2011

Lane County Hazard Analysis

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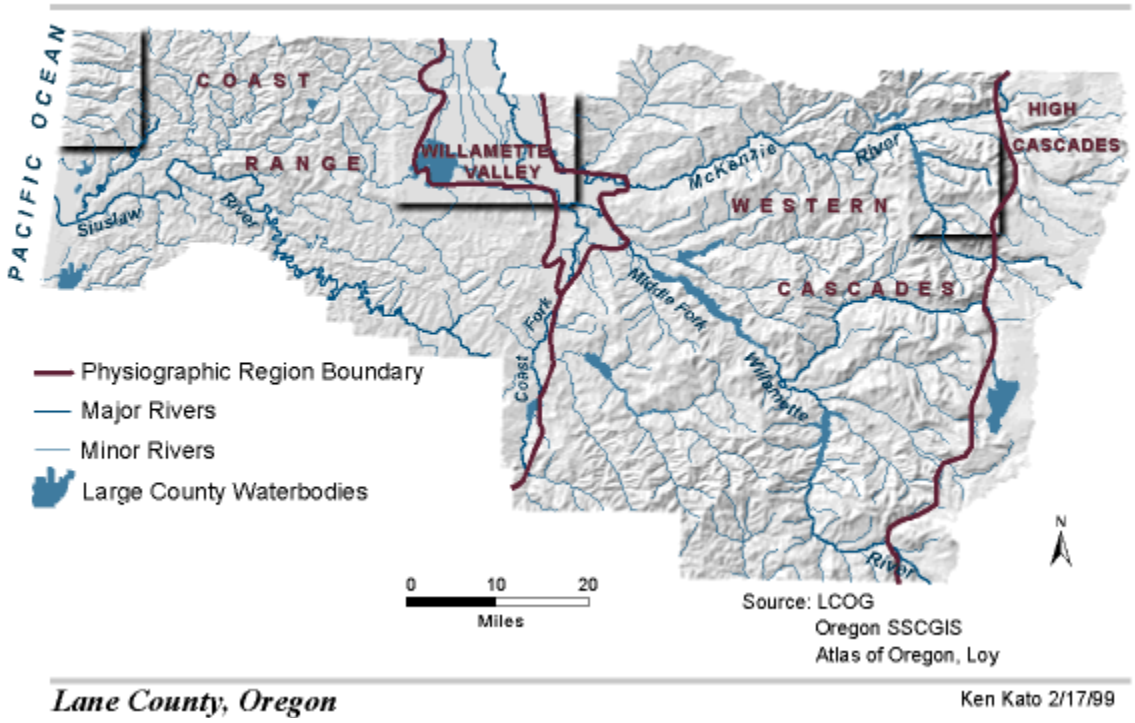
Table of Contents

Geography and Climate Overview

This section provides information for understanding the potential and chronic hazards affecting Lane County in order to identify which hazard risks are most significant and which locations are most adversely affected.



Lane County is one of only two counties in Oregon that reaches from the Pacific Coast to the crest of the Cascades. Lane County is located in western Oregon and covers about 4,554 square miles. The geography, topography, climate, and other natural attributes such as vegetation vary markedly throughout the county.

The large size and geographic diversity of Lane County are important factors to consider in mitigation planning for natural and manmade hazards. For planning purposes, we consider five main physiographic regions within Lane County, based on nomenclature commonly used by the National Weather Service.

Coast Region

The Coast Region is in the western portion of Lane County and is characterized by rocky beaches, sand dunes and other coastal features. Stretching along Oregon's Pacific border, the coast region is known for wet winters, relatively dry summers and mild temperatures throughout the year.

This region is the only portion of Lane County subject to coastal hazards such as storm surge flooding and tsunamis. Occasional strong winds strike the area, usually in advance of winter storms. Wind speeds can exceed hurricane force, and in rare cases have caused significant damage to structures or vegetation. Damage is most likely to occur at exposed coastal locations, but it may extend into inland valleys as well. Such events are typically short-lived, lasting less than one day.

Normal annual precipitation is between 65 to 90 inches. The highest monthly precipitation values for the coast occur in the winter months of November, December, and January. Freezing temperatures at the coast are rare. The months of July, August, and September tend to be the warmest, but average summer temperatures are only about 15 degrees above the coldest month, January.

Coast Range

Stretching the full length of the state, the Coast Range is a heavily forested area with peaks ranging from 2,000 to 5,500 feet above sea level. The area experiences heavy rainfall as a result of moist air masses moving off the Pacific Ocean onto land, especially during the winter months. Spots high on the west slopes of the range may get over 100 inches of rain annually. Snowfall in the Coast Range is minimal, usually only one to three inches annually.

Willamette Valley

Tall mountain ranges and the Willamette River create the V-shaped Willamette Valley that stretches approximately 125 miles long and 60 miles wide. The valley reaches the Oregon – Washington border to the north and the City of Cottage Grove to the south. Lane County is located in the southern portion of the Willamette Valley, characterized by mild temperatures through the year with cool, wet winters and warm, dry summers. The average annual precipitation is less than 40 inches.

Extreme temperatures in the valley are rare. Days with a maximum temperature above 90 degrees Fahrenheit occur only 5-15 times per year on average and, days with below zero temperatures occur only about once every 25 years. Mean high temperatures range from the low 80's in the summer to the low 40’s in the winter, while average lows are generally in the low 50's in summer and low 30's in winter.

Although snow falls every few years in the South Willamette Valley, amounts are generally quite low. Valley floor locations throughout Oregon average 5-10 inches per year, mostly during December through February, recognizing that much higher totals are observed at higher elevations in the foothills every year.

Ice storms occasionally occur and high winds typically occur several times per year in association with major weather systems.

