Chapter 2 RISK ASSESSMENT

In This Chapter

The Oregon NHMP Risk Assessment chapter is divided into three sections: 1) introduction, 2) state risk assessment, and 3) regional risk assessment. Following is a description of each section.

1. **Introduction:** States the purpose of the risk assessment and understanding risk.
2. **State Risk Assessment:** Includes the following components:
   - Oregon Hazards: Profiles each of Oregon's hazards by identifying each hazard, its generalized location and presidentially declared disasters; introduces how the state is impacted by climate change; characterizing each hazard that impacts Oregon; listing historic events; identifying the probability of future events; and introducing how climate change is predicted to impact each hazard statewide.
   - Oregon Vulnerabilities: Includes an overview and analysis of the State's vulnerability to each hazard by identifying which communities are most vulnerable to each hazard based on local and state vulnerability assessments; providing loss estimates for State-owned/leased facilities and critical/essential facilities located in hazard areas; and identifying seismic lifeline vulnerabilities.
   - Future Enhancements: Describes ways in which Oregon is planning to improve future state risk assessments.
3. **Regional Risk Assessment:** Includes the following components for each of the eight Oregon NHMP Natural Hazard Regions:
   - Summary: Summarizes the region's statistical profile and hazard and vulnerability analysis and generally describes projected impacts of climate change on hazards in the region.
   - Profile: Provides an overview of the region's unique characteristics, including a natural environment profile, social /demographic profile, economic profile, infrastructure profile, and built environment profile.
   - Hazards and Vulnerability: Further describes the hazards in each region by characterizing how each hazard presents itself in the region; listing historic hazard events; and identifying probability of future events based on local and state analysis. Also includes an overview and analysis of the region's vulnerability to each hazard; identifies which communities are most vulnerable to each hazard based on local and state analysis; provides loss estimates for State-owned/leased facilities and critical/essential facilities located in hazard areas; and identifies the region's seismic lifeline vulnerabilities.

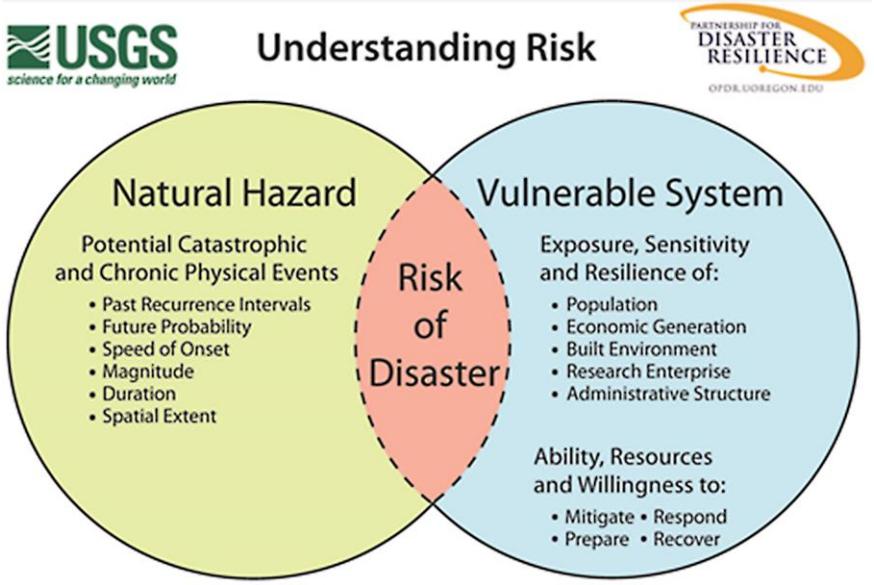
2.1 Introduction

Requirement 44 CFR §201.4(c)(2), [The plan must include] risk assessments that provide the factual basis for activities proposed in the strategy portion of the mitigation plan. Statewide risk assessments must characterize and analyze natural hazards and risks to provide a statewide overview. This overview will allow the State to compare potential losses throughout the State and to determine their priorities for implementing mitigation measures under the strategy, and to prioritize jurisdictions for receiving technical and financial support in developing more detailed local risk and vulnerability assessments.

The purpose of the Oregon NHMP Risk Assessment is to identify and characterize Oregon's natural hazards, determine which jurisdictions are most vulnerable to each hazard and estimate potential losses to vulnerable structures and infrastructure and to State facilities from those hazards.

It is impossible to predict exactly when natural hazards will occur, or the extent to which they will affect communities within the state. However, with careful planning and collaboration, it is possible to minimize the losses that can result from natural hazards. The identification of actions that reduce the state's sensitivity and increase its resilience assist in reducing overall risk — the area of overlap in **Figure 2-1**. The Oregon NHMP Risk Assessment informs the State's mitigation strategy, found in **Chapter 3**.

Figure 2-1. Understanding Risk



Source: Wood (2007)

Assessing the state's level of risk involves three components: characterizing natural hazards, assessing vulnerabilities and analyzing risk. Characterizing natural hazards involves determining hazards' causes and characteristics, documenting historic impacts, and identifying future probabilities of hazards occurring throughout the state. The section in this risk assessment titled Oregon Hazards characterizes each of the state's natural hazards.

A vulnerability assessment combines information from the hazard characterization 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 each hazard. Vulnerability is determined by a community's exposure, sensitivity, and resilience to natural hazards, as well as its ability to mitigate, prepare for, respond to, and recover from a disaster. The section Oregon Vulnerabilities identifies and assesses the state's vulnerabilities to each hazard identified in the Oregon Hazards section of this risk assessment.

A risk analysis involves estimating the damages, 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 vulnerability assessments, and 2) the likelihood or probability of the harm occurring, defined in the hazard characterization. Together, the Oregon Hazards and Oregon Vulnerabilities sections form the risk analysis at the state level.

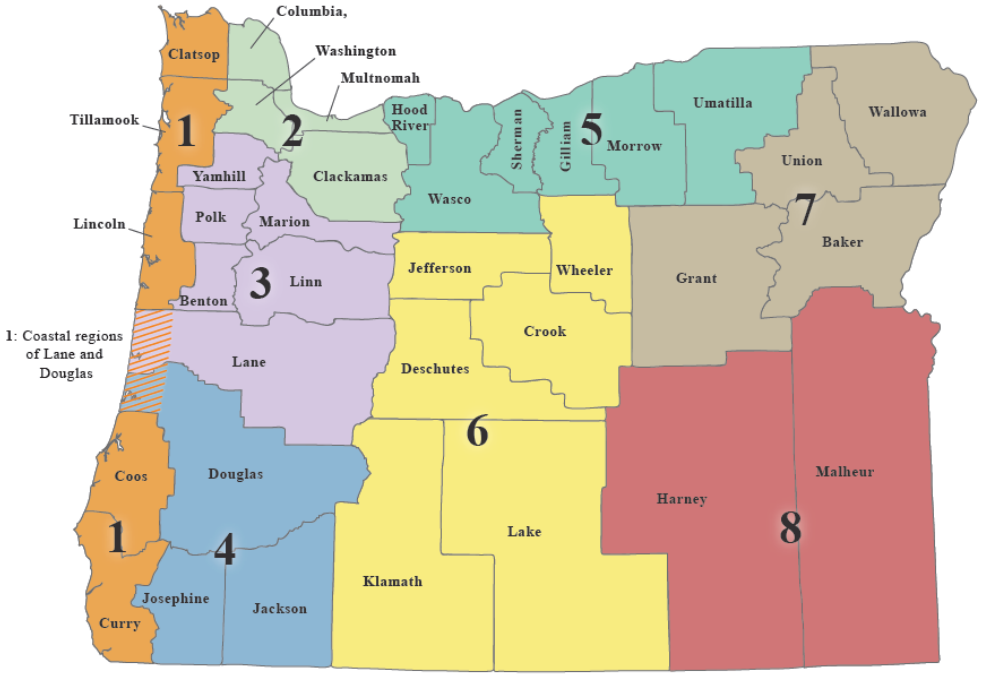
This plan also analyzes risk at the regional level. Regional risk assessments begin with a description of the region's assets in the Regional Profile section. The Profile is followed by a characterization of each hazard and identification of the vulnerabilities and potential impacts of each hazard. Regions are defined by the Oregon NHMP Natural Hazard Regions, which include:

- Region 1: Coast: Clatsop, Tillamook, Lincoln, Coastal Lane, Coastal Douglas, Coos, and Curry Counties
- Region 2: Northern Willamette Valley/Portland Metro: Colombia, Clackamas, Multnomah, and Washington Counties
- Region 3: Mid/Southern Willamette Valley: Benton, Lane, Linn, Marion, Polk, and Yamhill Counties
- Region 4: Southwest: Douglas (non-coastal), Jackson, and Josephine Counties
- Region 5: Mid-Columbia: Gilliam, Hood River, Morrow, Sherman, Umatilla, and Wasco Counties
- Region 6: Central: Crook, Deschutes, Jefferson, Klamath, Lake, and Wheeler Counties
- Region 7: Northeast: Baker, Grant, Wallowa, and Union Counties
- Region 8: Southeast: Harney and Malheur Counties

2.3 Regional Risk Assessments

The purpose of the Regional Risk Assessment is to assess risks at a regional scale by profiling the characteristics, natural hazards and vulnerabilities within the eight Oregon NHMP Natural Hazard Regions (**Figure 2-80**). Each region has its own Risk Assessment. Together, the eight Regional Risk Assessments combine to describe the State's overall risk to natural hazards.

Figure 2-80. Oregon NHMP Natural Hazard Regions



Each Regional Risk Assessment includes three sections:

1. The **Summary** provides a general overview of (a) the Regional Profile, (b) the Regional Hazards and Vulnerability, and (c) how climate change models predict hazards in the region will be impacted based on statewide data.
2. The **Profile** section provides an overview of the region's unique characteristics including profiles of the natural environment, social and demographic situation, economic environment, infrastructure, and built environment.

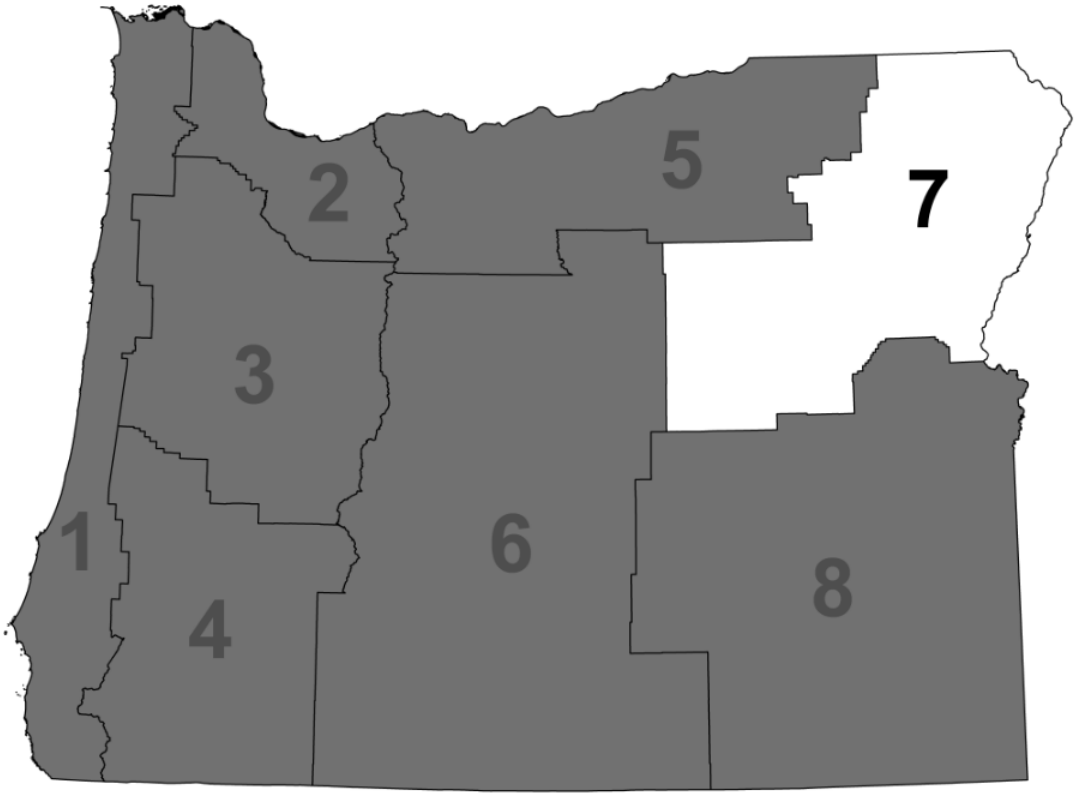
   The research of Susan Cutter, Professor of Geography at the University of South Carolina, Columbia, on vulnerability and environmental hazards provides the framework for discussion of vulnerability in the Regional Profile section. Cutter's framework helps to illustrate the geographic variability of vulnerability and allows policy makers to better understand how to prepare for, mitigate and reduce vulnerability (Cutter et al, 2003; Cutter, 2006).

3. The **Hazards and Vulnerability** section first identifies each hazard and its characteristics in the region. Then, the historical events that have impacted the region are listed. Lastly, probabilities and vulnerabilities are discussed as identified by local and state risk assessments. Vulnerabilities to and potential impacts from each hazard in the region are described including the identification and analysis of the region's State owned/leased facilities and critical/essential facilities located within hazard zones and seismic lifeline vulnerabilities.

Regional Risk Assessments add to the current body of literature and technical resource guides available to Oregon communities. The three levels of government—federal, state, and local—will find the Regional Risk Assessments useful when assessing natural hazards and vulnerabilities and when planning mitigation activities. Local governments can use the Regional Risk Assessments in the development of their jurisdiction's natural hazards mitigation plan. Information from these assessments is intended to be used as a springboard for more detailed community profiles. Likewise, information from local plans helps to inform the Oregon NHMP risk assessment overall.

2.3.7 Region 7: Northeast Oregon

Baker, Grant, Wallowa, and Union Counties



2.3.7.1 Summary

Profile

The region's demographic, economic, infrastructure and development patterns indicate that some populations, structures and places may be more vulnerable to certain natural hazards than others. Mitigation efforts directed at these vulnerabilities may help boost the area's ability to bounce back after a natural disaster.

Social vulnerability in Region 7 is driven by a declining population; high numbers of senior citizens, many of whom have disabilities; low rates of college degrees; child poverty; and low median household incomes. Additional vulnerabilities at the county level include high numbers of children in Baker and Wallowa Counties and vacant homes in Grant and Wallowa Counties.

Though Region 7 has been recovering jobs lost during the financial crisis that began in 2007, the area lags behind state numbers with fewer jobs and lower wages. Unemployment remains lower that statewide numbers. Regionally, wages remain low, averaging only 75% of the state median wage.

