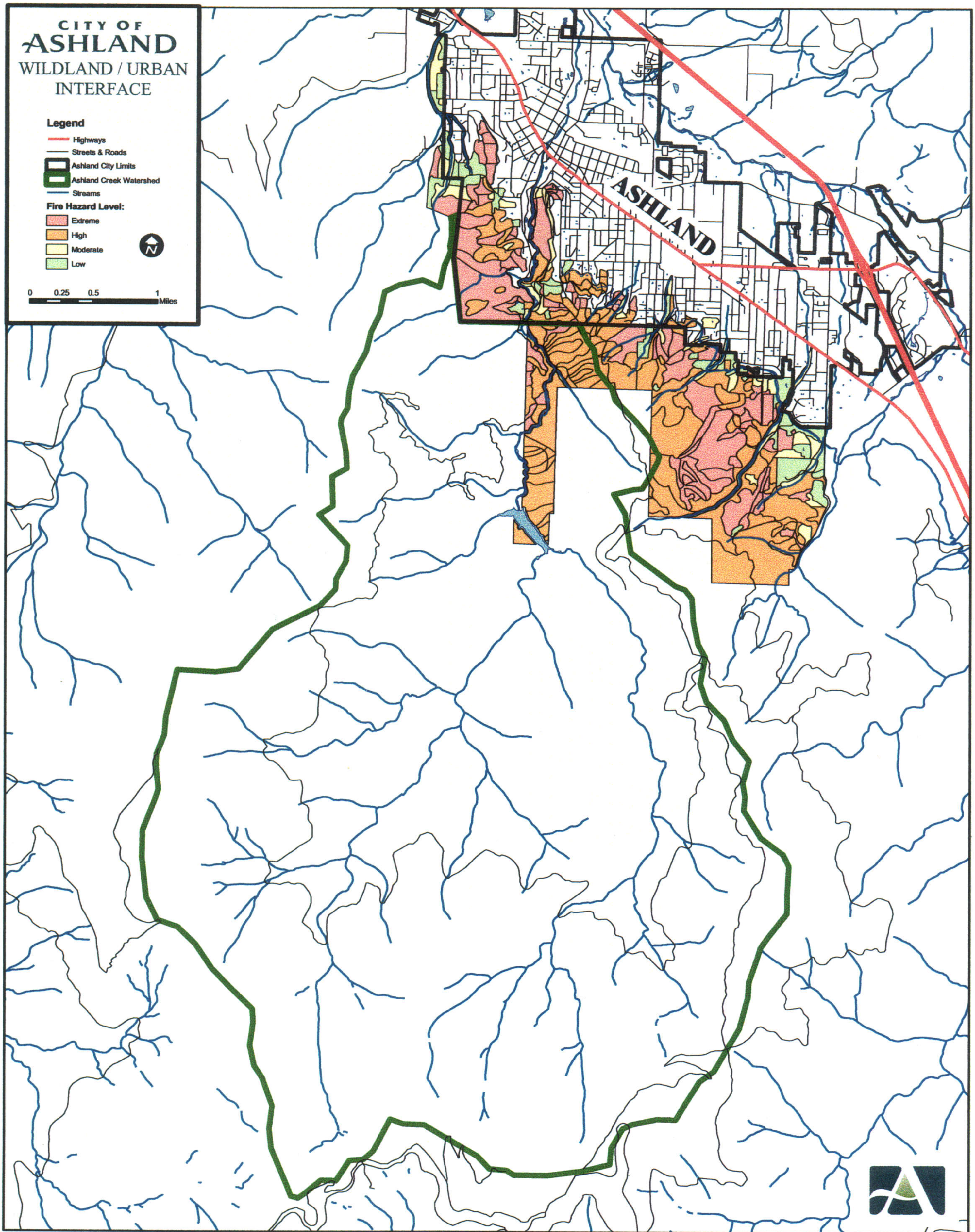
The Ashland Wildland/Urban Interface

Wildfire Management Inventory, Analysis, and Opportunities

Prepared by: Marty Main & Pat Uhtoff
Small Woodland Services, Inc.
1305 Butte Falls Hwy
Eagle Point, OR 97524


CITY OF
ASHLAND
WILDLAND / URBAN
INTERFACE
Legend
Highways
Streets & Roads
Ashland City Limits
Ashland Creek Watershed
Streams
Fire Hazard Level:
Extreme
High
Moderate
Low
0
0.25
0.5
1
Miles
ASHLAND

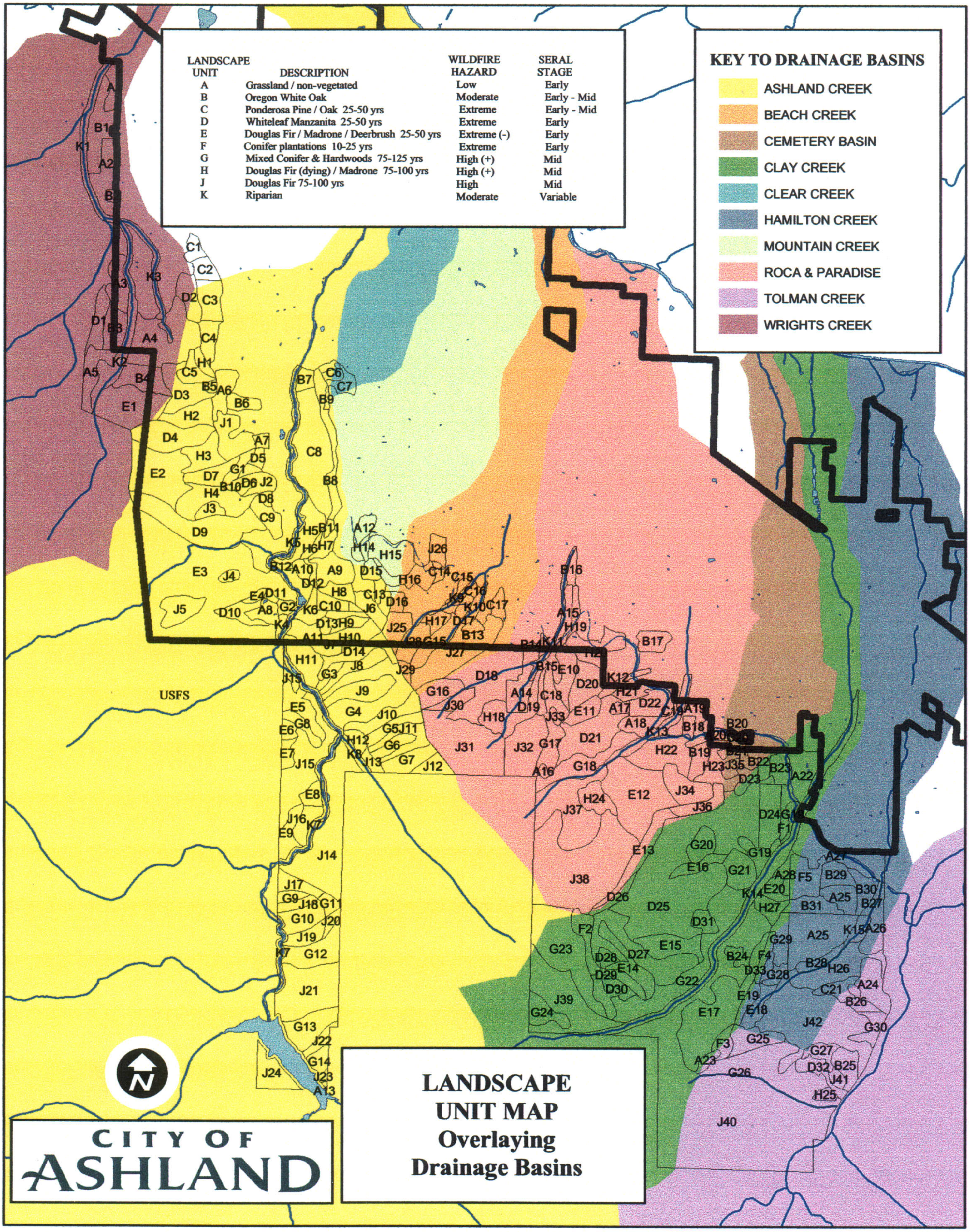

LANDSCAPE UNIT
DESCRIPTION
WILDFIRE HAZARD
SERAL STAGE
A Grassland / non-vegetated Low Early
B Oregon White Oak Moderate Early - Mid
C Ponderosa Pine / Oak 25-50 yrs Extreme Early - Mid
D Whiteleaf Manzanita 25-50 yrs Extreme Early
E Douglas Fir / Madrone / Deerbrush 25-50 yrs Extreme (-) Early
F Conifer plantations 10-25 yrs Extreme Early
G Mixed Conifer & Hardwoods 75-125 yrs High (+) Mid
H Douglas Fir (dying) / Madrone 75-100 yrs High (+) Mid
J Douglas Fir 75-100 yrs High Mid
K Riparian Moderate Variable
KEY TO DRAINAGE BASINS
ASHLAND CREEK
BEACH CREEK
CEMETERY BASIN
CLAY CREEK
CLEAR CREEK
HAMILTON CREEK
MOUNTAIN CREEK
ROCA & PARADISE
TOLMAN CREEK
WRIGHTS CREEK
USFS
N
CITY OF
ASHLAND
LANDSCAPE
UNIT MAP
Overlaying
Drainage Basins

Table of Contents

Acknowledgments

The following people reviewed this report and/or offered key insights:

Dr. James Agee, University of Washington

Dr. Tom Atzet, U. S. Forest Service

Wayne Rolle, U. S. Forest Service (botanical species input)

Bill Rose, U. S. Forest Service (retired)

Carl Skinner, Pacific Southwest Research Station, U. S. Forest Service, Redding, CA

Fred Way, U.S. Forest Service (wildlife input)

Jim Wolf, Oregon Department of Forestry

I. Abstract

The Ashland Wildland/Urban Interface, described by the acronym AWUI in this report, is an area at considerable risk of destruction from, and contribution to, large scale, high severity, catastrophic wildfire. The likelihood of significant loss of lives, property, and resource values clearly suggests that proactive strategies designed to minimize the likelihood, size, intensity, and duration of wildfire are of critical importance on individual, community, regional, and national scales. This report provides an inventory of current vegetational conditions/communities within the AWUI, a key determinant of wildfire behavior. A range of proactive management strategies designed to manipulate vegetation to more favorable conditions from a wildfire management perspective are described, based on existing landscape unit categories developed in the inventory. Management effects on other resources are described. Initial analyses of overall condition of the AWUI is discussed, including descriptions of individual management priorities to improve potentials for minimizing wildfire effects, as well as potential tactical opportunities delineated for use in a wildfire event.

II. The Ashland Wildland/Urban Interface Environment and Its Management

A. Introduction

Forests in the western United States have burned for millennia under a wide range of frequencies, intensities, durations and scales (Agee, 1993). Fire has been a critical process shaping the density, structure, and composition of forests throughout the biologically diverse Klamath-Siskiyou region. The predominant fire regime prior to Euroamerican settling (particularly those at low to mid-elevations) involved more frequent fires, of less intensity and duration, and on much smaller scales than those that occur today (Agee, 1991, 1993; USDA and USDI 1994). The Ashland Wildland Urban Interface (AWUI) is on the driest and warmest end of the Klamath Siskiyou province, hence the greater likelihood that frequent, low-intensity fire played a major role in shaping the development of its forests and wildlands.

However, beginning in the 1850s, fire regimes began to shift as a result of Euroamerican influences on the environment. In the last century, and particularly within the last 60 years, exclusion of fire from forest ecosystems has been attempted, utilizing increasingly advanced techniques of wildfire suppression. However, the more we have protected the forests from fire, the worse the problem has become (Agee, 2002). Increasingly, large scale, high intensity fires threaten lives, property, and resource values in the West every year.

There is no such thing as fire-free forests or wildlands. Perhaps more appropriately, fire can be expected to occur, and it is only the frequency, intensity, scale, and duration that we can influence through our actions. Creating a more resilient forest with fire regimes of lower intensities that are more easily controlled should be an obvious objective. Passive management (i.e., doing nothing) will not accomplish this objective; active management is necessary (Agee, 2002). This report describes strategies for implementing planned disturbances (i.e., management activities) that emulate pre-settlement disturbances and subsequently help return to a more benign fire regime.

Wildfire management priorities are increasingly being focused on wildland-urban interfaces, those geographic areas in which the urban and/or suburban setting is juxtaposed and transitionally grades into the wildland environment. By definition, interfaces are gradational and are thus difficult to delineate precisely. In this report, the Ashland Wildland/Urban Interface

(AWUI) is generally the area that extends from the edge of the urban/suburban residential and/or commercial areas up to the U.S. Forest Service boundary. The lands addressed in this report do not include U.S. Forest Service lands, but rather focus strictly on private and municipal (i.e. City of Ashland) lands. For the purposes of this report, Tolman Creek Road represents the southern boundary of the AWUI, while Wrights Creek comprises the northernmost boundary. This area comprises a total of approximately 2,625 acres. Elevation ranges from 2000 to 3600 feet above sea level.

Although the lower AWUI boundary was in many places difficult to precisely define, three general categories of interface boundaries exist. Classic interface boundaries occur where high density subdivisions lie adjacent to unsettled wildlands (e.g. Greenmeadows subdivision, Mountain Park Estates at the top of Morton Street, etc.). Mixed interface zones exist where less dense settlement patterns are scattered amidst wildland settings (e.g. upper end of Elkader Street; Timberline Terrace; homes in Morninglight Estates and along the upper end of Tolman Creek Road, etc.). Occluded interface zones occur where areas of wildland vegetation have become surrounded by more urban/suburban development (e.g., the wildlands of Lithia Park, lower Roca Canyon above Southern Oregon University, riparian vegetation along Hamilton Creek and others, etc.).

The AWUI is an area currently at considerable risk of destruction from the development and/or encroachment of high-intensity, rapidly spreading, large scale wildfire. This is at least in part the result of two main factors that have contributed to increased wildfire hazard throughout the West. First, the aforementioned altered fire regimes and disturbance histories have significantly changed vegetation structures, conditions and patterns such that a much more wildfire-prone vegetation exists. In essence, a dramatic increase has occurred in fire hazard, defined as the type, amount, arrangement, condition, and location of flammable fuels that form a threat of ignition, rate of spread, and resistance to control. The increased potential for wildfire and associated adverse impacts have become more likely in wildland-urban interfaces due to the higher inherent values, better access, and subsequent increases in successful fire suppression.

Picture #1 - Douglas-fir stand in center escaped 1959 wildfire, but is now succumbing to density and insect related mortality. Home in lower left surrounded by extremely wildfire prone vegetation (Landscape Unit D).

Perhaps equally important, however, has been a dramatic increase in the second factor that has occurred throughout the West, and certainly in the AWUI—increased population densities in areas formerly strictly wildland in nature. In Ashland, numerous homes currently exist in the area that burned intensely in the 4,000-acre 1959 wildfire (see Picture #1). With each of these residences and the various accesses to reach them, comes an associated increase in fire risk or the chance of ignition and sustenance of fire that threatens resources, property, and lives. Accidents, carelessness, arson, and other human-caused ignitions are clearly associated with increasing population density in wildland environments. Simultaneously, the presence of residences in wildland environments can significantly reduce the effectiveness of suppression efforts, as efforts to protect homes in a wildfire event remove suppression resources from actively battling the fire itself.

The Ashland Wildland/Urban Interface is a particularly critical area from a wildfire management perspective for several important reasons.

1. A large number of people live within this Ashland wildland/urban interface, and a significant number of lives could be lost in a major wildfire event, given the potentially explosive nature of fire in this area. This is a result of a combination of factors, including extreme fire hazard; extreme risk of ignition within an area of moderate to the steep topography; limited and restricted access that retards rapid escape in a wildfire event; the highly flammable nature of some of the homes that could ultimately contribute to wildfire behavior; and the likelihood of at least partial (or worse) ineffectiveness of suppression efforts in a major wildfire event. These characteristics are similar to those in the Oakland Hills fire in 1991 when 25 lives were lost.

2. The area is dominated by a significant number of residences, structures, and other values-at-risk. Many of those values-at-risk would be lost in a significant wildfire event, at considerable loss to individuals and the community. In fact, many homes have been constructed in areas that lie in the path of previous wildfire in the AWUI, such as the 750-acre Hillview fire and the 4,000-acre 1959 wildfire in the north end of the AWUI. In the Oakland Hills fire in 1991, over 6000 structures were partially or totally lost, resulting in slightly less than 2 billion dollars in damage; 790 homes were consumed in one hour alone.

In the Oakland Hills fire in 1991, over 6000 structures were partially or totally lost, resulting in slightly less than 2 billion dollars in damage; 790 homes were consumed in one hour alone.

3. Once wildfire is initiated within the AWUI, its potential for significantly impacting major wildland resources within the immediate vicinity is also quite likely. Most notable would be impacts on the adjacent Ashland Creek watershed with its key ecosystem values, including late successional/old growth forests of regional and national importance; critical habitats for sensitive, threatened, and/or endangered species; critical area for wildlife habitat connectivity and transfer of genetic resources between the Cascade and Siskiyou Mountains; and key watershed values associated with a municipal water supply. Extremely sensitive and erosion-prone soils suggest impacts from a wildfire would be considerable over the longer term as well. High to extreme wildfire hazard within the Ashland Creek watershed itself suggests that prevention of wildfire encroachment into its geographical area is of paramount importance from local, regional, and national perspectives.

There is a growing consensus among resource managers that relying solely on traditional suppression techniques will not offer long-term solutions to these concerns. Given the immensity of the task of trying to prepare for the eventuality of a major and potentially catastrophic fire, prioritization of appropriate pre-suppression activities becomes critically important. Proactive strategies designed to reduce the likelihood of such an event, as well as limiting its size, intensity, and duration when it does occur, are important public policy goals.

Numerous wildland fire hazard assessment protocols have been developed in recent years to aid in determining where to concentrate finite resources in this effort. Most of these analyses focus inventory efforts on three main factors:

(1) characteristics of structures and development on a site

(2) characteristics of suppression and response in a wildfire event

(3) environmental characteristics of a site.

Characteristics of structures in the AWUI are a critical factor in determining potential losses during a wildfire event, particularly in wildland-urban interfaces like the AWUI (Cohen, 2000). Structures always have been, and will continue to be, high priorities for protection, which obviously commits firefighting resources that might otherwise be used for suppression of the wildfire itself (see Picture #2). In major wildfire events, structures actually can become fuel and exacerbate wildfire behavior. Minimizing the effects of wildfire on structures, and/or their ultimate contribution to wildfire behavior if consumed, can be accomplished through many commonly described construction activities and/or modifications, particularly as regards roofs, siding, and/or decks, eaves, overhangs, etc. Another key factor that minimizes the potential for structural involvement in a wildfire is that of creation of defensible space around a home, that is reduction and/or redistribution of vegetation amounts and continuities within a specified distance from a home. Not only does creation of defensible space reduce wildfire advance towards a structure, but residences are also logical sources of ignition and vegetation manipulation within their vicinity reduces the rapidity of fire escalation and subsequently increases the likelihood of successful initial attack. The City of Ashland has recently been involved in a grant program that has provided financial assistance to landowners for creation of defensible space around their homes in portions of the AWUI.

Picture #2 - Landscape Unit H with dead and dying Douglas-fir. Extreme fire hazard in close proximity to home.

Access and resulting response time are also key determinants of the potential to minimize wildfire initiation and/or scale/intensity. In wildland settings, good access allows rapid initial attack and ultimate containment before fires explode into larger fires. Response time for aerial attack during wildland fire suppression activities is also critical; the move of the air tanker base from Medford to Klamath

Falls will reduce the likelihood of successful initial attack and/or wildfire containment in the AWUI. In more urban or suburban settings on the edge of the AWUI, actual road characteristics (width, grade, turnarounds, adjacent vegetation, etc.) can extend response time or perhaps even eliminate access for emergency fire-fighting vehicles. Available fire protection in these settings is also affected by water source availability—pressurized, non-pressurized, or fixed fire protection (e.g., sprinklers incorporated into structure design).

Obviously, the first two aforementioned factors are critical to determining the effectiveness of wildfire suppression efforts and particularly to minimizing losses of life and/or important property values-at-risk. It is difficult to argue with expenditures prioritized to improve wildfire management potentials in these two arenas. This report, however, focuses primarily on inventory and analysis of environmental characteristics of a site (i.e., fuels/vegetation, slope aspect, topography, etc.) and their subsequent potential contribution to wildfire behavior. Not only does this third factor affect wildfire behavior in the more urbanized portions of wildland-urban interfaces, but also increases in importance further from residential areas and into the more wildland portions of interfaces. The importance of environmental characteristics of a site, particularly fuels and vegetation, drives almost all wildland fire hazard assessments and is probably the most important variable affecting potential wildland fire behavior in the AWUI.

Given the considerable risk of damage to communities and ecosystems from high-intensity, large-scale wildfire, and the limited and finite resources available for proactive protection and restoration work from a wildfire management perspective, there is an urgent need regionally for focused, integrated approaches to vegetation management that can maximize wildfire management benefits while minimizing unintended adverse effects.

The importance of environmental characteristics of a site, particularly fuels and vegetation, drives almost all wildland fire hazard assessments and is probably the most important variable affecting potential wildland fire behavior in the AWUI.

Small Woodland Services, Inc., was asked by the City of Ashland in autumn, 2001, to begin development of an integrated approach to wildfire management within the Ashland Wildland-Urban Interface. The process of developing that approach produced four primary outputs in this report:

1) A general description of the AWUI and the underlying theoretical framework and management-related realities that form the basis for implementing wildfire

management activities while minimizing adverse impacts.

2) An inventory and mapping of the interface area with subsequent delineation of landscape units based on similar site conditions, vegetation types, and wildfire hazards.

3) Description of landscape units and subsequent general management prescriptions for each, thereby providing landowners in the AWUI an introduction to a range of management possibilities for their properties

4) An assessment and description of landscape level opportunities and priorities for minimizing the potential for and impacts from high-intensity, large scale wildfire through a) pre-suppression management activities and, b) delineation of tactical opportunities in a major wildfire event.

Presentation of this report was challenged by the need to present professionally accurate information in a way that is accessible to readers and audiences that range from professional resource managers and environmental advocates, to policy makers within the City of Ashland, to landowners and other interested parties, many of whom have limited knowledge of forest, resource and wildfire management issues. While many professionals may question some of the somewhat simplistic descriptions of many of the issues and recommendations in this report, other lay readers may be overwhelmed by its highly technical nature.

Too, it must be recognized that this report is being offered with very limited public input and involvement. Ashland is blessed with a very well educated and active citizenry, including many residents who are experts within specific disciplines covered in this report. Local residents' knowledge and expertise about wildfire issues is essential to creating an effective response to the threat of damage and destruction from wildfire. Residents can help identify the map features that are relevant in emergency response situations (e.g., location and condition of secondary access roads, locked gates, water sources, etc.). Interface residents can also assist in identifying and prioritizing values-at-risk threatened by fire. Ultimately, public acceptance of needed pre-fire management activities will undoubtedly depend largely on their

> *Ultimately, public acceptance of needed pre-fire management activities will undoubtedly depend largely on their belief that the process is open, transparent, and to their benefit, and that the knowledge, expertise, and values that they bring to the table are sincerely valued*

belief that the process is open, transparent, and to their benefit, and that the knowledge, expertise, and values that they bring to the table are sincerely valued. Without effective public involvement and ultimate acceptance of strategies for reducing negative impacts from wildfire, this report may be practically useless.

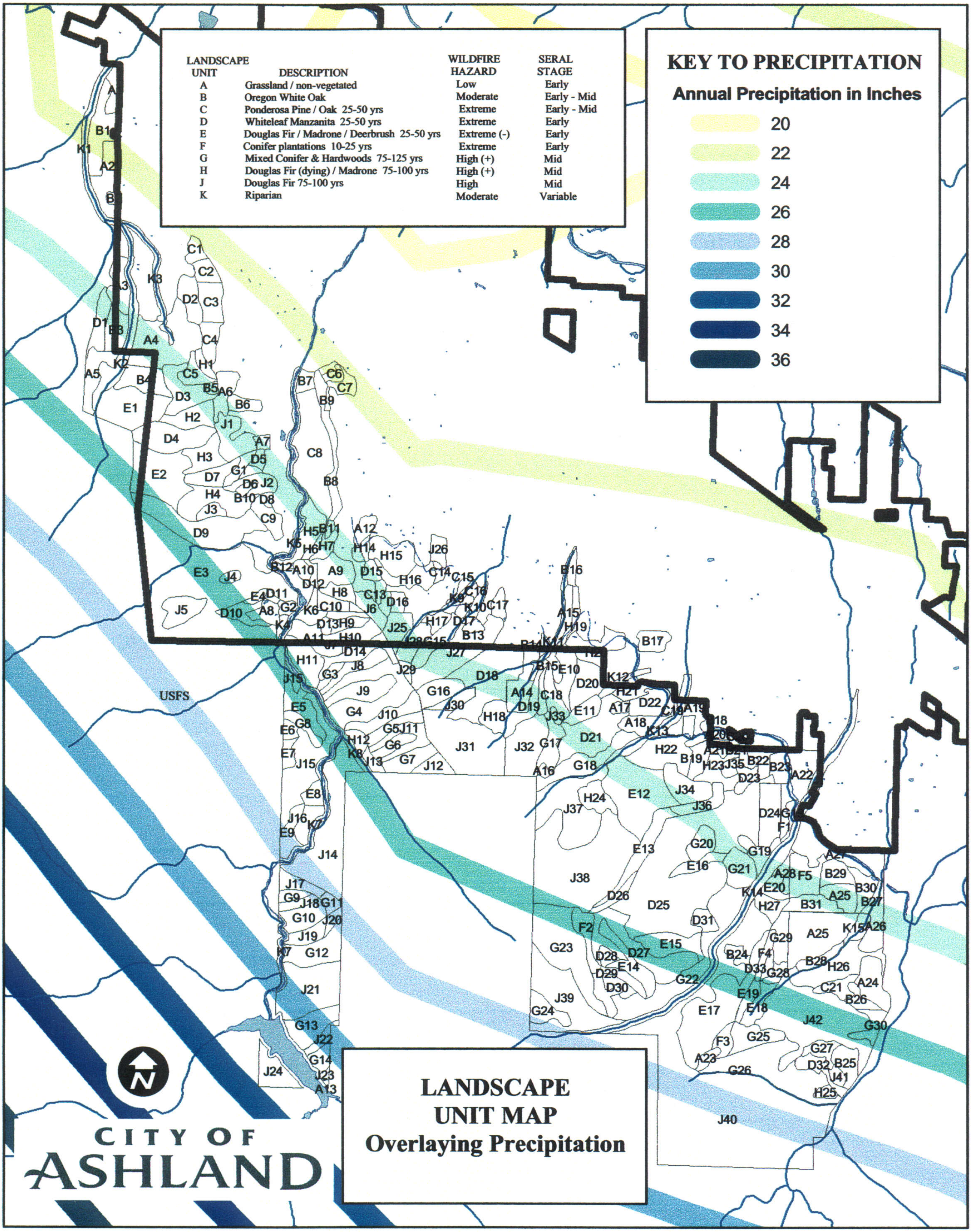
As a result, this report is designed to be a work-in-progress rather than a statement of fact. It should be utilized to facilitate discussion about opportunities and priorities that hopefully will be guided by additional, more complete information in the future. As this information (social, biological/ecological, management-related, logistical, etc.) is collected and added to the data base, analysis outputs will logically change, and have to be updated in order to remain accurate and useful. The use of Geographic Information Systems (GIS) to spatially categorize and display information should facilitate easy updating as changes occur. However, 150 years of human impacts on the landscape cannot be altered overnight. Although significant gaps in our knowledge exist, it is imperative that we move forward learning from both successes and failures (Brown, 2002). It is with considerable humility that this report is offered as a step in that process.

B. Vegetation Development and Disturbance History

Management of any vegetation type designed to achieve a particular set of objectives ultimately depends on an intimate understanding of: (1) how that type typically develops (i.e., the expected successionary pathway), (2) the reasons for its current set of conditions, and (3) reasonable and knowledgeable projections for how planned manipulations will produce desired changes in developing vegetation. This is particularly challenging because: (1) the Klamath Siskiyou province, in which the AWUI is located, is internationally known for its unusually high level of vegetational diversity and variability, (2) disturbance histories have been significantly altered since Euroamerican settling in the mid-1800s, often in highly diverse and complicated ways, and (3) vegetational communities today are functionally, compositionally, and structurally unique today, making guesses as to future developmental trajectories difficult and risky. Nonetheless, this is exactly what is asked of forest and resource land managers, particularly given that in many situations (including this one) doing nothing is well recognized as a highly undesirable approach, particularly in the AWUI.

Forest vegetation composition is continually and significantly determined by relatively constant environmental variables, such as elevation, aspect, annual rainfall, soil characteristics, and numerous other factors. Variations in these environmental variables alone produce significant differences in site conditions. In the Klamath Siskiyou region, these environmental variables are generally most critical in the influences they have upon moisture availability for plants, as moisture is usually the limiting factor affecting plant survival and growth throughout most of the area, and particularly at lower elevations in the eastern edge of the region where the AWUI is located. Most of this area is also within the rain shadow of Mt. Ashland, such that precipitation amounts average only 20-30 inches annually, compared with close to 60 inches at Mt. Ashland, only 7 miles to the south. In particular, the lack of precipitation during summer months greatly affects the type, quantity, and diversity of vegetation that can survive and prosper.

Aspect is an important environmental variable because greater amounts of solar radiation on southerly aspects during long, dry summer months limits moisture availability much more so than on northerly aspects (with easterly and westerly slopes intermediate). Obvious changes in vegetation occur in the AWUI on opposing southerly and northerly aspects. Douglas-fir, Pacific madrone, and deerbrush ceanothus tend to dominate the more northerly aspects, while much more



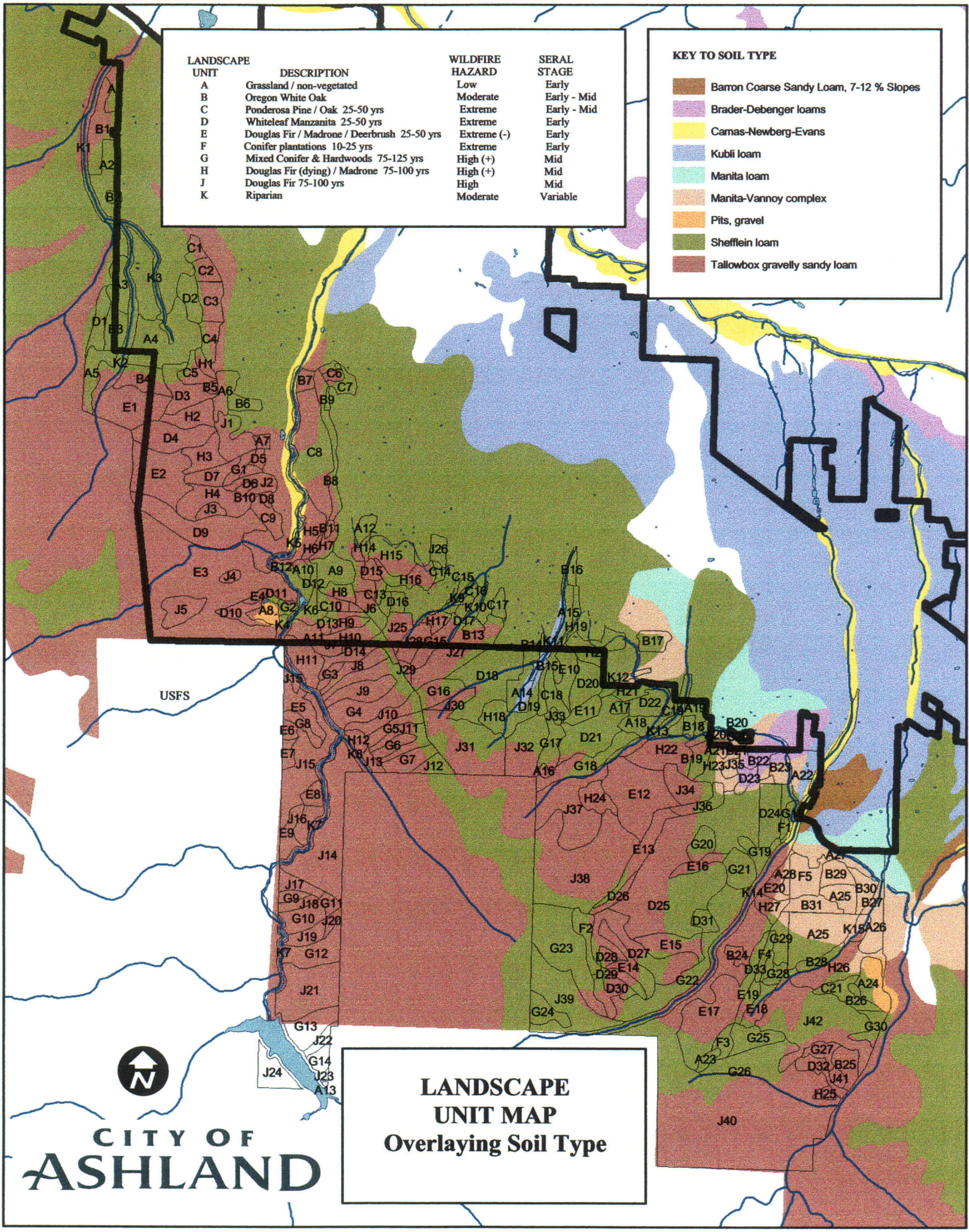
LANDSCAPE UNIT | DESCRIPTION | WILDFIRE HAZARD | SERAL STAGE
A | Grassland / non-vegetated | Low | Early
B | Oregon White Oak | Moderate | Early - Mid
C | Ponderosa Pine / Oak 25-50 yrs | Extreme | Early - Mid
D | Whiteleaf Manzanita 25-50 yrs | Extreme | Early
E | Douglas Fir / Madrone / Deerbrush 25-50 yrs | Extreme (-) | Early
F | Conifer plantations 10-25 yrs | Extreme | Early
G | Mixed Conifer & Hardwoods 75-125 yrs | High (+) | Mid
H | Douglas Fir (dying) / Madrone 75-100 yrs | High (+) | Mid
J | Douglas Fir 75-100 yrs | High | Mid
K | Riparian | Moderate | Variable
KEY TO PRECIPITATION
Annual Precipitation in Inches
20
22
24
26
28
30
32
34
36
USFS
CITY OF
ASHLAND
LANDSCAPE
UNIT MAP
Overlaying Precipitation

diverse species compositions occupy more southerly aspects, including not only Douglas-fir but also ponderosa pine, sugar pine, and incense cedar, as well as hardwoods (Pacific madrone, California black oak, Oregon white oak) and drought-tolerant brush species, most notably whiteleaf manzanita, and to a lesser extent deerbrush ceanothus.

