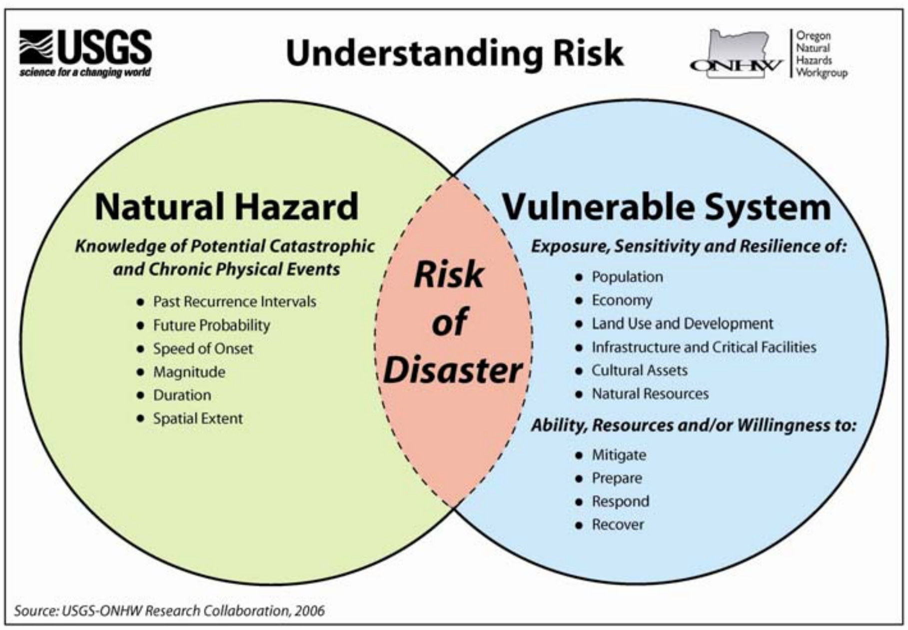
Section 4: Union County Risk Assessment Summary

The foundation of the Northeast Oregon Multi-Jurisdictional Natural Hazard Mitigation Plan is the risk assessment. Risk assessments provide information about the areas where the hazards may occur, the value of existing land and property in those areas, and an analysis of the potential risk to life, property, and the environment that may result from natural hazard events.

This section identifies and profiles the location, extent, previous occurrences, and future probability of natural hazards that can impact the community, as highlighted in Figure 4.1 below. The information in this section was paired with the information in Appendix G – Community Profiles during the planning process in order to identify issues and develop actions aimed at reducing the community's overall risk, or the area of overlap in the figure below.

Figure 4.1. Understanding Risk

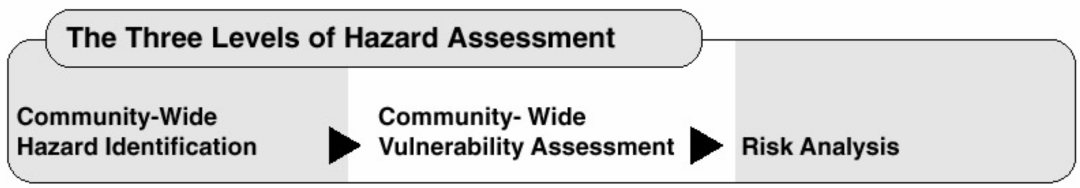


Source: Oregon Natural Hazards Workgroup, 2006

This section addresses local level information and risks the community faces. In addition to local data, the information here relies upon the Regional Risk Assessment in the State Natural Hazard Mitigation Plan. Additionally, detailed risk assessment information on existing policies, programs and reports for each hazard are included in the individual hazard annexes located at the end of the plan.

What is a Risk Assessment?

A risk assessment consists of three phases: hazard identification, vulnerability assessment, and risk analysis, as illustrated in the following graphic.



Source: Planning for Natural Hazards: Oregon Technical Resource Guide

The first phase, hazard identification, involves identification of the geographic extent of a hazard, its intensity, and its probability of occurrence. This level of assessment typically involves producing a map. The outputs from this phase can also be used for land use planning, management, and regulation; public awareness; defining areas for further study; and identifying properties or structures appropriate for acquisition or relocation.[i]

The second phase, vulnerability assessment, combines the information from the hazard identification with an inventory of the existing (or planned) property and population exposed to a hazard, and attempts to predict how different types of property and population groups will be affected by the hazard. This step can also assist communities to justify changes to building codes or development regulations, property acquisition programs, policies concerning critical and public facilities, taxation strategies for mitigation risk, and informational programs for members of the public who are at risk.[ii]

The third phase, risk analysis, involves estimating the damage, injuries, and costs likely to be incurred in a geographic area over a period of time. Risk has two measurable components: (1) the magnitude of the harm that may result, defined through the vulnerability assessment, and (2) the likelihood or probability of the harm occurring. An example of a product that can assist communities in completing the risk analysis phase is HAZUS, a risk assessment software program for analyzing potential losses from floods, hurricane winds and earthquakes. In HAZUS-MH current scientific and engineering knowledge is coupled with the latest geographic information systems (GIS) technology to produce estimates of hazard-related damage before, or after a disaster occurs.

This three-phase approach to developing a risk assessment should be conducted sequentially because each phase builds upon data from prior phases. However, gathering data for a risk assessment need not occur sequentially.

Hazard Summary

This section provides an overview of the risk assessments for the natural hazards affecting Union County. For additional information on each hazard, see Hazard Annexes located in Appendix C.

The majority of the hazard description text comes from the Hazard Chapters of the State of Oregon's Natural Hazard Mitigation Plan and the Oregon Technical Resource Guide.

Please note that information on the community's probability and vulnerability rankings in each table, listed as either, high, moderate, or low, comes from a 2005 analysis of risk conducted by county emergency services and public safety staff for Oregon Emergency Management.

The probability and vulnerability scores in the hazard summaries below address the likelihood of a future major emergency or disaster within a specific period of time, as follows:

High = *One incident likely within a 10 to 35 year period.*
Moderate = *One incident likely within a 35 to 75 year period.*
Low= One incident likely within a 75 to 100 year period.

The vulnerability scores address the percentage of population or regional assets likely to be affected by a major emergency or disaster, as follows:

High = *More than 10% affected.*
Moderate = *1-10% affected.*
Low = *Less than 1% affected.*

The hazard analysis methodology, presented above, was developed by the Oregon Emergency Management Agency. A more detailed summary of the methodology can be found in Appendix C.

Drought Summary

Drought can be defined in several ways. The American Heritage Dictionary defines drought as "a long period with no rain, especially during a planting season." Another definition of drought is a deficiency in surface and sub-surface water supplies. In socioeconomic terms, drought occurs when a physical water shortage begins to affect populations and economies.

Drought is typically measured in terms of water availability in a defined geographical area. It is common to express drought with a numerical index that ranks severity. The Oregon Drought Severity Index is the most commonly used drought measurement in the state because it incorporates both local conditions and mountain snow pack. The Oregon Drought Severity Index categorizes droughts as mild, moderate, severe, and extreme.

Impacts

Drought is frequently considered an "incremental" hazard; the onset and end of a drought are often difficult to determine. Its effects may accumulate slowly over a considerable period of time and may linger for years after the termination of the event. Droughts are largely the result of below-average precipitation; lack of snowfall during winter months, for example, can profoundly impact irrigation and agricultural production, hydro-electric power, recreational opportunities and a variety of industrial uses.

Droughts are not just a summer-time phenomenon; winter droughts can have a profound impact on agriculture, particularly east of the Cascade Mountains. Also, below average snowfall in higher elevations has a far-reaching effect, especially in terms of hydro-electric power, irrigation, recreational opportunities and a variety of industrial uses.

Drought can affect all segments of a jurisdiction’s population, particularly those employed in water-dependent activities (e.g., agriculture and timber industries, ranching, hydroelectric generation, recreation, etc.). Also, domestic water-users may be subject to stringent conservation measures (e.g., rationing) and could be faced with significant increases in electricity rates.

Low water also means reduced hydroelectric production, which can affect facilities and infrastructure such as communication, hospitals, and correctional facilities that are subject to power failures. Storage systems for potable water, sewage treatment facilities, water storage for firefighting, and hydroelectric generating plants also are vulnerable.

There also are environmental consequences. A prolonged drought in forests promotes an increase of insect pests, which can further damage already-weakened trees. Likewise, a moisture-deficient forest constitutes a significant fire hazard (see the Wildfire summary). In addition, streams below normal flow are unable to effectively dilute waste, which can negatively impact fish and endangered species’ habitats.