Cascade Foothills

The lower elevation area of the western slopes of the Cascade Range is considered the Cascade Foothills. This region is heavily forested and moderately populated in places.

Cascade Range

The dominant terrain feature in Oregon is the Cascade Range, stretching the entire length of the state from the California border to Washington. In eastern Lane County, the Cascade Range is characterized by heavily forested slopes with elevations ranging from an average of 4,000 feet to over 10,000 feet (western slopes of Three Sisters Peaks). This area experiences moderately heavy rainfalls as well as extreme winter conditions with heavy snowfalls. The area has a relatively low population.

Monthly mean snowfall totals vary significantly according to elevation. Since precipitation tends to increase with increasing elevation, more potential moisture for snowfall occurs at higher elevations.

Most of the precipitation in the Cascade Range occurs during the winter months with November through March accounting for more than 75 percent of the total annual precipitation. Spring rain, summer thunderstorms and fall snow all snow contribute to the annual precipitation total, but pale in comparison to winter precipitation totals.

Hazards Profile

This section provides information for understanding the potential and chronic hazards affecting Lane County in order to identify which hazard risks are most significant and which locations are most adversely affected.

Snow / Ice Storm

Geographic Extent

Snow and ice storms occur most commonly in the Cascade Range and Cascade Foothills in the eastern portion of the County and less frequently in the valley floor.

In eastern Lane County, the average annual snowfall for Oakridge is 12.6” and for McKenzie Bridge the average snowfall is 28.7”.

Annual snowfalls impact road conditions. Highway 58 provides a low elevation pass through the Cascades running through the towns of Pleasant Hill, Lowell, Westfir and Oakridge as it passes through to the east Lane County border. Highway 58 closes three to four times per year for several hours at a time.

The same is true for Highway 126 East which runs along the McKenzie River through the towns of Walterville, Deerhorn and Blue River.

Potential Health Hazards

Cold weather including low temperatures or ice and snow, has important effects on health. It causes deaths that would not have otherwise occurred at other times of the year. This is primarily because energy used by the immune system is diverted to keeping the body warm resulting in a compromised defense against disease.

Flu Encouraging target populations to get flu shots before the onset of winter can help prevent deaths during the coldest time of the year. Target populations include the elderly, pregnant mothers, those with certain medical conditions, those who live in a residential or nursing home, the main care givers for older or disabled persons and health or social care workers.

Carbon Monoxide Poisoning Encouraging the public to have all gas, solid fuel and oil burning appliances (i.e. boilers, heaters and cookers) serviced by an appropriately technician can help prevent cold weather related carbon monoxide poisoning.

Malfunctioning appliances can release carbon monoxide - a gas which at high levels will kill and at lower levels can cause health problems. Additional preventive measures include making sure flues and chimneys are swept and checked for blockages and that there is adequate ventilation in rooms to allow appliances to work properly. Carbon monoxide alarms can offer an alert that there is a problem but should not replace regular maintenance of appliances.

Winter Vomiting (Norovirus) Also called the winter vomiting bug – norovirus strikes during cold weather. Encouraging the public to use good hand hygiene, especially after using the toilet, can help prevent the infection from spreading to friends and relatives. Advising the public to clean contaminated surfaces thoroughly and more frequently while they or someone in the home is ill can also slow the spread of disease.

Slips and Falls The public should also be encouraged to wear well gripping shoes to prevent falls in cold weather and wear several layers of clothes to stay warm.

Significant Occurrences Since 2006[1]

In the past five years there have been no major disaster declarations related to snow storms. However, there have been significant localized occurrences that may be of interest to the community from a historical perspective.

2011

- **February 14:** Heavy snow reported at 31 inches at the McKenzie SNOTEL[2] (Oregon NRCS, 2007-2008) site located in Lane County in the Willamette National Forest.

- **February 27:** A late February heavy snowfall episode extended into March. A resident of Oakridge measured 13 inches of new snow.

2010

- **November 21:** A strong low pressure system dropped south out of British Columbia bringing cold air and heavy snow to the Cascades in Lane County.

- **November 18:** The McKenzie SNOTEL site measured 13 inches of new snow between during an eight hour period on November 18th.

2009

- **February 29:** Snowfall estimates were reported to be 16 to 24 inches at the McKenzie SNOTEL site.

- **March 14:** Seventeen inches of new snow was reported at Willamette Pass along Highway 58.

- **April 2:** Between 15 and 24 inches of storm total snowfall were reported at the McKenzie SNOTEL site.

2007

- **December 25:** A potent Pacific storm brought a substantial snowfall to the Cascades, Cascade Foothills and Coast Range.

[1] Unless otherwise stated, events listed under Significant Occurrences Since 2006 are from the National Climatic Data Center Storm Event database as retrieved from http://www4.ncdc.noaa.gov/cgi-win/wwcgi.dll?wwEvent~Storms

[2] The McKenzie SNOTEL (for SNOw TELmetry) site is part of the Natural Resources Conservation Service (NRCS) data collection program; the site is located in Lane County in the Willamette National Forest. Site elevation is 4770 ft; Latitude 44.21 Longitude -121.87

2006

- **March 8:** A strong Pacific storm and associated cold front brought relatively late winter conditions to northwest Oregon. Snow totals from this event ranged from a tenth of an inch to a few inches at the coast and throughout the Willamette Valley.

Flood

Geographic Extent

Lane County features several large rivers and smaller tributaries and streams that are susceptible to annual flooding events. The flooding of these waterways threatens life and safety and can cause significant property damage. Large rivers include the Willamette (Main Stem, Middle and Coast Forks) the McKenzie (including the South Fork), the Siuslaw (including the North Fork) the Row River and Lake Creek. Smaller streams and tributaries susceptible to frequent flooding include the Mohawk, Long Tom, Fall Creek, Little Fall Creek, Camp Creek, Horse Creek, Coyote Creek, Mosby Creek, Poodle Creek, Siltcoos River and Tenmile River.

