urban-wilderness interface. Development here poses nearly every challenge we have heard from the expert speakers today.

I am not the same kind of expert. Everything I know about land use and planning I learned from the bottom up—first as a victim of unwanted changes which government agencies sought to impose on my neighborhood, evolving into an observer of the administrative process, then becoming a principal participant and finally an initiator of the kinds of changes sought by neighborhoods and communities for their own protection and enhancement.

Most of what I know about fire and watershed safety I also learned by working through the system as a citizen. But here I started with a little inculcated wisdom: don't play with matches, for example. It was astonishing to find the City balking at efforts to ban the sale and use of fireworks in communities backed up against chaparral, as Los Angeles did for years. And equally surprising to find the City and County reluctant to ban shake and shingle roofs in fire hazardous zones. Beautiful St. Matthew's parish—just seen in a photo slide as a charred ruin of the 1978 Mandeville Fire—was built *after* the Topanga and Bel Air Fire. The good parishioners of St. Matthew's should not have had the option of endangering their sanctuary, and the homes of their neighbors, by building a gorgeous tinderbox.

But true progress, however slow, has been made in these areas—largely because of pressures from the bottom up rather than the reverse, powered by public outrage at the continuing parade of disasters often traceable to prior government policy. Which is one way of saying that in the planning field I give small credence to the trickle-down theory.

My topic is listed as "working with developers and agencies." The title presumes a few things which may be obvious and which may not always be the case.

First, who's working? From my perspective, it's the environmentalists and property owners who share a community of interest; we work harder and longer, in many cases, than either developers or agency staff. And—speaking as a survivor of many planning battles—we work sometimes with both developers and government agencies and sometimes against both.

At times we are an ally of one against the other.

[1/]Presented at the Conference and Public Workshop *Living in the Chaparral of Southern California*, October 20, 1984, Los Angeles County Museum of Natural History, Los Angeles, California.

[2/]Rubell Helgeson, Community & Environmental Activist, Writer and Editor, Pacific Palisades, California.

Partners or Natural Enemies?

The public generally views developers and environmentalists as natural enemies. That need not be the case, but developers are unlikely to take a community group serious until it has a proven record. This is natural. An applicant seeking approval from public agencies is not going to complicate matters by dealing with private entities unless they have demonstrated clout to impose change—*real* change, including the potential of denial of the project—through administrative or legal process.

So, for good or ill, community groups usually can't work with developers unless they have shown in a real-life context that they will, when necessary, work against them. Once the necessary ability and conviction and staying power are established, they carry into the future. Community groups can then become genuine partners in the planning process, working for sensitive and neighborhood-conforming development which credits all concerned.

To effectuate change in a project, a community group must be very well prepared, must exercise discretion, must have broad support, and must keep a close rein on its collective ego. Otherwise we may give away too much, or we may demand the impossible. In either case we will loose and the loss will be the community's.

How could we be led to concede too much? By failing to build a solid factual base so we know what the options are in each situation, and what chance each option has for success. By accepting the appearance of change rather than change itself. And by letting ourselves wear down when we simply have too many important issues to face, or we confuse peripheral issues for critical ones and waste energy on mistaken causes.

Why, on the other hand, would we demand too much? Because in our anxiety to achieve the best overall result we try to extract more than is reasonable or relevant at a given stage of the proceedings. Because we overstate our case. Or because we allow our sense of power to become inflated. The consequence for each of these all too human failings is to be dismissed as a crank and removed from effective influence on the decision.

To avoid pitfalls of either extreme, practice open communication—with agencies, with developers, with other community groups, with your membership, with your elected officials. The broader your sources of information and opinion, the more realistic and effective your position becomes. Call on agency staff for information; ask why a policy is or ought to be expressed, or where their data came from. You will often find a refreshingly candid answer. Developers are often cheerfully willing to provide information, even if you are in an adversarial position with them. In your dealings with all of these groups, old fashioned good manners are the most effective tool.

What kind of change shall we seek to impose? Not density reductions which are less than applicable law lets us hope for, and not cosmetics. We don't want to name the new streets; we want to ensure they won't dump intolerable traffic burdens into our established neighborhoods. We want development to honor our natural environment to the maximum extent possible, to meet the requirements of CEQA and other applicable law, and to conform to our General and Community Plans.

Mastering the Maze

How do we accomplish this? Through channels, through the bureaucratic maze, cumbersome and maddening though it be. Community groups must learn to be as effective as possible in dealing with agencies. and this means knowing how the agency functions and who bears influence upon it. We must work with one agency against another if the situation warrants, and understand that an agency which supports us in one situation may oppose us in the next.

This is merely to acknowledge that City Hall and the County Hall of Administration are not monoliths. To make the system work for us, we must know how the parts interrelate, who answers to whom, which bodies wield power and which are advisory, under what circumstances one branch can overrule another, and how you can help to make that happen. As a learning experience, make yourself an organizational chart tracking a complicated project through the decision-making process.

Of the three groups defined in this scenario—residents, developers and public agencies—residents have by far the greatest stake in the future development of the place in which they live. The joint investment of householders makes that of any developer picayune in comparison. Yet residents enter the fray as underdogs.

How do we change that? If you are not already organized, organize; if functioning, hard-working, effective and respected organizations are not in place, create them. Begin by defining the critical issue or issues at stake; then establish the boundaries of a community of interest which will give time and money to effect the outcome of decisions on these issues. A community of interest may be a few blocks, a few square miles, a whole city, or a region. An organization may arise to deal with a single issue and fade away when its goals are met or defeated; or it may deal with a broad spectrum of issues over a period of decades. The latter type offers the best opportunities for informed involvement.

Once it becomes effective, a community group will be called upon to do more than it reasonably can. So set priorities and establish limits. If your goals are broad-scale community protection, and somebody's tree obstructs his neighbor's view, tell them both to find their advocate elsewhere. Setting priorities is not easy and it can make enemies. But it must be done... diplomatically, unequivocally, and at once.

So you have organized and prioritized. Next strategize. Decide how the battles will be fought, who will be assigned which tasks, and how you can get them accomplished without sending your volunteer workforce to an institution for a rest cure. Become part of a network of community and environmental interests over as broad a geographic area as you can manage, and be willing to support other groups in matters of shared concern, even as you call upon them to assist you.

To organize beyond an immediate neighborhood level you need mailings, and for mailings you need money. But don't worry; you need money in any case if the issues are complex and the stakes high. You may need a legal fund and that makes the money for mailings look really insignificant in comparison. If expert assistance—whether in geology, soils, traffic, planning, law or other areas—cannot be solicited from the community, it must be paid for. Often choices must be made as to which of these is critical enough in the given situation to warrant the costs. In some areas—traffic for example—you can become your own expert, but it takes time and a lot of dull labor.

To provide for the required manpower, your association must have a devoted corps of workers, and a much larger body of supporting members. Deciding criteria for membership and creating bylaws is a major task in itself. To protect itself, the group should be incorporated under California law.

All of this would be overwhelming if it had to be taken on suddenly. But in most communities, associations have evolved over the last century or longer, gradually acquiring the collective skills and the community standing to take on the jobs at hand. What they need most is new blood, new commitment, new vitality. And you need not be an expert to provide that.

As an individual just entering the fray, find such a group and offer your services. Then volunteer to follow through the process a development application which does not affect you personally. Don't wait for the threat to rise next door. Learn the process, the language, the politics of planning while helping with somebody else's problem, and you will be far better equipped to deal with a crisis in your own neighborhood, if it does someday occur.

In spite of monumental efforts to involve all potentially impacted residents, community organizations will not hear from some of them until that awful moment when the decisions are all made and the bulldozers show up. The newly-aware may then demand that the world stop while everything worked out so far is rearranged to suit their preferences.

To minimize this possibility, organizations must develop as broad a consensus as possible. Most residents will be willing to accept some impacts if they believe the distribution is fair and that a resolution provides them with benefits and securities as well.

Say "No" With Conviction, "Yes" With Grace

This discussion presupposes that most applications for development will result in development. That is the bald fact of the matter. While a purist position—no more nothing nowhere no how—may be popular and emotionally satisfying in the short run, it is counterproductive. Community groups cannot afford to say absolutely no to absolutely everything. If they do, they will find themselves shut out from effective participation.

This is not to say we must acquiesce to some development *everywhere,* or that every use must be regarded as acceptable. But if absolute opposition is selectively rather than generally applied, and if all other projects are treated under fair and consistent criteria, we will indeed earn the right to demand changes in allowed development to protect our neighborhoods, our communities, and our regional environment.

Community groups should welcome inquiry from developers and should review their proposals with an open mind. The criteria for response should be uniform, based on broad public and community interests and on conformity with Community Plans and other applicable law. We cannot afford to oppose a project merely because we don't like it or because the neighbors want us to. We must have grounds.

When it is possible to come to an accommodation with a developer on this basis, that is an accomplishment. It should be accepted with grace, not begrudged. The project has met your community's standards, and you have helped to make it happen.

The great battles for residential development in the most sensitive and hazardous areas of Pacific Palisades are over, but the problems resulting from past development will continue. I wish that the National Foundation for Environmental Safety had been on the scene 20 years ago, and 10 years ago. We did well in our landuse battles, I believe, but we could have done better with the kind of expert information you provide. I wish you continued success in achieving a safer lifestyle for us all.

DEVELOPMENTS, PUBLIC SAFETY, ECONOMICS[1/]

John B. Kilbane[2/]

Abstract: To many visitors the natural habitat and climate of Southern California is considered mild and pleasant. To those of us who make our home here, the annual occurrence of brush fires, intense rainy seasons, floods, and mud slides, and the threat of earthquakes. are constant reminders that even paradise has its imperfections.

It is imperative that the public understand that all built environment must first be reviewed and approved by Government. The Government acting on behalf of the public, creates "building codes," which are, simply put, minimum standards for construction, intended to calculatedly reduce the risks to public welfare. These standards are based on historical data (such as 100 year flood plains), currently available technology, and economics.

The Governmental agencies and private developers must constantly deal with the issue of how safe should the built environment be? It is possible to spend more time and more money to make buildings safer. The public, as never before, must become involved in the decision making process, and to do so effectively it must educate itself, and government and private development must assist. At stake is, how safe, how affordable? The public needs to participate in the calculated risks taken on its behalf, and assume responsibility for that participation.

Public Safety and the Development Process

As an architect, and as a developer of residential projects in Southern California, I have been on both sides of issues which relate to public safety and the environmental hazards that are so unique to Southern California.

The process for taking a project from the planning stages to completion of construction is expensive, time consuming, and growing in complexity. This is the direct result of improvements in the environmental sciences, constant upgrading of building codes as the result of governmental agencies' efforts to better protect the public safety, and the public outcry which is heard with each occurrence of natural disaster.

Because of the importance of making man-made environments a safer place for people to live and work the process of planning and building will always be necessarily complex. This complexity has in my experience, directly resulted in a high level of mistrust on the part of the general public towards architects, engineers, and developers, and also the representatives of government who oversee city planning and building and safety. Too often this mistrust, in my experience. is the direct result of the general public's lack of education and understanding with regard to the development process.

Public Mistrust of Governmental Agencies

The first point I wish to make has to do with the public's mistrust of governmental agencies with respect to development. Too many times while attending homeowners meetings or public hearings concerning new developments, I have heard angry and frustrated people stand up and accuse government representatives of "being in bed" with the developer, or that "they are going to do exactly what the developer wants any way." As a developer my experience has always been that these representatives are highly professional, and do an oustanding job of enforcing the law as it is written. The problem most often is that the public does not understand how the approval process works, or what the law does and does not protect. The laws that govern the way developments can be built are the result of a democratic process which includes the input of architects, engineers, developers, the governments public safety representatives, and the public. No one special interest group monopolizes the decisions and as such the process is fair. It's just that the general public's limited knowledge circumvents its ability to participate in the forming of policy.

[1/] Presented at the Conference and Public Workshop *Living in the Chaparral of Southern California,* October 20, 1984, Los Angeles County Museum of Natural History, Los Angeles, California.

