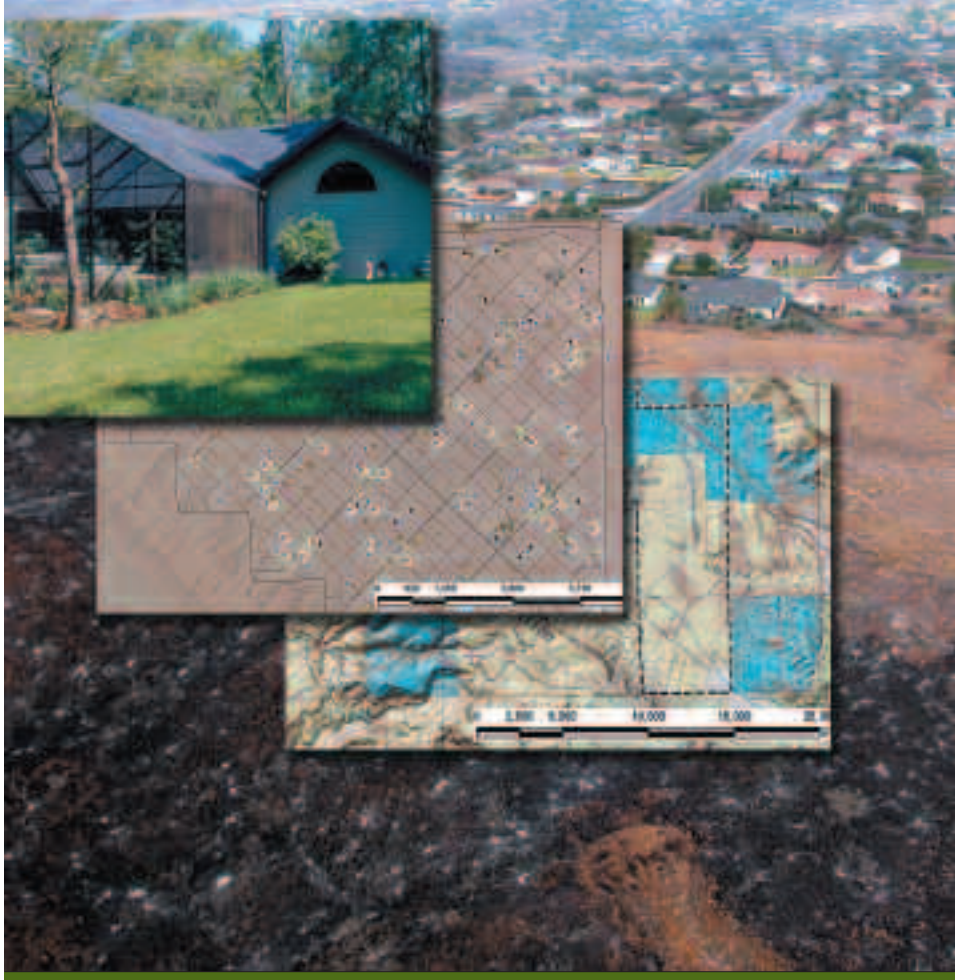

Wildland/Urban Interface Fire Hazards

# A New Look at Understanding HAZARD ASSESSMENT METHODOLOGIES

FIREWISE COMMUNITIES™

The development of Wildland/Urban Interface Fire Hazards: A New Look at Hazard Assessment Methodologies is an undertaking of the Wildland/Urban Interface Fire Working Team of the National Wildfire Coordinating Group.

This publication is a revision of Wildland/Urban Interface Fire Hazard Assessment Methodology, developed in 1997. Since the original introduction, the understanding of interface fire behavior, assessment of home ignition hazards, and mitigation planning has increased greatly. In addition, the introduction of the national Firewise Communities/USA Recognition program has encouraged thousands of interface residents to join together to reduce the threat of wildfire around their homes and within their communities. Citizens engaged in wildfire mitigation are changing the traditional approach to prevention and mitigation from a fire agency responsibility to one that encourages active participation by interface homeowners, residents and many others.

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# Scope and Purpose

The scope of this document is to create an awareness of a variety of concepts and methodologies for assessing the threat of wildfire to individual homes, residential developments, and communities in wildland areas throughout the United States and bordering countries.

The purpose of this document is to provide individuals and organizations involved or interested in preventing wildland/urban interface fire disasters with concepts, recommendations, and resources that may be used to assess and mitigate wildfire hazards in WUI areas. Specifically, this document addresses the relationships between the assessment of an individual home and the collective homes within a subdivision (residential development). Information is provided as to how the uniform hazard assessment process of the Firewise Communities program may relate to jurisdictional level planning, such as Community Wildfire Protection Plans.

# Section I

## Introduction to Assessing Wildfire Hazards in the Interface

Throughout the United States, it is increasingly common to see homes and other buildings located or being built in wildland environments. This expansion into wildland areas often results in homes located next to and among large volumes and areas of vegetation often untreated or unprepared for development. These homes become extremely vulnerable to wildfire in the surrounding area. However, many actions to reduce the potential ignition of homes in existing housing developments are relatively simple and can be assumed by the homeowner. Many of the principles that guide the mitigation of single homes may also be applied to planned developments.

The most effective way to prevent wildfire disasters is to prevent the ignition of homes by mitigating the hazards associated with the interface homes themselves and their surrounding vegetation. Due to the tremendous variability in fuels, weather, topography, codes and standards, and state and local laws and ordinances, each homeowner, subdivision, community, city or county is encouraged first to adopt a uniform systematic approach to assessment that will result in specific mitigation recommendations for residents and, second, to develop, modify or employ a rating system, if desired, that will meet specific needs (e.g., hazard evaluation and rating).

This guide will help users understand the need to assess the potential of home ignition by an approaching wildfire and focus on specific mitigation actions that may prevent ignition without the intervention of fire fighting personnel and equipment. To that end, wildfire hazard assessments should ultimately encourage individual and community commitment to the proactive, preventative actions of pre-fire mitigation rather than reactive fire suppression plans.

Since assessments are conducted for many different purposes, this guide addresses several methods for assessment that may be used depending on the desired outcome. Elements that should be assessed at various levels are described in detail. The guide next provides a five-step method to determine the focus and appropriate level of assessment in interface communities. Finally, this guide references a wide variety of systems, displays and tools that form the basis for the hazard components and the methodology described, including qualitative and quantitative approaches.

# Section II

## Relationships of Hazard Assessment and Planning Outcomes

Because there are many reasons to assess fire hazards in the wildland/urban interface, the specific method of assessment will be determined by your desired outcome. For example, if you wish to compare relative hazards or risks of one community to another within a region or state, your method will be different than that used to recommend mitigation actions to a single homeowner.

The purpose of Wildfire Hazard Assessment and Planning (Figure 1) is to graphically display the relationship of information (data) elements to the focus and level of planning within the scale of the geographic area being assessed. Read from left to right and bottom to top, each column represents a continuum of scale, size, number, or concern.

Hazard assessment, like planning, is a matter of scale and the user may begin anywhere along the continuum columns, including the information layers indicated by the overlapping quadrangles. Note that there are no distinct divisions at which one area may end and the next one begin.

The conceptual diagram (see pages 12-13) indicates the many variable elements and their interrelationship that comprise WUI hazard assessments on different levels and for different purposes.

The first two columns relate to the Focus of Planning and the Level of Assessment. Firewise Communities Planning includes the single structure focus or Hazard Ignition Zone (HIZ) and the residential development level (for the Firewise Communities/USA Recognition program). The higher level includes the larger scope of the Community Wildfire Protection Plan (CWPP).

**Planning Focus** (Column, far left). The selected FOCUS of the planning will drive the LEVEL of the assessment needed (Column 2). For example, if the intent of the assessment process is to focus on the Home Ignition Zone, then the appropriate beginning is the Single Structure level and the information to be gathered is indicated by the multi-level overlapping quadrangles to the right.