For more information on the drought hazard, please visit the state plan’s Drought chapter.

Location of Hazard: Drought occurs within all parts of Union County and is typically not site-specific. Drought severity can, however, vary unpredictably within county lines. See Appendix C for maps depicting average precipitation, and typical drought severity levels for Northeast Oregon.

Extent of Hazard at the Location: Drought can affect all segments of a jurisdiction's population. The extent to which a location is affected depends on precipitation levels, temperatures, and demand.   See Appendix C for maps depicting average precipitation, and typical drought severity levels for Northeast Oregon.

Previous Occurrences of the Hazard within Union County:

- 1904-1905: A statewide drought period of about 18 months.
- 1917-1931: A very dry period throughout Oregon, punctuated by brief wet spells in 1920-21 and 1927.
- 1931-1939: A prolonged statewide drought devastated agriculture. The only area spared was the northern coast.
- 1939-1941: A three-year intense drought in Oregon.
- 1959-1964: Drought primarily affected Eastern Oregon.
- 1985-1997: Generally a dry period, capped by statewide droughts in 1992 and 1994. Forests suffered from the lack of rain causing a number of fires and insect problems.
- 1986: Due to losses incurred from sustained drought conditions, farmers and producers in Union County were eligible to apply for low-interest loans from the USDA.
- 1987: Sustained drought conditions statewide contributed to job losses in the Pacific Northwest timber industry.
- 1999: Five counties in Oregon, including Union County, were declared disaster areas by the USDA due to drought and hailstorms. Farmers were eligible for low interest government loans.
- 2001: USDA designated Baker and Gilliam counties as primary disaster areas due to drought. Union County was designated a contiguous disaster area, also because of drought.
- 2003: Northeast Oregon counties declared local drought emergencies.
- 2004: Union and Wheeler Counties were designated as primary disaster areas due to ongoing drought conditions.
- 2005: Due to water rationing, farmers in Oregon and Washington cut back significantly on planting certain crops, including wheat and hay.
- 2005: In eastern Oregon, the state Department of Environmental Quality requested that wastewater treatment plant managers take voluntary measures to minimize the impact of effluent on streams and rivers affected by drought.
- 2007: Union County received a state drought declaration. Drought was due to low snow packs, low spring rains, and elevated early season temperatures.

- Between 1986 and June 15, 2007, Union County had 23 reported drought impacts: 6 caused agricultural losses; 4 resulted in fires; 2 disrupted water/energy production; 2 produced environmental consequences; 1 caused social hardship; and 8 produced 'other' consequences. See Appendix C for a description of these impacts.

Community's Probability of a Future Hazard Event: High *(One incident likely within a 10 to 35 year period.)*

- Oregon's drought history reveals many short-term and a few long-term events. The average recurrence interval for severe droughts in Oregon is somewhere between 8-12 years.

Community's Vulnerability to a Future Hazard Event: Low *(Less than 1% affected.)*

- The City of La Grande is concerned about aquifer capacities, should growth continue. The amount of water within the Grande Ronde Valley is currently unknown.
- Union County has identified three mitigation actions that specifically pertain to drought. Please see Section 6, "Mission, Goals, Action Items" for a listing and description of all actions.

Sources: local stakeholder interviews; Northeast Oregon Profile and Risk Assessment (Taylor, George H., and Ray Hatton, 1999, The Oregon Weather Book); Drought Impact Recorder, http://droughtreporter.unl.edu/ (Appendix C); the 2003 planning process (Appendix A); Oregon Emergency Management, Oct. 2005, County Hazard Analysis Scores.

Earthquake Summary

Seismic events were once thought to pose little or no threat to Oregon communities. However, recent earthquakes and scientific evidence indicate that the risk to people and property is much greater than previously thought. Oregon and the Pacific Northwest in general are susceptible to earthquakes from three sources: First, shallow earthquakes (depths of 0-10 miles) occur on active faults in the crust. Second, deeper earthquakes (depths of 10-31 miles) are associated with the subducting Juan de Fuca plate. Third, deep earthquakes (depths of 31-62 miles) happen where the continental crust and ocean floor plates are locked against each other and periodically snap loose.

When crustal faults slip, they can produce earthquakes with magnitudes (M) up to 7.0 and can cause extensive, but usually localized damage. Subduction zone earthquakes, on the other hand, occur at greater depths in the earth's crust, and have the potential to cause extensive damage and devastating loss of life. Subduction zone earthquakes occur when two techtonic plates meet and move towards one another. The Juan de Fuca Plate and the North American Plate meet off the Oregon Coast in an area called the Cascadia Subduction Zone (CSZ). The CSZ could produce an earthquake up to 9.0 or greater – the effects of which could reach Eastern Oregon communities.

Region 7 contains high mountains and broad inter-mountain valleys. Although there is abundant evidence of crustal faulting, seismic activity is low when compared with other areas of the state. There are a few identified faults in the region that have been active in the last 20,000 years. The region has been shaken historically by crustal earthquakes and prehistorically by subduction zone earthquakes centered outside the area. All considered, there is good reason to believe that the most devastating future earthquakes would probably originate along shallow crustal faults in the region.

The specific hazards associated with earthquakes include the following:

Ground Shaking

Ground shaking is defined as the motion or seismic waves felt on the earth's surface caused by an earthquake. Ground shaking is the primary cause of earthquake damage.

Ground Shaking Amplification

Ground shaking amplification refers to the soils and soft sedimentary rocks near the surface that can modify ground shaking from an earthquake. Such factors can increase or decrease the amplification (i.e., strength) as well as the frequency of the shaking.

Surface Faulting

Surface faulting are planes or surfaces in earth materials along which failure occurs. Such faults can be found deep within the earth or on the surface. Earthquakes occurring from deep lying faults usually only create ground shaking.

Earthquake-Induced Landslides

These landslides are secondary hazards that occur from ground shaking.

Liquefaction

Liquefaction takes place when ground shaking causes granular soils to turn from a solid into a liquid state. This in turn causes soils to lose their strength and their ability to support weight.

Impacts

The degree of damage to structures and injury and death to people will depend upon the type of earthquake, proximity to the epicenter and the magnitude and duration of the event. Buildings, airports, schools, dams, levees and lifelines including water, sewer, storm water and gas lines, transportation systems, and utility and communication networks are particularly at risk. Also, damage to roads and water systems will make it difficult to respond to post-earthquake fires.

Earthquake damage to roads and bridges can be particularly serious by hampering or cutting off the movement of people and goods and disrupting the provision of emergency response services. Such effects in turn can produce serious impacts on the local and regional economy by disconnecting people from work, home, food, school and needed commercial, medical and social services. A major earthquake can separate businesses and other employers from their employees, customers, and suppliers thereby further hurting the economy. Finally, following an earthquake event, the cleanup of debris can be a huge challenge for the community.

Oregon is rated third highest in the nation for potential losses due to earthquakes. This is due in part to the fact that until recently Oregon was not considered to be an area of high seismicity, and consequently the majority of buildings and infrastructure were not designed to withstand the magnitude of ground shaking that would occur in conjunction with a major seismic occurrence. Experts predict that in the event of a magnitude 8.5 Cascadia Subduction Zone earthquake, losses in the Cascadia Region (Northern California, Oregon, Washington and British Columbia) could exceed $12 billion, 30,000 buildings could be destroyed, and 8,000 lives lost.

The Oregon Department of Geology and Mineral Industries (DOGAMI) developed two earthquake loss models for Oregon based on the two most likely sources of seismic events: (1) the Cascadia Subduction Zone (CSZ) and (2) combined crustal events (500-year Model). Both models are based on HAZUS, a computerized program, currently used by the Federal Emergency Management Agency (FEMA) as a means of determining potential losses from earthquakes. A table describing estimated losses following these events can be found in the Northeast Oregon Profile and Risk Assessment in Appendix B.

For more information on earthquake hazards, please visit the state plan's Earthquake chapter or the Oregon Technical Resource Guide.

Location of Hazard: Union County has several faults that primarily fall within the Grande Ronde Valley, and specifically within the City of Union. See Appendix C for a map of Oregon's fault lines and past earthquakes.

Extent of Hazard at the Location: The majority of earthquakes recorded in Union County have been within 0.9 and 3.9 magnitudes. See Appendix C for the locations and magnitudes of Oregon's past earthquakes.