Lane County has nearly 140,000 Acres of land in the floodplain. This is equivalent to well over 200 square miles. Over 11,000 individual parcels are partially or entirely located within the floodplain. Statewide, Lane County has more river miles of floodplain than any other county. Ongoing development along these rivers continues to displace natural areas that have historically functioned to store flood waters.

The Army Corps of Engineers operates 13 multi-purpose water projects (also known as dams) in the Willamette Valley, with nine of those projects situated in Lane County. These dams were constructed between 1941 and 1968. A primary purpose of these dams is flood control, although they only control flooding on 50% of the tributaries in the Willamette Basin. Reservoirs behind the dams are drained throughout the summer and fall months to create storage capacity for water from heavy winter and spring rains. Therefore, most flooding in Lane County occurs along tributaries and rivers with no flood control devices, such as the Siuslaw and Mohawk rivers.

Flooding occurs when climate, geology, and hydrology combine to create conditions where river and stream waters flow outside of their usual course and “overspill” beyond their banks. In Lane County, the combination of these factors, augmented by ongoing development, create chronic seasonal flooding conditions. Lane County spans a wide range of climatic and geologic regions

from the Pacific coast to the high Cascades. This diversity results in considerable variation in precipitation. The average annual precipitation ranges from less than 40 inches in the Willamette Valley to over 100 inches in the Coast Range and along the west slope of the Cascades. Snowmelt from the Central Cascades provides a continuous water source throughout the year, and can contribute significantly to flooding.

Flooding is most common from October through April, when storms from the Pacific Ocean bring intense rainfall to the area. Larger floods result from heavy rains that continue over the course of several days, augmented by snowmelt at a time when the soil is near saturation from previous rains.

Repetitive Loss Properties

Repetitive loss properties are those for which two or more losses of at least $1,000 each have been paid under the National Flood Insurance Program (NFIP) within any 10-year period since 1978.

There are twenty one Repetitive Loss Properties identified in Lane County. The property locations are broken down as follows:

Mapleton	11 residences, 1 business
Springfield	5 residences
Cottage Grove	1 residence
Elmira	1 residence
Vida	1 residence
Walton	1 residence

Potential Health Hazards

Flooding presents a number of risks to health, drowning being the most obvious. Serious injury can be caused by falling into fast flowing water or from hidden dangers under the water, such as missing manhole covers. The stress and strain of being flooded and cleaning up can have a notable impact on mental health and wellbeing.

There is also a serious danger posed by carbon monoxide fumes from the indoor use of generators to dry out buildings. Infections arising as a result of floodwaters in this country are rare as harmful microbes in floodwater usually become very diluted.

Significant Occurrences Since 2006

In the past five years there have been no major disaster declarations related to flood in Lane County. However, there have been significant localized occurrences that may be of interest to the community from a historical perspective.

2007

- **December 3:** The Siuslaw River flooded near Mapleton, causing minor lowland flooding. An abnormally long period of consistently heavy rainfall led to widespread flooding, with the worst hit areas in the Coast Range and areas draining from the Coast Range to the Pacific Ocean.

2006

- **January 14:** A series of wet Pacific storms brought heavy rains to the area, causing flooding and damage. The Mohawk River near Springfield flooded and Oregon Governor Ted Kulongoski declared a state of emergency in 24 of Oregon's 36 counties.

- **January 17:** A strong, moisture-laden storm brought heavy rains and flooding to Oregon. The Siuslaw River at Mapleton flooded during the event. Flooding affected widespread low-lying areas and agricultural lands. Flooding was also the cause of multiple road closures around the area.

- **November 7:** The Siuslaw River near Mapleton crested at 18.8 feet with flood stage at 18.0 feet.

- **December 14:** The Siuslaw River near Mapleton crested at 18.3 feet; flood stage for this river is 18.0 feet.

Magnitude or Severity of Past Events

While some type of seasonal flood-related damage occurs nearly every year, the flooding and associated landslide events of February and November 1996 represent the most significant flooding in the recent past.

In February 1996, prolonged precipitation accompanied by an early snowmelt, caused by a warm-weather trend known as a “Pineapple Express,” caused many rivers and creeks throughout Lane County to rise to 100-year flood levels.

Flooding was particularly severe along the Siuslaw and Mohawk Rivers. (Lane County Land Management Division, 2011)

The Eugene/Springfield metropolitan wastewater system was forced to flush millions of gallons of raw sewage into the Willamette River when rainwater overwhelmed pipes and pumps leading to the treatment plant. If the effluent had not been released sewage would have backed up into buildings and low areas. About 40 residents and businesses reported sewage backups during the storm. (Pittman, 1996)

Damage to Lane County businesses, residences and infrastructure was estimated to be roughly $19 million dollars for this February storm. The approved federal share amounts for this storm's disaster declaration DR-1099-OR were as follows: Federal share approved amount for public assistance for Lane County was $564,608; Individual Assistance for disaster housing was for $720,706; Individual & Family Grant amount was $220,564. Small Business Administration loans reached $1.75M for home loans, $926,500 for business physical loans and $119,700 for economic injury loans.

Later in the year, on November 17 and 18, a moist southwest flow aloft produced moderate to heavy rain and strong winds over southwest Oregon. Storm total rainfall ranged from 8 to 12 inches on the coast with 3 to 7 inches inland. The rainfall amount and rate produced numerous landslides impacting residences and closing highways. Strong winds of 40 – 70 mph were reported on the coast and many trees and power lines were downed across southwest Oregon.

President Clinton declared the state a major disaster area (FEMA, 1997, January 23) after this storm citing damage from severe storms, high winds, flooding and land and mud slides.