[2/] John B. Kilbane, Developer, Architect, President J.B.K. and Associates, Los Angeles, California

Public Mistrust of the Development Industry

The second point has to do with the development industry itself. One of the saddest things I see all too often in the processing of new projects is a deep seated mistrust of developers on the part of the general public. This is extremely unfortunate, because the vast majority of developers in Southern California are highly professional and sensitive to the public's interest, and in most cases, seek involvement in the planning stage of new projects. But the mistrust undermines the usefulness of the collaboration. A common complaint on the part of developers is that they go out into an undeveloped area, put in the streets, sewers, and schools, build new homes, and stores, then the people move in, incorporate a new city, and then stop all new development with moratoriums on growth. I have seen and heard developers wrongly criticized for everything from simply wanting to make a profit, to building a shopping center in an area that desperately needs one. In a real example of this, I lived in a very sensitive Santa Monica Mountain Community, whose homeowners group bitterly opposed the development of a small commercial center. But once it was approved and built the center became extremely successful, and to this day I see many of the people who expressed the most violent oppositions shopping at the center on a regular basis. My contention is that a greater awareness and involvement on the part of the public will enable it to identify the good developer from the bad one, and stop or change bad developments in the planning stages, before they are built.

Public Education and Involvement

My final point has to do with the education and involvement of the public in the development process. We all are very busy people and feel that we have much better things to do with our time than to read about public safety in build environment, or attend government sponsored public hearings, or private meetings held by developers. But if you are interested in raising the standards of safety in the built and natural environment areas, then you have no choice.

In order for the process to work, a partnership must be formed. A commitment must be made by government, the development industry, and the general public to work together to build safe, sensible, and beautiful communities. Education and involvement can clear up mistrust and allow for cooperation, and an understanding and concern for the other partner's interests. Once this happens real progress can be made.

Public Safety and Cost

In closing, I would like to clarify a few common misunderstandings about public safety and how the process works in concept. First, laws concerning building and safety vary from city to city and state to state and are enforced through building codes and planning ordinances. There are numerous opportunities for the public to become involved in the improvement of the codes and ordinances.

Economic viability plays a strong part in establishing limits to the building code. For example, your house could be much safer if the structural support members were larger, or all the glass in your windows was tempered. So why isn't it? *Cost.* While it is not possible to design a building that is completely earthquake proof, or fire proof, or accident proof, it is possible for them to be safer than they are. If your home were built to the highest safety standards available, you probably could not afford to live in it. The point is that codes and ordinances are designed to determine the *minimum* acceptable standards for public safety. The general public's role is to get involved to the degree of understanding. What these minimum standards are and agreeing with them or working to change them is an issue which must be carefully examined by all citizens.

PLANNING AND BUILDING SAFE DEVELOPMENTS[1/]

Peter Severynen[2/]

Abstract: The safest and most satisfying new developments in chaparral areas are those where developer, land planner, public administrator, architect, landscape architect, engineer. geologist, and watershed manager work together from the beginning and consider all environmental impacts. Most problems can be anticipated and prevented or at least minimized. New or established hillside dwellers need to know which improvements are cost effective and how to recognize early warning signs. They must also learn simple preventive maintenance methods.

Careful planning will make living in the chaparral enjoyable and safe. The more any development, be it a single family home or a large subdivision, responds to existing natural processes and respects site imposed limitations,the longer it will stand, the easier the maintenance and the fewer the problems. For example, pre-development site analysis will show:

—natural draws that should not be blocked and flood plains that should not be built upon,

—any offsite improvements necessary such as debris basins or drainage devices,

—stable or unstable geology, landslides, previous fill,

—obvious fire paths and exposed locations,

—accessible terrain that does not need excessive grading

—capacity of the street system.

The planner laying out the development and the chaparral dweller who wants to make the house and yard safer, must both imagine living in and with the finished product, with a minimum of maintenance and a maximum of pleasure. No mud flows across the driveway and no blind corners, no neighbors' yard sinking into one's own, no unshaded windows to the West or South. No cracks in concrete floors, no plastic sheeting laid over winter wet slopes and no roof going up in flames. The homeowner has more limited choices, yet may need to know of many of the landscape architect's or planner's objectives:

—avoid concentration of water resulting in run-off across slopes, erosion, excessive infiltration of soil layers and slippages, sometimes months later.

—guide concentrated water (from downspouts, swales) into pipes, paved areas, streets; not backyards

—keep standing water away from foundations. especially where expansive clay soil will swell when wet and shrink when dry,

—grade down and away from all buildings.

—use reinforcing steel in foundations and concrete slabs,

—provide weepholes where retaining walls are necessary, to prevent buildup of hydrostatic pressure and failure of the wall,

—use proper drainage devices such as grassed swales for minor flows on flat land; concrete bench drains on high slopes (bench drains need inspection/cleaning prior to the rainy season and after every storm. This in turn may require cooperative neighbors or a homeowner association enforcing the rules),

—recognize the types of soil on site and prepare them at their optimum moisture content prior to building.

—build on cuts or a well compacted blanket of fill soil, but never span the cut and fill transition with one structure. Differential settlement may crack concrete and make doors sag,

—adapt buildings to the topography and not the topography to the buildings. Disturb a good site as little as possible.

—keep buildings set back from the top of slopes in order to stay clear of superficial failures and jumping flames.

—do not cut into the toe of slopes. It upsets the dynamic balance of a slope and failure may follow, depending on steepness, slope material, wetness, etc.,

—round top and toe of slopes for better looks, less erosion potential,

—design slopes to minimum height and minimum steepness possible. The taller and steeper a slope is, the harder it is to prepare, plant, water, weed and maintain

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[1/]Presented at the Conference and Public Workshop *Living in the Chaparral of Southern California,* October 20, 1984, Los Angeles County Museum of Natural History, Los Angeles, California.

[2/]Peter Severynen, Community Planning and Development Rep., Housing and Urban Development (HUD) Los Angeles, California.

it and to have it look naturalistic instead of scarred,

—eliminate rodents such as gophers and ground-squirrels. They 'swiss cheese' slopes. The holes fill up with rain or drainage water and induce local slope failures.

—water sparingly. Check for deteriorating and leaking pipes and irrigation heads which cause erosion.

—use appropriate planting for stabilizing slopes. Use of the many deep-rooted, drought-resistant plant materials available cuts down on watering and maintenance costs. Incorporating the deep rooted, undisturbed native chaparral into the landscape design is usually the best and most cost-effective method of planting. No amount of groundcover and shrubbery will hold an unstable slope in place. Big leaf iceplant is top-heavy, may cause slope slippage,

—evaluate site conditions and functional uses of plants,

—south facing slopes are hotter, and need a different vegetation than north facing ones. Cut slopes may expose infertile soils, or soil layers that are easily infiltrated by too much watering. Vast, low growing, summer green lawn areas are not well suited to our semi-desert areas.

—be careful of cuts and fills around existing trees. They may require expensive tree well work or may be responsible for dead trees. Existing native trees and shrubs also die easily from overwatering of new vegetation near their base,

—create a greenbelt around the house or development. Keep most vegetation low in the first 30 feet; practice fuel modification in the first 100 feet or more through selective pruning and thinning to reduce the fire load, keeping shrubs well separated. Trees may catch a house on fire if they are not kept a respectable distance away from buildings (like the radius of the mature crown) and if they are not properly maintained. Keep pines and eucalyptus species an even more respectable distance away; they may burn fast and furious. Do not clearcut to bare soil, it causes excessive erosion.

—fireproof the buildings. Wood shake and wood shingle roofs are easily ignited. Use tile; concrete shake or composition roofs instead, as the best chaparral area safety investment. Stucco and concrete block are safer than wood. Eaves should be stuccoed and boxed with vent holes away from walls and covered with maximum ¼ inch wirescreen,

—get the neighbors together. Neighbors watching out for each other make the area more secure and can help in emergencies,

—practice preventive maintenance and look for early signs of trouble. Check for leaking pipes or irrigation heads that may cause erosion; clean gutters and drain devices. Inspect wet spots anywhere on the slopes. Don't overlook trouble signs that may show soil movement such as cracks or offsets in walls, curbs, sidewalks, pavement.

Some of the above objectives are in conflict with each other. Many can be achieved only by careful consideration and integration of the views of specialists in fields as diverse as vegetation management and forestry, fire management, watershed management, planning, landscape architecture, architecture, geology, soils and structural engineering, flood control, public administration.

For a variety of reasons, building in the chaparral is no longer the simple affair we like to think it to be. First, the tremendous attraction of California has brought millions of people here. Wilder, less urban areas are in big demand. Those lucky enough to live in chaparral country have to satisfy themselves with more expensive, smaller parcels of land, and see more neighbors closer by.

Increases in population, coupled with higher standards of living, led to increased expectations, more demand for services like transportation, sanitation and firefighting, geometrically rising problems in providing those, more regulations necessary to protect the general health and welfare, and increasing government involvement as evidenced in a County General Plan, or a Coastal Commission. Then inflation pushed costs way up. In the meantime the easily accessible land as well as the favored locations such as the coastal areas had been developed and development is now occurring on sites with problems costly to correct. Unfortunately, some of the world's worst known geologic and soils problems occur at one place or another in California. Add to this the earthquake danger, an expensive and often overburdened water supply, a fire suppression policy so effective over the last few decades that artifical fuel loads built up to conflagration potentials, damaging winterstorms, and much ill advised building in the past, based on lack of understanding and application of flat land techniques in hillsides and you have a design for disaster. However, a great increase in knowledge in the fields mentioned above and related disciplines, a better understanding of the complexities involved in wildland/urban ecology and management as well as systematic application of the techniques necessary for a successful coexistence of urbanization in this much valued environment can lead to safe and attractive development.

LANDSLIDE HAZARDS IN CALIFORNIA [1/]

Cliffton H. Gray[2/]

Abstract: In order to make it possible to live more safely in a potentially hazardous environment, the California Department of Conservation has initiated a landslide hazard identification program. The primary mission of the program is to provide basic geological information to the public and to local agencies emphasizing slope stability and landslides so that they will be better informed of geologic conditions within their jurisdiction. Past cooperative programs have resulted in basic geology and special slope stability maps for use by local government.

Effective July 1, 1984 State funding is provided to implement AB 101 which requires the Director, Department of Conservation, to establish within the Division of Mines and Geology a program to map landslide hazards. Five geologists (in this program) are now mapping 3 areas in Southern and 2 in Northern California. It is anticipated that results of the studies will be published.

Introduction

Each year thousands of individual landslides occur as a result of natural, on-going erosional processes. Landslides activitated by natural processes are common in many areas of California, especially along the coastal region. The areal size of a landslide can range from several square feet to several square miles. Slide thicknesses may range from less than a foot to several hundred feet. Landslides vary both in type and rate of movement. The movement of landslide material may be rapid or so slow that a change can be noted only over a period of weeks, months, or years. Specific factors that can cause or contribute to the failure of rock or soil on slopes are (1) weakness of the slope material, (2) steep or undermined slopes, (3) unfavorable geologic structural conditions, (4) prolonged precipitation, (5) absence or sparsity of vegetative cover, and (6) ground shaking, usually from earthquakes but occasionally from blasting and construction work.

When man's activities are superimposed on natural conditions without regard for their impact, severe property damage, sometimes with loss of life or injuries, is the result. For example, landslide losses in the state during the 1968-69 rain season were conservatively estimated to be approximately $32 million. Damage from the 1978 storms within the city of Los Angeles alone has been estimated at about $50 million.

Actual figures for total economic cost of landsliding in California for any particular year or group of years are not available. However, as an example of the magnitude of the problem in one rapidly urbanizing southern California county—Orange County—available information shows that over 40 major bedrock landslides have occurred in urbanized areas within the county between 1966 and 1983. Each had an ultimate economic cost of over $200,000, and the total economic loss was over $40 million. Included within this is the Bluebird Canyon landslide which accounted for $12 to $15 million of this total. The only fatal landslide that occurred in Orange County was a mudflow-debris flow in Silverado Canyon in 1969 which took five lives. Altogether more than 1,200 massive landslides have been mapped in the hillsides and bluffs of Orange County and an additional 1,000+ possible landslides have been identified.