Previous Occurrences of the Hazard within Union County:

- Date: (Approximate Years) 1400 BCE*, 1050 BCE, 600 BCE, 400 CE, 750 CE, 900 CE
  Location: Offshore Cascadia Subduction Zone
  Magnitude: Probably 8-9
  Remarks: Based on studies of earthquake and tsunamis at Willapa Bay, Washington. These are the mid-points of the age ranges for these six events.
- Date: January, 1700
  Location: Offshore, Cascadia Subduction Zone
  Magnitude: Approximately 9.0
  Remarks: Generated a tsunami that struck Oregon, Washington, and Japan; destroyed Native American Villages along the coast.

Community's Probability of a Future Hazard Event: Low *(One incident likely within a 75 to 100 year period).*

- The Cascadia Subduction Zone generates an earthquake on average every 500-600 years. However, as with any natural process, the average time between events can be misleading. Some of the earthquakes may have been 150 years apart with some closer to 1,000 years apart. Establishing a probability for crustal earthquakes is more difficult given the small number of historic events in the region.
- Union County has numerous faults running northwest to southeast throughout the mountain ranges and along the valley floor. DOGAMI identifies the potential of a magnitude 7 earthquake in the Grande Ronde Valley.

Community's Vulnerability to a Future Hazard Event: Moderate *(1-10% affected.)*

- The earthquake risk is reflected in the International Building Code's (IBC) earthquake hazard maps (developed by the USGS, 2002). The higher the expected ground motions at a particular site, the more stringent the building standards become.
- The effects of an off-shore Cascadia Subduction Zone earthquake on Region 7 would largely be indirect. Building damages would be none to minimal while damages to the state's overall economy would be significant. Transportation corridors, such as I-84, to areas with the greatest damages (west of the Cascades) would be heavily traveled with relief supplies, equipment and personnel moving in one direction and evacuees in the other.
- Given the topography of Union County, even a small-to-moderately sized event could cause significant property damage, injury, and potential death and isolate the population from the outside world. Estimated losses within a 500 year model can be viewed in the Regional Profile, Appendix B.
- Badgley Hall at Eastern Oregon University contains a number of hazardous materials. The building has been secured by deep footings, but

should a high-magnitude earthquake occur, these materials may be released.

- From 2005-2007, under the direction of Oregon Senate Bill 2, DOGAMI additionally completed a statewide seismic needs assessment that surveyed K-12 public school buildings, hospital buildings with acute inpatient care facilities, fire stations, police stations, sheriff's offices and other law enforcement agency buildings. The needs assessment consisted of rapid visual screenings (RVS). RVS results were grouped into categories by risk of probable damage in a high magnitude earthquake. A list of at-risk buildings can be viewed in Appendix C.
- Union County has identified one mitigation action that specifically pertains to earthquakes. Please see Section 6, "Mission, Goals, Action Items" for a listing and description of all actions.

Sources: Region 7: Northeast Oregon Profile and Risk Assessment (University of Washington. List of Magnitude 4.0 or Larger Earthquakes in Washington and Oregon 1872-2002; and Wong and Bott, November 1995, A Look Baker at Oregon's Earthquake History, 1841-1994, Oregon Geology.); Oregon Emergency Management, Oct. 2005, County Hazard Analysis Scores.

Flood Summary

Oregon has a detailed history of flooding with flood records dating back to the 1860s. There are over 250 flood-prone communities in Oregon.

The principal types of flood that occur in the community include:

Riverine floods

Riverine floods occur when water levels in rivers and streams overflow their banks. Most communities located along such water bodies have the potential to experience this type of flooding after spring rains, heavy thunderstorms or rapid runoff from snow melt. Riverine floods can be slow or fast-rising, but usually develop over a period of days.

The danger of riverine flooding occurs mainly during the winter months, with the onset of persistent, heavy rainfall, and during the spring, with melting of snow in the Cascade and Coast Ranges.

Flash floods

Flash floods usually result from intense storms dropping large amounts of rain within a brief period. Flash floods usually occur in the summer during thunderstorm season, appear with little or no warning and can reach full peak in only a few minutes. They are most common in the arid and semi-arid central and eastern areas of the state where there is steep topography, little vegetation and intense but short-duration rainfall. Flash floods can occur in both urban and rural settings, often along smaller rivers and drainage ways.

In flash flood situations, waters not only rise rapidly, but also generally move at high velocities and often carry large amounts of debris. In these instances a flash flood may arrive as a fast moving wall of debris, mud, water or ice. Such material can accumulate at a natural or man-made obstruction and restrict the flow of water. Water held back in such a manner can cause flooding both upstream and then later downstream if the obstruction is removed or breaks free.

Urban floods

Urban flooding occurs where land has been converted from fields or woodlands to developed areas consisting of homes, parking lots, and commercial, industrial and public buildings and structures. In such areas the previous ability of water to filter into the ground is often prevented by the extensive impervious surfaces associated with urban development. This in turn results in more water quickly running off into watercourses which causes water levels to rise above pre-development levels. During periods of urban flooding streets can rapidly become swift moving rivers and basements and backyards can quickly fill with water. Storm drains often may back up with yard waste or other flood debris leading to further localized flooding. Another source of urban flooding is grading associated with development. In some cases, such grading can alter changes in drainage direction of water from one property to another.

Impacts

The extent of the damage and risk to people caused by flood events is primarily dependent on the depth and velocity of floodwaters. Fast moving floodwaters can wash buildings off their foundations and sweep vehicles downstream. Roads, bridges, and other infrastructure and lifelines (pipelines, utility, water, sewer, communications systems, etc.) can be seriously damaged when high water combines with flood debris, mud and ice. Extensive flood damage to residences and other structures also results from basement flooding and landslide damage related to soil saturation. Surface water entering into crawlspaces, basements and daylight basements is common during flood events not only in or near flooded areas but also on hillsides and other areas far removed from floodplains. Most damage is caused by water saturating materials susceptible to loss (e.g., wood, insulation, wallboard, fabric, furnishings, floor coverings and appliances.)

Homes in frequently flooded areas can also experience blocked sewer lines and damage to septic systems and drain fields. This is particularly the case of residences in rural flood prone areas who commonly utilize private individual sewage treatment systems. Inundation of these systems can result in the leakage of wastewater into surrounding areas creating the risk of serious water pollution and public health threats. This kind damage can render homes unlivable.

As was seen in Oregon's 1996 floods, many housing units that were damaged or lost were mobile homes and trailers. Many older manufactured home parks are located in floodplain areas. Manufactured homes have a lower level of structural stability than "stick-built" (standard wood frame construction) homes. Manufactured homes in floodplain zones must be anchored to provide additional structural stability during flood events. Lack of community enforcement of manufactured home construction and anchoring standards in floodplains can contribute to severe damages from flood events.

Flood events impact businesses by damaging property and interrupting commerce. Flood events can cut off customer access and close businesses for repairs. A quick response to the needs of businesses affected by flood events can help a community maintain economic viability in the face of flood damage.

Bridges are a major concern during flood events as they provide critical links in road networks by crossing water courses and other significant natural features. However bridges and their supporting structures can also be obstructions in flood-swollen watercourses and can inhibit the rapid flow of water during flood events.

The most damaging floods for Union County have occurred during the winter and spring months, when warm rains from tropical latitudes melt mountain snow packs. Such conditions were especially noteworthy in February 1957, February 1963, December 1964 and January 1965. Somewhat lesser flooding has been associated with ice jams, normal spring run-off, and summer thunderstorms. Heavily vegetated stream banks, low stream gradients (e.g., Grande Ronde Valley), and breeched dikes have contributed to past flooding at considerable economic cost. Region 7 counties also have experienced flooding associated with low bridge clearances, over-topped irrigation ditches, and natural stream constrictions such as Rhinehart gorge between Elgin and Imbler (Union County). See Appendix C for the number of NFIP Policies in Union County, as well as the number of flood losses and repetitive losses recorded.

For more information on the flood hazard, please visit the state plan's flood chapter or the Oregon Technical Resource Guide.

Location of Hazard: Principle flood sources within Union County include the Grande Ronde River, Catherine Creek, North Powder River, Little Creek, Gekeler Slough, Taylor Creek, Fresno Creek, Clark Creek, Indian Creek, and Wolf Creek.

Extent of Hazard at the Location: Properties, farmland, and infrastructure within municipal floodplains are susceptible to flooding damages. The extent of damages depends on annual precipitation levels and storm severity, and weather conditions.