Although the floods of 1996 represented a large-scale disaster, they are not unprecedented. The Christmas Flood of 1964 caused $157 million in damage statewide, and 20 Oregonians lost their lives.

In addition to the 1996 and 1964 floods, Lane County has experienced several other significant floods since records have been kept.

- In 1972, flooding along the Siuslaw River in the western portion of Lane County caused extensive damage within the community of Mapleton.
- The floods of 1945, 1942 and 1927 caused severe damage in the valley floor to the City of Eugene and the surrounding areas.
- Early records indicate that the Southern Willamette Valley flooded often in the mid to and late 1800's, with major flooding occurring in 1850-51, 1861, 1881 and 1890.

Probability of Future Events

Based on historical occurrence, Lane County expects a significant flood event every 15 – 20 years however much of the risk is mitigated through dams.

Windstorm

In the past five years there have been no major disaster declarations related to windstorms in Lane County. However, there have been significant localized occurrences that may be of interest to the community from a historical perspective.

Geographic Extent

For Lane County, the highest potential for severe windstorms is highest at the coast and then fairly uniform across the rest of the county. In the hilly areas, however, the level of wind hazard is strongly determined by local conditions of topography and vegetation cover.

For Lane County, the two-year recurrence interval of sustained wind speeds range from about 37 to 47 miles per hour. These two-year wind speeds are generally too low to cause widespread substantial wind damage. However, significant local wind damage can occur at sites where local wind speeds are higher or, where there are especially exposed locations, such as at the boundary between clear cut and forested lands.

For Lane County, the 50-year recurrence interval of wind speeds range from about 62 to 75 miles per hour. These wind speeds are high enough to cause widespread wind damage. Damage may be severe at particularly exposed sites. Thus, for most regions of Lane County winter storms with significant direct wind damage are not likely every year or every few years, but perhaps once every decade or so, on average, with major wind storm events happening at intervals averaging a few decades.

Potential Health Hazards

The most common effects on Lane County residents from windstorms are downed trees, power outages, road traffic accidents (overturning vehicles, collisions with fallen trees) and individual accidents (being trapped in a car or house by a fallen tree). Building failure represents a less significant, but still important, impact on human life (loss of roof, falling chimneys etc).

Being outside during the windstorm's peak activity emerges as the primary risk factor for injury and death. It has therefore been recognized that windstorms

peaking in the early hours of the morning have a smaller impact than those peaking during working hours.

As well as the traumatic injuries associated with road traffic accidents, individual accidents and building failure, windstorms can increase the risk of a number of other health effects:

Increased incidence of asthma attacks can occur as a result of elevated allergen concentrations in the air. Also of concern is an increased incidence of carbon monoxide poisoning caused by use of portable generators in confined or poorly ventilated areas during power outages.

Psychological impacts in the community may also persist well into the post-windstorm phase for those who experience severe windstorm damage.

Significant Occurrences Since 2006

2011

- March 13: A severe windstorm whipped through Lane County leaving travelers trapped on a West Boundary Road as they tried to bypass a highway 58 closure. West Boundary Road was impassable at both ends due to downed trees and power lines. Damages to public infrastructure Lane County totaled approximately $1.5 million.

2010

- December 29: In Creswell, a thunderstorm produced a funnel cloud, dime size hail and strong winds. A few trees and branches were blown down.

2007

- June 6: During an afternoon under a particularly cool and unstable airmass, a funnel cloud was sighted near the Eugene airport by the personnel at the Eugene Air Traffic Control Tower.

- December 3: High wind gusts measuring 76 knots were recorded at the Sugarloaf RAWS, about 8 miles west-southwest of Oakridge. The high wind speeds associated with this storm caused widespread damage to the area.

- Decemeber 19: A potent Pacific storm and associated cold front brought strong 52 knot winds to the coast and heavy snow to the Cascades.

2006

- February 3: A strong winter storm brought high winds to portions of western Oregon. Many residents experienced power outages due to trees blown down by strong winds. An estimated 3500 residents of Lane County were without power for portions of the night. $300,000 in damage was reported.

- March 7: A strong Pacific system brought a powerful cold front to northwest Oregon. Strong winds developed ahead of this cold front, and persisted through the event. Florence reported 37 knots. $375,000 in damage was reported.

Magnitude or Severity of Past Events

2011

- A wind storm whipped through Lane County on March 13, 2011 resulting in over $1.5 million in damages to public infrastructure with utilities and school districts being hardest hit.

  Although multiple Oregon counties are typically impacted by the same severe storm, this storm appeared to cause only pockets of damage statewide and nothing severe or widespread enough to trigger the disaster declaration process at the state or federal level. In order for Lane County to have been eligible for federal assistance separate from other counties damages would have had to meet the state's current threshold of approximately $4.6 million in damages.

2002

- The February 7, 2002 wind storm was the strongest to strike western Oregon in several years. Starting at approximately 4:00 PM and increasing in intensity over the next three to four hours, severe winds gusted ranging from 40 to 70 miles per hour in the valley floor resulting in extensive property, vegetation and electric utility damage. Other associated impacts included interruption of critical services, damage to homes and businesses, damaged vehicles, closure of roads and considerable loss of business revenues.

  On March 12, 2002, President Bush declared a major disaster for the State of Oregon. Lane County's damage estimate for public infrastructure as over $3.5 million.

Probability of Future Events

Based on historical occurrence, Lane County expects a significant windstorm about once every 10 years.