Variations in soil properties are particularly important determinants of vegetation on any given site. In the AWUI, soils are derived primarily from granitic parent material of the Tallowbox (on steeper sites)and Shefflein (on gentler slopes 10-35%) soil series USDA Soil Conservation Service, 1993). These are relatively deep, and well to excessively well-drained soils of a very coarse nature easily prone to erosion. Both surface erosion and mass wasting events, most notably debris slides and debris flows, have frequently occurred in these soil types in the AWUI, even in undisturbed landscapes. The potential for increasing these erosional events through active management and/or manipulation of sites and/or vegetation is of major concern. The New Years Day storm of 1997 revealed the potential for landslide activity and major associated flooding that occurred in the Ashland downtown plaza area. This concern is, of course, balanced with potential damage associated with severe wildfire, including increased soil erosion and landslide activity when vegetation is removed by wildfire.

The easterly edge of the AWUI adjacent the Ashland urban/suburban area and along the terraces and first hillslopes of the Bear Creek Valley grades into soils from more sedimentary/alluvial and metamorphic parent materials. These less-coarse soil textures, coupled with the gentler topography, result in far less potential for major erosional events. These soils also encourage a different type of vegetation, as they tend to be more moisture-limiting due to changes in depth (shallower) and/or other structural, textural, or chemical properties of soils can additionally reduce moisture availability. Clays, for instance, have physical and chemical properties that bind water and make it much less available for most plants, particularly conifers. Other plants, however, have adaptations that allow them to survive and even thrive in these conditions. Oregon white oak is an example of a tree that can survive and even thrive in heavy clays and/or very shallow soils. Although it too can thrive in more productive soils, it cannot compete favorably with other trees that prefer these locations (conifers, Pacific madrone, etc.).

In essence, each site contains given environmental characteristics (such as just described) that encourage (or discourage) certain types of vegetation. Existing plant species can potentially


LANDSCAPE UNIT | DESCRIPTION | WILDFIRE HAZARD | SERAL STAGE
A | Grassland / non-vegetated | Low | Early
B | Oregon White Oak | Moderate | Early - Mid
C | Ponderosa Pine / Oak 25-50 yrs | Extreme | Early - Mid
D | Whiteleaf Manzanita 25-50 yrs | Extreme | Early
E | Douglas Fir / Madrone / Deerbrush 25-50 yrs | Extreme (-) | Early
F | Conifer plantations 10-25 yrs | Extreme | Early
G | Mixed Conifer & Hardwoods 75-125 yrs | High (+) | Mid
H | Douglas Fir (dying) / Madrone 75-100 yrs | High (+) | Mid
J | Douglas Fir 75-100 yrs | High | Mid
K | Riparian | Moderate | Variable
KEY TO SOIL TYPE
Barron Coarse Sandy Loam, 7-12 % Slopes
Brader-Debenger loams
Camas-Newberg-Evans
Kubli loam
Manita loam
Manita-Vannoy complex
Pits, gravel
Shefflein loam
Tallowbox gravelly sandy loam
USFS
N
CITY OF
ASHLAND
LANDSCAPE
UNIT MAP
Overlaying Soil Type

act as indicators for potential site productivity. A collective analysis of all of the species and relative comparisons in vigor and abundance between species can help determine the potential productivity of a given site—and whether the condition of existing vegetation is within the range of historic conditions and/or an ecological range appropriate for the site.

General patterns of vegetation development over time can be fairly predictable for any one site, particularly if no disturbance alters the pattern. As vegetation develops, it typically progresses through a series of successional stages, each of which contains specific and recognizable characteristics (see Figure #4). Oliver and Larson (1990) describe four general stages of forest vegetation development that occur following a stand replacing disturbance: stand initiation, stem exclusion, understory re-initiation, and old growth. The stand initiation stage occurs for several years while new plant species invade the site. This stage can be extended for a considerable length of time in the AWUI when various brush species dominate the site, preventing the establishment and growth of larger emerging conifers and/or hardwoods. In most cases, however, eventually conifers and/or hardwood seedlings and saplings develop and grow, and the developing vegetation tends to make a transition towards stands of trees, initiating the stem exclusion stage. In this stage, growing space becomes fully occupied, site resources fully utilized, and new individuals prevented from becoming established. The stem exclusion stage continues until the developing trees reach densities where natural, density-related mortality occurs. This process initiates the understory re-initiation stage where new individuals begin to grow in the understory as overstory trees die. Eventually, this developing understory vegetation helps create a more typical old growth stand structure characterized by multiple age classes, size classes, and complex structures of multi-layered canopies.

This model, although somewhat simplistic, provides a good conceptual framework with which to understand how forest vegetation tends to develop over time, particularly in the absence of disturbance. Carried to logical conclusion, it would suggest that prior to settlement of the west by European peoples, forests were dominated by primarily late-successional forests.

However, extensive research over the last thirty years has suggested a different outcome. Rather, this march over time through the four stages of stand development is considerably modified by various natural disturbances, including wind storms; ice storms; droughts and related mortality; insect and disease outbreaks; landslides; flooding and/or erosion from peak storm events; fire (ignited by either lightning and/or Native Americans) and perhaps others. Atzet and Wheeler (1982) found that 98 percent of the stands in the Klamath Physiographic Province have been disturbed by one or more events. These disturbances historically returned developing stands, or portions of them, to earlier stages of development, and depending on their scale, frequency, magnitude, season, and historical variability produced a variety of vegetational types and structures across a landscape. Many of these disturbance events were synergistic—that is, they cumulatively altered vegetation types, producing an even wider diversity of vegetational conditions on a landscape. In essence, every forest type developed under the influence of its own particular disturbance history, which of course varied over time as well.

Prior to European settlement of southern Oregon, the primary disturbance mechanism in the Klamath Physiographic Province was fire (Atzet and Martin, 1991). These fires, ignited by Native Americans and/or lightning, ranged in frequency from 5 to 20 years in the interior valley and mixed conifer zones that dominate the AWUI.

Understanding of these three categories of site condition determinants (environmental site conditions, vegetation development patterns, natural disturbance history), can help explain the existing condition of vegetation type on a site if they are analyzed correctly. However, a fourth major determinant may be the most important of all— that of changes in disturbance history through active management within the last 150 years.

Typical post-settlement impacts include many that are commonly known—wildfire, mining, logging, grazing and livestock utilization, off-road vehicle use, road building, and various other construction and recreational activities. Perhaps the impact with the greatest influence is the one that until recently was the least known and understood—that of changes in fire regimes that were initiated with the settling of the area in the mid-1800s.

Beginning in the 1850's, significant vegetation modification and changes in disturbance history began to occur as Native American application of fire was eliminated and new forms of disturbance began to be implemented across the landscape. Forests began to be harvested in earnest to help build the developing town of Ashland, and the resulting

Beginning in the 1850's, significant vegetation modification and changes in disturbance history began to occur as Native American application of fire was eliminated and new forms of disturbance began to be implemented across the landscape.

slash from these operations, coupled with the resulting increase in more flammable early successional vegetation, created a landscape much more likely to burn at larger scales and higher intensities. In some cases, high-intensity fire was purposely initiated by ranchers desiring more pastureland or miners hoping to expose more rock strata and make mining easier—both clear and purposeful objectives.

Two large scale, high-intensity fires burned throughout large portions of the AWUI in 1901 and 1910. These fires further encouraged establishment and growth of vegetation more well-adapted to this new type of more infrequent but higher intensity disturbance, a pattern that continues today.

The 1901 and 1910 wildfires were part of a regional trend that led to a policy of fire suppression and subsequent exclusion from forest ecosystems that remained in place for most of the 20th century. This human-induced change in disturbance history from frequent, low-intensity fire to infrequent, high-intensity fire altered the ecological functions previously maintained by frequent, low-intensity fire. These included:

1. Periodically removed dead and downed material as well as ultimately reducing stand densities primarily through removal of brush, small conifers and other understory vegetation. Although some smaller seedlings and saplings always escaped, low-intensity fires that typically burns in a mosaic fashion and some larger trees were removed, vertical and horizontal discontinuities in fuel were generally increased by frequent low-to-moderate intensity fire. The result was a modified vegetation and fuel profile with a subsequent decreased likelihood, extent, and intensity of wildfire.

2. By maintaining a healthier, less crowded and more vigorous stand AND by reducing available habitat (downed slash), forests were far less susceptible to large scale increases in mortality from bark beetles and other insects that performed important ecological roles at reduced population levels. Fire, and smoke, also played a critical role as deterrents for deleterious forest diseases.

3. Frequent light to moderate intensity fire produced considerable variation in vegetation species, ages, densities, and structures. This maintenance of high degrees of biodiversity is an important feature of healthy, resilient forest ecosystems.

4. Frequent, low-intensity fire maintained more open stand conditions that encouraged development and maintenance of larger, shade-intolerant species, most notably Ponderosa pine and the oaks. In the absence of fire, species composition has significantly changed, with shade tolerant species favored. In addition, in the

absence of frequent fire, stump-sprouting hardwoods and brush species that typically grow quite slowly when initiated by seed, have become much more common, further altering species compositions.

5. Fire played a critical role in nutrient recycling, particularly in drier, moisture-limiting climates where decomposition can be very slow. Frequent, low-intensity fire recycled nutrients "locked-up" in above ground fuel (both dead and green) and provided a fresh flush of vigorous growth, including those species critical for wildlife. In the absence of frequent, light fire, a greater percentage of total site nutrient capital has been shifted above ground, with the potential for increased nutrient loss given the greater likelihood of stand destruction through infrequent high-intensity disturbance.

6. Frequent fire is suspected to have maintained a lower level of above-ground biomass than exists today after a century of fire exclusion. The increased transpirational demands of this additional vegetation has altered the amount and seasonality of water available as groundwater or as overland flow in streams and rivers, with subsequent impacts on the many competing users of water, including increasingly impacted fisheries and other aquatic resources.

Unfortunately, it is apparent today that we cannot prevent fire from occurring in the fire-prone forests of southern Oregon, particularly given ever-increasing fuel levels. It is more appropriate to think about attempting to manage the size and intensity of fire, rather than the occurrence of fire

Once initiated, however, the pattern of infrequent but intense wildfire (as opposed to frequent fire of low intensity) is reinforced by the resulting increased amounts of more wildfire prone early successional vegetation, which often occurs in relatively continuous vegetation and fuel profiles. This new disturbance regime further encourages those species that contain life history strategies (stump sprouting, stored seeds in the duff/soil, etc.) allowing them to thrive, and even outcompete other species, in infrequent, high intensity disturbance regimes—once again encouraging the likelihood of high intensity, large scale wildfire. Breaking this pattern and restoring more benign fire regimes is often a primary forest management goal in wildfire-prone environments.

> *Once initiated, however, the pattern of infrequent but intense wildfire (as opposed to frequent fire of low intensity) tends to reinforce itself as the dense brushfields and stands of thick, juvenile conifers and stump-sprouting hardwoods (the earlier stages of succession) are much more prone to wildfire of larger scales and higher intensities.*

However, these early successional vegetational communities are now common throughout the AWUI. Very few examples of vegetation types with individual trees greater than 100 years of age (initiated before the 1901/1910 wildfires) can be found within the AWUI, while mature trees 200 to 400 years of age are not uncommon in the mid to upper elevations of the adjacent Ashland Creek watershed.

Most of the vegetation in the AWUI is heavily dominated by stands of mixed conifers and hardwoods initiated within the last 40 to 100 years. More recent disturbance events (such as the wildfires of 1959 and 1973, clearing for homesite development, logging and/or other significant vegetation removals to achieve forest management goals, etc.) have resulted in vegetation in the earlier stages of succession, most notably brushfields, grasslands, and the like.

Changes in disturbance history have also resulted in a high proportion of individual trees and stands under significant stress in the AWUI. These stand conditions provide ideal conditions for rapid escalation of bark beetle populations, as bark beetles can sense and generally attack trees under severe cumulative stress. Other factors such as drought, disease, logging damage, soil compaction, and others add to cumulative stress, making trees that much more susceptible to insects.

Once a bark beetle gains entry to a weakened tree, it can chemically communicate this condition to others of its species, thereby causing a "mass attack" which kills trees outright. Usually, several species of beetles work synergistically to overcome individual tree's natural defenses (primarily excessive pitch production). Flat headed borers (Melanophila drummondi) and Douglas-fir beetles (Dendroctonus pseudotsuga) have been causing the extensive mortality of Douglas-fir throughout the AWUI. An entirely different cadré of bark beetles, primarily western pine beetle (Dendroctonus brevicomis), mountain pine beetle (Dendroctonus ponderosa), and pine engraver beetles (Ips pini) attack and kill the pines.

Each beetle has its own particular biology, and knowledge of that biology is critical to the success of any forest management activity. For example, Douglas-fir beetle tends to concentrate its activities in Douglas-fir trees 10 to 12 inches diameter and larger. This is particularly unfortunate in the AWUI because many of the preferred overstory Douglas-fir have been, and are being, killed by bark beetles, leaving only suppressed, poor quality understory conifers. The opportunity for improving stand conditions through silvicultural activities is compromised in this situation, as the preferred leave trees can be killed by bark beetles prior to initiation of stand density reduction.

Although insect-induced mortality of conifers is an important functional process in healthy forest ecosystems, its increased occurrence on larger scales has exacerbated the trend towards even more higher intensity, large scale disturbances, including wildfire.

Although insect-induced mortality of conifers is an important functional process in healthy forest ecosystems, its increased occurrence on larger scales has exacerbated the trend towards even more higher intensity, large scale disturbances, including wildfire. When populations of these cadres of bark beetles explode, even healthy trees can be overcome and mass mortality can occur. Without a proactive attempt to reverse this process through silvicultural treatments, this process of tree and stand mortality will continue, with much greater amounts of mortality possible. Increasing the amount of dead wood, both standing and on-the-ground, can increase the intensity, rate-of-spread, duration, and ultimately size of wildfire.

Another major form of disturbance currently in the AWUI is dwarfmistletoe disease, primarily on Douglas-fir. Dwarfmistletoes are flowering, seed-bearing, perennial plants that attack conifers. They do not have enough chlorophyll, however, to produce their own food. Thus, they rely totally on host trees for nutrients and water and continually weaken an infected conifer until it dies or succumbs to a secondary attack, such as bark beetles. When the host tree dies, the dwarfmistletoe plant dies.

A specific species of dwarfmistletoe is usually confined to a corresponding single species of conifer. Reproduction is by seed, which is aerially spread from tree to tree. Rate of spread is generally about 1 to 2 feet per year, although the sticky seeds, forcibly shot from the fruits in fall, can fly as much as 30 to 40 feet or more. Since they prefer high levels of sunlight, dwarfmistletoes can spread more rapidly in open stands than in closed stands. For this reason, partial cutting and/or thinning has been known to rapidly increase dwarfmistletoe infections if a diligent job of removal is not accomplished (usually followed by a second entry to remove infected trees missed in the first entry). The most undesirable element of dwarfmistletoe infection occurs when poor quality, infected overstory trees spread the disease to young, healthy saplings in the understory, thereby insuring the long-term continuation of the disease. Dwarfmistletoe disease is a slow, subtle form of disturbance that can significantly change stand conditions over time.

Root diseases are another slow, subtle form of disturbance that has long-term repercussions for vegetational development and stand succession. Although they appear to be uncommon in the AWUI at this time, these subtle, damaging agents are everywhere, are usually much underrated, and are very difficult to control.

Four major species of root disease are common in southern Oregon– Armillaria, Phellinus (laminated), Annosus, and Black Stain root disease. Each has its own particular biology and options for management. Unlike dwarfmistletoe disease, destruction of the above-ground portions of trees does not necessarily remove root disease from forest ecosystems. Ongoing monitoring and early protection is critical for preventing excessive destruction from these diseases. Minimizing damage to residual stems during logging, planting or encouraging resistant species, and particularly maintaining stands with trees of high vigor are the most important management techniques that can help limit the spread of most root diseases.

Picture #3 - Slump following vegetation clearing; Landscape Unit J.

Other forms of disturbance appear to be much less important in terms of influencing vegetation development in the AWUI currently. Stand level replacements of vegetation via insect, disease, or fire-related mortality may, however, increase the likelihood of slope stability failures as roots die (see Picture #3). Larger slope failures can be significant, though usually somewhat isolated, forms of disturbance that return sites to the beginning stages of succession.

C. The Silvicultural Basis for Vegetation Management

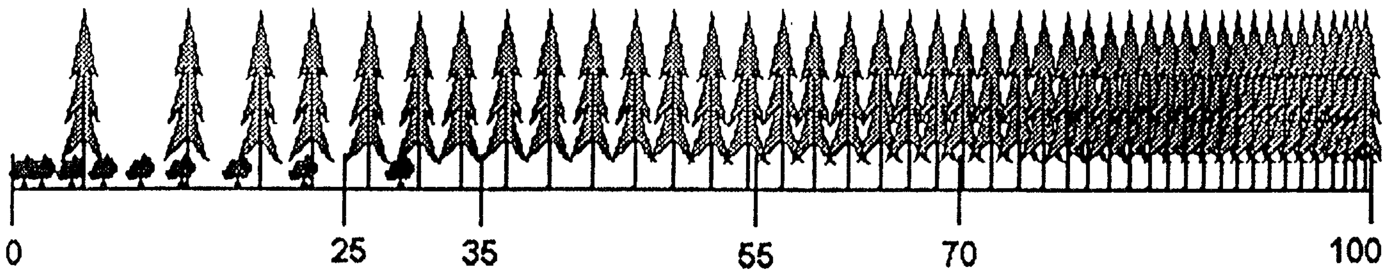
Humans have been manipulating vegetation to achieve pre-determined objectives (agricultural, forest resource, cultural, etc.) for thousands of years. In today's complex environment, where social, economic and ecological values intermix, silviculture is the science and the art of modifying and manipulating vegetation to achieve both short-term and long-term objectives of forest and resource landowners.

Humans have been manipulating vegetation to achieve pre-determined objectives (agricultural, forest resource, cultural, etc.) For thousands of years. . . . the primary objective for vegetation management in the AWUI is to achieve conditions that reduce the likelihood, size, and/or severity of wildfire, while minimizing negative impacts, or even promoting where possible other desirable values and resources (e.g., water, wildlife, aesthetic, etc).

In sound silviculture, an understanding of how and why vegetation initiates and develops, over time and place, is necessary if manipulation is going to be successful in achieving desired outcomes. For the purposes of this report, the primary objective for vegetation management in the AWUI is to achieve conditions that reduce the likelihood, size, and/or severity of wildfire, while minimizing negative impacts, or even promoting where possible, other desirable values and resources (e.g., water, wildlife, aesthetic, etc.). An overview of the effect of various styles of vegetation manipulation on these other resources is provided elsewhere in this plan. In this section, however, the use of silvicultural principles for vegetation manipulation to achieve wildfire management objectives is summarized.

Optimizing wildfire management benefits through active alterations in existing fuels and vegetation will depend on understanding relationships between two disciplines: silviculture and fire management (Weatherspoon, 1996). Planned and periodic removals of vegetation can be thought of as planned disturbance events that imitate natural disturbance events (e.g., fire in the pre-settlement era) in ways that help achieve desired objectives. In planned disturbance events, the most important vegetational characteristics to inventory, manipulate, and evaluate over time are structure, density, and composition. In current untreated conditions, the structures, densities, and compositions of vegetations in the existing stands in the AWUI are far from optimal in producing the desired objectives, particularly as regards wildfire management. In fact, stand conditions are currently conducive to producing outcomes, such as major stand replacements from insect-related

Stand Development and Density



RECRUITMENT

Individual tree growth maximized. Recruit-ment of new trees & shrubs onto forest floor.

EXCLUSION

New recruit-ment stops. Trees begin to compete.

Understory is suppressed. Competition increases between trees. Individual tree growth begins to slow.

COMPETITION

Tree competition slows individual tree growth. Stand growth maximized. Trees will be different-iating.

IMMINENT MORTALITY

Trees begin to die from competition. Intermediates become suppressed. Weaker Co-dominates fall to intermediate.

MAXIMUM DENSITY

Maximum stand density. All but dominate and strongest co-dominate have died or are near death. Replacement by more shade tolerant trees as mortality occurs.

Figure 1

> *In current untreated conditions, the structures, densities, and compositions of vegetation in the existing stands in the AWUI are far from optimal in producing the desired objectives, particularly as regards wildfire management. In fact, stand conditions are currently conducive to producing outcomes, such as major stand replacements from insect-related mortality and/or particularly wildfire, that are highly undesirable to the property owners in the AWUI, as well as to Ashland citizens.*

mortality and/or particularly wildfire, that are highly undesirable to the property owners in the AWUI, as well as to Ashland citizens.

Vegetational structure is the physical arrangement of vegetation in both horizontal and vertical directions. Obviously, structure can change considerably as stands move through the various stages of stand development. Understanding these changes, particularly after various types of disturbances, is essential for portraying outcomes, both beneficial or otherwise, of vegetation management.

Stand structure is particularly important in determining the potential for any stand to initiate and/or carry a rapidly expanding catastrophic crown fire (Agee, 1996). All silvicultural manipulations of vegetation (including utilization of prescribed fire) designed to restore more benign fire regimes focus on altering three critical structure-related values: (1) types, amounts, and arrangements of surface fuels; (2) type, amounts, and arrangements of crown fuels; and (3) the distance between the two, or crown base height, as influenced by the development of ladder fuels. Improvements in any of these three structural values reduces the potential severity of a wildfire and the subsequent impacts that result, while increasing the likelihood for potential control and ultimately reducing the size of developing wildfires (Agee, et al., 2000). From a management perspective, however, reduction in wildfire behavior is usually most dramatically reduced by first altering surface fuels, secondly increasing crown base height (i.e., ladder fuel removal) and thirdly altering crown fuels (Van Wagtendonk, 1996; Agee, 2002).

Vegetational density is the actual amount of vegetation growing on any given site, often expressed in terms such as trees per acre. Density follows relatively predictable increases following an initial disturbance that removes vegetation from a site. As vegetation returns and grows on such a site, desirable and undesirable outcomes can be predicted for any particular resource management perspective, such as wildfire management, wildlife habitat, etc.

Almost all of the vegetation in the AWUI currently was initiated following the significant change in disturbance history that occurred with European settling of the area. In fact, most of the vegetation in the AWUI appears to have been initiated following moderate to high intensity disturbances, primarily wildfire, in the 20th century, in which most and in some cases all of the vegetation was removed. Notable dates for these disturbances include 1901, 1910, 1959, and 1973.

Following major disturbances such as these, the earliest stage of stand development, the stand initiation stage, occurs. The stand initiation stage is currently comprised of areas in the AWUI such as grasslands, pastures, abandoned orchards, and sites with minimal amounts of naturally regenerated conifers, hardwoods, brush, grass, and herbaceous vegetation. In this stage, individual plants, including trees, are free to grow and fully utilize site resources. In tree dominated stands, overall growth is less than optimal during this stage as site resources are not fully utilized by developing seedlings and saplings. The very low fuel levels and considerable fuel discontinuity, in both horizontal and vertical directions, make these landscape units (e.g., Landscape Unit A) the most desirable from a wildfire management perspective. These sites provide important tactical opportunities for suppression in a wildfire event if they can be maintained in their current vegetational condition.

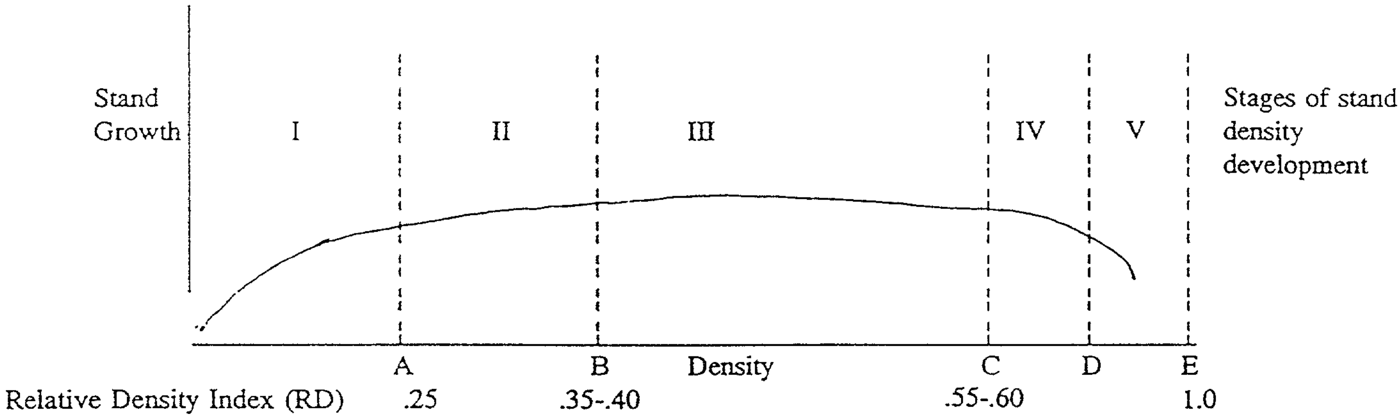
Eventually, vegetation continues to grow until competition between individuals begins (see Figure 3; RD = .25). Individual plant growth begins to decline (even though there is still less than full site occupancy) and total stand growth remains less than optimal. Within this gradational transition from stand initiation to stem exclusion stages, when vegetation and fuels become continuous both horizontally and vertically, are some of the most wildfire prone types in the AWUI–the early successional brushfields and plantations of Landscape Units C, D, E, and F, as well as portions of other landscape units.

Eventually, the stem exclusion stage of stand development is entered, where overall stand growth reaches its highest potential. Relatively closed canopies begin to significantly limit the development of understory vegetation as a result of shortages in light and moisture. Size differentiation between trees becomes more obvious as larger, more dominant trees begin to separate in size from smaller, less vigorous trees (see Picture #21). As stand densities continue to increase in the stem exclusion stage, a relatively long plateau occurs when stand growth is optimized and full site occupancy exists (see Figure 3).

If disturbance is forestalled, however, through such practices as fire suppression and exclusion, increasingly dense, stagnated stands continue to develop, and self-thinning from density-related mortality begins towards the end of the stem exclusion stage (see Figure 2.C.). Site occupancy can be more variable, particularly as individual trees or small patches of trees die, often in conjunction with insect attack exacerbated in these stressed stands. The biology of the cadre of insects that attack Douglas-fir results in the larger trees in the stands being attacked and killed. This is unfortunate in the AWUI because this size class is usually preferred from both silvicultural (stand vigor) and wildfire management perspectives.

In some situations (e.g., Landscape Unit J), however, size differentiation is minimal due to excessive stand densities, and stand stagnation can result in which individual trees significantly decrease in growth and vigor, while stand growth remains high. In these stand types, excessive competition throughout stand development encourages rapid early height growth, elevated crowns of minimal size, loss of lower limbs due to minimal light during the long period of closed canopies, and subsequent minimal development of ladder fuels (see Picture #27; Figure 4.A. - Stem Exclusion)—in essence, creating favorable fuel discontinuities between surface and crown fuels. Initiating crown fires in these stand structures is difficult, a favorable occurrence from a wildfire management perspective. However, in these situations very dense canopies on a stand level can also represent a continuous, though elevated, horizontal fuel profile that can carry crown fire if it enters and is sustained in such a stand.

Eventually, with continued stand growth and individual tree decline in these extremely stagnated, over-dense stands, a relatively predictable boundary is reached that is a theoretical maximum between tree size and stand density. At this boundary point (see Figure 2), additional stand growth is offset by a corresponding decrease in numbers of trees as they die. This decrease can occur dramatically, particularly in stagnated stands where populations of bark beetles can rapidly explode such that even the healthiest conifers can be attacked and killed. In these situations, patch sizes can become quite large, such as occurred in the upslope positions in Lithia Park in the early 1990's when virtually all of the 80± year-old overstory Douglas-fir 10 inches dbh and larger were killed. Insect-related mortality in patches of expanding sizes ultimately encourages the patch to return to the more fire-prone early successional vegetational structures, particularly if a stand was dominated by a single species, such as Douglas-fir. Fuel loading in



A. Crown closure; onset of competitive interaction; self-pruning occurs

B. Lower limit of full site occupancy

C. Lower limit of self-thinning; initiation of density related mortality

D. Considerable stand stagnation or within-stand mortality

E. Theoretical maximum density for given size

Figure 2

these patches can be excessive as the snags fall to the ground, and resulting fire impacts can be severe in terms of intensity and duration, as well as increasing the likelihood of wildfire spread into the crowns. This is the process that has occurred in much of Landscape Unit H, and is beginning in many places in Landscape Unit J (i.e., the beginnings of the understory re-initiation stage of stand development (see Figure 4A).

Picture #4 - Gaps of reduced vegetation, common in the pre-settlement era, are desirable from many perspectives, including wildfire management.

