WILDLAND FIRE HAZARDS IN HUMBOLDT COUNTY, CALIFORNIA

by

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WILDLAND FIRE HAZARDS IN HUMBOLDT COUNTY, CALIFORNIA

ABSTRACT: Humboldt County has several areas which have naturally high to extreme wildland fire hazards. Recent settlement within these areas increases the likelihood of a destructive fire. This report examines the extent and degree to which climate, slope and vegetation influence the wildland fire hazard in Humboldt County, as well as the problems posed by increasing settlement in hazardous areas. Several options for systematically addressing the problem are also offered.

Introduction

Many areas of Humboldt County are subject to repeated burnings by wildland fires[1]. The inland and mountainous portions of the County have experienced recent human settlement, which severely affects the wildland fire hazard. The more populated rural[2] areas of Humboldt County have had a large number of wildland fires, with 91% being caused by man (California Division of Forestry statistics 1983). Thus the mere presence of man increases the likelihood of starting a wildland fire.

Three natural factors combine to create the wildland fire hazard: slope (or topography), climate and vegetative cover. As a result of recent settlement, however, areas which had "naturally" medium or high wildland fire hazards now suffer from extreme wildland fire hazards. The incidence of fire and the potential for loss of life and property both increase.

The purpose of this paper is to examine the factors which create the wildland fire hazard in Humboldt County and the problems posed by increasing settlement in hazardous areas. By assessing the above-mentioned factors, in terms of where they occur in the County and to what extent they influence the wildland fire hazard, one can determine the impact recent and future settlement is likely to have in the event of fire. Additionally, information gained from this study can help planners and fire protection personnel 1) direct future growth to less hazardous areas and where adequate fire protection services would be available, and 2) determine what precautionary actions rural residents can take to help protect themselves from the threat of wildland fires.

To identify some of the options available to the County, several fire protection and prevention methods are presented in five policy options at the end of this report, along with recommendations from the author. Whatever legislative path is followed, wildland fires should be recognized as posing a real threat to many areas of Humboldt County and its residents. As Burton and Kates (1964) note, "where disbelief in (natural hazards) is strong, the resultant damages from the event are likely to be greater than where awareness of the danger leads to effective precautionary action."

Wildland Fire Review

Wildland fires have long been known to influence the environment. Marsh (1864) recognized changes in vegetation structure and diversity in the aftermath of wildland fires, and nearly a century later Weaver (1955) explored the uses of fire as a tool in commercial forestry practices. Early American settlers discovered that exclusion of fire from the tall-grass prairie led to an increase in the number of trees and shrubs (Trewartha 1941; Sauer 1950). Pre-white settlers may have increased the frequencies and intensities of fires, by either carelessness or in efforts to clear forests or encourage grass growth (Shinn 1980). Early logging efforts often produced high-intensity fires because of the availability of large amounts of fuel or slash left behind by previous forestry operations (Vale 1982).

It was not until the Gold Rush of 1849 and the arrival of white settlers that California experienced common-practice burning. The first legislative efforts to curb wildland fires in California occurred in 1872 (Sampson 1944). Aimed at stopping the setting of fires on state or federal lands, the legislation was poorly enforced and did little to control burning. Thus stronger laws were enacted in 1905 and again in 1927.

Some landowners felt that the early legislation exerted too much control over what and when they could burn (Benedict 1930). These views were held particularly in the chaparral areas of northern California (Sanford 1932), and have continued into the 1980 s. Recent legislation (the California Resources Code 4291), requiring removal of flammable vegetation from around a structure and minimum set-back requirements of

a structure from property lines, places increasing responsibility on homeowners to ensure a minimum degree of safety from wildland fires.

Wildland fires often are especially destructive because an increase in forest densities (fuel loading) has meant that areas formerly characterized by ground fires have now become susceptible to more catastrophic crown fires (Kilgore and Taylor 1979). Vale (1979) suggests that recent fires often kill trees that were spared in older, cooler ground fires.

Steiner and Brooks (1981) suggest a land use planning solution to wildland fire problems, consisting of an ecological approach to deal with man/land conflicts. Under their plan, wildland fire hazards would be examined with scientific and technological information, permitting precise and detailed answers to be made to land managers. Cattelino et al. (1979) proposed a similar approach, in which a model of plant succession is used to better understand the resultant communities, fire frequencies and wildland fire hazards.

Part of the problem today stems from the role of fire being misunderstood in the 19th century (Lotan 1979). Catastrophic wildland fires have led to the belief that fire was a destroying agent to be avoided. Fire suppression sometimes resulted in fuel accumulation and severe fires, especially in brushy environments such as the California chaparral (Parsons 1976). Attitudes toward fire have changed in the last few decades, however, and prescribed burns (purposely set and controlled fires) are used in many of the western national parks, such as the Sequoia-Kings National Park (Kilgore 1973). A "let-burn" policy, which allows fires to burn unless they threaten structures, developed or valuable resource areas, has been used in many national parks and monuments since the late 1920's

(Kilgore 1976), and more recently in wilderness areas of the national forests (Davis 1979).

Wildland Fire History in Humboldt County

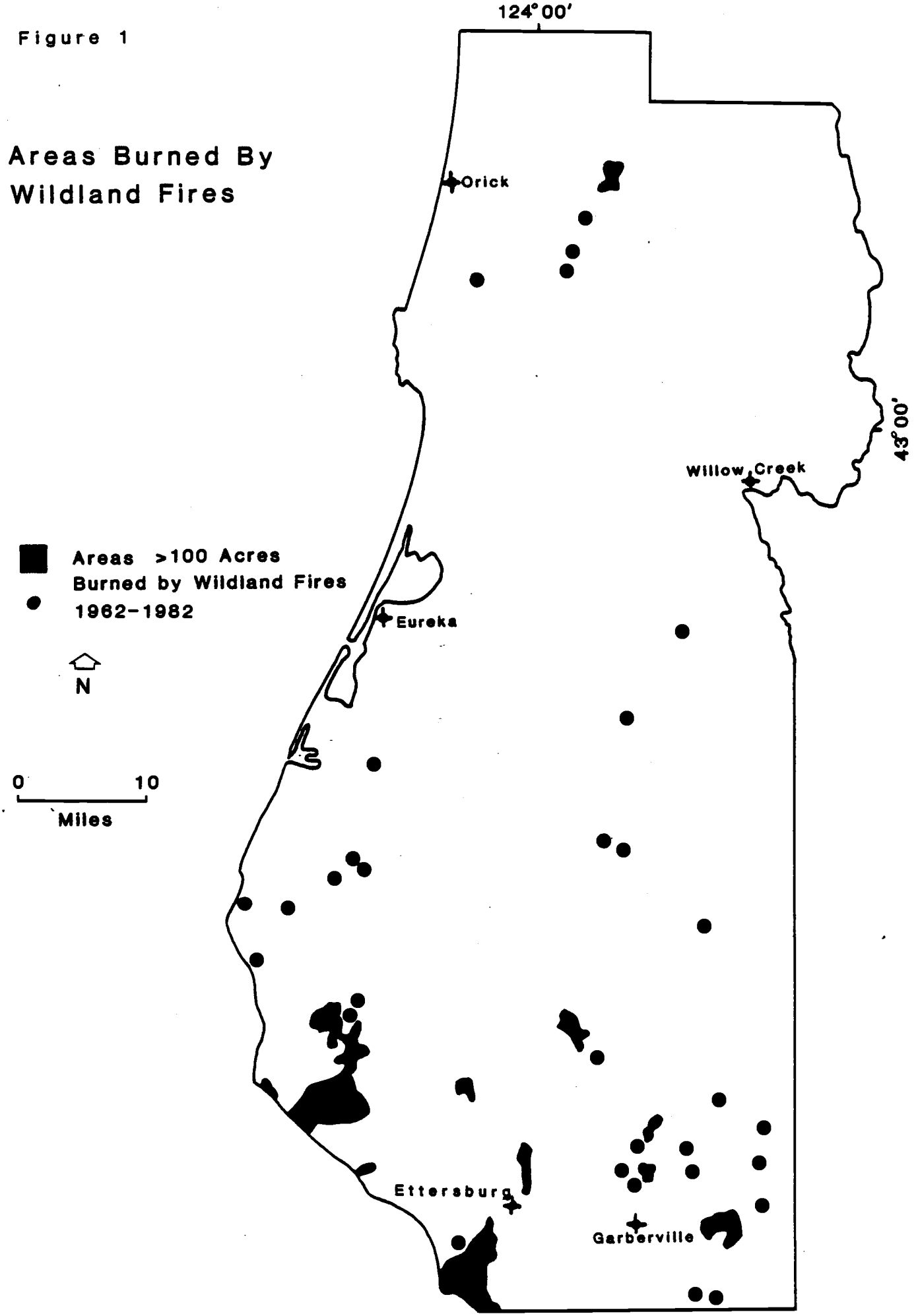
In Humboldt County, the dangers and destruction caused by wildland fires are well documented. As shown in Figure 1, the County experienced 43 wildland fires, consuming a minimum of 100 acres each, between 1962 and 1982 (Policy Background Study, Hazards, Humboldt County Planning Department 1983). The Finley Creek fire, which began September 7, 1973 near Ettersberg, burned 13,595 acres and caused $200,000 in damages to improvements, and nearly $8,000,000 in timber and grazing revenues were lost. Northeast of Orick, the Salmon fire of September 24, 1974 was contained to 1,133 acres, yet an estimated $1,000,000 in damages to timber resulted. On August 7, 1978, the Harris Road fire began east of Garberville and eventually consumed 2,550 acres of forest and grazing lands. Damages totalled $12,800 to improvements and $1,678,000 to timber and grazing lands. In 1982, the County suffered almost $250,000 in damages as a result of wildland fires. Figure 2 delineates wildland fire hazards in the County (the occurrence of large fires, on Figure 1, does not appear to directly relate to extreme wildland fire hazard areas; rather, fire occurrence appears to correlate with areas of higher population).