Roads and railways are susceptible to winter storms and flooding. Damage or service interruption to the region's transportation systems can have devastating effects on the region's economy. In addition, many of the bridges in the area are distressed or deficient.

Older centralized water infrastructure is vulnerable to pollution and flooding, which can have implications on human health and water quality. Drinking water is sourced from surface water or wells, and is susceptible to pollution from stormwater runoff and Combined Sewer Overflows (CSO) during high water events. Only Baker City employs Low Impact Development (LID) standards in its building regulations.

Northeast Oregon's energy facilities and conveyance system infrastructure support the regional economy and are susceptible to damage and dsiruptions due to natural hazards. The region has five power-generating facilities (hydroelectric, wind, and biomass). Liquid Natural Gas pipelines run through Union and Baker Counties. However, diversity of the region's energy sources boosts its ability to provide power should service be disrupted.

The region's limited growth is occurring within Union County and some other areas along Interstate 84. A high share of mobile homes and homes built before floodplain management and seismic building standards coupled with the lack of modernized Flood Insurance Rate Maps (FIRMs) increase the vulnerability of development in Northeast Oregon.

Hazards and Vulnerability

Region 7 is affected by nine of the 11 natural hazards that affect Oregon communities. Coastal hazards and tsunami do not directly impact this region.

Drought: Droughts are common in all Northeast Oregon counties, particularly within Lake and Klamath Counties. Drought conditions can result in limited water supplies, losses in agriculture, increased fire risk, and adverse impacts to tourism and therefore to the local economy. Baker County has been under an emergency drought declaration eight times and is considered one of the most vulnerable communities to drought conditions.

Dust Storms: Dust Storms occur when strong winds carry fine silt, sand, and clay particles into the air. They can travel over hundreds of miles, over 10,000 feet, and at least 25 miles per hour. Dust Storms are most common over areas of the dry land that are prevalent in this region. Dust Storms in Region 7 can lead to poor air quality and poor visibility which can lead to traffic accidents. Baker and Union Counties are the most vulnerable counties to dust storms in this region.

Earthquakes: Two types of earthquakes affect Region 7—shallow crustal events and earthquakes associated with volcanic activity. Northeast Oregon is considered moderately vulnerable to earthquake hazards due to earthquake-induced landslides, liquefaction, and ground shaking. The region's seismic lifelines have low vulnerability to a Cascadia Subduction Zone (CSZ) event as most of the region's impact will be secondary, due to disruptions to markets to the west. This region has 344 State-owned/leased facilities within an earthquake hazard zone, valuing over $130 million. Of these, 47 are critical/essential facilities. An additional 168 non-State-owned/leased critical/essential facilities are also located within this hazard zone.

Flooding: In this region, the most damaging floods have been rain-on-snow events in the mountains during the winter. Other forms of flooding here have been associated with ice jams, normal spring run-off, and summer thunderstorms. Flooding has also been associated with heavily vegetated stream banks, low stream gradients, breeched dikes, low bridge clearances, over-topped irrigation ditches, and natural stream constrictions. All of the region's counties are considered moderately vulnerable to the flood hazard. There are 89 State-owned/leased facilities located in this region's flood hazard zone valuing approximately $41 million. Of these, 14 are considered critical/essential facilities. An additional 28 non-State-owned/leased critical/essential facilities are located in this hazard zone.

Landslides: Landslides can occur throughout the region, though to a lesser extent than in parts of western Oregon. In general, areas with steeper slopes, weaker geology, and higher annual precipitation tend to have more landslides. Rain-induced landslides can occur during winter months. Earthquakes can also trigger landslides. The Blue and Wallowa Mountains have a moderate to high incidence of landslides. Landslides can also sever transportation routes along highways and rail lines, which can impact the region's economy. There are 419 State-owned/leased facilities in this region's landslide hazard zone, valuing over $139.5 million. Of these, 58 are critical/essential facilities. An additional 237 non-State-owned/leased critical/essential facilities are also located within this hazard zone.

Volcanoes: Though volcanic activity does not occur within this region, ash fall can travel many miles and may affect the region. Communities potentially vulnerable to ash fall are Baker City, La Grande, and John Day. There are zero State-owned/leased facilities located in a volcanic hazard zone. Similarly there are zero non-State-owned/leased critical/essential facilities located in this hazard zone.

Wildfire: Though population and development has declined in this region overall, development has increased in this region's non-federal forests and may impact fire protection capability. Summertime lightening-caused fires are prevalent in the mountainous and timbered regions of eastern Oregon. Wildfire in this region can adversely impact timber and rangeland, recreation and tourism, wildlife habitat and diversity including endangered species, and water quality and supply. Vulnerability is further heightened where fire stations are located far distances from many communities, resulting in longer response times. Based on data from the 2013 West Wide Wildfire Risk Assessment, in Region 7, Grant and Union Counties have high percentages of wildland acres subject to Fire Risk, Fire Effects, and Fire Threat, making them especially vulnerable. Other areas of vulnerability are within wildland-urban interface communities. There are 229 State-owned/leased facilities located in a wildfire hazard zone in Region 7, with a value of approximately $84 million. Of these, 32 are identified as critical/essential facilities. An additional 141 non-State-owned/leased critical/essential facilities are also located in this hazard zone.

Windstorms: Inter-mountain valley regions of Northeast Oregon are known for high winds. Windstorms generally affect the region's buildings, utilities, tree-lined roads, transmission lines, residential parcels and transportation systems along open areas such as grasslands and farmland.

Winter Storms: Winter storms bring colder weather and higher precipitation to this region anually. These storms average 24 inches of snow per year. Moderate to heavy snow fall is prepared for and expected. Heavier snow fall is expected and planned for in higher elevation of the Wallowa Mountains.

Climate Change

The most reliable information on climate change to date is at the state level. The state information indicates that hazards projected to be impacted by climate change in Region 7 include drought and wildfire climate models project warmer drier summers and a decline in mean summer precipitation for Oregon. Coupled with projected decreases in mountain snowpack due to warmer winter temperatures, all eight regions are expected to be affected by an increased incidence of drought and wildfire. An increase in drought could result in the increase incidence of dust storms; though no current research is available on the direct effects of future climate conditions on the incidence of dust storms. Areas that have historically been both hotter and drier than the statewide average — such as Eastern Oregon counties — are at somewhat higher risk of increased drought and wildfire than the state overall. While winter storms and windstorms affect Region 7, there is insufficient research available indicating any change in the incidence of either in Oregon due to changing climate conditions. For more information on climate drivers and the projected impacts of climate change in Oregon, see the section **Introduction to Climate Change**.

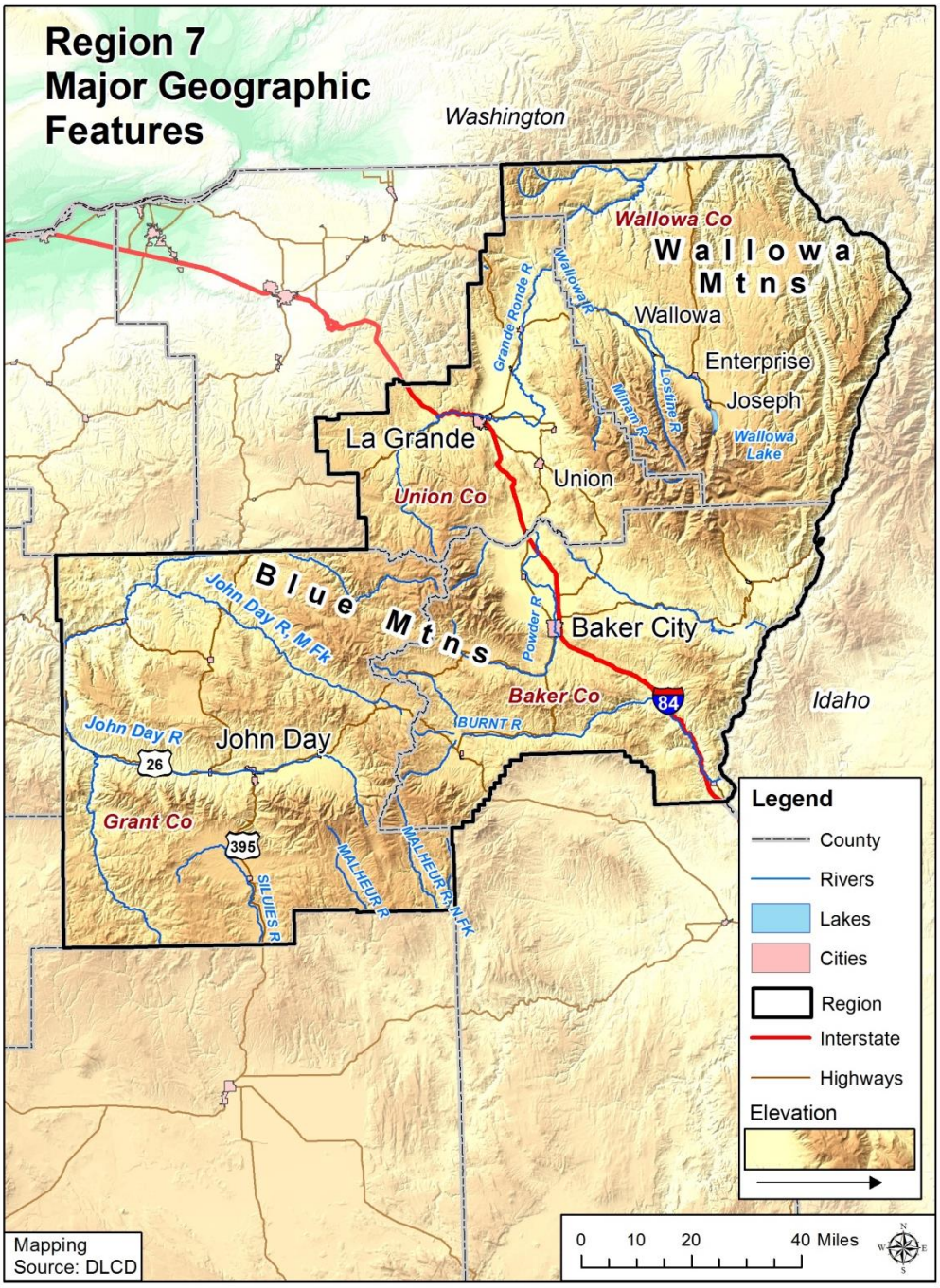
2.3.7.2 Profile

Natural Environment

Geography

Northeastern Oregon is approximately 12,765 square miles in size, and includes Baker, Grant, Union, and Wallowa Counties. The region is bordered by the Snake River to the east and the Columbia River to the north. Columbia River Basalt lava flows formed the high plateaus of the region and the Blue and Wallowa Mountains are included in the region. Major rivers in the region include the John Day, Grande Ronde, and the Snake.

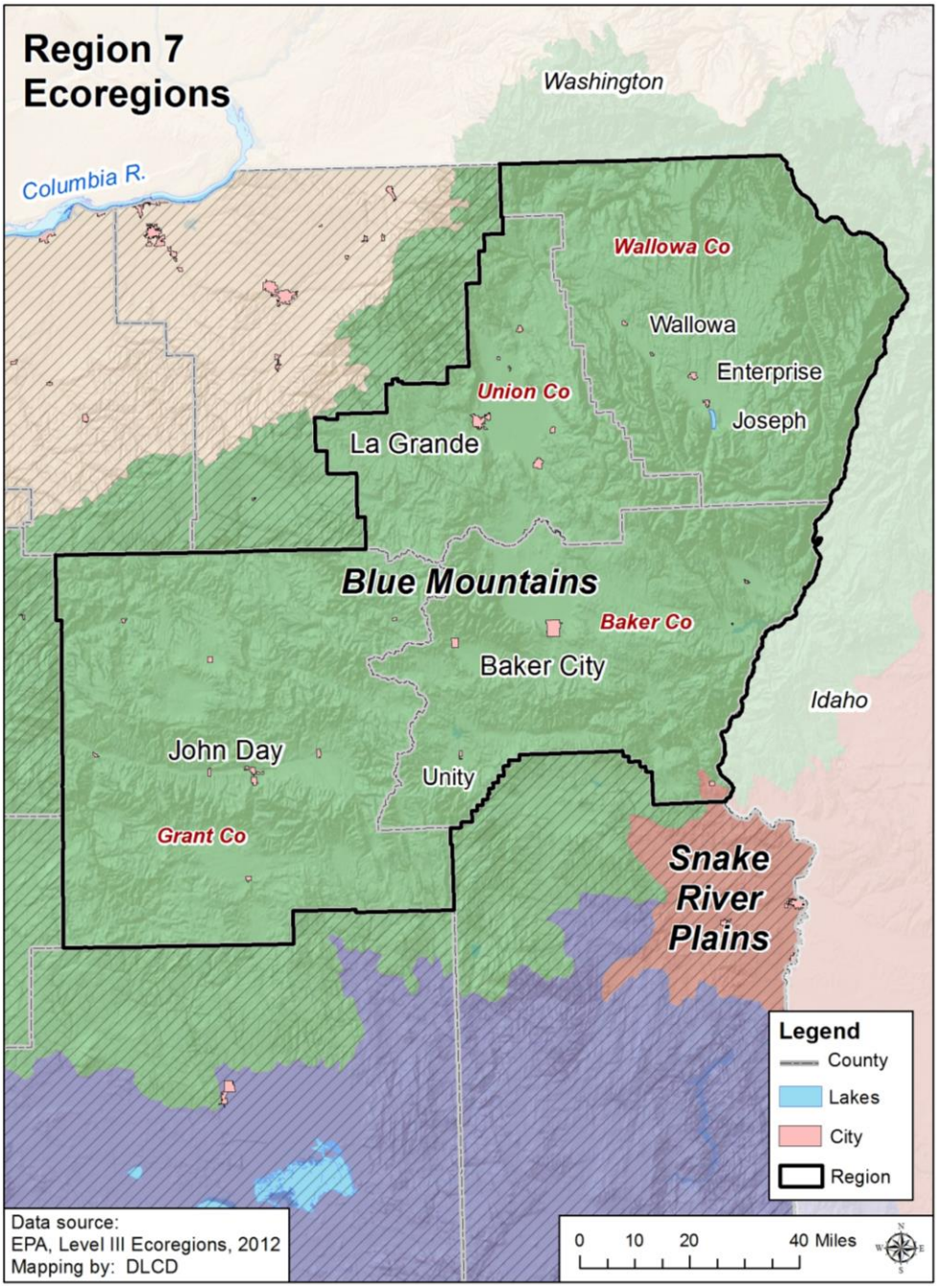
Figure 2-199. Region 7 Major Geographic Features



Source: Department of Land Conservation and Development, 2014

The U.S. EPA's ecoregions are used to describe areas of ecosystem similarity. Region 7 is comprised of two ecoregions: the Blue Mountains and very small area of the Snake River Plain ecoregion (**Figure 2-200**).