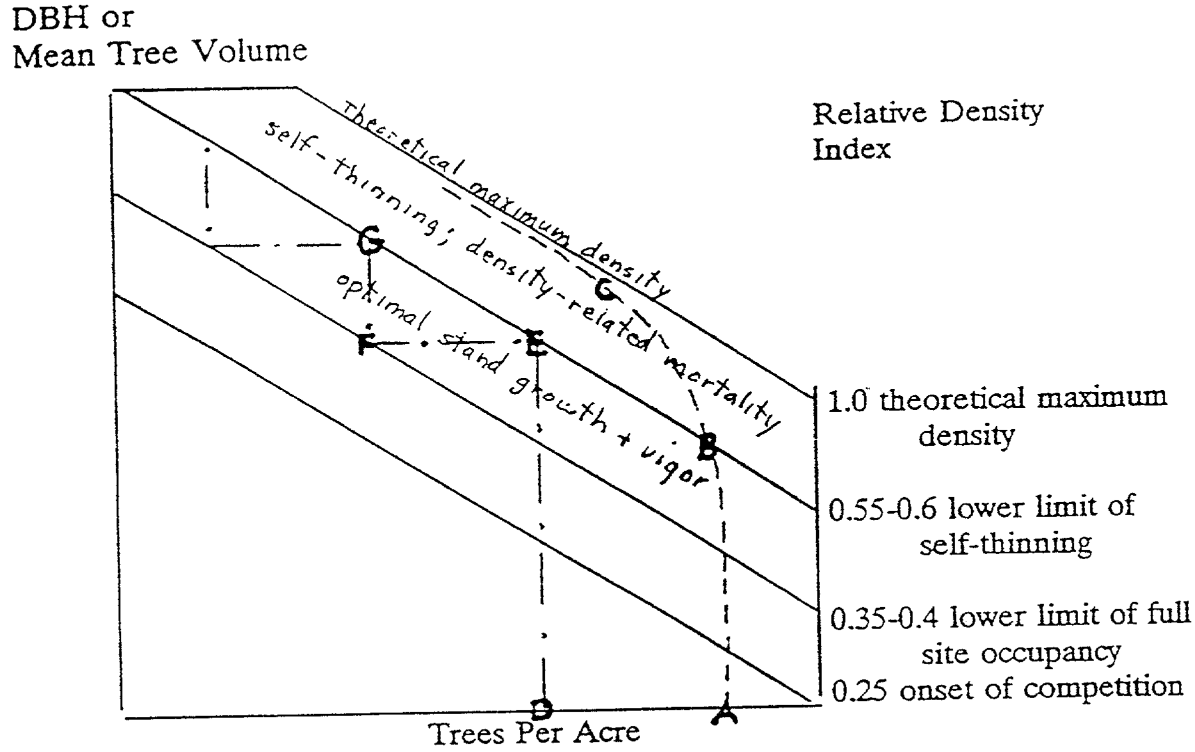
It must be noted that openings and/or patchy stand structures are not negatives to be avoided at all costs, particularly if considering the longer time frames and/or larger frames of reference typical of watershed level management. Creation of more diverse vegetational structures may be able to be planned for and initiated once the large bulk of the AWUI forestlands have been upgraded from silvicultural (improved stand vigor, reduced susceptibility to insects) and wildfire management (reduced fuel loading on an area-wide basis) perspectives. In fact, prior to the significant alteration of disturbance regimes initiated beginning with European settling of the area, it is likely that frequent, low to moderate fire in the AWUI and associated Ashland watershed created constantly changing patterns of gaps or openings of reduced vegetation and fuels. This pattern, called gap dynamics, creates a variable mosaic of fuels that can discourage development of stand replacement wildfire. These more heterogeneous combinations of stand structures and conditions is a desirable future condition from many perspectives, including wildfire management.

In some stands in the AWUI, most notably in Landscape Unit G on more southerly aspects, initial tree densities following the major disturbances were low, probably as a result of dense competition from associated brush species. In many situations, some of the older overstory trees survived the fires and helped produce a different successional pathway than occurred after stand replacement wildfire (see Figure 4B). As a result, a more open and variable density of overstory trees occurs in this landscape unit, particularly as compared to other mid-successional stands such as Landscape Unit J. Tree recruitment into the understory of more shade tolerant species such as Douglas-fir and incense cedar corresponds with gradual decline of shade intolerant brush species. Subsequent development of more ladder fuels and developing multi-layered canopies is undesirable from a wildfire management perspective, even though overstory canopies are less continuous horizontally than in associated Landscape Unit J.

Disturbances, either natural (fire, insects and disease, windthrow, landslides, etc.) or planned (prescribed burning, pre-commercial thinning and release, harvesting, etc.) shift stand densities backward into lower stand densities (i.e. fewer trees per acre). Successional pathways following disturbance in any stand are strongly influenced by the size and intensity of the disturbance (see Figure 4). Decreasing numbers of trees generally produces associated increases in growth and diameters of remaining trees, with subsequent increases in tree and stand vigor as well. Creation of patches or openings by these disturbances (i.e., new stand structures) ultimately can move existing stands toward the understory re-initiation stage of stand development- that is, if they are not first consumed by higher intensity, large scale disturbance events such as wildfire. These types of stands have only just begun to develop in the AWUI, while the large percentage remain at extremely high densities.

Management actions, such as stand density reduction treatments, can be implemented to create stand structures and densities that can improve individual and/or stand vigor while minimizing the potential for major density-related mortality in the AWUI, generally a negative from a wildfire management perspective (see Figure 3). These desired stand densities can be quantitatively measured through the use of various stand density indices, such as relative density. Relative density compares the density of trees in any stand relative to the theoretical maximum density for trees of that size. Using relative density, stands can be managed to create densities that minimize the development of within-stand insect-related mortality and/or stagnation (relative density is less than 0.65, or 65 percent of the theoretical maximum). Simultaneously, maintaining appropriate stand densities that fully occupy the sites (relative density is at least 0.35 or 35 percent of the theoretical maximum) can minimize further initiation of understory vegetation and ladder fuels and maintain vertical discontinuity of fuels, an obvious wildfire management benefit (see Figures 1 and 2).

Artificially forestalling disturbance through practices such as excluding fire from forest



---- stand development over time in absence of disturbance.
—.— managed stand (with thinning) development over time

Example: Most unmanaged stands start out with high numbers of small trees per acre (A). This obviously happened following intense stand replacement wildfire such as occurred during the 1901, 1910, and 1959 wildfire events in portions of the Ashland Watershed. These stands grow until density related mortality begins to occur (B), at which time trees per acre begin to decrease. As diameter or tree volume continues to increase over time, trees per acre continually decrease (C), along a theoretical maximum density line that stands do not exceed. In managed stands, initiation usually occurs with fewer trees per acre (D). Stands grow (in this case, without pre-commercial thinning) until the lower limit of self-thinning occurs (E), at which time stand density reduction reduces the number of trees per acre to (F), which then allows the remaining leave trees to grow in diameter to (G). In managed stands, unexpected density-related mortality can be avoided.

Figure 3

ecosystems only increases the likelihood that disturbance will occur, and be of a higher intensity when it does (i.e., wildfire, major insect-related mortality). Some of the stands in the AWUI are 100 years of age and have missed 10 or more low intensity disturbance events (fire), thereby being increasingly set up for a high intensity disturbance, with highly undesirable outcomes.

Implementing planned disturbances (i.e., management activities) can emulate historic disturbance patterns and help recreate less wildfire prone structures and densities. Implementing stand density reductions is usually much more effective and less costly, however, if it can be done earlier in the development of the stand (i.e., before 50 years of age and preferably between ages 15 and 30). Following initial treatments where more favorable vegetational conditions are created, an ongoing program of more frequent, multiple conservative interventions throughout the life of a stand can be more easily accomplished that more closely imitates historical disturbance patterns.

Implementing planned disturbances (i.e., management activities) can emulate historic disturbance patterns and help recreate less wildfire prone structures and densities.

Differences in species composition are not nearly as important as differences in density and structure in influencing wildfire behavior. Even with significant changes in disturbance history, all of the major native tree species remain in the AWUI, although alterations in percentage composition by species have occurred within the last century. The pines, both ponderosa and sugar, are less common than prior to the Euroamerican settling of southern Oregon, largely due to early preferential harvest of these species, and the impact of fire suppression and subsequent changes in stand densities, canopy closures, and other ecological relationships that influence the establishment and growth of pines. If ponderosa pine natural regeneration is going to be successful, significant stand openings and reductions in stand densities will have to occur—conditions historically produced by a more frequent, low-intensity type of disturbance. Changes in disturbance history towards more infrequent, high-intensity events has likely increased the abundance of those species well adapted to that change, namely hardwoods and brush species in early successional vegetation and more shade tolerant species (primarily Douglas-fir and incense cedar) in stand understories. Native grasses and herbaceous vegetation have likely decreased in abundance in the more dense stands throughout the AWUI, while exotic, non-native species (e.g., starthistle, hedgehog dogtail, scotch broom, Himalayan blackberry, and others) have increased, particularly in more open, disturbed sites.

Specific desirable species compositions should be decided on a site-by-site basis, dependent on characteristics of the site, the current condition of the stands, and long-term objectives for the site. Generalized suggestions for desirable species compositions are included in the prescriptions for each landscape unit.

Two Basic Successional Patterns (Paths)

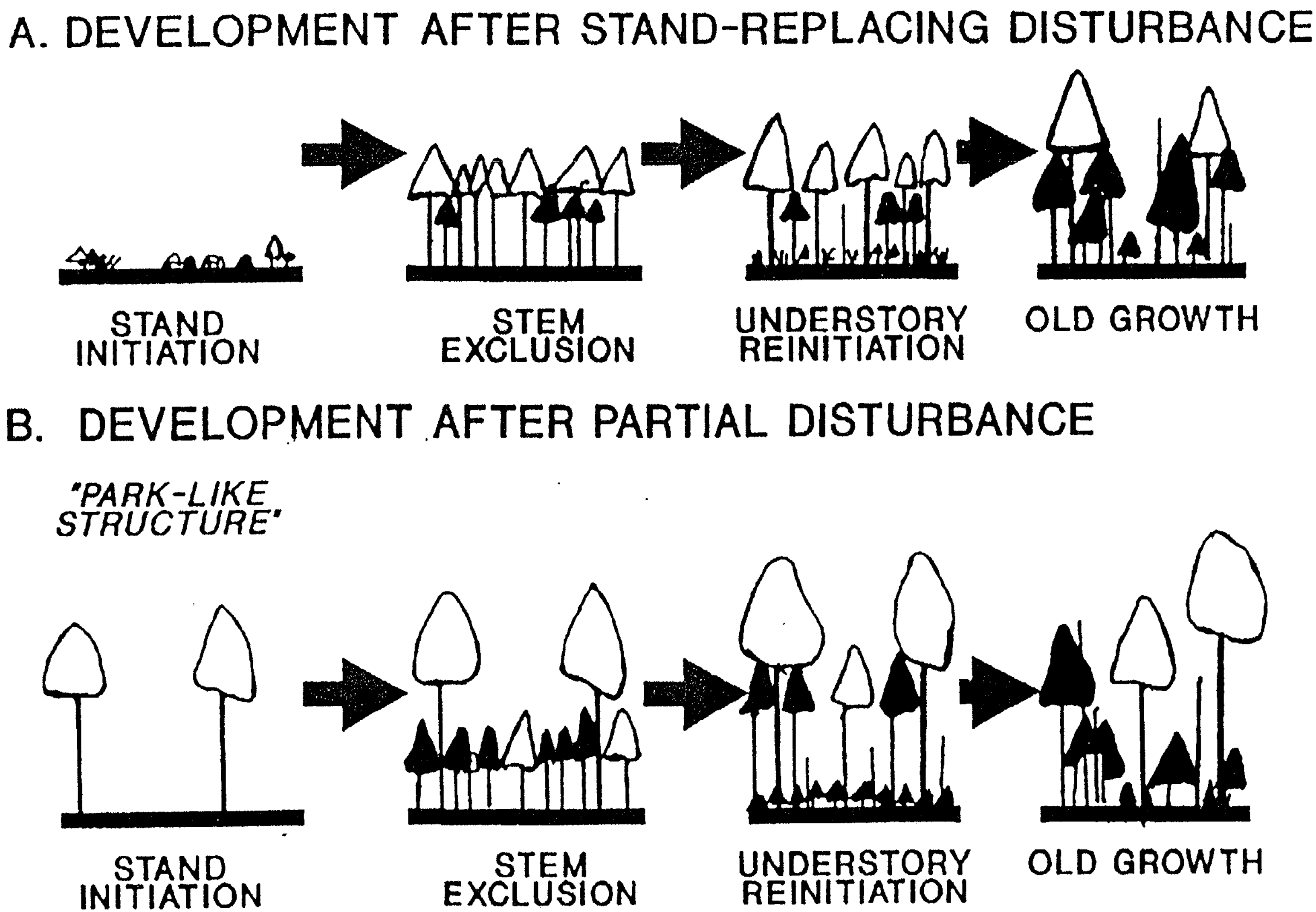


Figure 4

D. Vegetation and Fuels Management Strategies to Achieve Wildfire Management Objectives

From almost any ecologic, social, or economic viewpoint, a large scale high-intensity wildfire in the AWUI is undesirable. Reducing the risk of that type of fire in the AWUI is an obvious high priority. This section describes the various active management strategies that can be implemented to help achieve this objective.

Fire requires three basic elements to occur--fuel, oxygen, and an ignition source. Obviously, eliminating oxygen is not a viable alternative and, thus, wildfire management and prevention has historically focused efforts in two primary arenas—(1) reducing fire risk (i.e., minimizing potential ignition source), and (2) managing fire hazard (i.e., fuels/vegetation). The AWUI has been classified as extreme for both fire risk and fire hazard (Ashland Ranger District, 1995), clearly underscoring the importance of proactive wildfire management in the area.

> *Fire requires three basic elements to occur–fuel, oxygen, and an ignition source. Obviously, eliminating oxygen is not a viable alternative and, thus, wildfire management and prevention have historically focused efforts in two primary arenas–(1) reducing fire risk (i.e., minimizing potential ignition source), and (2) managing fire hazard (i.e., fuels/vegetation).*

Fire risk has been defined as the chance of various ignition sources, either lightning or human-caused, causing a wildland fire that ultimately threatens life, property, or various resource values. Prior to a fuller understanding of wildfire potentials, much of our efforts were focused on reducing fire risk (i.e., preventing ignition). Unfortunately, ignition can never be totally prevented. Lightning, arson, carelessness, and accidents always insure that fire will occur in forested settings. From 1967-1992, 53 fires have occurred in the interface area outside of the city limits of Ashland, and 93 percent of these fires have been started by people (McCormick, 1992). Although reduction of fire risk through education, regulation, rapid response time, etc., is still important, management and manipulation of fuels and vegetation (i.e. fire hazard) has increasingly become of more importance and is the primary focus of this report.

Once initiated, resulting wildfire behavior is determined by three primary elements—topography, weather, and fuels/vegetation, the "fire behavior triangle." All three legs of the triangle have significant effects on fire behavior (Agee, 1996).

Obviously, there is little that can be done to alter topography, but knowing that fire likelihood, rate of spread, and/or intensity increase on more southerly aspects, in uphill directions and in the upper one-third of slopes, allows wildland fire managers to prioritize wildfire management and fuel reduction activities. In much of the Klamath-Siskiyou region, topography can play a significant role in the size and intensity of wildfire due to the steep, highly dissected terrain (Taylor & Skinner, 1998). Utilizing topographical realities has historically tended to focus most fuel reduction activities on two primary topographical locations: (1) ridgelines, where wildfire suppression tactics (retardant application, personnel deployment, backburning, etc.) can offer the greatest benefit, and (2) canyon bottoms, where temperatures are cooler, humidities higher, and moisture availability greater, creating less flammable vegetation year-round. Other key topographical features that can affect wildfire behavior include V-canyons, chimneys, saddles, areas of unusually strong winds, and perhaps others.

Similarly, even though we cannot avoid the wildfire-prone, hotter, drier weather of summer, we can obviously develop much greater care and concern during fire season. This is particularly important in the most severe fire weather when fire behavior can overwhelm even very well implemented pre-suppression wildfire management activities, particularly in steeper topographies. In fact, some vegetational communities in the Pacific Northwest that have natural disturbance histories characterized by infrequent, high-intensity events (high elevation vegetation types, coastal rainforest types, and portions of the Intermountain West) have fire behavior more strongly controlled by weather phenomena than by topographical or fuels (vegetation) variables.

However, in low elevation, drier sites such as the AWUI, wildfire behavior is most strongly influenced by fuels/vegetation. Although knowledge about weather and topography are critical to successful wildfire management, neither can be proactively altered to improve wildfire management benefits; the fuels leg of the fire triangle is the only controllable factor of the three (Agee, 1996). Management of fire hazard is the basic premise

> *Once initiated, resulting wildfire behavior is determined by three primary elements– topography, weather, and fuels/vegetation, the "fire behavior triangle." . . . Although knowledge about weather and topography are critical to successful wildfire management, neither can be proactively altered to improve wildfire management benefits; the fuels leg of the fire triangle is the only controllable factor of the three.*

which guides much of the silvicultural prescriptions and ultimate vegetation manipulations suggested in this report.

Fire hazard is defined as the kind, volume, condition, arrangement, and location of fuels and vegetation that creates an increased threat of ignition, rate of spread, and resistance to control of wildfire. Productive management of fire hazard involves working with three primary conditions of fuels: types and amounts, arrangement, and continuity.

Greater accumulations of fuels obviously increase both the likelihood and ultimate intensity of wildfire. Smaller diameter, fine flashy fuels are easy to ignite and encourage rapid rate of spread of wildfire, while the opposite is true for larger fuels (although larger fuels can greatly contribute to the ultimate intensity and duration of wildfire).

Arrangement of fuels is important because dense, compacted fuels close to the ground do not pose the same hazard as do "ladder" fuels that form a constant fuel source from ground into forest canopies. Snags are also a serious fuel arrangement problem because, once ignited, sparks and fire can be spread great distances from their tops (i.e., spotting) rapidly increasing fire spread even when the fire itself may be of low intensity.

Picture #5 - Thinning of whiteleaf manzanita in this brushfield significantly reduced fuel continuity. Slash was dragged to road below and chipped.

Fuel continuity is important because fire spreads rapidly in continuous ground and aerial fuels. Interrupting the horizontal continuity of fuels (fuelbreaks, roads, grasslands, excessive canopy spacing, vegetational gaps, etc.) basically removes fuel from the fire in horizontal directions, thereby preventing or at least slowing its spread. Reducing the vertical continuity of fuels greatly decreases the likelihood of fire spreading vertically into crowns with its associated increase in spotting, rate of spread, and fire intensity. Vertical discontinuities in fuels helps maintain fires of lower intensities on-the-ground, with subsequent reduction in impacts and increased potential for successful suppression. Removal of ladder fuels, pruning of trees, reduction of surface fuels and minimizing development of early successional vegetation through appropriate stand management activities are management methods of maintaining or improving vertical discontinuities in fuels.

Fuel reduction zones are areas where benefits associated with fuel and vegetation modification are associated with topographical benefits or other key priorities based on location. Various styles of fuel reduction zones have already been implemented in many places in the AWUI. Fuelbreaks and shaded fuelbreaks have long been a key element of wildfire management strategies (Green, 1977; Green and Schimke, 1971; Omi, 1996; Agee et al., 2000). These are areas where vegetation has been reduced and/or modified such that fires burning into them are more easily controlled. Shaded fuelbreaks retain a minimum number of healthy overstory trees with flammable understory vegetation largely removed.

Numerous fuelbreaks/shaded fuelbreaks have been installed in the AWUI around homes, roads, or other improvements (see Picture #6), as well as in their more strategic locations along ridgetops in forested wildland settings where they historically have been 150 to 250 feet wide, designed to effectively suppress encroaching small to medium-sized wildfires. Not only are fuels reduced in these wildland locations, but fire fighting personnel have easier and safer access and aerial retardant can effectively reach the ground.

Picture #6 - Fuelbreak constructed in oak woodland (Landscape Unit B).

However, in severe fires, particularly those with excessive spotting, these fuelbreaks have often been ineffective (Weatherspoon and Skinner, 1996; Van Wagtendonk, 1996). In these situations, larger zones of modified and reduced fuels have greater effectiveness and use. These "defensible fuel reduction zones," which often use existing fuelbreaks or shaded fuelbreaks as anchor lines, are much wider than fuelbreaks, perhaps as much as one-quarter mile wide. These would include treated stands with reduced amounts, continuities, and/or distributions of fuels that would provide additional zones of opportunity for controlling wildfire. Ultimately, increasingly large areas of fuel reduction grade into area-wide or landscape level fuel reduction. This has rarely occurred in the West, although it is a desirable future condition, particularly for wildfire-prone areas with high inherent values, such as the AWUI and Ashland Creek Watershed. Ultimate ecological restoration goals can best be achieved once the area has reached some level of protection from destruction from large-scale, high-intensity wildfire.

> *Silvicultural thinning and prescribed fire are the most common active management methods designed to modify fuels and vegetation and subsequently reduce wildfire danger and restore more benign fire regimes. Both are legitimate and useful tools with associated advantages and disadvantages and will likely both have to be utilized in concert to achieve long-term forest restoration goals.*

Reducing the likelihood of severe destruction from wildfire depends, then, on an aggressive fuels reduction and/or modification. Silvicultural thinning and prescribed fire are the most common active management methods designed to modify fuels and vegetation and subsequently reduce wildfire danger and restore more benign fire regimes (see Picture #7). Both are legitimate and useful tools with associated advantages and disadvantages (Brown, 2002), and will likely both have to be utilized in concert to achieve long-term forest restoration goals (Weatherspoon, 1996). It is likely, however, that silvicultural thinning, brushing, and other stand density reductions and vegetation modifications will be much more commonly used than prescribed burning in the AWUI (at least initially) for the following reasons:

1. Prescribed burning is relatively imprecise and difficult to successfully achieve ecological and silvicultural objectives, particularly in initial entries when stand densities and fuel loadings are excessive.
2. The chance for escaped fire in the AWUI carries very serious economic and ecologic consequences–liabilities that few private owners will be willing to absorb.
3. Very narrow windows of opportunity exist annually when prescribed burning can be accomplished to meet silvicultural, ecological, and wildfire management objectives. An extreme level of professionalism, planning, and available skilled labor is needed in order to conduct a successful burn. Logistical and administrative realities often thwart implementation of prescribed burning.
4. Issues concerning smoke production and effects on air quality constrain public

support as well as the practical application of prescribed fire.

Silvicultural thinnings and other appropriate silvicultural practices avoid the previously described difficulties which are particularly concerning in the AWUI. Silvicultural thinning, however, can only at best emulate the effects of frequent, low-intensity fire by creating a structurally less wildfire-prone forest. There are many physical, chemical, biological, and ecological functions performed by fire that cannot be duplicated by silvicultural thinning (Agee, 1993; Chang, 1996; Kilgore, 1973). Hopefully, fire hazard can cumulatively be reduced through silvicultural thinnings and other vegetation manipulations in the AWUI such that prescribed fire can be more safely re-introduced in the future as an ecological process of fuel reduction and ecosystem restoration.

Picture #7 - Approximately 15 years after prescribed burn–small patch of moderate to high intensity creates gap (horizontal discontinuity) but incoming early successional vegetation and developing snags compromise wildfire management goals.

Silvicultural thinning and other stand density reductions can either increase or decrease fire intensity and associated severity of impacts (Graham et al., 1999; Agee, 1996; Weatherspoon, 1996), depending on the type of thinning employed and particularly on quality of slash treatment. Numerous examples of increased wildfire potential following conventional logging practices or other stand density reductions have occurred throughout the West, particularly if resulting slash has been left untreated. However, appropriate silvicultural practices have long been used to recreate or otherwise alter stands to conditions more favorable from a wildfire management perspective (Graham, et al., 1999; Agee, 1996; Weatherspoon, 1996). Stand improvement silvicultural thinnings can help achieve wildfire management-related objectives in the following ways:

1. By thinning and removing a portion of the above-ground fuel, both the likelihood of crown fire, as well as the intensity and the rate of spread of wildfire will be significantly reduced, particularly if the resulting slash is also utilized and/or removed. Thinning can be used to improve fuel discontinuities in both vertical and/or horizontal

directions.

2. By reducing the number of trees competing for a finite amount of nutrients, light, space, and principally water, a healthier, more vigorous remaining stand will result, with less likelihood of tree or stand replacement from insects and/or disease.

3. Growth can be redistributed onto fewer, healthier, more valuable trees, insuring their long-term survival. Larger trees can be maintained and/or developed much sooner, with associated elevated canopies, thicker bark, and greater likelihood of survival of low to moderate intensity fire.

4. Thinning can shift stands to more favorable or desirable species compositions, in particular encouraging the more shade intolerant species (i.e., the pines) that have declined in abundance in the last 100 years in the AWUI.

5. Trees infected with dwarfmistletoe or other diseases, or under current attack by bark beetles, can be removed to lessen the potential for excessive occurrence of these pathogens. Trees heavily infected with dwarfmistletoe are particularly susceptible to initiating crown fire, and all snags that ultimately develop are wildfire hazards. Removal of these trees must be balanced with the important ecological functions they serve in forest ecosystems.

6. Thinning can make it possible to utilize or market trees that otherwise might be outcompeted and killed in the natural progression of stand development, an important consideration for many private landowners. Marketing thinned trees that have commercial value is certainly appropriate, especially if they are captured as a byproduct of ecologically sound restoration activities (Brown, 2000; Noss, 2000).

Several different methods of thinning are available, dependent on objectives. The preferential technique in most situations prioritizing wildfire management in the AWUI is a "low thinning" or "thinning from below," as it most closely imitates the natural process of stand succession in which the smaller suppressed trees were outcompeted by larger, healthier trees and/or killed by low-intensity fire. Thinning from below also selectively removes ladder fuels, creating vertical fuel discontinuities and stand structures favorable from a wildfire management perspective. This generalized approach must be tailored to fit individualized stands, however. For example, it may not be appropriate in stands where the overstory conifers have died or are in rapid decline (and cannot benefit from the stand density reduction); are heavily diseased (e.g., dwarfmistletoe); are of unfavorable species mixes; are adjacent important values-at-risk that require different vegetation management strategies; and perhaps others.

In stand improvement thinnings in the younger age classes (100 years or less) in the AWUI, larger trees should only be considered for removal if they are obviously dying, heavily diseased, or insect-infested, or amidst an overstocking of other more vigorous, larger trees.

Leave trees following silvicultural thinnings should be healthy, vigorous, and of good form; free from damage, disease, or insects; and free to grow after thinning. In addition, leave trees should usually have *at least* one-third of their total height occupied by a healthy crown (foliage). In the highly altered stands in the AWUI, leave trees should also *usually* be the largest trees of any particular age class, and stand density reduction can be utilized to encourage development of older, larger trees (Main and Amaranthus, 1996). Having been dominant for the largest time, these larger trees will release more quickly than other less dominant trees, becoming larger in a shorter time. Larger conifers are particularly preferred over smaller conifers and hardwoods from a wildfire management perspective, largely because their crowns (the flammable portion of the tree) are farther removed from ground level and surface fires (Agee, 1997). This characteristic allows for greater fuel discontinuities in vertical directions. Thicker bark and other characteristics also allow these larger conifers to survive surface fire as well. In fact, frequent low-intensity disturbance (pre-settlement fire regimes) tends to direct successional processes towards stands dominated by large, mature conifers (Moir and Dieterick, 1988; Covington and Moore, 1994; Agee, 1993; Morrison and Swanson, 1990). In stand improvement thinnings in the younger age classes (100 years or less) in the AWUI, larger trees should only be considered for removal if they are obviously dying, heavily diseased, or insect-infested, or amidst an overstocking of other more vigorous, larger trees.

The pines, Ponderosa and (rarely) sugar, should generally be the preferred "leave" trees throughout the management area, particularly on more droughty southerly aspects. Prior to Euro-American settling of the area and the advent of logging and fire exclusion, native stands

Picture #8 - Silvicultural thinning to release large ponderosa pine on left.

contained a greater percentage of pines, and current species compositions may often be outside the range of historic conditions. Both pines (particularly ponderosa pine) are shade intolerant, however, and require reduced stand densities in order to remain vigorous, particularly as understory trees. In many situations, however, Douglas-fir and incense cedar are preferred over the pines for understory leave trees, as ponderosa pine in shade is usually tall, spindly, and with poorly developed crowns. Due to their current scarcity as overstory trees, sugar pine and incense cedar should be elevated in importance for retention in most silvicultural thinnings. When thinning in the mixed coniferous forests in the AWUI, however, any of the existing native conifers can be appropriate leave trees, and overall tree vigor and condition is usually more important than individual tree species.

In most stand improvement silvicultural thinnings in the AWUI, hardwoods should be selected for removal if they are significantly competing with preferred overstory conifers and/or are slowly dying as they become overtopped by developing conifers. The increasing number of hardwoods, particularly Pacific madrone, in the AWUI is largely a stand development response to the change in disturbance history towards more infrequent, higher intensity disturbances. In this disturbance regime, stump sprouters have significant advantages over trees that initiate from seed (i.e., conifers). Pacific madrone initiates quite slowly from seed and, given its thin bark, likely rarely gained establishment in more frequent fire regimes.

However, intentional retention of hardwoods in silvicultural thinnings throughout the AWUI is advised, as they perform numerous important ecological functions. The following reasons justify some retention of hardwoods:

(1) Hardwoods can contribute to improved soil physical, chemical, and biological properties, and form important mycorrhizal associations with conifers (Amaranthus et al., 1990; Amaranthus and Perry, 1989; Fried et al., 1990).

(2) Hardwoods are important for maintaining diverse wildlife populations and add to overall vegetational and structural diversity of a stand. Larger hardwoods, particularly California black oak, are especially valuable for foraging, nesting, and utilization by numerous wildlife species.

(3) Hardwoods may perform the role of a "nurse crop," ameliorating site conditions so that natural regeneration of more shade tolerant conifers can occur.

(4) Hardwoods may contribute to reduced wildfire intensity, particularly when compared to uniform stands of conifers (Perry, 1988; Perry, 1995).

(5) Hardwoods respond to density control measures just as conifers do, and perhaps with an even greater and more immediate response (Main and Hibbs, unpublished data).

(6) In mixed stands, hardwoods may contribute to greater overall gross volume production than in single species stands, particularly in stands where species niches are dramatically different and/or symbiosis between species occurs (Oliver and Larson, 1990). Not only do Douglas-fir and Pacific madrone have different levels of tolerance to shade (Douglas-fir are more tolerant than Pacific madrone and often grow under a madrone canopy), but also have important mycorrhizal and nitrogen fixation symbioses (Amaranthus et al., 1990; Amaranthus and Perry, 1989).

(7) Future markets may improve for hardwoods. Current prices as high as $1,000 per thousand board feet exist for very high quality hardwoods. Large hardwood burls have been sold for as high as $10,000 for an individual specimen. Stand management practices may focus on management of individual high value hardwoods to maximize economic value.

(8) Stump sprouting hardwoods may have slope stability and hydrologic value in high intensity disturbance regimes in that they are quickly re-established on site, minimizing potential losses from soil erosion or slope failures.

Post-treatment stand density is an important goal to identify prior to treatment. In areas of relatively uniform ages, sizes, and species (e.g., plantations), spacing guidelines can be used to determine desired stand densities. For example, in these settings a historical guideline known as the D+ rule has been used in which the average diameter of trees in an area to be thinned is added to in a figure of 4 to 5 to determine the footage spacing between trees.

Perhaps a better way to determine optimal densities, however, is to use basal area as a target rather than spacing. Spacing guidelines are more appropriate in plantations where species and diameters are much more uniform. Basal area targets allow one to easily make adjustments in the field when stands are comprised of multiple diameter sizes, with respective differences in competition. Basal area also allows one to leave trees in clusters (more typical in naturally developed stands) rather than forcing a given spacing upon the stand. Ultimately, these stand density guidelines can be used as checks on what is more commonly an intuitive process of leaving the most vigorous trees in patterns that allow crowns and root systems to expand and more fully utilize site resources (water, nutrients, light, space).

Preferred stand density after thinning also depends on the goals and desires of the landowner. If more rapid development of larger trees and/or more open forests with greater horizontal discontinuity are desired, heavier thinnings are suggested Lighter thinnings may be preferred to ease a stand out of severe stagnation, to maintain continuous canopies and retard understory development of ladder fuels, to reduce windthrow potentials, to grow tighter rings and maintain higher log quality, and/or to maintain other wildlife or aesthetic values.

Many stands within the AWUI may actually require several entries to reach preferred stand densities in order to avoid shock, scale, windthrow, or tipping over that occurs with stand density reduction accomplished too rapidly in stagnated stands. A strategy of multiple, conservative interventions also allows for ongoing project assessment prior to initiation of significant vegetational changes, particularly on a landscape level. Spreading out vegetational changes over time and space also tends to minimize potential negative impacts, particularly in a cumulative or landscape-level perspective.