**Assessment Level** (Column). This column represents the continuum of a number of homes and structures. For example, if the desired planning outcome is for the residential development to receive national Firewise Communities/USA recognition, consideration should be given for all of the items from "Decks & Fences" to "Infrastructure".

**Specific Information and Data** (Column). The elements in the layered quadrangles represent progressive concerns as the issue moves from the single structure level (i.e., Home Ignition Zone or 'HIZ') upward through subdivisions (i.e., Firewise Communities/USA Recognition) to the city or county level (e.g., Community Wildfire Protection Planning). The types of information in the Home Ignition Zone, Firewise Communities/USA, and Community Wildfire Protection Plans will be discussed in Section III.

Beginning at the HIZ level and moving to the right, the information is very specific because these are visible, physical conditions relating to a single structure, home, or building. As the level of focus or level moves upward, the information areas and data elements become more descriptive than prescriptive and, therefore, less defined and more open to the information that is deemed necessary by the organization conducting the assessment.

As an illustration, the information specific to the HIZ includes the elements from "Roof" to "Hazards 30 ft – 200 ft." As the level of focus expands above the HIZ level to include multiple homes, subdivisions or communities the information needed for the assessment also changes. The area and the number of buildings involved in the assessment will determine the specific information needed (e.g., "Common Areas and Shared Hazards" to "Ordinances"). At this level of assessment, overlapping Home Ignition Zones become a very important consideration in community (i.e., subdivision) level assessments.

### General Information and Data

**Fuels** (Column). The fuel considerations in the diagram progress from the home upward to include the vegetative fuels in the HIZ and then to include the fuels that compose the common area and the shared hazards of adjoining properties and structures/homes. This progression continues to larger geographic areas where the assessment must include vegetative fuels and fuel complexes that affect planning on a large and/or multi-agency scale.

**Fire Weather/Frequency** (Column). Fire weather and fire frequency increase in importance in the assessment as the number of buildings and area of assessment increase in size and complexity. At the structure level, the prime considerations are on the "little" hazards, or those hazards that contribute to the small ignitions that often go unnoticed or unattended until the house is fully involved and suppression is more difficult, if not impossible. The concern at the city/county level typically shifts to the large, uncontrolled wildfire and the widespread impact on fire response resources and public safety.

**Topography** (Column, far right). Like Fire Weather/Frequency, the importance of Topography increases in relevance for the assessment as areas increase in size. For example, large-scale topographical features may not be as relevant to home ignition as the topographical features within 100-200 feet of the home.

# Section III

## Assessment Elements

The assessment elements describe the building and vegetative fuel hazards that should be taken into consideration when assessing the ignition potential of individual homes and communities should they be threatened by wildfire. The three levels addressed here include the Home Ignition Zone, residential developments, and larger communities (towns, cities or counties).

To understand what to look for in an assessment of a home and its surroundings, it's important to understand how homes can ignite in a wildfire. Ignition occurs when heat is transferred to a combustible object. This transfer occurs by radiation, convection, and/or conduction. In wildland fire situations, all three methods of heat transfer are possible.

To be effective, it's important to understand the basic process of ignition before assessing hazards; in other words, being aware of the factors that contribute to ignition. Understanding the processes that allow a vegetation fire to ignite homes is critical to preventing homes from igniting. The most effective prevention results by removing the requirements of combustion that result in home ignition. To make this happen, a basic understanding of fire and heat transfer is needed.

Heat is transferred by radiation, convection, and conduction, including the collection of firebrands on combustible materials and surfaces. In wildfire situations, one, two, or all all three methods of heat transfer may contribute to a home's ignition.

Radiation. Radiation is defined as heat transfer by way of electromagnetic energy. The best example of heat transfer by radiation is the sun's heating of earth. Radiant exposure to a home from a wildfire depends on the intensity and duration of the flame front. The chance that a home will ignite from radiant heat exposure is proportional to:

- The size of the flames
- The home's surface area exposed to flames
- The duration of the exposure
- The distance between the flames and the structure

In addition to the threat of direct ignition from radiation, radiant heat from large flames in close proximity to a home may fracture large plate glass windows. Should the fractured glass fall out of its casing, the home becomes vulnerable to firebrands entering these openings and resulting in ignition(s) inside the home.

Convection. Convection is defined as heat transfer by circulation within a medium such as a gas or liquid. Convective heat transfer to combustible materials on or near homes requires direct contact with combustible materials by the flames or the hot gases emitted by the flames. In wildland fires, convective heat energy is usually not sufficient to ignite a wood wall when the distance becomes tens of feet beyond the wall. However, the duration of exposure to flame is more critical than the size of the flame. If materials capable of producing even small flames (e.g., dry grasses, low ground cover, pine needles, leaves, trash) that can come in contact with the home (e.g., eaves, overhangs), convection can ultimately ignite a home. Wind and steep slopes tilt flames and hot gases uphill, increasing the chance of igniting a home. Structures extending out over a slope have the greatest likelihood of ignition from convection.

Conduction. Conduction is defined as heat transfer to another body or within a body by direct contact. When heat is sustained near combustible fuels, conduction provides the process that continues to transfer heat through the fuel masses and supports the fuel's continued and complete combustion.

In wildfires, firebrands (embers) falling on combustible surfaces of a home transfer heat energy to the surface by conduction. Firebrands are pieces of burning material that detach from a fire due to the strong convection drafts in the burning zone. They can be carried a long distance (a mile or more) by fire drafts and winds. The chance of these firebrands igniting a home depends on their size and number, where and how they accumulate next to combustible elements of the building, how long they burn after contact, and the materials, design and construction of the home.

# A. Home Ignition Zone

The Home Ignition Zone (HIZ) includes the home and the surrounding area extending out to 100 to 200 feet from the home. The HIZ assessment includes only the home and the fuels within the 100 ft to 200 ft area. The following elements should be considered when completing a HIZ assessment:

**Overview of Surroundings (relative to the location of the home).** Look for features in the surroundings that can increase a home's vulnerability or maximize its survivability. Buildings set back from property lines (at least 30 feet) allow the residents to have some (if limited) control of fuels within the home ignition zone. Buildings located close to dangerous topographic features such as the top of slopes or adjacent to natural chimneys (draws and canyons) require s pecial attention.

**Building Materials and Design (from roof peak to the foundation and then outwards).** Should a building come in contact with heat, flames or firebrands, the building materials and design can prevent or retard the penetration of the fire into the interior of the building.

**Roof.** Roofs are less vulnerable to radiation and convection because of their slope but are more susceptible to ignition by firebrands. A major cause of home damage and loss in wildland areas is combustible roofs (e.g., non-rated wood). Fire-resistant roofs are those that are covered with noncombustible roofing (e.g., asphalt composite, tile, slate, metal) and are inspected for cracks and gaps which could expose ignitable sub-roofing or roof supports.

**Eaves and Overhangs.** Eaves and overhanging features—room push outs, bay windows and extensions over slopes—are very vulnerable to convective exposures and have a design that can sustain ignition. Fuels should be eliminated from contact with eaves and overhangs. Eaves and overhangs should be boxed or enclosed with noncombustible materials to reduce the surface area and eliminate the edges that can trap firebrands.

**Vents.** Vents allow for air circulation and help prevent condensation and subsequent wood decay. However, openings should be screened to prevent firebrands from entering the building. The screens should prevent passage of objects larger than 1/4 inch (3.0mm). Both vents and screens should be constructed of materials that will not burn or melt when exposed to heat or firebrands.

**Walls.** Walls are most susceptible to ignition by radiation and convection. The edges of combustible wall materials, such as trim materials on casings and facing, will ignite before flat surfaces do. The walls should be constructed of ignition or fire resistant materials. Wall materials that resist heat and flames include cement, plaster, stucco, and concrete masonry (stone, brick or block). Though some material, such as vinyl, will not burn they may lose their integrity when exposed to high temperature and fall away or melt, exposing interior materials.