Figure 2-200. Region 7 Ecoregions



Blue Mountains: This ecoregion is complex and diverse with many subecoregions with unique conditions. In general, the Blue Mountains areas of Region 7 have dry Continental climate with Marine intrusions because of proximity to the Columbia Gorge. While much of the Blue Mountains are flat with arid climates, the highly dissected John Day/Clarno Highlands contain

the John Day and Crooked Rivers that provide more abundant water than other parts of the Blue Mountains ecoregion, which leads to higher levels of human settlement in proximity to the rivers. Much of the Blue Mountains are underlain with volcanic rock although land in the Wallowas and Elkhorn Mountains ranges is composed of granatic intrusives, deep sea sediments, and metamorphic rocks. Grazing, logging, and fire suppression regimes have altered land cover throughout the region where Juniper woodlands have given way to sagebrush grasslands and grandfir forests have given way to spruce-fir forests. Other forests in the region predominantly have either a Douglas fir or Ponderosa pine canopy. Ponderosa forests tend toward sparsely vegetated understories the ecoregion's Douglas fir forests tend toward dense shrub understories, making them more difficult to log. Some wet, high meadows also exist within Cold Basins of the Blue Mountains in Region 7 and unchannelized streams tend toward a meandering nature within wide floodplains, moving dynamically through the landscape. While much of the Blue Mountains are underlain with volcanic rock, land in the Wallowas and Elkhorn Mountains ranges is composed of granatic intrusives, deep sea sediments, and metamorphic rocks. Riparian areas of the region have a diverse palette of understory shrubs with black cottonwoods, grand firs, and alders in the canopy layer.

Snake River Plain: The Region 7 portion of the Snake River Plain ecoregion is classified as the "Unwooded Alkaline Foothills," which is underlain by alkaline lacustrine deposits. The landscape includes rolling foothills, hills, benches, alluvial fans, and badlands. Wyoming sagebrush and associated grasses are the dominant vegetation with salt tolerant shrubs found on alkaline outcrops. The land is high value rangeland and wildlife habitat.

Climate

Climate refers to the temperatures, weather patterns, and precipitation in the region. This section covers historic climate information. For estimated future climate conditions and possible impacts refer to the **State Risk Assessment** for statewide.

Region 7 has diverse ecoregions with varying climatic conditions with the majority of the region's land divided almost equally between the two ecoregions. The region's predominantly arid climate supports limited agricultural activities, primarily livestock grazing. The region is subject drought, floods, landslides, and wildfires. When considering the climate, snowfall should also be taken into account. Flooding can be a direct result of rain-on-snow events. Likewise, the amount of snowpack in a region can also impact the ability of communities to cope with drought. **Table 2-421** shows mean annual precipitation and temperatures for the two ecoregions in Region 7. Temperature and precipitation vary widely by subecoregion and microclimates. For more detailed and locally relevant climate data refer to the Oregon Climate Service.

Table 2-421. Average Precipitation and Temperature Ranges in Region 7 Ecoregions

Ecoregion	Mean Annual Precipitation Range (inches)	Mean Temperature Range (°F) January min/max	Mean Temperature Range (°F) July min/max
Blue Mountains*	9-80	15/39	40/85
Snake River Plain	9-12	19/35	57/96

*Data have been generalized from all the sub-ecoregions of the ecoregion in Region 7.

Source: Thorson et al. (2003)

Demography

Population

Population forecasts are an indicator of future development needs and trends. Community demographics may indicate where specific vulnerabilities may be present in the aftermath of a natural hazard (Cutter et al., 2003). If a population is forecasted to increase substantially, a community's capacity to provide adequate housing stock, services, or resources for all populations post disaster may be stressed or compromised (Cutter et al., 2003).

Overall, from 2000-2013, Region 7 grew 13% less than the state overall. Union is the only county that grew in population during this 13-year period, and is the only county projected to grow by 2020. Growth in Baker and Wallowa Counties is expected to be relatively flat, while Grant County is expected to continue to decline in population.

Table 2-422. Population Estimate and Forecast for Region 7

	2000	2013	Percent Change (2000 to 2013)	2020 Projected	Percent Change (2013 to 2020)
Oregon	3,421,399	3,919,020	14.5%	4,252,100	8.5%
Region 7	56,432	57,085	1.2%	58,910	3.2%
Baker	16,741	16,280	-2.8%	16,315	0.2%
Grant	7,935	7,435	-6.3%	7,321	-1.5%
Union	24,530	26,325	7.3%	28,216	7.2%
Wallowa	7,226	7,045	-2.5%	7,058	0.2%

Source: Population Research Center, Portland State University, 2013; U.S. Census Bureau, 2000 Decennial Census. Table DP-1; Office of Economic Analysis, Long-Term Oregon State's County Population Forecast, 2010-2050, 2013

Tourists

Tourists are not counted in population statistics and are therefore considered separately in this analysis. Tourism activities in Region 7 (Longwoods Travel US.A, 2011d) are largely centered on outdoor activities (hiking/backpacking, visiting national/state parks etc.), touring (traveling to experience scenic beauty, history, and culture), and special events (such as fairs, festivals, or sporting events) ((Longwoods Travel US.A, 2011d). Approximately 8% (2.2 million) of all overnight visitor trips to Oregon included time within Region 7. Three fourths of all trips to the region occur between April and September and the average travel party contains 3.8 persons. The average trip length is 4.3 nights (Longwoods Travel US.A, 2011d). Visitors to the region are just as likely to be lodged in hotels/motels, private homes or other accommodations. The Longwoods Travel Report includes all of the Region 7 counties, Harney and Malheur Counties (Region 8), and Morrow, Umatilla, and parts of Gilliam Counties within the Eastern Region.

Difficulty locating or accounting for travelers increases their vulnerability in the event of a natural disaster. Furthermore, tourists are often unfamiliar with evacuation routes, communication outlets, or even the type of hazard that may occur (MDC Consultants, n.d.). Targeting natural hazard outreach efforts to places where tourist lodge can help increase awareness of hazards in the area and minimize the vulnerability of this population group.

Table 2-423. Annual Visitor Estimates in Person Nights in Region 7

	2011		2012		2013	
	Number	Percent	Number	Percent	Number	Percent
Region 7	6,153	—	6,104	—	6,095	—
Baker	4,797	100%	4,736	100%	4,756	100%
Hotel/Motel	1,571	32.7%	1,509	31.9%	1,493	31.4%
Private Home	1,914	39.9%	1,893	40.0%	1,914	40.2%
Other	1,312	27.4%	1,334	28.2%	1,349	28.4%
Grant	208	100%	206	100%	212	100%
Hotel/Motel	31	14.9%	30	14.6%	33	15.6%
Private Home	72	34.6%	72	35.0%	74	34.9%
Other	105	50.5%	104	50.5%	105	49.5%
Union	526	100%	538	100%	526	100%
Hotel/Motel	127	24.1%	130	24.2%	123	23.4%
Private Home	254	48.3%	259	48.1%	252	47.9%
Other	145	27.6%	149	27.7%	151	28.7%
Wallowa	622	100%	624	100%	601	100%
Hotel/Motel	136	21.9%	136	21.8%	124	20.6%
Private Home	69	11.1%	68	10.9%	67	11.1%
Other	417	67.0%	420	67.3%	410	68.2%

Source: Oregon Travel Impacts: 1991-2013, April 2014. Dean Runyan Associates, http://www.deanrunyan.com/doc_library/ORImp.pdf

Persons with Disabilities

Disabilities appear in many forms. While some disabilities may be easily identified, others may be less perceptible. Persons with disabilities, while difficult to identify and measure, are disproportionately affected during disasters (Cutter et al., 2003). About 5% more people in Region 7 identify as having a disability than do people throughout the state. Over 40% of seniors (65 or older) report having a disability. Local natural hazard mitigation plans should specifically target outreach programs toward helping disabled residents better prepare for and recover from hazard events.

Table 2-424. People with a Disability by Age Groups in Region 7, 2012

	Total Population*	With a Disability		Under 18 years with a Disability		65 Years and Over with a Disability	
	Estimate	Estimate	Percent	Estimate	Percent**	Estimate	Percent**
Oregon	3,796,881	511,297	13.5%	39,439	4.6%	200,374	37.8%
Region 7	55,230	10,124	18.3%	512	4.4%	4,764	43.3%
Baker	15,702	3,000	19.1%	179	5.5%	1,477	41.7%
Grant	7,285	1,538	21.1%	32	2.3%	833	48.8%
Union	25,363	4,211	16.6%	219	3.8%	1,851	44.4%
Wallowa	6,880	1,375	20.0%	82	6.3%	603	38.1%

*Total population does not include institutionalized population

**Percent of age group

Source: U.S. Census Bureau, 2008-2012 American Community Survey 5-Year Estimates, Table DP02

Homeless Population

Population estimates of the homelessin Oregon are performed each January. These are rough estimates and can fluctuate with many factors, including the economy or season. The overwhelming majority of homeless are either single adult males or families with children. Communities located along major transportation corridors, such as Interstate 84, tend to have higher concentrations of homeless populations (Thomas et al., 2008). Between 2009 and 2011 this population has held steady.

Extra attention is needed to care for and serve homeless communities. Some homeless people choose to remain hidden or anonymous, making it especially difficult to mitigate harm to them due to natural hazard events. Accessible shelter and social services are key emergency considerations for the homeless community.

Table 2-425. Homeless Population Estimate for Region 7

	2009	2010	2011	3-Year Average
Oregon	17,122	19,208	22,116	19,482
Region 7	45	43	27	38
Baker	22	4	6	11
Grant	0	0	n/a	0
Union	23	37	21	27
Wallowa	0	2	0	1

Source: Oregon Point in Time Homeless Count, Oregon Housing and Community Services.
http://www.oregon.gov/ohcs/pages/ra_point_in_time_homeless_count.aspx

Gender

The gender ratio in Region 7 is similar to that of the state, roughly 50:50 (U.S. Census Bureau; n.d.). It is important to recognize that women tend to have more institutionalized obstacles than men during recovery due to sector-specific employment, lower wages, and family care responsibilities (Cutter et al., 2003).

Age

All counties in Region 7 have a higher percentage of seniors than statewide numbers. Senior citizens may 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. In addition, the elderly may be reluctant to leave their homes in a disaster event. This implies the need for targeted preparatory programming that includes evacuation procedures and shelter locations accessible to the elderly populations (Morrow, 1999).

The percentage of children is slightly lower than the statewide percentage in all counties except Union. Special considerations should be given to young children, schools, and parents during the natural hazard mitigation process. Young children are more vulnerable to heat and cold, have fewer transportation options, and require assistance to access medical facilities. Parents may lose time and money when their children's childcare facilities and schools are impacted by disasters (Cutter et al., 2003).

Table 2-426. Population by Vulnerable Age Groups, in Region 7, 2012

	Total Population	Under 18 Years Old		65 Years and Older	
	Estimate	Estimate	Percent	Estimate	Percent
Oregon	3,836,628	864,243	22.5%	540,527	14.1%
Region 7	56,066	11,721	20.9%	11,273	20.1%
Baker	16,092	3,242	20.1%	3,590	22.3%
Grant	7,366	1,419	19.3%	1,746	23.7%
Union	25,670	5,755	22.4%	4,319	16.8%
Wallowa	6,938	1,305	18.8%	1,618	23.3%

Source: U.S. Census Bureau; 2008-2012 American Community Survey 5-Year Estimates, Table DP05

Language

A very small share of the population does not speak English "very well". Outreach materials used to communicate with and plan for this community should take into consideration their language needs.

Table 2-427. English Usage in Region 7, 2012

	Speak English "Very Well"		Speak English Less Than "Very Well"	
	Estimate	Percent	Estimate	Percent
Oregon	3,376,744	93.8%	224,905	6.2%
Region 7	52,233	98.5%	778	1.5%
Baker	15,142	99.0%	150	1.0%
Grant	6,988	99.4%	42	0.6%
Union	23,529	97.7%	552	2.3%
Wallowa	6,574	99.5%	34	0.5%

Source: U.S. Census Bureau; 2008-2012 American Community Survey 5-Year Estimates, Table DP02

Education Level

Studies (Cutter et al., 2003) show that education and socioeconomic status are deeply intertwined, with higher educational attainment correlating to increased lifetime earnings. Compared to statewide numbers 8% less of its population has a bachelor's degree or higher.

Education can influence the ability to access resources, while lack of resources may constrain the ability to understand warning information (Cutter et al., 2003). Therefore, levels of education within the region should be considered when designing hazard outreach materials to local communities.

Figure 2-201. Educational Attainment in Region 7, 2012

Source: U.S. Census Bureau; 2008-2012 American Community Survey 5-Year Estimates, Table DP02

Income

The impact of a disaster in terms of loss and the ability to recover varies among population groups. "The causes of social vulnerability are explained by the underlying social conditions that are often quite remote from the initiating hazard or disaster event" (Cutter, 2006). Historically, 80% of the disaster burden falls on the public. Of this number, a disproportionate burden is placed upon those living in poverty. People living in poverty are more likely to become isolated, are less likely to have the savings to rebuild after a disaster, and are less likely to have access to transportation and medical care.

All counties in the region have lower median household incomes than the state average, ranging from $8,200-$15,700 below the state numbers. Decreases in median household incomes were especially notable in Grant and Wallowa Counties between 2009 and 2012.