Previous Occurrences of the Hazard within Union County:

- 1917: NE Oregon: Widespread flooding.
- 1931: West and Northeast Oregon: Spring was extremely wet and mild. Rains on already wet soil caused rivers to quickly rise, bridges to wash and crop destruction. Bridges were washed out and farms were lost. 200 people were without food and water; 14 died.
- 1932: NE Oregon: Malheur, Grande Ronde, John Day and Umpqua Rivers: Widespread flooding.
- 1935: NE Oregon: Widespread flooding.
- March 1952: Malheur, Grande Ronde, John Day Rivers: Highest flood stages on these rivers in 40 years.
- May 1948: Columbia/NE Oregon: Unusually large mountain snow melt produced widespread flooding.
- December 1964-January 1965: Entire State: widespread destructive flooding from warm rain, melted snow, and runoff on frozen ground. Record snow depths and December rainfall led to hundreds of landslides. Bridges and roads washed out, homes were destroyed and thousands were evacuated. There were 47 deaths, 17 in Oregon. Damage totaled $430 million. In Region 7, property damage totaled $208,333.33.
- February 1986: Union, Grant, Baker, and Wallowa Counties: Warm rain melted snow, causing considerable damage to cropland and highways. A number of bridges were destroyed. Property damage totaled $172,413.79.
- June, 1988: Thunderstorms occurred throughout Baker, Union, and Wallowa Counties. Heavy rains and ¾ inch hail damaged crops and caused flooding in Baker and Enterprise.
- March 1989: SC and NE Oregon: warm rains and increasing temperatures caused snow packs to melt quickly.
- May 1991: Union and Baker Counties: 2-4 inches of rain in two days caused the Umatilla and Grande Ronde rivers to rise. Bridges, highways and farms were flooded. There was $50,000 in property damage and $500,000 in crop damage.
- February 1996: Grande Ronde River: City of Union flooded.
- January 1997: Imnaha, Grande Ronde, and John Day Rivers flooded.
- May 1998: Eastern and Central Oregon: persistent rains caused widespread damage. La Grande and Prineville reported 1-inch hail and

Union received .75 inches of rain in 20 minutes. Prineville was declared a disaster area.

- June, 1998: City of La Grande: Up to 1.5 inches of rain fell in 20 minutes with ¼ inch in two minutes. Winds gusted up to 50 mph. Several inches of water flowed along La Grande streets. Eight thousand were without power and the storm stripped crops.
- September 8, 1998: Town of North Powder: Flash flood.
- July 22, 2004: La Grande: 70 mph winds wreaked havoc on trees, houses, cars and streets. Water flowed into the ground level floors of Ackerman Hall, Pierce Library, and Hoke Student Center at Eastern Oregon University.

Community's Probability of a Future Hazard Event: High *(One incident likely within a 10 to 35 year period.)*

- Oregon's most severe flooding occurs between November and February and most are associated with a period of intense warm rain on a heavy mountain snow pack.
- Localized flooding occurs annually due to high spring runoff, heavy rains, or ice blockages.

Community's Vulnerability to a Future Hazard Event: High *(More than 10% affected.)*

- Pierce Library and Inlow Hall at Eastern Oregon University contain a number of historic documents. The library additionally maintains the communication systems through which the university connects with distance education students. Floods and earthquakes pose concerns for the secured content within these buildings.
- Union County has identified four mitigation actions that specifically pertain to flooding. Please see Section 6, "Mission, Goals, Action Items" for a listing and description of all actions.

Flood Mitigation Assistance Requirements

Since 1977, six NFIP policy-holders in Union county have collected flood-related damage payments. (See # of flood loss properties, and repetitive flood loss properties in Appendix C, "Flood"). There are 117 policies in count, 66 of which are held in La Grande, and 40 of which are held in the County's unincorporated areas. Two property holders have experienced repetitive losses within the County. Currently, Union County does not have the capability to identify the number and types of structures in the flood plain (see "vulnerability" below).

- Each county in Region 7 has a Flood Insurance Rate (FIRM) map; however, due to their age, the maps are not guaranteed to accurately represent present flood conditions. The most recent FIRM map for Union County was completed in 1996. In 2003, The Department of Homeland Security's Federal Emergency Management Agency (FEMA) initiated a Flood Map Modernization Program (FMMP). The goal of the national FMMP was to upgrade flood hazard data and mapping to create a more accurate digital product that would improve floodplain management across the country. In 2008, FEMA was scheduled to begin upgrading flood hazard data in Eastern Oregon. Funds, however, are not expected to continue. Communities that are able to demonstrate significant need, and/or are able to provide accurate topological data, road maps, base elevation measurements, and a description of populations at-risk will be competitive in acquiring a portion of the remaining funds.

Sources: local stakeholder interviews; Northeast Oregon Profile and Risk Assessment (Taylor and Hannon, 1999, The Oregon Weather Book, pp.96-103; and FEMA, Union County Flood Insurance Study (FIS), 04/03/96.); Oregon Emergency Management, Oct. 2005, County Hazard Analysis Scores.

Landslides Summary

Landslides are a major geologic threat in almost every state in the United States. In Oregon, a significant number of locations are at risk from dangerous landslides and debris flows. While not all landslides result in property damage, many landslides do pose serious risk to people and property. Increasing population in Oregon and the resultant growth in home ownership has caused the siting of more development in or near landslide areas. Often these areas are highly desirable owing to their location along the coast, rivers and on hillsides.

Landslides are fairly common, naturally occurring events in various parts of Oregon. In simplest terms, a landslide is any detached mass of soil, rock, or debris that falls, slides or flows down a slope or a stream channel. Landslides are classified according to the type and rate of movement and the type of materials that are transported.

In understanding a landslide, two forces are at work: 1) the driving forces that cause the material to move down slope, and 2) the friction forces and strength of materials that act to retard the movement and stabilize the slope. When the driving forces exceed the resisting forces, a landslide occurs.

Landslides can be grouped as “on-site” and “off-site” hazards. An “on-site” slide is one that occurs on or near a development site and is slow moving. It is slow moving slides that cause the most property damage in urban areas. On-site landslide hazards include features called slumps, earth flows and block slides. “Off-site” slides typically are rapid moving and begin on steep slopes at a distance from homes and development. A 1996 “off-site” slide in southern Oregon began a long distance away from homes and road, traveled at high velocity and killed five people and injured a number of others.

Landslides are classified based on causal factors and conditions and exist in three basic categories.

Falls

This type of landslide involves the movement of rock and soil which detaches from a steep slope or cliff and falls through the air and/or bounces or rolls down slope. This type of slide is termed a rock fall and is very common along Oregon highways where they have been cut through bedrock in steep canyons and along the coast.

Slides

This kind of landslide exists where the slide material moves in contact with the underlying surface. Here the slide moves along a plane and either slumps by moving along a curved surface (called a rotational slide) or along a flat surface (called a translational slide). While slow-moving slides can occur on relatively gentle slopes and are less likely to cause serious injuries or fatalities, they can result in very significant property damage.

Flows

In this case the landslide is characterized as plastic or liquid in nature in which the slide material breaks up and flows during movement. This type of landslide occurs when a landslide moves down slope as a semi-fluid mass scouring or partially scouring rock and soils from the slope along its path. A flow landslide is typically rapid moving and tends to increase in volume as it moves down slope and scours out its channel.

Rapidly moving flow landslides are often referred to a debris flows. Other terms given to debris flows are mudslides, mudflows, or debris avalanches. Debris flows frequently take place during or following an intense rainfall on previously saturated soil. Debris flows usually start on steep hillsides as slumps or slides that liquefy, accelerate to speeds as high as 35 miles per hour or more, and travel down slopes and channels onto gentle sloping or flat ground. Most slopes steeper than 70 percent are at risk for debris flows.

The consistency of a debris flow ranges from watery mud to thick, rocky, mud-like, wet cement which is dense enough to carry boulders, trees and cars. Separate debris flows from different starting points sometimes combine in canyons and channels where their destructive energy is greatly increased. Debris flows are difficult for people to outrun or escape; they present the greatest risk to human life and have caused most of their damage in rural areas.

Conditions Affecting Landslides

Natural conditions and human activities can both play a role in causing landslides. Certain geologic formations are more susceptible to landslides than others. Locations with steep slopes are at the greatest risk of slides. However, the incidence of landslides and their impact on people and property can be accelerated by development. Developers who are uninformed about geologic conditions and processes may create conditions that can increase the risk of or even trigger landslides.