Climate, Slope and Vegetation in Humboldt County

A dominant factor influencing fire season climate in Humboldt County is the position of the Pacific High in the eastern Pacific Ocean. This anticyclone moves northward in the summer, holding storm tracks north in Alaska and Canada. As a result, the County receives little or no precipitation during the summer. What little precipitation that does fall

Figure 1

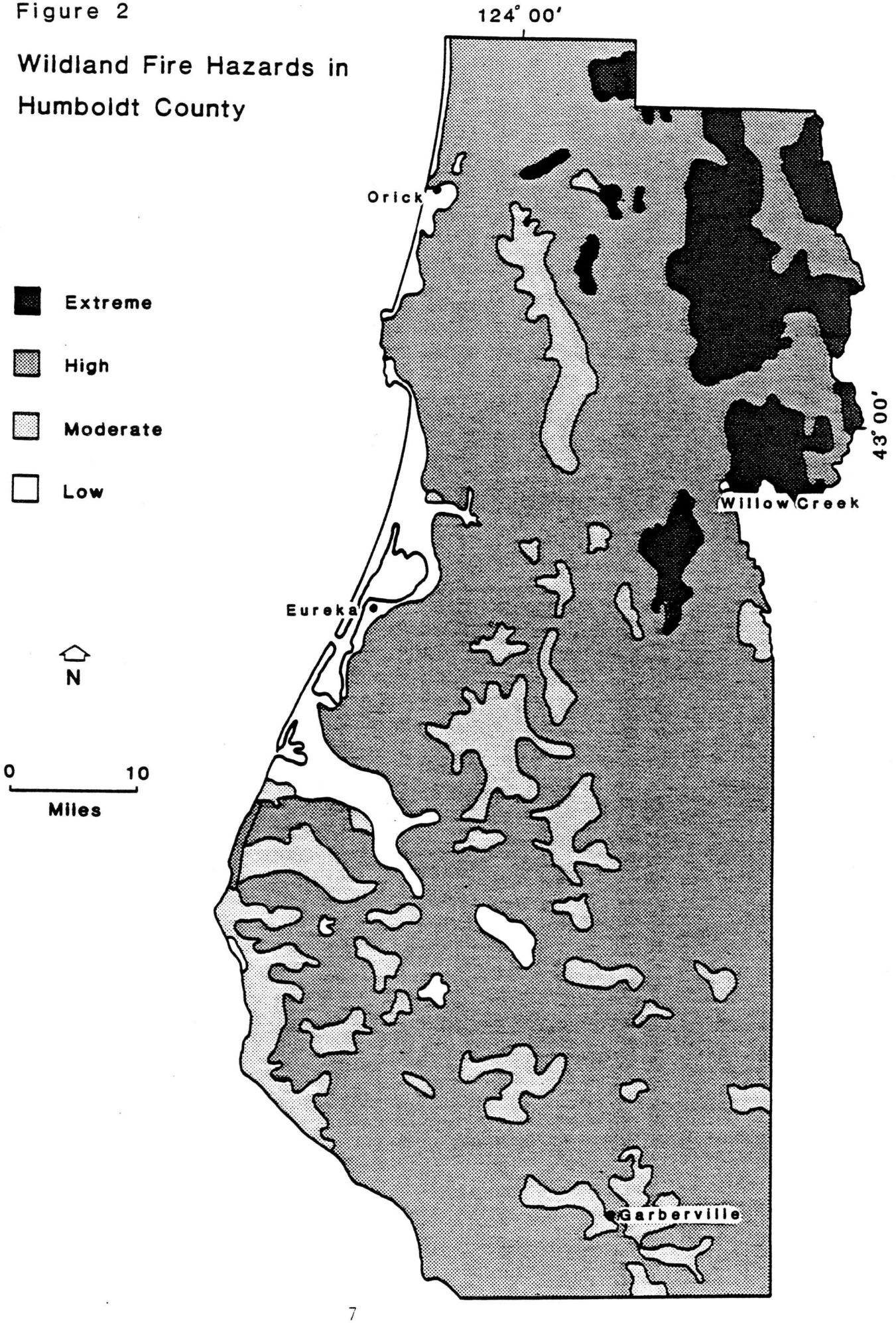
Areas Burned By Wildland Fires



(From CDF, 1983)

Figure 2

Wildland Fire Hazards in Humboldt County



(From CDF and Humboldt County Planning Department, 1982)

in the summer months comes in the form of infrequent showers and thunderstorms (Trewartha 1981).

The following figures (Climatological Data, California) illustrate the dry, hot conditions that plague the interior areas of the County in the summer, as well as the dramatic increase in temperature continentality that occurs from the coastline to interior regions (a distance of less than 15 miles inland from Eureka can equate to temperature differences of more than 20° F).

Location elevation (feet)	Annual Precipitation (inches)	June-September Precipitation Total (in.)	Summer Maximums, month
Eureka, 60	39.76	1.73	72-77°F, Sept.
Garberville, 340	68.16	2.60	110°F*, August
Willow Creek, 461	61.98	1.40	110-115°F, August
Orleans, 410	53.28	2.04	107-112°F, August

*Temperature data not available. This figure is taken from the Richardson Grove State Park station, located 8 miles due south of Garberville, where official records have been kept for 20 years; station elevation, 500 ft.

Records have been kept at each station as follows: Eureka, 95 years; Garberville, precipitation data, 45 years; Orleans, temperature data, 43 years, and precipitation data, 81 years; Willow Creek, 14 years.

A marine (fog) layer often influences the coastline during the summer months. This occurrence, however, leaves the inland areas hot and dry (Gripp 1976). Humid air occassionally reaches several miles into interior river drainages, leaving ridgetops hot and dry. Encroachment of marine air over the County can produce strong, shifting winds, temperature and humidity patterns that affect the inception, behavior and control of wildland fires (Phillips and Schroeder 1967).

Humboldt County has a very diverse landscape. As such, slope, another factor influencing wildland fire hazards, varies from place to place. In general , the interior portions of the County (where wildland fire hazards are typically high or extreme) have steep, heavily dissected mountains. These areas often are inaccessable to vehicles as the terrain tends to be rugged and covered with dense vegetation. Elevations reach above 4,000 feet in many areas.

The combined effects of weather and fuels on fire ignitions, intensity, and rate of spread are controlled to a great extent by slope and topography (the shape of the slope). When aided by strong winds and a complete "fuel ladder" of fuels up the slope, a wildland fire can spread with great speed. The third factor influencing wildland fire hazards is vegetation. It can change as a result of or in the absence of fire, from other environmental stimuli or from human impacts.

A prime example of fire acting as a changing agent in Humboldt County occurs with the chaparral vegetation of the interior mountains and valleys. The distribution in patches of this distinctive vegetation results mainly from periodic fires (Ornduff 1974). Its broad-leaved sclerophyll plants (with stiff, thick, heavily cutinized leaves) produce a dense vegetative network that often is virtually impassable except to small animals. This results in fuel loading which accumulates and worsens each successive year there are no wildland fires. If such a fire does occur, the chaparral will burn rapidly and with great intensity. After the above-ground portion of a plant is burned away, chaparral shrubs are quickly re-established through crown sprouting, and the fire-hazard cycle begins again as fuel loading increases.

Chaparral is by no means the dominant vegetation in Humboldt County (Figure 3). Redwood forest dominates on the North Coast, with the majestic coast redwood (Sequoia sempervirens) towering above all other trees. Often obtaining heights in excess of 70 meters, relatively few species are found growing in the shaded understory of this tree.

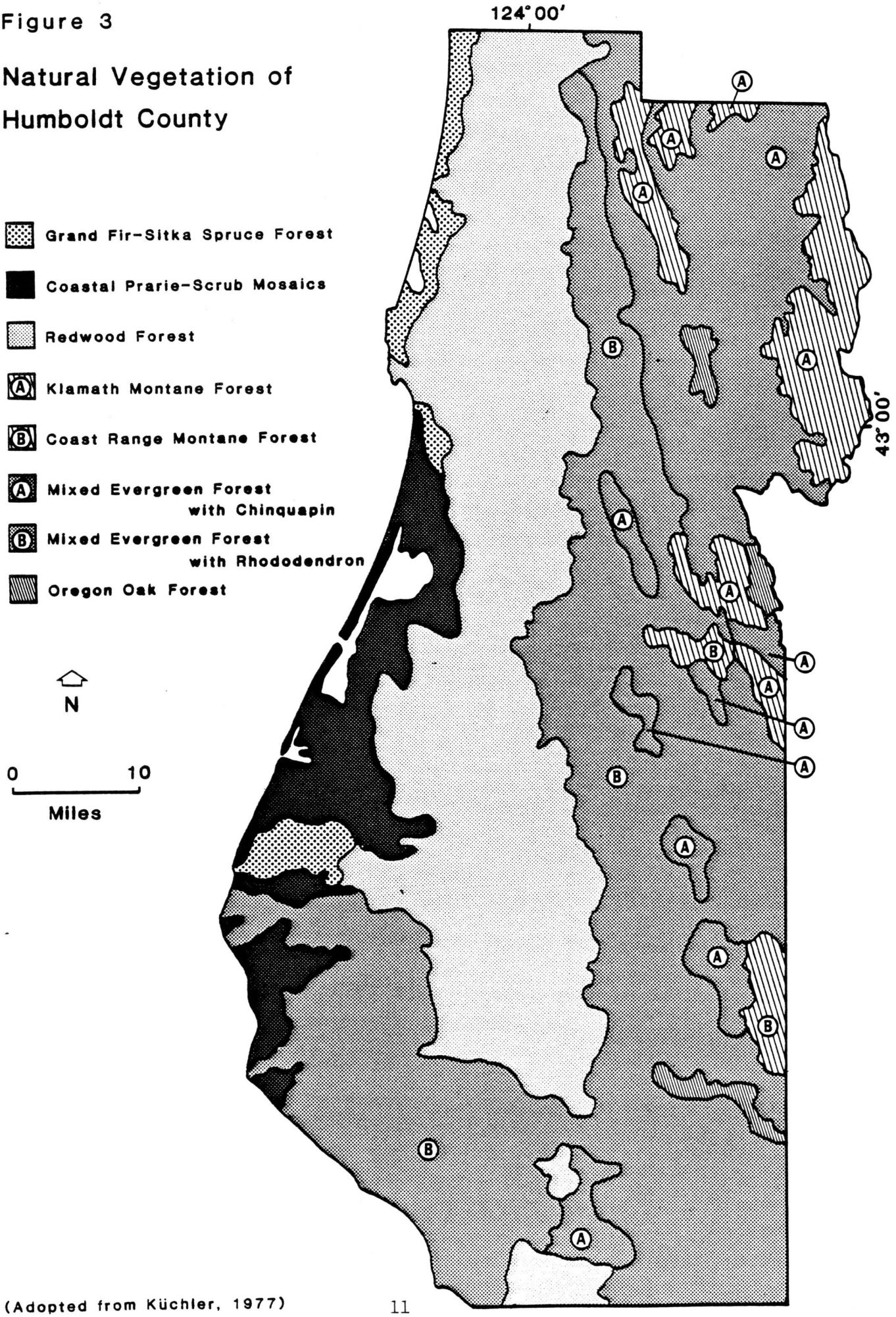
Wildland fires play an important and unique role in the redwood forest. The coast redwood is relatively fire tolerant because of its thick bark and its production of new shoots from the lower trunk or roots. Many potential competitors with the coast redwood are not fire tolerant, and may be destroyed by periodic fire (Ornduff 1974). The redwood forests lie within areas of high or medium risk from wildland fires. One investigator found that wildland fires burned through the County's redwood forests an average of four times per century over the last 1,100 years (Fritz 1932).

The mixed evergreen forest covering many areas of the inland mountains and the coastal hills is also important in Humboldt County. Two combinations of vegetation are notable: the mixed evergreen forest with chinquapin (Chrysolepsis chrysophylla), and the mixed evergreen forest with rhododendron (Rhododendron macrophyllum). In both forests, the shrub layers are dense and littered (Franklin and Dyrness 1973). These forests occur mostly in areas of high wildland fire hazards. Wildland fires can be called "sporadic" in the mixed evergreen forests, yet the County's largest fires in recent years have occurred within these more heavily populated rural areas (California Division of Forestry records 1983).

Besides the redwood and mixed evergreen forests, Humboldt County has large sections of Klamath and Coast Ranges montane forest. These forests have tall, dense needle-leaved evergreen trees with patches of broad-leaved

Figure 3

Natural Vegetation of Humboldt County



(Adopted from Küchler, 1977)

evergreen shrubs (chaparral species). These forests are located within zones of high to extreme wildland fire hazards. Additionally, the presence of the chaparral shrubs leads one to believe that periodic fires will naturally occur in these areas. With denser settlement or better access to these areas, the likelihood of a catastrophic wildland fire increases.

A few small pockets of oak forest exist in the inland mountains, with Oregon oak (Quercus garryana) the dominant tree. The steep terrain and hot, dry summers results in the Oregon oak forests being considered high to extreme in wildland fire hazards.