From a wildfire management perspective, stands with significant infestations of Douglas-fir dwarfmistletoe are also undesirable. Fuel loadings in these stands are typically higher, and the arrangement and distribution of fuels in dwarfmistletoe brooms can pose significant problems in a wildfire event, as they can rapidly convert ground fire to crown fire, as well as acting as torches, spotting fire far ahead, and rapidly increasing rate of spread of wildfire. Heavily infected trees are likely to die within the next five to ten years, further contributing to large snag development, an obvious disadvantage from a wildfire management perspective.

Management options rely on a careful delineation of dwarfmistletoe infection by location and stage of infection (dwarfmistletoe rating system), with perhaps a flexible management protocol depending on the age and vigor of the infected tree, degree of infection, and opportunities to reduce wildfire potential by removal and/or promote other important values through retention. Several features of dwarfmistletoes make them ideal candidates for silvicultural management strategies (Johnson and Hawksworth, 1985): (1) they obligate parasites that require a living host to survive, (2) dwarfmistletoes are generally confined to a single host species, (3) dwarfmistletoes have long life cycles and generally slow rates of spread, (4) dispersal of dwarfmistletoe seeds is generally of short distances, seldom more than 50 feet, (5) dwarfmistletoe infected trees are usually easy to detect.

Untreated dwarfmistletoe in overstory conifers can infect understory trees of the same species, thereby perpetuating compositions as the infected species is selected out of the stand. Isolation technology in which trees of another species surround the dwarfmistletoe-infected conifers, thereby preventing its spread, can be used to retain infected trees for their structural diversity and wildlife habitat values (a number of animals, including northern spotted owls, nest in dwarfmistletoe brooms). Pruning, an often suggested strategy for controlling dwarfmistletoe infection, is usually not recommended on a stand-level basis due to the cost of climbing-pruning and because repeated treatments are usually necessary to remove latent infections (Hawksworth and Wiens, 1996). The most often utilized strategy for decreasing dwarfmistletoe abundance in a stand is removal of infected trees. Diligence is required, however, because partial removals in stands can in crease light to dwarfmistletoe and actually increase its abundance.

As is hopefully obvious from the above discussion, decision-making regarding "leave" versus "take" trees is a complex one and varies with individual species, combinations of species, densities, sites, aspects, tree vigor, and a host of other considerations— not the least of which is the objectives of the owner. Given that these decisions will ultimately determine stand conditions many years into the future, the professionalism of the people actually implementing thinning decisions becomes very important in a long-term program of stand improvement.

> *. . .decision-making regarding "leave" versus "take" trees is a complex one and varies with individual species, combinations of species, densities, sites, aspects, tree vigor, and a host of other considerations— not the least of which is the objectives of the owner. Given that these decisions will ultimately determine stand conditions many years into the future, the professionalism of the people actually implementing thinning decisions becomes very important in a long-term program of stand improvement.*

Slash treatment following (and sometimes included in) implementation of appropriate silvicultural practices is critical to the successful simultaneous accomplishment of wildfire management objectives. Many different methods of slash treatment are available. The preferred method from an ecological perspective whenever possible is prescribed underburning.

Reintroduction of fire into fire-dependent ecosystems like that of the AWUI is likely the single most important management activity to restore ecosystem integrity, as the dynamic balance between vegetational structure and ecological functions/processes cannot be accomplished by any other single method. However, it is likely that it will rarely be used in the AWUI for the reasons previously stated. Implementation of other types of slash treatment will be necessary.

Removal and utilization of any marketable material (such as logs, post and poles, firewood, etc.) can be effective in achieving fuels reduction while garnering some income to offset expenses. Unfortunately, the costs of commodity extraction may supersede the potential income in many cases, particularly when access is poor or non-existent (except by helicopter, a very expensive form of utilization), as is the case throughout large portions of the AWUI. In these cases, fuel reduction and slash treatment will most likely have to be done on-site by other manual or mechanical treatments.

Piling and burning is the most common form of fuel reduction using fire. Slash is piled, manually or with equipment such as dozers, and often covered with plastic to facilitate burning in winter when little risk of fire escape exists. Swamper burning is a form of pile burning where the bulk of the slash is thrown into actively burning piles. Neither of these techniques truly emulates the low-intensity surface fires of the pre-settler era, but rather are small spots of intense fire. Although mechanical piling using dozers is often cheaper than hand piling, it has other associated disadvantages including inability to operate on steeper (greater than 30 to 35 percent) slopes, negative impacts on soil resources, and scarification and germination of stored seeds in the soil that then rapidly return the next generation of wildfire prone vegetation to the site.

Chipping of slash created by thinning, brushing, or other fuels reduction activities is also possible in accessible areas where chippers can be easily utilized. Chippers do not typically remove fuels in these situations (unless they are blown into trucks), but rather redistribute fuels into a dense layer spread over the forest floor. Chippers are particularly appropriate in areas close to homes and other improvements where the use of fire is less desirable.

Another form of vegetation modification that incorporates slash treatment is the use of a "slashbuster"—a large excavator with a cutting head that grinds undesirable vegetation into small sizes and spreads it out over the forest floor, much as a chipper would do. Set up on tracks, this machine has much better access than most chippers and can work on gentle to moderate slopes (up to 35 percent). Due to high move-in costs, however, they generally require greater acreage sizes in order to be practical. Soil disturbance and/or compaction may be an issue on sensitive soils, however, such as those that occur throughout most of the AWUI.

In low priority fuel management areas, lopping and scattering slash so that it lays closer to ground level will speed up decomposition and more quickly reduce the drastic fire danger. It must be noted that lop and scattering following silvicultural thinning, although not as desirable as other treatment techniques that remove it from the site, is certainly preferred in most stands to not thinning at all, even from a wildfire prevention perspective. Wildfire danger is extreme in dense, overstocked, untreated stands, and even though downed slash from thinning and release activities will represent an additional hazard for several years, the stand improvement that results over time will encourage a rapid decrease in the vertical continuity of fuels as trees grow and canopies become further removed from ground level. Slash should lose its fine fuel component (twigs and needles) within several years and in slowly compressing to ground level, wildfire potential in the fuelbed will be decreased. Too, improved vigor of leave trees will avoid wildfire hazards associated with density-related mortality, snag creation, and associated development of more wildfire-prone early successional vegetation.

Obviously, decisions regarding which method of fuel modification and/or slash treatment to use can be complicated and depend on a host of factors, including landowner objectives, site conditions, vegetation type and development trajectories, severity of wildfire hazard, contractor availability, and others. Ultimately, decisions should be made on a case-by-case basis.

Obviously, decisions regarding which method of fuel modification and/or slash treatment to use can be complicated and depend on a host of factors, including landowner objectives, site conditions, vegetation type and development trajectories, severity of wildfire hazard, contractor availability, and others. Ultimately, decisions should be made on a case-by-case basis.

Any plans for considering the use of fire in forest or resource management on private woodlands must be coordinated with the Oregon Department of Forestry. Not only does this coordination help prevent potential wildfire ignition, but also limits smoke production and direction to days when it will least impact populated areas.

E. Integrating Other Resource Values While Prioritizing Wildfire Management Objectives

Management of landscapes and vegetation to maintain or promote the many other resource values is often different than that which focuses primarily on wildfire management objectives. Understanding these differences and then delineating the relative importance of each should be a priority for any forest landowner or manager. Management practices can then be implemented that consider multiple objectives, while balancing priorities between these objectives.

In this report, however, it is generally assumed that wildfire management objectives will receive the highest priority, even to the minimization of other resource values on occasion. This is particularly appropriate for the AWUI because high-intensity, large scale wildfire, a distinct possibility in the AWUI, could very well significantly negatively impact all other important values inherent in forest and resource lands. Nonetheless, this section describing the other key resource values is certainly not meant to be exhaustive in nature, but rather to introduce landowners and other interested parties to key concepts. Additional study, information gathering, and professional assistance is advised for those who want to promote and/or protect multiple values within the context of implementation of wildfire management activities.

Management of landscapes and vegetation to maintain or promote the many other resource values is often different than that which focuses primarily on wildfire management objectives.

Wildlife management has historically been geared towards improving conditions for specific, highly desired animals, such as deer, elk, and other game animals, and more recently threatened or endangered species such as spotted owls in the Pacific Northwest. In this approach, management of the needs of a particular individual animal basically focuses on managing the four basic features to insure the continued existence of healthy populations: food, water, cover, and other habitat items needed for reproduction success. The specific combination of each of these four items for any one animal must be available from its particular habitat. Increasing the carrying capacity of any individual animal's habitat usually begins with increasing the habitat value that is "limiting"—or in other words, the one in the most critical short supply. Just as with trees, minimizing stress and maximizing energy reserves in animals is the key to maintaining healthy individuals and populations.

Just as in most forest management techniques designed to improve certain values (timber, water, wildfire management, etc.), management to maximize wildlife habitat values basically revolves around maintenance and/or manipulation of vegetation to achieve specific values. Every species of wildlife has a specific type of vegetation in which it thrives, as well as other types that it at least utilizes to some degree. Encouraging vegetation types (i.e. densities, structures, and species compositions) to fit the needs of desired wildlife species has historically been the primary objective of wildlife management.

Wildlife management has evolved in recent years, however, to include a much broader scale of reference than promotion of a single species of wildlife. Not only is it clear that managing for single species is not only very difficult to accomplish (particularly given that research information on habitat needs of most animals is lacking), but in so doing habitat needs for other animals may be ignored, altered, or, worse, depleted. Wildlife management has become increasingly focused on managing habitat values for the widest possible number of species over larger geographical areas and longer time frames. The complexity of this task is profound and has been made even more complicated by the fact that animals (and their interactions with their respective habitats) are difficult to monitor, largely because (unlike vegetation) most move continuously and often over large distances. Although the habitat needs of certain individual animals, such as big game ungulates, have become fairly well understood, the failure to maintain and/or provide for unique types of vegetation on a landscape level (such as old growth forests) has resulted in a rapid decline of other specific wildlife species that require or prefer this habitat type (such as spotted owls or other species dependent on mature forest habitat values).

Wildlife management, then, has developed into managing for habitat values on much larger landscapes, typically at watershed level scales or greater. It has become clear that the habitat needs for all animals *cannot* be met on single parcels, unless they are very large. However, individual parcels may contain specific and perhaps even rare habitat values that may be crucial for certain individual species (an isolated pond for western pond turtle habitat; a cave for bats; mature forests that provide uncommon late-successional wildlife habitat values; etc). In essence,

> *The simplest and most important procedure to encourage wildlife species and numbers in general is to encourage whenever possible the greatest possible diversity of vegetation, in terms of age, structure, and species*

management actions that may benefit some animals may simultaneously be disadvantages for others, while initiating developmental processes that may encourage yet another cadré of wildlife species in the future.

Even given this complexity, there are many generalized wildlife management practices that can be undertaken on individual parcels. The simplest and most important procedure to encourage wildlife species and numbers in general is to encourage whenever possible the greatest possible diversity of vegetation, in terms of age, structure, and species. Wildlife species are generally so dependent upon vegetation that increasing diversity of vegetation fosters greater numbers and diversities of wildlife species. It is for this reason that riparian habitats are so important for wildlife numbers and species diversity. Not only is water and usually cover available at these locations, but vegetational productivity and species diversity is often greatest in riparian habitats. Plants grow in these locations that do not grow elsewhere in the landscape. Often, riparian habitat occurs in narrow ribbons along seasonal creeks or perennial streams (such as in Landscape Unit K), creating a large amount of "edge effect" where animals are typically concentrated, utilizing closely located but contrasting vegetation types. This contrast or edge effect also occurs on edges of clearings, grasslands, or other significant changes in vegetation.

Oak woodlands, such as found in Landscape Units B and C, are an example of a unique habitat type of importance for many species of wildlife. They offer roosting, nesting, perching, and foraging habitat for a number of species. Acorns are a particularly valuable food source for a number of species including deer, squirrels, and other small mammals, some birds (most notably woodpeckers), and others. Over 175 wildlife species have been identified that use oak woodland habitat types. Furthermore, oak woodland habitat types are one of the most rapidly diminishing habitat types in the Western U.S.—hence its additional importance for retention. Stand improvement thinning can improve oak woodland habitat values just as with conifers, and thinning and fuel reduction techniques can improve the likelihood that these unique habitat types will survive intact a wildfire event.

Due to major disturbance events throughout virtually the entire AWUI within the last 100 years, no late successional forest habitat currently exists. Wildlife species dependent on late successional forest habitat, many of which are the most threatened on a regional perspective (e.g., northern spotted owl, red tree vole, etc.), likely do not currently reside in the AWUI, although some sporadic utilization of portions of it may occur (particularly the upper elevations adjacent U.S. Forest Service lands). Some of the older, 100+ year old forests in Landscape Units G, H, and J are beginning to develop characteristics that may soon become more utilizable by old-growth dependent species, if they can be retained and not consumed in a major wildfire event. Management practices, such as stand density reduction to maintain, and even improve growth of larger diameter conifers, may encourage and perhaps even accelerate this developmental process. Implementing management strategies to encourage vertical structure and multilayered canopies could certainly improve the long-term potentials for mature forest habitat values within the AWUI. However, creating these structures at this time would conflict with wildfire management strategies, as multilayered canopies contain excessive ladder fuels capable of initiating and/or aggravating wildfire behavior. Even in optimal late successional habitat such as portions of the Ashland watershed, managing suboptimal spotted owl habitat in strategic locations to maximize opportunities for wildfire management may be appropriate rather than risking catastrophic losses of late successional habitat to wildfire (Ashland Ranger District, 1995). Given the topographical location of the AWUI and the fact that it is located in an area with the greatest combination of fire hazard and fire risk of anywhere in the Ashland watershed (Ashland Ranger District, 1995), it seems clear that treatments designed to produce less flammable stand structures in the AWUI is imperative for protection of critical wildlife and late successional forest values in the adjacent 14,000 acre Ashland watershed. This is particularly important given its location within the 51,000-acre Mt. Ashland Late Successional Reserve--one of a series of late successional reserves (LSR) in a network across the Pacific Northwest. The Mt. Ashland LSR is particularly important because it is a critical part of a connecting link between the Cascade and Siskiyou Mountain provinces. The relatively large amount (close to 80 percent) of mid- to late successional vegetational stages within the Bear Watershed Analysis Area (Ashland Ranger District, 1995) make protection and maintenance of these stand structures and habitat values of critical importance on a regional scale.

Other wildlife management practices can improve both numbers and diversities of wildlife species. One of the most critical is the maintenance of snags—dead trees that are still standing. Over forty different species of birds and six species of mammals in southern Oregon alone rely on snags, at least partially, to complete their lifecycles. Any larger snags (20 inch DBH and larger) are particularly important as they offer increasingly rare nesting locations for some of the mammals and larger birds that depend on them—and are a critical habitat feature that has rapidly declined during the years of harvesting old growth. Ideally, ten acres of forestland should have at least two (and preferably more) larger snags greater than 20 inches DBH and 10 to 20 smaller snags for snag-dependent wildlife species. Clustering of snags, such as occurred where conifers were killed en masse by bark beetles, is particularly advantageous as wildlife habitat (particularly as compared with more scattered, isolated, individual snags).

Maintenance of conifers (particularly Douglas-fir) with dwarfmistletoe brooms is also an important wildlife habitat objective, as a number of birds and mammals utilize this dense cover for roosting, nesting, and foraging. Northern spotted owls in particular utilize brooms for nesting. Dwarfmistletoe brooms offer a unique type of cover and structural diversity in the canopies of forests.

Small piles of retained slash also provide excellent cover and nesting sites for a number of birds and small mammals, although this also has to be balanced with a corresponding increase in wildfire danger. Special houses specifically constructed for less common animals (bats, western bluebirds, woodducks, etc.) can improve nesting or roosting success and subsequently encourage the population viability of these animals.

If wildlife values are prioritized, trees normally removed in stand improvement activities, such as dying, diseased, defective, deformed, damaged, or heavily suppressed trees, can be retained for their inherent wildlife values. In addition, species diversity within stands can be encouraged by leaving a variety of species, regardless of economic value, during harvest or other stand management activities. A variety of stand conditions can be encouraged, including uneven-aged, multi-species individual stands, as well as a multiplicity of stand types within an area or landscape.

Typically, most owners attempt to incorporate management to promote wildlife habitat values whenever possible with management to achieve other values, such as wildfire management. Forest landowners or managers should prioritize finding methods and activities (perhaps with professional help) that balance these values in a way that meets their personal set of values. It must be noted, however, that the mere presence of large numbers of people, their associated improvements, and even their pets has already compromised many important wildlife habitat values in the AWUI.

Another common objective or value prioritized by many landowners is maintenance of biodiversity— that is, the variety of types of living organisms that reside in any given area. Two measures of diversity are species diversity (the different species living in an area) and ecosystem diversity (the different types of habitat that support various living organisms). Maintaining species diversity has been a primary driver of contentious resource management issues in the recent years. Identification of known locations of sensitive, rare and/or endangered organisms is the most important first step in this process. Although no known threatened or endangered species currently are resident in the AWUI, it is certainly possible that casual utilization of the area may occur. Numerous organisms of a sensitive status may exist, however, and identification and monitoring of these species and locations should be prioritized. If locations are known, management activities can often be adjusted to protect these organisms without sacrificing larger objectives.

Generally, however, effective management for total biodiversity most commonly attempts to maximize ecosystem diversity, as maintenance of a wide variety of habitat and vegetation types insures the greatest possibility for maintenance of the largest number of viable populations of species.

Maximizing ecosystem diversity, however, requires long-range planning over larger, watershed-level areas such that specific habitat types can be planned for over time and space. This type of coordinated planning has rarely been done for a variety of reasons. However, our failure to do so has resulted in significant gaps in habitat types, such as late successional forests. The decline in numbers of animals (such as northern spotted owls) are an outgrowth of such failures.

Conversely, the younger vegetation and stand structures that currently dominate the AWUI are less common higher in the Ashland watershed, where mid and late successional forests dominate. These younger successional stages in the AWUI support wildlife species that prefer these habitat conditions.

Within any individual management area, however, improving biodiversity and wildlife habitat values can be achieved by increasing structural diversity of forestlands through such practices as uneven-aged management; retaining snags and logs, particularly of larger sizes; or leaving patches of unthinned or untreated areas during harvest or thinning operations. These practices must be carefully coordinated with appropriate fuel and wildfire management objectives, however. Large scale, high-intensity disturbances such as large wildfires tend to homogenize landscapes, rather than promote biodiversity objectives.

Specific activities can also be undertaken to maintain long-term site productivity. The loss and/or displacement of nutrients within a forest ecosystem has become of increasing concern. Higher-intensity wildfires of today are consuming a much greater percentage of total site nutrient capital than the more frequent but less-intense fires of the pre-settler era—a potentially significant impact on long-term site productivity. The same result can occur by removing large percentages of above-ground biomass through whole-tree yarding, chipping and/or removal; and/or intense burning of all slash after major harvests. Much of the nutrient capital in the above-ground portion of the tree is in the needles, fine twigs, and small branches, and if these alone are left on site then impacts to long-term site productivity can be minimized. Of course, retention of these fine fuels for productivity reasons must be balanced with critical fuel management objectives. Variable retention styles of stand management can often be utilized to balance wildfire management and nutrient management objectives (Franklin et al., 1997).

It is also important to leave several large logs per acre on-site after harvest as downed woody debris to decay in place. Recent research has shown these to be important reservoirs of moisture, nutrients, microbial activity, and small animal activity—all performing critical roles in maintaining long-term site productivity. Large logs that have limited market value ("culls") are good logs to be retained on site during a harvest operation, either as snags or as downed woody debris. Determining appropriate levels of these features in the eastern Siskiyou Mountains is an important current research need.

Perhaps most important for maintenance of long-term site productivity is protection of healthy forest soils. Keeping healthy soils requires efforts to minimize soil compaction, erosion, and disturbance. These most often occur when ground-based equipment is utilized on-site and standards should be implemented and enforced to protect soils when equipment is being used. Prescribed burning can

Perhaps most important for maintenance of long-term site productivity is protection of healthy forest soils. Keeping healthy soils requires efforts to minimize soil compaction, erosion, and disturbance.

also increase erosion when protective duff layers are removed, exposing decomposed granitic soils in the AWUI. Fires of higher intensities, such as occur in wildfires, can destroy organic matter that binds soil particles, thereby once again increasing erosion potential. In fact, most of the serious long-term impacts to forest soils from fire occur when higher intensity fire produces lethal temperatures for soil organisms and nutrients and removes duff layers exposing large areas of surface erosion..

Manipulating vegetation to achieve wildfire management objectives is a basic tenet underlying this report. However, associated with removal of vegetation is a potential increase in surface flows and potential decrease in slope stability as roots decompose and root strength decreases. This ultimately can increase the potential for landslide activation and subsequent potential for increased downslope and downstream impacts upon values-at-risk. Carefully delineated mapping of landslide activity and zones of hazard by a qualified professional should be enveloped into the decision-making process regarding forest and resource management of any failure-prone site within the AWUI.

> *Carefully delineated mapping of landslide activity and zones of hazard by a qualified professional should be enveloped into the decision-making process regarding forest and resource management of any failure-prone site within the AWUI.*

From a soils, geological, or slope stability perspective, prevention of and/or minimization of catastrophic wildfire or other high-intensity disturbance events (i.e., large scale insect-related mortality) that remove all or almost all vegetation from a site is of the highest priority. This, then, infers the necessity of vegetation manipulation and/or modification such as previously described. Doing no vegetation and fuels work will not only increase the likelihood of catastrophic wildfire, but in many places in the AWUI will also encourage insect-related patch mortality of trees and subsequent undesirable impacts on slope stability anyway.

Water resources are another critical value to be considered and integrated in any land management endeavor in the AWUI. A special section in this report (Landscape Unit K) addresses the importance of hydrologic values in critical aquatic and riparian habitats. Although it is not within the scope of this report to discuss water and hydrologic values in depth, it is important to address the potential impacts roads have on forest ecosystems.

No other human impact (with the possible exception of large scale stand replacement wildfire) can have as significant an influence on hillslope processes, aquatic ecosystems, and ultimately watershed integrity, as does excessive road construction and/or lack of maintenance of existing roads. Roads dramatically increase drainage efficiency of watersheds, changing flow regimes such that peak flows are larger, more frequent, and occur much more rapidly. This happens through two basic processes: (1) road surfaces, compacted and devoid of vegetation and/or duff and litter, intercept precipitation and allow little infiltration or evapotranspiration; and (2) roads intercept, redirect, and concentrate subsurface flow. In effect, roads act as surface flow paths for water, becoming an integrated component of the stream network. Greatly accelerated sediment delivery to stream systems results, even without considering the impacts associated with the debris slides and debris torrents that occur during major storm events.

No other human impact (with the possible exception of large scale stand replacement wildfire) can have as significant an influence on hillslope processes, aquatic ecosystems, and ultimately watershed integrity, as does excessive road construction and/or lack of maintenance of existing roads.

Upgrading, closing and/or restoring, and/or ongoing maintenance of existing roads should be a high priority for any owner in the AWUI. Various techniques can be designed and implemented on roads to disperse water to subsurface pathways and reduce sediment input into the stream network. These include increasing the density of waterbars, drainages, and culverts; relocating these drainage devices where appropriate; outsloping road surfaces; stabilizing cutbanks with riprap retaining walls and/or filter fabric; restoring vegetation in fresh fills and/or failures; and numerous other techniques. Roads are also vectors for spread of exotic plants that often have detrimental impacts in forest ecosystems. Monitoring for and removal of these plants when they occur in road prisms is an important management responsibility for landowners.

III. The Ashland Wildland/Urban Interface - Inventory and Analysis

A. Landscape Unit Inventory and Descriptions

Through careful aerial photo interpretation, coupled with intensive field inventory and analysis, the entire AWUI was mapped for existing vegetation type; 252 units were individually delineated and mapped within the AWUI. These were subsequently lumped into 10 principal landscape units based on (1) similarities in site conditions (aspect, slope gradient, soil type, topographical location, etc.) (2) current composition, density, structure and successional stage of the vegetation, and (3) potential wildfire hazard.

Fuels and vegetation are the primary drivers of wildland fire behavior in the AWUI, and the singular feature that can be manipulated to achieve wildfire management objectives. Through careful aerial photo interpretation, coupled with intensive field inventory and analysis, the entire AWUI was mapped for existing vegetation type; 252 units were individually delineated and mapped within the AWUI. These were subsequently lumped into 10 principal landscape units based on (1) similarities in site conditions (aspect, slope gradient, soil type, topographical location, etc.) (2) current composition, density, structure and successional stage of the vegetation, and (3) potential wildfire hazard. This very intense vegetation mapping is at a much finer scale than most vegetation classification schemes, such as Atzets and McCrimmons (1996) guide to forested plant associations in southwestern Oregon. The ten landscape units delineated in this report would be represented in three or perhaps four of the above plant associations and would not have provided a level of detail sufficient to meet the objectives of this report.

Correlating the fine-scale mapping with potential wildfire hazard was another primary objective of this report. A number of wildland fire hazard rating systems have been developed throughout the West (Wildland Fire Hazard Assessment, 2000). Most, however, have been developed for use on much larger scales than for the area designated for this report. In addition, most of these hazard rating systems would have classified virtually all of the AWUI uniformly under the most extreme category, much as occurred in the Bear Watershed Analysis (Ashland Ranger District, 1995), where both fire hazard and risk were uniformly classified extreme throughout the AWUI. However, simply categorizing the entire AWUI as extreme would allow little opportunity to set priorities for management and/or evaluate opportunities. For this reason, each of the 10 landscape units were further categorized into 4 classes of wildfire hazard and

Landscape Unit Summary Information

Unit	Description	Seral Stage	Fuel Model	Typical Location	General Prescription	Current Wildfire Hazard if Unmangd	Managemnt Difficulty	Long-Term Potential Wildfire Management Effectiveness	Management Products and Values
A	Grassland/non-vegetated	Early	1	Lower elevations, close to City.	Mow, maintain	Low	Low	Can be excellent fuelbreak if maintained.	Hay, pasture?
B	Oregon white oak	Early -Mid	6 or 9	Lower elevations, close to city	May need understory thin/ brush removal; thin to 75 BA, encourage bigger trees	Mod-erate	Low	Good to excellent if understory fuels are reduced.	Pasture
C	Ponderosa Pine/oak, 25 to 50 years	Early -Mid	6	Mostly in north half of AWUI close to town	Promote overstory pines; significant understory thinning	Extreme	Moderate	Fair to good with significant work	Firewood, wildlife
D	Whiteleaf manzanita, 25 to 50 years	Early	4	Southerly aspects, mostly in south half of AWUI	Mosaic brush removal, plant PP/SP, maintain over time. Native grass established?	Extreme	Moderate	Fair to good, partial retention on steeper slopes limits effectiveness	-
E	Douglas-fir/madrone/ deerbrush, 25 to 50 years	Early	6	Steep northerly aspects throughout AWUI	Manage developing stand densities, promote existing conivers, thin hardwoods. Possible reforestation in spots. Geologic concerns.	Extreme	Moderate to High	Poor to fair, particularly on steeper topographical locations.	Access limitations over most of unit
F	Conifer plantations, 10 to 25 years	Early	4	Variable	Manage stand density, prune	Extreme	Moderate	Good to excellent if managed carefully; poor if unmanaged	Possible firewood,
G	Mixed conifer and hardwoods, 75 - 125 years	Mid	10	Moderate southerly aspects	Stand density reduction, primarily thin from below. Thin heavily around larger overstory trees (esp. Pines and black oak). Improve fuel discontinuity. Good slash treatment essential	High	High to Extreme	Species selection for retention can be complicated. Fair to good if good fuel discontinuity maintained.	Logs? Firewood, post and poles
H	Douglas-fir (dying)/ Madrone, 75 - 100 years	Mid	10	At intersection between conifer dominated and hardwood/brush dominated wildlands	Maintain hardwood dominance for now; encourage vigor by stand density reduction; remove excessive dead DF, both standing and downed. Promote conifers where possible.	High - Extreme	Moderate to extreme (standing snags are extremely dangerous)	Fair to good but requires careful management. Presence of snags and incoming early successional vegetation compromise wildfire management potentials.	Mostly firewood; perhaps logs if merchant-able conifer mortality is recent.
J	DF poles & small saw timber, 75-100 years; northerly aspects	Mid	9	Steep northerly aspects in upper half of AWUI	Stand density reduction, mostly from below. Multiple, light thinnings preferred. Good slash treatment essential.	High	Low to High, .	Good to excellent through stand density reduction and slash treatment; poor if unmanaged.	Logs? Fire-wood, posts and poles. Poor access generally
K	Riparian habitats	Various	Various	Along creeks and draws	Variable; conflicts inherent between riparian/aquatic/wildlife/aesthetic values and wildfire management objectives; balance where possible. Remove exotic species wherever appropriate.	Generlly moderte but much vari-ability	Low to High; special guidelines via Oregon Forest Practices Act	Variable depending on objectives. Can be good due to inherent increases in site and vegetation moisture.	Hydrology, wildlife, and aquatic values are significant. Same products as above if managed.

potential behavior, described as follows.

1. Extreme (Red) - These landscape units are characterized by a likelihood of very explosive wildfire behavior, largely due to dense, early successional vegetational profiles on moderate to steeper topography. Control by direct suppression is unlikely in most locations. Opportunities for improving wildfire management possibilities are difficult and expensive to achieve. The most extreme wildfire behavior within this extreme class would likely occur in Landscape Unit D, followed by Landscape Unit F, Landscape Unit C, and finally Landscape Unit E. Landscape Unit E is borderline between the extreme and high categories, as this vegetational community on cooler, moister northerly aspects with shortened fire seasons, and a proportionally high amount of deerbrush ceanothus that generally burns less intensely in wildfires than other early successional vegetation (Skinner, personal communication).

2. High (Orange) - These landscape units, mid-successional in nature, are slightly less likely than these landscape units in the extreme class to initiate and/or sustain crowning fires, mostly due to more inherent structural discontinuities in fuels, particularly vertically as ladder fuels drop out in typical stand development. However, greater overall fuel loading and relatively continuous canopy fuels in most situations can result in even more uncontrollable wildfire behavior in these landscape units in the most extreme events. Although generally not as explosive as those in the extreme category in most situations, this category also suggests a high likelihood of very difficult wildfire behavior to control by direct suppression tactics, particularly when individual units are located on steeper topography. Fire is more likely to burn at a range of intensities in this category. Landscape unit ratings for wildfire behavior within this class are (most extreme) Landscape Unit G, followed by Landscape Unit H and then Landscape Unit J. Landscape Unit J is significantly lower due to

Picture #9 - Three landscape units of increasing fire hazard in close proximity - Landscape Unit A in foreground, Landscape Unit B (oak woodlands) in center; Landscape Unit J in background.

greatly reduced surface fuels and ladder fuels. Landscape Unit H is similar to Landscape Unit J, except for major mortality of Douglas-fir overstory and subsequent increased potential wildfire behavior.

3. Yellow - Landscape units in this category are less likely to burn with to severe wildfire behavior, either due to greater live moisture percent in vegetation through the summer season (Landscape Unit K, riparian habitats) or generally reduced site productivities and subsequent fuel loadings (Landscape Unit B, oak woodlands). Both landscape units are also generally located on gentler slopes, a favorable wildfire management factor. Individual units, although also likely to burn in a wildfire event (although possibly less severely), contain opportunities for improving wildfire management possibilities at moderate cost. Considerable variation in vegetation and fuels exists within both landscape units, with portions of each containing conditions that could encourage extreme wildfire behavior, albeit in a smaller proportion of the total area.

4. Green - Units in this category have inherent site conditions that offer wildfire management opportunities at low or minimal cost, largely due to very low or even non-existent fuels, and generally gentle topographical locations. Examples include pastureland or other grasslands, orchards, quarries, or other areas where vegetation is significantly reduced.