**Windows.** Exposure to heat can cause windows to fracture and collapse leaving an opening for flames or firebrands to enter and ignite the interior of a home. Using glass products that can withstand the potential convective and radiant heat will reduce this risk. Tempered glass will withstand much higher temperatures than plate glass and should be used for large windows—particularly windows overlooking slopes or vegetation. Double pane glass is slightly more resistant to heat than single pane glass.

**Attachments.** Attachments include any structures connected to the residence such as decks, porches, and fences. When assessing the ignition potential of a home, attachments are considered part of the structure. For example, if the ignition potential of the attachment is high, the ignition potential of the inclusive structure is considered high.

**Vegetative Fuel Hazards.** Vegetative fuels include living and dead vegetation materials. The amount of heat energy released during a wildland fire is defined by the amount, arrangement and rate of combustion of the vegetative fuels. Vegetative fuel flame lengths can exceed 100 feet and the radiated heat can ignite combustible materials from distances of 100 feet or more. Winds can carry live firebrands over a mile from the wildfire.

Vegetative fuels within the immediate vicinity (within approximately 30 ft of the home) can have a significant impact on the potential of a home to ignite. The size of the "immediate vicinity" will vary depending on the vegetation and characteristics of the land. Vegetation within the immediate vicinity of the building should be fire resistant and maintained in fire resistant condition.

Vegetative fuels beyond the immediate vicinity (from 30 ft to 200 ft or to the extent of the HIZ) are those that surround the building but are not immediately adjacent to it. The concern with these fuels is primarily their ability to produce firebrands that can ignite the residential structure and their ability to produce long flame lengths and intense radiant energy. Fuels beyond the immediate vicinity of the building should consist of fire resistant ground cover and trees that are thinned and pruned to prevent ground fires from igniting the crowns, or tops of trees.

## B. Firewise Communities/USA Recognition

### *(Residential Developments)*

The national Firewise Communities program is a multi-agency effort designed to reach beyond the fire service by involving homeowners, community leaders, planners, developers and others in the effort to protect people, property and natural resources from the risk of wildland fire—before a fire starts. The Firewise Communities approach emphasizes community responsibility for planning in the design of a safe community as well as effective emergency response, and individual responsibility for safer home construction and design, landscaping and maintenance.

The national Firewise Communities program is intended to serve as a resource for agencies, tribes, organizations, fire departments, homeowners, residents, and communities working toward a common goal: to reduce loss of lives, property, and resources to wildfire by building and maintaining homes and communities in a manner compatible with the natural surroundings.

Firewise Communities/USA recognition is a homeowner/resident driven program, usually initiated and guided by a homeowners' association or similar organization. In order to be nationally recognized as Firewise, the residential area or community must complete the following actions:

1. Enlist a wildland/urban interface specialist to complete an assessment and create a plan that identifies locally agreed-upon, achievable solutions to be implemented by the community.
2. Sponsor a local Firewise task force, committee, commission or department that maintains the Firewise Community program and tracks its progress or status.
3. Observe a Firewise Communities/USA Day each year that is dedicated to a local Firewise project.
4. Invest a minimum of $2.00 per capita annually in local Firewise Communities/USA projects. (Work by municipal employees or volunteers using municipal and other equipment can be included, as can state/federal grants dedicated to that purpose.)
5. Submit an annual report to Firewise Communities/USA that documents continuing compliance with the program.

The community assessment for Firewise/USA recognition purposes, indicated in Step 1 (above), will include the "Common Areas and Shared Hazards" as they relate to the overall development and the predominant features of the HIZs within the community. In other words, a Firewise Community assessment is more than the sum of the individual home assessments because it must address the hazards around and among the homes (in general) within a community as well as the common elements that may put the community at risk. These include:

- The extent of use of combustible roofing materials.
- Overlapping home ignition zones.
- Placement of homes with respect to topography (e.g., at the top of a bluff).
- Dense/unhealthy vegetation.
- The extent and types of vegetation in direct contact with homes and around homes.
- Leaf/needle build-up on roofs and in gutters.
- Attached wooden fences/decks.
- Homeowner covenants and deed restrictions that may or may not allow Firewise mitigation measures.
- Evidence of the general level of fire safety education and awareness of the residents.
- Infrastructure conditions that may not contribute to Firewise mitigation.

Just as changing the character of the home ignition zone can alter the path of a wildfire approaching a single home, community residents have the opportunity to alter the path of a wildfire for an entire community by changing the character of their community's ignition zone.

## C. Community Wildfire Protection Plan (CWPP)

The Healthy Forests Restoration Act (HFRA) of 2003 provides for the development of the Community Wildfire Protection Plan (CWPP). These plans, generally initiated and led by fire agencies, can be as simple or as complex as the community or community's desire.

The minimum requirements for a CWPP as described in the HFRA are:

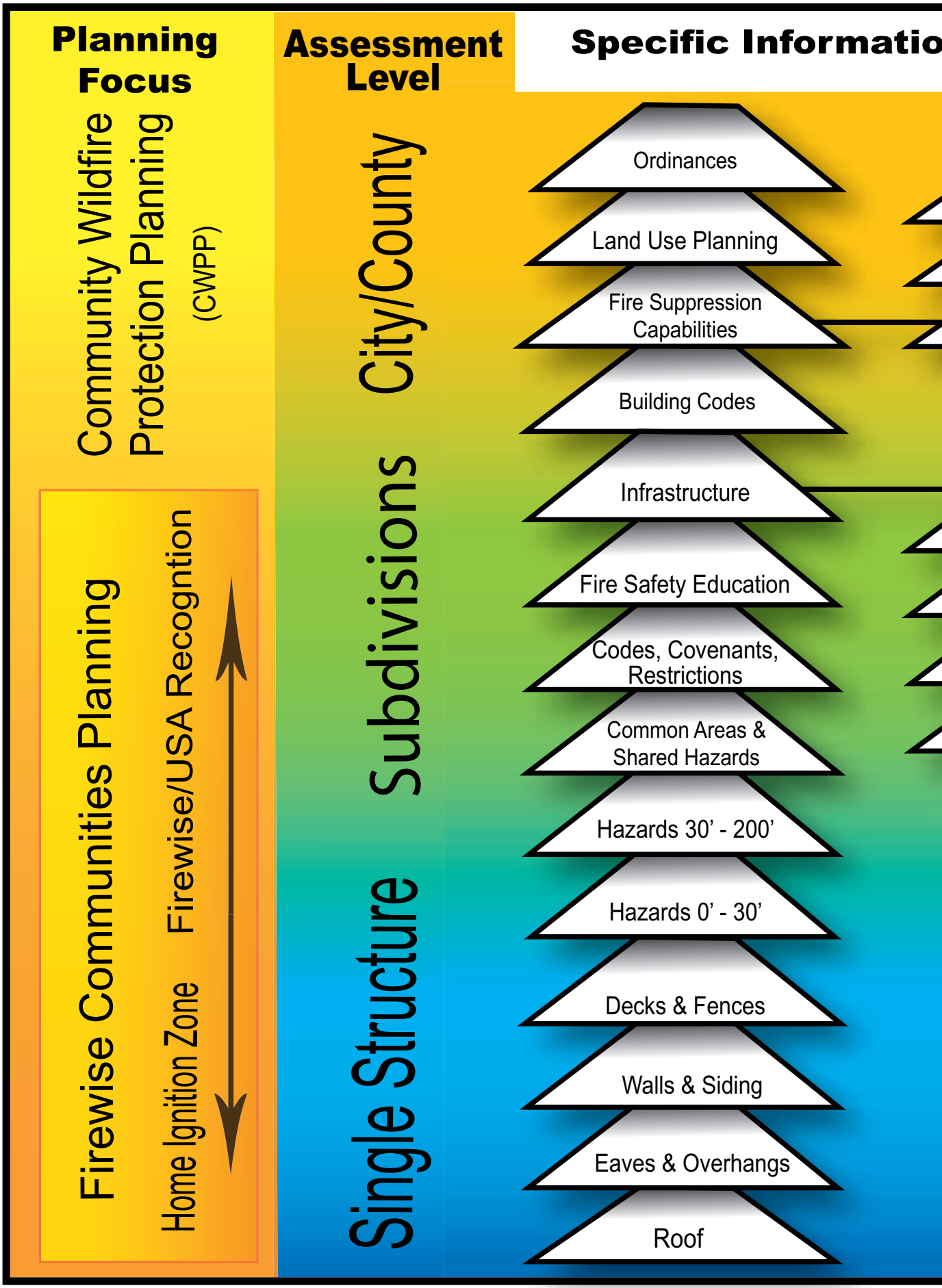
1. Collaboration: a CWPP must be collaboratively developed by local and state government representatives in consultation with federal agencies and other interested parties.
2. Prioritized Fuel Reduction: A CWPP must identify and prioritize areas for hazardous fuel reduction treatments on federal and non-federal lands and recommend the types and methods of treatment that will protect one or more at-risk communities and essential infrastructure.
3. Treatment of Structural Ignitability: A CWPP must recommend measures that homeowners and communities can take to reduce the ignitability of structures throughout the area addressed by the plan.