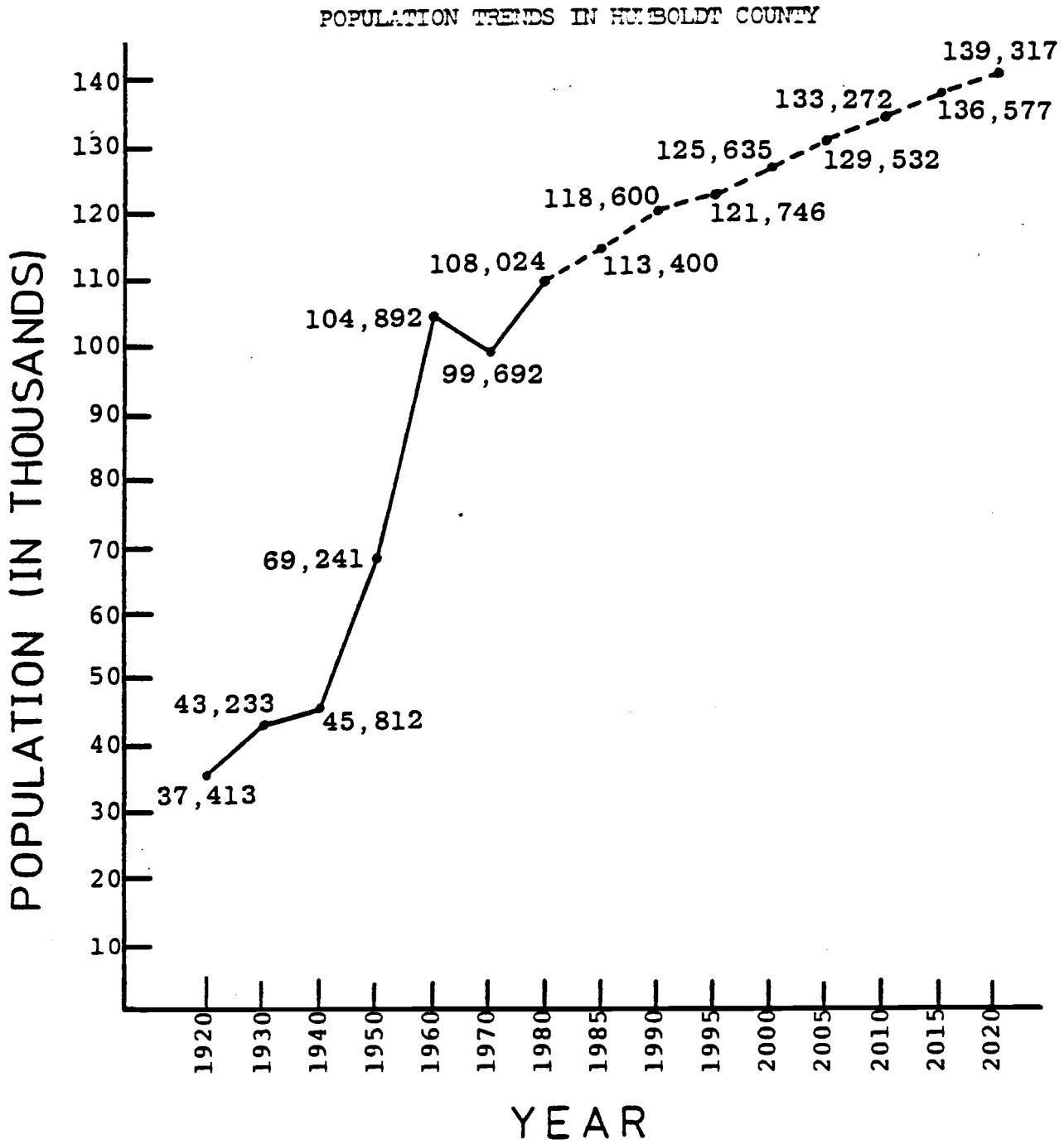
Other types of forest occur along the coast north of Arcata Bay and in a section from False Cape inland to the Sleepy Hollow/Buzzards Peak region. Grand fir (Abies grandis) and Sitka spruce (Picea sitchensis) dominate. Closeness to the Pacific Ocean (and the resultant lower summer temperatures) and little vegetative undergrowth aid in reducing wildland fire hazards in these areas. Similarly, the remaining coastal prairie and scrub mosaics that constitute the coastal communities have low wildland fire hazards.

Population and Settlement in Humboldt County

Population has been increasing in Humboldt County since the early 1900s (Table 1). It rose 8.4% in the last decade from 99,692 in 1970 to 108,024 in 1980 (these and the following statistics were taken from the Policy Background Study, Population, Humboldt County Planning Department 1983).

Changes in the County's overall population seem to parallel, to a great extent, the economy. When the timber industry lulls, the County experiences a lower population growth. But given the current resurgance

Table 1



(From Policy Background Study, Population, H.P.C.D., 1983)

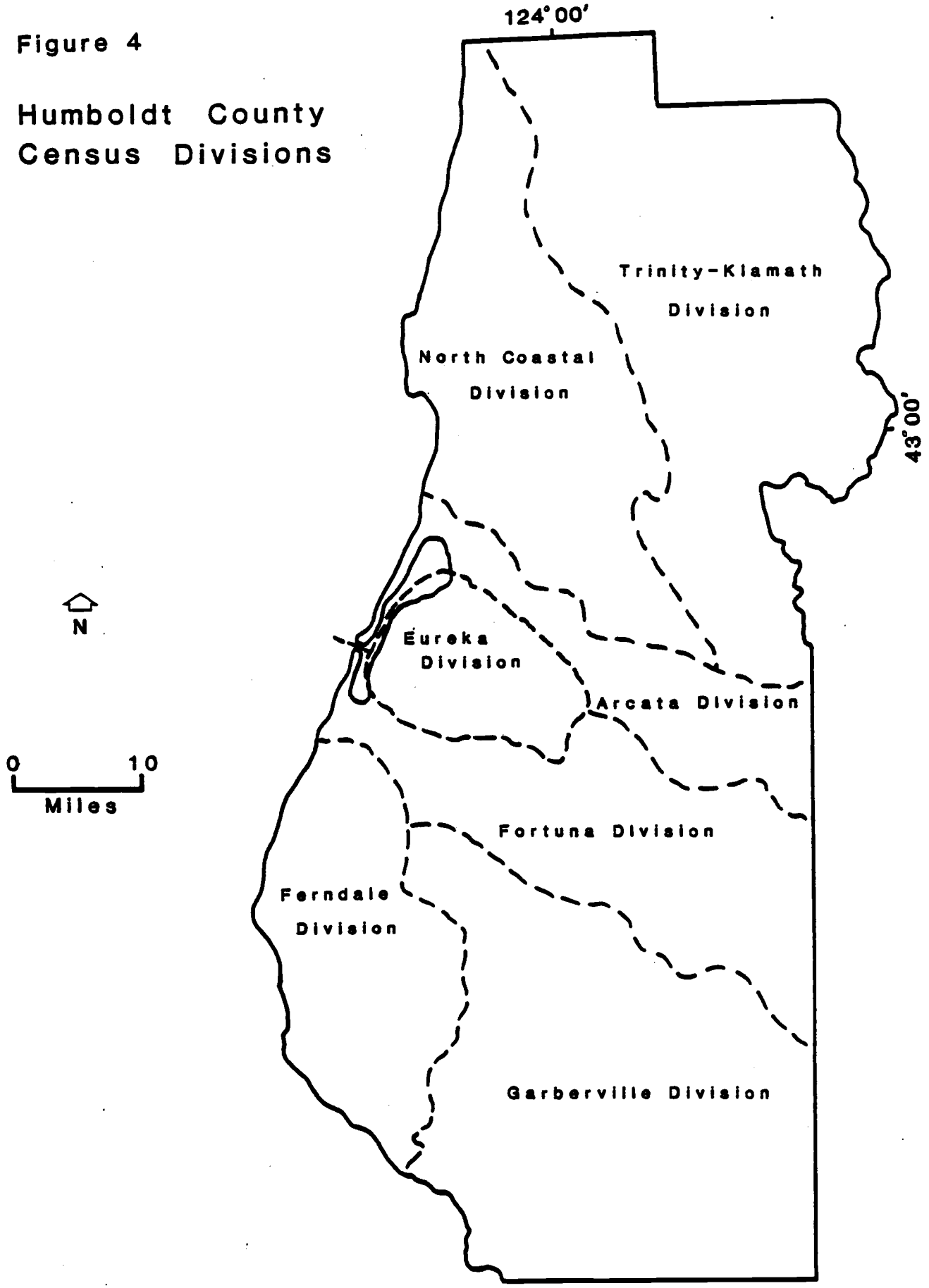
of the economy and resultant timber industry strengthening, one can forecast population gains in the 1980 s. Population projections indicate Humboldt County should experience population growth even beyond the next century, with a projected population of 140,000 people by the year 2020. The State of California's Department of Finance projects the following growth rates for Humboldt County:

Projected Year	Growth Rate In Percent
1980-1985	5.0
1985-1990	4.6
1990-1995	2.6
1995-2000	3.2

Census figures from 1980 show that 49,716 people, or 46% of Humboldt County's population, reside in seven incorporated cities, while 53,308 people, or 54% of the population, reside in unincorporated regions. The incorporated cities (Eureka, Arcata, Fortuna, Rio Dell, Ferndale, Blue Lake, and Trinidad) experienced a 15.3% population increase from 1970 to 1980. The unincorporated regions of Humboldt County, where rural towns and communities often are located in areas of moderate, high or extreme wildland fire hazards, experienced a 3.0% population increase in the same period. The increases, however, were significantly higher in the Census Divisions which have serious wildland fire problems (Figure 4). The Ferndale Division showed a 6.9% population increase from 1,804 to 1,929; the Garberville Division increased 23.2% from 6,714 to 8,275; the Fortuna Division increased 69.6% from 5,218 to 7,495. These three Census Divisions account for 79% of the County's major wildland fires over the last twenty years. They

Figure 4

Humboldt County Census Divisions



constitute approximately half of Humboldt County's land area and have only 16% of its population. Thus the addition of 3,963 residents in these regions over the last decade increases the likelihood of a catastrophic wildland fire occurring.

Housing in Humboldt County has increased to accommodate additional population. An increase of 7,130 homes occurred from 1970 to 1979, to a total of 42,352 housing units. Unincorporated regions of the County increased by 8.7% to 22,165 housing units. Worth noting is the increase in the number of mobile homes since 1970. The unincorporated areas of the County have 77% of all Humboldt County's mobile homes. The number of mobile homes in these areas has increased by 54% from 1970 to 1979, to 3,689 units.

Pressures to develop the more rural regions of the County, where wildland fire hazards may be high or extreme, will continue as the population increases. As already evidenced by the large number of wildland fires in inhabited portions of Humboldt County, the problem is likely to worsen. Assuming a population growth rate of 5.0% through 1985, 3,198 new housing units will be required to meet housing needs. Amplifying the problem will be that of providing adequate fire protection services. Fire departments, especially California Division of Forestry units, will be forced to protect additional residents in rural, hazardous areas, perhaps having to let the wildland burn unattended during a fire (Helm et al. 1973; personal communication, Bill Harrington and Mike Deitner, CDF, 1983).

Wildland Fire Hazard Surveys

Humboldt County residents and fire protection departments were surveyed to gain information on preceptions and precautionary actions

taken regarding wildland fires. Rural residents directly affect and are affected by wildland fire hazards. Their responses to the hazard plays a major role in determining its severity. Similarly, surveying fire protection departments permitted a view from a service-oriented standpoint, of how severe the wildland fire hazard is, and what, if any, problems exist and how they may be solved.

Methodology

A complete list of Humboldt County's fire protection departments was compiled. The Humboldt County Planning Department possessed a pre-existing list; to this, new fire protection departments were added (such as newly formed volunteer fire departments). Thirty-seven departments were sent surveys (a copy of the cover letter used for the survey is located in Appendix A).