Throughout the AWUI, individual units were also delineated in which wildfire management opportunities had been significantly improved through implementation of specific management activities that reduced fuel hazard and wildfire potential. Approximately one-third of the total acres in the AWUI were classified as implemented fuel reduction zones. In these units, the initial wildfire hazard rating may have been extreme, high or moderate, but through active fuel reduction or other vegetation/wildfire management activities, was effectively reduced to a lower category,

Throughout the AWUI, individual units were also delineated in which wildfire management opportunities had been significantly improved through implementation of specific management activities that reduced fuel hazard and wildfire potential. Approximately one-third of the total acres in the AWUI were classified as implemented fuel reduction zones.

usually by one to two classes (i.e. from extreme to high or moderate).[1] These areas can serve as examples of treatment styles designed to achieve wildfire management objectives. They also helped form the basis for the prescriptions delineated in this report.

The accuracy of the spatially explicit mapping of the AWUI was challenged by inherent difficulties in the process. These included:

1. The complex heterogenous nature of vegetation in the AWUI, which is characteristic of the Klamath-Siskiyou province, one of the most biologically diverse temperate regions in the world.

2. A complicated history of disturbance, particularly close to the urban setting of Ashland, that creates a confusing mixture of species compositions, stand structures, and age classes of vegetation.

3. The gradational nature of change between vegetation types, rather than the sharp and distinct unit boundary lines delineated on the map.

4. Units that did not fit cleanly into the 10 landscape unit categories, containing either a combination of landscape unit types or perhaps a unique vegetation type that had to be "squeezed" into the most appropriate landscape unit category.

5. Mapping errors that occurred simply because many areas were not available for ground-truthing from publicly available access.

6. Mapping errors that obviously occurred in the transport of field inventory data into the usable form displayed on maps in this report. Obtaining exact unit boundaries through technologies such as GPS were not only practically impossible (without prior approval of every private landowner—an unlikely possibility), but would have been exceedingly expensive.

Developing generic prescriptions and management treatments (e.g., thin everything less than 6 inches dbh) tends to homogenize vegetational conditions and does not necessarily consider

---

[1] Another way to portray the result of management activities on potential wildfire behavior is through the use of standardized fuel models (Anderson, 1982). Management activities can produce fuel amounts, distributions, and continuities as well as changes in vegetational structures that effectively change the rating to a less flammable or wildfire-prone fuel model (e.g., removal of logging slash alone could improve wildfire hazard from a much more Flammable Fuel Model 12 or 13 to Fuel Model 8, 10, or 11; brush removal in whiteleaf manzanita brushfields could change fuel model ratings from 4 to 2, 3, or 5).

the inherent variability in function, pattern, density, composition, and structure of a stand or forest. Thus, it is important to recognize that the descriptions/prescriptions provided in the following landscape unit inventory are, by intent, very general in nature and will obviously not apply directly to every individual unit. These were designed to give individual landowners in the AWUI an introduction to existing conditions on their properties and potential management possibilities to improve wildfire management objectives, while minimizing negative effects on other resource values. It is strongly suggested, however, that individual landowners not rely solely on this information but rather become much better informed through additional education and/or use of resource professionals to "fine tune" appropriate vegetation and wildfire management activities. Numerous examples exist throughout the AWUI where landowners have completed fuel reduction or other wildfire management activities to meet their own particular set of objectives. These are excellent locations to visually experience and learn about the various appropriate management activities–and, in some cases, the longer term effects.

The scope of this report did not allow a wildfire hazard ranking system to be developed for individual units delineated in the mapping process. However, it would be possible to more fine tune the wildfire hazard ranking system such that individual units could be ranked. A number of different wildfire hazard rating schemes have been developed to meet specific goals, utilizing site specific features for each site such as fuel model, slope, aspect, vegetation type, presence or absence of ladder fuels, canopy cover, crown base height, surface fuels assessments, and others. These ratings could then be combined with developmental features of a site (e.g., structural features of dwellings, dwelling density, emergency access, defensible space, etc.) To determine a rating for an individual site.

Picture #10 - Incoming manzanita compromising fuelbreak; brush removal needed again to maintain fuelbreak effectiveness. GIS-based mapping can track these changes over time.

It is important to note that some wildfire management activities completed in the spring of 2002 has not been entered and delineated on the maps for the project. One of the strengths of the GIS-based mapping, however, will be the ease with which changes from a wildfire management perspectives (i.e., recent fuels reduction completed; fuels and vegetation ingrowth into old projects) can be spatially incorporated onto the map.

The scope of this report also did not allow utilization of stand level or landscape level fire behavior models, such as BEHAVE (Burgan and Rothermel, 1984) or FARSITE (Finney, 1998), although some of the data collected could be useful if outputs from these models is desired in the future. A careful analysis of the applicability and usefulness of these models for the AWUI would be imperative prior to their utilization.

Landscape Unit A, Grasslands or Non-Vegetated - 28 units, 234 acres

Topographical Location- Located on various 0 to 30 percent aspects primarily clustered at low slope positions close to the urban area of Ashland

Vegetation Description - Landscape Unit A comprises various sites in the Ashland Interface area that have very limited existing vegetation, largely due to vegetation removal activities in the past. These areas have been cleared for various reasons, including pasture development, orchard establishment, wildfire protection, quarry establishment and/or expansion, and perhaps other reasons. These sites currently remain dominated by various grasses and herbaceous vegetation, usually growing close to the ground. Both native and non-native species are present. Many areas have scattered trees established at the time of clearing (such as orchards) or are slowly being re-invaded by native brush (most often whiteleaf manzanita and deerbrush ceanothus) and tree (typically Pacific Madrone, California black oak, Oregon white oak, ponderosa pine) species. On some sites, if this reinvasion process continues the unit will no longer be typical of this landscape unit but rather move into one of the other landscape units dominated by early successional vegetation.

Current Wildfire Conditions - The sites in this landscape unit currently are the most favorable of all the landscape units in the Ashland interface area from a wildfire management perspective. This is true for two primary reasons: (1) they are generally located on lower gradient slopes (desired for agricultural uses such as pastures and orchards) that tend to burn less aggressively than steeper slopes; and (2) fuel amounts are generally very low and confined to surface layers. Planted trees (e.g. old orchards) and invading trees and shrubs are generally of a very discontinuous distribution and will not contribute significantly to increased wildfire behavior in a wildfire event. Irrigated sites in Landscape Unit A (rare) represent the best

Picture #11 - Landscape Unit A - Excellent fuelbreak and tactical opportunity.

possible fuel profile in the AWUI. Even non-irrigated sites in Landscape Unit A offer strategic locations where crown fires will drop to the ground, offering opportunities for direct attack and possible prevention of wildfire spread. However non-irrigated sites dominated by dry groundcovers in summer also offer sites where fire initiation can easily occur and rapidly spread, although the intensity and duration of the fire is reduced. Wildfire suppression must catch these fires by rapid initial attack prior to their expansion into more wildfire prone adjacent fuel types. Fortunately, given their management history, most of these sites have good access, allowing rapid initial attack.

Picture #12 - Quarry (Landscape Unit A) with associated fuel reduction on edges to increase horizontal discontinuity of fuels in Ashland Creek canyon.

Management Opportunities - The various units in Landscape Unit A offer strategic opportunities for suppression in a wildfire event. Maintenance of reduced vegetational profiles and/or a favorable distribution of fuels is a highly desirable objective from a wildfire management perspective. Accomplishing this task requires, in the least, an annual mowing of grasses to reduce fire flame length and rate-of-spread and ongoing removal of invading trees and/or brush species as needed. If owners desire to return these areas to more typical native forest types, conifers and/or hardwoods can be planted and/or encouraged, preferably at wide spacings to maintain fuel discontinuity for as long as possible. Maintaining summer season irrigation on these sites, where possible, could be a valuable community objective.

Management Issues - Minimal. Relatively easy landscape unit to manage- basic maintenance can be accomplished with equipment or unskilled laborers. Values limited primarily to non-forest users—pasture, hay, fruit, aesthetics, open space.

Other Resource Issues - Minimal. Erosion and sediment production from quarries. Grassland habitat for wildlife is uncommon in the AWUI and may be utilized for forage values by a number of wildlife species.

Landscape Unit B - 31 units, 141 acres

Topographical Location- Low slope positions on valley edges, typically 15 to 45 percent of various aspects.

Picture #13 - Landscape Unit B - Oak woodland. Note limited surface fuels and ladder fuels–good wildfire management conditions.

Vegetation Description - Landscape Unit B is of uncommon occurrence in the Ashland interface area, but is separately delineated because it represents a unique vegetation and management type. Vegetation on the unit is dominated by relatively uniform stands of scrub 3 to 10-inch dbh Oregon white oak to 30 feet tall. An average of 300 to 750 white oak stems per acre typically occur and often represent virtually the only tree species. Occasionally, near transitions with more productive sites, ponderosa pine and/or California black oak may occur scattered in this landscape unit. Understory vegetation is often dominated by various grasses (native and/or non-native) and herbaceous vegetation (see Picture #13). A second understory type also occurs in which brush species occur intermixed with the oaks, primarily whiteleaf manzanita, wedgeleaf ceanothus, and most notably birchleaf mountain mahogany (see Picture #14). The collection of these species is indicative of harsh, droughty sites where moisture availability is limited due to either (1) the very shallow nature of the soils, or (2) the high percentage of clay soil particles that make water difficult to extract for many plants, especially conifers.

Current Wildfire Conditions - Landscape Unit B is a generally favorable vegetation type from a wildfire management perspective. Total fuel levels are low, as these sites of low productivity simply cannot support a large amount of biomass. However, the presence or absence of brush species and other ladder fuels as described above alters the wildfire potential of any site in Landscape Unit B. Sites lacking ladder fuels are particularly favorable from a wildfire management perspective, although the distance between surface fuels and crown fuels is not large

Picture #14 - Landscape Unit B - Oak woodland. Young Oregon white oak with intermixed mountain mahogany. More wildfire prone than Picture 13.

in these small oaks. The overstory canopy, however, can be fairly dense and continuous, and certainly capable of sustaining crown fire in a major wildfire, although probably not of the intensity or rate-of-spread of vegetation types that support greater amounts of uniformly distributed fuels. Individual units within Landscape Unit B that support a much more continuous understory component of brush species (i.e. ladder fuels) have high to extreme wildfire hazards, more typical of other early successional landscape units.

Management Opportunities - Units in Landscape Unit B likely supported the open oak savannah vegetation type in the pre-settlement era. This type was characterized by later Oregon white oak and occasional other species (ponderosa pine, California black oak) scattered at wide spacings over a native grass understory maintained by repeated prescribed burning by Native American peoples. Return to that vegetation type through active manipulation and understory clearing activities would be highly desirable from a wildfire management perspective. This can be done by machine and manual methods throughout most of this landscape unit due to gentle topography. Removal of excessive understory brush species should be the highest priority where they occur. A follow-up seeding with native grasses may inhibit re-establishment of more flammable brush species. Livestock grazing may also help retard development of understory fuels. Sites without excessive understory development of ladder fuels may only need to be maintained over time, although thinning to reduce canopy densities in these oak woodlands may also decrease the potential for sustaining crown fires. Creating and maintaining horizontal discontinuities in fuels and vegetation is usually much more effective in this landscape unit than attempting to create vertical discontinuity because low site productivity generally precludes: (1) rapid vertical growth of tree and elevation of canopies, and (2) development of continuous canopies that shade out understory species, particularly if the tree species is shade intolerant, such as Oregon white oak. Any thinning or brushing slash created in these activities can be utilized if possible; otherwise, it should be eliminated through piling and burning, chipping, etc.

Management Issues- Landscape Unit B is one of the easiest types in which to conduct management activities. Reduced slope gradients make access and equipment limitations minimal. Products of management have limited marketability, primarily firewood.

Other Resource Issues - Landscape Unit B represents an important wildlife habitat type that is rapidly declining in abundance in the western United States and should be managed to maintain those values wherever possible. Its close proximity to urban and suburban areas in the AWUI and generally gentle to moderate topography will make it highly susceptible to development in years to come. Due to the generally gentle slopes low in the topography of the AWUI, slope stability concerns are probably minimal in Landscape Unit B.

Landscape Unit C - Ponderosa Pine/Oak - 21 units, 114 acres

Topographical Location- On various aspects, usually in the lower third of concave slopes on moderate slopes (primarily 25 to 40 percent) immediately above the lowest slope positions characterized by Landscape Units A and B.

Picture #15 - Landscape Unit C - untreated.

Vegetation Description - Units in Landscape Unit C are located low in the topography of the AWUI, often adjacent to the more urbanized settings of the City of Ashland. Shallower and perhaps more clayey soils reduce productivity for conifer establishment and growth (particularly as compared to more productive Landscape Units G, H, and J upslope), although Landscape Unit C is slightly more productive than Landscape Unit B, which is typically dominated by extremely drought tolerant species such as Oregon white oak, wedgeleaf ceanothus, and birchleaf mountain mahogany. Landscape Unit C includes these species as minor parts of its vegetational mix, but is generally dominated by two other species indicative of slightly more productive sites—California black oak and ponderosa pine. The pines are present often as scattered overstory trees up to 20+ inches DBH, as well as younger, smaller trees primarily in openings. California black oak also forms a considerable part of the overstory and mid-story canopies, as well as being a prevalent understory species. Other vegetation includes whiteleaf manzanita and occasionally other conifers (often of poor vigor) such as Douglas-fir and incense cedar. Healthy Pacific madrone and Douglas-fir, site indicators of more productive soils such as found in Landscape Units G, H, and J, are much less common in Landscape Unit C. Structurally, the stands in Landscape Unit C are usually multi-storied, with minimal discontinuity vertically. The overstory pines are often not significantly above the oaks and other mid-story species. Overstory conifers can be under significant stress in this landscape unit from the abundance of hardwoods and brush in the understory, and bark beetle related mortality of pines is to be expected in years to come if no stand density reduction occurs.

Current Wildfire Conditions - Total fuel amounts in Landscape Unit C are intermediate between more productive sites (such as Landscape Units G, H and J) and the less productive sites (Landscape Unit B). However, in most places, Landscape Unit C supports a relatively continuous vegetation profile in both horizontal and vertical directions. Ladder fuels in the form of whiteleaf manzanita and various sizes of oaks form continuous vertical fuel profiles up into the scattered ponderosa pine overstory. In many places, older decadent and dying hardwood and brush species can create a volatile fuel profile. This is particularly important because this landscape unit is usually located on topographically low slope positions close to dwellings and more urban settings. It is particularly prevalent in the Ashland Creek canyon and in the Wrights Creek area to the north. Generally gentle slopes of this landscape unit can reduce potential wildfire behavior and enhance opportunities for suppression in a wildfire event.

Management Opportunities - Management opportunities in Landscape Unit C are similar to those in Landscape Unit B. Landscape Unit C likely supported the typical valley pine/oak vegetation type in the pre-settlement era. This type was characterized by large ponderosa pine (more than in Landscape Unit B) and oaks (both Oregon white and California black) scattered at wide spacings. Understory vegetation was probably dominated largely by native grasses. This pre-settlement vegetation type, highly desirable from a wildfire management perspective today, was likely maintained by repeated low-intensity fire ignited by Native American peoples. In the absence of this disturbance mechanism, these landscape units have been encroached upon by numerous oak and brush seedlings, effectively removing the more open grasslands common to earlier eras. Return to that vegetation type through active manipulation and understory clearing activities would be highly desirable to improve wildfire management possibilities. This can be done by machine and/or manual methods throughout most of this landscape unit due to generally gentle to moderate topography. Good examples of this type of treatment and non-treatment currently exist in the upper end of the Wrights Creek watershed. The 1959 wildfire, started near Jackson Hot Springs, burned intensely through this vegetation type, in areas that now support a large number of homes constructed since that fire. Growth of vegetation since that event has once again created a fuel profile that could burn intensely and rapidly in a wildfire event. Creating and maintaining horizontal discontinuities in fuels and vegetation is much more effective in this landscape unit than attempting to create vertical discontinuity, just as in Landscape Unit B.

Following clearing of brush and other ladder fuels, ponderosa pine seedlings can be planted to increase their abundance on these sites, although they should be planted at wide spacings of 15 to 20 feet.

Management Issues - Understory fuel reduction in this landscape unit may be able to be accomplished relatively easily in most places due to the gentle topography and smaller size classes of vegetation to be removed. Products from this work would be minimal, primarily firewood and other small diameter products. Gentle topography, stable slopes, and generally good access close to town suggest that equipment (crawlers, chippers, slashbuster, etc.) may be able to be used in this landscape unit.

Other Resource Issues - Gentle to moderate topography in Landscape Unit C make slope stability issues less problematic except where slope gradients rise above 50-55 percent. Soil resource values should be protected by limiting equipment utilization to slopes less than 25-30 percent. Wildlife habitat and biodiversity values can be very important in this landscape unit, primarily due to the scarcity of this vegetation type on a regional basis. These areas are remnants of the once more prevalent valley pine habitat type, likely maintained and promoted be frequent burning native peoples. Maintaining and promoting this vegetation type today would suggest extensive thinning/brushing/burning to create much more open stands dominated by large scattered ponderosa pine and oaks with an associated native grass understory. The oaks, and particularly California black oak in this case, are particularly valuable trees from a wildlife habitat perspective.

Landscape Unit D - Whiteleaf Manzanita Dominated Brushfields - 33 units, 374 acres

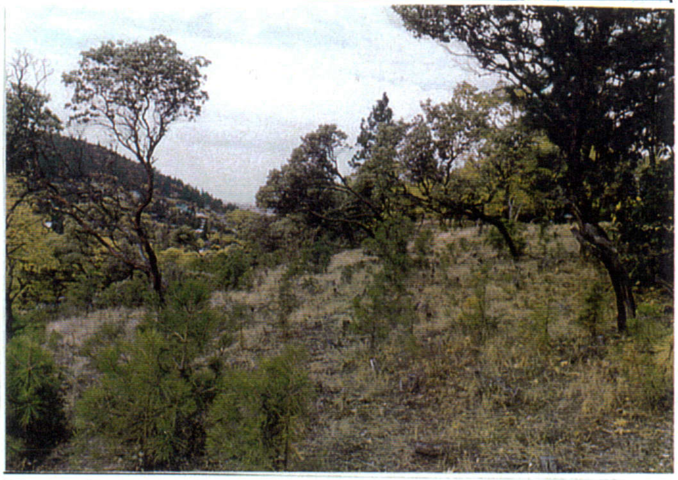
Topographical Location- Landscape Unit D is located throughout AWUI on drier, more southerly 15 to 45 percent (occasionally steeper) aspects and other moisture-limiting sites, most notably ridgeline locations

Picture #16 - Landscape Unit D - Extremely wildfire prone vegetation type.

Vegetation Description - Landscape Unit D is a very common type located throughout the AWUI area. It is located primarily on drier southerly aspects and is characterized by vegetation indicative of a major, high-intensity site disturbance generally within the last 10-50 years, such as the 1959 wildfire in the northern part of the AWUI, and the 1973 Hillview fire. Vegetation in Landscape Unit D is dominated by dense brushfields of whiteleaf manzanita, with interspersed clumps of stump sprouting Pacific madrone. Both species are well adapted to recover, if not thrive, following intense disturbance—whiteleaf manzanita through rapid germination of scarified (by the disturbance) seed stored in the duff, and Pacific madrone through rapid stump sprouting. These two species tend to totally dominate most sites in Landscape Unit D, although scattered ponderosa pine, California black oak, and deerbrush ceanothus may also occur, particularly around the transitional edges. Brushfields are usually dense and continuous, fully occupying the site and generally preventing establishment and/or growth of other vegetation even for as long as 50 years or more. Many of these sites are capable of, and historically probably did support, mixed stands of conifers (particularly ponderosa pine) and hardwoods, more similar to that currently found in Landscape Unit G.

Current Wildfire Conditions - Landscape Unit D is perhaps the most flammable and wildfire prone of the vegetation types in the AWUI. The vegetation is dense, uniform, and highly flammable, particularly during dry summer months, although this vegetation type can also burn during dry mid-winter times. The location of Landscape Unit D primarily on hot, dry, southerly aspects insures that it will support the longest burnable fire season. Units on steeper slopes of 40-50 percent or greater, are particularly prone to extreme wildfire behavior due to excessive convective fuels preheating. This allows for little chance for direct attack or immediate control in a wildfire, except perhaps on ridgelines.

Management Opportunities - Changing the vegetational profile to a less wildfire prone condition should be a priority throughout Landscape Unit D. Basically, this will involve removal of the vegetation through manual or mechanical means. Manual hand removal of vegetation has the advantages of not scarifying stored seed (i.e., whiteleaf manzanita) and subsequently minimizing re-establishment of this wildfire prone species. Hand removal, followed by piling and burning, can also be done on steeper slopes where mechanical removal is not desired, particularly on decomposed granitic soils. Mechanical removal, such as utilizing crawlers, slashbusters, or other chipping/grinding machinery can be done on gentler slopes more cheaply if enough acres are available to warrant move-in costs of this expensive machinery. In many situations, even partial removal in strips or patches can produce wildfire management benefits while avoiding the massive removals that can conflict with other values. Vegetation removal is particularly effective in specific topographic locations, favorable from a wildfire management perspective, most notably ridgelines and perhaps along roads where access for firefighting equipment and personnel is available. Regardless, the wildfire management benefits will be short-lived (10 years or less), as vegetation becomes re-established on site. Reforestation can often follow initial clearing (site preparation, in reforestation vernacular), as a short window of opportunity exists where planted conifer seedlings can compete favorably with other invading vegetation. Control of invading vegetation in a 3 to 4-foot radius around each seedling may be necessary in order to insure survival and/or improve growth during the first several years following planting. Ideally, conifer establishment followed by active management



Picture #17 - Landscape Unit D - Manzanita cleared to create fuel reduction zone; ponderosa pine naturally regenerated.

during the next phase of stand development (see Landscape Unit F) can, in the long term, produce a less wildfire prone vegetation type that can remain on site and perhaps retard development of the more wildfire prone, early seral brush and hardwood species that would otherwise develop and dominate. Ongoing maintenance to restrict wildfire-prone vegetation development (brushing, thinning, etc.) is necessary in order for units to remain as functional fuel reduction zones.

Management Issues - Completing fuels management in this vegetation type is generally a fairly simple process, although the work itself can be very taxing physically and/or very expensive if undertaken by manual methods. Using equipment on gentler slopes can reduce up-front costs, sometimes significantly, although soil disturbance and erosion impacts can increase dramatically on moderate to steep slopes in these decomposed granitic soils. Re-invading vegetation can also be difficult and expensive to control, especially when germination is encouraged by equipment utilization. Marketable products are minimal from vegetation removal from these sites.

Other Resource Issues - Extensive removals of vegetative cover to achieve other objectives (particularly wildfire management objectives) can potentially aggravate slope instability, particularly on slopes greater than 50 percent. Vegetation removal in patches or contour strips can help minimize this potential. Vegetation removal in this landscape unit can also improve wildlife access, as well as increase potential plant species diversity- two important factors in wildlife management. These types of removals also can encourage invasion and spread of exotics, however- an unfortunate outcome of complete vegetation removal on any site in the AWUI. Careful monitoring and removal of invading exotics should be an important priority in fuels reduction projects in Landscape Unit D. Establishing native grasses immediately after brush removal may be a way to discourage re-establishment of brush and invading exotics (see Picture #18).

Picture #18 - Manual conversion of whiteleaf manzanita brushfield; seeded with native grasses to discourage establishment of brush and exotics.

Landscape Unit E - Douglas-fir/Pacific Madrone/Deerbrush Ceanothus
25 to 50 Years - 20 units, 324 acres

Topographical Location- Landscape Unit E is located on mostly steep (primarily 40 to 65 percent, although ranging as high as 80+ percent) primarily northwesterly to northeasterly aspects in the upper half of concave slopes in the AWUI.

Vegetation Description - Landscape Unit E comprises sites primarily in the upper elevations of the interface area located on moderate to very steep northerly aspects . This landscape unit is characterized by early seral native vegetation initiated after major high-intensity wildfire events - most notably the 1959 wildfire in the northern portion of the AWUI (see Picture #19), and the 1973 Hillview fire in the southern portion of the AWUI. In these wildfire events, most, if not all of the above-ground vegetation in Landscape Unit E was removed by wildfire. Existing vegetation (40+ years of age and younger) is dominated by those species most well-adapted to thrive after this type of disturbance. Pacific madrone and deerbrush ceanothus. Both species are stump sprouters that quickly become re-established after wildfire, gaining rapid domination of the site and discouraging subsequent development of other invading species. In some situations, naturally regenerated Douglas-fir were able to gain establishment at the same time (usually because a nearby overstory seed source escaped the wildfire) and have been able to gain a place in the overstory, now as 2 to 12 inch DBH saplings emerging above their brushfield competitors. Understory conifers amidst this dense hardwood/brush vegetation have a difficult time thriving and are usually sparse and/or suppressed with little opportunity for long-term survival and growth. Other species that can occur include snowberry, dwarf Oregon grape, and others. Current vegetational structures are usually dense and

Picture #19 - Paths of intense wildfire in 1959 in Ashland Creek canyon–vegetation converted from mid-successional conifers to early successional hardwoods and brush (Landscape Unit E).

solid, with brushfield canopies and root zones fully occupied. Often, old Douglas-fir snags killed during the wildfire event are scattered throughout a unit, with an even larger number of jackstrawed downed Douglas-fir logs in various states of decay.

Current Wildfire Conditions - The dense early seral vegetation of Landscape Unit E is a vegetational profile well-predisposed to another wildfire, especially when located on very steep slopes of 50 percent and greater. This should not be surprising since this pattern of infrequent, intense wildfire appears to have been a common disturbance type in this landscape unit, at least since settlement of the area in the mid-1850's. This disturbance history on these sites results in even aged vegetational structures, usually continuous in both horizontal and vertical directions. These continuous fuels on steep topography make the likelihood for intense wildfire extreme. As a result, opportunities for direct suppression during wildfire events are minimal in this landscape unit. However, units in this landscape unit are probably less likely to burn than similar vegetational profiles on more southerly aspects (e.g. Landscape Unit D), due to higher humidities, shorter daylengths, and subsequently decreased length of fire season (due to shadier aspects). There is also some research information that suggests that deerbrush ceanothus is less flammable than many other brush species and may reduce wildfire behavior in some situations. However, these slight distinctions are overwhelmed during most of fire season, when fire conditions allow for intense fire throughout the duration of the season.

Management Opportunities- Vegetation in this landscape unit is perhaps the most difficult within the AWUI to manipulate in order to encourage short-term and long-term wildfire management benefits. In many places, that difficulty probably outweighs any wildfire management benefits that might accrue, particularly given the steep topography and the difficulty in creating adequate fuel discontinuities to be effective in a wildfire.


Picture #20 - Landscape Unit E - Area brushed and planted with Douglas-fir, now 7 years old.

Creating horizontal discontinuities in fuels is difficult because the two primary species that dominate these units- Pacific madrone and deerbrush ceanothus- are vigorous stump sprouters that rapidly re-colonize a site after manual or mechanical removal (Note- mechanical removal is rarely employed in this landscape unit due to the steep, inaccessible topography). Encouraging vertical discontinuity in the vegetational structure is at best a long term process given the early-seral nature of the existing vegetation, a process that can likely be thwarted by a subsequent return fire. Encouraging long-term vertical discontinuity through conifer re-establishment by planting can be difficult as these native stump-sprouters are aggressive, well-adapted to the sites, and can thoroughly out-compete planted seedlings, unless they can be controlled within the immediate vicinity of each planted seedling through grubbing (deerbrush ceanothus only), repeated annual cutting, or through the use of herbicides (see Picture #20). Where possible, releasing established trees, conifer or hardwood, through brushing, thinning, or other release treatments within their vicinity, is perhaps preferable to planting of conifers. Overall fuel amounts will be decreased, individual trees may be less apt to burn in a wildfire event, and vertical discontinuities will result sooner through these actions. Slash can be piled and burned to further reduce wildfire potential.

Management Issues- Fuels reduction in Landscape Unit E is a fairly straightforward process of brushing/thinning, piling and burning, although this work can mostly only be done by manual methods, as most sites are too steep for mechanical methods. However, the steep to very steep nature of the topography and difficult working conditions make the work physically very demanding, expensive, and dangerous. Few landowners undertake this type of work on their own. Marketable products are minimal, if not nonexistent, in this landscape unit, especially given the steep, inaccessible topography. The minimal benefits from a wildfire management perspective, coupled with the difficulty and/or high cost, make wildfire management activities in this landscape unit a low priority for most owners.

Other Resource Issues- The steep topography in Landscape Unit E make slope stability/failure an important issue to consider whenever vegetation removal is considered on slopes over 50% and/or when other signs of potential slope failure exist. Obtaining advice/assistance from a professional engineering geologist is recommended prior to initiating projects in this landscape unit. Fuel reduction, if desired, is best accomplished in narrow contour strips to minimize the likelihood of slope failure. Vegetation removal in small openings can help improve species and structural diversity- important wildlife habitat values- as well as increasing access for animals. Small openings can also be created around existing overstory hardwoods/conifers, increasing their long-term survival and growth.

Landscape Unit F- Conifer Plantations - 5 units, 29 acres

Topographical Location- Landscape Unit F occurs at various locations on gentler (15 to 30 percent) slopes of various aspects in the AWUI.

Vegetation Description - Landscape Unit F is characterized by an uncommon vegetation type in the Ashland interface area—plantations of conifers. These plantations, mostly dominated by ponderosa pine, were planted 10 to 25 years ago and are conspicuous blocks on the landscape. If planting survival percentage was good, ponderosa pine currently dominates 80 to 100 percent of the stand species composition. These plantations are located in various locations-ridgelines, more southerly aspects, or in transitional areas close to city limits in which soils gradually change from those dominated by decomposed granitics to those which contain a much higher percentage of clay. Some of these pine plantations can actually be off-site—that is, planted in situations and on soils that typically would not have supported anything more than scattered overstory ponderosa pine, amidst a more typical oak woodland/savanna vegetation type. Younger plantations, usually initiated after clearing of existing vegetation, have often been reinvaded by other sprouting or germinating brush and hardwood species. These developing brush and hardwood species can offer significant competition for moisture with the developing seedlings, as well as quickly growing into a more continuous fuel profile- an obvious negative from a wildfire management perspective. Older plantations with good survival, if left untreated and/or unthinned, can form dense vegetational profiles highly susceptible to rapid and intense wildfire spread (see Picture #21).

Picture #21 - Untreated ponderosa pine plantation (Landscape Unit F) approximately 12 years old, extremely wildfire prone.

Current Wildfire Conditions - Landscape Unit F provides examples of an intentional and direct shift in vegetation types initiated by human intervention. This management shift can create both positive and negative effects from a wildfire management perspective. In most of these plantations, initial site preparation (i.e., vegetation removal) to create planting spots significantly reduces fuel levels and site flammability, especially if the original site is dominated by early seral brushfields, such as found in Landscape Units C, D, and E. For the short term, these plantations can offer significant benefits from a wildfire management perspective. With the resulting very minimal fuel loads, these sites can act like those in Landscape Unit A, offering excellent locations to concentrate wildfire suppression activities in a wildfire event. As plantations mature, however, they begin to form characteristics typical of early seral vegetation— dense, uniform vegetational profiles that can burn rapidly and intensely in a wildfire. Successful ponderosa pine plantations can be particularly flammable when canopies become interlocking, as pines have needles with high surface-to-volume ratios and canopies that allow rapid convective air flow. Unmanaged dense pine plantations 10 to 25+ years of age found in this landscape unit can be some of the most wildfire prone of the vegetation types in the AWUI. Understory vegetation in these developing plantations can be dominated by brush species, most notably whiteleaf manzanita, which can further exacerbate wildfire susceptibility. Even understories dominated by grass species can encourage rapid fire rate of spread when the grass cures in late summer. Although grass fires are usually of low intensity and short duration, the low crown base heights in unpruned plantations usually makes them more susceptible to crown fire development.