The most recent landslides, an indication of the continuing and costly landslide problem in California, include the Devil's Slide area in San Francisco/San Mateo counties, the Highway 50 landslide in El Dorado County, the recently reactivated Big Rock Mesa landslide at Malibu Beach in Los Angeles County, the Love Creek landslide in Santa Cruz County, and Verde Canyon landslide in Orange County.

CDMG Landslide Studies

The primary mission of the Geologic Hazards Program of the Department of Conservation, Division of Mines and Geology (CDMG) is to provide basic geology information to the public and to local agencies to that they will be better informed of geologic conditions within their jurisdiction. As a result of cooperative programs with cities and counties, CDMG has prepared basic geologic and special slopes stability maps for use by local environmental and engineering departments, many of which have no geologists on their

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[1/] Presented at the Conference and Public Workshop *Living in the Chaparral of Southern California,* October 20, 1984, Los Angeles County Museum of Natural History, Los Angeles, California.

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staffs. CDMG's landslide information has been incorporated in General Plan elements and ordinances to determine if geologic reports are needed for particular developments and to guide city or county geologists in the preparation of geologic reports.

CDMG began "landslide mapping" in 1960 in the Palos Verdes Hills of Los Angeles County. This modest effort was the first project of many cooperative matching-fund agreements with local government.

In 1962 a program was begun to study the south front of the San Gabriel Mountains from San Bernardino County on the east to the area of Mt. Wilson on the west. This investigation was a cooperative effort of CDMG with the Department of County Engineer, Los Angeles County, and the Los Angeles County Flood Control District.

The passage of legislation (SB 703) in 1965 enabled the Division to increase emphasis on investigations of geologic hazards, such as earthquakes and landslides, by allowing CDMG to establish cost sharing and cooperative agreements with local governmental agencies, other state agencies, and Federal agencies.

In March 1980, for the first time, CDMG was authorized, required, and funded by legislative act (AB 1571) to carry out a specific slope stability investigation. This now completed study was partly in the city of Los Angeles and partly in Los Angeles County in the Baldwin Hills area, including portions of the communities of Culver City, View Park, and Windsor Hills.

CDMG's Geologic Hazards program has resulted in major reports and publications. One study in 1973 resulted in the publication of the "Urban Geology Master Plan for California" as CDMG Bulletin 198. The purpose of this report was to determine the magnitude and costs of geologic hazards in California and make recommendations for their mitigation. One of the major findings of the study was that approximately $10 billion in landslide damage would occur in the state between 1970 and 2000 if the 1972 loss-prevention practices were to continue unchanged. At the same time CDMG projected that rigorous application of all measures available in 1972 could reduce this 30-year loss by 90 percent at an estimated cost of approximately $1 billion during the same period (Bulletin 198, p. 96-97).

These estimates are in 1972 dollars and are undoubtedly low in relation to today's standards. But, they illustrate two important points about the landslide hazard that are as true today as they were then: first, that the application of known mitigative measures can significantly reduce landslide losses; and second, that the amount saved in decreased property damage from landslides as a result of these mitigative measures will far exceed the cost of implementing mitigative measures.

CDMG responds to specific geologic events that involve public safety or that provide a "laboratory" to document the case history of a specific event. Examples include investigations of storm-related slope failures in the Los Angeles region in 1978, 1979, 1980; and emergency support services in the San Francisco Bay region in January 1982.

Also, special studies or programs are conducted in cooperation with other state agencies. Most of the effort has been with the Department of Forestry in providing geologic expertise in the review of timber harvest plans where there are problems of erosion, slope stability, and landsliding. Several slope stability studies have been done for Department of Parks and Recreation.

AB 101 Landslide Hazard Identification Program

Many legislative bills are introduced concerning land use and some of them touch on use of engineering or geoscience in land-use decisions. A bill of current interest is AB 101, signed into law by the Governor in summer 1983. Before AB 101, existing law provided that the State Geologist may conduct, with the assistance of Federal and local agencies, investigations to identify geologic hazards in and adjacent to metropolitan areas. Now, AB 101 requires the Director of the Department of Conservation to establish within the Division of Mines and Geology a program to map landslide hazards. Such mapping is to be based on guidelines and priorities adopted by the State Mining and Geology Board. Priorities adopted by the Board shall reflect the severity of the landslide hazard, the willingness of agencies to share the cost of mapping within their jurisdictions, the availability of existing information, and the need to supplement information used in existing landslide hazard abatement or prevention programs.

Information developed by this program will be provided to local government for use in planning and decision making that affects building, grading, and development permits. The geologic information developed by the Department of Conservation to be properly utilized where landuse decisions are involved requires the local engineers and building officials to have a vital role in mitigation of landslide problems.

Effective Mitigation

The key to the successful mitigation of the landslide hazard potential lies in the enactment of adequate building and grading codes based on sound geologic information with adequate enforcement by local government. The state's role is to provide basic data surveys and overview of the region, but not a lot-by-lot assessment. The state may provide, for example, studies of geologic formations known to be landslide prone, maps that identify old landslide areas; and maps showing landslide propensity as derived from basic geologic studies, slope angle, and other factors. These studies are helpful from a statewide, regional, or area perspective but leave specific site evaluation to the landowners and their consultants, and those local

agencies closest to the problem. The actual site development studies and plans should be done by the private sector with the local agency reviewing and inspecting the work.

The number of damaging landslides can be signficantly reduced by three general preventive actions. These actions include:

1. Delineation of landslide localities—basic data surveys to identify existing and potential landslide problems, and special studies by key factors of slope stability such as problems in a particular geologic formation, vegetation, rainfall, and slope. These studies are done by technical agencies such as the California Division of Mines and Geology, the U.S. Geological Survey, some local agencies with geologic capability, and by contract with private geotechnical firms.

2. Commitment to strong planning and enforcement—general geotechnical planning, and rigorous building and grading code enforcement by local government. This activity is generally done through the County Engineer Department. In providing for public safety from geologic hazards, there is no substitute for ordinances or regulations based on good geologic information that are well written and carefully enforced. The Department's geologic mapping programs have helped to provide this basic geologic information to support local agency planning and enforcement programs.

3. Implementation of the geologic knowledge and grading codes at each building site. Multistaged site-specific geotechnical investigations by private consultants before and during construction.

Summary

Landslides and related slope failures in California are responsible for extensive economic losses due to damage and destruction of property, as well as exacting a tragic human toll in injury or death. As urban development further encroaches upon hillside and mountainous terrain, the losses due to slope failure will inevitably mount unless specific action is directed toward identifying hazardous terrain prior to development, and mitigating measures are provided for unstable slopes.

In the future, mitigation of the landslide problem will call for detailed geotechnical evaluation of both potential and existing landslides. Local agencies and private consultants will use this information to solve specific problems.

FIRE HAZARD: THE DIMENSION OF RESIDENT'S ATTITUDE[1/]

Larry L. Loeher[2/]

Abstract: Research was conducted to evaluate Santa Monica Mountains residents' beliefs regarding fire hazards, to inventory their adjustments made to the threat of fire, and to examine their expectations regarding the level of fire service to be provided them. Results indicate that they are well aware of hazard, they are uncertain of what technological safeguards are likely to be most effective, and they may have unreasonable expectations regarding their individual protection via fire service organizations. Great opportunities exist for individuals to make adjustments in cooperation with government agencies and to reduce potential losses. Specific types of information and education are essential.

There can be little argument that fire technologies in the United States have become adept in controlling low magnitude wildfires. Likewise, there is widespread acceptance of the premise that each success at suppression creates the pre-conditions for higher magnitude fires which can overwhelm our suppression technology and cause ever-greater losses. Attempting to break this response cycle is the subject of much current research. One research theme frequently overlooked however is the role played by the population risk in fire hazard areas. In Los Angeles, and in southern California in general, this population is self-selected; it has chosen to live in chaparral areas rather than been forced to endure such a hazardous environment by the lack of alternative choices. My interest is in studying these deliberate residents of fire hazard areas, determining how much they know about the danger from fire, and in finding out what, if anything, they have done to protect themselves in case a fire occurs. Answers to these questions afford opportunities to design more effective and comprehensive response systems to fire hazards.

The need to consider these cognitive factors was underscored by the summary statements of Zivnuska (1973) while addressing the costs of chaparral fires:

> The cost of chaparral fire is really a cost of living with chaparral. The main damages we experience from chaparral fire are the result of the way in which we live in this region, with both improvements and people either intermixed with or in immediate proximity to vast areas of chaparral. . .
>
> This, then, is our present pattern of bearing the costs of living with chaparral fire—a pattern based on extremely intensive fire control and occasional high losses to fires beyond the capacity of the control effort. This pattern of costs clearly is bearable, for we have, in fact, borne it for a number of decades during which both the numbers of people and their styles have changed only to increase, rather than decrease, the exposure to such costs. (p. 163)

A similar, and more positive conclusion was reached by the Task Force on California's Wildland Fire Problem (1972):

> California's wildland fire problem cannot be met by reliance solely on an improved fire-protection system, although improvement of that system is badly needed and will contribute importantly to solving the problem. Rather, there is a compelling need for a total systems approach to solving the fire problem. This approach will have to be so extensive as to touch on major aspects of the way we live and act in the State's high fire-hazardous areas.

Survey of Residents in Fire Hazardous Areas

In order to help solve the fire problem, research was initiated which looked at the way we live and act in high fire-hazardous areas.

To initiate this type of research, I used a questionnaire to survey some of the salient beliefs and attitudes of residents of the Santa Monica Mountains (Loeher,

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1983). The results were surprising in several ways; the information actually possessed by residents was in some ways superior, and their collective sense of responsibility inferior, to the anticipated reponses.

To summarize the description of the people who responded (180=100%), they are overwhelmingly homeowners (94% in fact.). For the most part, and in direct contradiction to many expressed opinions, they are not new arrivals to southern California. Of the 180 respondents, only 4% were not former residents of southern California. Their mean length of residence here was twenty six years.

These people, by their own reckoning, had considerable experience with fire; 60% reported that they, their family, or their possessions had been physically threatened by a brushfire.

Assessment of Environmental Problems

On the survey, I began by listing a number of environmental problems and asking, "How serious do you feel each of these is in the Los Angeles area?"

Although the Santa Monica Mountains may have some of the cleanest air in Los Angeles, its residents rated air pollution as the most serious problem. Brushfires were rated a close second. Landslides were rated third. Landslides and associated mudslides, debris flows, slumps, etc. are a seasonal counterpart to brushfires and are often linked together: "If the fires don't get you, the landslides will" was how one respondent put it. This level of rating seems appropriate in view of the potential problems and losses from landslide phenomena.

What was surprising was that earthquakes were rated only fourth highest in terms of being a serious problem. I had anticipated it would be first by a wide margin! Lower rated problems were drought, floods and windstorms.

Assessment of Neighborhood Problems

When I asked residents to rank these problems for their own neighborhood, a notable reordering occurred. Brushfires ranked significantly ahead of the other problems, landslides were ranked second, air pollution dropped to third, and the remaining categories were grouped roughly together. It is difficult for me to comprehend earthquakes and Santa Anas being placed in the same group. Other researchers have reported powerful efforts at psychological denial with regard to earthquakes, and that may be a factor with these residents.

Assessment of Fire Hazard

My next question, "If you were looking at a house in or near an area where brush grows, how could you tell if fires might present a significant problem?", was intended to elict responses which would indicate how people identify the presence of fire hazard. There were several broad categories of answers, which, because of multiple answers, add up to over 100%.

Seventy-four (46%) felt that some physical or visual assessment alone would be adequate to indicate hazard, with an additonal seventy-four (92% total) linking the physical assessment with other factors. Typical responses included: "by the closeness of the brush, . .. by the steepness of the slope, ... or, by how dry the brush is." These are interesting in that not only are significant factors included, i.e. proximity and volume of fuel and topographic intensification, but so is the seasonal and often irrelevant estimate of fuel "dryness." Here, and later in the survey, residents expressed somewhat inaccurate but strong belief in the virtues of watering chaparral. Fuel moisture is one of the dominant factors in fire spread, but increasing it through sprinkling, or estimating it by appearance in most cases, is beyond the capability of the average homeowner.