The HFRA requires that the three entities must agree to the final content of a CWPP:

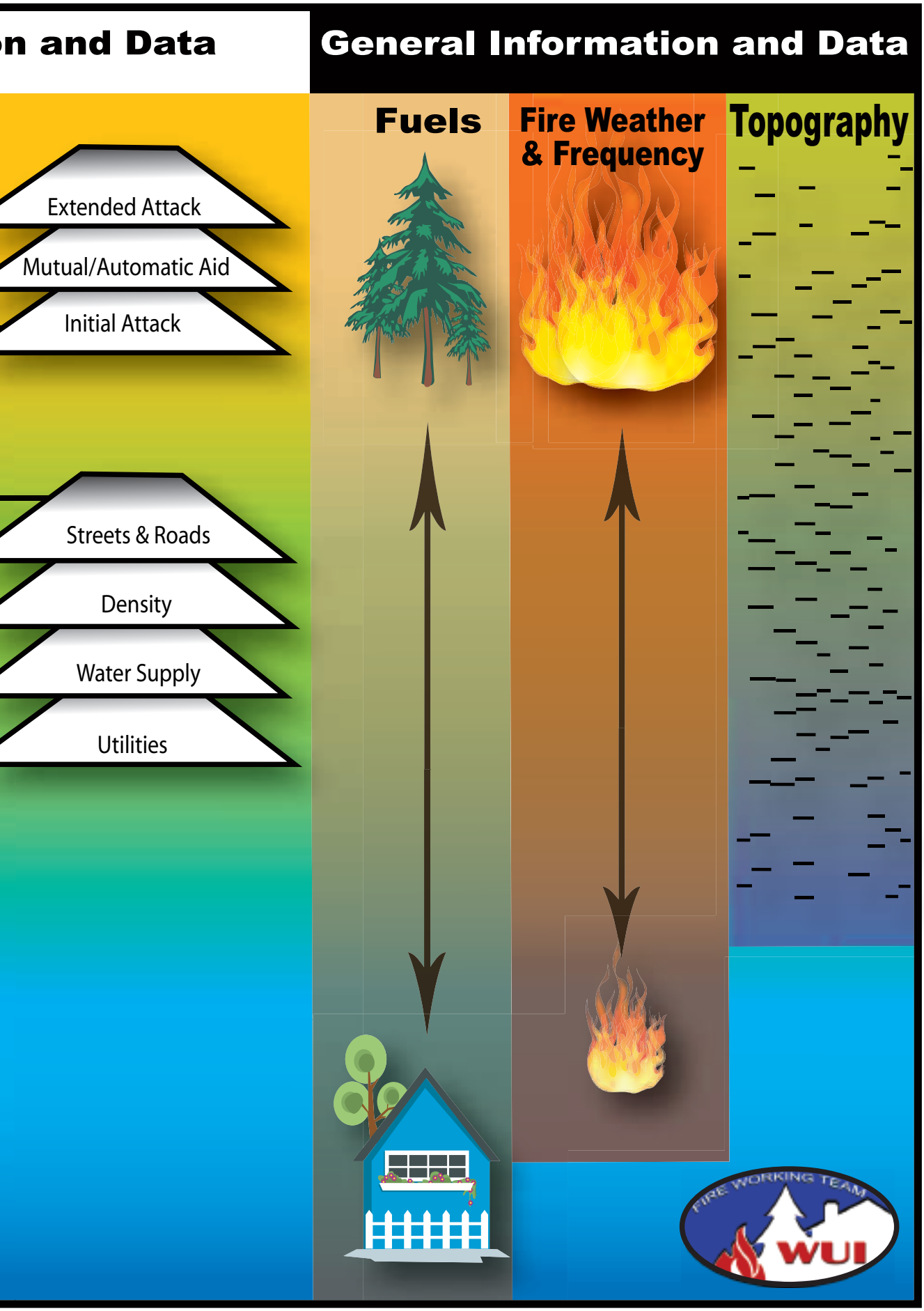
- The applicable local governments (i.e., counties or cities);
- The local fire department(s); and
- The state entity responsible for forest management.

Community Wildfire Protection Planning and the Firewise Communities/USA programs are both focused on reducing the threat of wildfire to communities and protecting life and property and, therefore, are not mutually exclusive. A community that has received Firewise Communities/USA Recognition could also have a CWPP with the identification, prioritization, and mapping of hazardous fuel treatment that could reduce the risk to the larger community or jurisdiction. The only other element involved in the CWPP would be the concurrence of the local government, local fire department, state forester and other collaborative partners that the Firewise Communities/USA plans do not specifically require.

## Figure 1. Wildfire Hazard A



Assessment and Planning



# Section IV.

## The Processes of Hazard Assessment

This section offers a five-step method for determining the focus and appropriate level and method of hazard assessment in interface communities. In addition, the guide suggests the most effective means of reducing the potential for future wildland/urban interface fire disasters is through a balance of the following approaches:

- Building a structure or altering an existing, structure to reduce its chance of ignition and,
- Completing mitigation measures on the surrounding wildland area., as well as guidance on recommended actions to reduce risk.

### Steps 1 and 2: Define the Focus of Hazard Assessment.

Clearly defining the focus (or purpose) of an assessment is the first step in protecting homes and communities from wildfire. If the purpose is clear, then the second step will provide the level at which assessments are to be conducted. Use Table 1 to help determine the focus (Step 1) and level of the wildfire hazard assessment effort (Step 2).

**Table 1. Determining the Focus and Level of Hazard Assessment**

| *Step 1 Determine the focus of the planning by answering the following question.* | *Step 2 If the answer to Step 1 is "yes" the appropriate level of the assessment is* | *At the selected level, the Desired Outcome(s) will be the:* |
|---|---|---|
| Is the assessment to be used to provide mitigation guidance for individual homeowners and residents? | The Home Ignition Zone (HIZ of individual homes) | Mitigation of the hazards of a single home and its immediate surroundings, and the vegetation out to 200'. (HIZ) |
| Is the assessment to be used to perform a subdivision or small community-wide assessment that will lead to Firewise Communities/USA Recognition (specific mitigation guidance for residents in subdivisions and/or small communities or residential developments)? | Subdivisions and small communities and the identification of both individual homes and communal hazards within and surrounding residential developments. | Cooperative mitigation planning and activities within a subdivision or residential development to reduce individual building and communal hazards. |
| Is the assessment to be used to complete a Community Wildfire Protection Plan (CWPP) for a large geographic area involving multiple private and public ownerships? | Community jurisdictions, towns, cities, counties, including adjacent wildland areas that may be in private or public ownership | Large scale collaborative mitigation planning and activities for improved fire protection and emergency response. Collaboration may include individuals, local, state and federal participation. |

### Step 3: Determine the appropriate Hazard Assessment Method.

Identifying the type of system or the purpose and use of the information helps determine the appropriate assessment method. This, in turn, helps determine the resources needed to conduct the assessment in terms of training, Geographic Information System (GIS) resources, personnel, logistics, materials, and other elements. There are two common methods for hazard assessment with many variations within each.

