



PLANNING FOR NATURAL HAZARDS:

Wildfire TRG

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Oregon Department of Land Conservation & Development

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Section 1: Introduction to the Wildfire Technical Resource Guide

Wildfire poses a significant threat to many communities in Oregon. The purpose of this guide is to help planners, local decision-makers, and community leaders reduce risk to life and property from wildfire. The guide is designed to help your local government address wildfire hazard issues through effective comprehensive plan inventories, policies, and implementing measures.

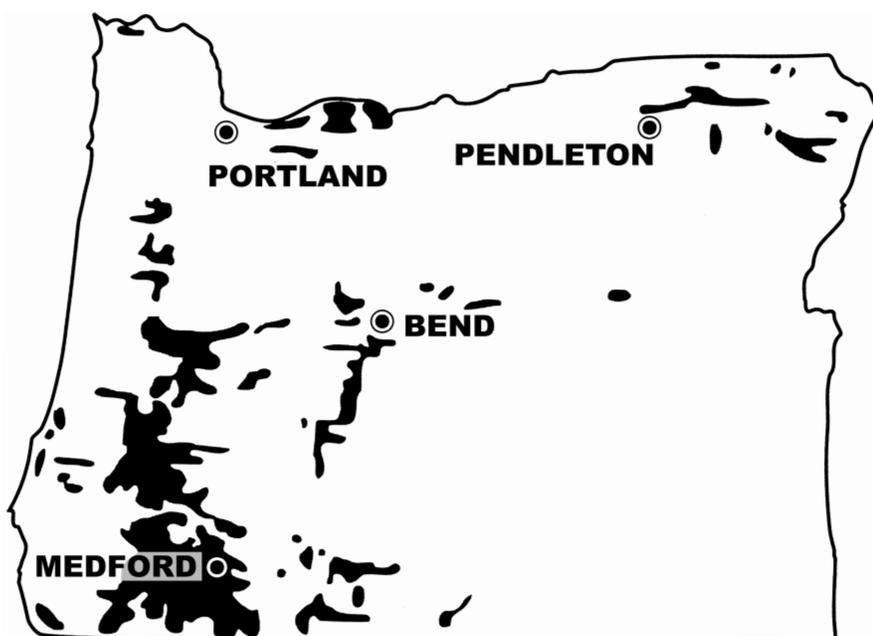


1.1 The Threat of Wildfire Hazards to Oregon Communities

Wildfire has caused tremendous destruction in Oregon communities. The severe fire season of 1987 resulted in a record setting mobilization of resources in the state.¹ In 1990, Bend's Awbrey Hall Fire destroyed 21 homes, causing approximately \$9 million in damage and costing over \$2 million to suppress.² In 1996, Bend's Skeleton Fire burned over 17,000 acres and damaged or destroyed 30 homes and structures. In that same year 218,000 acres were burned, 600 homes were threatened, and 44 homes were lost statewide.³

People in Oregon are becoming more vulnerable to wildfire by living near wildland settings characterized by large areas of flammable vegetation. Whether in populated urban areas or in remote locations, more people are living in wildfire-prone areas.⁴ Figure 1-1 shows regions of Oregon particularly prone to wildfire. As the map illustrates, areas of high risk exist throughout the state. The areas of highest risk are central, southwest, and northeast Oregon. There are around 200,000 Oregon homes built in areas where the risk of wildfire is high.⁵ Information in this Wildfire Technical Resource Guide can help your community reduce the level of risk to existing homes and future development.

Figure 1-1: High Risk Wildfire Areas in Oregon



Source: Oregon Department of Forestry. *Disaster in the Making*. Salem, Ore.: Oregon Department of Forestry Brochure.

Sidebar



Organization of the Natural Hazards Technical Resource Guide

The Natural Hazard Technical Resource Guide consists of eight chapters. The three preliminary *Planning for Natural Hazards* chapters include hazard-related information on reviewing your comprehensive plan, the elements of a comprehensive plan, and legal issues. Reviewing your comprehensive plan gives your community an opportunity to assess the adequacy of its existing natural hazard inventories and policies. The five hazard-specific chapters then provide detailed information on flood, landslide, coastal, wildfire, and seismic hazards. Appendices include information on Goal 2,7,17 and 18, a resource directory and a land use tools matrix for hazard mitigation.

1.2 How to Use the Wildfire Technical Resource Guide:

The Wildfire Technical Resource Guide provides information to help communities in Oregon plan for wildfire hazards. Each section heading asks a specific question to help direct you through information related to strengthening your comprehensive plan's factual base, policies, and implementing measures. This guide also contains numerous references and contacts for obtaining additional information about wildfire.

Section 2:

Is Your Community Threatened by Wildfire Hazards?

Section 2 presents an overview of the causes and characteristics of wildfire, and provides information to assist communities in wildfire hazard identification.

Section 3:

What are the Laws in Oregon for Wildfire Hazards?

Section 3 summarizes current laws that Oregon communities are required to address for wildfire hazards.

Section 4:

How can Your Community Reduce Risk from Wildfire Hazards?

Section 4 describes evaluation techniques for the development review process and hazard mitigation methods to help communities reduce risk from wildfire hazards.

Section 5:

How are Oregon Communities Addressing Wildfire Hazards?

Section 5 examines how two communities have addressed wildfire hazards through non-regulatory and regulatory approaches. These examples illustrate plan policies and implementing measures for wildfire.

Section 6:

Where can Your Community find Resources to Plan for Wildfire Hazards?

Section 6 is a resource directory listing contacts and documents that planners, local governments, and citizens can use to access additional information on wildfire hazards.



Section 2: Is Your Community Threatened by Wildfire Hazards?

Identifying hazard areas is a key step in developing effective plan policies and implementing measures to reduce loss of life and property damage. This section will assist your community in determining how wildfire may affect current and future development. An overview of the causes and characteristics of wildfire is included, along with information on identifying wildfire hazards in your community.

2.1 What are the Wildfire Hazards?

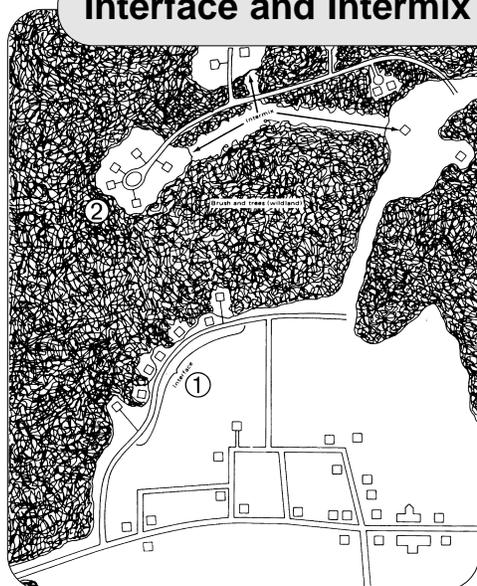
Wildfire can be divided into four categories: interface fires, wildland fires, firestorms, and prescribed fires.⁶ **Interface fire**, as defined below, is the primary fire hazard discussed in this Technical Resource Guide. Additional types of fire are also described in this section, as they potentially play roles in interface fire.

Interface

Interface fire occurs where wildland and developed areas come together with both vegetation and structural development combining to provide fuel.⁷ The catastrophic Oregon fires described in the introduction of this guide are examples of interface fire. The wildland/urban interface has three categories:⁸

- *The classic wildland-urban interface* exists where well-defined urban and suburban development presses up against open expanses of wildland areas.
- *The mixed wildland-urban interface* is more characteristic of the problems being created by exurban development: isolated homes, subdivisions and small communities situated predominantly in wildland settings.
- *The occluded wildland-urban interface* exists where islands of wildland vegetation occur inside a largely urbanized area.

Interface and Intermix Diagram



① = Interface

② = Intermix

Source: National Wildland / Urban Interface Fire Protection Program. *Fire Protection in the Wildland / Urban Interface*. Boise, Idaho: National Inter-agency p. 3.

Tip Box



Hazard Inventories

Oregon Statewide Planning Goal 2

requires cities and counties to develop a factual base (including inventories) as part of their comprehensive plans. Statewide Planning Goal 7 requires communities to inventory known hazards. Inventories contain facts about land use, natural resources, public facilities and development trends within the planning area, and provide the basis for comprehensive plan policies. Inventories must be periodically updated to reflect the best current information about resources, trends and local conditions that would affect plan decisions.

TRG Key



Chapter 2: Elements of a Comprehensive Plan examines natural hazard inventory and factual base development.



Wildfire Key

The Oregon Department of Forestry (ODF) administrative rules include criteria for determination of Wildfire Hazard Zones (Oregon Administrative Rules Chapter 629, Division 44). These criteria include rating systems for fuel, topography and weather. Refer to Section 4 of the Wildfire Technical Resource Guide for more information on ODF's Wildfire Hazard Zone program.

As a result of the Oregon Forestland-Urban Interface Fire Protection Act of 1997 (described further in Section 3 of this guide) additional criteria are being developed for the evaluation of interface areas in ODF Fire Protection Districts.

The distinctions above are not used in general literature, and the term “interface” is used to describe all three types of interface throughout this guide. The definitions are included to make clear that the interface is virtually everywhere — from the pine forests of Eastern Oregon, to the fir stands of the Coast Range, and even within the city limits of Portland.⁹

2.2 What Are Other Types of Fire?

2.2.1 Wildland

A wildland fire's main source of fuel is natural vegetation. These fires primarily occur in national forests and parks, rangeland, and privately owned timberland. A wildland fire may become an interface fire if it encroaches on developed areas. Fire in dryland farm areas may similarly affect development.

2.2.2 Firestorms

Firestorms are events of such extreme intensity that effective suppression is virtually impossible. Firestorms occur during dry, windy weather and generally burn until conditions change or the available fuel is exhausted. The disastrous 1991 East Bay Fire in Oakland, California is an example of an interface fire that developed into a firestorm.

2.2.3 Prescribed

Prescribed fires and prescribed natural fires are intentionally set or selected natural fires that are allowed to burn for beneficial purposes. An increasingly recognized beneficial purpose is to keep fuel from building up that might otherwise feed an interface fire. [The Biswell Symposium: Fire Issues and Solutions in Urban Interface and Wildfire Ecosystems](#), listed in Section 6 of this guide, examines prescribed fire in depth.