Wildfire

Geographic Extent

The Lane County wildland-urban interface is large, approximately 2,269,000 acres or 3,543 square miles. The size of Lane County's wildland-urban interface is the result of a dispersed population in close proximity to abundant vegetative fuels. Nearly 90% of Lane County is forestland and nearly 2.5 million of the county's 2.9 million acres are zoned non-impacted forestland. The U.S. Forest Service and the Bureau of Land Management own and manage the majority of the zoned property. These forestlands contain extensive fuels comprised of flammable grasses, brush, slash and Timber. Excluding the population of Eugene/Springfield metro area, nearly 100,000 Lane County residents live throughout or adjacent to these forestlands. (Lane County CWPP, 2005)

Potential Health Hazards

The smoke created by wildfire is an air pollutant and can lower the quality of the air we breathe. Smoke is a complex mixture of different gases and particles. Burning wood, fuel, plastics, and other synthetic materials produce smoke with a variety of chemicals. Regardless of what specific chemicals make up the smoke, it can cause health effects.

Exposure to smoke typically causes eye, nose and throat irritation. In healthy individuals, these symptoms are usually short-term and are unlikely to lead to ongoing health problems. Fires can also contribute to odors, which may linger and enter nearby buildings. These odors are typically a nuisance only.

More serious health effects potentially caused by fire include shortness of breath or chest pains. People that are most vulnerable to health effects from fire are those with asthma, heart disease or other medical conditions that could be exacerbated by exposure to smoke.

Advising the public to reduce exposure by staying indoors, and, if possible, keeping windows closed, can help minimize health effects. The fresh-air intake

on air conditioners should be closed to prevent outdoor air from entering homes and buildings.

Significant Events Since 2006

Although there have been thirteen Fire Management Assistance Declarations in the state of Oregon since 2003 (FEMA, 2011) none of these fires occurred in Lane County. Nonetheless, significant fires either in or near the eastern portion of Lane County occur consistent with the state average of about once every four years. However, in Lane County the cause of fire includes both natural causes such as lightning as well as manmade causes such as arson.

2009

- The **Tumblebug Complex** fire located 23 miles southeast of Oakridge in the Willamette National Forest, started as a series of 25 small fires sparked by lightning. Firefighters knocked down all but three of the fires. The remaining three fires grew rapidly, exploding to 500, then 2,000 and then 12,000 acres as 35 mph winds in drought like conditions spread the fire through unseasonably dry forests.

2008

- Aug 7: Multiple lightning storms started over sixty fires in an approximately 500,000 acre area in the south zone of the Willamette National Forest near Oakridge. Fifty-two of the fires were confirmed, and over 200 acres in total were burned.

Magnitude or Severity of Past Events

2002

- The **Office Bridge** Fire was held to 140 acres, as cooler September weather arrived to bolster efforts of 357 firefighters and aerial crews working on steep, rocky terrain north of the Middle Fork of the Willamette River.

  Residents of nearby communities - Hemlock, southwest of the fire, and Westfir, across the river and to the east of the fire – were placed on a three-hour evacuation notice although no structures were threatened. Access to the community of Hemlock was restricted to residents only.

- August 17: The Siuslaw River Fire located 18 miles west of Veneta burned 840 acres. Cause of fire is unknown. Cost of suppression was $1.5 million.

1998

- Aug 13: An accidentally human-caused fire consumed 260 acres of timber on steep ridges along the North Fork of the Willamette River east of Road 19 near Huckleberry Flats in the High Prairie area. There was $100k in crop damage attributed to what was known as the Gorge fire.

1996

- A fire occurred in Oakridge two days after someone torched a pickup and spray-painted "Earth Liberation Front" and anti-logging messages on the walls of the Willamette National Forest's Detroit Ranger Station, east of Salem. (The Associated Press, 2000) The fire caused an estimated $9 million in damage to the ranger station.

- August 13: Lightning triggered 37 forest fires in the Willamette National Forest near Oakridge, Oregon. These fires, known as the **South Zone Complex**, burned 3700 acres and smoldered for 4 weeks before being declared out on September 9.

- August 24: Lightning caused a series of forest fires, known as the **Moolack Complex**, in the Willamette National Forest east of Oakridge. 11,375 acres were burned with $1.7 million in damage to campgrounds and timber interests. The fire smoldered for almost 2 months before it was declared out on October 16.

1991

- The **Warner Creek** Fire was set by an unknown arsonist on October 10, 1991. By the time it was controlled on October 27, it had burned 8,973 acres in the Oakridge Ranger District, at a cost of $10 million. The burned area lies north of State Highway 58, about 12 miles east of the City of Oakridge. The entire fire area lay within what was soon (January 1992) to be designated a Habitat Conservation Area (specifically, HCA 0-10), a designated management area primarily for Northern Spotted Owl habitat. It was the first large fire in a Spotted Owl HCA. (US Forest Service, Pacific Northwest Region, 1991)

1988

- A wind-whipped forest fire burned out of control in private and federal land southeast of Oakridge. The fire broke out in the Willamette National Forest and grew quickly in 20-40 mph winds. Authorities estimated at least 2,000 acres were blackened. Lane County sheriff's deputies warned residents in the Salt Creek (Polk County) drainage about six miles southeast of Oakridge to be ready to evacuate.

Other

- The Nelson Mountain Fire was one of many large fires in 1910 that burned most areas that are now state forest lands in western Lane County. Large fires burned again in western Lane County in 1917 and 1922. Then in 1929, a number of large fires burned most of the central Coast Range in Lane County, covering nearly 80,000 acres. The fires re-burned some previously burned areas, and burned green forest as well. With the timber gone, the Great Depression starting, and the land unsuitable for homesteading, many landowners allowed their land to revert to the county in place of back taxes. Lane County deeded its timberlands to the Board of Forestry in the mid-1940s. (Oregon Department of Forestry, 2010)

Probability of Future Events

The statewide average for Oregon counties experiencing a major wildfire is roughly once every four years. However, a major wildfire occurs somewhere in the state at least once per year.