Some 198 residents of rural Humboldt County were surveyed (the cover letter used for the survey is located in Appendix B). To better understand how each segment of the population responds to wildland fire hazards, the surveys were divided approximately into thirds according to the level of hazard in selected areas. This enabled a direct comparison between groups and provided more specific information to planners. Some 70 surveys (35%) were sent to residents in moderate hazard areas, 67 surveys (34%) were sent to residents in high hazard areas, and 61 surveys (31%) were sent to residents in extreme hazard areas.

The level of wildland fire hazard in an area was identified from the Humboldt County Planning Department's 1982 map of "Flooding and Wildland Fire". The map was produced using the California Division of Forestry's 1973 fire hazard severity classification system (Table 2).

Table 2

WILDLAND FIRE HAZARD RATING

Fuel Loading	Critical Fire Weather Frequency					
	Low			High		
	% Slope			% Slope		
	0-40	41-60	61+	0-40	41-60	61+
Extreme (chaparral)	H	H	E	E	E	E
High (pine/fir and coastal coniferous forest, foothill woodland)	H	H	H	H	E	E
Low (grassland and cultivated pasture)	M	M	M	M	M	M
Low to nil (coastal dunes and saltwater marsh)	L	L	L	L	L	L

(From C.D.F., 1973)

Critical fire weather frequency:

Low = average of less than one day per year
High = average of 1 to 9.5 days per year

Hazard Rating:

E Extreme H High M Moderate L Low

Several survey sites were then chosen (Figure 5). The selection of these sites was based on the potential for conflicts (fires) due mostly to recent population increases, such as in the Ettersburg-Briceland and Kneeland areas. With low population in the extreme wildland fire hazard areas, choices of whom to survey were limited. As a result, the greater Orleans region was surveyed. This information was gained using the County Assessor's records.

Care was taken to correctly survey only those areas in one hazard level by using the County Assessor's records to identify the exact location of a resident's home. The intended survey areas were finally overlaid with the wildland fire hazards map to ensure that, for example, surveys sent to residents in a moderate wildland fire hazard zone didn't include residents from outside that zone. All surveys were then numbered to ensure getting valid returns. A self-addressed stamped envelope was included with the surveys to encourage their return. Approximately half of the residents were contacted by phone three weeks after mailing the surveys out in an effort to further increase survey returns.

Survey Results

Sixteen fire protection departments (43%) responded to the survey. This figure likely would have been higher, but some of the California Division of Forestry District stations returned the questionnaire to their main office in Fortuna.

The residents survey was only slightly more successful, with 90 (45%) surveys returned. Returns according to each hazard level were as follows: 32 (46%) returns from moderate hazard areas; 33 (49%) returns from high hazard areas; 25 (41%) returns from extreme hazard areas. The relatively

Figure 5

Residents Survey Areas

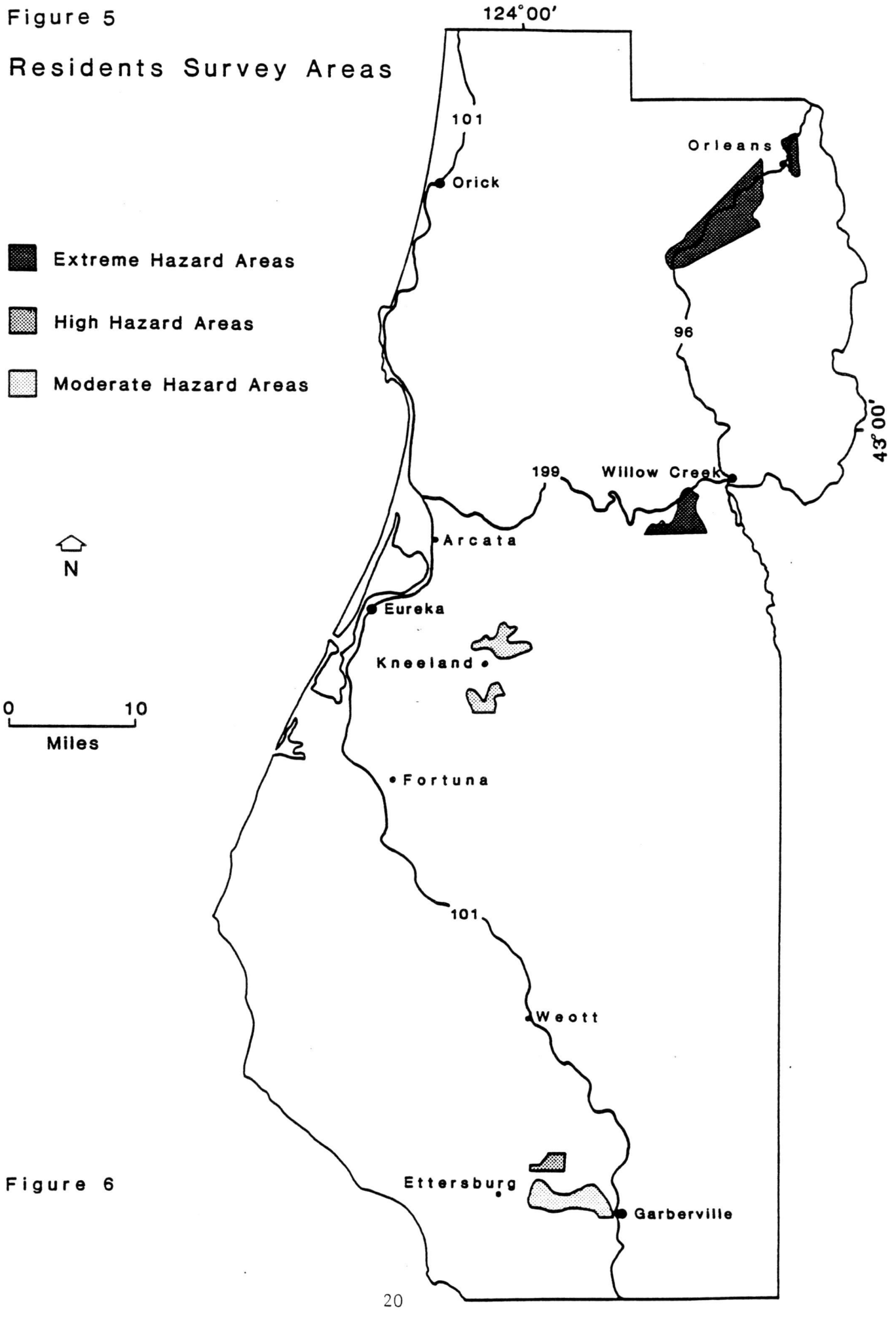


Figure 6

low return figure stems in part from the delicate nature of the survey. Many residents no doubt felt an "invasion of privacy" when they found that the planning department was conducting a survey to find out what residents do to protect themselves from wildland fires. This point is further strengthened by the low return percentages from extreme wildland fire hazard areas. Many of these residents probably live in rural, remote areas to escape the faster pace of daily life in urban settings. Acknowledging the survey may have been viewed as an invitation for unnecessary County intervention. Residents away from home on vacation may also account for the low return figures (the surveys having been mailed in late July).

The results of the fire protection survey are located in Appendix C, followed by the results of the residents survey in Appendix D. The latter includes responses to each question from all of the residents, along with responses from each of the fire hazard levels. All figures are adjusted frequencies, as blank answers were not tabulated in the results. Responses to the surveys were tabulated with a CDC Cyber 170 at Humboldt State University's Computer Center, using the Statistical Information Package for the Social Sciences (SIPPS).

Discussion

One way to combat wildland fire hazards is to disseminate information that would help would-be homebuyers or present homeowners and renters to understand the hazards presented by fire. One such useful tool has not been used: the wildland fire hazards map of Humboldt County. Only 25% of the fire protection agencies and 2% of the residents were aware of its existence. Just as with zoning ordinances, many residents probably would be interested in knowing how severe the wildland fire hazard is around

their home and in their neighborhood. Informing the public that this map exists, along with allowing easy access to it, may encourage residents to take needed precautionary actions against fire.

Fire protection personnel considered 10 of 16 factors on the survey checklist (on number 2) to be very important. They were, with a minimum of 50% of the responses for each factor, a) clearance of vegetation around the perimeter of a home, b) having a spark arrester on the chimney or stove, c) access routes (i.e. more than one), d) road width, e) type of road, f) water availability, g) resident's experience living in areas of high wildland fire hazards, h) type of vegetation around the home, i) and the critical fire-weather.[3] Many of these factors coincide with specified regulations set forth in the Fire Safe Guides.

Receiving sound "not important" votes were household income (93%) and the resident's formal education (87%). Of the residents who answered these questions, 55% had a household income of above $15,000 per year, and 81% had at least one year of college or trade school education. On the average, residents in extreme wildland fire hazard areas had slightly lower levels of income and education than the other survey respondents.

Population increased in 62% of the fire protection districts in the last ten years, with 18% of the districts experiencing no population changes. Only one station reported a decrease in population. Most of the departments reported little change in the incidences (57%) and sizes (69%) of wildland fires. This is a surprising answer in light of the California Division of Forestry statistics. While acreage-burned has shown a rather steady decrease, with only 308 acres burned in 1982 in State responsibility areas of Humboldt County, the incidence of wildland fires has increased.

In five-year groupings, the number of fires (in State responsibility areas of the Humboldt-Del Norte district) were: 1968-1972, 173 wildland fires per year; 1973-1977, 275 wildland fires per year; 1978-1982, 283 wildland fires per year. This figure is likely to increase as the rural population increases. To quote the low acreage-burned figures as reason to allow development in rural Humboldt County is to be venturesome; it only takes one day with high temperatures, low humidity and strong winds to start a major conflagration (Anderson 1980).

Asked to rank three factors that may help reduce wildland fire hazards in Humboldt County, fire protection personnel wanted an upgrading of existing fire departments (50%) over the creation of a County network of fire departments (43%) as their first choice. A similar margin occurred with their second choice, with 37% choosing to upgrade stations rather than forming the network (31%). The creation of new fire departments was a sound third, receiving 68% of the votes.

A split occurred on question 5, which asked if Humboldt County had any existing problems in its current wildland fire protection services. Two departments (14%) didn't know, while six departments (37%) said yes and six (37%) departments said no. Only two departments responded to the opportunity to describe the existing problems. Their comments focused mainly on poor access routes to rural homes, difficulties in identifying house numbers, and the problem of brush build-up that often accompanies "backwoods" homes.

Results of the residents survey provided insight to the perceptions and precautionary actions taken regarding wildland fires. Setting the stage for the remainder of the survey, 82 residents (97%) said they regarded wildland fires as a hazard.

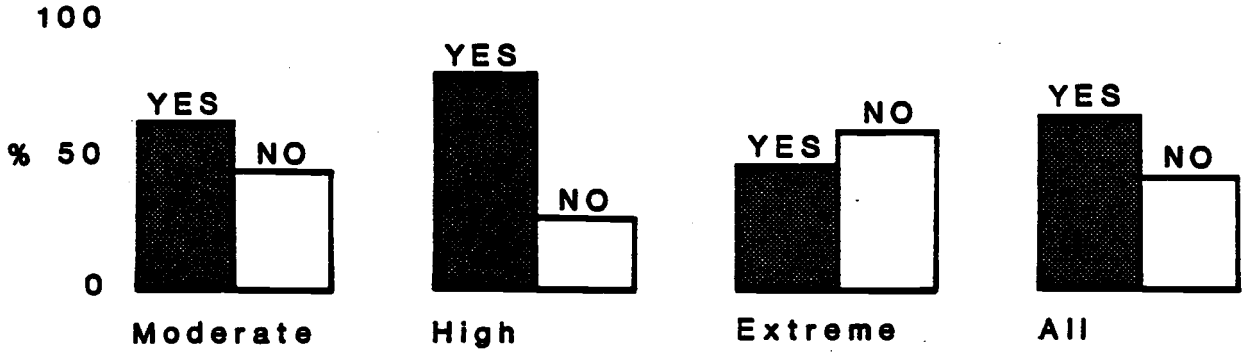
Asked if they had ever experienced a wildland fire, 52 people (61%) said yes, and 32 people (38%) said no (Table 3, A). Interesting was that 55% of the residents in extreme wildland fire hazard regions had not experienced a wildland fire--the highest of the three groups surveyed. One interpretation of this is that people in the most hazardous areas may be the least familiar with fire, and thus are less likely to take precautionary actions against it, having never seen its destructive forces.