2.3 What are the Conditions that Contribute to Wildfire?

Ignition of a wildfire may come from a lightning strike or, more frequently, one of many possible human sources (most often arson or debris burns).¹⁰ Once a fire has started, four main conditions influence its behavior: fuel, topography, weather, and development.

2.3.1 Fuel

Fuel is the material that feeds a fire, and is a key factor in wildfire behavior. Fuel is classified by volume and by type. Volume is described in terms of “fuel loading,” the amount of available vegetative fuel. If fuel-loading doubles, the energy released can also be expected to double.¹¹ The type of fuel also influences wildfire. Oregon, as a western state with prevalent conifer, brush, and rangeland fuel types, is subject to more frequent wildfires than other regions of the nation.¹² Another important element of fuel is its continuity. A house surrounded by brushy growth rather than cleared space allows for greater continuity of fuel and increases the fire's ability to spread.



2.3.2 Topography

Topography influences the movement of air, directing a fire's course. Slope is a key topographic feature in fire behavior. If the percentage of uphill slope doubles, the rate of spread in wildfire will likely double.¹³ Gulches and canyons can funnel air and act as chimneys, which intensify fire behavior and cause the fire to spread faster. Similarly, saddle-shaped lands on ridge-tops lower resistance to the passage of air and draw fires. Solar heating of drier, south-facing slopes produces upslope drafts that can complicate fire behavior.¹⁴ Unfortunately, hillsides with hazardous topographic characteristics are also desirable residential areas in many communities.

2.3.3 Weather

Weather is the most variable factor affecting wildfire behavior, with some geographic locations having a favorable overall climate for wildfire activity. High-risk areas in Oregon (Figure 1-1) share a hot, dry season in late summer and early fall when high temperatures and low humidity favor fire activity. Predominant wind directions may guide a fire's path, as demonstrated by New Mexico's wind driven Los Alamos fire in 2000. It is often a change in weather that marks the end of a wildfire's growth.¹⁵

2.3.4 Development

Development of interface areas is increasing in Oregon. While there are many reasons people want to live in interface areas, homes in such areas often create risk. Fire has historically been a natural wildland element, and can sweep through vegetation that is adjacent to a combustible home. Major wildland fires may rapidly grow to sizes that require many fire fighters to control. New residents in remote locations are often surprised to find that in escaping urban areas, they left behind readily available fire services for structure protection.¹⁶

Wildfire has an obvious effect on development, yet development can also play an influencing role with wildfire. Owners often prefer homes that are private, have scenic views, are nestled in vegetation, and use natural materials (wood shake roofing, for example). A private setting may be a location far from public roads, or at least hidden behind a narrow, curving driveway. These conditions make evacuation and firefighting difficult. The scenic views found along mountain ridges and valley slopes can also mean areas of dangerous topography. Natural vegetation contributes to scenic beauty, but it may also provide a ready trail of fuel leading a fire directly to the combustible fuels of the home itself.¹⁷ Wildfire can threaten buildings, or, conversely, a burning structure can introduce fire into wildlands with the potential of destroying valuable natural resources such as timberlands, habitat and watersheds.¹⁸

Tip Box



By providing information from hazard identification to local building departments, wildfire roofing standards can be applied to reduce risk from interface wildfire.

TRG Key



For information on calculating percent slope, refer to Section 2 of the Landslide Guide of this Natural Hazards Technical Resource Guide.

Sidebar



Wildfire and Other Hazards

By removing vegetative cover within a watershed, wildfires can contribute to landslides and floods.¹⁹ Earthquakes and volcanoes have the potential to cause wildfires.

Wildfire Key



Because development has a strong influence on the behavior of interface wildfire, identification of hazard areas benefits from site-specific evaluation of development. For more information refer to Section 4 of this guide.

TRG Key



The first step of hazard assessment is hazard identification, estimating the geographic extent, intensity and occurrence of a hazard. More information on the three levels of hazard assessment can be found in Chapter 2: Elements of a Comprehensive Plan.

Wildfire Key



Refer to the list of Wildfire Publications in Section 6 of this guide for ordering information.

2.4 How Can Your Community Identify Wildfire Hazard Areas?

The Wildland/Urban Interface Fire Protection Program (the formal name given to a national initiative spawned by destructive fires of 1985) developed a generic five-step method for assessing wildfire hazard. By assessing components such as fuel, topography, weather, fire history, and development, a community can identify specific wildfire hazard areas. This information can strengthen the inventory of a comprehensive plan, providing further support for policies and implementing measures.

Wildland/Urban Interface Hazard Assessment Methodology

Step 1:

- Select the areas to be evaluated.
- Define the area or scope of the assessment.
- Using a map, display the interface areas.
- Name or number each area.

Step 2:

- Select the hazard components to be considered in the assessment. Assemble the list of hazard components that will be included in the assessment (fuel, topography, weather, fire history, roofing materials, etc.)

Step 3:

- Rank the hazard components.
- Define a system to rank the hazard level of the components.
- Evaluate and rank each individual component included in the assessment.
- Develop an overall hazard rating system.
- Calculate the overall hazard rating.

Step 4:

- Compile the hazard rankings in a useable format.
- Use a variety of display methods to make the data usable and understandable.
- Consider maps, clear overlays and computer modeling as methods for analyzing and displaying data.

Step 5:

- Develop Future Actions.
- Use the information developed to reduce the fire-loss potential in the wildland/urban interface.

Further information on the five-step method is included in the pamphlet: *Wildland/Urban Interface Hazard Assessment Methodology*. The pamphlet also includes profiles on 16 effective hazard assessment systems.



Mapping the results of your wildfire assessment may prove difficult. Information about hazard mapping processes can be found in the following locations of this Wildfire Guide:

- Section 3 - ORS 477.015-061;
- Section 4 - Wildfire Hazard Zones;
- Section 5 - Bend and Ashland Case Studies;
- Section 6 - Oregon Department of Forestry Mapping;
- Section 6 - Risk Mitigation of Wildfire Hazards at the Wildland/Urban Interface of Northwest Arkansas - web site; and
- Section 6 - Wildfire Hazard Maps of the Eastside Sierra Nevada - web site.

Once hazard areas are identified, compiling information about population and structural value in those areas helps assess a community's vulnerability to wildfire. This information can be a powerful tool in building support for wildfire risk reduction. Vulnerability assessment for wildfire hazards requires the cooperation of different local government departments, particularly planning, fire, and emergency management departments. Section 4 provides a profile of Wildfire Hazard Identification and Mitigation System (WHIMs) as an example of an applied wildfire vulnerability assessment.



Wildfire Key

The National Fire Protection Association's Standard 299: Protection of Life and Property from Wildfire is a resource to help planners assess wildfire hazards. It includes basic standardized rating systems for fuel, slope, structure, and additional factors. A profile of the standard is included in Section 4: Reducing Risk from Wildfire Hazards.

2.5 Summary: Wildfire Hazard Identification

- The principal type of wildfire affecting communities is interface wildfire.
- Fuel, slope, weather, and development are key components in wildfire hazard area identification.
- Following a standard methodology can assist a community in identifying wildfire hazard areas.
- By identifying wildfire hazard areas, a community can increase public support for policy and implementing measures.
- Once wildfire hazard areas are identified, communities can perform a vulnerability assessment, which examines loss potential and may further increase support for wildfire hazard mitigation.
- Has your community conducted a community wide vulnerability assessment?

Planning for Natural Hazards: Reviewing your Comprehensive Plan



Chapter 2: Elements of a Comprehensive Plan provides information on three phases of hazard assessment: hazard identification, vulnerability assessment and risk analysis. The factual base of your community's comprehensive plan should reflect a current inventory of all natural hazards and a vulnerability assessment. The inventory should include a history of natural disasters, maps, current conditions and trends. A vulnerability assessment examines identified hazards and the existing or planned property development, current population, and the types of development at risk. A vulnerability assessment will set the foundation for plan policies.

Your community should ask the following questions in determining whether or not its comprehensive plan has adequately inventoried wildfire hazards.

- Are there wildfire hazards in your community?
- Does your comprehensive plan hazard inventory describe wildfire in terms of the geographical extent, the severity and the frequency of occurrence?



Section 3: What are the Laws in Oregon for Wildfire Hazards?

Oregon communities have a statutory mandate to develop comprehensive plans and implementing ordinances. As a part of the comprehensive planning process, cities and counties must address areas with “known” natural hazards. This section of the Wildfire Hazard Technical Resource Guide presents laws that Oregon communities are required to address.

3.1 Oregon Laws Related to Wildfire Hazards

3.1.1 Statewide Planning Goal 7: Areas Subject to Natural Disasters and Hazards

Goal 7 is the Statewide Planning requirement that directs local governments to address natural hazards in their comprehensive plans. Goal 7 states “Developments subject to damage, or that could result in loss of life, shall not be planned or located in known areas of natural disasters and hazards without appropriate safeguards. Plans shall be based on an inventory of known areas of natural disasters and hazards...”

3.1.2 Oregon Revised Statute 215.730: Additional Criteria for Forestland Dwellings

ORS 215.730 (County Planning; Zoning, Housing Codes) provides additional criteria for approving dwellings located on lands zoned for forest and mixed agriculture/forest use. Under its provisions, county governments must require, as a condition of approval, that single-family dwellings on lands zoned forestland meet the following requirements:

1. Dwelling has a fire retardant roof;
2. Dwelling will not be sited on a slope of greater than 40 percent;
3. Evidence is provided that the domestic water supply is from a source authorized by the Water Resources Department and not from a Class II stream as designated by the State Board of Forestry;
4. Dwelling is located upon a parcel within a fire protection district or is provided with residential fire protection by contract;
5. If dwelling is not within a fire protection district, the applicant provides evidence that the applicant has asked to be included in the nearest such district;
6. If dwelling has a chimney or chimneys, each chimney has a spark arrester; and
7. Dwelling owner provides and maintains a primary fuel-free break and secondary break areas on land surrounding the dwelling that is owned or controlled by the owner.