Conferring with insurance agents, or delegating the responsibility for knowing, was mentioned by 10 (6%) of the respondents. Thirty (19%) felt that proximity to a fire station indicated a measure of safety (unlike a measure of hazard), but only 9 (6%) residents would think of asking the fire department about the presence of fire hazards. Five (3%) would prefer to ask neighbors, and only 22 (14%) would try to determine fire history for the area. Thirty-seven (23%) were concerned with access, either in terms of the fire department being able to reach their residence, or in terms of their ability to escape easily from the site. This concern, or awareness, is stronger than I anticipated and could easily be extended to include entire neighborhoods and canyons beyond the resident's immediate site. Only twenty-seven respondents (17%) mentioned the type of construction, building materials, and structural design of the house relative to hazards. Finally, twenty-four residents (15%) cited water availability and pressure as a factor in the assessment of hazard.

Clearly these responses indicate that the residents have a small amount of accurate information upon which to build, namely in the issues of fuel accumulation, access and building construction; they have a general disregard for seeking information from agencies such a the fire department and insurance agencies; and they have a significant amount of partial knowledge—which may lead to potential misunderstanding—of the role of fuel moisture, water application, topography, and fuel types.

A series of eight statements which respondents were asked to evaluate in terms of agreement or disagreement on a five point bipolar scale, reinforced the previous conclusions, i.e. that the residents are better informed about their exposure to hazard than they are generally given credit for, that they are less certain about the temporal factors influencing their risk, and that they are not confident in public agencies' identification of risk.

Assessment of Damage Mitigation

Another question I asked looked for an indication of how residents felt damage might be minimized. Sixteen residents failed to respond. The remaining 164 responses were categorized in three major groupings. The first group, with 9% favoring it alone, and another 29% combining it with other categories, preferred additonal legal approaches. These approaches included restricting access to chaparral areas during periods of high fire danger, increasing penalties to homeowners for failing to clear brush on their property, an almost rabid desire to severely punish arsonists, and an overwhelming feeling that current regulations were not being enforced and should be. It is the latter response which was surprising by implying that not only were homeowners aware of existing regulations, but that the county and city were negligent in enforcing those regulations.

The second group of responses, favored alone by 37% and in combination with other methods by an additional 37% promoted an active method of defending themselves and property. Active methods include prescribed burning, installing hoses and sprinklers, clearing vegetation, and watering. Here, and at other points in the survey as noted before, watering the brush in the absence of fire has a strange appeal to residents; they consider routine watering to be essential. It has been estimated (Younger et al. 1974) that between 250 and 500 cm of water per year would be necessary to keep live fuel moisture at a level which would lower ignition and spread. In fact a major effect of watering is to encourage sprouting and the production of additional amounts of fine fuels—the very fraction which is most easily dessicated by Santa Ana winds and is very influential in fire contagion. Watering fuel as a fire advances rarely provides an adequate heat sink and generally serves merely to delay burnout. The amount of water deliverable to the Santa Monica Mountains is far below the amount necessary to provide a wide-spread deterrent to wildfire advance. On the other hand, the suggestions made by residents for prescribed burning indicate a reasonably sophisticated understanding of fire/fuel volume problems.

The third group of responses, favored by 7% alone and in combination with the previous groups by an additional 30%, advocated a passive method of defense. Such methods include public education, restrictive and/or exclusive zoning, and the creation of stricter building codes. It is in this category that one of the most prolonged see-saw battles for hazard adjustment has been argued. Despite overwhelming evidence against, and disastrous experience with combustible roofing materials, specifically wooden shingles and split shakes, no prescription against them has endured for long against various lobbying efforts. Several times these materials have been banned or limited in their application, and each time they have eventually been exempted from such regulations. Little effort has been made in zoning, neither in the creation of a special restrictive hazard zone, nor in the discouragement of dispersed, and thus more vulnerable, housing. Public education efforts, despite the apparent willingness, even eagerness of the public have been traditional, limited, and basically ineffectual.

Two percent of the respondents claimed that there was nothing that could be done to minimize damage.

Responsibility for Damage Mitigation

With these ideas in mind, I then asked, "Who should be responsible for developing, implementing or maintaining methods to minimize damage. The results were eye-opening!

Thirty two percent felt that public officials were solely responsible for minimizing damage.

Nineteen percent felt that homeowners were solely responsible, and roughly two percent each felt that homeowner groups or insurance companies were solely responsible. In combination, 45% felt that public officials and homeowners together should prevent damage.

What is astonishing is that 37% felt no sense of personal responsibility whatsoever, and in complete contrast, 19% felt entirely self-dependent in minimizing the risk present in fire hazards! With either of these extreme views, the chances of minimizing risk are substantially decreased. Public management and service agencies can greatly determine the outcome of risk events both in terms of which risks or approaches to risk they choose to address, and with regard to management policies and procedures. Homeowners in turn can significantly alter the outcome of events by both individual and collective adjustments to hazards.

Preparation for Brushfire Disasters

The exact nature of adjustments undertaken was explored in another question: "Do you happen to have made any preparations in case a brushfire might occur in your neighborhood? If so, what sort of preparation?"

Twenty five percent reported no preparation at all. Twenty percent had made evacuation and coordination preparations, such as: making lists of priority items to save or take with (or to be thrown in the family swimming pool), determining how members of a family would contact each other in the event of a fire emergency, establishing and practicing family fire drills, and others.

Only three percent had provided aids to fire departments such as painting identifying numbers on rooftops or providing clear access to property. Clearly residents do not consider it necessary to volunteer cooperation with fire agencies.

Forty percent had employed personal active systems, implying that they intended to stay and provide active resistance measures to protect property from damage. They assume external aid will not be forthcoming (and

frequently they are correct), and that their efforts alone will determine whether property is lost or saved. This is a critical group of people in that, should their estimate of fire magnitude be erroneously low, they would be very likely to suffer physical injury or death. On the other hand, their efforts at resistance are likely to be successful if their estimate of the fire's magnitude is correct. Thus risk-taking behavior and refusing to cooperate with official evacuation plans are encouraged.

Lastly, sixty percent cited personal passive systems which require no activation or individual direction. These systems include brush clearance, efforts to keep brush non-flammable by daily watering, planting fire-retardent vegetation, purchasing fire insurance, and by employing fire-resistant construction materials or incorporating fire-restrictive structural design. Some of the latter adjustments may be mandated building codes, but such codes are non-uniform, and tend to be subject to significant political manipulation. This type of adjustment was found most frequently in combination with other categories of adjustment.

An inventory of the adjustments cited by the residents includes the following:

A Evacuation and Coordination
- established rendezvous points
- "We have just discussed where we will go to get away"
- made escape plans
- held evacuation drills
- made checklists for evacuation
- evacuation plans for animals
- neighborhood "phone calls" and "telephone tree" for information and warning
- "Get the hell out of here fast"

B Aids to Fire Department
- painted house number on roof
- keep fire phone numbers posted
- clear around hydrant
- keep road clear for fire trucks

C Personal Active Systems
- sprinklers on roof
- lawn sprinklers
- hoses
- water tanks
- pumps, pool and gas-powered
- backback pump
- buckets and "gunnysacks"
- hand tools
- ladders
- "close liason with neighbors to pool resources"

D Personal Passive Systems
- fire retardent roofs
- fire proof roofs (tile, rock)
- fire proof walls
- plantings and landscaping
- watering
- brush removal
- "thinning" plants
- pruning brush
- trash and vegetation removal
- buffer area and fuel breaks
- structural design
- no building overhangs
- large dimensions only for exterior wood
- heavy drapes
- window shutters
- "lots of insurance"
- "keep fingers crossed"
- "pray a lot"

While far from being exhaustive, this list represents an amibitous inventory of personal adjustments. Many of the respondents pointed out that even though they were aware of these measurers, certain obstacles prevented these adjustments from being fully adopted: e.g. having no place to dump brush after removing it. Or, that they personally had made reasonable attempts to adopt adjustments, but such efforts (specifically in regard to brush clearance) were futile if done in isolation. Therefore they frequently advocated increased enforcement of existing regulations. They see themselves as being fully capable of acting independently at a certain level of adjustment, and being more than willing to support more collective measures if only someone will help organize them.

Believes and Personal Adjustments to Disasters

I was curious if experience influences beliefs or behavior, or how belief and behavior influence each other. So I looked at combinations of answers.

I found that residents who have felt threatened are likely to have acquired a greater amount of information after fire and about the likelyhood of fire impacting the resident. They were significantly more likely to have made preparations for future fire events than those who have not been threatened.

Because threat is determined primarily by external factors beyond the individual's control, it is easy to postulate that the experience directly influences the other variable. Such is not the case with "preparation," where it is just as likely to be the dependent as it is the independent variable.

A high level of awareness is most commonly found among people who have made preparations. As the level of awareness, or information drops off, so does the likelihood of having made preparations. Thus the role of education regarding fires, whether through public education efforts or through direct experience, is closely tied with the likelihood of preparations in the resistance to fire through advance preparations.

As expected, people who have made preparations are also more likely to think it their responsibility, either alone or in combination with organizations, to deter a fire's impact.

Summary and Conclusion

To date, the collective social adjustments to fire hazards are primiarly technological and are just beginning to evolve into a comprehensive pattern. The greatest effort has been placed on establishing intricate systems of fire detection and suppression. Massive investment has been made into manpower, tools, aircraft, equipment, training, and communications. There is yet only a very disjointed interest in the collective individual adjustments of the population at risk and little official effort in aiding these adjustments (mainly achieved through regulation). However, as increased blame is placed upon fire organizations for failure to eliminate or reduce loss, increased interest in admitting technological limitations and requesting cooperative efforts is likely. In this interest is the appearance of publications about and for homeowners interested in adopting fire hazard adjustments to their property (e.g. Fisher and Books 1977, Radtke 1982, 1984). Even so, homeowners are uncertain which adjustments are most worthwhile and just how best to implement them. There remains a discernible lack of access to information.

Likewise, adjustments ,must be *successfully* adopted in order to benefit from them. It is the unclear communication of likelihood of success which frustrates most homeowners in their decision of which, if any, adjustments are to be made. While this is perhaps understandable, though regretable, in the case of individuals or households, it is less understandable for formal organizations, communities, and higher social units. Yet, as Kueneman (1976) so aptly pointed out:

> A more serious problem is the somewhat exaggerated rational model of community management portrayed in the discussion of human responses to disaster situations. Time and again, disaster research in emergency situations demonstrates that the impact of a major emergency hinders the execution of a centralized, coordinated and flexible response to hazards. While it is useful to identify the most adequate patterns of response in theoretical terms, it is imperative for any study of human responses to hazards to identify the recurring social sources of problems that hinder a more adequate response. The identification of and planning for these problems is a necessary part of research designed to minimize the damage created by disaster agents.

It is this very area of response which is least likely to be pursued by the existing management agencies. Because it is not already part of their area of interest, inertial forces seem to ensure that it will never become part of their responsibility. Such agencies do not evolve to assume new functions, rather new agencies are created to complete these roles. Our prevailing approach, as cited by Burton et al. in their first research paper on extreme events (1968) is to provide immediate refief to the victims (thus providing little incentive for change) and then to turn towards technological approaches to the problem. This is exactly the case with fire. Owners of burned out homes frequently are given disaster assistance to rebuild, and pleas are made for increased fire equipment and services. The latter argument is especially strong from the victims and the potential future victims because it has the advantage of not affecting their own behavior, while at the same time it distributes the cost of protection from that behavior away from themselves and onto the society at large. Existing fire services usually do not argue against the prospect of augmentations to their budgets. Thus the pattern is repeated and lower magnitude events are suppressed until the next increment upwards overwhelms the system and creates a higher order disaster. Any success in breaking this existing pattern of fire as a natural hazard will require viewing fire in its entire ecologic setting and, as a response, adopting adjustments in all the social and physical dimensions of disaster.

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PUBLIC POLICY, INSURANCE COVERAGE AND COST[1/]

Robert B. Holtom[2/]

Abstract: Most residential fire and homeowners policies do not cover losses from earthquakes or flood. Earthquake protection is readily available through agents and brokers. The cost of $100,000 of coverage on a dwelling and its contents is roughly $175 a year. A deductible of $1,000 to $5,000 usually applies.