Using the Qualitative (Evaluation) method, the assessor identifies hazards and ignition threats for a particular home and/or groups of homes (e.g., subdivisions) and makes specific recommendations to the resident (homeowner) for correction with an agreed upon schedule for mitigating the hazard and maintaining the mitigation.

Using the Quantitative (Rating) method, the assessor typically notes many kinds of hazards, some of which may include response and fire suppression concerns. These conditions or situations are given a numerical value. Generally, the ratings are then totaled and the resulting hazard condition is determined by where the total falls within a scale of hazard from "low" to "extreme".

Between the two approaches are several considerations that must be taken into account. Table 2 provides a quick overview of some of the assets and liabilities of each method.

**Table 2. Comparison of Qualitative and Quantitative Assessment**

| Qualitative (Evaluation) Assessment | | Quantitative (Rating) Assessment | |
|---|---|---|---|
| Asset | Liability | Asset | Liability |
| Easy to assess factors around the home | Subjective evaluation based on the level of training and experience of assessor | Easy to train assessors (e.g., a road is either 24 feet wide or it isn't) | Lack of scientific justification on values; includes infrastructure elements (e.g., street grades, water supplies) that have little to do with a home's ignition potential |
| Results in mitigation recommendations based on observation | Hard to quantify for analysis purposes | Quantified values can be used in GIS maps and analysis | Often includes elements that are not specifically home ignition related (e.g., combustible street signs) |
| Less threatening to residents | Difficult to enforce | Quantified elements can be easily re-evaluated for compliance | Some situations are difficult to quantify, particularly in relation to other elements |
| Allows latitude in resident goal setting and scheduling of mitigations | Assessed hazards include infrastructure issues but only as appropriate | Results in data array for analysis | Numerical ratings often lead to misunderstanding and resulting misuse of final value |
| Allows for flexibility on a site-by-site basis | Does not provide an objective way to compare one property to another | Provides a quantitative way to compare features, risks, attributes | Will not work well if raters cannot agree on weights/values of factors being rated |
| Allows evaluator to account for context of Home Ignition Zone features as well as site characteristics (e.g., topography, setback) | Relies heavily on the knowledge and background of the evaluator | For large-scale decision-making, helps quantify and rank data to help focus on where to begin mitigation efforts | Must have scientific, defensible basis for rating numbers or risks being too subjective to be used in some cases |
| An evaluation report can include plenty of detail about the features being observed and what makes them more/less vulnerable | Can be misunderstood if evaluator cannot translate technical information into plain language | Provides ease of evaluation and follow-up for compliance | Oversimplifies complex data to a number or level which becomes the focus (rather than focusing on what actions can be taken to improve) |
| What is being evaluated is evident | Results do not lend themselves readily to scientific/quantifiable analysis | Simplifies an array of complex factors into a numerical or "level" value | Can appear to be linked to other kinds of rating schemes affecting property insurance rates/availability |
| Allows for resident participation to gain understanding of what hazards | Results can lose impact if they fail to focus on the Home Ignition Zone in favor of context and infrastructure | Can help motivate those being rated to improve their number/level | Without detailed explanation of what the rating means, can be easily misunderstood by those being rated |
| Evaluation speaks directly to the property owner and what they can do about the hazards at the property (does not provide numbers to be used to compare to others) | | | Without detailed explanation of how to improve a rating score, can initiate defensiveness, fear, apathy |

## Step 4: Determine the information needed for assessment

Knowing the level (focus) of the assessment will help determine the types and range of information that will be needed. Using the diagram that describes Wildfire Hazard Assessment and Planning Relationships (Figure 1) will help determine the information and data that is need to adequately assess hazards at various levels. Some of these elements may be readily quantified and useful in GIS mapping or other graphic display, but other elements may require descriptions that are not as easy to quantify.

**Example 1:** If the focus is on the Home Ignition Zone (HIZ) with the intent of encouraging mitigation actions for a single home or "one home at a time," Figure 1 indicates that the specific information will include the "Roof" through "Hazards 30'–200'." The assessment approach at this level may be either qualitative or quantitative, depending on the desired outcome(s) and how best to achieve those outcome(s).

**Example 2:** If the focus is on a subdivision wishing to qualify for recognition under the Firewise Communities/USA program, then the needed information (as indicated in Figure 1) will include "Hazards 30'–200'" through "Infrastructure". Because this level of assessment is not simply the collection of detailed HIZ assessments on every home, it will also include general notations on predominant wildland hazards and conditions within the HIZs of subdivision. This will result in notations of the overall use of wood roofs and decks, the density of vegetation with HIZs, and other factors of the overall subdivision that help produce an overall assessment of the entire development. From this community-wide assessment, mitigation action and maintenance plans for he homeowners' association (for instance) can be developed. The assessment approach at this level may be a combination of qualitative or quantitative information, again depending on the desired outcome(s) and how best to achieve those outcome(s).

**Example 3:** Community Wildfire Protection Planning (CWPP) normally requires a broader view of a much larger geographic area. Focusing on broader scale issues might mean that the required elements (as indicated in Figure 1) begin at "Common Areas and Shared Hazards" or above (e.g., "Infrastructure") and end at "Ordinances". Again, at this level, the assessment approach at this level may be a combination of qualitative or quantitative information.

Again, there are no distinct boundaries indicated within the focus and the assessment levels in Figure 1. The specific information elements (quadrangles) should be adjusted as necessary to meet the needs of a specific assessment.

### Step 5: Conduct the Hazard Assessment and compile the Information

First, develop a method to collect the information required based on the level of the assessment desired. Make sure that an evaluation of each individual component will be included in the assessment and work to develop logical statements and supporting data that describe the overall hazard of the target (i.e., home, subdivision, city, county). Second, compile the information in a useable form. Often, a variety of display methods are necessary to make the data usable and understandable by groups and individuals who may not be used to working with technical information. Consider maps, clear overlays and computer modeling as methods for analyzing and displaying data as well as brief summaries and reports.

# Section V.

## Applications and Potential/Expected Outcomes

Maintenance of mitigation measures taken, whether from the single home to the community level, is key to ensuring that mitigation will achieve a long term impact. Only by reducing the ignition hazards will future interface fire disasters be prevented. Depending on the type, quantity and quality of information, the data developed from the assessment may be used to develop strategies that may further reduce or eliminate wildfire hazards in the wildland/urban interface.

Uses of the information include:

- Create mitigation and maintenance strategies
- Project future requirements of community services
- Provide data for mapping hazard areas
- Develop fire and emergency community evacuation plans
- Provide reference tools for planners and local code officials
- Supplement information for fire suppression evaluation in conjunction with the Insurance Service Office's (ISO) Fire Suppression Rating Schedule to improve emergency fire response
- Distribute public fire safety education information
- Improve fire fighter and public safety
- Improve fire and emergency response
- Perform cost/benefit analysis for proposed programs
- Implement or evaluate existing programs
- Adopt a more sophisticated fire modeling program
- Strategically focus fuel reduction projects
- Educate property owners, local and state governments and fire-service agencies

# Section VI.

## Assessment Systems and Tools

The following references are the basis for the hazard components and the methodology outlined in this publication. These publications give details on a variety of hazard rating systems and can be used as additional information.