Earthquake / Tsunami

A tsunami is a series of sea waves, usually caused by a displacement of the ocean floor by an undersea earthquake. As tsunamis enter shallow water near land, they increase in height and can cause great loss of life and property damage.

Geographic Extent

Recent research suggests that tsunamis have struck the Oregon coast on a regular basis. They can occur any time of day or night. Typical wave heights from tsunamis occurring in the Pacific Ocean over the last 500 years have been 20 – 65 feet at the shoreline. However, because of local conditions a few waves may have been much higher – as much as 100 feet.

We distinguish between a tsunami caused by an undersea earthquake near the Oregon coast (a local tsunami) and an undersea earthquake far away from the coast (a distant tsunami).

A local tsunami can come onshore within 15 to 20 minutes after the earthquake whereas a distant tsunami can take several hours. The worst case scenario for a distant tsunami for Lane County is one generated from Alaska.

Potential Health Hazards

The majority of deaths associated with tsunamis are related to drowning, but traumatic injuries are also a primary concern in both earthquakes and tsunamis. Injuries such as broken limbs and head injuries are caused by the physical impact of people being washed into debris such as houses, trees, and other stationary items. As the water recedes, the strong suction of debris being pulled into large populated areas can further cause injuries and undermine buildings and services.

Significant Events Since 2006

A devastating M9 earthquake struck off the coast of Japan at about 3:00 PM on Friday, March 11, 2011 – the time zone conversion made it 10:00 PM on Thursday, March 10, local time. As such, Thursday evening at 11:30 PM a tsunami watch was issued for the coastal areas of Oregon by the National Weather Service in Portland.

Friday morning at 12:44 AM the tsunami watch was updated to a warning:

> "This message updates the alert status to warning and advisory.
> ..A tsunami warning is now in effect which includes the coastal areas of California and Oregon from Point Conception California to the Oregon-Washington Border..."

The update from a tsunami watch to warning triggered the decision making process for when to invoke evacuation procedures. The areas to be evacuated were the coastal areas of Lane County inside the inundation zone as defined by the Oregon Department of Geology and Mineral Industries (DOGAMI). Tsunami wave arrival times for the central Oregon coast were predicted for 7:00 AM.

Fire Chief John Buchanan and Police Chief Maury Sanders monitored the impact of this distant tsunami on Hawaii along with NOAA information and made the official decision to evacuate the inundations zones at around 2:30 AM.

To ensure a smooth and safe evacuation effort and to discourage travel to the coast, resources were quickly mobilized from various agencies.

A full activation was invoked for the West Lane Emergency Operations Center (EOC) located at Siuslaw Valley Fire & Rescue in Florence. The Lane County Sheriff's Office located in downtown Eugene also initiated a Level Two (limited) EOC activation to provide support to the city. Communications between the two EOC's were frequent and effective resulting in excellent information flow going both ways. At all times the City of Florence and Siuslaw Valley Fire & Rescue were considered a Unified Command and the lead agencies for this incident.

A smooth and successful evacuation was accomplished as a direct result of years of tsunami preparedness planning, training and exercises sponsored by the West Lane Emergency Operations Group. Years of public education and outreach also proved effective as the majority of citizens were poised to follow instructions and evacuate according to plan. There was a segment of the population that was unaware of their location in proximity to the inundation zone and therefore created a spike in calls to the City of Florence.

There were three times at Heceta Beach when it was observed that the water was receding anywhere from 50 to 150 feet and then followed by a returning surge of water that would reach the original water level. The behavior of the water was as expected for on oncoming tsunami wave but stopped short of flooding the area. Surge times were 7:30 AM, 8:00 AM and 9:30 AM.

Previous Occurrences

Tsunamis from locations across the Pacific Ocean basin and from the Cascadia Subduction Zone off the Washington coast have hit coastal communities in the 900 – 930 era, 1700, the 1890's, 1944-1953 era, 1949, 1960, 1964 and 1980.

Probability of Future Events

Great earthquakes in the Pacific Ocean basin generating tsunamis that impact Oregon's outer coast and the Strait of Juan de Fuca occur at a rate of about every six hundred years. A rate of occurrence for local earthquakes and landslides that generate tsunamis has not been determined

Landslide

In many parts Lane County, weathering and the decomposition of geologic materials produces conditions conducive to landslides. Although landslides are a natural geologic process, the incidence of landslides and their impacts on people can be exacerbated by human activities. Grading for road construction and development can increase slope steepness, decrease the stability of a hill slope

(by adding weight to the top of the slope and removing support at the base of the slope), and increasing water content. For these reasons, landslides periodically affect county roadways, and response (debris removal), as well as slope stabilization are part of Lane County Public Work's routine work. Development coupled with natural processes such as heavy rainfall or rapid snowmelt can cause landslides or re-activate historical landslide sites.

Although much can be said generally about landslides in Lane County, a risk and vulnerability assessment needs to be formally conducted, documented and published to better understand the true nature of the hazard specific to Lane County.

Terrorism

Past incidents coupled with the presence of active radical organizations put Lane County at some perceived level of risk for terrorism. However, specific information is too sparse to actually "measure" the terrorism risk for Lane County in quantifiable terms. This section will discuss the presence of toxic materials in Lane County and the history of domestic acts of violence and civil unrest, noting that any actual acts of terrorism affecting a large segment of the local population are uncommon.

Since the 1960's, when an ROTC building on the University of Oregon (U of O) campus was bombed and burned, this area has been known for civil unrest and demonstration. In 2000 the U of O was declared the most politically active student body by Mother Jones, a "liberal leaning magazine dedicated to progressive causes". Also in 2000 Eugene and Lane County were featured on the 60 minutes television program as the center for the anarchist movement and a haven for fugitives. Anarchists have held organized training camps in unincorporated Lane County to prepare for anarchist movements. These groups have established the path of escalation from protests to arsons to explosives.