Flood insurance is written only by the Federal Government, through insurance agents and brokers. It is about $500 a year for $100,000 on a dwelling, and more for its contents. A $2.000 deductible would apply. Landslide insurance is generally not available.

Basic fire insurance on property located in brush areas is generally available only through the California FAIR Plan, an organization composed of all insurance companies. Standard rates are used.

Introduction

Insurance gives the protection which enables people to live and build in areas which are subject to natural catastrophes. Without insurance, loans could not be secured for building or buying property, and few people would take the chance of losing a home or business because of the total damage which can result from the destructive acts of nature.

Property in California is immune to few of the world's natural disasters. Tornados are not common, but they have occurred. For example, on March 1, 1983, a small tornado damaged businesses and homes in the Broadway area of South Los Angeles near the Santa Monica Freeway, and even damaged the Convention Center in that neighborhood, resulting in a $2½ million loss. Hurricane winds have not struck California in recorded times, but torrential rains from the edge of hurricanes off of Mexico have struck Southern California several times in recent years, giving evidence to the nearness of these violent storms. Sink holes have not opened in California, as in several other states during the past decade, but similar conditions could develop at any time.

California is located in the "Ring of Fire" which rims the Pacific Ocean. Volcanoes are not uncommon in the region. Prior to the Mount St. Helens eruption in Washington on May 18, 1980 the most recent volcanic action in the contiguous United States was at Lassen Peak in Northern California, where a series of eruptions started on May 30, 1914 and continued through 1917. Earthquakes are a hallmark of this geologically-disturbed area, and the state is subject to daily shocks, most of them doing no damage, but a few each year cause concern if not actual injury. Some of California's rivers periodically flood their banks. Much of Southern California is a natural desert, with native plants which must conserve their precious moisture by means of drought adaptive mechanisms inclusive of volatile substances which can lead to disastrous brush fires.

Insurance Coverages

Most property owners are unaware of the broad coverages included in common insurance policies. Since the late 1950's, almost all dwelling policies in California, and many commercial policies, have been written on an "all risk" basis. This means that all causes of loss are covered except for those that are specifically excluded.

In contrast, the most common policies in many other states are "broad form" policies, which list the causes of loss which are covered. (The reason for this geographical difference is historical; state rating bureaus in the early years of these broad policies adopted different rate approaches, almost forcing logical buyers into these patters. Today, a single rating bureau services almost all states and uses a common rating approach, but the buying habits remain.) Both types of policies cover almost exactly the same losses, except that the "all risk" approach covers what might be called the "unknown perils."

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Insurance people have realized in recent years that the term "all risk" is a misnomer, and might be misleading since there are risks (uncertainties of losses) which are not covered. The wording is being changed, and terms such as "open perils" are being used.

All of these policies, under whatever title, exclude such types of loss as earthquake, landslide, flood, and subsidence (settling). These losses are not covered at standard rates for several reasons.

1. Affordability. Insurance policies need to be affordable for most property owners if they are to properly spread the risk, and to give the protection which is needed. These types of perils are quite expensive, because they can result in such large losses. In many parts of California, earthquake coverage can cost almost as much as the total of all of the other coverage in the policy. Flood insurance is even more expensive in many areas.

2. Fairness. A basic principle of insurance is that the price should measure the chance of loss as much as possible, and that those who are more exposed to the loss should pay a higher premium. Flood insurance is an excellent example. People who live in the hills, or away from rivers, have very little exposure to flood losses, and they would naturally resent having to pay very much premium for the flood exposure. On the other hand, people owning property which is located near to a river which floods every few years should expect to pay a substantial amount for the protection.

3. Catastrophe exposure. Earthquakes and floods have a potential for great damage, which can cost massive amounts of money for repairs and rebuilding. If these coverages were automatically written on all policies, insurance companies might not be able to pay all of the losses. As a result, some companies could become insolvent, which would cause hardships to many policyholders and claimants.

Although these coverages are not a part of standard policies, the protection is available in most cases. The programs vary, and it is important to know where to get the necessary information.

Court Decisions

Insurance companies have been hampered in their efforts to offer broad coverages at reasonable rates by a series of adverse court decisions in California. These decisions have extended the protection far beyond the intent of the parties, and afforded coverage for which no premium was paid.

The leading theory upon which the courts have built their liberal construction is called "concurrent causation." It states that whenever two or more causes combine to produce a loss, and one of those causes is not specifically excluded from coverage, the loss is covered. This doctrine has been applied in earthquake, landslides, and flooding cases. Although these perils are undeniably excluded, the courts have held that the loss is covered if improper construction, inadequate compaction, faulty design, or similar negligent acts have contributed to the damage.

Insurance claims under this theory have been substantial. Even worse, they could have bankrupted the companies if a major catastrophe had occurred before steps could be taken to correct the policies.

Underwriters have reacted in several ways.

1. The "earth movement" exclusion has been rewritten to strengthen it. Those who drafted the new language hope that this wording will be effective in limiting coverage to those policyholders who desire the coverage and pay for it. The new working has been adopted in most states, because this legal theory had been used in several states, although the major impact has been in California.

2. The "all risk" terminology has been abandoned and replaced by such terms as "open perils." Some courts have felt that the former "all risks of physical loss" created "reasonable expectation" in the minds of policy-holders, even though the phrase was immediately followed by "subject" to the exclusion found elsewhere in this policy" (or similar wording).

3. Legislative action was sought, to return the policies to their original intent. A law was passed in 1984, but since it applied only to earthquake, it will be discussed in that section, later in this report.

Underwriting Actions

Insurance company underwriters are charged with a responsibility for maintaining the solvency of the companies. In order to do this, they need to restrict the exposure which they write in certain areas, or on certain perils. These actions have undoubtedly contributed to the difficulties in buying insurance which some property owners have faced.

As will be explained in later sections of this report, flood insurance is unavailable through private insurance companies, earthquake coverage is written cautiously, and landslide protection is almost impossible to buy. Even fire insurance, which is so freely written in most territories, is generally available only through a pooling association for property located in the brush areas. Each of these lines will be discussed separately.

Flood Insurance

Most people who need flood coverage can buy it. The federal government has a program under which the flood-prone areas are mapped and rated. This program is subsidized by the government.

Governmental involvement is needed because this is a coverage which cannot be written by private companies. Losses are almost certain every year or two in some areas. Only those people who are exposed would buy the coverage, resulting in a classical case of adverse selection against the company. The potential losses are so great that no one but the federal government has the

resources to pay for the major catastrophes. Finally, if insurance is made available but no controls are placed on land use, the problem will continue to escalate as people build in the flood plains, secure in the knowledge that they will be paid if the property is destroyed. Only the government has the power to enforce zoning laws which regulate construction in these areas.

Under the Federal Flood Insurance Program, eligible areas are identified by potential flooding characteristics. Zoning laws are required for eligibility. Only people owning property in these designated locations are able to purchase this protection. The rates are not inexpensive; a rough average is about $500 a year for $100,000 coverage on a dwelling, and $300 to $400 a year for $50,000 on personal property in the dwelling. The usual deductible is two per cent, which would be $2,000 on this dwelling building.

Any licensed insurance agent or broker can write this coverage. Servicing is handled by some insurance companies under contract with the government. A waiting period of five days is required before the insurance is effective, to avoid situations where property owners would buy the protection as the flood waters were reaching the doorstep.

Earthquake Insurance

Earthquake coverage is generally available on property in California. It may be purchased either as a separate policy or as an addition to a fire or homeowners policy.

Almost all property insurance companies will write this coverage, but some are more willing than others. The problem is that insurance companies do not want to write so much exposure that their solvency would be threatened when the next great earthquake strikes, and many companies feel that they are approaching that limit. Experts say that there is about a 50 percent chance of a great earthquake occurring on the southern portion of the San Andreas Fault within the next 30 years. (A "great earthquake" is one with an intensity of 8.3 or more on the Richter scale. The San Francisco earthquake of 1906 was estimated as 8.25 or 8.3.)

The damage from such a shock would be heavy. Studies are under way to try to estimate the loss which would occur. The California Department of Insurance publishes an annual report showing the total exposure of all companies, by zones, for the earthquake coverage itself. Other studies are considering the estimated impact of the fire which might be expected to follow the earthquake, the loss of life and the bodily injuries, the damage to automobiles and other properties, the cost to repair bridges and roads, and the impact on financial markets. When the total has been estimated, efforts will be made to find a means of guaranteeing that all losses will be paid without jeopardizing the solvency of the insurance companies.

Property owners who are concerned about the possibility of damage to their property can purchase insurance. The cost varies by territory and construction, as well as by company. A frame or frame-stucco dwelling in one of the coastal counties might cost about $175 a year for a $100,000 dwelling and its contents. The deductible is either 5 percent ($5,000 on the property used in this example) or 10 percent ($10.000). Many companies have changed to 10 percent recently. so a buyer might need to shop around to find 5 percent if that is desired. These large deductibles (large in comparison to fire or theft deductibles) are needed to avoid paying for the cracks in plaster and stucco which are present in virtually every California dwelling but which are not noticed until the owner looks carefully at the walls after an earthquake. Claims have been presented for "earthquake damage" when there is dust, or even paint, in the cracks, indicating that they were there long before the earthquake struck.

Earlier in this report, the problem of concurrent causation was described. While these court decisions are somewhat expensive when applied to landslide losses, they could be completely disastrous if applied to earthquakes. If the great earthquake struck at a time when every, or almost every, dwelling policy was interpreted to carry earthquake coverage, the insurance companies would almost certainly be bankrupt. To solve this problem, the California Legislature enacted Assembly Bill 2865 in 1984. It gave the companies a guarantee that concurrent causation would not apply to earthquake losses; if the property owner did not pay for this coverage, the resulting losses would not be paid. In return, the companies are required to make a specific offer of earthquake coverage to every residential policyholder. The way the bill was written, it was almost mandatory that the offer be made by registered mail. This is the reason that most homeowners received such an offer early in 1985; only a few companies chose to make the offer in conjunction with the next renewal. It is generally assumed that the making of a concrete offer will result in some additional sales; the coverage has long been available but only about 7 percent of the dwellings in the state have been protected against this peril. Insurance companies had felt that they were exposed almost as heavily as they could stand, before the law became effective on January 1, 1985. The expectation of increased sales has been a prime factor in the increase in the deductible from 5 percent to 10 percent.

Rates and deductibles vary by company. A property owner may need to search for the most advantageous program which fits his or her needs.

Several special programs of earthquake-only policies have been offered by associations of insurance agents and brokers. Some of these programs have only a $1,000 deductible. The tightening of the insurance market in early 1985 is raising questions about the future of these programs, so again it is suggested that interested property owners look into the various alternatives which are available.

Landslide

The one natural hazard for which it is difficult to get insurance is landslide. This damage is not covered by standard policies, and few companies sell specific protection.

From an insurance standpoint, landslide is similar to flooding: the only people who want to buy the coverage are those whose property is almost certain to have a loss. The spread of risk and the lack of adverse selection, which are essential to the proper operation of the insurance function, are lacking in both of these types of losses.

Only properties located on hillsides are exposed to loss by landslide (unless we also include structures immediately below them). Not all such property will slide, of course, but some structures are damaged each year by spillage. A winter of heavy rains will usually have more than the average number of landslides, because the ground gets heavy from the water.

Continued building in the hills has caused the problem to grow. Proper compaction seems difficult to achieve. Landowners tend to add swimming pools, driveways, walls, and other structures in locations which were not designed for them. Hills are stripped of the natural brush which tends to hold the ground in place, and slopes are left bare or are covered with groundcover which is inadequate and can get heavy and helps to start slides.

Some buildings in the hills have lasted for many years, and insurance companies included landslide protection in the first editions of the broad dwelling policies which were introduced in the mid-1950's. Losses soon became so great that the coverage was removed from the policies. The reason was that a sizeable rate increase would have been necessary if the policies were not changed, and it was considered unfair to raise the price of insurance for everyone, in order to benefit a few. Since then, extensive building has occurred in the hills, as the supply of flat land in the metropolitan areas disappeared, and the coverage has never been put back into the standard policies.