## A. Hazard Assessment Approaches

### 1. Qualitative Hazard Assessment

a. NFPA 1144 Reducing Wildfire Hazards in the Structure Ignition Zone, 2008 edition (proposed). This document, developed by the NFPA Technical Committee on Forest and Rural Fire Protection, provides a standardized approach to assessing wildfire hazards and contains examples of both a qualitative and quantitative assessment forms that may be used to gather information and provide mitigation recommendations to the resident/homeowner. This edition, unlike the previous 1997 and 2002 editions (see below) does not include specifications for fire protection infrastructure (e.g., water supplies, street width, signage, access) whose presence or absence has little impact on whether homes ignite from exposure to wildfire. For more information: **www.nfpa.org**

b. Assessing Wildfire Hazards in the Home Ignition Zone—training course from the National W/UI Fire Program (www.firewise.org) This is a two-day course developed to 1) provide reference material and basic knowledge to increase an understanding and competency in wildland/urban interface fire prevention and mitigation strategies and 2) assist wildfire mitigation and prevention professionals, regardless of organizational affiliation, in assessing risks to individual homes in wildland, forested, or grassland areas, and 3) encourage and prepare residents and homeowner associations to participate in Firewise Communities/USA® Recognition Program. For more information: **www.firewise.org**

c. The Firewise Learning Center offers courses at no charge and is designed to encourage self-paced learning on a variety of topics. The courses feature video, lectures, interactive quizzes and tests. The Firewise Learning Center is part of the newly re-designed Firewise Web site, which features a new look and easier navigation. The Firewise Learning Center is available at **www.firewise.org/learningcenter**.

### 2. Quantitative Hazard Rating

a. NFPA 1144 Standard for Protecting Life and Property from Wildfire, 2002 edition. (Formerly NFPA 299) This document, developed by the NFPA Technical Committee on Forest and Rural Fire Protection, 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. This edition of NFPA 1144 contains information on hazard assessment and an example of a quantitative form that may be used to gather and provide a hazard rating value (number) for each home. The hazard assessment system in this edition includes assessment ratings for fire protection infrastructure concerns of water supplies, street width, signage, access, and others. For more information: www.nfpa.org

b. International Code Council. Wildland-Urban Interface Code, 2006 edition. This wildland interface code provides specifications for water supplies, defensible space and access in wildland interface areas. It includes a rating system that provides a numeric value based on the severity of the hazard based on vegetation, slope, fire and weather frequency, and fuel models. For more information: **www.iccsafe.org**

c. Texas Forest Service. Wildfire Hazard Risk Assessment, a Microsoft Access-based Subdivision Survey 2005. The intent of this Access-based wildfire hazard risk assessment program is to identify communities at risk based on overall hazards to the homes in a particular subdivision.

d. Virginia Division of Forestry. Wildfire Risk Analysis, 1997. This statewide project used the Wildfire Prevention Analysis and Planning procedure. Field personnel determined the level of risk, hazard and value in each county, based on local knowledge of an area and historical fire occurrence. The result was a series of GIS-based maps to be used to identify and prioritize planned specific actions to reduce fires in problem areas. The Virginia Department of Forestry also conducted woodland home and development forest fire hazard ratings, and a five-year woodland home survey.

e. Colorado State Forest Service. Colorado Wildland Urban Interface Hazard Assessment Methodology 2002. This methodology builds on the work of earlier hazard methodologies and provides new and updated data to further enhance accuracy and scale. This assessment also includes all of the counties in Colorado. For more information: **www.colostate.edu/dept/CSFS/Methodology.pdf**

f. Florida Dept of Forestry. Wildfire Hazard Assessment Guide for Florida Homeowners 2002. Developed to help Florida neighborhoods: (1) determine if a wildfire hazard exists for their neighborhood or subdivision, (2) evaluate the wildfire risk of the neighborhood, and (3) take action to mitigate the existing wildfire hazard, thereby reducing the risk to an acceptable level.

g. Protecting Life and Property from Wildfire: An Introduction to Designing Zoning & Building Standards for Local Officials. Great Lakes Forest Fire Compact, 1996. This document focuses on planning needs and considerations for assessing the urban interface and includes recommendations for firewise landscapes, access, water supplies, and structural design. The appendix provides ideas for risk assessment and a sample risk rating system for a subdivision or development.

h. Wildfire Hazard Evaluation—Field Notes. Colorado State Forest Service, 1992. This hazard-rating field form, developed for subdivision level use, considers many of the key elements defined in the NWCG document. It is simple in function and design using low, moderate and high fire risks based on numeric scores.

i. Wildfire Hazard Identification & Mitigation System (WHIMS), Boulder, Colorado. 1992. Through the involvement of multiple local, state, and federal government agencies, wildfire components have been tied together to identify hazardous areas. The fire protection district can foresee these high-hazard areas, passing along mitigation tips to the individual residents, homeowners and homeowner associations and showing them the importance of mitigation around their homes. **www.co.boulder.co.us/lu/wildfire/whims.htm**

j. Fire Risk Rating for Existing and Planned Wildland Residential Interface Development. Montana Department of Natural Resources and Conservation, Missoula, MT, March, 1993. This rating system allows prevention planners to assess interface areas for risks and hazards, rank them according to their risk score, and then set priorities for prevention resources and actions. It organizes physical site information, such as road access, topography, fuels, construction and water sources, so that the fire managers can easily review all the information at once.

# B. GIS Software Packages and/or Downloads

1. ESRI—ArcGIS—is an integrated collection of geographic information system (GIS) software products for building a complete GIS for your organization. The ArcGIS framework enables you to deploy GIS functionality and business logic wherever it is needed—in desktops, servers (including the Web), or mobile information systems. **www.esri.com**
2. ERDAS Imagine Professional—is raster-based software designed specifically to extract information from images. Vast arrays of tools allow the user to study data using complex image analysis, radar analysis and advanced classification tools. **http://gi.leica-geosystems.com/default.aspx**
3. MapInfo Professional—is a powerful Microsoft Windows-based mapping application that enables business analysts and GIS professionals to easily visualize the relationships between data and geography. With MapInfo Professional, you can perform sophisticated and detailed data analysis by leveraging the power of location. Including location in your decision- making and daily operations can help you increase revenue, lower costs, boost efficiency and improve services.) **www.mapinfo.com**
4. Geographic Resources Analysis Support System—Commonly referred to as GRASS, this is a GIS used for geospatial data management and analysis, image processing, graphics/ maps production, spatial modeling, and visualization. GRASS is currently used in academic and commercial settings around the world, as well as by many governmental agencies and environmental consulting companies.
5. MS MapPoint—MapPoint 2006 includes updated geographic and demographic data, plus new features including advanced GPS functionality, text and voice-prompted driving guidance for Windows XP users, Location Finder, and more. MapPoint 2006 with GPS Locator combines complete business mapping and analysis software with the latest Global Positioning System (GPS) receiver. **www.mappoint.com**
6. Delorme XMap 4.5 Professional—is powerful and scalable mapping software that provides users with easy-to-use and affordable digital mapping tools. Add-on software modules expand capabilities further encompassing image registration and aerial photography mission planning. XMap software can be bundle with Earthmate USB GPS receiver. **www.delorme.com**
7. National Geographic Topo! Pro Products—series combine National Geographic Atlas Maps, topographic data sets, and GIS technologies creating powerful, intelligent and interactive mapping tools that are easy to use, can be used anywhere and in real-time. The National Geographic TOPO! Fire Pro is an associated turn-key solution that optimizes the process of capturing and sharing Urban and Wildland Fire information. **http://maps.nationalgeographic.com/topo/index.cfm** and **www.nationalgeographic.com/maps**
8. Google Earth—is free for personal use. No registration is required. Optional upgrade to Google Earth Plus. (Windows only). The technology makes it easy for non-specialist users to interact with massive quantities of satellite imagery and GIS data to penetrate the clutter of data and get to the knowledge that could make a critical difference. **www.earth.google.com**
9. GEOMA—Geospatial Multi-Agency Coordination Group or GeoMAC, is an internet-based mapping application originally designed for fire managers to access online maps of current fire locations and perimeters in the conterminous 48 States and Alaska. Using a standard web browser, fire personnel can view this information to pinpoint the affected areas. **www.geomac.gov**

# Glossary of Terms

Assessment – The evaluation and interpretation of measurements, intelligence, and other information to provide a basis for decision-making.

Attachments – Any structure connected to the residence such as decks, porches, garage, wooden walkways, and fences etc.