If a governing body determines that meeting the fourth requirement is impractical, local officials can approve an alternative means for protecting the dwelling from fire hazards.

TRG Key



Information on Goal 7 can be found in Appendix A of the Natural Hazards Technical Resource Guide.



Tip Box

For more information on forestland zones consult the Oregon Department of Land Conservation and Development; Statewide Goal 4 -Forest Lands and Oregon Administrative Rules 660-006.

This can include a fire sprinkling system, on-site equipment and water storage, or other methods that are reasonable, given the site conditions.

If a water supply is required under this subsection, it must be a swimming pool, pond, lake or similar body of water that at all times contains at least 4,000 gallons or a stream that has a minimum flow of at least one cubic foot per second. Road access must be provided to within 15 feet of the water's edge for fire-fighting pumping units, and the road access must accommodate a turnaround for fire-fighting equipment.

3.1.3 Oregon Revised Statute 477.015-061 Urban Interface Fire Protection

These provisions were established through efforts of the Oregon Department of Forestry, the Office of the State Fire Marshal, fire service agencies from across the state, and the Commissioners of Deschutes, Jefferson, and Jackson Counties.²⁰ It is innovative legislation designed to address the expanding interface wildfire problem within Oregon Department of Forestry Fire Protection Districts. Full implementation of the statute will occur on or after January 1, 2002. The statute does the following:²¹

1. Directs the State Forester to establish a system of classifying forestland-urban interface areas;
2. Defines forestland-urban interface areas;
3. Provides education to property owners about fire hazards in forestland-urban interface areas. Allows for a forestland-urban interface county committee to establish classification standards;
4. Requires maps identifying classified areas to be made public;
5. Requires public hearings and mailings to affected property owners on proposed classifications;
6. Allows property owners appeal rights;
7. Directs the Board of Forestry to promulgate rules that set minimum acceptable standards to minimize and mitigate fire hazards within forestland-urban interface areas; and
8. Creates a certification system for property owners meeting acceptable standards. Establishes a \$100,000 liability limit for cost of suppressing fires, if certification requirements are not met.



3.2 Summary: Laws for Wildfire Hazards

- Oregon Statewide Planning Goal 7: Areas Subject to Natural Hazards
- Oregon Revised Statute 215.730: Additional Criteria for Forestland Dwellings
- Oregon Revised Statute 477.015-061 Urban Interface Fire Protection



Wildfire Key

Refer to Internet Resources in Section 6 for information on accessing a map of the Oregon Department of Forestry Fire Protection Districts. Implementation of ORS 477.015-061 will occur in these districts.

Planning for Natural Hazards: Reviewing your Comprehensive Plan



Statewide Planning Goal 2 requires that comprehensive plan policies be supported by an adequate factual base. The laws in Section 3 of the Wildfire Technical Resource Guide are those that communities are required to address in their comprehensive plans.

Your community should ask the following questions after identifying wildfire hazards in your jurisdiction:

- Does your community's comprehensive plan contain an inventory of wildfire hazards, vulnerability assessment and policies addressing wildfire hazards?
- Has your community's comprehensive plan been updated to reflect the latest information on wildfire hazards in your community and current laws related to wildfire?
- Does your comprehensive plan have policies and implementing measures to reduce risk to existing and future development in wildfire hazard areas?



Wildfire Key

Section 2 of this document provides information that can assist your community in identifying wildfire hazard areas.

**Section 4:
How Can Your Community Reduce Risk from Wildfire Hazards?**

Avoiding development in hazard areas is the most effective way to reduce risk. The appreciation of land values, however, and other short-term economic advantages of development in wildfire hazard areas often create an active constituency strongly opposed to regulatory efforts.²² This section presents strategies to reduce risk from wildfire including site-specific evaluation, land use planning tools, and non-regulatory activities. These strategies can further assist communities planning for wildfire hazards through strengthened factual base, policies, and implementing measures.

4.1 How Can Your Community Plan for Wildfire Hazards?

It is possible to plan, at least to some degree, for wildfire hazards. The nature of your community's response will depend on severity of the hazard. Avoiding, or significantly limiting development in wildfire areas through zoning and careful planning lessens the need for other types of mitigation measures, and is the safest strategy for reducing risks to development in the most dangerous locations.

To successfully plan for wildfire hazards, consider the following steps:



TRG Key

Chapter 2: Elements of a Comprehensive Plan provides further information on hazard identification.

✓ **Identify the hazard**

Hazard identification is the first phase of hazard assessment and is part of the foundation for developing plan policies and implementing measures for natural hazards.

✓ **Avoid the hazard**

Restrict development in hazard-prone areas. For areas with high potential for severe property damage or loss of life, this option should be followed.

✓ **Evaluate site-specific development**

Evaluating site-specific development may assist in further identifying wildfire hazard areas, and can help determine site-specific measures needed for risk reduction. Site-specific evaluation processes, examples of which are described below, may enhance the factual base upon which policies and implementation measures are built. They may also be of use in the development permit process. Programs described in this section include:

- Wildland Home Fire Risk Meter & Forest Home Risk Form
- Colorado State Forest Service (CSFS) Wildfire Hazard Mitigation and Response Plan
- Woodland Home Forest Fire Hazard Rating
- NFPA Standard 299: Protection of Life and Property from Wildfire



- ✓ **Conduct a community-wide vulnerability assessment**
A vulnerability assessment can provide a basis for wildfire hazard policy and implementing measures. This section includes a profile of Boulder, Colorado's Wildfire Hazard Identification and Mitigation System (WHIMs), which contains an example of wildfire vulnerability assessment.
- ✓ **Implement risk reduction measures through land use planning**
Regulating development in hazard areas through land use planning can reduce risk of property damage and loss of life. This section describes a Wildfire Hazard Overlay District for Jefferson County, Colorado.
- ✓ **Implement additional non-regulatory measures**
Non-regulatory measures can further reduce risk from wildfire. Programs described in this subsection include:
 - FireFree
 - Firewise
 - Oregon Wildfire Hazard Zones

4.2 How is Development in Wildfire-Prone Areas Evaluated?

This subsection describes methods for evaluating site-specific development, including home-site evaluations, subdivision evaluations, and a comprehensive program that includes various elements of site-specific evaluation.

4.2.1 Wildland Home Fire Risk Meter & Forest Home Risk Form

Home site evaluation tools like the Risk Meter, Risk Form, FireFree checklist, and Wildfire Hazard Assessment and Mitigation System (WHIMs) questionnaire can be used to increase public involvement by prompting homeowners to think about interface wildfire. Information produced by using these tools can also help assess a community's risk to interface fire and enhance a community's factual base of the wildfire hazard.

The *Wildland Home Risk Meter* is designed simply (multiple cardboard dials on a placard), and provides a model for communities interested in designing similar evaluation tools. The meter computes a wildfire hazard level using the following four steps:

1. Estimate the terrain slope around the home and line up the first dial.
2. Select the vegetation type rating from a given chart, and line up the rating on the second dial.
3. Select the roof material.
4. The wildfire risk meter then points to the danger rating from low to extreme.

Created under the Great Lakes Forest Fire Compact, the *Forest Home Risk Form* is an online evaluation tool. The user checks the appropriate answers to a series of questions and is presented with an automatic calculation of site risk. The user can then use the form to calculate risk reduced from using different prevention measures. To access the Risk Form visit <http://www.dnr.state.mi.us/www/fmd/fire/hazardform.htm>.

4.2.2 Colorado State Forest Service (CSFS) Wildfire Hazard Mitigation and Response Plan

This state agency plan can be used as a model to guide wildfire hazard assessment at the local level. Information gathered from the assessment can be used to increase public awareness and enhance a community's factual base for wildfire hazard.

In an effort to increase uniformity and improve the quality of wildfire hazard assessment, the CSFS evaluated existing assessment models to produce this dynamic system for the state of Colorado. The system acts as a baseline for local jurisdictions and was created with the understanding that, "To be accepted and utilized such a system must be easy to understand, simple to apply, not require excessive time and effort, and provide consistent results regardless of who conducts the evaluation."²³

The hazard assessment system is enhanced by the use of standards and codes, and it may be updated as new techniques are developed. This system includes techniques for assessing both individual homes and subdivisions and a response plan outline (for use by local fire agencies) combining the information gathered in the assessments.

The Plan is available by contacting:

Colorado State Forest Service
 Colorado State University
 Fort Collins, CO 80523
 Phone: (970) 491-6303
 Fax: (970) 491-7736
<http://www.colostate.edu/Depts/CSFS/fire/mitplan.pdf> (a downloadable Plan)



Wildfire Key

Refer to Internet Resources in Section 6 for more information on CSFS.

4.2.3 Woodland Home Forest Fire Hazard Rating

This user-friendly evaluation tool for subdivisions is included in the National Wildland/Urban Interface Fire Protection Program document Fire Protection in the Wildland/Urban Interface: Everyone's Responsibility. The evaluation can be used in the approval process for a proposed subdivision or in the development of factual base for a community's wildfire hazard. The rating system uses the following criteria to calculate subdivision fire hazard:

- Fuel Hazard Rating;
- Slope Hazard Rating;
- Structure Hazard Rating;
- Emergency Vehicle Access Rating;
- Safety Zone Rating (the zone of cleared vegetation around a house); and
- Additional Factor Rating (street signs, power lines, water sources, density, etc.)



4.2.4 National Fire Protection Association (NFPA) Standard 299: Protection of Life and Property from Wildfire

This national standard provides suggested criteria for fire agencies, land use planners, architects, developers, and local government for fire-safe development in areas that may be threatened by wildfire.²⁴ NFPA Standard 299 presents minimum planning criteria for the protection of life and property from wildfire, and it outlines standardized procedures for addressing the following issues:

- Evaluation of the wildland/urban interface (includes fuel, slope, hazard ratings, additional factors);
- Street design;
- Signage of streets and buildings;
- Emergency water supplies; and
- Structural design and construction.

This document is an excellent resource for evaluating existing or proposed development. It is also useful for development of sound local interface wildfire policies and implementing measures.