Also to note, radioactive substances and chemicals classified as extremely toxic are housed in the U of O Science Departments along with facilities and equipment that could be used for releasing the materials. Additionally, large quantities of toxic substances (i.e., ammonia, chlorine, sulfur dioxide, epichlorhydrin, etc.) routinely arrive in the region by either rail or highway. Large volumes of flammables are stored at numerous manufacturing facilities and fuel depots; fuel depots have been identified as potential targets for terrorist attacks.

In addition to threats of WMD, there is also an existing threat that a person infected with a communicable agent could attend a large gathering at any one of the many facilities designed for large crowds in Lane County.

Potential Targets

There are a number of potential targets in Lane County, including but not limited to:

- The I-5 corridor runs through Lane County, between the cities of Eugene and Springfield, and is the primary north-south thorough fare of the west coast. Many areas situated along this corridor are thriving and diverse locations of commerce and home to a variety of manufacturing, warehouse and distribution companies. Any interference with this road system or its bridges could impact commerce.
- The Eugene Airport is the fifth largest airport in the Pacific Northwest, providing commercial air service to a six county region in mid-Oregon. The airport also has an expanded air cargo facility to serve the growing air cargo demands of the region.
- There are several rails lines that if successfully targeted could halt or severely curtail rail commuter service along the entire west coast.
- High voltage lines of Bonneville Power Administration and Eugene Water and Electric Board along with numerous natural gas lines exist in Lane County.
- The terminus of gasoline line running from refineries in Washington, supplying fuel for much of southwestern Oregon, are stored in above ground tanks in north Eugene.
- The Army Corps of Engineers dam structure includes 11 dams within the county and 3 dams in neighboring Linn County.
- Recruiting centers for several branches of the military, reserve unit training facilities and a National Guard Armory are in Lane County.
- Numerous events for large crowds are commonly held at the Hult Center for the Performing Arts, the Lane Convention Center, Lane County Fair Grounds, Florence Events Center the Oregon Country Fair site in Veneta and the U of O's Hayward Field, Autzen Stadium and Matt Knight Arena.
- Numerous government buildings and private corporation facilities also represent potential targets.

Summary Table of Significant Weather Events in Lane County

	Snow / Ice Storm	Flood	Windstorm	Wildfire (at or near Lane County)	Landslide	Earth-quake	Distant Tsunami	Volcano	Drought
2011	CSCD/R CSCD/F		CSCD/R CST		CST		CST		
2010	CSCD/R CSCD/F WVF		CSCD/F						
2009	CSCD/R		CSCD/R	CSCD/R					
2008	CSCD/R CSCD/F WVF			CSCD/R					
2007	CSCD/R CST/R	CST WVF	CSCD/R CSCD/F CST/R WVF						
2006	CSCD/R CSCD/F CST/R	CST WVF	CST WVF						
2005	CSCD/R CSCD/F WVF CST/R	CST WVF	WVF				CST		WVF
2004	CSCD/R CSCD/F WVF CST/R (DR 1510)		WVF (DR 1510)						
2003	CSCD/R CSCD/F WVF CST/R		CST		CST				
2002	CSCD/R CSCD/F CST/R		CST WVF (DR 1405)	CST/R					
2001	CSCD/R CSCD/F WVF CST/R		CST						
2000	CSCD/R								
1999	CSCD/R CSCD/F		WVF		CST				
1998	CSCD/R CSCD/F			CSCD/R					
1997	CSCD/R CSCD/F WVF	CST WVF (DR 1160)							

	Snow / Ice Storm	Flood	Windstorm	Wildfire (at or near Lane County)	Landslide	Earth-quake	Distant Tsunami	Volcano	Drought
1996	**CSCD/R CSCD/F WVF**	**CST WVF (DR 1099)**	**CST WVF (DR 1107)**	CSCD/R					
1995	**CSCD/R**	WVF	WVF						
1994	**CSCD/R CST/R**		CST WVF						
1993	**CSCD/R WVF**		CST						
1992									
1991				CSCD/R					
1990	WVF								
1989	CST WVF		WVF						
1988				CSCD/R					
1987									
1986									
1985									
1984			WVF						
1983									
1982									
1981			WVF						
1974		**WVF (DR 413)**	WVF						
1972		**WVF (DR 319)**	WVF						
1971	WVF		WVF						
1969	WVF CST								
1968	WVF								
1964		**WVF (DR 184)**	WVF				CST		
1963			WVF						
1962			**WVF (DR 136)**						
1950	CSCD/R WVF								

Cst	Coast Region	Cscd/F	Cascade Foothills
Cst/R	Coast Range	Cscd/R	Cascade Range
WVF	Willamette Valley Floor	(DR XXX)	FEMA Disaster Declaration and Number

Hazard Analysis Scoring (Quantification)

This section discusses a scoring method that is used to assist with prioritizing hazards and understanding risk. It doesn't predict the occurrence of a particular hazard, but it does "quantify" the risk of one hazard compared with another. By doing this analysis, planning can first be focused where the risk is greatest. Among other things, this hazard analysis can:

- help establish priorities for planning, capability development, and hazard mitigation;
- serve as a tool in the identification of hazard mitigation measures;
- be one tool in conducting a hazard-based needs analysis;
- serve to educate the public and public officials about hazards and vulnerabilities;
- help communities make objective judgments about acceptable risk.

For Lane County, this analysis allows comparison of the same hazard across various local jurisdictions; for example, the score for the windstorm or earthquake in central Lane County will differ from the score in coastal Lane County. Therefore, two hazard analyses are produced for Lane County due to the diversity of Lane County's geography.