Most insurance companies do not write landslide protection. A few catastrophe-type policies do include the coverage, and interested would-be buyers can inquire of licensed agents or brokers. Where available the protection would be combined with other natural causes of loss, and thus probably would be fairly expensive.

The federal government does not have a program to write this type of insurance. Policies written under the Federal Flood Insurance Program do cover mudslides. These would usually be slides which occur in conjunction with a flood. A mudslide is a river, flow, or inundation of liquid mud. It often occurs as the result of a loss of brush cover, followed by an accumulation of water from heavy or prolonged rain. A mudslide can occur as part of a landslide, but only the mudslide which caused the damage would be covered, not the landslide itself. There are no known plans to expand the Federal Flood Insurance Program to cover landslides, probably because the total number of losses in any one year is not large enough to adversely affect the economy, as is the case with flooding. It is true that the individual whose property is damaged will suffer as much under one type of loss as under another, but there are few sources from which to buy insurance for the landslide peril.

Brush Areas

Fire insurance is available on properties located in the brush areas, but not from every company and not always with all of the coverages that might be desired.

Insurance problems in the brush areas began about 1960. Studies were conducted by research groups and the California Legislature, as people became aware that the amount of construction in those areas was increasing rapidly. In 1961, the fire rating bureau adopted a new program designed to secure more adequate rates for structures located in the hills; surcharges were adopted for many buildings. Rates were based on the distance from the natural brush, the type of roof and construction, and the accessibility to fire stations and hydrants.

On November 6, 1961, the Bel-Air Fire occurred in the eastern Santa Monica Mountains. Burning wood shingles and other flammable materials helped to spread the fire; it was reported that burning embers were carried as much as a mile by the wind, and started new fires. No lives were lost, but over 500 buildings were destroyed or severely damaged. *Sunset Magazine* reported that this fire ranked second in the Western states only to the San Francisco fire which followed the earthquake of 1906. The insurance loss was estimated at $24 million.

The winter rains started only two weeks after the Bel-Air fire. Mud poured down the barren hillsides. Some houses which had escaped the fire were damaged severely by the mud and water. The erosion problem was demonstrated dramatically by this event.

Regulations were adopted after the fire, attempting to control the brush and the types of construction. Wood shingle roofs were particularly attacked because of their performance in the fire. Although these regulations will help, they are resisted by the occupants of those areas and also special interest groups, and they will not be effective for some time because they usually apply only to new construction or major changes.

Insurance companies were alarmed by the size of the fire. Where concerns had been expressed before the fire, action was demanded after it occurred. Many companies limited their writings of fire insurance in the brush areas. Special programs were established to maintain a market for those property owners who

wanted insurance. By 1968, even these programs were threatened as insurance underwriters became concerned about the chances for more major fires in the brush areas. The reasons that underwriters were very selective and limited in their acceptance of applications for fire insurance in the brush areas are these:

1. Fires are inevitable in the hills. It is natural for the brush to burn periodically. In contrast, structures in the flat lands of cities can survive for many years, and may need to be torn down to remove them. Insurance is based on the unlikelihood of a loss occurring.

2. Structures have been built in these brush areas within the past few decades. Fires in the brush itself are of little concern to insurance companies, but fires where buildings are located are very much of a problem.

3. Even if property owners wanted to remove the brush, they could not. The chances of landslides and flooding are greatly increased when the brush has been cleared. The native brush can be replaced by controlled plantings, but considerable difficulties are encountered in getting water to those plants, and it appears to be impossible to replant the long slopes which are not close to dwellings.

Brush fires can be major catastrophes. Insurance companies do not like to write coverages where the catastrophe hazard is great because of the severe adverse impact on their financial results. For these reasons, the voluntary market for fire insurance in the brush areas had almost disappeared by the late 1960's.

In 1968, the California FAIR Plan Association was established by the insurance companies and authorized by state law. It is an association of all of the property insurers writing in the state. Standard rates are used. Standard policies are issued, with options of fire, extended coverage (windstorm and a few other perils), vandalism and malicious mischief, and earthquake. The FAIR Plan writes in two distinct areas:

1. Designated brush areas. These are the hill areas which have been mapped by the rating bureau, principally considering the presence of native chaparral. The territory with the highest concentration of values is the Santa Monica Mountains, west to the ocean. Also eligible are parts of the San Gabriel Mountains, the Ventura-Santa Barbara region, and south in Orange and San Diego Counties.

2. Inner cities, sometimes referred to as "urban core areas." These are the places where voluntary insurance may be difficult to secure because of the "environmental hazard," meaning that losses are more likely than normal because of the surrounding neighborhood, regardless of the construction or maintenance of the property itself. Many of the larger metropolitan areas in the state are eligible.

The California FAIR Plan Association writes substantial amounts of the business in each of these areas. (The acronym FAIR stands for Fair Access to Insurance Requirements). The shock losses of brush fires are spread among all of the insurance companies, so it is hoped that the impact will not seriously damage any company. Losses in the inner cities consistently exceed the amounts contemplated by the rates, but again these losses are divided among many insurance companies.

Property owners in eligible locations can secure insurance through the FAIR Plan. All licensed agents and brokers are able to handle the placement and servicing of the coverage. This program represents a major effort by all segments of the insurance business to be certain that protection is available to all property owners who desire it.

DISASTER PREPARATION & ASSISTANCE[1/]

Verne Paule [2/]

Abstract: The Federal Emergency Management Agency (FEMA) is the central point of contact with the Federal government for a wide-range of emergency management activities in both peace and war. FEMA is dedicated to work closely with all the members of the emergency management community to achieve a realistic state of preparedness and an increased capacity to respond to emergencies of all types—floods, earthquakes, fires, hurricanes, tsunamis, volcanoes, off-site emergencies at nuclear power plants, fire safety, civil defense emergencies and many others.

As the theme for this conference—"An Integrated Approach To Public Safety And Enjoyment"—identifies your objective. FEMA's approach to emergency planning preparedness is also an integrated approach. We define it as protection of the population for all hazards, or more specifically, the INTEGRATED EMERGENCY MANAGEMENT SYSTEM. Utilizing the commonalities of emergency planning, such as the need for trained personnel, communications, the ability to relocate population in the event of any emergency, the need for support for these people with food, shelter, and medical assistance, to name a few, these requirements are being integrated at all levels of government for all disaster planning.

In addition to planning to respond to emergencies, FEMA, working with state and local governments, has continually assisted and supported awareness campaigns to make the citizens aware of what type of individual planning can be done for one's own survival.

Introduction

On behalf of the Federal Emergency Management Agency, Region IX, in San Francisco, many thanks for allowing my agency and me to participate in this most informative and worthwhile conference. My congratulations and compliments to Dr. Radtke, the National Foundation for Environmental Safety, and the National Park Service for sponsoring this conference and public workshop. This turnout is a tribute to the increase in this important subject.

There is great logic for an integrated approach to the problems of living in the chaparral and the hazards one faces here. The Federal Emergency Management Agency (FEMA) has a similar approach to emergency planning and response, that is, the necessity for an integrated approach. FEMA has focused on the concept of Comprehensive Management to mean the total integration of preparedness, response, recovery, and mitigation responsibilities throughout the nation. The "Integrated Emergency Management System" is the implementing strategy for that concept. It is a system of population protection for all hazards and utilizes the commonalities of resources for all hazards. This includes planning, communication, training, care and shelter, public information, transportation, relocation and warning, among the most important.

The Federal Emergency Management Agency (FEMA)

As a starting point, let me state that FEMA is the central point of contact within the Federal government for a wide range of emergency management activities in both peace and war. We are dedicated to working closely with all members of the emergency management community to achieve a realistic state of preparedness and an increased capacity to respond to emergencies of all types.

FEMA is a supportive partner to the public and private organizations and groups which contribute to emergency management. Many life and property-threatening emergencies are best dealt with at the state and local levels. We will support these local efforts by providing resources and guidance and always being ready to respond when demand exceeds local capabilities. FEMA is involved in supplemental support to state and local governments when natural disasters

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[1/] Presented at the Conference and Public Workshop *Living in the Chaparral of Southern California,* October 20, 1984, Los Angeles County Museum of Natural History, Los Angeles California.

[2/] Verne Paule, Public Information Officer, Region IX, Federal Emergency Management Agency, San Francisco, California.

qualify for a Presidential declaration. We coordinate the Federal response providing whatever supplemental assistance is required. FEMA is also involved in administering the Federal flood insurance program, earthquake planning for a catastrophic earthquake, emergency planning to cope with a national emergency if our nation was attacked, hazardous material planning, fire safety, dam safety, as well as being involved in the event of any extraordinary emergency that would involve the Federal government. For example, we were involved in the planning and had a small cadre of our people on site during the Los Angeles Olympics. Thankfully, we were not called upon for any coordinative action.

The United States Fire Administration and the U.S. Fire Academy are an important part of FEMA. Emmitsburg, Maryland is the home of FEMA's Emergency Management Institute, and includes the National Emergency Training Center, the Senior Executive Policy Center, the National Fire Academy and the U.S. Fire Administration. FEMA is presently working with the State of Nevada in the activation of the National Emergency Training Center (NETC) West, to be located at the Stewart Indian School, just outside of Carson City, Nevada.

Communication, Cooperation, Coordination

As an information practitioner, I believe the hallmark of success in planning and dissemination of information can be focused on the 3 C's—COMMUNICATION, COOPERATION, and COORDINATION. If we remember this, I believe we can be successful in our respective roles for better informing and educating our constituencies.

What is the best approach to know how to live in the chaparral? To answer this question, let me propose the following:

* Obtain as much information on the hazards;
* Conduct a survey of your property and business to determine what conditions and improvements are necessary;
* Determine what fire hazards exist, the areas subject to earthquake, flooding, mudslides and erosion;
* Determine if your insurance for all hazards is adequate;
* Determine if professional assistance is necessary;
* Determine if you have a plan; if not prepare one and test its adequacy;
* Determine your basic survival needs, such as communications, radio, flashlight, batteries, medicines, water, food, care for pets, etc.;
* Determine if you have assistance available for the disabled;
* Determine if your car or truck is ready for a relocation if necessary;
* Determine what valuables and emergency supplies would be needed if it was necessary to relocate;
* Determine where and how you would go to a relocation site;
* Determine if you have adequate training in cardiovascular resuscitation (CPR) and emergency first aid.

Disaster Assistance and Preparation

To help to determine the assistance needed, let me provide some resources:

* FEMA has published a Citizens' Handbook called "In Time of Emergency (H-14)" which is available from local emergency services offices or through the San Francisco regional office;
* Red Cross, the Salvation Army, and other volunteer agencies can assist;
* Local government emergency services coordinators are available, and through the California Mutual Aid Plan do provide emergency response;
* State and Federal assistance is available for Presidentially-declared disasters, providing individual assistance as well as public assistance. The former is for individuals and businesses that qualify and the latter is for publicly-owned properties such as roads, hospitals, schools, water systems, sewage facilities, etc. This is supplemental assistance to the state and local governments who qualify.

The bottom line is that everyone must prepare for their own survival. It has been said that civil defense, that is emergency response planning, is done or not done at the local level. Awareness campaigns help motivate governments and people. The California Office of Emergency Services, and our agency, along with many local jurisdictions embarked April 15-20, 1985 on the first statewide Earthquake Awareness Campaign. Last winter and again this year there have been statewide Winter Storm Campaigns.

There is a determined need for the private sector to be involved. A shining example is the progress that the City of Los Angeles has made and continues in earthquake awareness. Under the leadership of elected officials such as Councilman Hal Bernson, many unique public awareness projects have been launched. The latest is the participation of Mr. Joseph Barbera, the creator of the Yogi Bear character and the Hanna Barbera Company, in developing a Yogi Bear cartoon book providing basic earthquake information for children. Safeway Stores have printed millions of copies of this publication. And Isuzu Motors contributed a van that has been modified to simulate earthquakes, vibrating in a vertical and horizontal manner. It is called the Yogi Bear Quakey-Shakey Van, and is visiting schools to acquaint students with earthquake preparedness.

Your attention is also called to the August 16, 1984 *Los Angeles Times* story captioned "Agencies Fight Brush Fires with Public Information," which quotes Dr. Radtke as a resource. There are many useful publications that many agencies have available that can provide valuable assistance to those who live in the chaparral.