4.2.5 Wildfire Hazard Identification and Mitigation System (WHIMs)

In response to Colorado's Black Tiger Fire of 1989, which destroyed 44 homes and 2,086 acres, the Boulder Board of County Commissioners established the Boulder County Wildfire Mitigation Group.²⁵ The mission of this group was to discuss and coordinate actions that could be taken to help minimize the loss of lives and property from the next wildfire. They used the spatial analysis and mapping abilities of the county's computer Geographic Information System (GIS) for identification of wildfire hazards. A technical working group was formed to design WHIMs, a program to coordinate all the components of wildfire mitigation, while providing motivation for homeowners and residents to actively participate. WHIMs combines elements of evaluation and implementation.

WHIMs assesses community vulnerability by using GIS to create hazard maps which relate county assessor's parcel ownership and structure data to physical data (such as slope or fuel type). It then compiles a hazard rating survey of the individual parcels. The survey is in the form of a questionnaire produced using the advice of wildfire hazard experts. The questionnaire is taken to individual properties and residents by volunteer fire fighters within the fire district.

Wildfire Key



Water Supply

Increased risk in some interface locations can be caused by lack of emergency water supplies. Creative methods for addressing this problem can be found in the National Wildland/Urban Interface Fire Protection Program's Planning for Water Supply and Distribution in the Wildland/Urban Interface. You can obtain this document through the National Fire Protection Association's Public Fire Protection Division. Refer to Section 6 for more information on accessing this Wildfire publication.

Boulder County Wildfire Hazard Pilot Map

WILDFIRE HAZARD IDENTIFICATION AND MITIGATION SYSTEM

Pine Brook Hills Pilot Area



Boulder County GIS

Copyright 1995 County of Boulder, Colorado. All Rights Reserved. This map is for illustrative purposes only. Boulder County does not warrant the level of hazard represented for any lot.

Roof Material of Structure by Lot (survey question #3)

- | | |
|----------------------|-----------------|
| Metal or Tile | Treated Shake |
| Composite or Asphalt | Untreated Shake |

- | | |
|--------------|--|
| Parcel Lines | Pine Brook Hills Fire Protection District Boundary |
|--------------|--|



1650 feet

Date: April 28, 1995
Map Design: J. Korte

Sidebar

Contact Boulder County

You can contact Boulder County to find out how elements of WHIMs might function in your area.

Boulder County Land Use Department
P.O. Box 471
Boulder, CO 80306
Telephone: (303) 441-3930
<http://www.co.boulder.co.us/gislu/whims.html>

Source: *Federal Emergency Management Agency. Multi-Hazard Identification and Risk Assessment. Washington, D.C.: FEMA (1997) p. 243.*

WHIMs is a multi-faceted program. From the vulnerability assessment comes a stronger factual base for planning. Increased public involvement and fire agency interaction also increases support for wildfire mitigation. The WHIMs system accomplishes its objectives using four main components: data collection and entry, analysis, dissemination, and maintenance. A thorough review of how these components function within the system (as well as cost and staffing considerations, results, and future developments) can be obtained using the contact information below. It is not suggested that a program like WHIMs could be applied the same way in any location.



4.3 What Land Use Tools can be Used for Wildfire Hazards?

Land use planning for wildfire hazards often involves identifying a community's hazard areas and developing regulations applying specifically to those areas. This method is used in places like Ashland, Oregon and Jefferson County, Colorado. A profile of Ashland is included in Section 5 of this guide. Jefferson County's regulation is discussed below. Another effective land use tool for reducing wildfire risk is subdivision regulation. Subdivision regulations used in Bend, Oregon are described in Section 5.

4.3.1 Wildfire Hazard Overlay District - Jefferson County, CO

Once areas prone to wildfire are evaluated and mapped, a community can regulate land use within those areas by creating an overlay zone. This kind of land use tool builds directly from the hazard identification process often used for comprehensive plan hazard inventories. The general provisions of the wildfire hazard overlay district in Colorado are listed below (complete ordinance language can be accessed on-line at <http://www.co.jefferson.co.us/dpt/planning/zoning/sec45.html>).

A. INTENT AND PURPOSE OF DISTRICT

This District is intended to promote the public health, safety and general welfare of the citizens of Jefferson County; minimize the risk of loss of life and property in Wildfire Hazard Overlay Zone District; encourage and regulate prudent land use in the Wildfire Hazard Overlay Zone District so as not to increase the danger to the public health, safety and property; reduce the demands for public expenditures for relief and protection of structures and facilities permitted in the Wildfire Hazard Overlay Zone District; regulate buildings and structures so as to minimize the hazard to public health, safety, welfare, and to public or private property.

B. GENERAL PROVISIONS

1. Boundaries (a statement of applicability)
2. Wildfire Hazard District Overlays Other Zone Districts (an illustration of how the overlay zone applies)
3. Warning and Disclaimer of Liability

C. USE REGULATION

D. BUILDING PERMITS (performance standards, key issues for wildfire mitigation)

1. Building Permits
2. Site Plans
3. Design Standards
4. Defensible Space Certification Procedures

E. MAPPING CONFLICTS

Tip Box



Jefferson County, Colorado Ordinance

This Jefferson County, Colorado zoning ordinance demonstrates several key elements that your community should include to safeguard against legal challenges: 1. A clear statement of the "intent and purpose" of the district. Note that the intent of the district is to "promote health, safety and general welfare" and "to minimize the risk of loss of life and property in Wildfire Hazard Overlay Zone District." 2. A clear statement of applicability – property owners know if they are in or out of the hazard overlay district. 3. Performance standards that provide information to the property owner on what activities they can or must take to minimize risks of wildfire.



Wildfire Key

Refer to section 6 for information on FEMA's Project Impact.

4.4 What are Non-Regulatory Programs to Reduce Risk from Wildfire Hazards?

This subsection profiles a variety of non-regulatory programs available in Oregon for interface fire mitigation at the local level.

4.4.1 FireFree

FireFree is a unique private/public program for interface wildfire mitigation involving partnerships between an insurance company and local government agencies. It is an example of an effective non-regulatory approach to hazard mitigation. Originating in Bend, the program was developed in response to the city's "Skeleton Fire" of 1996, which burned over 17,000 acres and damaged or destroyed 30 homes and structures.²⁶ Bend sought to create a new kind of public education initiative that emphasized local involvement. SAFECO Insurance Corporation was a willing collaborator in this effort.

Bend's pilot program included:

- A short video production featuring local citizens as actors, made available at local video stores, libraries, and fire stations;
- Two city-wide yard debris removal events;
- A 30-minute program on a model FireFree home, aired on a local cable television station; and
- Distribution of brochures, featuring a property owner's evaluation checklist and a listing of fire-resistant indigenous plants.

The success of the program helped to secure \$300,000 in Federal Emergency Management Agency (FEMA) "Project Impact" matching funds.²⁷ By fostering local community involvement, FireFree also has the potential for building support for sound interface wildfire policy. To obtain information regarding how FireFree might work in a particular community contact:

SAFECO
SAFECO Plaza T-8
Seattle, WA 98185
(206) 545-6188
<http://www.FireFree.org>



4.4.2 Firewise

Firewise is a program developed within the National Wildland/Urban Interface Fire Protection Program, and it is the primary federal program addressing interface fire. It is administered through the National Wildfire Coordinating Group whose extensive list of participants includes a wide range of federal agencies.

The program can empower planners and decision-makers at the local level. Through conferences and information dissemination, Firewise increases support for interface wildfire mitigation by educating professionals and the general public about hazard evaluation and policy implementation techniques.

Firewise offers online wildfire protection information and checklists, as well as listings of other publications, videos, and conferences. The interactive home page allows users to ask fire protection experts questions, and to register for new information as it becomes available. For more information on the Firewise program, contact:

The Wildland/Urban Interface Fire Program
c/o The National Fire Protection Association
1 Batterymarch Park
Quincy, MA 02269
<http://www.firewise.org>

Applegate Watershed Partnership (Southern Oregon)



Integrated approaches to wildfire hazard mitigation can provide multiple community benefits. An example of an integrated approach is the Applegate Watershed Partnership, in Josephine County, which has cooperated with federal agencies and a private timber company.

Before European settlement of the watershed, Native Americans set frequent, low-intensity fires throughout the watershed. This resulted in forests with large, widely spaced trees and diverse under-story, while reducing the danger of catastrophic fires.²⁸ After a period of extensive stand-clearing fires set by Euro-Americans in the mid-to-late 1800's, followed by nearly a century of fire suppression,²⁹ much of the forested slopes have grown into dense, choked stands of small-diameter trees, which pose an extreme fire danger in an increasingly populated valley.³⁰

A project to reduce fire hazard and enhance the local economy involves contract sales to thin large numbers of smaller trees. This reduces fire hazard in the Applegate watershed while leaving the largest trees to begin reestablishing old growth characteristics. The small trees, which traditionally would have little value as lumber, have tight growth rings and superior tensile strength because of their age. Some of the proceeds from the timber sales go to restoration of pine-oak savannas, which historically have been an important element in regional biodiversity, but for which there currently is no economic market to support their restoration.³¹



Wildfire Key

For more information on ORS 215.730, refer to the State

Wildfire Policies in Section 2. For more information on ODF's Wildfire Hazard Zones, refer to ODF contact information in Section 6 of this guide.

4.4.3 Oregon Wildfire Hazard Zones

A statute enacted by the 1993 Legislature and changes to Oregon's Building Code encourage local governments to *voluntarily* designate those portions of their jurisdictions subject to catastrophic fire as "Wildfire Hazard Zones". The purpose of these zones is to define those areas where buildings need to be more resistant to fires spreading through adjacent wildlands.

The determination of wildfire hazard zones involves the inventorying and mapping of the wildfire hazard at the jurisdiction level. The mapping must be done using the Oregon Department of Forestry's criteria as defined in Oregon Administrative Rules chapter 629, Division 44.