There are four principal factors that affect or increase the likelihood of landslides:

- Natural conditions and processes including the geology of the site, rainfall, wave and water action, seismic tremors and earthquakes and volcanic activity.

- Excavation and grading on sloping ground for homes, roads and other structures.

- Drainage and groundwater alterations that are natural or human-caused can trigger landslides. Human activities that may cause slides include broken or leaking water or sewer lines, water retention facilities, irrigation and stream alterations, ineffective storm water management and excess runoff due to increased impervious surfaces.

- Change or removal of vegetation on very steep slopes due to timber harvesting, land clearing and wildfire.

Impacts

Depending upon the type, location, severity and area affected, severe property damage, injuries and loss of life can be caused by landslide hazards. Landslides can damage or temporarily disrupt utility services, roads and other transportation systems and critical lifeline services such as police, fire, medical, utility and communication systems, and emergency response. In additional to the immediate damage and loss of services, serious disruption of roads, infrastructure and critical facilities and services may also have longer term impacts on the economy of the community and surrounding area.

Increasing the risk to people and property from the effects of landslides are the following three factors:

- Improper excavation practices, sometimes aggravated by drainage issues, can reduce the stability of otherwise stable slopes.
- Allowing development on or adjacent to existing landslides or known landslide-prone areas raises the risk of future slides regardless of excavation and drainage practices. Homeowners and developers should understand that in many potential landslide settings that there are no development practices that can completely assure slope stability from future slide events
- Building on fairly gentle slopes can still be subject to landslides that begin a long distance away from the development. Sites at greatest risk are those situated against the base of very steep slopes, in confined stream channels (small canyons), and on fans (rises) at the mouth of these confined channels. Home siting practices do not cause these landslides, but rather put residents and property at risk of landslide impacts. In these cases, the simplest way to avoid such potential effects is to locate development out of the impact area, or to construct debris flow diversions for the structures that are at risk.

For more information on the landslide hazard, please visit the state plan's Landslide chapter or the Oregon Technical Resource Guide.

Location of Hazard: In the event of an earthquake, avalanches could originate on the east flank of Mount Emily. The partially undercut dacite cliff at Halfway Spring may be the most likely source for future debris flow avalanches. Other potentially hazardous landslide complexes are located in Owsley Canyon and on the Grande Ronde River 6km upstream of La Grande.

Extent of Hazard at the Location: In general, northeastern Oregon soil profiles are shallow and rainfall is less frequent and intense than the western portion of the state. Most landslides occur within the Interstate 84 corridor, and state highway 82.

Slides are more likely to happen during rain storms and earthquakes. The severity of a slide will vary depending on its location and magnitude.

Previous Occurrences of the Hazard within Union County:

- None; Relic landslides are known to have existed in the valley, but there have been no documented instances. Small, isolated events due to extremely heavy precipitation have occurred in mountainous regions, but there have been no documented injuries, death, or property damages associated with these events.

Community's Probability of a Future Hazard Event: Low *(One incident likely within a 10 to 35 year period.)*

- There is a correlation between precipitation (e.g., rain or snow) and the occurrence of landslides / debris flows. Geo-engineers with the Oregon Department of Forestry estimate widespread activity about every 20 years; in western Oregon, landslides at a local level can be expected every 2 or 3 years. In Region 7, landslides will occur less frequently.
- Rock-fall and/or landslide-generated debris flow avalanches, as well as mudflows pose a hazard in the Grande Ronde Valley. In the event of an earthquake, avalanches could originate on the east flank of Mt Emily; remnants of old debris-flow avalanches and rock-falls form boulder fields that extend into the valley as far as 2 km. Triggering mechanisms for these types of debris avalanches are varied; heavy rainfall, earthquakes, and simple freeze-thaw cycles could all trigger cliff collapse. The partially undercut dacite cliff at Halfway Spring may be the most likely source for future debris flow avalanches. Other potentially hazardous landslide complexes are located on Owsley Canyon and on the Grande Ronde River about 6km upstream of La Grande.

Community's Vulnerability to a Future Hazard Event: Low *(Less than 1% affected.)*

- Landslides have the potential to block streams; areas in Union County where landslide damming may occur include a spot 28 km south of La Grande along Wolf Creek, and a point 24 km southwest of La Grande along Beaver Creek. Channels at the mouths of both Mill Creek and Deal Creek are cut into Holocene mudflow deposits on the west side of the La Grande. Both channels contain remnants of younger mudflows.
- The Grande Ronde Hospital is constructed on an ancient landslide.
- At this time, there are no cost-effective actions to specifically mitigate landslides in Union County. Multi-hazard actions 2, 7, 8, 9, 10, and 11 may help to mitigate the effects of a landslide. Please see Section 6, "Mission, Goals, Action Items" for a listing and description of all actions.

Sources: local stakeholder interviews, steering committee meetings, Northeast Oregon Profile and Risk Assessment (See Appendix B); Oregon Emergency Management, Oct. 2005, County Hazard Analysis Scores.

Volcanic Event Summary

The Cascade Range of the Pacific Northwest has more than a dozen active volcanoes. These familiar snow-clad peaks are part of a 1,000 mile-long chain of mountains which extend from southern British Columbia to northern California. Cascades volcanoes tend to erupt explosively, and have occurred at an average rate of 1-2 per century during the last 4,000 years. Future eruptions are certain. Seven Cascades volcanoes have erupted since the first U.S. Independence Day slightly more than 200 years ago. Four of those eruptions would have caused considerable property damage and loss of life had they occurred today without warning. The most recent events were Mt. St. Helens in Washington (1980-86) and Lassen Peak in California (1914-1917). The existence, position and recurrent activity of Cascades volcanoes are generally thought to be related to the convergence of shifting crustal plates. As population increases in the Pacific Northwest, areas near volcanoes are being developed and recreational usage is expanding. As a result more and more people and property are at risk from volcanic activity.

To identify the areas that are likely to be affected by future events, pre-historic rock deposits are mapped and studied to learn about the types and frequency of past eruptions at each volcano. This information helps scientists to better anticipate future activity at a volcano, and provides a basis for preparing for the effects of future eruptions through emergency planning,

Impacts

The effects of a major volcanic event can be widespread and devastating. The Cascade Range in Washington, Oregon and northern California is one of the most volcanically active regions in the United States. Volcanoes produce a wide variety of hazards that can destroy property and kill people. Large explosive eruptions can endanger people and property hundreds of miles away and can even affect the global climate. Some volcano hazards such as landslides can occur even when a volcano is not erupting.

The volcanic Cascade Mountain Range is not within Region 7 counties; consequently, the risk from local volcano-associated hazards (e.g., lahars, pyroclastic flows, lava flows, etc.) is not a consideration. However, there is some risk from air-borne tephra (volcanic ash). This fine-grained material, blown aloft during a volcanic eruption, can travel many miles from its source. The cities of Yakima and Spokane, Washington were covered with ash during the May 1980, Mt. Saint Helens eruption. Air borne tephra can reduce visibility to zero, and bring street, highway, and air traffic to an abrupt halt. The material is noted for its abrasive properties and is especially damaging to machinery.

Eruption Columns and Clouds

An explosive eruption blasts solid and molten rock fragments called tephra and volcanic gases into the air with tremendous force. The largest rock fragments called bombs usually fall back to the ground within two miles of the event. Small fragments (less than 0.1 inch across) of volcanic glass, mineral and rock (ash) rise high into the air forming a huge, billowing eruption column. Eruption columns creating an eruption cloud can grow rapidly and reach more than 12 miles above a volcano in less than 30 minutes. Volcanic ash clouds can pose serious hazards to aviation. Several commercial jets have nearly crashed because of engine failure from inadvertently flying into ash clouds.

Large eruption clouds can extend hundreds of miles downwind resulting in ash fall over enormous areas. Ash from the May 18, 1980 Mt. St. Helens eruption fell over an area of 22,000 square miles in the western U.S. Heavy ash fall, particularly when mixed with rain, can collapse buildings. Minor ash fall can damage crops, electronics and machinery.

For more information on the volcanic hazard, please visit the state plan's Volcano chapter.

Location of Hazard: There are no sources of volcanic activity within Union County. Mt. St. Helens in Washington remains a possible source of air borne tephra. Mt. Jefferson is a possible, but probably unlikely source. Areas affected by tephra are determined by the vigor, duration of the eruption, and the wind direction. It is impossible to predict the direction and speed of tephra transport more than a few hours in advance (USGS Open File Report 95-247, p.6).