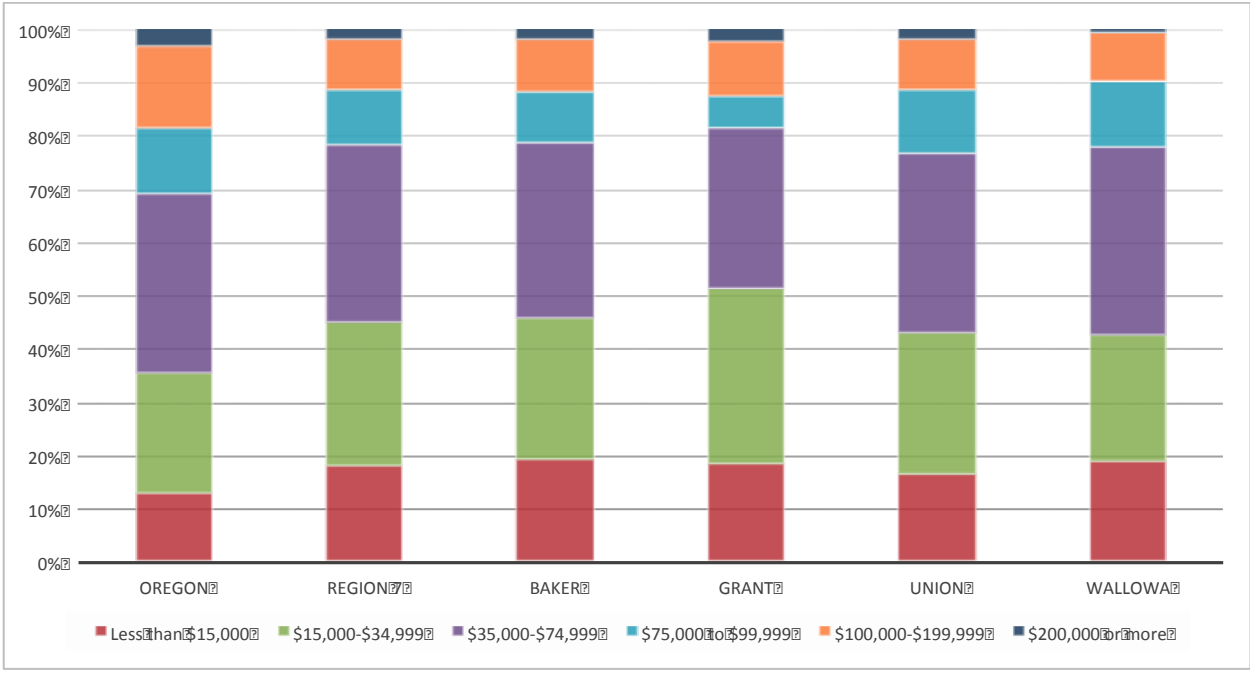
Table 2-428. Median Household Income in Region 7

	2009	2012	Percent Change
Oregon	$52,474	50,036	-4.6%
Region 7	n/a	n/a	n/a
Baker	$41,096	40,348	-1.8%
Grant	$37,759	34,337	-9.1%
Union	$43,387	41,784	-3.7%
Wallowa	$44,286	40,204	-9.2%

Source: U.S. Census Bureau. 2005-2009 and 2008-2012. American Community Survey – 5-Year Estimates. Table DP03.
Note: 2009 dollars are adjusted for 2012 using Bureau of Labor Statistics' Consumer Price Index Inflation Calculator.
n/a = data not aggregated at the regional level.

Compared to statewide numbers, the region has a greater share (10% more) of its households making less than $35,000 per year. More than half of all households in Grant County make less than $35,000 per year. In addition, roughly 9% fewer households make more than $75,000.

Figure 2-202. Median Household Income Distribution in Region 7, 2012



Source: U.S. Census Bureau; 2008-2012 American Community Survey 5-Year Estimates, Table DP03

The region has about the same percentage of individuals living in poverty as the state overall, but child poverty is 9% higher. Notably, poverty overall grew by almost 40% in Wallowa County. All counties except Union have experienced a growth in child poverty. Though Baker is the only county with a declining poverty rate, one third of all children in the county live in poverty.

Table 2-429. Poverty Rates in Region 7, 2012

	Total Population in Poverty			Children Under 18 in Poverty		
	Number	Percent	Percent Change*	Number	Percent	Percent Change*
Oregon	584,059	15.5%	17.7%	175,303	20.6%	17.6%
Region 7	9,517	17.3%	11.6%	2,785	29.3%	22.9%
Baker	3,059	19.6%	-0.7%	1,048	33.3%	45.6%
Grant	1,144	15.7%	15.0%	277	19.6%	27.6%
Union	4,318	17.2%	15.5%	1,238	21.6%	6.9%
Wallowa	996	14.5%	39.5%	222	17.1%	29.8%

*Percent change since 2009

Source:U.S. Census Bureau. 2005-2009 and 2008-2012. American Community Survey – 5-Year Estimates, Table S1701

Low-income populations require special consideration when mitigating loss to a natural hazard. Often, those who make less have little to no savings and other assets to withstand economic setbacks. When a natural disaster interrupts work, the ability to provide housing, food, and basic necessities becomes increasingly difficult. In addition, low-income populations are hit especially hard as public transportation, public food assistance, public housing, and other public programs upon which they rely for day-to-day activities are often impacted in the aftermath of the natural disaster. To reduce the compounded loss incurred by low income populations post-disaster, mitigation actions need to be specially tailored to ensure safety nets are in place to provide further support to those with fewer personal resources (Cutter et al., 2003).

Housing Tenure

Wealth can increase the ability to recover following a natural disaster (Cutter et al., 2003), and homeownership, versus renting, is often linked to having more wealth. Renters often do not have personal financial resources or insurance to help recover post-disaster. On the other hand, renters tend to be more mobile and have fewer assets at risk. In the most extreme cases, renters lack sufficient shelter options when lodging becomes uninhabitable or unaffordable due to natural disaster events.

Slightly lower than statewide numbers, roughly 33% of housing units in this region are rentals. Union County has the highest share of rental units. The region has about a 3% higher vacancy rate than the state—Grant and Wallowa Counties have the highest vacancy rates; and Baker and Union Counties have the highest number of vacant units. In addition, the region has about 5% more seasonal, or recreational homes than the state average (U.S. Census Bureau, 2008-2012 American Community Survey, Table DP04 and Table B25004).

Table 2-430. Housing Tenure in Region 7, 2012

	Total Occupied Units	Owner-occupied		Renter-occupied		Vacant^	
		Estimate	Percent	Estimate	Percent	Estimate	Percent
Oregon	1,512,718	945,824	62.5%	566,894	37.5%	105,417	6.3%
Region 7	23,729	16,001	67.4%	7,728	32.6%	2,629	9.2%
Baker	7,074	4,827	68.2%	2,247	31.8%	854	9.7%
Grant	3,376	2,368	70.1%	1,008	29.9%	485	11.2%
Union	10,299	6,666	64.7%	3,633	35.3%	858	7.5%
Wallowa	2,980	2,140	71.8%	840	28.2%	432	10.5%

^ = Functional vacant units, computed after removing seasonal, recreational, or occasional housing units from vacant housing units.

Source: U.S. Census Bureau, 2008-2012 American Community Survey 5-Year Estimates, Table DP04 and Table B25004.

Families and Living Arrangements

Family care and obligations can create additional hardship during post-disaster recovery, especially for single parent households. Region 7 is predominately comprised of family households. Just under one-quarter of all households have families with children. About three times as many single parent households are headed by females than by males. These numbers are similar to statewide averages.

Table 2-431. Family vs. Non-family Households in Region 7, 2012

	Total Households	Family Households		Nonfamily Households		Householder Living Alone	
	Estimate	Estimate	Percent	Estimate	Percent	Estimate	Percent
Oregon	1,512,718	964,274	63.7%	548,444	36.3%	421,620	27.9%
Region 7	23,729	15,670	66.0%	8,059	34.0%	6,638	28.0%
Baker	7,074	4,781	67.6%	2,293	32.4%	1,941	27.4%
Grant	3,376	2,213	65.6%	1,163	34.4%	1,015	30.1%
Union	10,299	6,852	66.5%	3,447	33.5%	2,635	25.6%
Wallowa	2,980	1,824	61.2%	1,156	38.8%	1,047	35.1%

Source: U.S. Census Bureau, 2008-2012 American Community Survey 5-Year Estimates, Table DP04

Table 2-432. Family Households with Children by Head of Household in Region 7, 2012

	Family Households with Children		Single Parent (male)		Single Parent (female)		Married Couple with Childern	
	Estimate	Percent	Estimate	Percent	Estimate	Percent	Estimate	Percent
Oregon	415,538	27.5%	35,855	2.4%	93,575	6.2%	286,108	18.9%
Region 7	5,812	24.5%	514	2.2%	1,425	6.0%	3,873	16.3%
Baker	1,714	24.2%	127	1.8%	419	5.9%	1,168	16.5%
Grant	756	22.4%	84	2.5%	164	4.9%	508	15.0%
Union	2,805	27.2%	279	2.7%	651	6.3%	1,875	18.2%
Wallowa	537	18.0%	24	0.8%	191	6.4%	322	10.8%

Note: The table shows the percent of total households represented by each family household structure category.

Source: U.S. Census Bureau; 2008-2012 American Community Survey 5-Year Estimates, Table DP04

Social and Demographic Trends and Issues

This analysis shows that Region 7 has a greater number of people than the state average who are predisposed to be particularly vulnerable during a hazard event, in the following categories:

- Population has been declining and is expected to continue to clime or stay flat, except in Union County;
- High percentages of children (Baker and Wallow Counties);
- High percentage of seniors, and of seniors with a disability (all counties);
- Low rate of college degrees;
- Regionally low median household incomes, and a significant decline in Grant and Wallow Counties;
- High child poverty; and
- Home vacancies in Grant and Wallowa Counties.

Economy

Employment

Employment status and salary level may impact the resilience of individuals and families in the face of disasters as well as their ability to mitigate losses created by natural hazards (Cutter et al., 2003). "The potential loss of employment following a disaster exacerbates the number of unemployed workers in a community, contributing to a slower recovery from the disaster" (Cutter et al., 2003). The region is still recovering from the financial crisis that began in 2007. Unemployment rates have been declining steadily since 2009 but remain 1.4% higher than the state. Union County has the largest labor force and the lowest unemployment rate. Conversely, Grant County has the smallest labor force and the highest unemployment rate. Nonfarm job counts are up in Union and Wallowa Counties, but struggling to mount a sustained recovery in Baker and Grant Counties (Tauer, 2014). Overall, average salaries are 73% that of the state. For example, the average salary in Union County is $33,840, and in Wallowa County is $30,002.

Table 2-433. Unemployment Rates in Region 7, 2009–2013

	2009	2010	2011	2012	2013	Change (2009–2013)
Oregon	11.1%	10.8%	9.7%	8.8%	7.7%	-3.4%
Region 7	11.4%	11.0%	10.8%	10.2%	9.1%	-2.3%
Baker	10.2%	10.1%	10.6%	10.1%	9.2%	-1.0%
Grant	13.4%	13.5%	13.5%	13.5%	11.8%	-1.7%
Union	11.4%	10.5%	10.1%	9.3%	8.2%	-3.3%
Wallowa	11.8%	12.0%	11.3%	10.3%	9.9%	-1.9%

Source: Oregon Employment Department, 2014.

Table 2-434. Employment and Unemployment Rates in Region 7, 2013

	Civilian Labor Force	Employed Workers		Unemployed	
	Total	Total	Percent	Total	Percent
Oregon	1,924,604	1,775,890	92.3%	148,714	7.7%
Region 7	25,895	23,526	90.9%	2,369	9.1%
Baker	7,073	6,423	90.8%	650	9.2%
Grant	3,337	2,944	88.2%	393	11.8%
Union	11,950	10,974	91.8%	976	8.2%
Wallowa	3,535	3,185	90.1%	350	9.9%

Source: Oregon Employment Department, 2014.

Table 2-435. Employment and Payroll in Region 7, 2013

	Employees	Average Pay	Percent State Average
Oregon	1,679,364	$45,010	100%
Region 7	19,149	$32,868	73.0%
Baker	5,014	$32,063	71.2%
Grant	2,324	$33,503	74.4%
Union	9,488	$33,840	75.2%
Wallowa	2,323	$30,002	66.7%

Source: Oregon Employment Department, 2014

Employment Sectors and Key Industries

In 2013, the five major employment sectors in Region 7 were: Government (25.6%), Trade Transportation and Utilities (13.1%), Education and Health Services (13.9%), Manufacturing (10.3%), and Leisure and Hospitality (9.5%). **Table 2-436** shows the distribution of total employment across all sectors. Region 7 is expected to have a 9-10% increase in employment from 2012-2022.

Table 2-436. Covered Employment by Sector in Region 7, 2013

Industry	Region 7	Baker		Grant	
		Employment	Percent	Employment	Percent
Total All Ownerships	19,149	5,014	100%	2,324	100%
Total Private Coverage	74.4%	3,884	77.5%	1,362	58.6%
Natural Resources & Mining	5.0%	176	3.5%	228	9.8%
Construction	4.0%	196	3.9%	57	2.5%
Manufacturing	10.3%	475	9.5%	141	6.1%
Trade, Transportation & Utilities	18.5%	970	19.3%	305	13.1%
Information	1.2%	72	1.4%	38	1.6%
Financial Activities	3.3%	138	2.8%	66	2.8%
Professional & Business Services	5.0%	301	6.0%	119	5.1%
Education & Health Services	13.9%	742	14.8%	169	7.3%
Leisure & Hospitality	9.5%	581	11.6%	174	7.5%
Other Services	3.7%	234	4.7%	63	2.7%
Private Non-Classified	—	—	—	(c)	—
Total All Government	25.6%	1,130	22.5%	962	41.4%
Federal Government	4.2%	218	4.3%	265	11.4%
State Government	7.6%	250	5.0%	138	5.9%
Local Government	13.8%	662	13.2%	559	24.1%

Industry	Region 7	Union		Wallowa	
		Employment	Percent	Employment	Percent
Total All Ownerships	19,149	9,488	100%	2,323	100%
Total Private Coverage	74.4%	7,321	77.2%	1,688	72.7%
Natural Resources & Mining	5.0%	377	4.0%	168	7.2%
Construction	4.0%	380	4.0%	127	5.5%
Manufacturing	10.3%	1,207	12.7%	142	6.1%
Trade, Transportation & Utilities	18.5%	1,865	19.7%	402	17.3%
Information	1.2%	115	1.2%	12	0.5%
Financial Activities	3.3%	301	3.2%	136	5.9%
Professional & Business Services	5.0%	450	4.7%	95	4.1%
Education & Health Services	13.9%	1,479	15.6%	275	11.8%
Leisure & Hospitality	9.5%	837	8.8%	220	9.5%
Other Services	3.7%	312	3.3%	109	4.7%
Private Non-Classified	—	(c)	—	(c)	—
Total All Government	25.6%	2,167	22.8%	635	27.3%
Federal Government	4.2%	223	2.4%	95	4.1%
State Government	7.6%	967	10.2%	97	4.2%
Local Government	13.8%	977	10.3%	443	19.1%

Source: Oregon Employment Department, 2013

Note: (c) = confidential, information not provided by Oregon Employment Department to prevent identifying specific businesses.

Each industry faces distinct vulnerabilities to natural hazards. Identifying key industries in the region enables communities to target mitigation activities toward those industries' specific sensitivities. Each of the primary private employment sectors has sensitivity to natural hazards, as follows.

Trade, Transportation, and Utilities: Retail Trade is the largest employment subsector within the Trade, Transportation, and Utilities sector. Retail Trade is vulnerable to disruptions in the disposable income of regional residents and to disruptions in the transportation system. Residents' discretionary spending diminishes after natural disasters as spending priorities tend to focus on essential items. Disruption of the transportation system could sever connectivity of people and retail hubs. Retail businesses are concentrated in the larger cities of the region.

Education and Health Services: The industries in these sectors play important roles in emergency response in the event of a disaster. Health care is a relatively stable revenue sector regionally with an increasing distribution of businesses primarily serving a local and aging population.