When a jurisdiction adopts a Wildfire Hazard Zone the provisions of ORS 93.270(4) become active. These provisions state that legal action cannot be brought against a property owner for using fire resistant roofing material, even if a flammable material, such as cedar shakes, is specifically required by covenants which run with the land. Several provisions in the 1993 Building Code also become active. These provisions require that fire safe roofing materials be used and that street addresses be clearly posted. The roofing material provisions compliment similar existing requirements in ORS 215.730, which sets standards for new dwellings built on land zoned for forest use.³²



4.5 Summary: Reducing Your Community's Risk from Wildfire Hazards

- ❑ Reduce the level of risk in hazard prone areas by minimizing development, or implementing mitigation measures such as building code standards when developing in hazard-prone locations is unavoidable.
- ❑ Possible steps in planning for the wildfire hazard include:
 - Identifying the hazard;
 - Evaluating existing or proposed site-specific development;
 - Performing community vulnerability assessment and risk analysis;
 - Implementing risk reduction measures through land use planning; and
 - Implementing additional mitigation activities.

Planning for Natural Hazards: Reviewing your Comprehensive Plan



Refer to Chapter 2: Elements of a Comprehensive Plan for more information on developing inventories. Implementing measures tied to specific actions are essential to carrying out plan policies in a comprehensive plan. Your local government should ask the following questions in determining the strength of your comprehensive plan in addressing wildfire hazards:

- ❑ Do your comprehensive plan policies authorize lower density zoning provisions for areas of high vulnerability to natural hazards in general?
- ❑ Has your community implemented a process for evaluating site-specific development requests in wildfire hazard areas?
- ❑ Does your community have an approach to reduce risk from wildfire through a combination of regulatory and non-regulatory measures?
- ❑ Do the implementing measures carry out your comprehensive plan's policies related to wildfire in your community?



Tip Box

All implementing ordinances should have clear intent and purpose sections to help withstand legal challenges.

**Section 5:
How are Oregon Communities Addressing
Wildfire Hazards?**

This section summarizes background, policy development, and implementing measures for Oregon communities addressing wildfire hazards and development in wildfire-prone areas.

5.1 Creating Public/Private Partnerships in Bend, Oregon

Bend, having experienced interface fire destruction, has addressed the wildfire hazard through a unique effort involving fire and planning department cooperation and a public/private, action-oriented educational program.

5.1.1 Background

The city of Bend, located in Deschutes County, has direct experience with destructive interface wildfire. The Awbrey Hall fire of 1990 destroyed 21 homes, burning approximately 3,400 acres.³³ In 1996, the city's Skeleton fire burned over 17,000 acres and damaged or destroyed 30 homes and structures. Losses from the fire reached over \$7 million.³⁴

Deschutes County's wildfire hazards have been mapped using Oregon Department of Forestry criteria for Wildfire Hazard Zones. Under the criteria, the entire county is considered a Wildfire Hazard Zone. Within Bend's Urban Growth Boundary (UGB), some risk is offset by central city development that incorporates built-in fuel breaks in the form of roads and an adequate water supply. Yet, the interface (which is constantly changing in Bend and many other communities) remains an area of high risk when sufficient mitigation efforts are not taken.

Hazard mapping was facilitated by a Central Oregon Community College Geographic Information System (GIS) specialist, which demonstrates the positive role academia can play in hazard mitigation.

Greater initiative for wildfire hazard mitigation in Bend came after the devastating incidents mentioned above. Unfortunately, that initiative had to compete with the many other planning demands of a rapidly growing city, and an opportunity to strengthen city wildfire policies had to be postponed. Policies in Bend's General Plan providing a link to wildfire protection include the following:

- Narrow streets may have limited parking to ensure emergency vehicle access;
- Emergency vehicle access will be considered in review of new residential development; and
- A shortened block length under Street System Policies to create more of a grid system.
- In areas where the natural slope exceeds 20 percent, the city may reduce the minimum residential density (allow larger lots) or alternatively, may require cluster development through the Planned Unit Development (PUD) process to preserve the natural topography and vegetation, and improve fire protection.



TRG Key

For further information on academic research for inventory and factual base development, refer to Chapter 2 of the Natural Hazards Technical Resource Guide, Elements of a Comprehensive Plan.



After the Skeleton fire of 1996, the community came together to support wildfire mitigation through a unique public/private program involving the Bend Fire Department, Deschutes County Rural Fire Protection District #2, Bend City Planning, and Deschutes National Forest. Bend became the pilot community for the FireFree program.

5.1.2 Implementation

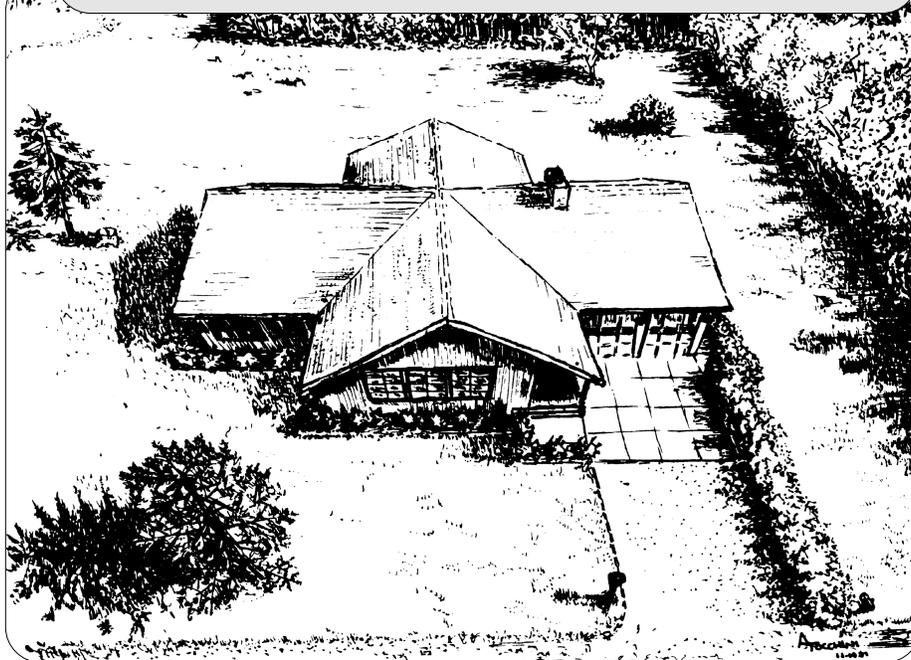
Bend's fuel break ordinance is a regulatory tool for creating "defensible space" or an area around a structure free from flammable vegetation (refer to figure 5-1). The objectives of the ordinance often are met through the non-regulatory FireFree program. Bend holds annual community clean-up weekends, during which residents can dispose of yard debris free of charge at local facilities. Hauling the debris has been done at no cost to the property owner, as well. These kinds of local, private partnerships help sustain the FireFree program at an effective level. The 1999 designation of Deschutes County as a FEMA Project Impact community increases the effort to utilize all levels of government and numerous business interests to support and increase the use of the FireFree program.



TRG Key

Refer to Appendix C: Land Use Tools for more information on Planned Unit Developments.

Figure 5-1: Defensible Space



Source: Northwest Interagency Fire Prevention Group. *Fire Safety Considerations for Developments in Forested Areas*. Salem, Ore.: Oregon Department of Forestry (1997) p. 15.



Wildfire Key

Refer to Section 6 of this guide for more Project Impact information.

5.1.3 Ordinance Language: Flammable Vegetation Fuel Breaks, City of Bend

The City of Bend Code addresses risk reduction of interface wildfire by requiring property owners to remove flammable vegetation surrounding structures and other objects susceptible to fire. The four main items of Bend Code Section 5.345 (Flammable Vegetation Fuel Breaks) read as follows:

- 1) It shall be the responsibility of every property owner and occupier of property within the City of Bend to reduce the fire hazard created by flammable weeds, grass, vines, brush and other combustible vegetation on their property by complying with the requirements of this ordinance.
- 2) Every property owner and occupier of property shall establish fuel breaks (also known as firebreaks) on their property in the following manner:
 - a) A fuel break shall be created by removing or cutting all of the flammable weeds, grass, vines, brush, and other combustible vegetation within the fuel break as close to the ground as is reasonably practicable given the nature of the terrain and property.
 - b) The fuel break shall be a minimum of ten feet in width or depth, or three times the height of the tallest vegetation adjacent to the fuel break, if this would be more than ten feet.
 - c) The fuel breaks shall be located along the boundaries of the property; and also around any structures, power poles,



Mike Byers “Planner’s Perspective”

Bend has experienced several small lightning caused fires in the past, but it was the human caused 1990 Awbrey Hall fire that brought the reality of wildfire to Bend. Policy changes to require fire flows tests and second emergency evacuation routes out of subdivisions – both critical concerns during the Awbrey Hall fire – were made following the fire. The rapid growth during the early 1990s kept the Bend planning and engineering staff busy with current planning issues, and unfortunately better wildfire planning slipped into the “to do” file.

The 1996 Skeleton fire, just southeast of Bend in an area of junipers and brush, made it clear that the risk of wildfire is present throughout Central Oregon. Since the development patterns in the urban area and rural subdivisions are already established, the city staff and rural fire department worked on ways to mitigate damage and protect the public from future wildfires. In addition to the very successful FireFree! education program, changes to the city subdivision codes were drafted to require multiple roads in and out of new development to provide safe evacuation of residents and access by emergency equipment. Other changes to street widths, block length, design standards, and pedestrian access ways were made to ensure rapid response to fires and protection of the public. These mitigation measures also considered planning design and livability issues like “skinny streets”, connectivity, streetscape, and tree preservation. Exceptions to street width, length and design standards can be granted upon a determination by the planning and fire departments that public safety can be maintained.

The variety of both voluntary and regulatory measures taken in Bend after both the Awbrey Hall and Skeleton fires will help reduce the risk of wildfire hazards and damage to the community.