Residents of extreme hazard zones again had the highest percentage of negative responses (81%) when asked if a wildland fire ever threatened their property. In question 4, almost 62% of the residents of extreme wildland fire hazard regions did not consider the fire hazard when choosing their homesite, again the highest percentage of negative answers among the three hazard groups (Table 3, B).

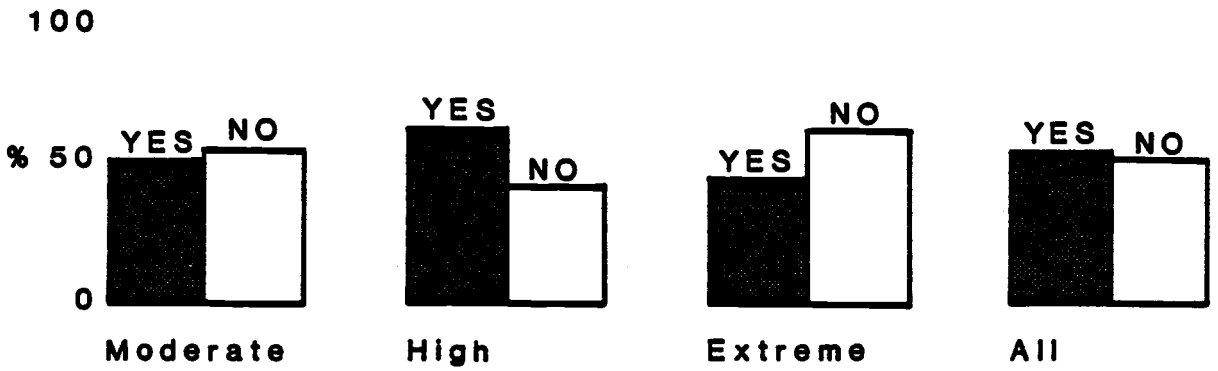
Question 7 asked the residents what they would do if a fire was approaching their home. Perhaps directly related to distance and response time from a fire department are the percentages of residents who would call the fire department and fight the fire (Table 3, C). A steady drop occurred with such residents from moderate to extreme wildland fire hazard areas (from 73% down to 33%). A similar drop occurred with those who would stay and fight the fire, with only 12% of the residents in extreme hazard areas "braving it out." If rural residents think the fire department response time will be an hour or more, they could well be choosing correctly when deciding to evacuate their homes. Seldom will a fire wait to be conveniently suppressed.

To check their preparedness for emergency evacuations, the answers of those residents who responded they would leave, or evaluate the fire and leave if it were serious, had their answers cross-tabulated with their responses to question 8a (which asked how many access routes exist into/out

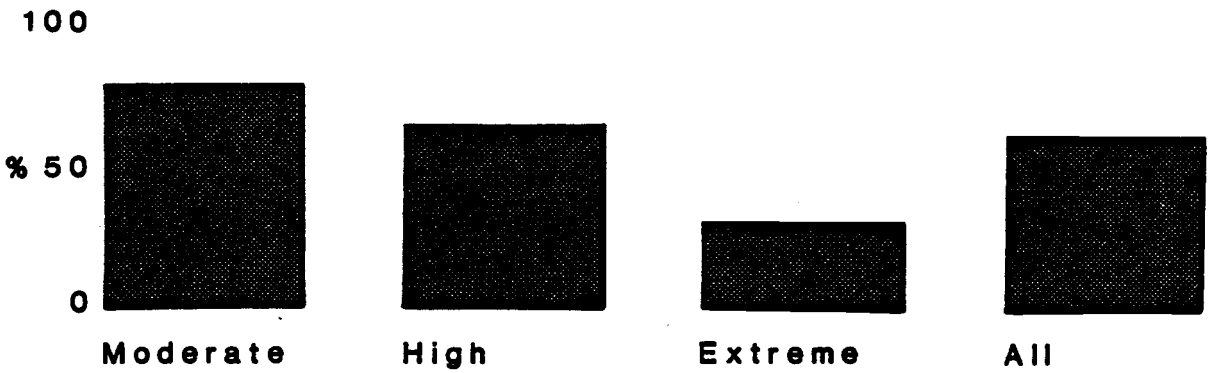
Table 3 Residents Survey Results



A) Have you ever experienced a wildland fire ?



B) Did you consider the wildland fire hazard when you chose your homesite ?



C) What would you do if a fire was approaching ?
(Above results indicate percentages who would call the fire department).

of their homesite which are wide enough for two vehicles to pass freely). The percentages of those residents with zero or one exists who would choose to leave their homes increases directly with the hazard: in moderate hazard areas, 54% (or 6 of 11 residents) would leave; in high hazard areas, 70% (or 7 of 10 residents) would leave; and in extreme hazard areas, 100% (or 9 of 9 residents) would leave. With only one or no exits, these people's main line of defense, evacuating the area, is essentially non-existant. The typically narrow roads into the County's rural homesites can easily become blocked by burning vegetation, a fallen tree, or even an incoming fire vehicle. Without adequate access routes, both residents and fire fighters are endangered.

Despite actions that would lead one to believe that rural residents of Humboldt County do not expect or plan for wildland fires (such as from the above results), 94% of the survey respondents said they do take precautionary actions around their homes to reduce wildland fire hazards. Nearly 90% said they cleared brush and mowed grass around their homes, while 31% said they exercise general caution, such as not smoking outdoors and taking great care when and how they burn trash. Only four residents used innovative measures to reduce fire hazards, like grazing animals to keep the plant growth down or landscaping with slow-burning shrubs.

Fire Safe Guides Evaluation

The Fire Safe Guides, currently used by the Humboldt County Planning Department, lists a series of recommended fire safety standards for use by planners, developers and fire agencies for reviewing rural development plans. Use of the guidelines helps in reducing wildland fire hazards to acceptable levels of risk (the level of loss, injury or destruction below which no

specific action by local government is deemed necessary other than making the risk known). Standards are set for access/traffic circulation, water supply, roofing and building construction, building spacing and densities and vegetation clearance.

After interviewing resource managers and fire protection personnel, and analyzing both surveys, it appears the Fire Safe Guides offer too strict a set of recommendations for the level of wildland fire hazard in Humboldt County. While there certainly is reason to prepare and defend against it, Humboldt County does not experience as severe a threat from wildland fires as do several other regions of California. One reason for this is that the County does not possess great expanses of fire-adapted vegetation that significantly influences the fire hazard. A second reason is that Humboldt County does not have as many severe periods of critical fire-weather as do many other areas of the State (Helm et al. 1973).

Though planning is important, one must be careful not to over-regulate rural residential developments. Humboldt County is not in need of policies as stern as the 1980 Fire Safe Guides. Conversely, one cannot dismiss the wildland fire hazard as non-existant. In his 1976 study of northwestern California, Gripp determined that large fires occur at much lower burning indexes than those now recognized and identified as critical index levels by local fire managers. He suggests that local fire management planning accurately reflect local burning conditions.

A revised set of Fire Safe Guides is located in Appendix E. It has been adapted to adequately meet development needs in Humboldt County, and offers the required "middle-of-the-road" stance, in terms of regulations. Only a set of "partial" guidelines has been given in this paper; the fully revised edition, submitted in a report to the Humboldt County Planning

Department, offers thorough protection standards for all developments on hazardous lands.

Regulating rural residential development in a realistic, sensible manner can only result from analyzing the severity of the wildland fire hazard for an individual area. As evidenced by the survey, extreme wildland fire hazard regions require stricter regulations than moderate or high wildland fire hazard regions. The development recommendations in Appendix E are based largely on that presumption.

Of importance is that the original and revised editions of the Fire Safe Guides should be viewed as only one or part of the answer to the County's wildland fire problem. Other methods of reducing the threat from wildland fires in Humboldt County should be investigated and implemented as applicable.

Policy Options Introduction

This section presents five policy options to serve as a basis or starting point for a County policy designed to reduce the threat from wildland fires. At the end of the section, a short policy option analysis is offered to provide a brief overview of the merits and problems which occur in each of the fire policy options. A recommendation for the most desirable policy option has also been included.

The policies range from a "do nothing" strategy in Policy Option 1, offering a great deal of freedom to developers, homeowners and residents, to Policy Option 5, where the emphasis lies on funding new methods and techniques of fire control.

Policy Option 1

Goal

Provide maximum freedom from wildland fire hazards to developers and homeowners to locate and erect structures on any lands when they purchase or rent the land, passing fire protection responsibilities to homeowners and residents.

Policies

1. The local planning authority will review each development request without regard to existing or potential wildland fires.

2. No public education measures for wildland fire safety will be taken by any authorities.

3. No recommendation for reducing wildland fire hazards will be made by any authorities.

4. Each homeowner or resident shall prepare their own fire protection plans.

Standards

1. "Existing or potential wildland fire hazards" are a product of the natural environment (slope, vegetation and climate) along with the presence of man, who may occupy a hazardous area.

2. "Homeowner or resident" includes any person who owns, rents or resides within a structure or on the property of the land-owner.

Implementation

The Humboldt County Planning Department shall review all requests for development.

Homeowners and residents assume all responsibilities and liabilities for adequate fire protection services.

Policy Option 2

Goal

Maintain present levels of wildland fire protection and awareness.

Policies

1. To apply the California Division of Forestry Fire Safe Guides as guidelines for reviews of residential developments in rural areas.

2. To continue to use at existing levels the following methods and programs of fuel reduction:

   a. prescribed or prescription burning
   b. issue burning permits
   c. Chaparral Management Program

3. Provide adequate fire protection to rural residents via existing rural fire departments, volunteer fire departments and the California Division of Forestry protection units.

4. Public education on wildland fire hazards (in schools, on radio, etc.) shall continue at current levels.

Standards

1. "Prescribed or prescription burning" is fire used for land management purposes which is conducted under previously prescribed conditions of temperature, humidity, fuel mositure, wind speed and direction to achieve a specified purpose, e.g. fire hazard reduction.

2. "Chaparral Management Program" is operated by the California Division of Forestry. It enables a land-owner, with labor and financial aid from C.D.F., to reduce the fuel loading on their property through removal of brush, grass and other fuels.

3. "Provide fire protection" means existing fire protection departments or units shall provide as effective protection as possible, given the constraints of man-power and the nature, direction and location of a wildland fire.

4. "Public education" involves contacting and informing the public, through schools, radio and television announcements, posters, etc., about the hazards presented by wildland fires, and what precautions are available to reduce the existing hazards.

Implementation

The Humboldt County Planning Department and the California Division of Forestry shall review requests for developments in rural areas in regards to the severity of the wildland fire hazard.

The California Division of Forestry shall direct the Chaparral Management Program, prescribed burns and public education programs and issue burning permits.

Policy Option 3

Goal

Change fire protection efforts to achieve desired standards.