Management Opportunities - Minimizing fuel continuity in developing plantations is a high priority from a wildfire management perspective. This can be accomplished by pre-commercial thinning practices traditionally employed to maintain growth and vigor of preferred leave trees, followed by an aggressive pruning of limbs to increase crown base height (to 8 to 16 feet if possible) and create opportunities for future improved log quality (see Picture #22). Vertical discontinuity of fuels can be created in this fashion if thinning and

Picture #22 - Ponderosa pine plantation (Landscape Unit F). Thinned, pruned, piled and burned; vertical and horizontal discontinuity improved, wildfire hazard reduced.

pruning slash can be chipped, piled and burned, or perhaps utilized (portable sawmills can be used to cut boards if thinned pines are large enough). The pre-commercial thinning itself should be aggressive enough to create some horizontal discontinuity between canopy fuels, with 100 to 200 retained trees per acre (15 to 20 foot spacing) targets to shoot for. Wider spacings will create greater discontinuities in canopy fuels, but may open up stands enough to encourage understory development of ladder fuels in openings. Leaving untreated slash certainly increases wildfire susceptibility in pine plantations, as crown fire initiation is much more likely. Untreated pine slash can also serve as ideal bark beetle habitat, increasing insect populations that can then initiate a successful attack on retained preferred leave trees. Effective slash treatment is particularly important in pine plantations.

Management Issues - Pre-commercial thinning in pine plantations requires basic knowledge of thinning decision making (i.e. preferred leave trees, etc) and practical safety issues. If thinnings are of a merchantable size, more technical and professional expertise may be needed to harvest, market and/or utilize (lumber) logs. Utilizing fire to eliminate slash also requires a high degree of professionalism on sites close to homes and other improvements.

Other Resource Issues - Most of the plantations in the Ashland interface area are located on gentle slopes close to city limits and thus are not candidates for slope stability concerns. However, there are occasional plantations on steeper slopes of decomposed granitic soil types, and thinning prescriptions may be altered to retain more trees if slope stability is a concern. Single species, uniform age plantations are the least attractive vegetation types for wildlife in general, although dense cover in unmanaged plantations is used for hiding by some larger animals, such as deer and bear. Leave tree selection during thinning activities can improve species diversity by leaving more hardwoods and/or other conifer species, which will subsequently improve wildlife habitat values.

Landscape Unit G - Mixed Conifer & Hardwood, 75-125 Years - 30 units, 312 acres

Topographical Location - Landscape Unit G is typically located on 25 to 45 percent, mostly southerly/southeasterly aspects, usually on moderately sloped low to midslope locations at low to mid elevations in the AWUI.

Vegetative Description - Landscape Unit G is a vegetationally complex unit with a wide array of vegetational ages, species compositions, structures and densities. Typically, the sites are dominated by a mixed overstory of relatively equal amounts of ponderosa pine and Douglas-fir in the 60 to 100 (occasionally older) year age class. These two conifers generally comprise around three-quarters of the total stand basal area throughout Landscape Unit G. The high percentage of these larger overstory conifers is indicative of the deeper soils and higher site productivities than landscape units in lower slope positions (i.e. Landscape Units B and C). California black oak and especially Pacific madrone are also common parts of the overstory, although the larger conifers (typically up to 24+ inches DBH) usually are emergent above the hardwood component. Other overstory species include occasional sugar pine, incense cedar, and on the drier portions of this landscape unit, Oregon white oak. Typically, overstory trees range from 10 to 18 inches DBH, although structurally the stands in Landscape Unit G are complex and variable, and usually arranged within multiple cohorts, with trees of various sizes and ages intermixed throughout. Often these stands can be moderately to severely overstocked, particularly given the amount of competition for site resources from understory saplings, small trees, and brush. Understory species are typically dominated by two principal brush species - deerbrush ceanothus and whiteleaf manzanita, with a variety of other species and groundcovers. Portions of stands in this landscape unit can be dominated by brush species. In fact, in many locations, Landscape Units D and G have very similar site capabilities, and the dominance of

Picture #23 - Landscape Unit G - Untreated.

whiteleaf manzanita in Landscape Unit D is mostly related to a difference in disturbance history-namely, more recent higher intensity fire (such as the 1973 wildfire in the Hamilton Creek watershed), as compared to lower intensity fire in Landscape Unit G. Basal areas average 125 to 175 square feet per acre, although the range can be considerable from site-to-site. Overstory conifers also range considerably in vigor depending largely on stand density. Douglas-fir appear to be most affected by excessive stand densities, and Douglas-fir snags are not uncommon throughout Landscape Unit G.

Current Wildfire Conditions - Wildfire potential in the untreated portions of Landscape Unit G are usually very high for several reasons: 1) the unit is located on primarily southerly aspects that not only lengthens fire season, but also reduces fuel moisture and increases potential flammability and subsequent wildfire behavior, and 2) stand structures include high amounts of ladder fuels and relatively uniform and contiguous fuel profiles in both horizontal and vertical directions. Excessive snag development in portions of Landscape Unit G exacerbates wildfire behavior and potential spotting. Gentle to moderate topography in Landscape Unit G is favorable from a wildfire management perspective and access for wildfire suppression activities is often good.

Management Opportunities - The opportunity to create less wildfire prone vegetation types in Landscape Unit G is usually good (see Picture #24). Overstory conifers and even hardwoods often tower above understory vegetation and are vigorous enough to respond to stand density reductions in their vicinity. Often, non-commercial thinning and brushing alone can reduce stand densities to more favorable levels form a stand health perspective. (Bark beetle related mortality of overstory conifers following the 2001 drought year is becoming evident throughout the AWUI, however.) Utilization, piling and burning and perhaps in some cases prescribed underburning can

Picture #24 - Landscape Unit G - Recently treated (brushing, thinning, piling and burning). Vertical and horizontal discontinuity improved.

reduce fuel loads to much more acceptable levels. The more definite dominance of the larger overstory conifers in Landscape Unit G offers opportunities for maintaining reduced post-treatment understory development. However, stands in Landscape Unit G can also often be relatively open in nature, encouraging understory development and ultimately stand structures with less vertical discontinuity. However, this same discontinuous canopy profile in horizontal directions can provide wildfire management benefits if understory development can be controlled. Some of the largest and oldest conifers in the Ashland interface area (100 to 150 years) can be found in Landscape Unit G. Maintaining these larger trees through aggressive thinning within their vicinity should be a priority.

Management Issues - Understory thinning, brushing and fuel reduction activities can be accomplished at the same level of difficulty as other areas dominated by early successional vegetation. However, moving into the larger, more merchantable size classes will require a greater degree of skill and professionalism. Logs and/or lumber from home sawmilling may be able to be generated from fuels management activities in this landscape unit. Moderate slope gradients and easier access in many locations tend to increase management options and reduce costs.

Other Resource Issues- Slope stability concerns are generally minimal on these gentle to moderate slopes. Isolated spots that exceed 50-55 percent gradient may be of a slope stability concern and perhaps require professional assistance from a consulting engineering geologist. Good wildlife habitat and biodiversity values can be maintained in this landscape unit, particularly given the inherent species and structural diversity and older age classes of trees. The larger pines and hardwoods are particularly important to retain (and promote if possible) for these reasons. Re-creation of a vegetation type more typical of the pre-settlement era is probably more easily accomplished in this landscape unit than in perhaps any other in the AWUI. Open stand conditions in established mid-successional forests in the AWUI are rare- hence, their importance on the landscape level.

Landscape Unit H - Douglas-fir (Dead & Dying)/Pacific Madrone, 75-100 years - 27 units, 207 acres

Topographical Location- Landscape Unit H is located on moderate (25 to 55 percent) primarily northwesterly to northeasterly aspects, usually in midslope locations, often in association with steeper slopes of Landscape Unit J above.

Vegetation Description - Landscape Unit H is a transitional type on more northerly aspects in the AWUI between the lower elevation valley edge types, such as Landscape Units B and C, and the more productive, upper elevation sites of Landscape Units E and J. Vegetational conditions in this landscape unit and in adjacent Landscape Unit J were very similar twenty years ago, although these lower elevation sites contained a higher percentage of hardwoods, and conifers were slightly smaller, perhaps occurring at greater densities, and thus under greater moisture stress. In effect, much of this landscape unit could have been considered a lower extension of Landscape Unit J at that time. However, greater overall site and stand moisture stress in this landscape unit made the conifers (primarily Douglas-fir) highly susceptible to attack from bark beetles, particularly given the excessive densities. Extensive mortality has, in fact, been occurring in this landscape unit since the drought years of the late 1980's and early 1990's (see Picture #25). The area around the upper end of Lithia Park (Units H5 through H11) is the classic example of this situation, with 50 to 100 percent mortality of overstory 8 to 16 inch dbh Douglas-fir already having occurred within individual stands. On the other end of this transitional spectrum are sites that are currently experiencing initial but ongoing mortality of their overstory Douglas-fir component, such as Units H15 and H16 at the upper end of Morton Street. This disturbance event (i.e., bark beetle related mortality of dominant overstory Douglas-fir), in response to the lack of disturbance associated

Picture #25 - Density-related mortality of Douglas-fir (Landscape Unit 4).

with fire exclusion policies and subsequent excessive stand densities, has resulted in uniquely different vegetational types on the landscape, hence the separate delineation of Landscape Units H and J.. With the demise of the overstory Douglas-fir, total stand basal areas have dropped significantly, currently averaging 100 to 150 square feet per acre, as compared with pre-mortality totals of 175 to 225 square feet per acre. Unfortunately, the bark beetles that attack Douglas-fir tend to focus on the larger diameter classes, so the remaining Douglas-fir tend to be the smaller, suppressed individuals formerly in the understory. Scattered larger Douglas-fir 12 to 16 inches dbh also exist, although many remain of marginal vigor and may succumb to bark beetles in the future. The 2001 drought year exacerbated tree decline, and additional mortality in 2002 is likely. As a result, native hardwoods currently form a much greater percentage of the existing overstory, typically averaging two-thirds of the total stand basal area, with Pacific madrone about twice as abundant as California black oak. Douglas-fir snag abundance is variable in this landscape unit, depending largely on the timing of bark beetle attack and subsequent mortality. Some units are currently dominated by snags (e.g. Units H3, H4, H16), while others that were attacked ten or more years ago have fewer standing snags, but much greater amounts of large woody debris on the ground (e.g. Units H5 and H6 at the upper end of Lithia Park). The sudden availability of site resources, most notably water, following stand-level mortality of Douglas-fir, has resulted in rapid development of understory vegetation, most notably deerbrush ceanothus, poison oak, snowberry, hairy honeysuckle, and various grasses and broadleaved herbaceous plants. Also included in this landscape unit are several units that appear to have been dominated throughout their lives by hardwoods, in particular Pacific madrone in the 5 to 16 inch DBH class, with very little simultaneous development of conifers. These isolated stands (e.g. Units H20 and H21) have much higher basal areas, currently supporting 150 to 200 square feet per acre of primarily Pacific madrone, with only scattered emergent Douglas-fir.

Current Wildfire Conditions - Landscape Unit H has variable wildfire management characteristics, largely dependent on the amount of bark beetle related mortality of overstory Douglas-fir. In stands currently dominated by larger hardwoods and a minimal amount of bark beetle related mortality of Douglas-fir (e.g., Units H20 and H21), wildfire management potentials can be good, given decreased surface fuels. Existing dense stands will also continue to thwart development of ladder fuels. In a low to moderate intensity fire event, initiation and/or sustenance of rapidly expanding crown fire is unlikely. However, a dense canopy of primarily hardwoods could certainly sustain a rapidly spreading crown fire if one were to enter (rather than be initiated) in these types of stands. As increasing numbers of snags develop in stands in Landscape Unit H, however, wildfire potentials are dramatically increased for several reasons: 1) snags increase spotting of wildfire, provide a vector for transporting fire from surface to crown fuels, and can ultimately increase surface fuel loads as snags die and fall to the ground as large woody debris, 2) developing openings from mortality of overstory Douglas-fir initiate development of more wildfire prone early-successional vegetation. There is some evidence that hardwoods may be less susceptible in wildfire events due to physical and/or chemical characteristics that may retard fire behavior slightly, at least compared to conifers. However, hardwoods can also be susceptible to damage and/or mortality following a major fire than are the thicker-barked conifers. Rapid stump sprouting following mortality of hardwoods will likely insure continued dominance of this species on these sites, perhaps to the continued decline of Douglas-fir in the species composition.

Management Opportunities - In stands that still contain Douglas-fir as a considerable portion of their overstory component, stand density reduction to improve their vigor is desirable, provided they are still capable of responding. This would be a similar treatment to that described for Landscape Unit J. On the other end of the spectrum in Landscape Unit H, there are few examples in the Eastern Siskiyous of older stands dominated by hardwoods (particularly Pacific madrone) that have grown to an advanced stage of development, making it more difficult to project possible management directions for these types of stands. Rather, this stand type exists largely because of a change in disturbance history from frequent, low-intensity disturbance in the pre-settlement era to infrequent, moderate to high-intensity disturbance today. It is unknown how long Pacific madrone can maintain individual tree vigor amidst escalating stand densities, but one can assume that those

Picture #26 - Silvicultural thinning and piling along Strawberry Lane in Landscape Unit H.

stands currently at high densities of hardwoods (i.e. basal areas of 150-175+ square feet per acre or more) will continue to experience mortality over time, with the associated negatives from a wildfire management perspective. In between these two extremes in Landscape Unit H are the mixed stands with light to heavy Douglas-fir snag components- in effect, various levels of ongoing stand density reduction initiated by bark beetles. Additional stand density reduction may be needed in some stands to meet stand vigor and wildfire management objectives, while others in this landscape unit may already be at sufficiently reduced stand densities. In those areas throughout Landscape Unit H where wildfire management objectives are prioritized, snags should be felled and their tops and limbs piled and burned. If large enough and still merchantable (Douglas-fir can rapidly decay and check, and become unmerchantable), logs can be sold to mills if harvest and removal can be accomplished in an ecologically and economically sound fashion. Snags and large woody debris may also be left on-site for other values (see below), particularly in low priority areas from a wildfire management perspective (e.g. midslope positions, steeper sites, etc.). Hardwood thinning may be appropriate in stands that are currently overstocked with hardwoods. Maintaining a sufficient overstory (even of hardwoods) to retard development of understory ladder fuels is a desirable objective, at least in the short term. Utilization (Pacific madrone is the most desired species for firewood in southern Oregon) and/or piling and burning of thinning slash is highly desirable in order to maintain reduced surface fuels. Coupled with good crown base heights and increased canopy spacing, this treatment could improve an already reasonable vegetational profile from a wildfire management perspective. Small clearings within these stands can also be planted with conifers to try to return conifers to these sites, although this practice will ultimately result in increased ladder fuels (which may already be occurring as a result of natural regeneration following overstory mortality.

Management Issues - Landscape Unit H is perhaps the most difficult landscape unit to actively implement management activities in the AWUI due to a combination of moderate to steep slopes, poor access, larger trees, and a high number of dangerous snags. Accomplishing management objectives in this landscape unit will require a high degree of professionalism. Logs, as well as smaller by-products, may be retrievable from this landscape unit if access is available. Ground-based equipment should only be utilized on the gentler slopes (up to 25-30 percent) in this landscape unit to avoid excessive soil disturbance and displacement. On steeper slopes, product utilization will probably be limited to merchantable logs, and then only if sufficient volumes of timber can warrant utilization of a helicopter. Selecting leave trees and/or thinning strategies in these highly stressed, stagnated stands also requires a high degree of professionalism–thinning too few or too many of these types of stands can produce negative results.

Other Resource Issues - Snags are critical wildlife habitat features that not only serve important roles standing but also when they fall, becoming large woody debris and serving a variety of important ecological functions in that capacity. Currently, there are more conifer snags in Landscape Unit H than in any other location in the AWUI, although it is rare that they are larger than 18 inches DBH. Although this size class of snags are not as valuable as larger size classes, retention of snags in this landscape unit is still a priority from a wildlife habitat perspective. Selecting appropriate locations for snag retention that don't conflict with wildfire management objectives is one strategy for accomplishing both objectives on a landscape basis. To the degree possible, thinning to retain and promote the larger Douglas-fir in Landscape Unit H is desirable and should encourage more rapid development of the more valuable larger conifers in the long term. In the interim, it is suspected that ongoing snag development will continue to occur over time in this landscape unit, as well as elsewhere in the AWUI. The expanding patch mortality of Douglas-fir has also created a more structurally diverse vegetational community, as well as increasing plant species diversity within the stands as early successional vegetation re-establishes in previously more homogenous vegetational profile. These are important plusses from wildlife habitat and biodiversity perspectives, but certainly a concern from a wildfire management viewpoint. It is also a concern from a slope stability perspective, as vegetation removal and subsequent loss of root strength can aggravate slope failure on failure-prone sites. It is advised that an engineering geologist be consulted prior to initiating management activities on these steeper or failure prone sites, particularly those that have recently (within the last ten years) sustained a high amount of tree mortality.

Landscape Unit J - Douglas-fir/Pacific Madrone

75-100 Years - 42 units, 734 acres

Topographical Location - Landscape Unit J is located on 40 to 65 percent (and occasionally steeper) mostly northerly aspects, primarily in upper slope positions, including headwalls

Vegetation Description - Landscape Unit J is a relatively common type located on moderately steep to very steep northeasterly to northwesterly aspects in the AWUI. This type, usually initiated after intense wildfire in 1901 or 1910, is currently dominated by extremely dense Douglas-fir poles 4 to 16 inches DBH, and occasionally larger (particularly at the upper elevations). These stands, grown at excessive densities throughout their life, are currently at very high densities for these sites, averaging 175 to 225 square feet per acre basal area. Douglas-fir generally comprise 75 to 90 percent of this total stand basal area, with the remainder usually comprised of similar sized Pacific madrone that are rapidly becoming overtopped and shaded out. The Douglas-fir, are moderately to severely suppressed and of generally very poor vigor, as evidenced by growth rates of 15 to 50 rings per inch and very small crowns of 20 percent crown ratio or less. In this condition, many of these trees and stands are ripe for a serious outbreak of bark beetle related mortality, such as has occurred in the slightly less productive sites in Landscape Unit H below. In fact, mortality of Douglas-fir is occurring in this landscape unit, particularly at lower elevations or in transitional areas (unit edges) with Landscape Unit H or other less productive landscape units. Understory vegetation is usually sparse, except in snag -related openings where invading early seral vegetation develops. Site productivities are the best on these northerly aspects of any of the landscape units in the interface, particularly those at the higher elevations.

Picture #27 - Landscape Unit J - Untreated; density related mortality and bark beetle infestation likely.

Current Wildfire Conditions - Landscape Unit J is comprised of stands of conifers that have good wildfire management characteristics, if they can be retained. Surface fuels are low and height to crown base is very high, typically 35 to 60 feet. However, the excessive stand densities throughout most of the unit insure that snag development and subsequent openings will continue to occur, both characteristics that can rapidly escalate wildfire behavior. Once crown fire is initiated in these stands on steeper slopes, it can often easily spread as crown fuels are both excessive and continuous. The potential for considerable bark beetle related mortality in these overstocked stands can create excessive snags and ultimately produce perhaps our most wildfire prone landscape unit (e.g., Landscape Unit H)—steep slopes covered with standing snags and jackstrawed downed snags intermixed amongst highly flammable early seral vegetation that establishes following mortality of the overstory component. If at all possible, avoiding this scenario through stand density reduction and maintaining existing favorable wildfire management conditions is highly desirable.

Management Opportunity - Stand density reduction in the overstocked stands of Landscape Unit J is the obvious management priority. Sometimes, this can be accomplished solely through non-commercial thinning of suppressed conifers and understory hardwoods. However, on more productive sites, particularly those at higher elevation, achieving appropriate stand densities will require removal of conifers of merchantable size classes. Topographic reality, erosive soils, and limited access in most situations suggest that helicopters would be used in commercial harvest activities. Stands should be thinned to densities that will release preferred leave trees and allow them to improve in growth and vigor, while simultaneously remaining dense enough to discourage development of understory ladder fuels. Once this is accomplished, the stands in Landscape Unit J will retain excellent structural characteristics from a wildfire management perspective, with high distances to crown base and excellent vertical discontinuity of fuels (see Picture #28). Even

Picture #28 - Fifteen years after silvicultural thinning-from-below; note limited development of understory ladder fuels due to retention of fully stocked stand crown fuels can be reduced, although great care should be taken not to open these stands too excessively as they can easily shock and/or tip over due to their high height-to-crown ratios. Removal and/or burning (pile burning or perhaps prescribed underburning) of thinning slash is imperative to maintain an effective fuel reduction zone. In areas where dense snags have already occurred, snag removal has to be coupled with management activities such as described in Landscape Unit H. Some snags can be retained for wildlife habitat values in locations where wildfire management is not a critical priority, although most snags in Landscape Unit J are small (14 inches DBH or less).

Management Issues- Landscape Unit J (along with Landscape Unit H) is probably the most difficult landscape unit in the AWUI in which to accomplish vegetation and wildfire management objectives. Steep topography and associated access and safety issues, larger vegetation size classes, sensitivity of the existing sites and stands to manipulation, and the potential commercial value of some of the conifers to be removed all suggest that great care and a high degree of professionalism be utilized when implementing management actions in Landscape Unit J.

Other Resource Issues - Steeper slopes in Landscape Unit J are prone to slope failures and subsequent development of debris slides, potentially impacting structures and other property and resource values below. Openings in stands, either intentional or via insect/disease attacks, can exacerbate this possibility. Professional assistance via an engineering geologist is recommended prior to initiating work throughout most of this landscape unit, particularly on those sites above 50 to 55 percent gradient. Stand density reduction in Landscape Unit J should open some growing space, improve light availability, and increase plant species diversity- important wildlife habitat and biodiversity objectives. If these stands can be retained, if not promoted, through stand density reduction, they offer the best likelihood in the AWUI of providing mid to late successional values in the future. Harvest of any merchantable timber in this landscape unit should be done in ways (e.g. helicopter) that minimize soil disturbance on these steeper slopes.

Landscape Unit K - 15 units, 155 acres

Topographical Location- Along creeks and draws throughout the AWUI, most of which flow in a northerly to easterly direction.

Vegetation Description - Landscape Unit K comprises the various aquatic and riparian ecosystems within the AWUI. Riparian and aquatic ecosystems primarily include creeks and streams (aquatic ecosystems) as well as transitional areas (riparian ecosystems) between aquatic ecosystems and adjacent upland or terrestrial ecosystems. In the AWUI, most waterways are seasonal in nature, primarily running surface water only during the winter months. The one major exception is Ashland Creek, which runs water year-round and has the most well-developed aquatic and riparian ecosystem values in the AWUI. Tolman Creek, Hamilton Creek, and Roca Creek are three other largely seasonal creeks south of Ashland Creek that drain the slopes above town. Although these three often do not run surface water in the late summer season, they do support high levels of groundwater throughout the year. The vegetation that thrive in these situations is unique and contains species that are not found elsewhere in the area. These include tree species such as Oregon ash, black cottonwood, red alder, bigleaf maple, and willow species, as well as other plant species including mock orange, ninebark, horsetails, sedges, rushes, and others. Also included in riparian ecosystems are most of the other species native to adjacent uplands, particularly growing in the upper portions of the riparian ecosystem. Exotics such as Himalayan blackberry and English ivy have also become well established in many riparian habitats, often to the exclusion of other native species. This complex of vegetation offers the greatest species and structural diversity in the AWUI.

Picture #29 - Riparian habitat (Landscape Unit K) along Hamilton Creek.

Current Wildfire Conditions - Wildfire potentials in riparian habitats are generally reduced from adjacent upland areas on a landscape basis. The reason is obvious—higher humidities, cooler

Picture #30 - Multi-species, multi-layered stand in riparian habitat of Landscape Unit K. Ladder fuels make this stand very wildfire prone.

temperatures, and the high amount of perennially available water allows for vegetation with higher moisture levels than elsewhere on the landscape, and for far longer periods of time, thereby shortening the fire season. Nonetheless, wildfire is certainly a potentiality in these areas, increasingly so as the size of the aquatic ecosystem decreases. Minor draws higher in landscapes can often burn just as intensely as adjacent uplands. In the AWUI, as in many areas, the importance of retention of vegetation in riparian ecosystems for hydrological, ecological, aesthetic, and other reasons is perhaps greater than elsewhere in the landscape. Unfortunately, retention of this high amount of vegetation, often occurring in a structurally diverse fashion with multiple canopies and significant vegetational continuity, can also result in increased wildfire behavior, intensity, and rate of spread. In the AWUI, dense, highly flammable wildland vegetation extends the farthest into the urban areas of Ashland within the riparian habitats along the major creeks and streams. In these locations, balancing wildfire management goals with other significant and important values in riparian/aquatic ecosystems will be a real challenge.

Management Opportunities/Management Issues/Other Resource Issues - The aquatic and riparian portions of almost all landscapes in the western United States have come under dramatically increased attention and pressure within the last 10 to 20 years because:

(1) Availability of large quantities and quality of water is becoming an increasingly valuable, albeit rarer, commodity, being highly desired by municipal, industrial, agricultural, commercial, and residential users.

(2) These areas inherently contain high recreational and developmental potential.

(3) Riparian ecosystems contain habitat values that are not only unique on the landscape but are also the habitat type that has often been most abused, and subsequently diminished, both in terms of quantity and quality.

(4) An increasing number of species have decreased dramatically in abundance (most notably salmonids) such that regulatory mechanisms have been instituted and are continually being upgraded to protect riparian and aquatic ecosystems and the threatened or endangered organisms that depend on them.

(5) These areas can act as buffers during floodstage flows, helping absorb the destructive energy of excessive water.

This report is not designed to present detailed descriptions or management recommendations for these critically important and inherently complex ecosystems. However, it is important to fully understand the important inherent values that exist in functioning aquatic and riparian habitats. In many cases, in this landscape unit, the management choice to do nothing will still retain many critically important values.

The presence and functioning of great numbers and diversities of vegetation, many of which are only found in these aquatic/riparian ecosystems, provides for a unique vegetational community. Its associated diversity, seldom found elsewhere in the landscape, simultaneously provides for disproportionately large numbers and diversities of wildlife species—much greater than for any other habitat type. Good riparian habitat usually supplies all of the basic components of good wildlife habitat: food, cover, and most importantly water. Cover is often well developed along riparian areas. This is fortunate because all animals are highly dependent upon year-round water sources (particularly in droughty southern Oregon), and this cover provides the necessary protection around these highly used areas, as well as providing access corridors for migration and dispersal. Too, the location of long, thin riparian habitats along stream courses allows for a high percentage of ecotonal boundaries (edge effect) where wildlife species have access to multiple adjacent habitat types.

Several wildlife species are only found in year-round sources of water. Amphibians are particularly dependent on sources of water and, along with some reptiles (such as western pond turtles, a rapidly declining species) spend most of their lives in water, particularly relying on it during reproduction. Bird densities are over twice as high in riparian habitat as in adjacent upland habitat, a particularly important figure influencing rapidly declining populations of neotropical songbirds. Perhaps most important are the influences that healthy aquatic and riparian ecosystems have on native fish populations, particularly salmonids, although this effect is mostly downstream from the creek systems in the AWUI.

Healthy riparian systems also perform important functions relating to water quantity and quality, as well as mitigation of erosional effects. Streamside vegetational buffers improve overall water quality by acting as natural filters to trap water-borne sediments, excess nutrients, and pollutants pulsing through the system via streamflow, groundwater flow, or being carried overland. This function helps minimize the downstream development of algal blooms, low oxygen levels, and other water quality deficiencies that can negatively affect all types of aquatic life, including native fish populations.

Riparian vegetation also acts like a natural sponge to reduce floodstage flows, a critical benefit for the Ashland community. Riparian vegetation also creates a beneficial microclimate which prolongs the average flow for longer periods of time, even into summer when low flows are the greatest threat to aquatic organisms. The greater proliferation of roads, skidroads, driveways, and other bare soil surfaces within a watershed encourage much more rapid movement of water through the hydrologic system, thereby encouraging more rapid accumulation of high peak flows in major storm events. A potential for greatly accelerated erosion in creek and stream channels results, with dramatically increased amounts of sediment and debris scouring drainages, significantly increasing flood effects and sediment entry into major streams, with significant deleterious effects on fish populations by clouding the water, suffocating fish eggs placed in gravel spawning beds, damaging delicate gills of fish, and degrading habitat for the aquatic macro invertebrates (larval forms of aquatic insects) upon which fish populations depend for a food source. Downcutting can also lead to lowering of groundwater tables and subsequent reduction in adjacent meadow, pasture, or forestland productivity. Establishment and maintenance of riparian buffers subsequently becomes that much more important, as its "buffering" effect helps to reduce creek flow intensity, velocity, and associated erosion and is of critical importance during major storm events. Conversely, destruction of riparian vegetation along stream courses reduces this buffering effect, accelerating downcutting of the stream channel. Vegetation in riparian buffers also provides stream shading which lowers water temperatures, especially in lower reaches where higher water temperatures stress native fish and encourage deleterious algal blooms. Overhanging vegetation also drops leaves, twigs, and insects into the water, providing food sources for aquatic insects and ultimately all other organisms higher up the food chain.

To protect and/or improve the aquatic resources, numerous practices have been employed within stream and riparian ecosystems. Key practices include the following:

1. Leaving large trees to provide shade, stabilize streambanks, and provide future large woody debris. Large wood provides many structural and biological benefits in complex stream habitats, including fostering of pool development, dissipation of hydraulic power of streams, helping to store sediments and gravel for spawning, providing hiding cover and encouraging development of off-channel habitat (low velocity refuges) during high flows, slowing transport of sediment and bedload, trapping and retaining organic debris, providing a food source itself for aquatic macroinvertebrates, and others. In some situations, large woody debris or rocks can be added to stream channels to create complex in-stream structure, thereby providing future hiding, resting, feeding, and rearing habitat in those fish-bearing creeks (only Ashland Creek in the AWUI).

2. Adding future shade and large tree development by planting conifers in denuded portions of streams. Many riparian buffers have had conifers systematically removed and are currently dominated by hardwoods, shrubs, and other non-coniferous species. These not only provide much smaller forms of debris, but are generally much less resistant to decay, thereby reducing their effectiveness at improving structural complexity in streams. It is important to note that conifers do not necessarily regenerate and succeed hardwoods without additional disturbance (i.e., cutting) to create gaps where they can get a start.

3. Planting other streamside vegetation (e.g., willows or other riparian vegetation) to stabilize eroding banks or downcutting channels and reduce inputs of sediments.

4. Shift vegetation away from dominance by aggressive, non-native species such as blackberry, ivy, and others.

5. Preventing unnecessary additions of excess sediment through such upland management practices as: careful and professional planning and construction of new roads; creation and/or maintenance of adequate road drainage facilities so that water and sediment are diverted rather than flowing directly downroad; minimizing road or skid road use during periods of high rain or snowmelt; and constant monitoring of road drainage facilities, particularly during major storm events when the greatest amount of erosion, sedimentation, and watershed deterioration occur.

6. Returning streams to their original channels where past management endeavors have intentionally or unintentionally altered their course.

These more traditional management practices employed to improve riparian and aquatic habitat values may have to be modified in portions of the AWUI if wildfire management objectives are prioritized. Left untreated to minimize wildfire potential, it is possible that these locations could burn *more* intensely than elsewhere on the landscape—an unfortunate outcome from multiple perspectives. The principles of stand density and stand structure, and their relationship with wildfire behavior, apply in riparian habitats as directly as elsewhere in the AWUI. Retention of highly wildfire prone vegetational conditions within riparian/aquatic ecosystems is particularly undesirable within the urban setting, where rapid wildfire escalation could have dire consequences.

Creating vegetational and fuel discontinuities could be utilized in this landscape unit as elsewhere in the AWUI, hopefully while retaining other important values. A secondary option would be to implement heavier vegetation and fuel reductions adjacent heavily vegetated riparian habitats. Removal of Himalayan blackberry alone in many riparian habitats could improve wildfire management potentials by reducing these ladder fuels.

Use of other more moisture sensitive species, such as mosses, lichens, and bryophytes, as indicators to determine gradations of riparian influence is an important emerging management strategy that can guide the size of the area where riparian management guidelines should apply.

B. Landscape Level Analysis of AWUI

The previous section described methods by which quantitative hazard assessments can be made for any one location within the AWUI. This scale of analysis is important to decipher each location's relative potential for initiation and/or contribution to wildfire behavior.

Wildfires today, however, are typically much larger than the fine scale unit delineations used in this report. Wildfires in the 1,000 to 10,000 acre scale have become commonplace in southern Oregon in the last 50 years. This is the type of wildfire event that is the highest priority to try to avoid in the AWUI for the variety of reasons previously described. In these types of wildfire events, cumulative effects of wildfire behavior can create a much different type of fire than those only involving single, smaller locations. Similarly, the cumulative analysis of vegetative types and wildfire susceptibilities, coupled with resulting reductions from active management activities, can create a different set of issues and opportunities than when simply analyzing individual locations. A landscape level approach to wildfire management, both in terms of preventative measures and during an actual event, is necessary to minimize negative impacts and effects associated with large scale, high-intensity, vegetation replacement wildfire.