Mike Byers - Bend Long Range Planning



- vehicles, trees or other improvements on the property that would be vulnerable to a fire hazard created by flammable weeds, grass, vines, brush and other combustible vegetation.
- d) The purpose of the fuel breaks shall be to protect the property from the spread of fire from other properties; as well as confining any fire on the property by preventing its spread to other properties. In addition to the fuel breaks described above, the Fire Chief or Fire Chief representative may also permit smaller properties to comply with the purpose of this ordinance by cutting all of the flammable weeds, grass, vines, brush and other combustible vegetation on those properties to a prescribed height that will create a defensible fire space and accomplish the purpose of this ordinance.
 - 3) The requirements of this ordinance shall be interpreted and applied consistently with the Uniform Fire Code in effect within the City of Bend.
 - 4) A violation of this ordinance by any person, firm or corporation shall be a Class B Civil Infraction. In addition, any person, firm or corporation not complying with the provisions of this ordinance shall be subject to the abatement procedures provided in Bend Code Section 5.400 – 5.425.

Cooperation between planners and the fire protection community is key for reducing risk to development in wildfire-prone areas. Bend accomplishes this through interaction that occurs between the city’s planning department and fire department. When conflicts of interest arise between development proposals and fire protection, there may be a meeting of planning department staff, fire department personnel, developers and engineers. Representatives from the fire department occasionally participate in public planning hearings, and planning department representatives attend fire department demonstrations. A year’s worth of cooperation between the planning and fire departments facilitated the first of the following items in Bend’s subdivision code.

Bend’s Subdivision Code:

Design Standards

To help find common ground between developers’ desires and fire department needs, Article VI (Design Standards and Improvements) of the subdivision code addresses exceptions to street standards. The exceptions are allowed only after the fire department reviews the proposed design. This review assures that the design will not restrict or prevent emergency vehicle access or create an unsafe situation for adjacent buildings or properties. Street standard exceptions may be granted if they allow for approved fire department access within 150 feet of all exterior portions of structures, do not require emergency vehicles to back-up more than 150 feet, or if there are increased fire protection measures inside structures (a fire sprinkler system for example).

Water Availability

For any land division, information needs to be provided on the fire hydrant location and sizes of water mains.

Tip Box



Defensible Space

Creation of “defensible space” may meet with opposition from property owners who do not want to denude their landscape. Yet, non-flammable vegetation (preferably native to the area) can be planted in defensible space. A compilation of fire performance ratings for residential landscape plants can be accessed at: <http://www.prefire.ucfpl.ucop.edu/vegetati.htm>

Tip Box



Bend’s Ordinance

Bend’s ordinance includes a clear purpose statement and clear, objective performance standards. Also, the ordinance tells property owners exactly what is expected of them and exactly what the penalty is if they don’t comply.

Land Division

Safety from fire, flood, and other natural hazards needs to be considered in the review of a land division proposal. Placement of available utilities and adequate provision of public facilities and services must also be considered. The general provision on fire hazards applies to all land divisions not just subdivisions.

Block Length

Maximum residential block length is 600 feet to help ensure connectivity and multiple access routes in and out.

5.2 Regulatory Approaches to Wildfire in Ashland, Oregon

Ashland, after a detailed survey of wildfire hazard areas, has addressed the wildfire hazard through regulatory measures in specific hazard locations.

5.2.1 Background

Along with Deschutes County, Jackson County is a pilot area for ORS 477, interface mapping. This southwestern portion of the state experienced severe losses during the 1987 fire season. Ashland is situated in an area of high wildfire risk encompassing most of Jackson County.

The city of Ashland has mapped wildfire hazard areas within its Urban Growth Boundary, providing a strong fact base for wildfire hazard planning. This was done through a site-specific survey performed by Ashland's fire department in cooperation with the Oregon Department of Forestry, using United States Forest Service fuel models. Ashland has 1,100 acres categorized as wildfire hazard areas.³⁵ Some key criteria include connectivity of fuel, roofing materials, density of vegetation, and slope.

5.2.2 Wildfire Policy

Increased development pressure in Ashland led to a policy change in interface wildfire mitigation. Originally adopted in the early 1980s, the physical constraints chapter of Ashland's land use code (which deals with multiple hazard-related land development constraints) addressed development of wildfire hazard areas on a site-specific basis. In 1994, a change was made to include regulation at the subdivision level, as well (the original version of the code is included as an element of the updated version). The end result has been to create a lower level of risk for development in wildfire areas by addressing a broader level of development.

5.2.3 Implementation

Implementation of Ashland's code is similar to that of Colorado's Jefferson County Overlay District profiled in Section 4. Ashland has defined areas of wildfire hazard as a result of the mapping process described above. Within these mapped areas the city can apply effective regulation, because it has the factual base to support that regulation. The implementation procedure is highlighted within the second version of the code listed below.

Ashland illustrates a key requirement for community implementing measures with its clear and objective standards. Property owners



know exactly what size fuel break they need to install (A) and how to maintain it (B). Also included are clear building code requirements. As part of Ashland's implementing measure, the subdivision code includes a provision for a fire prevention and control plan, again stressing the need for cooperation between the planning department and fire/emergency management agencies.

Ashland's planning department can be contacted at Community Development; 20 East Main; Ashland, OR; 97520. Phone: (541) 488-5305.

Ashland Municipal Code (Original Version)

Chapter 18.62 Physical Constraints, Section 18.62.110, Development Standards for Class E Lands (wildfire hazard areas)

- A) A 30-ft. shaded fuel break shall be installed and maintained around each dwelling unit or structure. Such fuel break shall be increased by 5 ft. for each 10% increase in slope over 10%.
- B) A shaded fuel break is defined as an area that is free of dead or dying vegetation, and has native, fast-burning species sufficiently thinned so that there is no interlocking canopy of this type of vegetation. Where necessary for erosion control or aesthetic purposes, the fuel break may be planted in slow-burning species. Fuel breaks do not involve stripping the ground of all native vegetation.
- C) No structure shall be constructed or re-roofed with wooden shingles, shakes or other combustible roofing material, as defined in the City's building code.
- D) Fuel breaks in areas that are also Class C (constraints due to erosion hazards) lands shall be included in the erosion control measures outlined in Section 18.62.090.

Ashland Municipal Code (Updated Version)

Chapter 18.62 Physical and Environmental Constraints, Section 18.62.090, Development Standards for Wildfire Lands

Complete code language can be accessed at <http://www.ashland.or.us/MunicipalCode>.

Requirements for Subdivisions, Performance Standards Developments, or Partitions:

- A Fire Prevention and Control Plan shall be required with the submission of any application for an outline plan approval of a Performance Standards Development, preliminary plat of a subdivision, or application to partition land which contains areas designated as Wildfire Hazard areas.
- Criterion for Approval. The hearing authority shall approve the Fire Prevention and Control Plan when, in addition to the findings required by this chapter, the additional finding is made that the wildfire hazards present on the property have been reduced to a reasonable degree, balanced with the need to preserve and/or plant a sufficient number of trees and plants for erosion prevention, wildlife habitat, and aesthetics.

- The Fire Prevention and Control Plan shall be implemented during the public improvements required of a subdivision or Performance Standards Development, and shall be considered part of the subdivider's obligations for land development. The Plan shall be implemented prior to the issuance of any building permit for structures to be located on lots created by partitions and for subdivisions or Performance Standards developments not requiring public improvements. The Fire Chief, or designee, shall inspect and approve the implementation of the Fire Prevention and Control Plan, and the Plan shall not be considered fully implemented until the Fire Chief has given written notice to the Staff Advisor that the Plan was completed as approved by the hearing authority.

Planning for Natural Hazards: Reviewing your Comprehensive Plan



Your comprehensive plan should be coordinated with and reflect other comprehensive plan, plan policies and implementing measures of other communities within your region.

Natural hazards do not respect community boundaries, making it important to coordinate with other jurisdictions in your area. In reviewing your comprehensive plans, your community should ask the following questions in developing plan policies and implementing measures for wildfire hazards:

- What policy measures would assist your community in planning for wildfire hazards?
- Are there communities that face similar wildfire threats that have developed ordinances or non-regulatory programs that could be adopted by your community?
- Is your comprehensive plan consistent with plans or actions of other jurisdictions and regional plans and policies (such as school, utilities, fire, park, and transportation districts)?



Section 6: Where Can Your Community Find Resources to Plan for Wildfire Hazards?

This section is a resource directory including contacts, documents, and internet resources to assist planners, local governments and citizens in obtaining further information on wildfire hazards.

6.1 State Agency Resources

Oregon Department of Forestry (ODF)

ODF's Fire Prevention Unit is involved in interface wildfire mitigation, providing information about Oregon's Wildfire Hazard Zones (refer to Section 4 of this Guide). ODF has mapping relevant to wildfire hazard mitigation (refer to Internet Resources below). ODF's Graphics Department can produce mapping at the local level, but data availability may limit the usefulness of this resource.

Contact: Fire Prevention Unit
Address: 2600 State Street
Salem, OR 97310
Phone : (503) 945-7440
Fax: (503) 945-7454
Website: <http://www.odf.state.or.us>
Contact: Graphics Department
Address: 2600 State Street, Salem, OR 97310
Phone: (503) 945-7200

Oregon Department of Consumer and Business Services

The Building Codes Division of Oregon's Department of Consumer and Business Services is responsible for administering statewide building codes. Its responsibilities include adoption of statewide construction standards that help create disaster-resistant buildings, particularly for flood, wildfire, wind, foundation stability, and seismic hazards. Information about wildfire related building codes is found through this department.

Contact: Building Codes Division
Address: 1535 Edgewater St. NW
P.O. Box 14470, Salem, OR 97309
Phone : (503) 373-4133
Fax: (503) 378-2322
Website: <http://www.cbs.state.or.us/external/bcd>

Sidebar



The Governor's
Interagency Hazard
Mitigation Team

(GIHMT) is an important organization for interagency coordination, formalized by Governor Kitzhaber after the 1996-97 flood and landslide events. One of the most important roles of the GIHMT is to provide a forum for resolving issues regarding hazard mitigation goals, policies and programs. The team's strategies to mitigate loss of life, property and natural resources are reflected in the state's *Natural Hazards Mitigation Plan*. This plan is dubbed the "409 plan" since it is required by section 409 of the Robert T. Stafford Disaster Relief and Emergency Assistance Act (P.L. 93-288). The GIHMT reviews policies and plans and makes recommendations with an emphasis on mitigation and education. Representatives from Oregon Emergency Management staff the GIHMT.