Manufacturing is highly dependent upon transportation networks in order to access supplies and send finished products to outside markets. For these reasons the manufacturing sector may be susceptible to disruptions in transportation infrastructure. However, manufacturers are not dependent on local markets for sales, which may contribute to the economic resilience of this sector.

The ***Leisure and Hospitality*** sector primarily serves regional residents with disposable income and tourists. The behavior of both of these social groups would be disrupted by a natural disaster. Regional residents may have less disposable income and tourists may choose not to visit a region with unstable infrastructure.

Revenue by Sector

In 2007 Trade (Retail and Wholesale), Manufacturing, and Healthcare and Social Assistance were the highest revenue grossing industries in Region 7. (Revenue data from the 2012 Economic Census will not be released prior to the publication of this Plan.) Combined, these three industries generated over $1.3 billion (88% of total revenue) for the region. Trade (Retail and Wholesale) is the largest grossing sector in all counties, except Union County.

Note: Due to the small size and few industries in the region, the collected data is withheld in several categories to avoid disclosing data for individual companies. Data is aggregated to the county level).

Table 2-437. Revenue of Top Industries (in Thousands of Dollars) in Region 7, 2007

	Total Revenue (in Thousands)	Trade (Retail and Wholesale)	Manufacturing	Health Care and Social Assistance
Oregon	$277,017,733	44.4%	24.1%	7.3%
Region 7	$1,436,457	46.2%	33.1%	8.4%
Baker	$362,682	48.1%	38.0%	D
Grant	$82,545	87.9%	—	D
Union	$856,609	39.0%	39.4%	11.2%
Wallowa	$134,621	61.5%	—	18.0%

Notes: D = Withheld to avoid disclosing data for individual companies; data are included in higher level totals, and

"-" = data not provided.

Source: U.S. Census, Economic Census. 2007, Table ECO700A1

Sectors that are anticipated to be major employers in the future warrant special attention, especially in the hazard mitigation planning process so workforces and employers can be more prepared to respond and adapt to needs that arise after a natural hazard event. According to the Oregon Employment Department, between 2012 and 2022, the largest job growth in Region 7 is expected to occur in the following sectors: education and health services; natural resources and mining; Trade, Transportation, and Utilities (including retail trade); government; and leisure and hospitality (Oregon Employment Department, Employment Projections by Industry and Occupation 2012–2022, Northeast and Southeast Oregon Reports, 2012).

Identifying sectors with a large number of businesses, and targeting mitigation strategies to support those sectors, can help the region's resiliency. The Trade, Transportation, and Utilities sector includes the most businesses in Region 7 with 18.0% of all businesses. Government (particularly local government) has the second most number of businesses. Construction, Other Services, and Education and Health Services round out the top five sectors (Oregon Employment Department, 2012). While many of these are small businesses, employing fewer than 20 employees, collectively they represent almost two thirds of the businesses in the region. Due to their small size and large collective share of the economy, these businesses are particularly sensitive to temporary decreases in demand, such as may occur following a natural hazard event.

Economic Trends and Issues

Current and anticipated financial conditions of a community are strong determinants of community resilience, since a strong and diverse economic base increases the ability of individuals, families, and communities to absorb impacts of a disaster and recover more quickly. The economic analysis shows that Region 7 is particularly vulnerable during a hazard event due to the following characteristics:

- Higher unemployment, especially in Grant County; and
- Lower regional wages

Northeastern Oregon is still recovering from the financial crisis that began in 2007. Much of the growth in employment within the region is spurred by the health care industrial sector and the regions aging population. Supporting the growth of dominant industries and employment sectors, as well as emerging sectors identified in this analysis, can help the region become more resilient to economic downturns that often follow a hazard event (Stahl et al., 2000).

Infrastructure Profile

Infrastructure analyzed in this Plan include, transportation networks, power transmission systems, telecommunications, and water systems.

Transportation

Roads

The largest population bases in Region 7 are located along the region's major freeways. Interstate 84 runs north-south and is the main passage for automobiles and trucks traveling east of the Cascade Range between Portland and Idaho. Highways 26, 244, 245, and 395 provide access west into Grant County. Highway 82 provides access into Wallowa County. An additional north-south access is provided from Wallowa County to Washington via Highway 3.

A high percentage of workers driving alone to work coupled with interstate and international freight movement create additional stresses on transportation systems. Some of these include added maintenance, congestion, oversized loads, and traffic accidents.

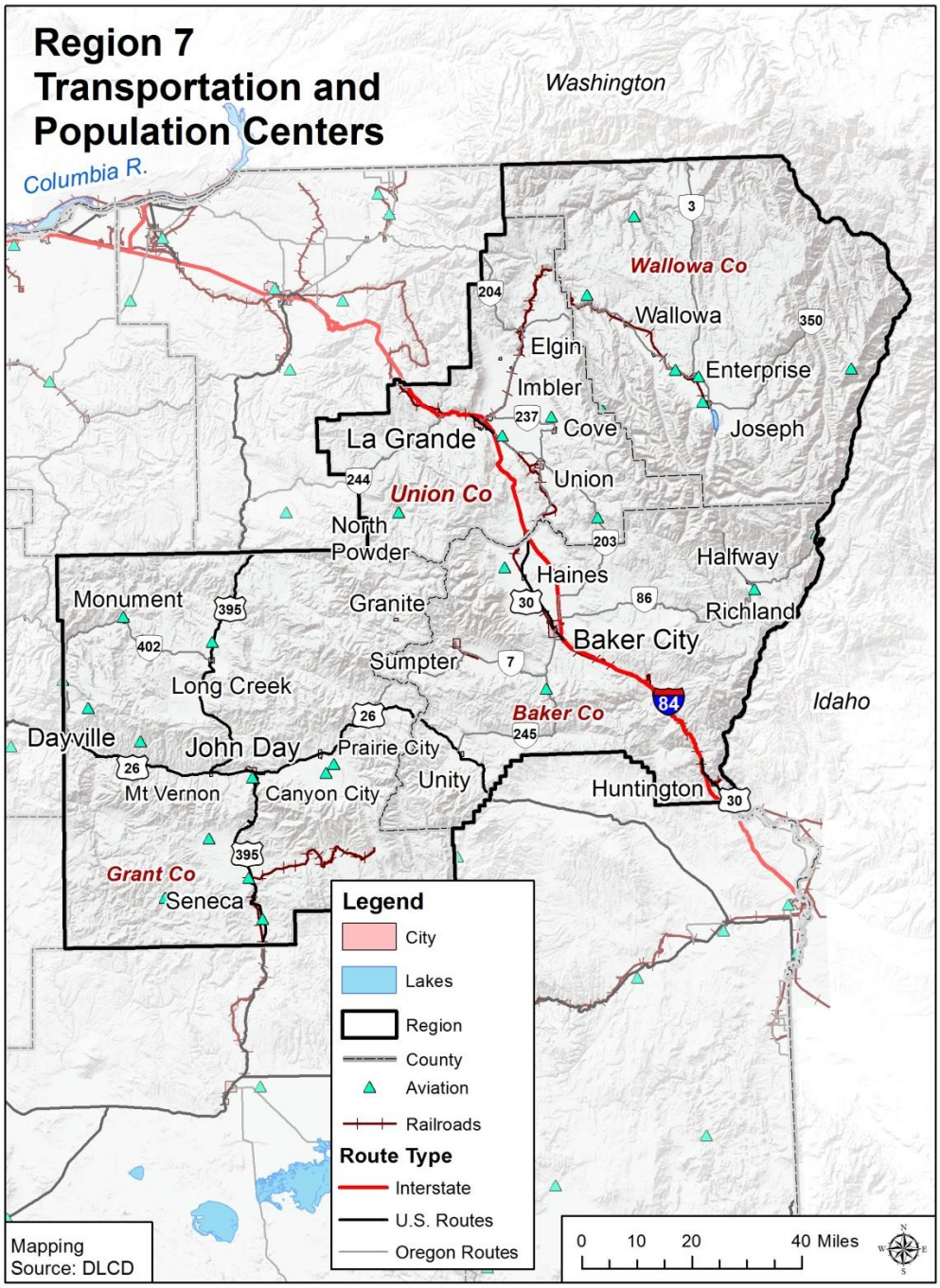
Region 7's growing population centers bring more workers, automobiles and trucks onto roads. A high percentage of workers driving alone to work coupled with interstate and international freight movement create additional stresses on transportation systems. Some of these include added maintenance, congestion, oversized loads, and traffic accidents.

Natural hazards and emergency events can further disrupt automobile traffic, create gridlock, and shut down local transit systems, making evacuations and other emergency operations difficult. Hazards such as localized flooding can render roads unusable. Likewise, a severe winter storm has the potential to disrupt the daily driving routine of thousands of people.

According to the Oregon Department of Transportation's (ODOT's) Seismic Lifeline Report, the projected impacts of a CSZ event are considered negligible in this part of the state. However, damage to I 84 to the west and damage to the Columbia River's freight functions could impact

the region's economy. For information on ODOT's Seismic Lifeline Report findings for Region 7, see **Seismic Lifelines**.

Figure 2-203. Region 7 Transportation and Population Centers



Source: Oregon Department of Transportation, 2014

Bridges

Because of earthquake risk in Region 7, the seismic vulnerability of the region's bridges is an important issue. Non-functional bridges can disrupt emergency operations, sever lifelines, and disrupt local and freight traffic. These disruptions may exacerbate local economic losses if industries are unable to transport goods. The region's bridges are part of the state and interstate highway system that is maintained by the Oregon Department of Transportation (ODOT) or that are part of regional and local systems that are maintained by the region's counties and cities. For information on ODOT's Seismic Lifeline Report findings for Region 7, see **Seismic Lifelines**.

Table 2-438 shows the structural condition of bridges in the region. A distressed bridge (Di) is a condition rating used by the Oregon Department of Transportation (ODOT) indicating that a bridge has been identified as having a structural or other deficiency, while a deficient bridge (De) is a federal performance measure used for non-ODOT bridges; the ratings do not imply that a bridge is unsafe (ODOT, 2012, 2013). In this region, 14% of bridges are distressed and/or deficient.

Table 2-438. Bridge Inventory for Region 7

	State Owned			County Owned			City Owned			Other Owned			Area Total			Historic Covered
	Di	ST	%D*	De	ST	%D	De	ST	%D	De	ST	%D	D	T	%D	
Oregon	610	2,718	22%	633	3,420	19%	160	614	26%	40	115	35%	1,443	6,769	21%	334
Region 7	36	212	17%	33	237	14%	3	33	9%	0	4	0%	72	499	14%	15
Baker	11	81	14%	10	79	13%	0	8	0%	0	0	-	21	165	13%	3
Grant	4	45	8%	10	38	26%	2	9	22%	0	1	0%	16	96	17%	1
Union	15	69	19%	5	61	8%	1	6	17%	0	1	0%	21	146	14%	6
Wallowa	6	17	29%	8	59	14%	0	10	0%	0	2	0%	14	92	15%	5

Note: Di = ODOT bridges Identified as distressed with structural or other deficiencies; De = Non-ODOT bridge Identified with a structural deficiency or as functionally obsolete; D = Total od Di and De bridges; ST = Jurisdictional Subtotal; %D = Percent distressed (ODOT) and/or deficient bridges; * = ODOT bridge classifications overlap and total (ST) is not used to calculate percent distressed, calculation for ODOT distressed bridges accounts for this overlap.

Source: ODOT (2012, 2013)

Railroads

Railroads that run through Region 7 support cargo and trade flows. The region's major (Class I) freight rail providers are the Union Pacific (UP) and the Burlington Northern-Santa Fe (BNSF) railroads. The Class I rail line follows the Interstate 84 corridor and another non-class I rail line provides access to the city of Enterprise (Wallowa County). There are no active rail lines in Grant County. There is one rail yard in the region (in La Grande, Union County) operated by UP (Cambridge Systematics, 2014).

There is no passenger rail available in Region 7.

Oregon's rail system is critical to the state's economy, energy, and food systems. Rail systems export lumber and wood products, pulp and paper, and other goods produced in Oregon and products from other states that are shipped to and through Oregon by rail (Cambridge Systematics, 2014).

Rails are sensitive to icing from winter storms that can occur in Region 7. Disruptions in the rail system can result economic losses for the region. The potential for harm from rail accidents can also have serious implications for local communities, particularly if hazardous materials are involved.

Airports

There are no commercial airports in the region, however. There are several general aviation public airports including the Baker City and La Grande airport.

In the event of a natural disaster, public and private airports are important staging areas for emergency response activities. Public airport closures will impact the region's tourism industries, as well as the ability for people to leave the region by air. Businesses relying on airfreight may also be impacted by airport closures.

Table 2-439. Public and Private Airports in Region 7

	Number of Airports by FAA Designation				
	Public Airport	**Private Airport**	**Public Helipad**	**Private Helipad**	**Total**
Region 7	7	23	0	5	35
Baker	1	5	0	5	11
Grant	2	9	0	0	11
Union	1	3	0	0	4
Wallowa	3	6	0	0	9

Source: FAA Airport Master Record (Form 5010), 2014

Energy

Electricity

The region is served by several investor-owned, public, cooperative and municipal utilities. The Bonneville Power Administration is the area's wholesale electricity distributor. Pacific Power and Light (Pacific Power) is the primary investor-owned utility company serving Wallowa County. Idaho Power Company serves portions of Baker County. The region's electric cooperatives include: Oregon Trail Electric Cooperative (Baker, Grant, and Union), Central Electric

Cooperative (Grant), Columbia Power Cooperative (Grant), and the Umatilla Electric Cooperative (Union). The Oregon Trail Electric Cooperative serves the major population centers in the region.

Table 2-440 lists electric power generating facilities in Region 7. The region has a total of five power-generating facilities: three are hydroelectric power facilities; one is a wind power facility; and one is categorized as "other" (biomass). In total the power generating facilities have the ability to produce up to 1,277 megawatts (MW) of electricity.