Chimney – 1) Steep narrow draw or small canyon that draw fire up them in the same manner a flue draws heat from a fireplace. 2) Containing one or more vertical or nearly vertical passageways for conveying flue gases to the outside atmosphere.

Combustible – Any material that, in the form in which it is used and under the conditions anticipated, will ignite and burn.

Combustion – The rapid oxidation of fuel in which heat and usually flame are produced. Combustion can be divided into four phases: pre-ignition, flaming, smoldering, and glowing.

Common Area – An area set aside that is shared by all property owners within a homeowner association or subdivision for recreational purposes.

Community – A body of people living in one place or district and considered as a whole; a neighborhood, subdivision, small town, village or township with boundaries defined by the residents or by regulatory jurisdiction. For the purposes of Firewise action and mitigation, the definition of community also includes shared home ignition risk from wildfire.

Conduction – Conduction is defined as heat transfer to another body or within a body by direct contact. When heat is sustained near combustible fuels, conduction provides the process that continues to transfer heat through the fuel masses and supports the fuels continued and complete combustion.

Convection – Convection is defined as heat transfer by circulation within a medium such as a gas or liquid. Convective heat transfer to combustible materials on, or near, homes requires direct contact with combustible materials by the flames or the hot gases emitted by the flames.

Decks – See Attachments.

Defensible space – An area, typically a width of 9 m (30 ft) or more, between an improved property and a potential wildfire where the combustibles have been removed or modified.

Eave(s) – The projecting overhang at the lower edge of a roof.

Ember – A particle of solid material that emits radiant energy due either to its temperature or the process of combustion on its surface. Also see: Firebrands

Environment – The complex surroundings of an item or area of interest, such as air, water, natural resources, and their physical conditions (temperature, humidity).

Exposure – 1) Property that may be endangered by a fire burning in another home or by a wildfire. 2) Direction in which a slope faces, usually with respect to cardinal directions. 3) The general surroundings of a site with special reference to its openness to winds.

Fence – A freestanding wall, balustrade, or railing (as of wood, plastic, or wire) having a height of no less than 1 m (3 ft) erected to divide property, to serve as a barrier or guard, or for decoration. also see: Attachments

Fire – Rapid oxidation, usually with the evolution of heat and light; heat fuel, oxygen and interaction of the three.

Fire Behavior – The manner in which a fire reacts to the influences of fuel, weather, and topography.

Firebrand – Any source of heat, natural or human made, capable of igniting wildland fuels. Flaming or glowing fuel particles (embers) that can be carried naturally by wind, convection currents, or by gravity into unburned fuels. Also see: Embers

Fire Prevention – Activities such as public education, community outreach, law enforcement, and reduction of fuel hazards that are intended to reduce wildland fire and the risks it poses to life and property.

Fire Resistant – Construction designed to provide reasonable protection against fire.

Fire Resistive – Refers to properties or designs to resist the effects of any fire to which a material or structure can be expected to be subjected.

Firewise – 1) A national, multi-agency effort designed to reach beyond the fire service by involving homeowners, community leaders, planners, developers, and others in the effort to protect people, property, and natural resources from the risk of wildland fire before a fire starts. 2) A series of practical steps that individuals and communities can take to minimize wildfire risks to people, property and natural resources. It emphasizes community responsibility for planning in the design of a safe community as well as effective emergency response, and individual responsibility for safer home construction and design, landscaping, and maintenance. 3) The condition or state of being knowledgeable about how to protect homes and resources from wildfire threats.

Firewise Construction – The use of materials and systems in the design and construction of a home to safeguard against the ignition from a wildfire.

Firewise Landscaping – Vegetative management that removes combustible fuels from around a home to reduce ignition exposure from radiant heat. The combustible fuels may be replaced with green lawn, gardens, certain individually spaced green, ornamental shrubs, individually spaced and pruned trees, decorative stone or other non-combustible or flame-resistant materials.

Fuel(s) – 1) Any material that will maintain combustion under specified environmental conditions. 2) Any substance that reacts with the oxygen in the air or with the oxygen yielded by an oxidizer to produce combustion. 3) A material that yields heat through combustion.

Geographic Information Systems (GIS) – GIS is a technology that is used to view and analyze data from a geographic perspective. GIS, most often associated with maps, links locations to information (such as people to addresses, buildings to parcels, or streets within a network) and layers that information to give you a better understanding of how it all interrelates.

Gutter – A U-shaped device hung under the eaves to collect and transport rainwater from the home.

Hazard Assessment – Assess hazards to determine risks. Assess the impact of each hazard in terms of potential loss, cost, or strategic degradation based on probability and severity.

Hazard Reduction – Any treatment of living and dead fuels that reduces the potential spread or consequences of fire.

Home – A constructed object, usually a free-standing building above ground providing complete and independent living facilities for one or more persons, including, permanent provisions for living, sleeping, eating, cooking, and sanitation.

Home Assessment – Evaluation of a dwelling and its immediate surrounding to determine its potential to escape damage by an

approaching wildland fire. Includes the fuels and vegetation in the yard and adjacent to the home, roof environment, decking and siding materials, prevailing winds, topography, fire history, etc., with the intent of mitigating fire hazards and risks.

Home Ignition Zone – The Home Ignition Zone principally determines a home's ignition potential during an intense fire. The "Zone" includes the homes and their immediate surroundings within 100-200 ft.

Ignition Potential – Chance that a firebrand will cause an ignition when it lands on receptive fuels.

Land Use Plan[ning] – A set of decisions that establish management direction for land within an administrative area; an assimilation of land-use-plan-level decisions developed through the planning process regardless of the scale at which the decisions were developed.

Mitigation – Those activities implemented prior to, during, or after an incident, which are designed to reduce or eliminate risks to persons or property that lessen the actual or potential effects or consequences of an incident. Mitigation measures can include Iefforts to educate governments, businesses, and the general public on measures they can take to reduce loss and injury and are often informed by lessons learned from prior incidents. Also see Prevention and Hazard Reduction.

Noncombustible – Any material that, in the form in which it is used and under the conditions anticipated will not ignite and burn nor add appreciable heat to an ambient fire.

Prevention – Activities directed at reducing the incidence of fires, including public education, law enforcement, personal contact, and reduction of fuel hazards (fuels management). Also see: Mitigation

Radiant Heat – Heat energy carried by electromagnetic waves longer than light waves and shorter than radio waves. Radiant heat (electromagnetic radiation) increases the sensible temperature of any substance capable of absorbing the radiation, especially solid and opaque objects.

Radiation – Radiation is defined as heat transfer by way of electromagnetic energy. The best example of heat transfer by radiation is the sun's heating of earth.

Risk – 1) The chance of fire starting as determined by the presence and activity of causative agents; 2) A chance of suffering harm or loss; 3) A number related to the potential of firebrands to which a given area will be exposed during the rating day. (NFDRS – National Fire Danger Rating System). Risk factors can be either natural (weather i.e. wind, temperature) or human-associated. Human-associated risk factors are those we have control of such as building materials (roofs, chimneys, siding, windows etc), design and location of the home that can influence whether a home or structure can easily ignite, and if so, whether fire can be sustained to the extent the structure would be lost.

Roof Classification – Roof classification is determined by tests that expose the top surface of roof decks (primarily the roof covering) to both gas flames and standardized burning wood brands. Tests are arranged to provide three levels of severity by adjusting the temperature and duration of the gas flame and the sizes of the burning wood brands. Successful coverings are rated Class A, Class B, or Class C, with Class A withstanding the most severe exposure, Class B withstanding intermediate exposure, and Class C withstanding the least severe exposure.

Roof Covering – The membrane, which may also be the roof assembly that resists fire and provides weather protection to the building against water infiltration, wind, and impact.

Slope – Upward or downward incline or slant, usually calculated as a percentage.

Structure – A constructed object, usually a free-standing building above ground.

Subdivision – An area of land laid out and divided into lots, blocks, and building sites, and in which public facilities are laid out, such as streets, alleys, parks, and easements for public utilities.

Topography – A configuration of the earth's surface, including its relief and the position of its natural and man made features.