Office of the State Fire Marshal (OSFM)

The Prevention Unit of Oregon's Office of the State Fire Marshal includes 19 Deputy State Fire Marshals located in various regions. The responsibilities of these deputies include public education for local fire districts and inspection of businesses, public assemblies, schools, daycare centers, and adult foster homes.

Contact: Prevention Unit
Address: 4760 Portland Rd. NW
Salem OR 97305-1760
Phone : (503) 378-3473
Fax: (503) 373-1825
Email: oregon.sfm@state.or.us
Website: <http://www.sfm.state.or.us>

6.2 Federal Agency Resources

Federal Emergency Management Agency (FEMA)

FEMA Region 10 serves the northwestern states of Alaska, Idaho, Oregon and Washington. The Federal Regional Center (FRC) for Region 10 is located in Bothell, Washington. FEMA is an agency of the federal government whose purpose is to reduce risks, strengthen support systems, and help people and their communities prepare for and cope with disasters regardless of the cause. FEMA's mission is to "reduce loss of life and property and protect our nation's critical infrastructure from all types of hazards through a comprehensive, risk-based emergency management program of mitigation, preparedness, response and recovery."

Contact: Federal Regional Center, Region 10
Address: 130-228th St. SW
Bothell, WA 98021-9796
Phone: (425) 487-4678
Website: www.fema.gov

National Fire Protection Association (NFPA)

NFPA is the principal federal agency involved in the National Wildland/Urban Interface Fire Protection Initiative. NFPA has information on the initiative's programs and documents. Other members of the initiative include: the National Association of State Foresters, the U.S. Department of Agriculture Forest Service, the U.S. Department of the Interior (including Bureau of Land Management, Bureau of Indian Affairs, Fish and Wildlife Service, and National Park Service), and the United States Fire Administration.

Contact: Public Fire Protection Division
Address: 1 Batterymarch Park, P.O. Box 9101
Quincy, MA 02269-9101
Phone: (617) 770-3000
Website: <http://www.nfpa.org>



6.3 Recommended Wildfire Publications

The following list groups publications into three categories: primary, secondary, and technical. Documents listed as primary are those that every community should use in planning for wildfire hazards. Secondary documents may not be as essential as primary documents or as readily accessible, yet they still provide useful information to communities. Technical documents are those that focus on a particular specialized aspect of wildfire hazard mitigation.

Primary Resources

These documents represent the principal resources communities can use to better plan for the wildfire hazard. They are key tools for reducing the risks associated with wildfire-prone areas.

National Fire Protection Association Standard 299: Protection of Life and Property from Wildfire. National Wildland/Urban Interface Fire Protection Program. (1991). Washington, D.C.: National Fire Protection Association.

This document, developed by the NFPA Forest and Rural Fire Protection Committee, provides criteria for fire agencies, land use planners, architects, developers, and local governments to use in the development of areas that may be threatened by wildfire. The document is further profiled in Section 4 of this Guide.

To obtain this resource: National Fire Protection Association Publications (www.nfpa.org or 800 344-3555), Firewise (<http://www.firewise.org>)

An International Collection of Wildland-Urban Interface Resource Materials (Information Report NOR-X-344). Hirsch, K., Pinedo, M., & Greenlee, J. (1996). Edmonton, Alberta: Canadian Forest Service.

A comprehensive bibliography of interface wildfire materials. Over 2,000 resources are included, grouped under the categories of general and technical reports, newspaper articles, and public education materials. The citation format allows the reader to obtain most items through a library or directly from the publisher. The bibliography is available in hard copy or diskette at no cost. It is also available in downloadable PDF form.

To obtain this resource: Canadian Forest Service- Northwest Region, Northern Forestry Centre (780 435-7210), I-Zone Series (<http://www.prefire.ucfpl.ucop.edu/uwibib.htm>)

Wildland/Urban Interface Fire Hazard Assessment Methodology. National Wildland/Urban Interface Fire Protection Program. (1998). Washington, D.C.: Author.

This detailed 17-page pamphlet addresses the generic methodology listed in Section 4 of this Guide. Included in the back cover are 17 profiles of quality hazard assessment resources. Copies are limited, and bulk orders are not recommended.

To obtain this resource: Firewise (www.firewise.org), NFPA Public Fire Protection Division (617) 984-7486

Fire Protection in the Wildland/Urban Interface: Everyone's Responsibility. National Wildland/Urban Interface Fire Protection Program. (1998). Washington, D.C.: Author.

A pamphlet providing three case studies of interface wildfire areas (Shenandoah Co., VA; Prescott, AZ; Orange Co., CA) with reviews of local interface wildfire programs. Includes general information on the process of developing a strong program. Also of value is information on rating systems and wildfire ordinances. Copies are limited, and bulk orders are not recommended.

To obtain this resource: Firewise (www.firewise.org) NFPA Public Fire Protection Division (617) 984-7486



Project Impact: Building Disaster Resistant Communities

FEMA's Project Impact is a nationwide initiative that operates on a common sense damage reduction approach, basing its work and planning on three simple principles:

1. Preventive actions must be decided at the local level;
2. Private sector participation is vital; and
3. Long-term efforts and investments in prevention measures are essential.

Project Impact began in October of 1997 when FEMA formed partnerships with seven pilot communities across the country. FEMA offered expertise and technical assistance from the national and regional level and used all the available mechanisms to get the latest technology and mitigation practices into the hands of the local communities. FEMA has enlisted the partnership of all fifty states and U.S. Territories, including nearly 200 Project Impact communities, as well as over 1,100 businesses.³⁶

Benton, Deschutes, and Tillamook counties, and Multnomah County with the City of Portland are the Oregon communities currently participating in this initiative to build disaster resistant communities. Application for participation in the program in Oregon is through the Office of Emergency Management in Salem.³⁷ For more information about Project Impact visit <http://www.fema.gov> on the World Wide Web (<http://www.fema.gov/impact/impact00.htm>), or contact the Oregon Office of Emergency Management.



Secondary Resources

These documents provide additional information and tools for reducing the risks associated with wildfire-prone areas.

IFCI Urban/Wildland Interface Code. International Fire Code Institute. (1996). Whittier, CA.

California's I-Zone: Wildland/Urban Fire Prevention and Mitigation. Slaughter, R. (Ed.). (1996). Sacramento, CA: Governor's Office of Emergency Services.

Wildland/Urban Interface Fire Policy Action Report. Western Governor's Association. (1996). Denver, CO.

Wildfire Strikes Home (2nd Edition). National Wildland/Urban Interface Fire Protection Program. (1991). Washington, D.C..

The Wildland/Urban Fire Hazard. Insurance Services Office, Inc. (1997). New York, NY.

Questions and Answers about Wildfire Hazard Zones. Oregon Department of Forestry. (1996). Salem, OR.

Disaster in the Making: Awbrey Hall Fire (brochure). Oregon Department of Forestry. (1991). Salem, OR.

Cooperating with Nature: Confronting Natural Hazards with Land Use Planning for Sustainable Communities. Burby, R. (1998). Washington, D.C.: Joseph Henry Press.

Protecting Life and Property from Wildfire: An Introduction to Designing Zoning and Building Standards for Local Officials. Great Lakes Forest Fire Compact. (1996). Sault Ste. Marie, Ontario.

The Biswell Symposium: Fire Issues and Solutions in Urban Interface and Wildfire Ecosystems. Weise, D. (1995). Albany, CA: Pacific Southwest Research Station.

The East Bay Hills Fire Oakland-Berkeley, California. Routley, J. (1991). Washington, D.C.: United States Fire Administration.

Wildfire Hazard Management in the Urban/Wildland Interface in Southern Oregon. Curran, C. (1978). Ashland, OR: Southern Oregon State College.



Sidebar

Similar to Oregon's catastrophic flooding in 1996, California's 1993 wildfire events resulted in a presidential declaration of emergency triggering FEMA's Hazard Mitigation Grant Program. One ensuing mitigation project created an online guide (The I-Zone Series) containing downloadable interface wildfire publications. This Internet resource can be used to supplement the listed document resources.

Technical Resources

The document listed here focuses on the technical aspects of wildfire hazard mitigation. It may require interpretation by a technical specialist.

Planning for Water Supply and Distribution in the Wildland/Urban Interface. National Wildland/Urban Interface Fire Protection Program. (1994). Washington, D.C.

6.4 Internet Resources

Urban/Wildland Interface Fire: The I-Zone Series

<http://www.prefire.ucfpl.ucop.edu/izone.htm>

This is a comprehensive Web site with extensive information on all aspects of interface wildfire. The I-Zone series is an online "strategic resource planning guide" featuring downloadable publications, a homeowner's guide, a hazard assessment report, and more. Downloadable publications are found under: "Relevant Reports on the Urban/Wildland Interface".

Firewise

<http://www.firewise.org/>

Firewise maintains a Web site designed for people who live, vacation, or own structures in wildfire-prone areas, but it also can be of use to local planners and decision-makers. It offers online wildfire protection information and checklists, as well as listings of other publications, videos, and conferences. The interactive site allows users to ask questions of fire-protection experts and to register and receive further information as it becomes available.

Colorado State Forest Service (CSFS)- Interface Fire

<http://www.colostate.edu/Depts/CSFS/fire/interface.html>

The interface section of CSFS's Web site contains valuable links to Colorado mitigation strategies involving planning departments. Also included is the Wildfire Hazard Mitigation and Response Plan evaluation tool (refer to Section 4 of this Guide) and summaries of state fire hazard mitigation grant projects.

FireFree Program

<http://www.ci.bend.or.us/firedept/FireFree.htm> or <http://www.FireFree.org>

A site sponsored by SAFECO Insurance Corporation, the Bend Fire Department, and Deschutes County Rural Fire Protection District Number Two. It includes a home rating questionnaire for interface wildfire mitigation and a list of prevention tips for homeowners.



Oregon Department of Forestry (ODF), Protection from Fire and Geographic Information System (GIS)

www.odf.state.or.us/FIREPROT.HTM and www.odf.state.or.us/gis/gisatlas.html

The Protection from Fire section of the ODF site includes Oregon specific fire protection resources. Wildfire condition reports can be accessed here. The GIS section of the site includes state maps of the following: slope, fire weather zones, precipitation, forest protection districts, potential natural vegetation, GAP vegetation, Northwest Oregon fire history, Southwest Oregon vegetation, lightning frequency, major watersheds, and general land ownership.