Table 2-440. Power Plants in Region 7

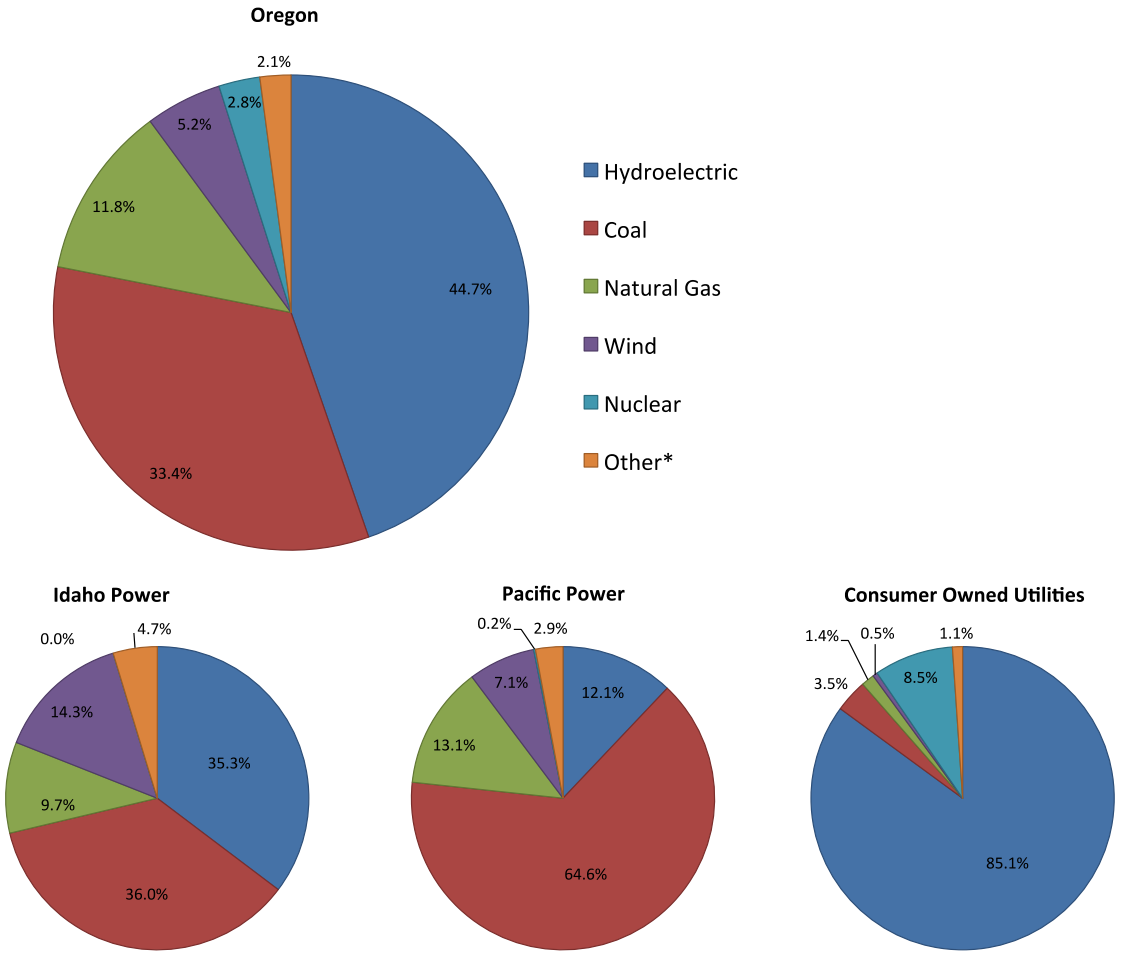
	Hydro-electric	Natural Gas	Wind	Coal	Other*	Total
Region 7	3	0	1	0	1	5
Baker	2	0	0	0	0	2
Grant	0	0	0	0	1	1
Union	0	0	1	0	0	1
Wallowa	1	0	0	0	0	1
Energy Production (MW)	1,166	0	101	0	10	1,277

*"Other" includes biomass, geothermal, landfill gas, solar, petroleum, and waste.

Source: Army Corps of Engineers; Biomass Power Association; Calpine Corporation; Eugene Water and Electric Board; Iberdola Renewables; Idaho Power Company; Klamath Energy LLC; Oregon Department of Energy; Owyhee Irrigation District; Form 10K Annual Report (2013), PacifiCorps; Form 10K Annual Report (2013), Portland General Electric; U.S. Geothermal, Inc.

Oregon has a diverse energy portfolio (Figure 2-204) (Oregon Department of Energy, n.d.b). Consumer Owned Utilities provide for approximately 30% of the states electricity consumption (largely through Bonneville Power Administrations electric generation facilities) while Pacific Power provides about 28% of the states electricity need.

Figure 2-204. Oregon Energy Portfolio



Note: 3.9% of Oregon's electricity needs are met through Electric Service Suppliers that are not required to provide descriptions of their power sources to the State of Oregon.

*Other includes biomass, geothermal, landfill gas, solar, petroleum, and waste.

Source: Oregon Department of Energy, 2014.

Pacific Power generates its power supply from a variety of sources including sites in Oregon and other western states. Transmission lines from the Rocky Mountain Region provide additional energy sources. Natural hazrd events can created additional stresses to energy infrastructure that may lead to system damage or disruption in service. The redundancies and diversity in Pacific Power's energy generation portfolio and pipeline systems adds to the region's resilience in the face of power system damage or service disruption.

Hydropower

Major dams in the region are located on the Snake River (Brownlee, Oxbow, and Hells Canyon). Dam failures can occur at any time. Most result in minor damage to structures and pose little or no risk to life safety. However, the potential for severe damage and fatalities does exist (major dam failures have occurred most recently near Hermiston, 2005, and Klamath Lake, 2006)

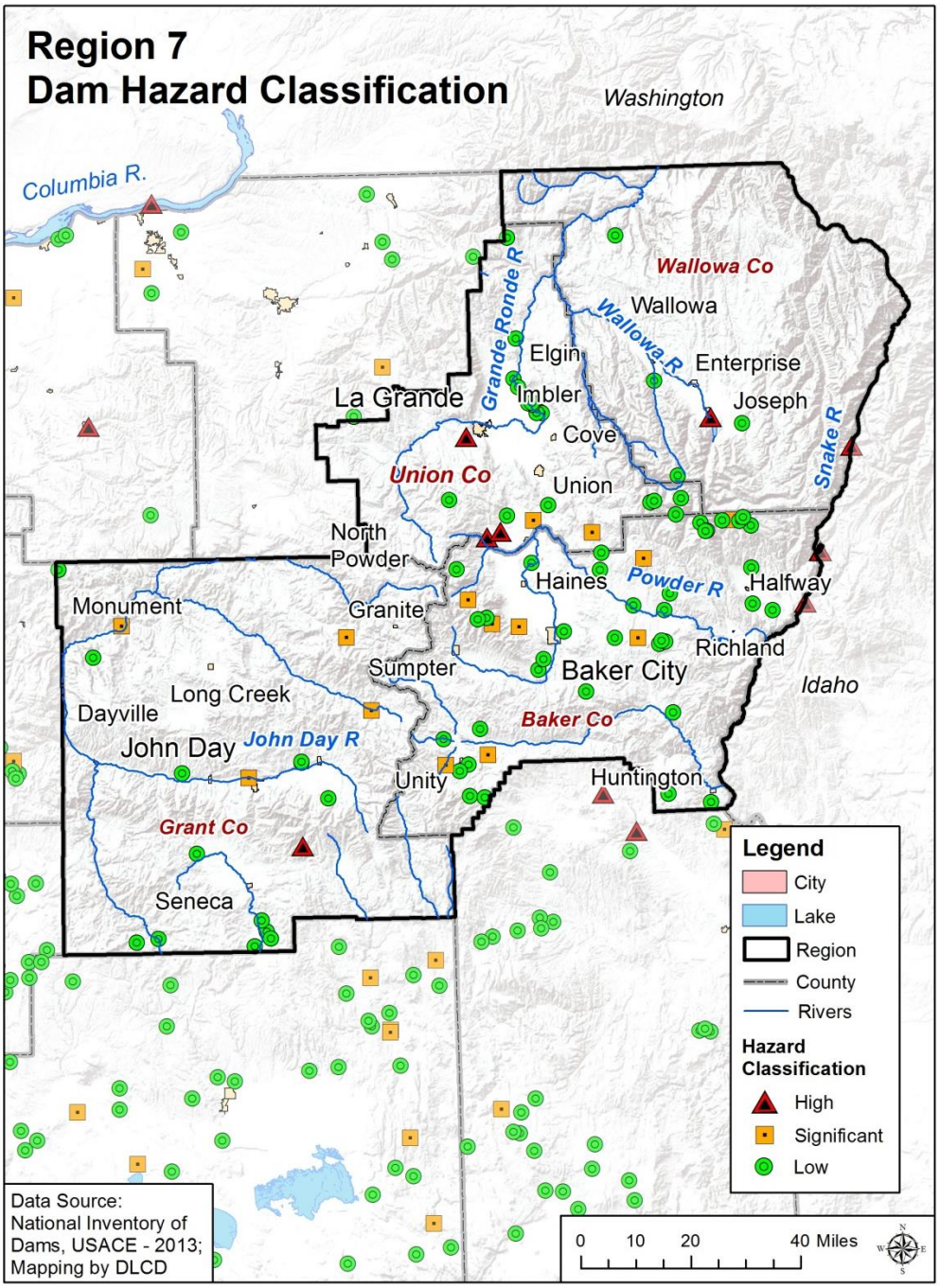
(Association of Dam Safety Officials, n.d.). The Oregon Water Resources Department maintains an inventory of all large dams located in Oregon (using the National Inventory of Dams (NID) threat potential methodology). The majority of dams in the region are located in Baker County (70). There are 11 High Threat Potential dams and 10 Significant Threat Potential dams in the region.

Table 2-441. Threat Potential of Dams in Region 7

	Threat Potential			Total Dams
	High	Significant	Low	
Region 7	11	10	117	138
Baker	5	8	57	70
Grant	1	0	27	28
Union	3	2	26	31
Wallowa	2	0	7	9

Source: Oregon Water Resources Department, Dam Inventory Query, 2014

Figure 2-205. Region 7 Dam Hazard Classification

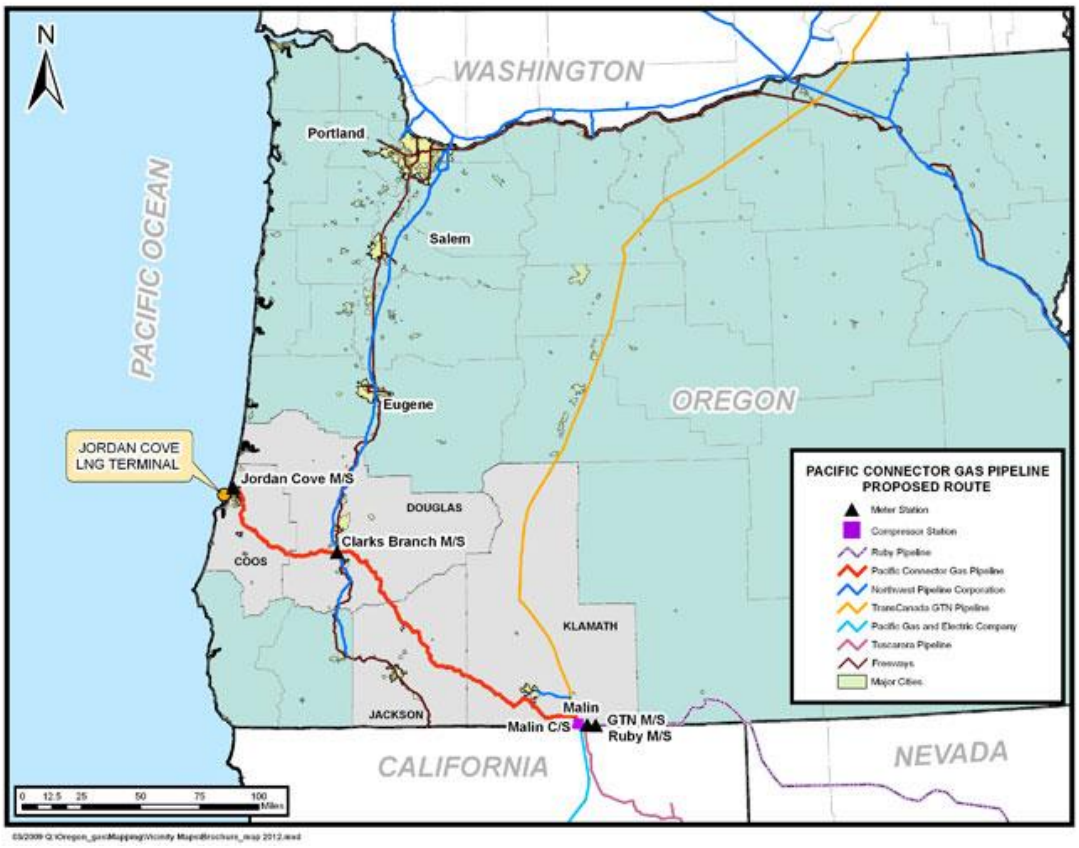


Source: National Inventory of Dams, USACE, 2013

Natural Gas

Although natural gas does not provide the most energy to the region, it does contribute a significant amount of energy to the region's energy portfolio. Liquefied Natural Gas (LNG) is transported via pipelines throughout the United States. **Figure 2-206** shows the Northwest Pipeline, which runs through Union and Baker Counties (in blue) (*Northwest Pipeline* Retrieved from http://www.northwest.williams.com/NWP_Portal/extLoc.action?Loc=FilesNorthwestother&File=pipelineInfo.html). LNG pipelines, like other buried pipe infrastructure are vulnerable to earthquakes and can cause danger to human life and safety, as well as environmental impacts in the case of a spill.

Figure 2-206. Liquefied Natural Gas Pipelines in Region 7



Source: Williams Corporation

Utility Lifelines

Northeast Oregon is an important throughway for oil and gas pipelines and electricity transmission lines, connecting Oregon to Idaho and Washington. The infrastructure associated with power generation and transmission plays a critical role in supporting the regional economy. These lines may be vulnerable to severe, but infrequent natural hazards, such as earthquakes.

Region 7 primarily receives oil and gas from Alaska by way of the Puget Sound through pipelines and tankers. The region is at the southern end of this pipeline network. Oil and gas are supplied by Northern California from a separate network. The electric, oil, and gas lifelines that run through the County are both municipally and privately owned (Loy et al., 1976).

The network of electricity transmission lines running through Region 7 is operated primarily by Pacific Power and regional electrical cooperatives (and supplied by the Idaho Power Company and Bonneville Power Administration) and primarily facilitates local energy production and distribution (Loy et al., 1976). Most of the natural gas Oregon uses originates in Alberta, Canada. The Williams Company owns the main natural gas transmission pipeline in northeastern Oregon.

Telecommunications

Telecommunications infrastructure includes television, telephone, broadband internet, radio, and amateur radio (Ham radio). Region 7 is part of the Eastern Oregon Operational Area under The Oregon State Emergency Alert System Plan (Oregon Office of Emergency Management (2013). There is a memorandum of understanding between these counties that facilitates the launching of emergency messages. Counties in these areas can launch emergency messages by contacting the Oregon Emergency Response System (OERS), which in turn creates emergency messages to communities statewide.

Beyond day to day operations, maintaining communications capabilities during disaster events and other emergency situations helps to keep citizens safe by keeping them informed of the situation's status, areas to avoid, and other procedural information. Additionally, responders depend on telecommunications infrastructure to be routed to sites where they are needed.