Extent of Hazard at the Location: Air borne tephra is a fine-grained material. Blown aloft during a volcanic eruption, it can travel many miles from its source. All locations within Union County are equally susceptible to this hazard. Developed areas are more likely to experience the negative effects of tephra.

Previous Occurrences of the Hazard within Union County:

- Union County received a small amount of ash when Mt. St. Helens erupted in 1980. No harm or damages were recorded.

Community's Probability of a Future Hazard Event: Low *(One incident likely within a 75 to 100 year period).*

- Mt. St. Helens remains a possible source of air borne tephra. It has repeatedly produced voluminous amounts of this material and has erupted much more frequently in recent geologic time than any other Cascade volcano. It blanketed Yakima and Spokane during the 1980 eruption and it continues to be active. Mt. Jefferson, located about 150 miles west of the City of John Day, is a possible, but probably unlikely source. The annual probability of 1 cm or more of tephra accumulation within the Region 7 counties, from any Cascade volcano, is about 1 in 5,000 (USGS Open File Report 97-513, p.9).

Community's Vulnerability to a Future Hazard Event: Low *(Less than 1% affected.)*

- The volcanic Cascade Mountain Range is not within Region 7 counties; consequently, the risk from local volcano-related hazards (e.g., lahars, pyroclastic flows, lava flows, etc.) is not a consideration.
- If air borne tephra reaches Eastern Oregon, it has the potential to reduce visibility, and bring street, highway, and air traffic to an abrupt halt. The material is noted for its abrasive properties and is especially damaging to machinery.

- At this time, there are no cost-effective actions to specifically mitigate volcano-related hazards in Union County. Multi-hazard actions 3, 5, 7, and 10 may help to mitigate the effects of volcanic hazards. Please see Section 6, “Mission, Goals, Action Items” for a listing and description of all actions.

Sources: local stakeholder interviews; steering committee meetings; Northeast Oregon Profile and Risk Assessment (see Appendix B). Oregon Emergency Management, Nov. 2005, County Hazard Analysis Scores.

Wildfire Summary

Fire is an essential part of Oregon's ecosystem, but it is also a serious threat to life and property particularly in the state's growing rural communities. Wildfires are fires occurring in areas having large areas of flammable vegetation that require a suppression response. Areas of wildfire risk exist throughout the state with areas in central, southwest and northeast Oregon having the highest risk. The Oregon Department of Forestry has estimated that there are about 200,000 homes in areas of serious wildfire risk.

The impact on communities from wildfire can be huge. In 1990, Bend's Awbrey Hill fire destroyed 21 homes, causing $9 million in damage and costing over $2 million to suppress. The 1996 Skeleton fire in Bend burned over 17,000 acres and damaged or destroyed 30 homes and structures. Statewide that same year, 218,000 acres were burned, 600 homes threatened and 44 homes were lost. The 2002 Biscuit fire in southern Oregon affected over 500,000 acres and cost $150 million to suppress.

Wildfire can be divided into three categories: interface, wildland, and firestorms.

Interface Fires

Essentially an interface fire occurs where wildland and developed areas come together with both vegetation and structural development combining to provide fuel. The wildland/urban interface (sometimes called rural interface in small communities or outlying areas) can be divided into three categories.

The <u>classic wildland/urban interface</u> (WUI) exists where well-defined urban and suburban development presses up against open expanses of wildland areas.

The <u>mixed wildland/urban interface</u> is more typical of the problems in areas of exurban or rural development: isolated homes, subdivisions, resorts and small communities situated in predominantly in wildland settings.

The <u>occluded wildland/urban interface</u> where islands of wildland vegetation exist within a largely urbanized area.

Wildland Fires

A wildland fire's main fuel source is natural vegetation. Often referred to as forest or rangeland fires, these fires occur in national forests and parks, private timberland, and on public and private rangeland. A wildland fire can become an interface fire if it encroaches on developed areas.

Firestorms

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

Conditions Contributing to Wildfires

Ignition of a wildfire may occur naturally from lightning or from human causes such as debris burns, arson, careless smoking, and recreational activities or from an industrial accident. Once started, four main conditions affect the fire's behavior: fuel, topography, weather and development.

Fuel is the material that feeds a fire. Fuel is classified by volume and type. As a western state, Oregon is prone to wildfires due to its prevalent conifer, brush and rangeland fuel types.

Topography influences the movement of air and directs a fire's course. Slope and hillsides are key factors in fire behavior. Unfortunately, hillsides with steep topographic characteristics are also desirable areas for residential development.

Weather is the most variable factor affecting wildfire behavior. High risk areas in Oregon share a hot, dry season in late summer and early fall with high temperatures and low humidity.

The increase in residential development in interface areas has resulted in greater wildfire risk. Fire has historically been a natural wildland element and can sweep through vegetation that is adjacent to a combustible home. New residents in remote locations are often surprised to learn that in moving away from built-up urban areas, they have also left behind readily available fire services providing structural protection.

Impacts

The effects of fire on ecosystem resources can include damages, benefits, or some combination of both. Ultimately, a fire's effects depend largely on the characteristics of the fire site, the severity of the fire, its duration and the value of the resources affected by the fire.

The ecosystems of most forest and wildlands depend upon fire to maintain various functions. These benefits can include, depending upon location and other circumstances, reduced fuel load, disposal of slash and thinned tree stands, increased forage plant production, and improved wildlife habitats, hydrological processes and aesthetic environments. Despite these potential benefits, fire has historically been suppressed for years because of its effects on timber harvest, loss of scenic and recreational values and the obvious threat to property and human life.

At the same time, the effects of a wildfire on the built environment, particularly in the face of a major wildfire event, can be devastating to people, homes, businesses and communities. As noted above, fuel, topography, weather and the extent of development are the key determinants for wildfires. A number of other factors also have been identified which affect the degree of risk to people and property in identified wildfire interface areas. These include:

- Combustible roofing material (for example cedar shakes)
- Wood construction
- Homes and other structures with no defensible space
- Roads and streets with substandard width, grades, weight-load and connectivity standards making evacuation and fire response more difficult
- Subdivisions and homes surrounded by heavy natural fuel types
- Structures on steep slopes covered with flammable vegetation
- Limited on-site or community water supply

Locations with normal prevailing winds over 30 miles per hour

The financial, social and economic costs of wildfires demonstrate the need to reduce their impact on lives and property, as well as the short and long-term economic and environmental consequences of large-scale fires. Cost savings can be realized through preparedness and risk reduction including a coordinated effort of planning for fire protection and implementing preparedness activities among local, state, and federal agencies, the private sector, and community organizations. Individual property owners have a major role to play in this coordinated effort, especially in WUI areas.

For more information on the wildfire hazard within Union County, please visit Union County' Community Wildfire Protection Plan (Appendix H, as well as the state plan's Wildfire chapter or the Oregon Technical Resource Guide.

Location of Hazard: All forested and rangeland areas within the County are susceptible to wildfire. Wildland/urban interface (WUI) zones include Morgan Lake, Cove, Mt. Emily, Palmer Junction, Perry/Hilgard, Stubblefield Mountain, Beaver Creek Watershed, Catherine Creek, Medical Springs, Kamela, Pumpkin Ridge/Ruckle, Elkanah, Clarks Creek, Cricket Flat, and Starkey.

Extent of Hazard at the Location: The extent of each fire depends on the type and amount of fuel in the area, the location of the fire, and mitigation and response efforts.