Fire Safety and Prevention: Wildfire Report

<http://www.ci.medford.or.us/fire/urbanwild.html>

This site provides an overview of interface wildfire including prevention strategies for both homeowners and fire departments.

Fire Policy in the Wildland/Urban Interface (Western Governor's Association)

<http://www.westgov.org/wga/policy/98013.htm> and <http://www.westgov.org/wga/publicat/feb.wpd>

A profile of a 1998 interface wildfire policy resolution including policy statements and management directives adopted by the Western Governor's Association. Also available through the Association's site is an online version of the Wildland/Urban Interface Fire Policy Action Report. The report broadly addresses what needs to be accomplished to mitigate interface wildfire in the Western United States.

Risk Mitigation of Wildfire Hazards at the Wildland/Urban Interface of Northwest Arkansas

<http://www.cast.uark.edu/~mike/thesis.html>

This site is a thesis on interface fire mitigation. It includes a detailed overview of the wildfire hazard mapping process for an Arkansas Forestry Commission Fire Protection District.

Wildfire Hazard Maps of the Eastside Sierra Nevada

http://www.npr.unr.edu/fire_new.html

This site is an outline of the wildfire hazard mapping process completed by the University of Nevada- Reno's Department of Environmental and Resource Science. The project was aided by a multiple partnership of non-governmental organizations, academic institutions, and both state and federal government.

The Wildland/Urban Fire Hazard (Executive Summary)

<http://www.iso.com/docs/stud009.htm>

An executive summary of the Insurance Services Office, Inc. report on interface wildfire. Intended for use by regulators, legislators, the general public, and insurance company personnel, the report offers an overview of interface wildfire and presents the insurance industry's role in hazard mitigation.

Great Lakes Forest Fire Compact

http://www.glffc.com/fire_prevention.htm

The fire prevention section of the Compact's Web site provides a downloadable version of their pamphlet Protecting Life and Property from Wildfire: An Introduction to Designing Zoning and Building Standards for Local Officials and a printable homeowner's evaluation questionnaire. The pamphlet draws on NFPA Standard 299, listed above as a primary resource.

Wildland/Urban Interface Fire Mitigation

<http://www.ak-prepared.com/plans/mitigation.fire.htm>

A list of actions homeowners can take to make their dwellings less susceptible to interface wildfire. The State of Alaska Division of Emergency Services maintains this site.

National Interagency Fire Center (NIFC)

<http://www.nifc.gov>

The National Interagency Fire Center employs wildland fire experts in the fields of fire ecology, fire behavior, technology, aviation, and weather. Working together with state and local agencies, NIFC's role is to serve as a focal point for wildland fire information and technology. The site provides National Weather Service fire weather forecasts, information about cooperating agencies, and other information about NIFC projects.

Fire Globe

<http://www.uni-freiburg.de/fireglobe>

Fire Globe is a resource providing links on multiple aspects of wildfire. The site evolved from a need for global information and a monitoring system that national and international agencies involved in land use planning, disaster management, or other fire-related tasks could use in planning and decision-making.

Canadian Forest Service's Fire Management Network

<http://www.nofc.forestry.ca/fire/>

The mission of the Canadian Forest Service's Fire Management Network is to "increase understanding and ability to manage wildland fires within the context of sustainable development of Canada's forests." The site offers network information; a publications list; a glossary of fire acronyms; and information about the Canadian Forest Fire Danger Rating System, Forest Fire Weather Index System, and Forest Fire Behavior Prediction System.

California Fire Safe Council

<http://www.firesafecouncil.org>

The main goal of the council is to preserve California's natural and manmade resources by mobilizing all Californians to make their homes, neighborhoods, and communities fire safe. The site provides a model for creating fire safe councils in California.



Interface Fire

<http://www.interfacefire.com>

A dedicated fire official's effort to stimulate fire protection. Interface Fire acts as a news source with links to recently published articles.

Alaska Fire and Safety Net

<http://www.alaskafire.net>

One of the main goals of Alaska Fire and Safety Net is wildfire prevention. The site provides a link to the organization's Firewise program, including tips on interface wildfire mitigation.

Wildfire Assessment System

<http://www.fs.fed.us/land/wfas>

Utilizing the National Fire Danger Rating System (NFDRS), this site is maintained by the United States Department of Agriculture- Forest Service. It gives daily forecasts, and it contains graphic information on national conditions for wildfire. National maps for fuel and fire danger are available at this site.

Federal Emergency Management Agency (FEMA)

Wildfire Publications

<http://www.fema.gov/MIT/wfpubs.htm> and <http://www.fema.gov/library/wildlanf.htm>

FEMA offers a short list of wildfire publications available for order through the Internet. It also provides "fact sheets" (including preparedness and mitigation tips) concerning most natural hazards. The collection includes a wildland fire fact sheet.

Federal Wildland Fire Policy, Wildland/Urban Interface Protection

<http://www.fs.fed.us/land/wdfire7c.htm>

This is a report describing federal policy and interface fire. Areas of needed improvement are identified and addressed through recommended goals and actions.

Planning for Natural Hazards: Reviewing your Comprehensive Plan



Coordination and consistency is essential to implementing plan policies that reduce wildfire risk within your community. Your community should ask the following questions in reviewing your comprehensive plan to assist you in identifying resources to strengthen plan policies and implementing regulations:

- Have you made use of technical assistance provided by agencies to assist your community in planning for the wildfire hazard?
- What documents or resources does your community need to find to further understanding of the wildfire hazard and begin the process of assessing community risk from wildfire hazard?

Wildfire Endnotes:

- ¹ Oregon Department of Forestry. (1998). Oregon Forestland-Urban Interface Fire Protection Act of 1997 "Senate Bill 360". Salem, OR.
- ² FireFree Program. (1998). Wildfire Safety Program Launches in March. Bend, OR.
- ³ (ibid.)
- ⁴ National Wildland/Urban Interface Fire Protection Program. (1998). Fire Protection in the Wildland/Urban Interface: Everyone's Responsibility. Washington, D.C..
- ⁵ Oregon Department of Forestry. (1991). Disaster in the Making: Awbrey Hall Fire (brochure). Salem, OR.
- ⁶ Federal Emergency Management Agency (FEMA). (1997). Multihazard, Identification and Risk Assessment Report. Washington, D.C..
- ⁷ National Wildland/Urban Interface Fire Protection Program. (1998). Fire Protection in the Wildland/Urban Interface: Everyone's Responsibility. Washington, D.C..
- ⁸ Cooperating with Nature: Confronting Natural Hazards with Land-Use Planning for Sustainable Communities. Burby, R. (1998). Washington, D.C.: Joseph Henry Press.
- ⁹ Wildfire Planning Task Force. (1988). An Action Plan for Protecting Rural/Forest Lands from Wildfire. Salem, OR.
- ¹⁰ Federal Emergency Management Agency (FEMA). (1997). Multihazard, Identification and Risk Assessment Report. Washington, D.C..
- ¹¹ (ibid.)
- ¹² (ibid.)
- ¹³ (ibid.)
- ¹⁴ (ibid.)
- ¹⁵ (ibid.)
- ¹⁶ National Wildland/Urban Interface Fire Protection Program. (1991). Wildfire Strikes Home (2nd Edition). Washington, D.C..
- ¹⁷ (ibid.)
- ¹⁸ Wildfire Hazard Management in the Urban/Wildland Interface in Southern Oregon. Curran, C. (1978). Ashland, OR: Southern Oregon State College.
- ¹⁹ Federal Emergency Management Agency (FEMA). (1997). Multihazard, Identification and Risk Assessment Report. Washington, D.C..
- ²⁰ Oregon Department of Forestry. (1998). Oregon Forestland-Urban Interface Fire Protection Act of 1997 "Senate Bill 360". Salem, OR.
- ²¹ Oregon Revised Statutes(1999). <http://www.leg.state.or.us/ors/477.html> (2000, May 13).
- ²² Federal Emergency Management Agency (FEMA). (1997). Multihazard, Identification and Risk Assessment Report. Washington, D.C..
- ²³ Wildfire Hazard Mitigation and Response Plan (1997). <http://www.colostate.edu/Depts/24> National Wildland/Urban Interface Fire Protection Program. (1991). National Fire Protection Association Standard 299: Protection of Life and Property from Wildfire. Washington, D.C.: National Fire Protection Association.
- ²⁵ A Wildfire Hazard Identification and Mitigation System for Boulder Co. Colorado (1998). www.co.boulder.co.us/gislu/nacoawar.html (2000, April 17).
- ²⁶ FireFree Program. (1998). Wildfire Safety Program Launches in March. Bend, OR: Author.
- ²⁷ FireFree expands in central Oregon. FEMA Region 10 (2000). http://www.fema.gov/reg-x/2000/r10_39.htm (2000, May 7).
- ²⁸ Ecology and participation in landscape-based planning within the Pacific Northwest. Johnson, B. (1999). Policy Studies Journal, 27(3), 502-530.
- ²⁹ An Environmental History of the Little Applegate Watershed, Jackson County, Oregon. Lalande, J. (1995). Medford, OR: USDA Forest Service.



- ³⁰ Ecology and participation in landscape-based planning within the Pacific Northwest. Johnson, B. (1999). *Policy Studies Journal*, 27(3), 502-530.
- ³¹ (ibid.)
- ³² Oregon Department of Forestry. (1996). *Questions and Answers about Wildfire Hazard Zones*. Salem, OR.
- ³³ Oregon Department of Forestry. (1991). *Disaster in the Making: Awbrey Hall Fire (brochure)*. Salem, OR.
- ³⁴ FireFree Program. (1998). *Wildfire Safety Program Launches in March*. Bend, OR: Author.
- ³⁵ Woodley, Keith. *Personal Interview*. 4 April 2000.
- ³⁶ Federal Emergency Management Agency <http://www.fema.gov> (April 2000)
- ³⁷ OEM Murray, Joseph. Personal Interview. 9 Feb 2000.