Policies

1. Adopt the original or the revised set of Fire Safe Guides as standards for reviews of residential development in rural areas.

2. Increase the use of the following fuel reduction methods and programs.

   a. prescribed or prescription burning
   b. issue burning permits
   c. Chaparral Management Program

3. Increase public education efforts on wildland fire hazards.

4. Increase the number of volunteer or regional fire protection departments to ensure reliable fire protection to all rural homeowners and residents.

Standards

1. "Reliable fire protection" means a sufficient number of fire departments will exist to protect all rural residents from wildland fires.

Implementation

The Humboldt County Planning Department and the California Division of Forestry shall review requests for developments in rural areas in regards to the severity of the wildland fire hazard.

The California Division of Forestry shall direct the Chaparral Management Program, prescribed burns and public education programs and issue burning permits.

Payments for additional fire departments and equipment shall come from the basic tax structure of the County; the majority of these costs should be borne by rural County residents. Funds should also be requested from the State to help defray costs.

Policy Option 4

Goal

Reassign protection efforts to give the most protection to rural residents and significant timber stands.

Policies

1. To apply either the Fire Safe Guides in their original or revised editions as standards for reviews of residential developments in rural areas.

2. To protect important resource areas with the aid of fuelbreaks, greenbelts or a type-conversion program.

3. To continue with public education programs by the California Division of Forestry.

4. To continue with the following fuel reduction methods and programs:
   a. prescribed or prescription burning
   b. issue burning permits
   c. Chaparral Management Programs

5. Encourage the use of tax breaks or incentives to developers, homeowners and residents who comply with required wildland fire hazard reduction standards.

6. To coordinate future population growth with regards to the location of existing fire departments OR to relocate existing fire departments to areas of recent population growth. All future growth shall then occur only within a specified distance (measured in estimated response time) of the nearest fire department.

7. A land use classification map should be prepared by the California Division of Forestry and the Humboldt County Planning Department, showing areas of low resource value. These should be designated as "let burn" areas, where 1) no development may occur, and 2) no efforts would be made to suppress wildland fires. Initial suppression efforts would come in buffer zones around these areas. This policy would permit fire to experience a more natural role in the environment--an important aspect that often is neglected.

Standards

1. "Fuelbreaks" means an area, usually a long strip strategically located, wherein vegetative fuels are reduced in volume and maintained so as to produce a reduction of fire intensity if a wildland fire burns into it.

2. "Greenbelt" means an irrigated, landscaped and regularly maintained fuelbreak.

3. "Type-conversion" involves the replacement of natural vegetation (usually brush) with another cover plant (primarily grasses).

4. "Resource" is identified as any area of human occupance, where improvements (i.e. structures) may be located, or areas which have been identified as having significant natural value (such as timber lands or scenic vistas).

Implementation

The Humboldt County Planning Department and the California Division of Forestry shall review requests for developments in rural areas in regards to the severity of the wildland fire hazard.

The California Division of Forestry shall direct the Chaparral Management Program, prescribed burns, the public education program and issue burning permits.

The California Division of Forestry shall also oversee all greenbelt, etc. activities and determine their optimum extent and location.

The Humboldt County Planning Department and the California Division of Forestry would work together in determining areas suitable for fire department location and areas of planned future growth.

Policy Option 5

Goal

Begin a gradual shift of budgets toward action on new opportunities which may offer greater benefits than traditional fire control methods.

Policies

1. Provide funds to develop better fire attack methods and devices (i.e. chemical fire retardants and equipment).

2. Encourage the use of demonstration homes and subdivisions which exemplify safe construction and maintenance techniques. New ideas for fire prevention and protection should be incorporated in these homes as they occur.

3. Pursue new ideas in fire modelling. These computer models help to answer questions about a fire's rate of spread, directions, etc. for a particular area. Different fire protection techniques can be assessed with these models, including an action's long-term effects (Lotan 1979).

Standards

None identified

Implementation

Coordinating efforts between the Humboldt County Planning Department and the California Division of Forestry would help provide a smooth transition from traditional to new fire control methods.

Policy Options Analyses

A complete spectrum of policy options are available, ranging from the "do nothing" approach in Policy Option 1 to a re-routing of funds for research and new fire control methods in Policy Option 5.

Problems inherent with Policy Option 1 are plain; chief among them is the inability of most homeowners and residents to provide their own adequate fire protection services. Add to this unrestricted growth and the potential problems are quickly apparent. While the notion of reducing government's influence in rural development plans may appear desirable, complete removal of such planning involvement is not feasible.

Policy Option 2 would keep fire protection and awareness at current levels. Though desirable over Policy Option 1, the County's present wildland fire policies do not adequately address existing and future problems (i.e. increasing population pressures in hazardous areas). Strict adherence to the Fire Safe Guides would likely reduce the problems presented by residents building their homes in the "backwoods", but adopting them per se could prove too restrictive in some cases, while not being restrictive enough in others (as in cases dealing with different levels of wildland fire hazards and building densities at two separate locations).

Changing fire protection efforts to achieve desired standards (Policy Option 3) provides flexibility to County planning officials, fire protection agencies, developers and the public to adopt either the original or revised set of Fires Safe Guides. Increasing fire protection and public education and reducing fuel loading also act to reduce wildland fire hazards, though admittedly at a greater cost than present protection efforts.

Policy Option 4 offers a unique solution to the problem of increasing population in areas where fire protection services remain on the same level. Protection efforts are reassigned to "critical" areas to protect key resources (rural residents, timber, etc.). Future development would then be directed to these areas. This policy option also allows fire to play a larger role in the natural environment with the "let-burn" policy in designated areas.

A complete shift of fire protection efforts occurs in Policy Option 5, where new technologies would be emphasized to find better, less expensive and labor-intensive solutions. Though certainly of value in the future, this policy option would be difficult to implement on the required "experimental" basis at the present time.

Regardless of which policy option is desired or created, the following suggestions should be addressed to accomplish the most beneficial changes in Humboldt County's wildland fire hazard policies:

--attempt to complete a cost/benefit analysis of the desired policy to determine current and future costs

--attempt to reintroduce the natural role of fire, both in policy standards and in public education

--no reduction in current fire fighting capabilities should occur; increased public awareness of wildland fire hazards, though desirable, is not reason enough to reduce required fire department man-power and funding

--lastly, policies should not be passed without their guaranteed means of enforcement (Hollick 1981). Enforcement plans should be coordinated to monitor and reassess the wildland fire hazard, and have the needed man-power and legal support to carry out policy incentives.

Recommendations

Policy Option 3 is recommended. It deals with many of the problems on the required level. Much of the funding for increased fire protection can be raised from developers, homeowners and residents in the hazardous areas. Though the regulations, regardless of which version of the Fire Safe Guides are chosen, may be interpreted as restrictive and costly by the affected groups, they would ensure a reasonable degree of safety from wildland fires in Humboldt County.

Conclusion

Humboldt County's rural residents need to take greater precautionary actions to reduce wildland fire hazards. Current planning and fire protection efforts do not adequately protect residents from the threat of these destructive fires. Actions taken now to direct future developments or to require compliance with ordinances to reduce wildland fire hazards around the home would save lives and property in the event of a large conflagration. With increasing population pressures and a proven wildland fire history, Humboldt County should take actions to prevent a future catastrophe.

NOTES

1. A wildland fire is defined as any uncontrolled fire burning through vegetative fuels, structures or any other human development.

2. A rural area is defined as any non-urban setting, often occurring in rustic or natural areas, where the density of developments tends to be low.

3. Critical fire-weather is determined for any single day by measurements of such factors as ambient air temperature, relative humidity, fuel moisture, wind speed and duration and amount of precipitation.

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INTERVIEWS

California Division of Forestry
(Fortuna, CA) Cliff Chapman, Mike Deitner, Bill Harrington and Dan Krader.

(Sacramento, CA) Dick Clanton, Chaparral Management Program Director

Tom Jamerson, Six Rivers National Forest

Jack Lahr, Bureau of Land Management, Arcata, CA

Joseph Leeper, Department of Geography, H.S.U.

Vince O'Rourke, State Fire Marshall, Ukiah, CA

Don Raffelli, Traffic Engineer, Humboldt County

Joel Rankin, private forester

John Sawyer, Department of Botany, H.S.U.

Ray Schwabenland, Chief Building Inspector, Humboldt County.

APPENDICES

(Appendix A)

PLANNING DEPARTMENT
COUNTY OF HUMBOLDT
3015 H STREET
EUREKA, CALIF. 95501-4484 PHONE (707) 445-7541

July 11, 1983

Humboldt County Fire Protection Districts:

As part of the implementation of the Hearing Draft General Plan Volume I-Framework, the Humboldt County Planning Department is evaluating the County's wildland fire hazard, and its relationship with development in rural areas of the County. We would like your insight on one of the issues raised frequently during the public hearing before the Planning Commission.

We are conducting a survey to determine the relationship between increased population in rural areas and the wildland fire hazard. By completing this short questionnaire, you will help us in assessing the wildland fire hazard situation. Unless otherwise noted, your responses to the questionnaire should reflect the wildland fire hazard condition in <u>your</u> protection district.

Please complete and return the questionnaire by July 25, 1983; an enclosed stamped envelope has been provided for its easy return.

If you have any questions, please feel free to call Brian Millar at the Humboldt County Planning Department. Thank you for your time.

Sincerely,

HUMBOLDT COUNTY PLANNING DEPARTMENT

Martin G. McClelland
Planning Director

Brian Millar

Brian Millar
Planning Intern

BM/MGM:jam

Attachment

PLANNING DEPARTMENT
COUNTY OF HUMBOLDT
3015 H STREET
EUREKA, CALIF. 95501-4484 PHONE (707) 445-7541

July 13, 1983

Humboldt County Resident:

As part of the implementation of the Hearing Draft General Plan Volume I - Framework, the Humboldt County Planning Department is evaluating the County's wildland fire hazard, and its relationship with development in rural areas of the County. We would like your insight on one of the issues raised frequently during the public hearing before the Planning Commission.

We are conducting a survey to determine the relationship between increased population in rural areas and the wildland fire hazard. By completing this short questionnaire, you will help us in assessing the wildland fire hazard situation.

The following questions are intended for a response dealing with the wildland fire hazard in your area, and not for the entire county. All responses will be kept confidential; the questionnaires have been numbered to 1) insure getting valid questionnaire returns, and 2) help correlate responses to broad geographic regions. Information gained from questions 14 and 15 (which deal with family income and education) will help us assess the needs involved in creating a public education program on wildland fire hazards awareness.

Please take a few minutes to complete the questionnaire, and use the enclosed stamped envelope for its easy return. We would appreciate having all questionnaires returned by July 28, 1983.

If you have any questions, please feel free to contact Brian Millar at the Humboldt County Planning Department. Thank you for your time.