Previous Occurrences of the Hazard within Union County:

- 1973 'Rooster Peak': Lightning-caused; burned approximately 6,400 acres including six structures. Much of the fire was located near La Grande's southwest city limits. Because structures were lost and the fire threatened the City of La Grande, this is the most significant fire in recent history.
- 1981 'Mt. Harris': Human-caused fire resulting in significant timber loss; burned 850 acres. The fire was highly visible from La Grande, Summerville, Imbler and Cove.
- 1986 'Frizzel': Lightning-caused; 250 acres burned. Took place in the Mt. Emily WUI.
- 1986 'Clear': Baker, Grant, and Union Counties: Lightning-caused; 6,000 acres burned.
- 1988 'Turner': Baker, Union, Grant Counties: 8,000 acres burned.
- 2001 'Boulevard': Lightning-caused; 150 acres burned. The fire threatened the La Grande watershed, a rugged and road-less area of high environmental value. Much like the previous fires the potential for a catastrophic fire was high, but for different reasons. The watershed contains substantial fuel and has very limited access. Had conditions been less favorable, a major event could have occurred.
- 2003 'Craig Loop': Human-caused; 43 acres burned. Took place in the Mt. Emily WUI

- 2005 ‘Clark Creek and Indian Creek’: 15 miles NE of La Grande. 450-500 acres of grass, brush, agricultural fields, and timber burned in the vicinity of Mt. Harris.
- 2005 ‘Mule Peak’: Wallowa Whitman Forest, 20 miles SE of La Grande. 1,150 acres burned.
- 2007 ‘Gordon Creek’: Elgin: 17 acres burned

Community’s Probability of a Future Hazard Event: High *(One incident likely within a 10 to 35 year period.)*

- The elimination of logging and the continuous drought cycle has resulted in explosive fuel loading and high risk for extreme fire danger.
- The majority of wildfires occur between June and October. However, wildfires can occur at other times of the year when weather and fuel conditions combine to allow ignition and spread. Seventy percent of Oregon’s wildland fires result from human activity. The remaining thirty percent result from lightning, occurring most frequently in eastern and southern Oregon.

Community’s Vulnerability to a Future Hazard Event: High *(More than 10% affected.)*

- Sixteen WUI’s were identified for Union County as areas of concern. The Mt. Emily WUI is recognized as one of Union County’s most populated and most at-risk interface areas.
- A wildfire of any magnitude in Union County would severely impact the economy by reducing the amount of wood available for market. This in turn would limit the business relationships and opportunities of those who are dependent on forest resources as the amount of available timber is in decline. A catastrophic fire would also impact tourism and recreational opportunities over the long term. As forestland is consumed by wildfire wildlife habitat diminishes and the aesthetic value declines.
- Union County has identified one mitigation action that specifically pertains to wildfire. Please see Section 6, “Mission, Goals, Action Items” for a listing and description of all actions.

Sources: Union County Community Wildfire Protection Plan (see Appendix H); Northeast Oregon Profile and Risk Assessment (Oregon Emergency Management State Natural Hazard Mitigation Plan, 2003, Wildland/Urban Interface chapter); Oregon Emergency Management, Oct. 2005, County Hazard Analysis Scores; The La Grande Observer; InciWeb Incident Information System (www.inciweb.org).

Wind Storm Summary

Extreme winds occur throughout Oregon. The most persistent high winds take place along the Oregon Coast and in the Columbia River Gorge. High winds in the Columbia Gorge are well documented. The Gorge is the most significant east-west gap in the Cascade Mountains between California and Canada. Wind conditions in eastern Oregon are not as dramatic as those along the coast or in the Gorge, but high winds can cause dust storms or be associated with severe winter conditions such as blizzards. A majority of the destructive surface winds striking Oregon are from the southwest. Some winds blow from the east but most often do not carry the same destructive force as those from the Pacific Ocean.

The Columbus Day storm in 1962 was the most destructive windstorm ever recorded in Oregon in terms of both loss of life and property. Damage from this event was greatest in the Willamette Valley. The storm killed 38 people and left over $200 million in damage. Hundreds of thousands of homes were without power for short periods, while others were without power for two to three weeks. More than 50,000 homes suffered some damage and nearly 100 were destroyed. Entire fruit and nut orchards were destroyed and livestock were killed as barns collapsed and trees blew over. In Portland, the highest gusts were 116 miles per hour.

Although rare, tornados can and do occur in Oregon. Only nine have been recorded since 1888, but damages to timber, personal property, and critical infrastructure have been severe.

Impacts

Windstorms can have significant impacts on life and property. Debris carried along by extreme winds can contribute directly to injury and loss of life and indirectly through the failure of protective structures (i.e., buildings) and infrastructure. Windstorms have the ability to cause damage more than 100 miles from the center of storm activity. High winds can topple trees and break limbs which in turn can result in power outages and disrupt telephone, computer, and TV and radio service.

In addition to the immediate effects of wind damage, the loss of power due to windstorms can have widespread impacts on business and economic activity. A sustained loss of power can also seriously strain the provision of emergency services and the operation of water and sewer facilities and transportation systems.

For more information on the windstorm hazard, please visit the state plan's Windstorm chapter.

Location of Hazard: High winds occur within all parts of the county. See Appendix C for a map of past wind damaged areas.

Extent of Hazard at the Location: High winds occur within all parts of the county. Timber, agricultural, and developed areas are most susceptible to wind damage. Within Union County, wind speeds have reached at least 70 mph.

Previous Occurrences of the Hazard within Union County:

- Apr., 1931: NE Oregon: Unofficial wind speeds reported at 78 mph. Damage to fruit orchards and timber.
- Nov. 10-11, 1951: Statewide: Widespread damage to transmission and utility lines; Wind speeds of 40-60 mph; Gusts up to 80 mph.
- Dec., 1951: Statewide: Wind speed 60 mph in Willamette Valley. 75 mph gusts. Damage to buildings and utility lines.
- Dec., 1955: Statewide: Wind speeds 55-65 mph with 69 mph gusts. Considerable damage to buildings and utility lines. Pendleton experienced 61 mph winds and gusts up to 69 mph. Four lives were lost and there was significant property damage.
- Nov., 1958: Statewide: Wind speeds at 51 mph with 71 mph gusts. Every major highway was blocked by fallen trees.
- Oct., 1962: Statewide: Columbus Day Storm; Oregon's most destructive storm to date. 116 mph winds in Willamette Valley.
- Mar. 1971: Most of Oregon: Greatest damage in Willamette Valley. Homes and power lines destroyed by falling trees. Destruction to timber in Lane County.
- Nov., 1981: Pacific NW: Back to back storms hit the NW with wind gusts at 60 mph throughout the state. The storms caused $50 million in damages and eleven deaths.
- Jan., 1986: NE Oregon: Wind gusts 80-90 mph. Heavy drifting snow in Ladd Canyon (Union Co.). Strong winds tore pieces off storage hangers and the Elgin High School Gym. Sustained winds of 80 and 90 mph with drifted snow lead to the closure of I-84.
- Jan., 1990: Statewide: Heavy winds exceeding 75 mph caused damage throughout the state. Nine people were injured, and two people died.
- Mar., 1991: NE Oregon and Cascades, including Union, Wallowa, Grant and Baker Counties: Severe wind storm. In Pendleton, wind was 48 mph with gusts of up to 74 mph. Dust storms caused traffic accidents. Union, Baker, Wallowa and Grant Counties each recorded $2,000 in property damages.
- Dec. 1992: Northeastern Mountains: Severe wind storm.
- Jan., 1993: NE Oregon: The storm moved northward along the Oregon coast and then inland to Northeast Oregon. Northeast Oregon winds neared 70 mph.
- Dec., 1993: NE Oregon: High winds ranged between 70 and 80 mph with gusts of up to 103 mph. No significant damage was reported.
- June, 1998: City of La Grande: Up to 1.5 inches of rain fell in 20 minutes with ¼ inch in two minutes. Winds gusted up to 50 mph. Several inches of water flowed along La Grande streets. Eight thousand were without power and the storm stripped crops.

- June, 2001: La Grande: Wind gusts reached 60 mph. Zero visibility along Highway 237; power outages and fallen trees.
- Nov. 2001: La Grande: Sustained winds of 18 mph with gusts up to 30 mph, and blowing snow and slick pavement closed Interstate 84 and Highway 82.
- Nov. 12, 2002: La Grande: Sustained winds of 38 mph, with gusts up to 50 mph. A large tree fell on the home of a La Grande resident.
- July 22, 2004: La Grande: 70 mph winds wreaked havoc on trees, houses, cars and streets. Water flowed into the ground level floors of Ackerman Hall, Pierce Library, and Hoke Student Center at Eastern Oregon University.
- Aug, 2004: Grande Ronde Valley: Strong winds, clocked at about 35 mph with gusts up to 54 mph, sent clouds of top soil billowing across the Grande Ronde Valley mid-afternoon.
- Nov. 2006: Statewide: In Union County, the winds peaked at 52mph around 7:30pm. High winds continued through the night. Trees fell on Highway 203 between Union and Medical Springs.