Television

Television serves as a major provider for local, regional, and national news and weather information and can play a vital role in emergency communications. The Oregon State Emergency Alert System Plan does not identify a local primary station for emergency messages. However, messages are provided via the three state primary networks: Oregon Public Broadcasting (Portland), KOBI-TV (Medford), and KWAX-FM (Eugene).

Telephone and Broadband

Landline telephone, mobile wireless telephone, and broadband service providers serve Region 7. Broadband technology (including mobile wireless) is provided in the region via five primary technologies: cable, digital subscriber line (DSL), fiber, fixed wireless, and mobile wireless. Internet service is readily available throughout most parts the region with a smaller number of providers and service types available in the more remote parts of the region (NTIA, n.d.). Landline telephones are common throughout the region; however, residents in rural areas rely more heavily upon the service since they may not have cellular reception outside of major transportation corridors.

Wireless providers sometimes offer free emergency mobile phones to those impacted by disasters, which can aid in communication when landlines and broadband service are unavailable.

Radio

Radio is readily available to those who live within Region 7 and can be accessed through car radios, emergency radios, and home sound systems. Radio is a major communication tool for weather and emergency messages. Due to the remote nature and sparse population there lacks a station that would serve the Eastern Oregon Operational Area. Radio transmitters for The Eastern Oregon Operational Area include:

Local Primary Stations:

- KCMB-FM 104.7 MHZ (Baker City, Baker, Morrow, Umatilla, and Union Counties)
- KJDY-FM, 94.5 MHZ (John Day, Grant County)
- WVR-FM, 92.1 MHZ (Enterprise, Wallowa County)

State Primary Stations:

- KOBK-FM, 104.7 MHZ, Baker City (OPB Radio Network, also monitors KBOI-AM 690, Boise, PEP station)
- KOJD-FM, 89.7 MHZ, John Day (OPB Radio Network)
- KTVR-FM, 90.3 MHZ, La Grande (OPB Radio Network)
- KETP-FM, 88.7 MHZ, Enterprise (OPB Radio Network)

Ham Radio

Amateur Radio, or Ham Radio, is a service provided by licensed Amateur Radio operators (hams) and is considered to be an alternate means of communicating when normal systems are down or at capacity. Emergency communications is a priority for the Amateur Radio Relay League (ARRL). ARES Districts 3 (Union, Wallowa) and 6 (Baker, Grant) provide service to Region 7. Radio Amateur Civil Emergency Services (RACES) is a special phase of amateur radio recognized by FEMA that provides radio communications for civil preparedness purposes including natural disasters (Oregon Office of Emergency Management, n.d.). Union County is the only county in the region with an active Ham emergency station, calls for Region 7 include (American Relay Radio League Oregon Chapter, n.d., www.arrloregon.org):

- Baker County: Vacant
- Grant County: Vacant
- Union County: KE7QYU
- Wallowa County: Vacant

Water

Water infrastructure includes drinking water, stormwater, and wastewater systems. All of these systems possess some level of vulnerability to natural hazards that can have repercussions on human health, ecosystems, and industry.

Drinking Water

In Region 7 municipal drinking water supply is obtained from both surface and ground sources. In Wallowa and Grant Counties, the majority of municipal drinking water is from wells drawing from the aquifer with cities having water rights for surface water sources as back-up sources in late summer. In Grant County, cities draw drinking water equally from a combination of surface and ground sources. Baker City draws its water from mountain springs and is unique in the state because it uses only ultraviolet water treatment without any filtration. Other cities in Baker County depend primarily on groundwater wells for municipal drinking water. Rural residences also obtain water primarily from both surface sources and groundwater wells.

Region 7 is impacted by several threats to water quality and quantity. Low levels of snowpack can lead to severe shortages in a region that is already subject to annual shortages. Low water levels in surface sources can cause stagnation, flow levels and increased mineralization the further downstream a surface water source flows, which negatively impacts water quality. Effluent runoff from feedlots is a lower priority concern for the region's water quality however other agricultural products such as pesticides and herbicides leeching nitrates into ground and surface water sources is a concern for water quality. High water temperatures are a concern in the region because of impacts to wildlife as well as increases in bacteria levels that can be associated with high surface water temperatures. Riparian improvement projects are being implemented in Grant County to combat the issue of high surface water temperatures. Other concerns for water quality include industrial contamination, diesel spills, chromium, arsenic, iron and sulfur levels.

Surface sources for drinking water are vulnerable to pollutants caused by non-point sources and natural hazards. Non-point source pollution is a major threat to surface water quality, and may include stormwater runoff from roadways, agricultural operations, timber harvest, erosion and sedimentation. Landslides, flood events, and earthquakes and resulting liquefaction can cause increased erosion and sedimentation in waterways

Underground water supplies and aging or outdated infrastructure—such as reservoirs, treatment facilities, and pump stations—can be severed during a seismic event. Rigid materials such as cast iron may snap under the pressure of liquefaction. More flexible materials such as polyvinyl chloride (PVC) and ductile iron may pull apart at joints under the same stresses. These types of infrastructure damages could result in a loss of water pressure in municipal water supply systems, thus limiting access to potable water. This can lead to unsanitary conditions that may threaten human health. Lack of water can also impact industry, such as the manufacturing sector. Moreover, if transportation infrastructure is impacted by a disaster event, repairs to water infrastructure will be delayed.

Stormwater and Wastewater

In urbanized areas severe precipitation events may cause urban flooding, leading to stormwater runoff– and this can become a serious issue. Stormwater is one non-point source of water pollution and may impact drinking water quality. Other environmental impacts of stormwater runoff include increased temperatures in surface water quality, adversely affecting habitat health, flooding, and erosion due to the fast moving large volumes of water entering surface waterways from storm sewer systems.

Stormwater can also impact water infrastructure. Leaves and other debris can be carried into storm drains and pipes, which can clog stormwater systems. In areas where stormwater systems

are combined with wastewater systems, a.k.a. combined sewers, flooding events can lead to combined sewer overflows (CSOs). CSOs present a heightened health threat as sewage can flood urban areas and waterways. Underground stormwater and wastewater pipes are also vulnerable to damage by seismic events.

In Region 7, most municipal building codes and stormwater management plans (city and county) emphasize use of centralized storm sewer systems to manage stormwater. Low impact development (LID) mitigation strategies can alleviate or lighten the burden to a jurisdiction's storm sewer system by allowing water to percolate through soil onsite or detaining water so water enters the storm sewer system at lower volumes, at lower speed, and at lower temperatures. In Region 7 only Baker City refers to LID techniques in its municipal code, where new surface parking areas are required to provide LID for stormwater runoff. Requiring decentralized LID stormwater management strategies could help reduce the burden of new development on storm sewer systems, and increase a community's resilience to many types of hazard events.

Infrastructure Trends and Issues

Physical infrastructure is critical for every day operations and is essential following a disaster. Lack, or poor condition, of infrastructure can negatively affect a community's ability to cope, respond and recover from a hazard event. Diversity, redundancy and consistent maintenance in infrastructure systems help to create system resiliency (Meadows, 2008).

Damage or service interruption to roads, bridges, rail systems andports can have devastating effects the region's economy. Hazards such as flooding and winter weather can close the highways that connect communities in Region 7 to the rest of the state. Fourteen percent of all bridges in Northeast Oregon are distressed or deficient. Railroads that run through Region 7 support cargo and trade flows, and are vulnerable to icy conditions.

The infrastructure associated with power generation and transmission plays a critical role in supporting the regional economy and is vulnerable to severe, but infrequent, natural hazards. There are five power-generating facilities located in this region: three hydroelectric, one wind, and one biomass facility. The area is the location of three large dams and hydroelectric projects on the Snake River. LNG is transported through the region via the Northwest Pipeline that runs through Union and Baker Counties.

Decentralization and redundancy in the region's telecommunication systems can help boost the area's ability to communicate before, during, and after a disaster event. It is important to note that broadband and mobile telephone services may not cover rural areas of the region that are distant from Interstate 84. This may present a communication challenge in the wake of a hazard event. Encouraging residents to keep AM/FM radios available for emergency situations could help increase the capacity for communicating important messages throughout the region.

Water systems in the region are particularly vulnerable to hazard events because they tend to be older, centralized and lacki system redundancies. Because most drinking water is sourced from surface water or wells, the region is at risk of high levels of pollutants entering waterways via stormwater runoff or Combined Sewer Overflows (CSO) during high water events. Older, centralized infrastructure in storm and wastewater infrastructure creates vulnerability in the system during flood events. Baker City if the only community Northeast Oregon that refers to Low Impact Development (LID) stormwater management practices in their building code pertaining to new surface parking.

Built Environment

Requirement: 44 CFR §201.4(d): The Plan must be reviewed and revised to reflect changes in development…

Development Patterns

Balancing growth with hazard mitigation is key to planning resilient communities. Therefore, understanding where development occurs and the vulnerabilities of the region's building stock is integral to developing mitigation efforts that move people and property out of harm's way. Eliminating or limiting development in hazard prone areas can reduce exposure to hazards, and potential losses and damages.

Since 1973, Oregon has maintained a strong statewide program for land use planning. The foundation of Oregon's program is 19 land use goals that "help communities and citizens plan for, protect and improve the built and natural systems." These goals are achieved through local comprehensive planning. The intent of Goal 7, Areas Subject to Natural Hazards, is to protect people and property from natural hazards (DLCD website: http://www.oregon.gov/).

Settlement Patterns

Statewide, Oregon counties added residents from 2000 to 2010, but several northeast counties lost population over the decade. Baker, Grant, and Wallowa Counties all decreased in population over the 10-year period, a combined population decrease of over 1,300 people. Union County increased by 5% and was the only county to experience growth in both urban and rural areas; however, its rate of growth was less than half of the state as a whole. At the city level, La Grande grew the most (+755). The region's population is clustered around the Interstate 84 corridor and the cities of Baker City, La Grande, John Day, and Enterprise.

Table 2-442. Urban and Rural Populations in Region 7

	Urban			Rural		
	2000	2010	Percent Change	2000	2010	Percent Change
Oregon	2,694,144	3,104,382	15.2%	727,255	726,692	-0.1%
Region 7	23,883	24,427	2.3%	32,549	31,908	-2.0%
Baker	9,605	9,518	-0.9%	7,136	6,616	-7.3%
Grant	0	0	--	7,935	7,445	-6.2%
Union	14,278	14,909	4.4%	10,252	10,839	5.7%
Wallowa	0	0	--	7,226	7,008	-3.0%

Source: U.S. Census Bureau. 2000 Decennial Census, Table P002 and 2010 Decennial Census, Table P2

Note: The U.S. Census Bureau defines "urban" as either an "urbanized area" of 50,000 or more people, or an "urban cluster" of at least 2,500 people (but less than 50,000). Grant and Wallowa Counties do not meet either definition, therefore all of their populations are considered rural even though the counties include incorporated cities.

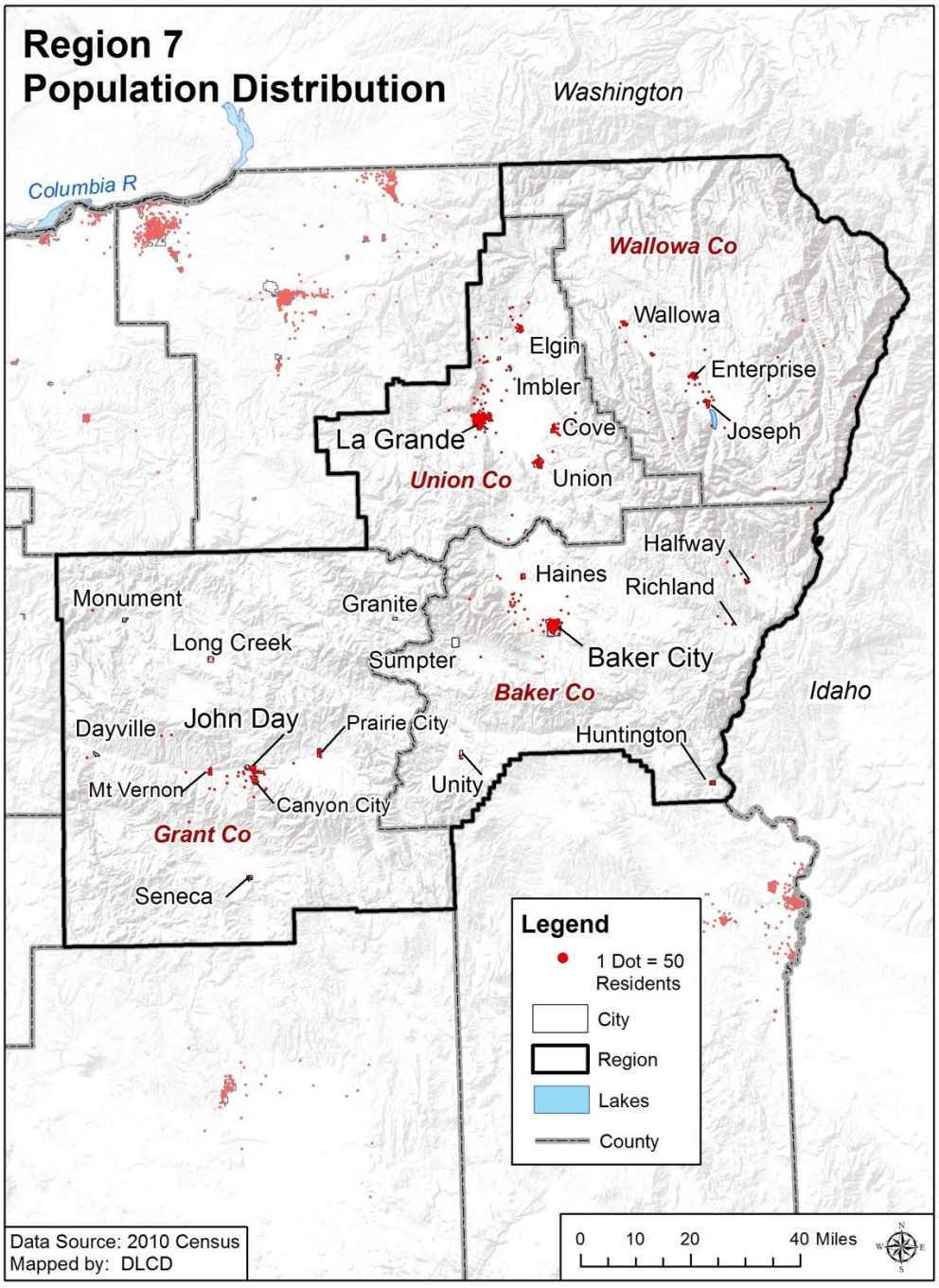
Table 2-443. Urban and Rural Housing Units in Region 7

	Urban			Rural		
	2000	2010	Percent Change	2000	2010	Percent Change
Oregon	1,131,574	1,328,268	17.4%	321,135	347,294	8.1%
Region 7	10,552	11,039	4.6%	16,357	17,728	8.4%
Baker	4,342	4,498	3.6%	4,060	4,328	6.6%
Grant	0	0	--	4,004	4,344	8.5%
Union	6,210	6,541	5.3%	4,393	4,948	12.6%
Wallowa	0	0	--	3,900	4,108	5.3%

Note: The U.S. Census Bureau defines "urban" as either an "urbanized area" of 50,000 or more people, or an "urban cluster" of at least 2,500 people (but less than 50,000). Grant and Wallowa Counties do not meet either definition, therefore all of their populations are considered rural even though the counties include incorporated cities.