The methodology was first developed by the Federal Emergency Management Agency (FEMA) circa 1983, and gradually refined by Oregon Emergency Management (OEM) over the years.

The methodology produces scores that range from 24 (lowest possible) to 240 (highest possible). By applying one order of magnitude from lowest to highest, a hazard with a score of 240 is considered ten times more severe than a hazard with a rating of 24.

Vulnerability and probability are the two key components of the methodology. Vulnerability examines both typical and maximum credible events, and probability endeavors to reflect how physical changes in the jurisdiction and scientific research modify the historical record for each hazard. Vulnerability accounts for approximately 60% of the total score, and probability approximately 40%.

In connection with Emergency Management Performance Grant funding administered by OEM, there is a requirement that hazard analyses must be current and updated within the past ten years, and include a written synopsis (narrative) of the most credible events possible to occur within a jurisdiction. Having a current local hazard analysis is also one element in meeting Oregon Progress Board Benchmark #67, "Emergency Preparedness."

In this analysis, severity ratings are applied to the four categories of history, vulnerability, maximum threat (worst-case scenario), and probability based as follows:

LOW = choose the most appropriate number between 1 to 3 points

MEDIUM = choose the most appropriate number between 4 to 7 points
HIGH = choose the most appropriate number between 8 to 10 points

Weight factors also apply to each of the four categories as shown below.

HISTORY (weight factor for category = 2)
History is the record of previous occurrences. Events to include in assessing history of a hazard event for which the following types of activities were required:

- The EOC or alternate EOC was activated;
- Three or more EOP functions were implemented, e.g., alert & warning, evacuation, shelter, etc.
- An extraordinary multi-jurisdictional response was required; and/or
- A "Local Emergency" was declared.

LOW – score at 1 to 3 points based on… 0 - 1 event past 100 years
MEDIUM – score at 4 to 7 points based on… 2 - 3 events past100 years
HIGH – score at 8 to 10 points based on… 4 + events past100 years

VULNERABILITY (weight factor for category = 5)
Vulnerability is the percentage of population and property likely to be affected under an "average" occurrence of the hazard.

LOW – score at 1 to 3 points based on… < 1% affected
MEDIUM – score at 4 to 7 points based on… 1 - 10% affected
HIGH – score at 8 to 10 points based on… > 10% affected

MAXIMUM THREAT (weight factor for category = 10)
Maximum threat is the highest percentage of population and property that could be impacted under a worst-case scenario.

LOW – score at 1 to 3 points based on… < 5% affected
MEDIUM – score at 4 to 7 points based on… 5 - 25% affected
HIGH – score at 8 to 10 points based on… > 25% affected

PROBABILITY (weight factor for category = 7)
Probability is the likelihood of future occurrence within a specified period of time.

LOW – score at 1 to 3 points based on… one incident likely within 75 to 100 years
MEDIUM – score at 4 to 7 points based on… one incident likely within 35 to 75 years
HIGH – score at 8 to 10 points based on… one incident likely within 10 to 35 years

By multiplying the *weight factors* associated with the categories by the *severity ratings*, we can arrive at a subscore for history, vulnerability, maximum threat, and probability for each hazard. Adding the subscores will produce a total score for each hazard.

The total score isn't as important as how it compares with the total scores for other hazards in Lane County. By comparing scores, we can determine priorities: Which hazards should the jurisdiction be most concerned about? Which ones less so?

Lane County – Central

HAZARD	HISTORY WF=2	VULNERABILITY WF=5	MAXIMUM THREAT WF=10	PROBABILITY WF=7	TOTAL
Snow/Ice Storm	10 x 2 = 20	10 x 5= 50	10 x 10 =100	10 x 7 = 70	240
Flood	10 x 2 = 20	7 x 5 = 35	5 x 10 = 50	8 x 7 = 56	161
Windstorm	10 x 2 = 20	4 x 5 = 20	4 x 10 = 40	10 x 7 = 70	150
Wildfire	10 x 2 = 20	5 x 5 = 25	5 x 10 = 50	8 x 7 = 56	131
Domestic Terrorism	9 x 2 = 18	3 x 5 = 15	4 x 10 = 40	8 x 7 = 56	129
Landslide	8 x 2 = 16	2 x 5 = 10	5 x 10 = 50	4 x 7 = 28	104
HazMat Incident	10 x 2 = 20	2 x 5 = 10	1 x 10 = 10	8 x 7 = 56	96
Earthquake	8 x 2 = 16	4 x 5 = 20	4 x 10 = 40	2 x 7 = 14	90
Volcano	1 x 2 = 2	4 x 5 = 20	3 x 10 = 30	1 x 7 = 7	59

Lane County – Coastal

HAZARD	HISTORY WF=2	VULNERABILITY WF=5	MAXIMUM THREAT WF=10	PROBABILITY WF=7	TOTAL
Windstorm	0 x 2 = 20	10 x 5 = 50	10 x 10 = 100	10 x 7 = 70	240
Earthquake/Tsunami	0 x 2 = 0	7 x 5 = 35	10 x 10 = 100	4 x 7 = 28	191
Flood	10 x 2 = 20	7 x 5 = 35	5 x 10 = 50	8 x 7 = 56	161
Snow/Ice Storm	1 x 2 = 2	1 x 5 = 5	4 x 10 = 40	1 x 7 = 7	57
Domestic Terrorism	6 x 2 = 12	3 x 5 = 15	4 x 10 = 40	7 x 7 = 49	116
Landslide	8 x 2 = 16	5 x 5 = 25	6 x 10 = 60	10 x 7 = 70	171
HazMat Incident	10 x 2 = 20	2 x 5 = 10	1 x 10 = 10	8 x 7 = 56	96
Wildfire	1 x 2 = 2	2 x 5 = 10	2 x 10 = 20	2 x 7 = 14	46