DISASTER PSYCHOLOGY—COPING WITH DISASTERS[1/]

Bertram R. Forer[2/]

Abstract: Residents of urban and suburban areas often tend to disregard their fragile dependence on nature until confronted by natural disasters that threaten their lives, homes and possessions and disrupt their daily lives by breaking the supply systems for utilities, food and transporation. Disasters or threats to stability, like any crises such as illness and burglary can mobilize constructive action and improve lives. More often disasters, natural or man-made, undermine morale, competence and health with possibly chronic and disabling impact. Both disasters and their victimizing emotional aftermaths can be prevented or reduced by accurate information, active effort and emotional awareness.

Introduction

We human beings have always been dependent on physical nature but often ignore this fact of life because so many of our habitats are shielded from direct contact with nature. Many live in incubators supplied by pipelines that provide utilities, airconditioning, food-distribution and sewage systems, communication media for social contact and enclosed vehicles for transportation. People tend to replace their ultimate dependency on nature with reliance on the governmental and utility representatives that intervene between them and nature. They also attribute to these agents the same powers and motives that they believe exist in nature, because they are so vulnerable to disruption of services.

Some choose or can afford to live in sheltered environments. Others want and are able to own their own homes, live close to nature with its charms and risk and even enjoy struggling with it. Those who live closer to nature may be more directly exposed to some of the inevitable natural disasters such as fires, landslides, floods, earthquakes, volcanoes and ocean tides. Disaster and other life crises bring out the primitive emotional part in most of us at first: disbelief, fear and anxiety, rage and superstitious explanations, such as luck, an act of God, or fate. While these are normal first reactions to sudden or persistent stressful events, survival requires that they be followed by effective coping. Like reactions to combat, rape, burglary or assault; they can persist long afterwards and leave us mired in feelings of chronic helplessness, depression, jumpiness, loss of drive, insomnia and even physical illness: lifelong victims. This condition, known as post-traumatic stress disorder, is a habitual carry-over of an initial emergency reaction to an abnormal situation into all aspects of life. We are concerned about what we can do as individuals and communities to prevent or lessen both the physical and emotional damage and the potentially chronic emotional reactions to disasters.

Disaster Research

Much research has been done in the past few years, mostly since the Anchorage, Alaska earthquake, through interviewing victims, comparing before and after social statistics and studying government response to disasters. Follow-up studies are continuing long after the Mt. St. Helens eruption, the Three Mile Island nuclear threat, the Love Canal toxic waste discovery and a variety of fires, earthquakes, tornadoes and floods to learn more about two aspects of natural and human-caused disaster: the emotional effects on people and the best means of handling both the disasters and their victims.

I shall try to summarize what has been learned and suggest ways in which this information can be used by individuals and communities.

1. General Post Disaster Response

After most natural or human-made disasters there is a huge increase in death rate, suicide, sick-leave, child-abuse, marital violence, drug and alcohol abuse, vandalism, mental health crises. These are social syptoms of undermined personal security: anxiety about the future with feelings of helplessness and doubts about

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1/Presented at the Conference and Public Workshop *Living in the Chaparral of Southern California,* October 20, 1984, Los Angeles County Museum of Natural History, Los Angeles, California.

2/Bertram R. Forer, Ph.D., Emeritus Professor of Clinical Psychology, UCLA, residing in Malibu, California.

one's ability to run one's own life. Even in the comparative tranquility of daily work people who FEEL overburdened show signs of stress which they may express indirectly in irritability with their families and escape into alcoholism.

2. The Young and the Old

Children and older people are more likely to be shattered by radical changes because they have fewer personal and emotional resources. Children are strongly affected by the ways their parents react to crises, learning their parents' fears and helplessness. They are enormously dependent on their parents' understanding acceptance of the childrens' anxiety. Lasting emotional crippling of the children is more difficult to prevent unless supportive attention is immediate.

3. Lack of Clear-cut Information

Lack of clear-cut information generates fantasies and rumors that may exaggerate the damage or threat. The therapeutic value of expert advice is basic. Advice from astrologers, witch doctors or uninformed well-meaning people and unrealistic promises by government officials breed worse emotional effects and discourage constructive actions. Media, especially television, depictions of damage add to the anxiety of victims and potential victims, strengthening their belief that the world is hopelessly dangerous. Unfounded fears and convictions that are not checked against reality are generally more destructive to morale and subsequent lives than actual events or damage to one's home.

4. Sharing Our Fears

When daily life is significantly disrupted, it is crucial for individuals to know what has happened to them and what future prospects there are, to recognize the reality of the event, not to deny it or focus too long on blaming nature or society, though it is normal to do so at first. Accepting that we feel fear of forces beyond our control, saying so aloud, permitting such feeling in our children, sharing it with others keeps the emotion in the open rather than buried inside. Unaccepted dread can be converted into physical symptoms and lessen both competence and the will to face and solve real issues. Denying fears is not heroic; it is dangerous. Shame about admitting fears, nightmares or anxiety is more self-undermining than sharing these feelings with others who may be in a position to support, advise or help and lessen feelings of aloneness.

5. Predictability

Research findings show clearly that a major source of individual and group panic after a disaster is the loss of a stable, predictable view of the present and the future, not knowing how long the disruption will last or how frequently it might recur.

6. Individual Disaster Preparation

Individuals who participate actively in preparing for threatened disasters, acquiring technical information, taking steps for immediate repair or prevention of further damage may strengthen themselves as persons, increase their self-esteem, reveal prowess or flexibility they did not know they possessed, even find a kind of pleasure in coping with emergencies that interfere with rigid schedules and routines. Sometimes crises are therapeutic, particularly when we learn how to master new knowledge and skills that enhance our self-respect. Those who run away, hold onto blaming or feelings of outrage or do not participate, are more likely to fail in saving both their property and their morale. They are more likely to develop chronic disabilities.

7. Use of Existing Knowledge

Knowledge that is used usually puts one ahead. If there is evidence of weakness in one's home or geography, delaying solutions not only increases one's vulnerability but also may add to later self-blame which itself undermines personal power. It is an unfortunate fact of human nature that only a small proportion of persons seek and follow medical advice, safety rules, use seat-belts, fix leaky roofs in dry weather or cut flammable brush from their grounds. They are the survivors. They respect the real world and are willing to deal with it. Those who prefer to hold onto lovely fantasies that everything will be fine without trying new ways are the ones most likely to become and remain victims. They literally force the outside world to mistreat them.

8. Community Reaction to Disaster

Let's now pay more attention to the role of community reaction to disasters, because it is rare for individuals to experience or be able to deal with them alone. In fact, disasters have milder personal impacts when they are shared by many persons in the same geographic area. Primitive beliefs that one has been somehow singled out are less prevalent. Healthy humorous or philosophical attitudes become more likely. Greater morale reinforced by mutual suffering and concern tends to stimulate will, ingenuity and competence.

9. Government's Leadership Role

The more responsibility accepted by all governments of a leadership role in dealing with crises of any kind, the less likely will there be group panic and the more quickly both the environmental and personal issues

will be resolved. Two powerful aspects of disasters in undermining human morale are (a) the unexpectedness, that is, lack of emotional preparation and (b) uncertainty about the future. Emotional, social and medical problems are much less common and more quickly healed in communities that provide their citizens with accurate information and warnings when they are possible, that foster public feelings of hope by showing enlightened concern and take immediate steps to enlist the entire public in confronting the issues.

In Malibu much of the community became and remained unnecessarily anxious, resentful and helpless after the Big Rock slide until Caltrans wisely began to provide bulletins explaining the events and plans for solutions. When government agencies reject responsibility, interest or positive communication as in Love Canal, the public correctly feels abandoned, alone, demoralized and distrustful of authorities' motivation.

10. Community Disaster Preparation

Communities that establish a pre-disaster program with well-trained staffs are able to prevent much human agony, antisocial acts and chronic invalidism and ultimately save much public money. Today's workshop is a perfect example of community educational preparation that will prevent many participants from suffering the worst impacts of whatever disasters they may encounter. Forewarning oriented toward prevention reduces the paralyzing shock reactions to catastrophe.

11. Agency Response and Public Information

The course of reducing and recovery from disaster has been more successful when Government and community agencies have used the media quickly to inform the public of the facts of the disaster and future possibilities, agency roles and plans and assigning jobs to the residents. Quick, organized and preplanned agency response enlists eager and healthy constructive citizen participation. Mobilization of group efforts to deal with threats from the outside, as in invasion by an enemy, enhances morale, feelings of worth as members of the group, increases cooperation.

12. Speed of Response

Speed of reaction is critical. The earlier a community response is activated, the less will be the emotional damage and the more rapidly and permanently can it be repaired. Delay, regardless of the reason in starting personal and social first aid is potentially lethal.

13. Personal Reactions to Disasters

A final personal hygiene point. Many competent, self-reliant people believe that it is a sign of weakness or that they are "cracking up" if they suffer some of the emotional symptoms of stress, such as jitteriness, irritability, persistent worrying, insomnia. Some fear their repetitive dreams which are a necessary part of recovery from a car accident.

All of the evidence suggests that these are normal and even valuable feelings under the circumstances. But they can become serious life-long limitations if they are not heeded and followed up by mental hygiene measures. An assault on one's self deserves at least as much repair as a break in one's water line.

Summary

All kinds of disasters and crises have deep and powerful emotional effects on individuals that spill over into their community behavior. It is possible to lessen personal anguish, chronic disability, loss of lives and property and future financial drain. Success requires early prediction, quick response, public participation, agency leadership and much planning.

California Department of Conservation, Division of Mines and Geology
Geologic Maps and Reports
Cliffton H. Gray, Jr.

Published geologic maps and reports of the California Department of Conservation, Division of Mines and Geology are displayed. These maps and reports provide basic geologic information with emphasis on slope stability and landslide conditions. Most of them result from past cooperative programs with cities and counties where the Division has prepared geologic and slope stability maps for use by local environmental and engineering departments. Report and maps are printed in limited numbers; they are available for purchase by the public as long as they remain in print. All of these reports and maps are available for reference at the Regional Office of the Department of Conservation, Division of Mines and Geology, 107 South Broadway, Room 1065, Los Angeles.

California Geology is the official monthly publication of the Division of Mines and Geology. It deals largely with California geology, mineral resources, and slope stability problems. It is available to the public with a yearly subscription of $5.00.

California Department of Forestry
A Cooperative Approach to Public Safety
Jerry Partain

The three main areas of responsibility of the California Department of Forestry are fire protection, regulation of timber harvesting, and assisting small landowners in the management of their wildland resources.

CDF is specifically responsible for fire protection on all private lands in unincorporated areas of California totalling approximately 28 million acres.

The California Department of Forestry display is a static display depicting the various aspects of CDF operations. Special emphasis is placed on chaparral related programs. The general areas of presentation correspond to the keynote address of the conference. These are (1) Fire Protection, (2) Fire Prevention, (3) Fire Environment Modification, and (4) Resource Management. A rear screen projector shows slides that enhance the visuals on display.

California Wet Roof Systems
Exterior Fire Protection System
Gordon Allen

Our Fire Protection Systems are designed to operate effectively in the three conditions which normally occur during wildfires - loss of water pressure, power outage, and strong Santa Ana winds. Unlike rooftop sprinklers and the garden hose, which can be rendered useless by one or more of these conditions, our systems will perform reliably because they are independently powered gasoline or diesel engine pumps, utilizing an independent water source (swimming pool or tank), and through our uniquely designed ridgeline deflector assembly, we create a sheet or deluge of water directly onto the roof surface.

For Californians looking for an alternative to resurfacing their roofs with fire resistant substitutes before the expiration of the useful life of the roof or who want to make the best use of the water in their swimming pools, for exterior fire protection, California Wet Roof Systems offer automatic or manual-start options.

Committee for Firesafe Roofing
Firesafe Roofing
Raquel Montoya

The Committee for Firesafe Roofing ("CFFR") is a group of individuals and organizations that develops and promotes pertinent information regarding different types of fire retardant roofing products and systems.

Information is made available to the general public, the construction industry, City, County and State planning and legislative bodies, building code development and enforcement agencies and other interested organizations.