Sincerely,

HUMBOLDT COUNTY PLANNING DEPARTMENT

Martin G. McClelland
Planning Director

Brian Millar

Brian Millar
Planning Intern

BM:jam

Attachment

APPENDIX C

FIRE DISTRICTS
WILDLAND FIRE HAZARD QUESTIONNAIRE

1) A wildland fire hazards map is currently used by the Humboldt County Planning Department to evaluate wildland fire hazards. Were you aware of its existance? (check one)

4 (25%) yes

12 (75%) no

2. Check off each of the following factors as very important, important, or not important in considering wildland fire hazards near a home:

	Construction factors	Very Important	Important	Not Important
a.	Clearance of vegetation around the permimeter of the home	16 (100%)	0	0
b.	Type of roofing material	7 (43.8%)	9 (56.3%)	0
c.	Spark arrester on chimney/stove	8 (50%)	7 (43.8%)	1 (6.3%)
d.	Alternative power source in the home (i.e., generator)	1 (6.3%)	8 (50%)	7 (43.8%)
	Subdivision design factors			
e.	Access routes (i.e., more than one)	11 (68.8%)	5 (31.3%)	0
f.	Road width (i.e., room for a fire vehicle and a resident's vehicle to pass freely)	10 (62.5%)	6 (37.5)	0
g.	Type of road (i.e., one with easy, year-round access)	9 (56.3%)	7 (43.8%)	0
h.	Water availability	9 (56.3%)	6 (37.5%)	0
	Resident's activities			
i.	Residents experience living in areas of high wildland fire hazard	8 (50%)	5 (31.3%)	3 (18.8%)
j.	Children in the home	2 (12.5%)	10 (62.5%)	4 (25%)
k.	Residents formal education (i.e., more than 1 year of college completed)	0	2 (12.5%)	14 (87.5%)
l.	Residents annual income (i.e., above $15,000 year)	0	1 (6.3%)	15 (93.4%)

APPENDIX D

RESIDENTS WILDLAND FIRE HAZARD SURVEY

1) Do you regard wildland fires as a hazard?

All responses:	82 (97.6%)	Yes	2 (2.4%)	No
Moderate hazard region:	30 (100%)	Yes	0	No
High hazard region:	32 (97.0%)	Yes	1 (3.0%)	No
Extreme hazard region:	20 (95.2%)	Yes	1 (4.8%)	No

2) Have you ever experienced a wildland fire?
If yes, go to questions 2a and 2b; if no, skip to question 3.

All responses:	52 (61.9%)	Yes	32 (38.1%)	No
Moderate hazard region:	18 (58.1%)	Yes	13 (41.9%)	No
High hazard region:	25 (75.8%)	Yes	8 (24.0%)	No
Extreme hazard region:	9 (45.0%)	Yes	11 (55.0%)	No

2a) How many wildland fires have you experienced?

All responses:	1	6 (12.0%)	2-3	19 (38.0%)	4-6	13 (26.0%)	7+	12 (24.0%)
Moderate region:	1	1 (5.6%)	2-3	9 (50.0%)	4-6	3 (16.7%)	7+	5 (27.8%)
High region:	1	1 (4.5%)	2-3	9 (40.9%)	4-6	9 (40.9%)	7+	3 (13.6%)
Extreme region:	1	4 (40.0%)	2-3	1 (10.0%)	4-6	1 (10.0%)	7+	4 (40.0%)

2b) What is the largest wildland fire you have experienced?

All responses:	5 acres	4 (8.3%)	5-19 acres	7 (14.6%)				
	20-99 acres	6 (12.5%)	100-499 acres	13 (27.1%)	500+ acres	18 (37.5%)		
Moderate region:	5 acres	1 (5.6%)	5-19 acres	3 (16.7%)				
	20-99 acres	1 (5.6%)	100-499 acres	7 (38.9%)	500+ acres	6 (33.3%)		
High region:	5 acres	3 (13.6%)	5-19 acres	3 (13.6%)				
	20-99 acres	4 (18.2%)	100-499 acres	5 (22.7%)	500+ acres	7 (31.8%)		
Extreme region:	5 acres	0	5-19 acres	1 (12.5%)				
	20-99 acres	1 (12.5%)	100-499 acres	1 (12.5%)	500+ acres	5 (62.5%)		

3) Has a wildland fire ever threatened your property?

All responses:	29 (34.1%)	Yes	56 (65.9%)	No
Moderate hazard region:	8 (25.8%)	Yes	23 (74.2%)	No
High hazard region:	17 (51.5%)	Yes	16 (48.5%)	No
Extreme hazard region:	4 (19.0%)	Yes	17 (81.0%)	No

4) Did you consider the wildland fire hazard when you chose your homesite?

All responses:	43 (51.8%)	Yes	40 (48.2%)	No
Moderate hazard regions:	14 (48.3%)	Yes	15 (51.7%)	No
High hazard regions:	21 (63.6%)	Yes	12 (36.4%)	No
Extreme hazard regions:	8 (38.1%)	Yes	13 (61.9%)	No

5) Did you use the Humboldt County Planning Department's wildland fire hazard maps to evaluate the wildland fire hazard for your homesite? If yes, skip to question 6; if no, then go to question 5a.

All responses:	2 (2.4%)	Yes	81 (97.6%)	No
Moderate hazard regions:	1 (3.4%)	Yes	28 (96.6%)	No
High hazard regions:	1 (3.0%)	Yes	32 (97.0%)	No
Extreme hazard regions:	0	Yes	21 (100%)	No

5a) Were you aware of this map's existance?

All responses:	1 (1.2%)	Yes	80 (98.8%)	No
Moderate hazard regions:	1 (3.4%)	Yes	28 (96.6%)	No
High hazard regions:	0	Yes	33 (100%)	No
Extreme hazard regions:	0	Yes	21 (100%)	No

6) How long have you resided in Humboldt County?

All responses:	1 year 0	1-1.9 years 3 (3.5%)		
2-4.9 years 8 (9.4%)	5-9.9 years 20 (23.5%)	10- years 54 (63.5%)		
Moderate hazard regions:	1 year 0	1-1.9 years 0		
2-4.9 years 2 (6.5%)	5-9.9 years 3 (9.7%)	10+ years 26 (83.9%)		
High hazard regions:	1 year 0	1-1.9 years 1 (3.0%)		
2-4.9 years 5 (15.2%)	5-9.9 years 15 (45.5%)	10- years 12 (36.4%)		
Extreme hazard regions:	1 year 0	1-1.9 years 2 (9.5%)		
2-4.9 years 1 (4.8%)	5-9.9 years 2 (9.5%)	10- years 16 (76.2%)		

7) If a fire was approaching, what would you do?

	All responses	Moderate regions	High regions	Extreme regions
Leave	15 (18.4%)	7 (23.3%)	5 (16.1%)	4 (19.0%)
Fight fire	28 (33.3%)	16 (50.0%)	10 (32.3%)	3 (14.3%)
Call fire dept.	49 (56.3%)	22 (73.3%)	19 (61.3%)	8 (38.1%)
Evaluate fire	14 (16.1%)	4 (13.3%)	5 (16.1%)	5 (23.8%)
Other (water, set backfires,...)	35 (40.2%)	11 (36.7%)	9 (29.0%)	15 (71.4%)

8) How many access routes exist into/out of your homesite?

	1	2	3	4+
All responses:	53 (60.2%)	27 (30.7%)	6 (6.8%)	2 (2.3%)
Moderate regions:	16 (50.0%)	12 (37.5%)	3 (9.4%)	1 (3.1%)
High regions:	19 (57.6%)	10 (30.3%)	3 (9.1%)	1 (3.0%)
Extreme regions:	18 (78.3%)	5 (21.7%)	0	0

8a) How many of these roads are wide enough to permit two vehicles to pass freely?

	1	2	3	4+
All responses:	67 (77.9%)	17 (19.8%)	2 (2.3%)	0
Moderate regions:	20 (62.5%)	11 (34.4%)	1 (3.1%)	0
High regions:	25 (78.1%)	6 (18.8%)	1 (3.1%)	0
Extreme regions:	22 (100%)	0	0	0

9) Do you have any alternative power sources in your home, should electrical power fail during a wildland fire?

All responses:	41 (47.7%) Yes	45 (52.3%) No
Moderate hazard regions:	10 (33.3%) Yes	20 (66.7%) No
High hazard regions:	23 (69.7%) Yes	10 (30.3%) No
Extreme hazard regions:	8 (25.0%) Yes	15 (65.2%) No

10) Do you have a spark arrester on your chimney/stove?

All responses:	64 (74.4%) Yes	22 (25.6%) No
Moderate hazard regions:	22 (70.9%) Yes	9 (29.0%) No
High hazard regions:	23 (71.9%) Yes	9 (28.1%) No
Extreme hazard regions:	19 (82.6%) Yes	4 (17.4%) No

11) Do you have an ample (i.e. 2500 gallon) emergency water supply near your homesite?

All responses:	68 (78.2%) Yes	19 (21.8%) No
Moderate hazard regions:	26 (81.9%) Yes	6 (18.8%) No
High hazard region:	27 (84.4%) Yes	5 (15.6%) No
Extreme hazard regions:	15 (65.2%) Yes	8 (25.0%) No

12) What is your roof made of?

All responses:	Composition shingle (asphalt) 57 (65.5%)				
Wood shingle 8 (9.2%)	Metal 13 (14.9%)	Tar 2 (2.3%)	Tile 2 (2.3%)		
Other 5 (5.7%)					
Moderate hazard regions:	Composition shingle (asphalt) 19 (61.3%)				
Wood shingle 7 1.9%)	Metal 1 (3.2%)	Tar 1 (3.2%)	Tile 1 (3.2%)		
Other 2 (6.4%)					
High hazard regions:	Composition shingle (asphalt) 25 (75.8%)				
Wood shingle 1 (3.0%)	Metal 3 (9.1%)	Tar 1 (3.0%)	Tile 1 (3.0%)		
Other 2 (6.1%)					
Extreme hazard regions:	Composition shingle (asphalt) 13 (56.5%)				
Wood shingle 0	Metal 2 (39.1%)	Tar 0	Tile 0		
Other 1 (4.3%)					

13) Do you take any steps to reduce the wildland fire hazard around your home and on your property? If yes, go to question 13a; if no, skip to question 14.

All responses:	83 (94.3%)	Yes	5 (5.7%)	No
Moderate hazard regions:	30 (93.4%)	Yes	2 (6.3%)	No
High hazard regions:	30 (90.9%)	Yes	3 (9.1%)	No
Extreme hazard regions:	23 (100%)	Yes	0	No

13a) What steps do you take to reduce wildland fire hazards around your home?

	All responses	Moderate regions	High regions	Extreme regions
Brush/grass removal	77 (87.5%)	28 (93.3%)	22 (96.7%)	20 (87.0%)
Remove heavy fuels	13 (14.8%)	4 (13.3%)	8 (26.7%)	1 (4.3%)
Use caution	28 (31.8%)	12 (40.0%)	10 (30.0%)	6 (26.1%)
Graze animals	2 (2.3%)	1 (3.3%)	1 (3.3%)	0
Water plants	6 (6.8%)	0	1 (3.3%)	5 (21.7%)
Burn brush	4 (4.5%)	2 (6.6%)	1 (3.3%)	1 (4.3%)
Landscape yard	2 (2.3%)	0	1 (3.3%)	1 (4.3%)
Other	5 (5.7%)	1 (3.3%)	3 (10.0%)	1 (4.3%)

14) Is your annual household income above $15,000 per year?

All responses:	43 (55.8%)	Yes	34 (44.2%)	
Moderate hazard regions:	18 (62.1%)	Yes	11 (37.9%)	
High hazard regions:	17 (54.8%)	Yes	14 (45.2%)	
Extreme hazard regions:	8 (47.1%)	Yes	9 (52.9%)	

15) Have you or any member of your household completed more than 13 years of school?

All responses:	68 (81.0%) Yes	16 (19.0%) No
Moderate hazard regions:	27 (84.4%) Yes	5 (15.6%) No
High hazard regions:	26 (81.3%) Yes	6 (18.8%) No
Extreme hazard regions:	15 (75.0%) Yes	5 (25.0%) No

16) How large a parcel do you own or rent?