A landscape level approach to wildfire management, both in terms of preventative measures and during an actual event, is necessary to minimize negative impacts and effects associated with large scale, high-intensity, vegetation replacement wildfire.

On a landscape level within the AWUI, there are key areas where existing site conditions (vegetational profiles, topography, access limitations, etc.) allow for the greatest opportunity for suppressing escalating wildfire behavior. Implementation of pre-suppression management activities within these individual units could be particularly effective in minimizing the size and/or intensity of a wildfire , its subsequent effects on important values. In addition, there are other areas of critical concern where vegetation manipulation to achieve wildfire management objectives could significantly increase the potential protection of important homes, improvements, or resource values. Wildfire management and fuel reduction within these areas are management priorities; that is, these are areas where the greatest benefit per given unit of cost can be obtained.

Within the AWUI, there are also key areas that offer specific tactical opportunities for effective suppression during a wildfire. These are generally areas that currently have favorable fuel and vegetation profiles from a wildfire management perspective, as well as reasonable access for utilization of them during wildfires. Effective utilization of these tactical opportunities in a wildfire could be critical in minimizing losses of life, property, and/or resource values.

The delineation of management priorities and tactical opportunities in this report is not exhaustive, and it is fully acknowledged that other important locations for the above may exist as well. It is also recognized that management priorities and tactical opportunities will change with time as vegetation grows and/or is altered, and/or other wildfire management practices are implemented

It is also important to note that this landscape level analysis focused strictly on existing site, fuels/vegetation, access and other wildfire management conditions regardless of existing property boundaries. The management priorities and tactical opportunities that follow do not take into account opportunities and/or difficulties that result when objectives and desires of individual owners are considered. It is critical to understand that the effectiveness of any landscape level wildfire plan, or of the specific management priorities or practical opportunities suggested, will ultimately depend on community level acceptance and involvement, particularly by the AWUI residents affected.

It is critical to understand that the effectiveness of any landscape level wildfire plan, or of the specific management priorities or practical opportunities suggested, will ultimately depend on community level acceptance and involvement, particularly by the AWUI residents affected.

The following suggestions for management priorities and tactical opportunities are also strongly affected by the quality and extent of wildfire management practices implemented in areas adjacent to the AWUI. Within the city limits of Ashland, numerous activities can decrease both the likelihood, extent, and severity of fire when it occurs. Creation of defensible space around homes on the urban/suburban fringe close to the AWUI is particularly important. Other important factors include access and associated response time, wildfire suppression capabilities, dwelling density, firesafe construction practices, and others

In the other direction, the effectiveness of wildfire management practices on a landscape level will be strongly influenced by coordination with the U.S. Forest Service on lands above the AWUI. A key use of this report lies in its potential to interface with U.S. Forest Service fire management planning and on-the-ground activities on lands adjacent to the AWUI. To be effective, fire management planning must work across jurisdictional boundaries to allow for landscape scale prioritization and implementation of pre-fire treatments, as well as suppression activities in a wildfire.

1. Management Priorities for Pre-Suppression Activities

Management Priority #1

This area comprises a major topographical ridgeline separating the Wrights Creek drainage from the Ashland Creek drainage. The 4,000-acre 1959 wildfire, driven by up-valley winds in the Bear Creek Valley, crossed at this location into the Ashland Creek watershed, turning southeast and racing unimpeded upcanyon into the Ashland watershed. Intensive fuel reduction in this location would allow the first suppression opportunity to try to prevent a recurrence of this event and subsequent threatening of homes and lives in the Ashland Creek canyon, as well as critical resource values in the Ashland watershed. Development of this fuel reduction zone would concentrate on breaking up horizontal fuel and vegetation continuity currently in early successional stages. This fuel reduction zone could utilize favorable wildfire management zones at the upper end of Wrights Creek (Tactical Opportunity #1) and work the ridgeline adjacent Hitt Road well up into the U.S. Forest Service ownership. This fuel reduction zone would provide a distinct opportunity for compartmentalizing a developing wildfire into a discreetly smaller event.

Management Priority #2

A major area of untreated wildland vegetation extends northerly along a small knob/ridgeline separating the Wrights Creek drainage from the main Bear Creek Valley. Recent development in the Wrights Creek drainage is beginning to encircle this knob, making the presence of the highly wildfire-prone vegetation that much more ominous in a wildfire event. Area-wide fuel reduction in this location can hopefully prevent wildfire from spreading from the Wrights Creek drainage into the more urban settings to the east, or vice-versa. Recent fuel reduction work in this area (Units C2,C4,C5,H1) has begun a fuel reduction zone that could be a significant suppression opportunity in a wildfire event, as well as protecting homes in the vicinity. Although more vegetation and fuels reduction could be done in these treated areas in the future, they serve as a sample of a good first step in a proactive wildfire management strategy for the area.

Management Priority #3

The largest area of fuels of extreme hazard in the AWUI exists on the moderately steep to very steep easterly aspects west of Ashland Creek. This area was mostly burned at high intensities in the 1959 wildfire. Existing early seral vegetation that has since returned to the area is once again an extreme hazard, with subsequent likelihood for a return of high-intensity wildfire. A wildfire in this area could threaten not only homes west of Granite Street, but also important resource values upcanyon in the Ashland watershed. In 1959, wildfire intensity was low in the areas immediately above the homes along Granite Street (perhaps these areas were intentionally backburned to prevent wildfire spread into the urban area). Existing vegetation in Units J1,G1, and J2 currently comprises primarily older conifers and hardwoods that offer good possibilities for creation of vertical fuel discontinuities and favorable stand structures from a wildfire management perspective. Stand density reduction through understory thinning in this location, followed by excellent slash treatment, could accomplish this goal while improving the health and vigor of the remaining overstory trees. Completion of this work would create a fuel reduction zone running from existing grasslands in Unit A6 south to a fuel reduction zone described in Management Opportunity #4.

Management Opportunity #4

A series of fuel reduction zones and tactical opportunities have been created by the U.S. Forest Service and the City of Ashland upslope, perpendicular to, and on the west side of Ashland Creek (Units G2/D11/E4; G8/E6; U.S. Forest Service fuelbreak in southwest quarter of Section 16). Each of these provide an opportunity to utilize suppression tactics to check wildfire advancing upcanyon towards the valuable Ashland watershed. Fuel reduction in Management Opportunity #4 would provide yet one more opportunity to check this advance. Multiple opportunities are highly desirable because it is never known what time of day (with resulting fire intensity) the advancing wildfire will reach a fuel reduction zone. This management opportunity could be particularly effective

Picture #31 - New home construction into wildfire prone vegetation in lower portion of Management Opportunity #4. Conifer patch in background (Landscape Units H, J) escaped 1959 wildfire (early successional vegetation in upper third of slope).

because it is a relatively broad area on more moderate slopes with generally reduced site productivities and vegetation abundance—all features that lend themselves to fuel reduction zone effectiveness, particularly in this area where utilization of fuel reduction zones in a wildfire event is problematic given the dense early successional vegetation and extreme fire hazard on very steep slopes. This fuel reduction zone could also tie into Management Opportunity #1 at the top, allowing potentially more effective compartmentalization of wildfire. Fuel reduction in the lower (easternmost) portion of this management opportunity is particularly important in providing protection for the Ashland Creek Drive subdivision (see Picture #31). Work would primarily entail manual brushing, and piling and burning to create horizontal fuel discontinuities. Once completed, this management opportunity would tie into Management Opportunity #3 at its bottom (easternmost) portion, providing yet another opportunity for compartmentalization of a developing wildfire. Slope stability issues in this area above Ashland Creek subdivision will have to be addressed, however.

Management Priority #5

Management Priority #5 comprises the single most significant extension of wildland vegetation into the urban area of Ashland—that being the upper slopes of Lithia Park immediately above and east of Ashland Creek. This is a major area of dense, fire prone vegetation of high to extreme hazard adjacent an area of considerable human use with its associated extreme risk of ignition. Wildfire behavior could escalate dramatically in this area, particularly if strong upslope or upcanyon winds were occurring—not an unlikely scenario in a wildfire event. Rapid escalation of wildfire behavior upcanyon could threaten homes south of this unit and perhaps challenge the effectiveness of fuel reduction efforts undertaken south of this unit (primarily on City of Ashland lands) in the throat of the Ashland watershed. Also potentially threatened could be homes along the ridgetop east of this unit, along Ridge and Terrace Streets. Fortunately, good fuel reduction work recently completed along Glenview Street has reduced this possibility and provided an accessible opportunity for suppression response (see Tactical Opportunity #5). Continuing this type of vegetation manipulation and fuel reduction throughout this Management Priority could significantly minimize wildfire potential. It must be noted that in the absence of other stand density reduction activities, significant insect-related mortality of almost all overstory Douglas-fir in this area occurred during the drought years of the early 1990s. These dead trees were felled to minimize their contribution to wildfire spread, although they currently contribute significant fuel loading on the ground, particularly in the south half of the area.

Management Priority #6

Mountain Park Estates is a planned unit subdivision at the top of Morton Street that extends well up into wildland vegetation types in relatively steep topography. Although some management to reduce wildfire hazard has been accomplished in the vicinity, this area is surrounded on portions of all sides by highly flammable, wildfire-prone vegetation types. Several stands (Units H16, H17) of severely overstocked Douglas-fir/Pacific madrone are located in close proximity, each with a significant number of recent snags, a process which will undoubtedly continue. Wildfire-prone dense early seral vegetation (Units C14, C15, D16) is also located in close proximity. Both of these vegetation conditions can produce extreme wildfire behavior, particularly in steeper topography such as occurs here. Of additional concern is an extended wildland vegetation type downhill from the subdivision (Units C14/J26). Wildfire in this occluded interface would not only threatens homes within and immediately adjacent it, but also can contribute to rapidly escalating wildfire behavior in uphill directions (towards Mountain Park Estates). Manipulating vegetation to achieve wildfire management objectives are described in this report for Landscape Units 2, 3, 6, 7, and 10, which all occur in close proximity to this location.

Management Priority #7

Similar to Management Opportunity #6, this location is another instance where dense, wildfire-prone, wildland vegetation extends into a more urban/suburban setting at the upper end of Beech Street. Residences on all sides and within this vegetation are susceptible to rapidly developing and/or encroaching wildfire. Vegetation manipulation to create more wildfire resistant vegetational types would be appropriate in this area. Vegetation manipulation on a broad, gentle ridgeline between two seasonal creeks west of Beech Street (Units C16, D17) could create the type of fuel reduction zone that could be extremely valuable in a wildfire event. The more easterly of these two draws (Unit K10) contains dense riparian vegetation very close to homes along Beech Street. Accomplishing wildfire management objectives through vegetation manipulation while maintaining maximum riparian habitat values can be difficult to accomplish (see section on Landscape Unit K), but may be particularly important in this location.

Management Priority #8

Two relatively large areas of early seral vegetational communities dominated by whiteleaf manzanita and Pacific madrone are located adjacent Ashland city limits on either side of Elkader Street. These extreme fire hazard types were initiated following the 1973 Hillview fire, which ultimately consumed about 750 acres, was initiated by arson at the very bottom of Unit E10 and spread rapidly up and into the Hamilton Creek watershed in a very hot, high intensity wildfire. Brushfields in both units could easily create a similar wildfire scenario, threatening not only homes in the immediate vicinity but also residents at the upper end of Elkader Street and Timberline Terrace above these wildfire-prone early seral vegetation types. This is particularly unnerving given that these two streets offer the only vehicle access for these residences; hence, the possible disastrous scenario of having to drive through an advancing wildfire in order to escape. Wildfire management opportunities to reduce wildfire danger in these brushfields is described for Landscape Units D and E elsewhere in this report. Two units of Landscape Unit H (Units H20, H21) are also located adjacent and intermixed with houses in this area. These units, dominated by older overstory hardwoods, have reasonably favorable stand characteristics from a wildfire management perspective (low surface fuels, minimal ladder fuels), but generally have very dense canopies that could carry fire in a wildfire event. Light to moderate stand density reduction could decrease this continuous fuel profile while minimizing ladder fuel development (see section on Management Opportunities for Landscape Unit H). Excellent slash treatment in all these areas would be imperative.

Management Priority #9

Flammable vegetation types also extend well into the urban/suburban portions of Ashland along Roca Creek. Fortunately, a considerable portion of this area has been maintained as pastureland (Unit A15), a highly favorable vegetation type from a wildfire management perspective, particularly if irrigated during summer. The narrow riparian buffer with limited vegetational development at the bottom of Unit A15 probably also contributes to a less wildfire-prone condition. Although fire intensity and/or duration is not high in this vegetation type and can usually be easily suppressed if firefighting equipment can reach the site, fire rate of spread can be very fast in dryland pastures or grasslands. Running quickly uphill or upcanyon, it could possibly spread into fuel types above Unit A15 (the older overstory trees in Unit H19) that could rapidly escalate wildfire behavior into the crowns and ultimately into the subdivision to the east (which also supports a fairly dense canopy of overstory trees), as well as parcels and structures to the south as described in Management Opportunity #8 Maintaining irrigated pasture in Unit A15 for as long as possible in the summer season would be an excellent wildfire prevention strategy. Stand management activities such as described for Landscape Units B and H could decrease the potential for crown fires in Units B16 and H19.

Management Priority #10

Hamilton Creek is the second largest riparian habitat (after Ashland Creek) with associated wildland vegetation to extend down into the urban/suburban area of Ashland. This vegetation type extends all the way to Siskiyou Boulevard and provides many important values in the urban/suburban context (wildlife habitat, vegetation buffering and flood stage control, aesthetics, open space, recreation, etc.). In dry summer conditions, however, these riparian corridors can rapidly escalate wildfire behavior and even become a corridor for wildfire themselves. A similar situation was described for Management Opportunity #4 (upper Lithia Park). Actual management to minimize wildfire potential and impacts may or may not be desirable when the multiplicity of other values are considered. Nonetheless, it is important that this area (Unit K14) be identified and analyzed when considering potential wildfire concerns. Areas adjacent the upper portions of Unit K14 also contain an important management opportunity. Fuel reduction in the uplands immediately adjacent and west of the riparian habitat of Hamilton Creek could help prevent spread of wildfire across the canyon such as occurred in the 1973 Hillview Fire. Slope gradients are gentler on the west side of the creek, making fuel reduction benefits more compelling than on the steeper eastern side of the creek. Good access is also available paralleling the creek for almost its entire length. An effective fuel reduction zone in this location could help compartmentalize a developing wildfire and subsequently reduce the likelihood of wildfire spread into the Ashland watershed or other forested areas upslope.

Management Priority #11 - Throughout the Interface

Two management priorities exist throughout the AWUI and are combined under this category. These are:

1. Roadside clearing of excessive flammable vegetation along all major roadways in the AWUI should be a management priority. These locations are high probability locations for fire ignition from accidents, arsonists, cigarettes, etc. Reducing the flammability of roadside vegetation will increase the likelihood that timely response may be able to suppress the developing fire before it escalates and becomes uncontrollable.
2. Ongoing maintenance of all currently delineated tactical opportunities to insure their continued utilization and effectiveness in a wildfire event.

2. Tactical Opportunities for Wildfire Suppression

Landscape level mapping of the AWUI has provided some clear opportunities for tactical suppression in a developing wildfire event. The following areas have been delineated because the vegetation/fuel complex is such that fire intensities and rates-of-spread would likely be decreased in a wildfire event, offering opportunities for control. Identifying and ultimately linking these areas through appropriate wildfire management activities should improve opportunities to minimize and/or compartmentalize wildfire behavior and potential deleterious impacts in a wildfire. Currently these areas can be identified on the map as areas of naturally low fuels (green) or areas where implemented management activities have produced more favorable conditions from a wildfire management perspective (green icons overlaying individual units). However, many other factors not considered here (access and response time, available equipment and personnel, proximity of important values-at-risk, landowner cooperation, etc.) would additionally determine potential utilization of these tactical opportunities in a wildfire event. It is important to note that the potential effectiveness of these tactical opportunities will vary with effectiveness of treatment, as well as both diurnally and seasonally, each producing resulting changes in associated wildfire behavior.

Tactical Opportunity #1

Picture #32 - Grasslands (landscape Unit A) formTactical Opportunity #1 between Wrights Creek and Ashland Creek watersheds.

Extensive grasslands and old orchards/ag lands at the top of Wrights Creek (Units A3, A4, A5) and low fuel zones (Units B3, B4) offer a large contiguous area of low to moderate wildfire hazard (see Picture #32), and an excellent opportunity to check wildfire advancing upslope from the north (i.e., the path of the 4,000-acre 1959 wildfire). Recent work in the adjacent woodlands to the east has further expanded this fuel reduction zone, extending it to and tying in with Tactical Opportunity #2 to the southeast in the Ashland Creek canyon. Completion of Management Priority #1 would dramatically improve the effectiveness of Tactical Opportunity #1 in preventing wildfire expansion from the north in Wrights Creek into the Ashland Creek drainage.

Tactical Opportunity #2

Recent wildfire management activities completed along Strawberry Lane have produced a fuel reduction zone that ties together the Wrights Creek drainage (see Tactical Opportunity #1) with a reduced wildfire hazard zone (Unit A6) in the Ashland Creek drainage. This area could be expanded by completing additional fuels reduction in Units B5 and B6, although fuels are already fairly low in these oak woodlands. This would help prevent wildfire spread downslope towards residences above Granite Street. Completing Management Opportunity #2 would dramatically extend the fuel reduction zone to the south, beginning with TO #2 and extending upcanyon in the Ashland Creek canyon.

Tactical Opportunity #3

Fuels reduction activities completed by the City of Ashland on their lands in the "throat" of the Ashland watershed (primarily in Section 16) have provided a sizable fuel reduction zone in which suppression activities could be concentrated in a wildfire event. An "area-wide" approach to fuels reduction has been completed in an area over one-half mile wide on the east side of Ashland Creek. This has included brush removal and understory non-commercial thinning, followed by piling and burning of resulting slash. On the north end, this is incorporated into a pasture on private land (Unit A9) that further improves the tactical opportunity. Similar activities have been conducted on the west side of the creek, although not as extensively largely due to very steep slopes, topographically unfavorable locations for wildfire management activities, and slope stability issues. Several key areas have been treated on the west side, however, creating smaller fuel reduction zones with which to concentrate suppression activities during a wildfire. The northern-most of the two is clustered around a City of Ashland quarry–an excellent fuelbreak and the first opportunity on the west side of the creek to suppress a wildfire spreading upcanyon. The southern-most portion of TO #3 (Units G8 and E6) is in a particularly useful topographical location for a fuel reduction zone and will hopefully soon "tie in" to a shaded fuelbreak on adjacent U.S. Forest Service land (fuel reduction work for this small, untreated area between the two shaded fuelbreaks is planned in the upcoming U.S. Forest Service project). Tactical Opportunity #3 is a key location for the ultimate protection of a major wildfire intrusion into the Ashland watershed. Obviously, ignition source is most likely in the urban area immediately north and below Tactical Opportunity #3. Upcanyon winds will likely force any wildfire initiated downcanyon into this location (such as occurred in 1959). If a wildfire is able to break through this narrow portion of the Ashland Creek canyon, airflow restricted by topographical influence would exert considerable pressure on the upcanyon side, likely rapidly escalating wildfire behavior into the larger Ashland Creek watershed.

Tactical Opportunity #4

Several other large fuel reduction zones created by area-wide non-commercial thinning, brushing, piling and burning, and/or prescribed underburning have been implemented on City of Ashland lands in the canyon along Ashland Creek below Reeder Reservoir. Each of these comprise larger areas that may be effective in most wildfires in preventing wildfire spotting and spread. The southerly-most of the two is particularly important because of its location at Reeder Reservoir. Stopping a wildfire advancing upwards into the watershed is particularly critical at this location because the watershed spreads into two major drainages, East and West Fork, above Reeder Reservoir. This fuel reduction zone also ties into a major U.S. Forest Service shaded fuelbreak to the east.

Tactical Opportunity #5

Picture #33 - Upper Lithia Park. Note recent fuel reduction work between roads has helped create tactical opportunity.

The vegetated slopes in Lithia Park east of Ashland Creek represent the single largest intrusion of wildland vegetation into the City of Ashland. As a result, reducing wildfire potential through wildfire management activities is a priority, as described in Management Priority #5. At the top of these westerly aspects, significant vegetation manipulation and fuel reduction has recently been accomplished both above and below Glenview St., extending upslope to the major ridgeline along Ridge and Terrace Streets (see Picture #33). These fuel reduction activities, coupled with good access for firefighting equipment, provide a critical tactical opportunity for wildfire suppression in the event of a developing fire in the wildland portions of Lithia Park. Hopefully, this recent work will prevent wildfire from spreading over the ridge and into the major urban/suburban portions of Ashland to the east.

Tactical Opportunity #6

Management Priority #9 described needed vegetation management to achieve wildfire management objectives in the Roca Canyon occluded interface. This work would "tie in" to existing areas of reduced fuels largely represented by pasturelands/grasslands in two units, A14 and A15. The alignment of these units perpendicular to upvalley air flow in the Bear Creek Valley could be particularly important in any fire advancing easterly/southeasterly. Stopping developing fire in this location could be particularly important given the high density of structures in the vicinity and the large adjacent acreages of vegetation with high to extreme fire hazard ratings. Maintaining irrigated pasture in these units would even further enhance the area's effectiveness as a fuel reduction zone and potential utilization in a wildfire event.

Tactical Opportunity #7

A major ridgeline fuelbreak has been implemented on Ashland Parks land in Siskiyou Mountain Park (see Picture #34). This fuelbreak has been created in the hope of compartmentalizing wildfire to stay within a single watershed, rather than crossing over from the Roca Creek watershed into the Hamilton Creek watershed as occurred in the 1973 Hillview Fire. Effectiveness of these types of fuelbreaks are largely dependent on the quality of work done in the fuelbreak (i.e. size, current condition of the vegetation, when it was last treated, etc.), the behavior of the fire when it reaches the fuelbreak, and the availability of suppression activities. There are certainly many wildfire situations in which this fuelbreak would not suffice to stop advancing wildfire. However, it does provide a significant opportunity with which to concentrate suppression activities, most likely application of aerial retardant. Vehicle access would not be available to this fuelbreak.

Picture #34 - Slash pile in shaded fuelbreak in Tactical Opportunity #7.

Tactical Opportunity #8

Tactical Opportunity #8 is a large area in the headwaters of the Roca Creek watershed on lands managed by Ashland City Parks and Recreation. The land was part of a purchase by the City following a timber sale in the early 1990s. Since that time, a considerable amount of fuel reduction work (thinning, brushing, grubbing, piling and burning, etc.) Has been completed. Although the generally steep nature of the area reduces its effectiveness as a fuel reduction zone, the work completed has created a large area of generally reduced fuels that will likely reduce fire intensity and rate-of-spread in a wildfire event, increasing the likelihood that it can be stopped prior to entering the Ashland Creek watershed. Ongoing work is needed in this area to improve its effectiveness as a fuel reduction zone/tactical opportunity. Its location adjacent other major fuel reduction zones (Tactical Opportunities 7 and 9, as well as on adjacent U.S. Forest Service land–both current and planned) contributes to a much larger and subsequently more effective fuel reduction zone.

Tactical Opportunity #9

Significant fuel reduction and wildfire management activities have been completed on the Bill and Sara Epstein property in Section 22 in the upper end of the Hamilton Creek watershed. Work in both conifer/hardwood stands and brushfields has significantly reduced the potential for developing high-intensity wildfire. Excellent opportunities exist to prevent spread of wildfire into the Ashland Creek Watershed, particularly if suppression forces and activities are available. Additional work in the Roca Canyon watershed on Ashland Parks and Recreation land to the north (Tactical Opportunity #8) has also improved the size of the fuel reduction zone, making it that much more likely to be effective in a wildfire. Access to the upper end of Tactical Opportunity #9 is available from Ashland Loop Road, as well as from various forest management roads on the Epstein property. This large fuel reduction zone, created by active management activities on two larger ownerships, serve as an excellent model for wildfire management strategies that have greatly increased the likelihood that wildfire could be prevented from moving into the Ashland Creek Watershed from the adjacent Hamilton Creek and Roca Canyon watersheds. Maintaining the effectiveness and potential utilization of Tactical Opportunity #9 will require additional work in the near future.

Tactical Opportunity #10

A large area of reduced fuels is located between Tolman Creek Road and Hamilton Creek in the southeast corner of the AWUI. This area includes old ranchlands/grasslands, managed oak woodlands and/or those with very low fuel levels—quarries, abandoned orchards, and a recently managed plantation that has been precommercially thinned, pruned, piled, and burned. This area is an excellent example of reduced fuels of various types over a large area, providing an excellent tactical opportunity for suppression in a wildfire event. Access is good throughout and topography is gentle, combining to provide a good level of protection from wildfire for the major suburban area immediately to the north (Greenmeadows Subdivision).

Tactical Opportunity #11

Similar to Tactical Opportunity #7, a northerly/northeasterly descending ridgeline fuelbreak system has been installed along the easterly boundary of the Hamilton Creek watershed. primarily on the Bill and Sara Epstein property (see Picture #35). This fuelbreak is somewhat narrower in some places than occurs in Tactical Opportunity #7. Brush removal and silvicultural thinning along this ridgeline was mostly accomplished in the early 1990s, followed by conversion to conifers by planting. These developing plantations are becoming less effective as fuelbreaks, although recent thinning to wide spacing, pruning, and pile burning is helping to maintain effectiveness, while minimizing further development of extremely wildfire-prone manzanita brushfields. The bottom northerly end of this fuelbreak system ties into a large area of reduced fuels (Tactical Opportunity #10) in old ranchland/grassland. Access for utilizing suppression forces in this fuelbreak system is generally good—either from Morninglight Estates at the bottom or Tolman Creek Road at the top. Maintenance of this fuel reduction zone should become a management priority within the next several years, allowing continued opportunities for containment and compartmentalization of a developing wildfire.

Picture #35 - Tactical Opportunity #11. Note fuelbreak on ridgeline, an ideal location separating Hamilton Creek watershed from Tolman Creek watershed. Landscape Unit J in lower right; Landscape Unit E in center initiated after 1973 Hillview fire.

V. Conclusion

This report was developed in the hope of providing a general framework with which to analyze the Ashland Wildland Urban Interface (AWUI), with a special emphasis on wildfire potentials and subsequent opportunities to minimize its undesirable effects when it occurs. The report focused primarily on fuels inventory and analysis of fuels and vegetation in the AWUI–the key factors affecting wildfire behavior in the AWUI. Fully realizing that passive management (doing nothing) is a choice that results in predictable and undesirable outcomes, specific options for management to minimize wildfire behavior are prescribed in this report. These suggested "planned disturbances" are designed to hopefully recreate stand structures and ecological processes that will help encourage the type of more benign disturbance regimes typical of the pre-settlement era, as opposed to the more infrequent, higher intensity disturbances being experienced today. These suggested management activities should be tempered with retroactive looks at the effects of management activities and fuel reduction to date on multi-resource values of various sites in the AWUI. Monitoring changes in the future, both on the ground in individual units and on a landscape level, will also be an essential element by which one can learn and adapt accordingly. The spatially explicit mapping in this report of landscape units and vegetation types in the AWUI should allow the means of recording these changes in wildfire potential over time and space, as well as offering a way for all interested parties to visually comprehend the larger scale problems and opportunities. Engaging the citizens of Ashland, particularly those with lands in the AWUI, is critical to the successful implementation of acceptable wildfire reduction strategies. Given these realities, it should be clear that this report is merely a start, and it is hoped that it facilitates a more aggressive approach to the protection and promotion of the multiple values threatened by high intensity, large scale wildfire in the AWUI and adjacent lands.

Types of Wildfire Management Activities

Activity	Effectiveness	Difficulty	Costs/Acre	Other
Manual Silvicultural Activity				
Silvicultural Thinning	Moderate to high. Immediate effectiveness depends on following treatment of thinning slash	Moderate to Extreme	$100-$350; costs reduced if thinnings are merchantable & can be sold.	Most common wildfire management activity; other associated benefits accrue. Professionalism in determining leave trees important.
Brushing	Low to High	Low to High	Extremely variable depending on brush amounts; $100-$750	Usually associated w/piling & burning brush in order to be immediately effectively
Pruning	Low to Moderate	Low to Moderate		Creates vertical discontinuity–height of pruning determines effectiveness.
Manual Slash Treatment				
Lop and Scatter	Poor to Fair - improves in time w/decompo-sition and loss of fine fuels.	Low	$25-$100	None of the fuel is removed from site.
Pile and Burn	Good to Excellent if done well.	Piling - easy; Burning - moderate to high	$200-$1500, variation depends on amount to be piled.	Chance of escaped fire, particularly from smouldering piles.
Prescribed Underburn	Fair to Excellent	Extreme - only recommended for professionals, w/Oregon Dept. of Forestry oversight.	$200 to $750	Professionalism and planning imperative; chance of escape. Ecologically the most desirable of slash treatments
Utilization	Moderate to good; usually fine fuels remain which contribute to rapid rate-of-spread of fire.	Low to High	Variable; can be income producer in some situations, particularly if merchantable material available.	Firewood or logs can produce income; highly dependent on access; removal of logs will usually require a skilled contractor..
Mechanical Fuel Reduction				
Dozer Brushing & Piling	Excellent	Only done by Contractor	$300-$600	Piles should be burned, soil disturbance & compaction concerns. Topsoil in piles reduces site produc-tivity and increases fire holdover potential. Restricted to slopes less than 25 to 30 percent
Slashbuster	Excellent	Only done by Contractor	$300-$450	Restricted to slopes less than 35%. Move-in costs restrict availability for smaller jobs-usually done in conjunction with work on larger acreages (e.g., US Forest Svc.). Soil disturbance and compaction concerns.
Chipping	Good	Usually done by contractor, slow if done by owner.	Usually in spot locations near homes; costs are high.	Access limitations. Done in association w/other manual work (brushing, thinning, etc.). Chip piles can be unsightly/fire hazard.
Fireline Construction	Poor - Fair	Easy whether done by hand or machine.	Variable; hand firelines $.75-$1/foot	Narrow widths only restrict advance of low intensity ground fires.
Other				
Fuelbreak/Shaded Fuelbreak	Fair to excellent, but depends on multiple factors.	Moderate to extreme	Variable; some income can be generated if logs removed.	Historically 200 feet wide; best if completed over larger areas. Historically used as location to optimize use of wildfire suppression activities. Usually along ridges, roads.

Literature Cited

Agee, J. K. 1991. "Fire History Along on Elevational Gradient in the Siskiyou Mountains, Oregon." *Northwest Science 65*: 188-99.

Agee, J. K. 1996. "The Influence of Forest Structure on Fire Behavior." In: *Proceedings, 17th Forest Vegetation Management Conference*, Redding, California.

Agee, J. K. 1997. "Restoration of Blue Mountain Forests with Fire: Is It Possible?" *Natural Resource News, 7*(3), summer 1997.

Agee, J. K., B. Bahro, M. A. Finney, R. N. Omi, D. B. Sapsis, C. N. Skinner, J. W. Van Wagtendonk, and C. P. Weatherspoon. 2000. "The Use of Shaded Fuelbreaks in Landscape Fire Management." *Forest Ecology and Management, 127*: 55-66.

Agee, J. K. Winter, 2002. "The Fallacy of Passive Management: Managing for Firesafe Forest Reserves. *Conservation Biology in Practice, 3*(1).

Alexander, J. D., and F. E. Hawksworth. 1975. *Wildland Fires and Dwarfmistletoes: A Literature Review of Ecology and Prescribed Burning.* USDA Forest Serv. Gen. Tech. Rep. RM-14.

Amaranthus, M. P., and D. A. Perry. 1989. "Interaction Effects of Vegetation Type and Pacific Madrone Soil Inocula on Survival, Growth, and Mycorrhiza Formation in Douglas-fir. *Canadian Journal of Forest Resources, 19*: 550-556.