The committee communicates this information by way of print and broadcast media, by response to telephone and mail inquires and by public appearances of qualified speakers.

Membership is open to persons, agencies or organizations who support the purposes, programs and principles of the Committee for Firesafe Roofing.

Fire Protection Agencies
Cooperative Displays

This display gives fire protection agencies the opportunity to be part of the program and to communicate their approach in wildland fire protection of their communities to the public and other agencies.

Local brush clearance ordinances, planning and building guidelines for foothill communities, and homeowner related safety literature are displayed along with other visual aids.

Halprin Supply Co.
Homeowner Fire Fighting Equipment
Robert Grenader

Wildland fire fighting agencies realize that during large scale wildland fire fighting emergencies manpower and equipment is spread thing and the homeowner may be the key to successfully saving the home. Where water is readily available, this can be done effectively. Tools such as portable and floating pool pumps and accessories as well as a whole line of portable lightweight generators have been developed by private industry to assist the homeowner and community with this task. For example, floatable, gasoline powered pool pumps are easily handled by one person, efficiently use the available water supply, and are powerful enough to direct a strong stream of water to any area of the home, even against strong winds.

Landscape Architecture - UCLA Extension
Meadow Oaks Project – Wildland Development
Claire Feay

The field of landscape architecture encompasses the individual design of a project and goes beyond those boundaries to become involved with the larger region in which a project lies.

The systematic analysis of this larger region aids in determining the land's suitability or capability for future uses. This process is strongly based on ecological and natural sciences (watershed, seasonal streams, viewshed, plant & animal communities, exposure, climate, etc.)

The analysis of this data is incorporated into the site and the requirements for the use program are brought together in creative synthesis.

Such an analysis and synthesis was employed in a research project for a final presentation in the Landscape Architecture Professional Designation program at UCLA Extension.

Los Angeles City Fire Department
Wildland Fire Control in Urban Environs
Donald F. Anthony

The Los Angeles City Fire Department is faced with a variety of fires ranging from large scale industrial and commercial structures to single family dwellings, from oil tankers to hillside brush communities.

Slides, overlays and other visual aids are used to analyse the 1978 Mandeville Canyon Fire, a large scale brush fire which swept through hillside communities. The hour by hour analysis shows the fire spread and the commitment and movement of manpower and equipment. It portrays a realistic picture of the difficulty faced in attempting to fight large wildfires under extreme fire weather conditions while attempting to protect and save structures. Such an analysis is a valuable tool for understanding fire behavior and fire spread, identifying high risk fire areas, reducing property losses in such areas, and preparing for the next fire which is sure to come with the regrowth of the brush.

Los Angeles County Flood Control District
Flood and Erosion Control
David Potter

The Los Angeles Basin is periodically subject to devastating floods resulting in substantial property damage. Such damage is intensified by debris flows resulting from the destruction of the foothill watersheds by major brush fires.

During debris flows, the primary responsibility of your Flood Control District is the control of flood waters in the major rivers and channels throughout the District. Therefore, assistance to individual property owners is not always possible during this emergency period. Past disasters due to debris flows are displayed along with several protective measures. The booklet A Homeowner's Guide For Debris and Erosion Control, published by the Los Angeles County Flood Control District, is available to homeowners. It describes debris and erosion control measures which a homeowner can install.

Los Angeles Department of Water and Power
Leak Detection/Water Conservation
Raymond L. Nelson

The Leak Detection/Water Conservation Unit of the Water Operating Division was initiated in 1976 in an effort to reduce water loss within the Los Angeles City Water Distribution System. The program was introduced partly in response to the drought conditions existing at the time. The unit has two primary responsibilities: (1) surveying the distribution system for leaks; (2) informing the consumer when leakage is suspected on the residence or business side of the meter. Other functions which the unit performs, as time and need dictate, are pinpointing hard-to-find leaks for the leak repair crew, SPECIAL LEAK SURVEYS IN SLIDE AREAS, and responding to consumer problems. Slopes saturated either by rainfall or water leaks are major causes of hillside failures.

National Foundation for Environmental Safety (NFES)
Making Your Neighborhood A Safer Place To Live
Louis E. Hill

NFES is a nonprofit public benefit corporation dedicated to making the community in which we live a safer place for everyone. NFES has brought together, both as directors and advisors, experts in their specific fields of interest such as watershed management, fire management, soil science, geology, hydrology, forestry, plant ecology, engineering, etc. The Foundation (1) promotes public awareness of environmental hazards, (2) assists the public in living more safely in disaster-prone areas, (3) carries out and assists with scientific research, (4) produces newsletters and relevant publications, (5) supports community projects, (6) promotes communication among experts and the public, (7) provides assistance to other agencies in carrying out the goals of NFES.

A display of fire maps, newspaper articles, and research reports illustrates and analyses the fire history of the Santa Monica Mountains and other wildland areas in Southern California. Aerial photographs of often predictable landslides raise the question of adequacy and enforcement of current minimal safety standards for mountain development and of the lack of adequate property management by the homeowner. Infrared aerial photographs of the Santa Monica Mountains viewed in stereo (courtesy of NPS) provide the homeowner with the opportunity to firsthand evaluate the watershed and fire problems in mountain communities. Additionally, public safety literature distributed free by NFES or provided at cost (A Homeowner's Guide..., Living More Safely...) is displayed.

National Park Service - SMMNRA
Living in the Chaparral: Cooperative Resource Management in a Complex National Park Unit
Kheryn Klubnikin

Santa Monica Mountains National Recreation Area has been a unit of the National Park System since 1978. Its boundary encompasses 150,000 acres of Mediterranean-type ecosystems, dominated by expanses of Southern California chaparral.

The primary goals of the National Park Service in this unit are maintaining the airshed value of the Mountains, preservation of natural resources, and the provision of resource-based recreational opportunity. The management philosophy of the national recreation area focuses on the cooperation of agencies, residents and landowners and interest groups to achieve these legislative goals. The National Park Service is actively acquiring land in the Mountains and will have direct management authority on lands in fee and easement, approximately 40% of the NRA. Other public agencies will continue to manage approximately 28% of the area, with the other 32% remaining in private ownership.

Catastrophic natural events, such as fire and flood, and other less dramatic natural ecosystem processes cut across ownership boundaries to affect private, public and recreational interests. Using the park's Natural Resource Management Plan as a focal point, the National Park Service is initiating a Cooperative Resource Management Program that will integrate the needs of people with the preservation of resources. Eventually it will include habitat restoration, landowner outreach, and a variety of cooperative activities. Information transfer, such as the "Living in the Chaparral" Conference is seen as yet another aspect of the program.

Santa Barbara City Fire Department
Wildfire
Jack Armstrong

The Santa Barbara City Fire Department and Ryland Research developed this Audio Visual Program from information developed during a fire scope study using computers to fire model wildfire potential.

This 2 project tape sync program uses an actual Santa Barbara canyon and makes predictions on the number of homes that will be destroyed using three different scenarios. Each scenario uses a different set of wildfire prevention strategies.

This 13 minute audio visual program is designed to educate the residents who live in the High Fire areas of Santa Barbara. The central message is brush fires will continue and residents should replace flammable roofs and remove flammable vegetation from around their homes.

UCLA Map Library
The Chaparral Plant Community: Effective Watershed Cover
Carlos Hagen

The display introduces the audience to woody chaparral plants and their usefulness as effective watershed cover and for drysite landscaping.

Chaparral is a plant community in California that has adapted over millions of years to summer drought and frequent fires. Similar vegetation is found in regions of Mediterranean climate (hot, dry summers - wet, moderate winters) throughout the world. Chaparral plant species have been looked upon as a nuisance because many become highly flammable as they mature and the fine dead fuel increases. Some, such as chamise, are also inherently flammable because of the high oil content of the needlelike foliage. However, these plants are an effective watershed cover because individual plant species are adapted to a wide range of site conditions, even to the harshest sites. Their roots bind the soil particles and anchor the soil to the bedrock. Roots also serve to pump water out of the ground leaving the soil dry like a sponge to quickly absorb the winter rains.

Research has shown that least hillside slippage occurs in natural chaparral watersheds covered by deep rooted woody plant species such as laurel sumac and California scrub oak.

United States Department of Agriculture - Forest Service
Gordon Rowley

A. Angeles National Forest:
Fire Resistant Environment

Fires burning under extreme fire weather conditions can sweep within minutes out of the wildlands and consume seemingly safe residential communities. A slide tape documents the Stable Fire of November 1980 which burned through the Duarte Mesa Housing Tracts under extreme Santa Ana conditions. Also covered are green belts, types of construction, use of native vegetation, water systems, and planning for fire emergencies in wildland areas.

B. Pacific Southwest Forest and Range Experiment Station:
Cooperative Research

The research arm of the Forest Service for years has supported the concept of living more safely in disaster prone environments through basic and applied research. The Station has also cooperated with and supported the research of other agencies through cooperative agreements. The Station's research program, "Chaparral Research and Development" was a successful cooperative effort with many other agencies. Displayed are research publications of this and related programs which have practical applications to public safety and which may serve as guides to living more safely in the chaparral-urban interface. If still in print, they may be ordered from Pacific Southwest Forest & Range Exp. Sta., P. O. Box 245, Berkeley, CA 94701.

Aims and Goals of NFES

The National Foundation for Environmental Safety is a nonprofit public benefit foundation dedicated to mitigating or avoiding environmental disasters through the concept of experts helping people. A major aim of NFES is that we become knowledgeable managers of the area in which we live and encourage our neighbors to do the same.

Specific goals of NFES are:

1. **To update existing information** through gathering, collating, and translating into everyday language much needed practical information on environmental safety and to distribute it to the public.

2. **To generate new information** through stimulating, promoting, supporting and carrying out research and providing expertise towards solving public safety problems.

3. **To promote public awareness of environmental safety hazards** through coordinating, sponsoring, and supporting seminars, symposia and field trips that expose to public view existing and potential hazards such as fire, flood, earth slippage, unstable geology, and other natural or man-made threats to community safety.

4. **To promote a spirit of self-help and cooperation** through encouraging the formation of local resident groups and cooperation among public and private agencies that understand and put into practical use up-to-date, factual information on environmental safety.

5. **To produce newsletters and other publications** for communication, reinforcement, and expansion of the goals of the foundation.

6. **To draw upon knowledge everywhere** through encouragement of strong communication among professional societies and knowledgable people in their own respective sciences in order to bring about an integrated management approach to community safety.

7. **To provide financial aid** in assisting community agencies, groups, and organizations that support and carry out the goals of the foundation.

Membership in NFES is open to any individual, group and private or public organization that can benefit from the goals of the foundation.

LIVING IN THE CHAPARRAL OF SOUTHERN CALIFORNIA is the third in a series of publications on effective property management in which members of NFES participated. All of these are available through NFES or other organizations. These publications are:

1. A Homeowner's Guide To Fire And Watershed Management at the Chaparral-Urban Interface (published jointly by USFS PSW Forest & Range Exp. Sta., Berkeley, CA and County of Los Angeles, CA. 32 p. Author: K. Radtke). 1982

2. Living More Safely in The Chaparral-Urban Interface (USFS PSW Forest & Range Exp. Sta., Berkeley, CA. Gen. Tech. Report PSW-67, 51 p. Author: K. Radtke). 1984

3. Living in the Chaparral of Southern California. Conference proceedings published by the National Foundation for Environmental Safety, Santa Monica, CA. 72 p. 1985

For further information call or write to the above mailing address.

PARTICIPATING ORGANIZATIONS

California Department of Conservation,
Division of Mines & Geology

California Department of Forestry

California Polytechnic University

California Wet Roof Systems

Committee For Firesafe Roofing

Department of Housing and Urban Development

Federal Emergency Management Agency

Fire Protection Agencies of Southern California

GEO Safety, Inc.

Halprin Supply Company

J. B. K. & Associates

Los Angeles City Fire Department

Los Angeles County Flood Control District

Los Angeles Department of Water and Power

National Foundation for Environmental Safety

National Park Service - SMMNRA

Santa Barbara City Fire Department

Transamerica Insurance Company

United States Forest Service

University of California Berkeley

University of California Los Angeles

University of Montana