Community's Probability of a Future Hazard Event: High *(One incident likely within a 10 to 35 year period.)*

Community's Vulnerability to a Future Hazard Event: Moderate *(1-10% affected.)*

- Many buildings, utilities, and transportation systems within Region 7 are vulnerable to wind damage. This is especially true in open areas, such as natural grasslands or farmlands. It is also true in forested areas, along tree-lined roads and electrical transmission lines, and on residential parcels where trees have been planted or left for aesthetic purposes. Structures most vulnerable to high winds include insufficiently anchored manufactured homes and older buildings in need of roof repair.
- All buildings and homes within Union County, and particularly those on the valley floor, are subject to severe weather, including ice and snow storms, lightning storms, hail, heavy rain, and fast winds.
- Union County has identified one mitigation action that specifically pertains to both wind storms and winter storms (multi-hazard action #1). Please see Section 6, "Mission, Goals, Action Items" for a listing and description of all actions.

Sources: local stakeholders; steering committee members; Northeast Oregon Profile and Risk Assessment (Taylor, George H., and Ray Hatton. (1999), The Oregon Weather Book. P.151-157, Hazard Mitigation Team Survey Report, Severe Windstorm in Western Oregon, February 7, 2002 (FEMA 1405-DR-OR)); Oregon Emergency Management, Oct. 2005, County Hazard Analysis Scores.

Winter Storm Summary

Destructive winter storms that produce heavy snow, ice, rain and freezing rain, and high winds have a long history in Oregon. Severe storms affecting Oregon with snow and ice typically originate in the Gulf of Alaska or in the central Pacific Ocean. These storms are most common from October through March.

Ice storms are comprised of cold temperatures and moisture, but subtle changes can result in varying types of ice formation which may include freezing rain, sleet and hail. Of these, freezing rain can be the most damaging of ice formations.

Outside of mountainous areas significant snow accumulations are much less likely in western Oregon than on the eastside of the Cascades. However, if a cold air mass moves northwest through the Columbia Gorge and collides with a wet Pacific storm then a larger than average snow fall may result.

An example of this type of snowstorm occurred in January 1980 when snow, ice, wind and freezing rain struck Oregon statewide. In the Portland area alone, 200,000 utility customers were left without power and phone service for several days.

Impacts

Severe winter weather can be a deceptive killer. Winter storms which bring snow, ice and high winds can cause significant impacts on life and property. Many severe winter storm deaths occur as a result of traffic accidents on icy roads, heart attacks when shoveling snow, and hypothermia from prolonged exposure to the cold. The temporary loss of home heating can be particularly hard on the elderly, young children and other vulnerable individuals.

Property is at risk due to flooding and landslides that may result if there is a heavy snowmelt. Additionally, ice, wind and snow can affect the stability of trees, power and telephone lines and TV and radio antennas. Down trees and limbs can become major hazards for houses, cars, utilities and other property. Such damage in turn can become major obstacles to providing critical emergency response, police, fire and other disaster recovery services.

Severe winter weather also can cause the temporary closure of key roads and highways, air and train operations, businesses, schools, government offices and other important community services. Below freezing temperatures can also lead to breaks in uninsulated water lines serving schools, businesses, and industry and individual homes. All of these effects, if they last for more than several days can create significant economic impacts on local communities, the surrounding region, and communities outside of Oregon as well. In the rural areas of Oregon severe winter storms can isolate small communities, and farms and ranches, and create serious problems for open range cattle operations such as those in southeastern Oregon.

For more information on the winter storm hazard, please visit the state plan's Winter Storm chapter.

Location of Hazard: Winter storms occur in all parts of Union County.

Extent of Hazard at the Location: The entire county is affected by winter storms. Severity varies per year. Developed areas are most susceptible to winter storm hazards.

Previous Occurrences of the Hazard within Union County:

- Dec., 1861: Entire State: Storm produced between 1 and 3 feet of snow throughout Oregon.
- Dec., 1892: Northern Counties: Between 15 and 30 inches of snow fell throughout the northern counties.
- Jan., 1916: Entire state: Two storms. Heavy snowfall, especially in mountainous areas. At the Northern Oregon border there was a total of 81.5 inches.
- Jan. – Feb., 1937: Entire state: Deep snow drifts blocked most roads in northern Oregon
- Jan., 1950: Entire state: Record snow falls; property was damaged throughout the state. Low temperatures injured orchards, ornamental trees, power and telephone lines. A severe blizzard occurred on January 13. Sleet and ice caused traffic accidents on January 18 and 19.
- March, 1960: Entire state: Many automobile accidents; school closures and two fatalities. Snow produced 3-12 inches in lower elevations and 30 inches in the mountains.
- Jan. 1963: Most of Northern Oregon: Snowfall with icing conditions resulted in hazardous highways. Power lines were down; many injuries and statewide school closures were reported.
- Jan., 1969: Entire state: Heavy snow throughout state; monthly snowfalls ranged from 2-3 feet. $3-4 million in property damage; heavy livestock damage and many communities were isolated. Property damage in Grant, Union, Baker, and Wallowa Counties totaled $5,555.56.
- Jan., 1980: Entire state: Series of storms across state: High snowfall and extreme winds caused injuries, power outages and travel problems. Six people died.
- Feb., 1985: Entire state: Two feet of snow in northeast mountains produced downed power lines and two fatalities.
- Feb., 1986: Cascades and NE Oregon: Heavy snow. 6 to 12 inches of snow in basins and valleys. School closures. Traffic accidents; Broken power lines.
- Mar., 1988: Pacific NW: Strong winds and heavy snow all throughout the northwest.
- Dec., 1988 – Jan., 1989: Northeast Oregon: Three blizzards in a 4-week period. 15 ft. drifts. Wind over 60 mph. $13,888.89 in property damage was recorded for Union, Baker, Grant and Wallowa counties.
- Feb., 1990: Entire state: Heavy snow throughout state.

- Jan., 1991: Eastern Oregon: Eastern Oregon communities received between 1 and 6 inches of snow.
- Jan., 1994: Cascade and Northeast mountains. Heavy snow throughout region. NE mountains received 7 inches.
- Jan., 1998: Northern Oregon: Heavy snow throughout region. Arctic air brought snow and freezing rain into eastern Oregon. Many locations had over 12 inches of snow.
- Winter 1998-99: Entire state: One of the snowiest winters in Oregon history (snowfall at Crater Lake: 586 inches)
- Dec. – Jan. 2004: Entire state: Severe winter storms. Public assistance to state and local governments for the repair or replacement or disaster-damaged public facilities available to Baker, Grant, Union, and Wallowa Counties among others. All counties in the State of Oregon were eligible to apply for assistance under the Hazard Mitigation Grant Program.

Community's Probability of a Future Hazard Event: High *(One incident likely within a 10 to 35 year period.)*

- The recurrence interval for severe winter storms throughout Oregon is about every 13 years; however, there can be many localized storms between these periods.

Community's Vulnerability to a Future Hazard Event: High *(More than 10% affected.)*

- Winter storms can cause freeway closure both east and west, stranding motorists and disrupting supply chains. Air ambulance transports are not possible during severe winter weather.
- Union County has seven incorporated cities within its boundaries: Cove, Elgin, Imbler, Island City, La Grande, North Powder, Summerville, and Union. Depending on road closures and distances from La Grande, these cities are at risk of isolation (from transport, medical care, emergency services, etc.) during a disaster event.
- All buildings and homes within Union County, and particularly those on the valley floor, are subject to severe weather, including ice and snow storms, lightning storms, hail, heavy rain, and fast winds.
- Union County has minimal population growth (1.7% between 2000 and 2005), and an increasing number of persons aged 65 and above (16% in 2005 and an expected 20% in 2025). Elderly individuals require special consideration due to their sensitivities to heat and cold, their reliance upon transportation for medications, and their comparative difficulty in making home modifications that reduce risk to hazards.
- Union County has identified one mitigation action that specifically pertains to both wind storms and winter storms (multi-hazard action #1). Multi-hazard action # 7 may also help to mitigation winter storm hazards. Please see Section 6, "Mission, Goals, Action Items" for a listing and description of all actions.

Sources: local stakeholders; steering committee members; Northeast Oregon Profile and Risk Assessment (Taylor, George and Ray Hatton, 1999, The Oregon Weather Book, p.118-122); Oregon Emergency Management, Oct. 2005, County Hazard Analysis Scores.

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[i] Burby, R. 1998. Cooperating with Nature. Washington, DC: Joseph Henry Press. Pg. 126.

[ii] Burby, R. 1998. Cooperating with Nature. Washington DC: Joseph Henry Press. Pg. 133.