All responses: 1 acre 3 (3.4%) 1-4.9 acres 12 (13.8%)
5-9.9 acres 6 (6.9%) 10-19.9 acres 13 (14.9%) 20-39.9 acres 8 (9.2%)
40+ acres 45 (51.7%)

Moderate hazard regions: 1 acre 2 (6.3%) 1-4.9 acres 4 (12.5%)
5-9.9 acres 1 (3.1%) 10-19.9 acres 1 (3.1%) 20-39.9 acres 4 (12.5%)
40+ acres 20 (62.5%)

High hazard regions: 1 acre 0 1-4.9 acres 0
5-9.9 acres 3 (9.1%) 10-19.9 acres 1 (3.1%) 20-39.9 acres 3 (9.1%)
40+ acres 22 (66.7%)

Extreme hazard regions: 1 acre 1 (4.5%) 1-4.9 acres 8 (36.4%)
5-9.9 acres 2 (9.1%) 10-19.9 acres 7 (31.8%) 20-39.9%)
40+ acres 3 (13.6%)

17) Please feel free to add additional comments.

APPENDIX E

FIRE SAFE GUIDES EVALUATIONS; POLICY RECOMMENDATIONS

These standards would apply to all subdivisions planned for structural development. Any deviation must be reviewed and approved by the responsible fire and building agency and the Humboldt County Planning Department.

1.0 ACCESS ROADWAYS/SAFE INGRESS AND EGRESS

As evidenced by results of the resident's and fire protection department surveys, and discussed in interviews with fire protection personnel, adequate access routes into and out of a home-site are of utmost importance. Roadways must be wide enough to allow two vehicles (i.e. an incoming fire engine and an outgoing resident) to pass freely. In addition, these roadways should be protected from the hazard of burning roadside vegetation, and be limited in length and slope, depending on local conditions.

1.1 At least two ingress/egress routes are required for every home to insure evacuation of residents and movement of emergency equipment during major emergencies.

2.0 STREET, ROAD AND BUILDING IDENTIFICATION

To help avoid confusion and enable as rapid a response to a fire as possible, all roads, streets and buildings should be easily indentifiable by name or number. As noted by firefighters in the Fire District's Survey, many rural homes were difficult to locate and identify due to inadequate markings.

2.1.a Every building or structure shall be provided with an appropriate non-cumbustible marker located with respect to the nearest public highway, street or road servicing such building or structure so as to be clearly visible at all times to an approaching vehicle for a distance of not less than 100 feet.

2.1.b A cluster of buildings compromising a single occupancy or close grouping of several buildings may use one marker and one identification number for location identification.

2.2 Road and street identification numbers shall be provided by Humboldt County. The cost of installation and maintenance of such markers shall be paid for from the basic tax structure of Humboldt County. Street and building numbers must not be less than 3 inches high and not less than $\frac{1}{2}$ inch in stroke. Every building or structure number required must be located or positioned not less than 3 feet nor more than 6 feet above ground level so as to be visible to emergency equipment for a distance of not less than 100 feet.

3.0 WATER STANDARDS FOR EMERGENCY FIREFIGHTING

An adequate emergency water supply is essential for protecting structures and the wildland from fire. The following recommendations are based on building density and the level of wildland fire hazard. These requirements will assure satisfactory and reliable water supplies for emergency fire protection. For the purpose of this section, building density will be divided into three classes:

Class I - 2 to 6 one family dwellings per acre.

Class II - one family dwelling per 1 to 5 acre parcel.

Class III - 1 one family dwelling per parcel larger than 5 acres.

3.1 Class I requirements

3.1.a Requires a public water system.

3.2 Class II requirements: All Class II subdivisions should have an adequate water system for fire protection as determined by the responsible fire agency which is designed to meet that area's needs. When selecting a system from the alternatives available, consider the potential and probability of future expansion and development in the area.

3.3 Alternative 1: A public water system.

3.4 Alternative 2: In lieu of a public water system, each one family dwelling should have an emergency firefighting reserve of at least 2,000 gallons. This reserve may be part of a domestic system but must not be directly connected to or be dependent on a pressure system. The reserve may be in the form of a storage tank, cistern, reservoir, or swimming pool, etc. It must be readily accessible to mobile fire apparatus for direct draft or by a gravity flow system with a $1\frac{1}{2}$-inch feeder line terminating in a $1\frac{1}{2}$-inch NH gated outlet. The water source shall be no less than 75 feet from the building.

3.5 Class III requirements: With such low densities, it is unrealistic (in terms of time and money required) to install a public water system. With a lack of neighborhood water supplies, each one family dwelling should have an emergency firefighting reserve of at least 2,500 gallons. In regions of extreme fire hazard, a 3,000 gallon water supply is recommended. This reserve may be part of the domestic system but must not be directly connected to or be dependent on a pressure system. The reserve may be in the form of a storage tank, cistern, reservoir, or swimming pool, etc. It must be readily avalable to mobile fire apparatus for direct draft or by a gravity flow system with a $1\frac{1}{2}$-inch feeder line terminating in a $1\frac{1}{2}$-inch NH gated outlet. The water source shall be no less than 75 feet from the dwelling.

4.0 BUILDING CONSTRUCTION STANDARDS

The use of fire-resistant roofing materials may help save a building from an advancing wildland fire. Firebrands can travel well in advance of a fire-line and settle on roof tops, beginning a new fire and threatening the structure. When untreated wood shakes are used, the possibility of of such a fire occurring is increased.

4.1 The zoning designations established for all roofs in the urban/rural interface and wildland areas should be in accordance with the following:

Fire Hazard Severity Classifications	Type Roofing Required*
Extreme	CLASS A
High	CLASS B
Moderate	CLASS C

*Uniform Building Code - Standard 32.7

4.2 Automatic sprinkler systems shall not be permitted as a substitute for the required roof covering.

4.3 Existing building or structures, unless moved into or within any fire hazardous wildland area or buffer zone, need not comply with the provisions of this section except when altering, repairing or replacing more than 25 percent of the value of that portion of the building or structure to which the various subsections of this section apply.

5.0 BUILDING SPACING

Building density should be governed by slope as this is an important factor determining fire behavior; it is of paramount importance in areas of extreme wildland fire hazard. The density factor shall be:

5.1 In extreme wildland fire hazard regions:

Level ground to 15% slope: Maximum of 3 dwelling per acre.
16% to 30% slope: Maximum of 2 dwellings per acre.
Above 30% slope: Limited to one dwelling for every 3 to 5 acres, depending on local conditions. In some cases, structural development should be prohibited altogether.

5.1.a Spacing Details: Except for groups of not more than 5 utility buildings, each of which does not exceed 100 square feet in floor area, buildings, or structures located on terrain having a slope of more than 6 percent from the horizontal shall be separated from each other by not less than 100 feet and shall be located not less than 50 feet from property lines.

5.2 In moderate to high wildland fire hazard regions:

Level ground to 5% slope: Not more than six dwellings per acre.
6% to 15% slope: Maximum of four dwellings per acre.
16% to 30% slope: Maximum of two dwellings per acre.
Above 30% slope: Limited to one dwelling for every three to five acres, depending on local conditions. In some cases, structural development should be prohibited altogether.

5.3 Higher standards should be imposed or structural development should be prohibited where local conditions (i.e. excessive slope, box canyons, ridge saddles) create critical wildland fire hazards.

5.4 Buildings and structures moved into any hazardous fire region shall comply with the spacing/density requirements of this section.

6.0 VEGETATION CLEARANCES

Brush and dense forest undergrowth can quickly accumulate and increase the wildland fire hazard via increased fuel loading. This type of vegetation, as well as, "dead and down" materials, ignites readily, burns with intense heat and spreads rapidly. Residents can significantly reduce this hazard by taking the following precautions:

6.1 Building Clearance: California Public Resources Code 4291 requires a certain minimum clearance and states, "Any person who owns, leases, controls, operates, or maintains any building or structure in, upon, or adjoining any mountainous area or forest-brush-, or grass-covered lands or land covered with flammable material shall at all times do all of the following";

6.1.a Maintain around and adjacent to such building or structure a firebreak made by removing and clearing away, for a distance of not less than 30 feet on each side thereof or to the property line, whichever is nearer, all flammable vegetation or other combustible growth. This subdivision does not apply to single specimens of trees, ornamental shrubbery, or similar plants which are used as ground cover, provided that they do not form a means of rapidly transmitting fire from the native growth to any building or structure.

6.1.b Maintain around and adjacent to any such building or structure additional fire protection of firebreak made by removing all brush, flammable vegetation, or combustible growth which is located from 30 feet to 100 feet from such building or structure or to the property line, whichever is nearer, as may be required by the Director of Forestry when he finds that because of extra hazardous conditions, a firebreak of only 30 feet around such building or structure is not sufficient to provide reasonable

fire safety. Grass and other vegetation located more than 30 feet from such building or structure and less than 18 inches in height above the ground may be maintained where necessary to stabilize the soil and prevent erosion.

6.1.c Remove any portion of any tree which extends within 10 feet of the outlet of any chimney or stovepipe.

6.1.d Maintain any tree adjacent to or overhanging any building free of dead or dying wood.

6.1.e Maintain the roof of any structure free of leaves, needles, or other dead vegetative growth.

6.1.f Every chimney or stovepipe that is attached to any fireplace, stove, or other device that burns any solid or liquid fuel shall be provided and maintained at all times with a screen over the outlet. Such screen shall be constructed on non-flammable material with openings of not more than one-half inch in size.

6.1.g Lot size and placement of buildings thereon should be such that adequate clearance of hazardous flammable vegetation cover may be performed within the limits of the owner's lot.

	Natural factors	Very Important	Important	Not Important
m.	Type of vegetation around the home	8 (50%)	8 (50%)	0
n.	Aspect of home (i.e., on a south vs. a north-facing slope)	1 (6.3%)	6 (37.5%)	9 (56.3%)
o.	Slope steepness (i.e., greater than 40%)	4 (25%)	10 (62.5%)	2 (12.5%)
p.	Critical fire-weather (i.e., hot temperature, no rain, low humidity)	8 (50%)	7 (43.8%)	1 (6.3%)

3) Has the population in rural areas of your fire protection district increased, decreased, or remained the same during the last ten years? (check one)

10 (62.5%) Increased (Go to question 3a)

3 (18.8%) Remained the same (Go to question 3a)

1 (6.3%) Decreased (Go to question 3a)

2 (12.5%) Don't know (skip to question 4)

3a. Has the incidence (number) of wildland fires increased, remained the same, or decreased on an annual basis?

2 (14.3%) Increased (Go to question 3b)

8 (57.1%) Remained the same (Go to question 3b)

3 (21.4%) Decreased (Go to question 3b)

1 (7.1%) Don't know (skip to question 4)

3b. Has the size of the wildland fires (acreage burned) increased, remained the same or decreased on an annual basis?

0 Increased

9 (69.2%) Remained the same

3 (23.1%) Decreased

1 (7.7%) Don't know

4) Rank the following factors in order (i.e., number them 1, 2 and 3) according to your perceived importance of each to aid in reducing the wildland fire hazard:

	Rankings		
	1st	2nd	3rd
Upgrade existing fire departments	9 (50%)	0	7 (43.8%)
Create new volunteer fire departments	6 (37.5%)	1 (6.3%)	5 (31.3%)
Provide a coordinating service, or network, throughout the County between existing fire departments	0	11 (68.8%)	1 (6.3%)

5) Do you feel Humboldt County's current wildland fire protection services have any existing problems that may endanger lives and property? (check one)

6 (37.5%) Yes (Go to question 5a) 2 (12.5%) Don't know

6 (37.5%) No (skip to question 6)

5a. What are the existing problems, and what steps do you feel would help to solve them?

(For results, see the following discussion section).

6) If you feel you have additional information that may help us in completing this study, please leave your name, phone number and address. We will contact you as soon as possible.

7) Please feel free to add any additional comments.