Vegetation – Plant life and or covering.

Weather, Fire – Weather conditions that influence fire ignition, behavior, and suppression.

Wildland – An area in which development is essentially non-existent, except for roads, railroads, powerlines, and similar transportation facilities. Homes, if any, are widely scattered.

Wildland Urban Interface (WUI) – An area so designated such that a wildfire directly influences with flames and firebrands the potential ignition of the structures within that area.

# Appendicies

## A. Bibliography

Below is a list of additional literature and audiovisual resource material.

California's I-Zone—Wildland/Urban Fire Prevention and Mitigation. Rodney Slaughter, editor. Governor's Office of Emergency Services. 1996. This book was made possible by hazard mitigation grant funding from the Federal Emergency Management Agency and involved several agencies. It is a reference manual that addresses: model codes, hazard zoning and enforcement; building standards and technology; domestic and wildland fuels; and community programs. It is available from CFESTES Bookstore, 7171 Bowling Drive, Sacramento, CA 95823-2034.

California Fire Plan: A Framework for Minimizing Costs and Losses from Wildland Fires. California State Board of Forestry. 1996. This document gives a detailed framework for evaluating and prioritizing wildfire hazards including structures, watersheds, timber, range land, air quality, recreation potential, sensitive habitats and cultural resources. It includes a process for developing assessments that involve multiple jurisdictions and interested parties.

Colorado Wildland Interface Pre-plan Initiative. Colorado State Forest Service (CSFS). 1997. This system is being taught through classroom and field sessions. It provides a simple method to rate homes within the wildland/urban interface on their ability to withstand wildfire. This system uses the Wildland Home Fire Risk Meter, a rating sheet developed jointly by CSFS and the Fire Protection Districts and the Fire Hazard Severity Form as shown in the 1997 Urban/Wildland Interface Code.

Development Strategies in the Wildland/Urban Interface. International Association of Fire Chiefs and Western Fire Chiefs Association. 1996. This handbook was designed to be an educational tool for the fire service and academic and development professionals protecting or developing wildland or forested areas. It provides strategies for land use decisions, risk assessment, vegetation management, public education and fire operations.

Fire Safety Considerations for Residential Development in Forested Areas—A Guide for Fire Agencies, Planning Boards and Subdivision or Housing Developers. New Hampshire Rural Fire Protection Task Force. February, 1997. This guide lists minimum fire safety considerations for woodland development, guidelines for a sample subdivision rating, and a wildfire hazard rating form for subdivisions.

Incline Village/Crystal Bay Defensible Space Handbooks: A Volunteer's Guide to Reducing the Wildfire Threat. University of Nevada Cooperative Extension Service, 1991. This handbook, designed as a reference guide for neighborhood leaders, provides guidance in understanding the threat of wildfire, implementing defensible space and developing the role of leadership in neighborhood efforts.

North Whitefish Fire Risk Ration GIS Project. Fire and Aviation Management Office, Montana Department of Natural Resources and Conservation, Missoula, MT, 1995. This project applies geographic information systems (GIS) to Montana's Fire Risk Rating System (FRA). Twenty-eight key variables are assigned a weighted score and the scores are added to achieve a composite score. This publication is useful for agencies wishing to automate all or part of an existing fire hazard rating system.

US Department of the Interior. Wildfire Prevention Analysis and Planning, 1992. This procedure was developed to determine the locations and levels of fire risks, hazards (fuels and topography of an area), and values (areas where loss of destruction by fire would be unacceptable) in fire-prone forests or wildland developments. Ratings of low, medium and high are determined for risks, hazards and values (delineated on a map), as well as a ranking system for planned activities in specific areas.

## Articles

Fahnestock, George. Rating Forest-Fire Hazard in Residential Developments in Colorado, 1971.

Lynch, Dennis and Standish, Broome. Mountain Land Planning. 1973.

Summit Country Colorado. Fire Hazard Mitigation Requirements For New Construction Amended. 1995.

Cohen, J., What is the Wildland Fire Threat to Homes?, Presented as the Thompson Memorial Lecture, April 10, 2000, School of Forestry, Northern Arizona University, Flagstaff, AZ

- USDA Forest Service, Fire Science Laboratory, Missoula, MT, Wildland-Urban Fire – A different Approach, presentation at the IAWF Fire Safety Summit, Missoula MT, 2001
- Preventing Disaster, Home Ignitability in the Wildland/urban Interface, Journal of Forestry, 1998 (3): 15-21

Zoning News, "Saving Homes from Wildfires: Regulating the Home Ignition Zone," American Planning Association, Chicago, IL 2001

## Wildland/Urban Interface Fires Case Studies

Stanford Research Institute, Howard, et. Al. 1973, The Belair-Brentwood Fire of 1961

National Wildland/Urban Interface Fire Protection Initiative,

- Black Tiger Fire Case Study, July 9, 1989
- Stephen Bridge Road Fire Case Study: Crawford County, Michigan, May 8, 1990
- The Oakland/Berkeley Hills Fire Case Study, October 20, 1991
- Fire Storm'91 Case Study, Spokane, Washington, October 16, 1991

Wilson, Rex, The Devil Wind and Wood Shingles, NFPA Quarterly, January 1962,

Firemen Magazine, Conflagration in Los Angeles Hills, December 1961

University of California, Berkeley, CA, Foote, Ethan, 1994, Santa Barbara Paint Fire

## Print Materials and Videos

(Unless otherwise noted, the following booklets, brochures and videos may be ordered from the Firewise Online Publications Catalog at www.firewise.org.)

Planning for Wildfires, American Planning Association, Chicago, IL, 2005 (Available at www.apa.org.)

Wildland/Urban Interface Hazard Assessment Training, 4-CD Set, 2003

Wildfire! Preventing Home Ignitions, Video, 2001

Protecting Your Home from Wildfire, Video, 2000

Firewise: Community Solutions to a National Problem, 2006

Assessing Hazards in the Home Ignition Zone (training course materials), 2006

## NFPA Codes and Standards/Publications

(NFPA publications may be ordered from the online catalog at www.nfpa.org.)

NFPA 220 – Standard on Types of Building Construction, 1999 edition

NFPA 256, Standard Methods of Fire Tests of Roof Coverings, 2003 edition

NFPA 1142 – Standard on Water Supplies for Suburban and Rural Fire Fighting, 2007 edition

## Other references

International Code Council (ICC), International Wildland Urban Interface Code, 2006 edition

## Websites for Additional Information

www.fs.fed.us – USDA Forest Service

www.doi.gov – United States Department of the Interior

www.firewise.org – Firewise Communities/USA

www.firelab.org – Fire Science Laboratory, Missoula, MT

www.fema.gov – Federal Emergency Management Agency

www.planning.org – American Planning Association

www.geomac.gov – GeoMAC: Geospatial Multi-agency Coordination

www.wildfireprograms.com – National Database of State and Local Wildfire Hazard Mitigation Programs

www.nfpa.org – National Fire Protection Association

www.nifc.gov – National Interagency Fire Center

www.nwcg.gov – National Wildfire Coordinating Group

www.iccsafe.org – International Code Council

For more information on Firewise Communities™ and the National Wildland/Urban Interface Fire Program, contact: Firewise Communities, 1 Batterymarch Park, Quincy, Massachusetts, 02169 or go to www.firewise.org

The National Firewise Communities Programs is an interagency program designed to encourage local solutions for wildfire safety by involving homeowners, community leaders, planners, developers, firefighters, and other in the effort to protect people and property from the risk of wildfire. The Firewise Communities program is sponsored by the National Wildfire Coordinating Group's Wildfire/Urban Interface Working Team, a consortium of wildland fire agencies that includes the USDA Forest Service, the Department of the Interior, the Federal Emergency Management Agency, the International Association of Fire Chiefs, the National Emergency Management Association, the US Fire Administration, the National Association of State Fire Marshals, the National Fire Protection Association, and state forestry organizations. For more information, visit www.firewise.com.

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