Amaranthus, M. P., C. Y. Li, and D. A. Perry. 1990. "Influence of Vegetation Type and Madrone Soil Inoculum on Associative Nitrogen Fixation in Douglas-fir Rhizospheres." *Canadian* Journal *of Forest Resources, 20*: 368-371.

Anderson, H. E. 1982. *Aids to Determining Fuel Models for Estimating Fire Behavior.* USDA For. Serv. Gen. Tech. Rep. INT-122.

Ashland Ranger District, Rogue River National Forest. 1995. *Bear Watershed Analysis.* Ashland, OR.

Atzet, T., and D. L. Wheeler. 1982. *Historical and Ecological Perspectives on Fire Activity in the Klamath Geologic Province of the Rogue River and Siskiyou National Forests.* USDA For. Serv., Pacific Northwest Region, pub. R-6-Range-102. Portland, OR.

Atzet, T., and R. E. Martin. 1991. "Natural Disturbance Regimes in the Klamath Province." In: *Proceedings of the Symposium on Biodiversity of Northwestern California, October 28-30, 1991.* Santa Rosa, CA.

Atzet, T., V. E. White, L. A. McCrimmon, P. A. Martinez, P. R. Fong, and V. D. Randall. Sept. 1996. "Field Guide to the Forested Plant Associations of Southwestern Oregon," Tech Paper R6-NR-ECOL-TPL17-96.

Brown, R. 2000. *Thinning, Fire, and Forest Restoration: A Science-Based Approach for National Forests of the Interior Northwest.* Washington, DC: Defenders of Wildlife.

Chang, C. 1996. "Ecosystem Responses to Fire and Variations in Fire Regimes." In: *Sierra Nevada Ecosystem Project: Final Report to Congress*, Vol. II, Chap. 39. Davis: University of California, Centers for Water and Wildland Resources.

Cohen, D. 2000. "Preventing Disaster: Home Ignitability in the Wildland-Urban Interface." *Journal of Forestry 98*(3): 15-21.

Covington, W. W., and M. M. Moore. 1994. "Southwestern Ponderosa Pine Forest Structure." *Journal of Forestry, 92*: 39-47.

Franklin, J. F., D. A. Perry, R. Noss, D. Montgomery, and G. Frissell. 2000. "Alternative Silvicultural Approaches to Timber Harvesting: Variable Retention Harvest Systems. In Kohm, K.A. and J.F. Franklin, eds., *Creating a Forestry for the 21st Century.* Washington, D.C.: Island Press.

Fried, S. J., J. R. Boyle, J. E. Tappeiner III, and K. C. Cromack, Jr. 1990. "Effects of Bigleaf Maple on Soils in Douglas-fir Forests." *Canadian Journal of Forestry, 92*(7): 16-19.

Graham, R. T., A. E. Haney, T. B. Jain, and J. R. Tonn. 1999. "The Effects of Thinning and Similar Stand Treatments on Fire Behavior in Western Forests." USDA Gen. Tech. Rep. PNW-GTR-463.

Green, L. R., and H. E. Schimke. 1971. "Guides for Fuel-breaks in the Sierra Nevada Mixed-conifer Type." *USDA Forest Service PSW Station Report.*

Green, L. R. 1997. "Fuelbreaks and Other Fuel Modification for Wildland Fire Control." *USDA Forest Service Agriculture Handbook* 499.

Harrington, M. G., and F. G. Hawksworth. 1990. "Interactions of Fire and Dwarfmistletoe on Mortality of Southwestern Ponderosa Pine." In: Krammes, J. S. (tech. coord.), *Effects of Fire Management of Southwestern Natural Resources.* USDA For. Serv. Gen. Tech. Rep. Rm-191.

Hawksworth, F. G., and D. Wiens. 1996. "Dwarfmistletoes: Biology, Pathology, and Systematics." *USDA Agricultural Handbook* 709.

Irby, B., F. Beall, B. Barrette, and M. Frago (eds.). 2000. *Wildland Fire Hazard Assessment–A Volume of the I-Zone Series.*

Johnson, D. W., and F. G. Hawksworth. 1985. "Dwarf mistletoes: Candidates for Control through Cultural Management." In: *Insect and Disease Conditions in the United States, 1979-1983.* General Technical Report WO-46.

Kilgore, B. M. 1973. "The Ecological Role of Fire in Sierran Conifer Forests: Its Application to National Park Management." *Quaternary Research, 3*: 496-513.

Main, M. L., and M. P. Amaranthus. 1996. "Reducing Stand Densities in Immature and Mature Stands, Applegate Watershed, Southwest Oregon." *USDA For. Serv. Res.* Note PNW-RN-518.

McCormick, R. J., and Associates. 1992. *Ashland Forest Plan.*

Moire, W. H., and J. H. Dieterich. 1988. "Old Growth Ponderosa Pine, from Succession in Pine-Bunch Grass Forest in Arizona and New Mexico." *Natural Areas Journal, 8*(1): 17-24.

Morrison, P., and F. J. Swanson. 1990. *Fire History and Pattern in the Cascade Range Landscape.* USDA For. Serv. Gen. Tech. Rep. PNW-GTR-254.

Noss, R. F. 2000. Society for Conservation Biology comment letter on USDA Forest Service Roadless Areas Protection Initiative.

Oliver, C. D., and B. C. Larson. 1990. *Forest Stand Dynamics*. New York: McGraw-Hill, Inc.

Omi, P. N. 1996. "The Role of Fuelbreaks." In: *Proceedings: 17th Annual Forest Vegetation Management Conference*, Redding, CA.

Perry, D. A. 1988. "Landscape Pattern and Forest Pests." *The Northwest Environmental Journal, 4*: 213-228.

Perry, D. A. 1995. "Landscapes, Humans and Other System-level Considerations: A Discourse on Ecstasy and Laundry." In: *Proceedings of Ecosystem Management in Western Interior Forests*, May 3-5, 1994. Spokane, WA.

Skinner, C. N. 2002. Personal communication.

Taylor, A. H., & C. N. Skinner. 1998. "Fire History and Landscape Dynamics in a Late-Successional Reserve, Klamath Mountains, California, USA." *Forest Ecology and Management, III*, 285-301.

U. S. Dept. of Agriculture, Forest Service, Rogue River and Siskiyou National Forests, Pacific Northwest Research Station, and U.S. Department of Interior, Bureau of Land Management, Medford District. 1994. *Applegate Adaptive Management Area Ecosystem Health Assessment.* Medford, OR.

USDA Soil Conservation Service. 1993. *Soil Series of Jackson County Area.*

Van Wagtendonk, J. W. 1996. "Use of a Deterministic Fire Growth Model to Test Fuel Treatments." In: *Sierra Nevada Ecosystem Project: Final Report to Congress*, Vol. II, Chap. 43. Davis: University of California, Centers for Water and Wildland Resources.

Weatherspoon, C. P. 1996. "Firesilviculture Relationships in Sierra Forests." In: *Sierra Nevada Ecosystem Project: Final Report to Congress*, Vol. II, Chap. 44. Davis: University of California, Centers for Water and Wildland Resources.

Weatherspoon, C. P., and C. N. Skinner. 1996. "Landscape Level Strategies for Forest Fuel Management." In: *Sierra Nevada Ecosystem Project: Final Report to Congress*, Vol. II, Chap. 44. Davis: University of California, Centers for Water and Wildland Resources.

Glossary

Age class: A classification of trees of a certain range of ages.

Aspect: The direction in which any piece of land faces.

Basal area: The cross-sectional area of tree boles in a forested area as measured at dbh.

Board foot: A unit of measurement represented by a board one foot long, one foot wide, and one inch thick. Also, a standard way of measuring volume of standing trees, logs, or lumber, usually expressed in thousand board feet, or mbf.

Bole: The main stem or trunk of a tree.

Canopy: The relatively continuous cover of crowns of trees.

Coarse woody debris: Boles of trees that have fallen or been cut and area laying on the forest floor; usually refers to larger diameter material.

Competing vegetation: Any vegetation that competes with a preferred tree or seedlings for site resources.

Crown fire: Fire that advances through the tops of trees.

Defensible fuel reduction zones: Areas of modified and reduced fuels that extend beyond fuel breaks to include a larger area of decreased fuels. These would include managed stands with reduced amounts, continuities, and/or distributions of fuels that would provide additional zones of opportunity for controlling wildfire.

Density management: Management practices implemented to alter the density of trees in a forest.

Diameter at breast height (dbh): The diameter of any tree at 4.5 feet above ground level.

Down, dead woody fuels: Dead twigs, branches, stems, and boles of trees and shrugs that have fallen and lie on or near the ground.

Fire hazard: The kind, volume, condition, arrangement, and location of fuels and vegetation that creates an increased threat of ignition, rate of spread, and resistance to control of wildfire.

Fire intensity: The energy release rate per unit length of fireline; can be related to flame length.

Fire risk: The chance of various ignition sources, either lightning or human-caused, causing a fire.

Fire season: The period of time, usually during the summer and fall, when there are drier conditions and higher temperatures, and restrictions and rules designed to minimize forest fire risks are put into effect.

Fire severity: Measures the effect of fire on an ecosystem, especially the effect on plants. Fires are commonly classed as low, medium, and high.

Fire weather conditions: The state of the atmosphere within 5 to 10 miles of the earth's surface indicated by measures of temperature, pressure, wind speed, wind direction, humidity, visibility, clouds, and precipitation. The potential for fire weather conditions to influence fire behavior is generally described in terms of low to extreme.

Fuel continuity: A qualitative description of the distribution of fuel both horizontally and vertically. Continuous fuels readily support fire spread. The larger the fuel discontinuity, the greater the fire intensity required for fire spread.

Fuelbreak: A strip of land in which vegetation has been manipulated such that fires burning into one are more easily controlled.

Ladder fuels: Flammable vegetation that provides vertical continuity between the surface fuels and tree crowns.

Landscape unit: An area of land with relatively consistent topography and vegetation.

Lop and scatter: A method of slash treatment in which slash is cut into smaller pieces so that it lies closer to the ground to increase decomposition and perhaps spread out to decrease fuel accumulations.

Merchantable timber: Trees large enough to be sold to a mill.

Monitoring: The process of initiating and collecting information over time to determine if desired outcomes of planned management activities are being realized.

Mycorrhizae: Symbiotic associations between particular species of fungi and the roots of vascular plants.

Overstory: The uppermost canopy layer in a stand.

Pre-commercial (or noncommercial) thinning: The cutting of non-merchantable trees to improve forest conditions and/or help achieve specific objectives or values.

Prescribed burning: The professional application of fire to forest or range sites under specific conditions of weather, fuel conditions, moisture, time of day, and season resulting in a pre-designated fire intensity and rate-of-spread.

Release: A term used to indicate the increased growth that occurs in a tree or stand of trees following stand density reduction.

Restoration: The process of aiding the recovery of ecological integrity on a degraded site or landscape.

Riparian area: A geographic area containing an aquatic component and adjacent upland areas.

Thinning from below: The cutting of non-dominant trees in a stand, usually in order to give more site resources to the dominant trees or to reduce ladder fuels.

Site productivity: The capacity of an area of land to produce biomass.

Slash: Tree tops, branches, bark, and other typically non-merchantable debris left after forest management activities.

Snag: A standing dead tree

Species composition: The variety of species in any particular vegetation type.

Stand: A grouping of trees in a forest of similar conditions that separate it from trees in other adjacent areas.

Stand density: A quantitative description of the number and size of trees in a stand.

Stocking level: The number of trees in any given area.

Succession: The process through which vegetation develops over time as one community of plants replaces another; often described in terms of stages or seres.

Surface fire: A fire that burns fuels such as downed wood, litter, shrubs, and small trees which are near the ground.

Swamper burning: A method of burning in which slash is thrown onto a burning pile.

Tree vigor: A measure, either subjective or quantitative, of the relative health of an individual tree.

Understory: The vegetation layer between the canopy and the forest floor, including forbs, shrubs, smaller trees, and other low-lying vegetation.

Uneven-age management: Management of forests that encourages different age classes within a stand, involving both the retention of older age classes and the encouragement of new trees.

Wildland/urban interface: A geographic area in which the urban and/or suburban setting is juxtaposed and transitionally grades into the wildland environment.

List of Scientific and Common Names Used in This Report

Conifers:

Douglas-fir - *Pseudotsuga menziesii*
Incense cedar - *Calocedrus decurrens*
Ponderosa pine - *Pinus ponderosa*
Sugar pine - *Pinus lambertiani*

Hardwoods:

Bigleaf maple - *Acer macrophyllum*
Black cottonwood - *Populus trichocarpa*
California black oak - *Quercus kelloggi*
Mountain mahogany - *Cercocarpus betuloides*
Oregon ash - *Fraxinus latifolia*
Oregon white oak - *Quercus garryana*
Pacific madrone - *Arbutus menziesii*
Red alder - *Alnus rubra*
Willow - *Salix spp*

Shrubs:

Deerbrush ceanothus - *Ceanothus integerrimus*
Dwarf Oregon grape - *Berberis nervosa*
Hairy honeysuckle - *Lonicera hispidula*
Mock orange - *Philadelphus lewisii*
Pacific ninebark - *Physocarpus capitatus*
Poison oak - *Rhus diversiloba*
Snowberry - *Symphoricarpus mollis*
Wedgeleaf cenaothus - *Ceanothus cuneatus*
Whiteleaf manzanita - *Arctostaphylos viscida*

Forbs:

Horsetail - *Equisetum spp.*
Sedges - *Carex spp.*
Rushes - *Juncus spp.*

Exotics:

English ivy - *Hedera helix*
Himalayan blackberry - *Rubus discolor*

Rare Vascular Plants Likely in the Ashland Wildland/Urban Interface

Oregon Natural Heritage List Status	Scientific Name	Common Name
1	Cypripedium fasciculatum	clustered lady's slipper
4	Cypripedium monatanum	mountain lady's slipper
	Gymnocarpium dryopteris	0
3	Hieracium greenei	Green's hawkweed
2	Horkelia tridentata	clustered horkelia
	Juniperus occidentalis	western juniper
4	Lewisia cotyledon var. howellii	Howell's lewisia
3	Linanthus bakeri	Baker's linanthus
3	Poa bolanderi	Bolander's bluegrass
3	Salix orestera	Sierra willow
3	Silene lemmonii	Lemmon's campion

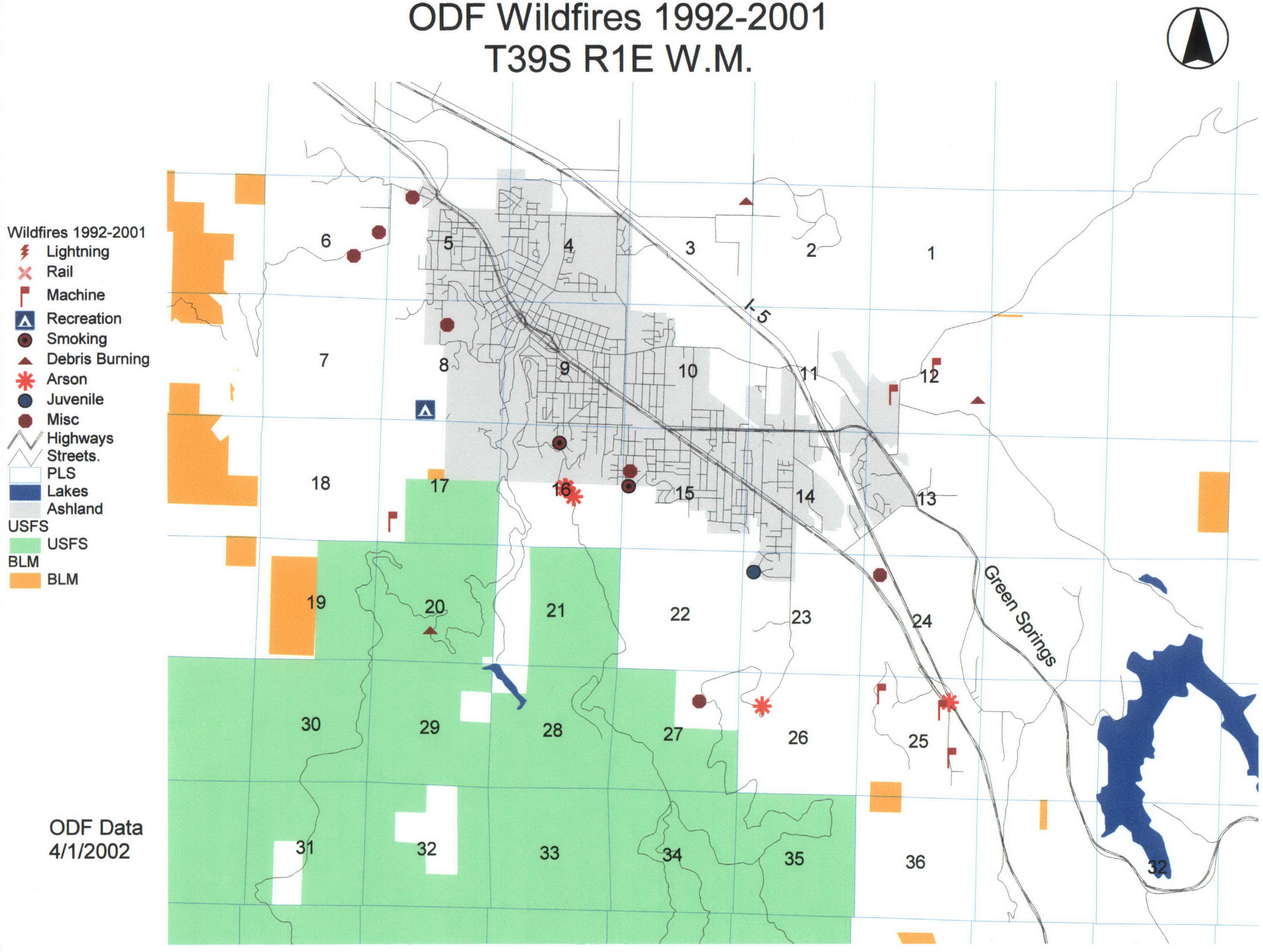
Exotic, Noxious Plants in AWUI (partial list)

Common Name	Latin Name
Himalayan blackberry	*Rubus discoler*
Dalmatian toadflax	*Linaria dalmatica*
St. John's wort	*Hypericum perforatum*
Scotch broom	*Cytisus scoparis*
poison hemlock	*Conium maculatum*
yellow starthistle	*Centaurea solstitalis*
hedgehog dogtail	*Cynosurus echinatus*
medusahead rye	*Taeniatherum caput-medusae*
Canada thistle	*Cirsium arvense*
bull thistle	*Cirsium vulgare*
rose campion	*Lychnis coronaria*
ripgut brome	*Bromus diandrus*
spotted knapweed	*Centaurea maculosa*
English ivy	*Hederahelix*
periwinkle	*Vinca minor*

Rare Animals Likely in the Ashland Wildland/Urban Interface

Status	Scientific name	Common Name
Threatened	Strix occidentalis	Northern spotted owl
Sensitive	Clemmys marmorata marmorata	Western pond turtle
Sensitive	Lampropeltis getula	Common king snake
Sensitive	Myotis thysanodes vespertinus	Fringed myotis
Sensitive	Antrozous pallidus pacificus	Pacific pallid bat
Survey and Manage	Strix nebulosa	Great gray owl
Additional Protection or Protection Buffer	Lasionyeteris noctivagans	Silver haired bat
Additional Protection or Protection Buffer	Myotis evotis	Long-eared myotis
Additional Protection or Protection Buffer	Myotis volans	Long-legged myotis
Additional Protection or Protection Buffer	Plecotus townsendii	Townsend's big-eared bat

ODF Wildfires 1992-2001
T39S R1E W.M.

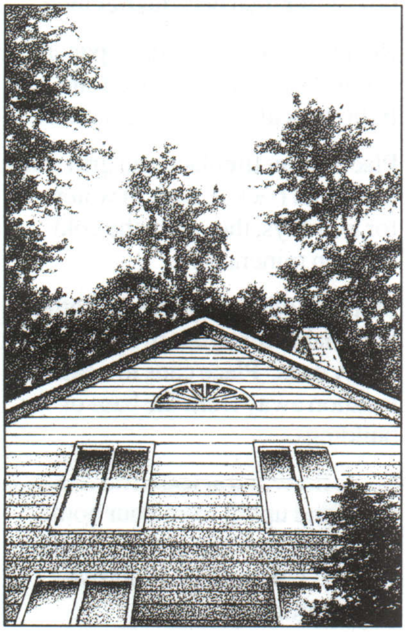


WILDFIRE • WILDFIRE • WILDFIRE • WILDFIRE • WILDFIRE • WILDFIRE • WILDFIRE • WILDFIRE

Wildfire... Are You Prepared?

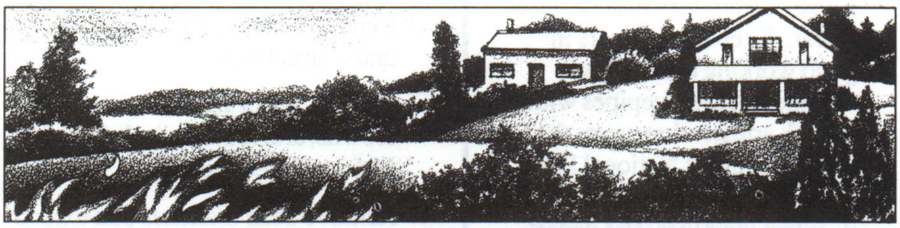
FAMILY EMERGENCY PREPAREDNESS

More and more people are making their homes in woodland settings — in or near forests, rural areas or remote mountain sites.



There, homeowners enjoy the beauty of the environment but face the very real danger of wildfire.

Wildfires often begin unnoticed. They spread quickly, igniting brush, trees and homes. Reduce your risk by preparing now — *before* wildfire strikes. Meet with your family to decide what to do and where to go if wildfires threaten your area. Follow the steps listed in this brochure to protect your family, home and property.



Practice Wildfire Safety

People start most wildfires . . . find out how you can promote and practice wildfire safety.

- Contact your local fire department, health department or forestry office for information on fire laws. Make sure that fire vehicles can get to your home. Clearly mark all driveway entrances and display your name and address.
- Report hazardous conditions that could cause a wildfire.
- Teach children about fire safety. Keep matches out of their reach.
- Post fire emergency telephone numbers.
- Plan several escape routes away from your home — by car and by foot.
- Talk to your neighbors about wildfire safety. Plan how the neighborhood could work together after a wildfire. Make a list of your neighbors' skills such as medical or technical. Consider how you could help neighbors who have special needs such as elderly or disabled persons. Make plans to take care of children who may be on their own if parents can't get home.

PROTECT YOUR HOME

- Regularly clean roof and gutters.
- Inspect chimneys at least twice a year. Clean them at least once a year. Keep the dampers in good working order. Equip chimneys and stovepipes with a spark arrester that meets the requirements of National Fire Protection Association Code 211. (Contact your local fire department for exact specifications.)
- Use 1/2-inch mesh screen beneath porches, decks, floor areas and the home itself. Also, screen openings to floors, roof and attic.
- Install a smoke detector on each level of your home, especially near bedrooms; test monthly and change the batteries two times each year.
- Teach each family member how to use the fire extinguisher (ABC type) and show them where it's kept.
- Keep a ladder that will reach the roof.
- Consider installing protective shutters or heavy fire-resistant drapes.
- Keep handy household items that can be used as fire tools: a rake, axe, handsaw or chainsaw, bucket and shovel.

Before Wildfire Threatens

Design and landscape your home with wildfire safety in mind. Select materials and plants that can help contain fire rather than fuel it. Use fire resistant or non-combustible materials on the roof and exterior structure of the dwelling. Or treat wood or combustible material used in roofs, siding, decking or trim with UL-approved fire-retardant chemicals. Plant fire-resistant shrubs and trees. For example, hardwood trees are less flammable than pine, evergreen, eucalyptus or fir trees.

Create a 30 to 50 foot safety zone around your home

Within this area, you can take steps to reduce potential exposure to flames and radiant heat. Homes built in pine forests should have a minimum safety zone of 100 feet. If your home sits on a steep slope, standard protective measures may not suffice. Contact your local fire department or forestry office for additional information.

- ❑ Rake leaves, dead limbs and twigs. Clear all flammable vegetation.
- ❑ Remove leaves and rubbish from under structures.
- ❑ Thin a 15-foot space between tree crowns, and remove limbs within 15 feet of the ground.
- ❑ Remove dead branches that extend over the roof.
- ❑ Prune tree branches and shrubs within 15 feet of a stovepipe or chimney outlet.
- ❑ Ask the power company to clear branches from powerlines.
- ❑ Remove vines from the walls of the home.
- ❑ Mow grass regularly.
- ❑ Clear a 10-foot area around propane tanks and the barbecue. Place a screen over the grill — use non-flammable material with mesh no coarser than one-quarter inch.
- ❑ Regularly dispose of newspapers and rubbish at an approved site. Follow local burning regulations.
- ❑ Place stove, fireplace and grill ashes in a metal bucket, soak in water for two days, then bury the cold ashes in mineral soil.
- ❑ Store gasoline, oily rags and other flammable materials in approved safety cans. Place cans in a safe location away from the base of buildings.
- ❑ Stack firewood at least 100 feet away and uphill from your home. Clear combustible material within 20 feet. Use only UL-approved woodburning devices.

PLAN YOUR WATER NEEDS

- Identify and maintain an adequate outside water source such as a small pond, cistern, well, swimming pool or hydrant.
- Have a garden hose that is long enough to reach any area of the home and other structures on the property.
- Install freeze-proof exterior water outlets on at least two sides of the home and near other structures on the property. Install additional outlets at least 50 feet from the home.
- Consider obtaining a portable gasoline powered pump in case electrical power is cut off.

When Wildfire Threatens

If you are warned that a wildfire is threatening your area, listen to your battery-operated radio for reports and evacuation information. *Follow the instructions of local officials.*

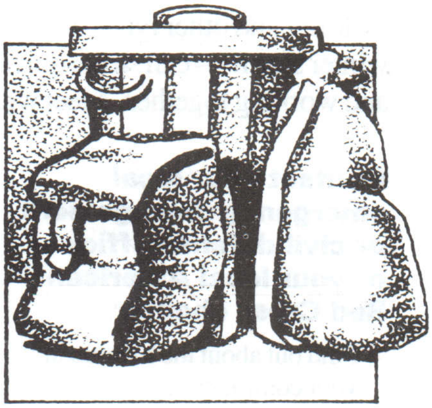
- ❑ Back your car into the garage or park it in an open space facing the direction of escape. Shut doors and roll up windows. Leave the key in the ignition. Close garage windows and doors, but leave them unlocked. Disconnect automatic garage door openers.
- ❑ Confine pets to one room. Make plans to care for your pets in case you must evacuate.
- ❑ Arrange temporary housing at a friend or relative's home outside the threatened area.

If advised to evacuate, do so immediately

- ❑ Wear protective clothing — sturdy shoes, cotton or woolen clothing, long pants, a long-sleeved shirt, gloves and a handkerchief to protect your face.
- ❑ Take your Disaster Supplies Kit.
- ❑ Lock your home.
- ❑ Tell someone when you left and where you are going.
- ❑ Choose a route away from fire hazards. Watch for changes in the speed and direction of fire and smoke.

If you're sure you have time, take steps to protect your home:

- ❑ Close windows, vents, doors, venetian blinds or non-combustible window coverings and heavy drapes. Remove lightweight curtains.
- ❑ Shut off gas at the meter. Turn off pilot lights.
- ❑ Open fireplace damper. Close fireplace screens.
- ❑ Move flammable furniture into the center of the home away from windows and sliding-glass doors.
- ❑ Turn on a light in each room to increase the visibility of your home in heavy smoke.
- ❑ Seal attic and ground vents with pre-cut plywood or commercial seals.
- ❑ Turn off propane tanks.
- ❑ Place combustible patio furniture inside.
- ❑ Connect the garden hose to outside taps.
- ❑ Set up the portable gasoline-powered pump.
- ❑ Place lawn sprinklers on the roof and near above-ground fuel tanks. Wet the roof.
- ❑ Wet or remove shrubs within 15 feet of the home.
- ❑ Gather fire tools.



EMERGENCY SUPPLIES

When wildfire threatens, you won't have time to shop or search for supplies. Assemble a Disaster Supplies Kit with items you may need if advised to evacuate. Store these supplies in sturdy, easy-to-carry containers such as backpacks, dufflebags or trash containers.

- A three-day supply of water (one gallon per person per day) and food that won't spoil.
- One change of clothing and foot-wear per person and one blanket or sleeping bag per person.
- A first aid kit that includes your family's prescription medications.
- Emergency tools including a battery-powered radio, flashlight and plenty of extra batteries.
- An extra set of car keys and a credit card, cash or traveler's checks.
- Sanitation supplies.
- Special items for infant, elderly or disabled family members.
- An extra pair of eyeglasses.

Keep important family documents in a waterproof container. Assemble a smaller version of your kit to keep in the trunk of your car.

CREATE A FAMILY DISASTER PLAN

Wildfire and other types of disasters — hurricane, flood, tornado, earthquake, hazardous materials spill, winter storm — can strike quickly and without warning. You can cope with disaster by preparing in advance and working together. Meet with your family to create a disaster plan. To get started...

Contact your local emergency management or civil defense office or your local American Red Cross chapter

- ❑ Find out about the hazards in your community.
- ❑ Ask how you would be warned.
- ❑ Find out how to prepare for each type of disaster.

Meet with your family

- ❑ Discuss the types of disasters that could occur.
- ❑ Explain how to prepare and respond to each type of disaster.
- ❑ Discuss where to go and what to bring if advised to evacuate.
- ❑ Practice what you have discussed.

Plan how your family will stay in contact if separated by disaster

- ❑ Pick two meeting places:

  1) a place a safe distance from your home in case of a home fire.

  2) a place outside your neighborhood in case you can't return home.

- ❑ Choose an out-of-state friend as a "check-in contact" for everyone to call.

Complete these steps

- ❑ Post emergency telephone numbers by every phone.
- ❑ Show responsible family members how and when to shut off water, gas and electricity at main switches.
- ❑ Contact your local fire department to learn about home fire hazards.
- ❑ Learn first aid and CPR. Contact your local American Red Cross chapter for information and training.

Practice and review these steps.

The Federal Emergency Management Agency's Family Protection Program is a nationwide effort to help people prepare for disasters of all types. For more information, please contact your local or state office of emergency management. Ask for: *Your Family Disaster Plan* (English: L-191; Spanish: L-191S), *Your Family Disaster Supplies Kit* (English: L-189; Spanish: L-189S), *Emergency Preparedness Checklist* (English: L-154; Spanish L-154S)

Or write to: FEMA
P.O. Box 70274
Washington, D.C. 20024

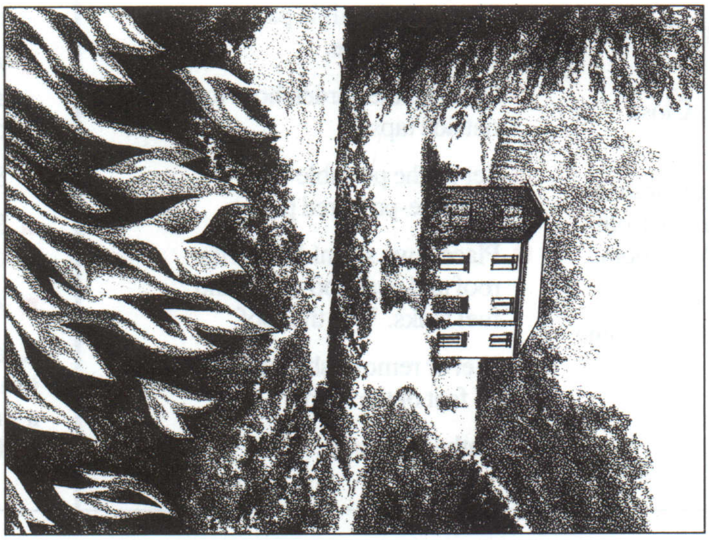
L-203/February 1993

Local sponsorship provided by:

WILDFIRE • WILDFIRE • WILDFIRE • WILDFIRE

Federal Emergency Management Agency

United States Fire Administration



Wildfire
Are You Prepared?

WILDFIRE • WILDFIRE • WILDFIRE • WILDFIRE