Source: U.S. Census Bureau. 2000 Decennial Census, Table H002 and 2010 Decennial Census, Table H2

Figure 2-207. Region 7 Population Distribution



Source: US Census, 2012

Land Use and Development Patterns

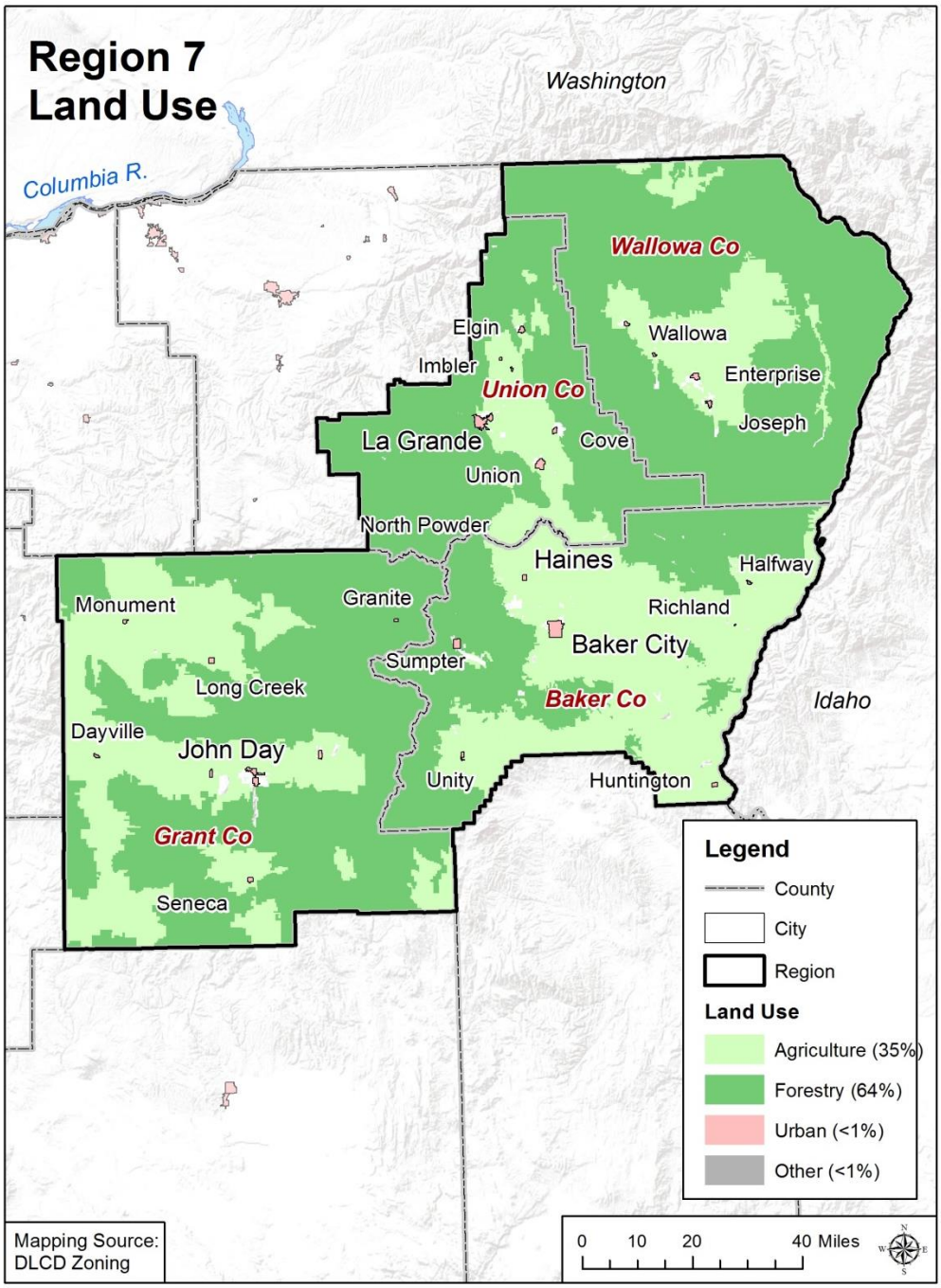
Private land generally has developed more slowly in Eastern Oregon than in Western Oregon between 1974 and 2009. State and local programs have been successful in limiting rural residential and urban development and maintaining large parcel sizes. Demand for large scale development in this part of the state has historically been very low. Land ownership is almost completely split between federal (60%) and private (39+%) with less than 1% shared between state and local government.

To the extent it has occurred, development has generally been located along existing transportation corridors. Nearly half of the people in the Northeast Region reside in the cities of Baker City, John Day, La Grande, and Enterprise, and most unincorporated development in this Region is located along the I-84 corridor.

As with other regions in the state this area has seen an upswing in building permits since the spring of 2012, although modest (U.S. Census Bureau, 2010). Any regional rate of growth is expected to be small. The Office of Economic Analysis projects by 2040 that the Northeast Region's population will increase less than 1% over a 30-year period.

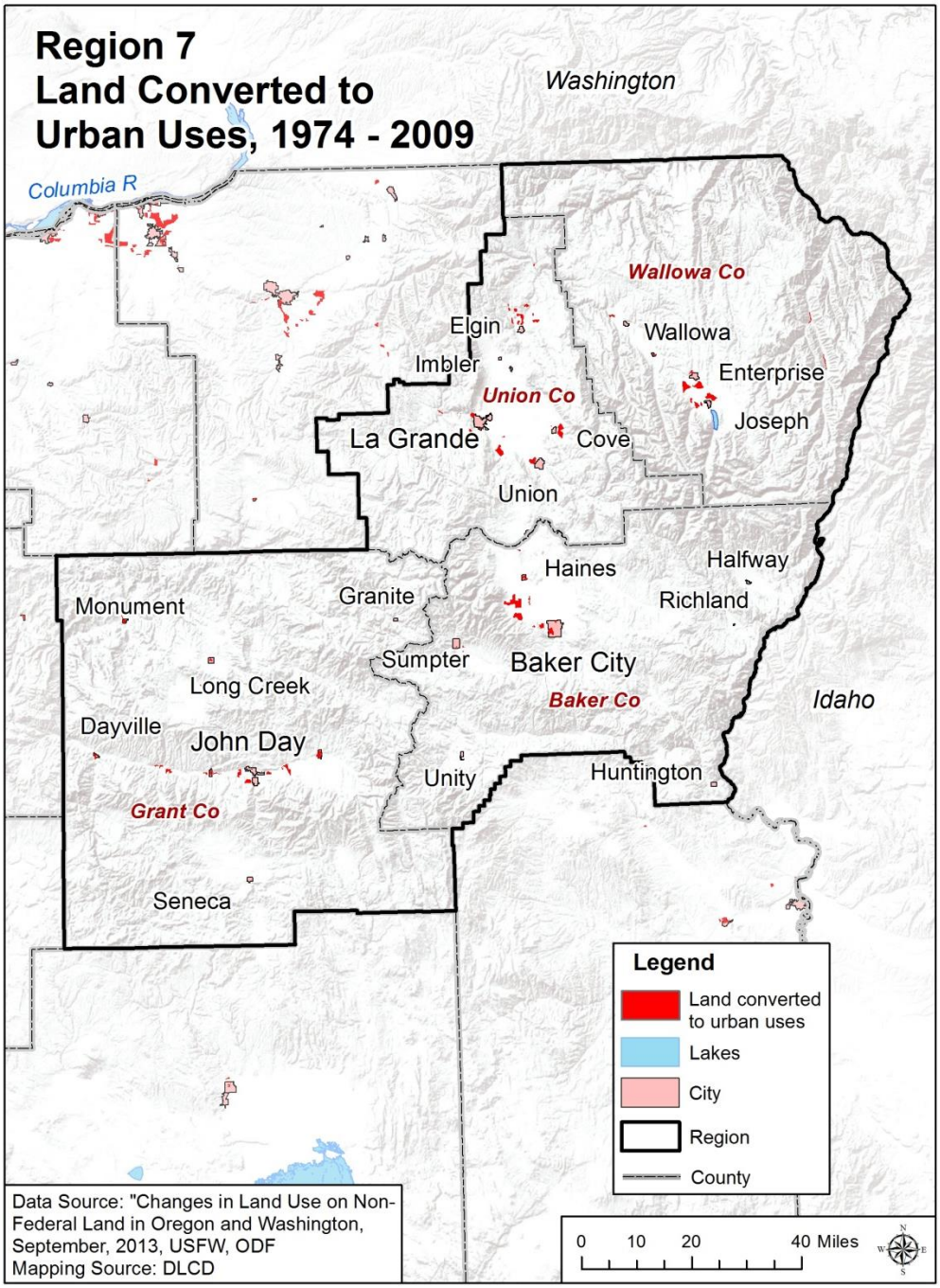
All the cities within the four counties of the region have acknowledged comprehensive land use plans that are periodically reviewed and updated. In 2013, the City of La Grande's Urban Growth Boundary (UGB) was extended, adding over 250 acres of vacant industrial land to the city and county's available land inventory.

Figure 2-208. Region 7 Land Use



Source: Department of Land Conservation and Development, 2014

Figure 2-209. Region 7 Land Converted to Urban Uses, 1974–2009



Source: Land Use Change on Non-Federal Land in Oregon and Washington, September, 2013, USFS, ODF

Housing

In addition to location, the character of the housing stock can also affect the level of risk a community faces from natural hazards. Almost 71% of the region's housing stock is single-family homes. The region's share of multi-family units is less than half that of the state, and almost two thirds of those units are in Union County. The region's has two times the percentage of mobile homes as the state; comprising one-quarter of all homes in Grant County. This is important because, in natural hazard events, such as earthquakes and floods, moveable structures like mobile homes are more likely to shift on their foundations and create hazardous conditions for occupants (California Governor's Office of Emergency Services, 1997).

Table 2-444. Housing Profile for Region 7, 2012

	Total Housing Units	Single Family		Multi-Family		Mobile Homes	
		Number	Percent of Total	Number	Percent of Total	Number	Percent of Total
Oregon	1,673,593	1,140,319	68.1%	460,852	27.5%	139,768	8.4%
Region 7	28,698	20,361	70.9%	3,668	12.8%	4,637	16.2%
Baker	8,826	6,509	73.7%	1,023	11.6%	1,274	14.4%
Grant	4,327	3,079	71.2%	200	4.6%	1,048	24.2%
Union	11,444	7,618	66.6%	2,104	18.4%	1,710	14.9%
Wallowa	4,101	3,155	76.9%	341	8.3%	605	14.8%

Source: U.S. Census Bureau. 2008-2012. American Community Survey 5-Year Estimates, Table B25024

Aside from location and type of housing, the year structures were built has implications. Seismic building standards were codified in Oregon building code starting in 1974. More rigorous building code standards were passed in 1993 that accounted for the Cascadia earthquake fault (State of Oregon Building Codes Division, 2012). Therefore, homes built before 1993 are more vulnerable to seismic events. Also in the 1970s, FEMA began assisting communities with floodplain mapping as a response to administer the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973. Upon receipt of floodplain maps, communities started to develop floodplain management ordinances to protect people and property from flood loss and damage (see tables below for more information on floodplain maps). Regionally about one half of the housing stock was built prior to 1970, before the implementation of floodplain management ordinances. About 80% of the housing stock was built before 1990 and the codification of seismic building standards.

Note: The percentages listed above do not reflect the number of structures that are built within special flood hazard areas, or that are at risk of seismic damage.

Table 2-445. Age of Housing Stock in Region 7, 2012

	Total Housing Units	Pre 1970		1970 to 1989		1990 or later	
		Number	Percent of Total	Number	Percent of Total	Number	Percent of Total
Oregon	1,673,593	609,062	36.4%	518,569	31.0%	545,962	32.6%
Region 7	28,698	14,574	50.8%	8,691	30.3%	5,433	18.9%
Baker	8,826	4,987	56.5%	2,150	24.4%	1,689	19.1%
Grant	4,327	2,249	52.0%	1,443	33.3%	635	14.7%
Union	11,444	5,326	46.5%	3,913	34.2%	2,205	19.3%
Wallowa	4,101	2,012	49.1%	1,185	28.9%	904	22.0%

Source: U.S. Census Bureau. 2008-2012. American Community Survey 5-Year Estimates, Table B25034

The National Flood Insurance Program's (NFIP's) Flood Insurance Rate Maps (FIRMs) delineate flood-prone areas. They are used to assess flood insurance premiums and to regulate construction so that in the event of a flood, damage minimized. **Table 2-446** shows the initial and current FIRM effective dates for Region 7 communities. For more information about the flood hazard, NFIP, and FIRMs, please refer to the State Risk Assessment, **Flood** section.

Table 2-446. Community Flood Map History in Region 7

	Initial FIRM	Current FIRM
Baker County	Feb. 28, 1978	June 3, 1988
Baker City	Apr.17, 1984	June 3, 1988
Haines	June 3, 1988	June 3, 1988
Halfway	Sep. 24, 1984	June 3, 1988
Huntington	Sep 24, 1984	June 3, 1988
Sumpter	Sep 24, 1984	June 3, 1988
Grant County	Feb. 15, 1979	May 18, 1982
Canyon City	Sep 18, 1987	Sep 18, 1987
Dayville	Sep 24, 1984	Sep 24, 1984 (M)
John Day	Sep 15, 1977	Feb. 23, 1982
Long Creek	Sep 24, 1984	Sep 24, 1984 (M)
Monument	Sep 24, 1984	Sep 24, 1984 (M)
Mt. Vernon	Sep 18, 1987	Sep 18, 1987
Prarie City	Feb. 17, 1988	Feb. 17, 1988
Seneca	Sep 24, 1984	Sep 24, 1984 (M)
Spray	Aug. 16, 1988	Aug. 16, 1988 (M)
Union County	May 15, 1980	Apr. 3, 1996
Elgin	Nov. 15, 1978	Nov. 15, 1978
Island City	Nov. 15, 1978	Sep 30, 1987
La Grande	Sep 30, 1980	Apr.3, 1996
North Powder	Sep 29, 1978	Sep 29, 1987
Summerville	Jan. 15, 1980	Jan. 15, 1980 (M)
Union City	Dec.15, 1978	Dec. 15, 1978
Wallowa County	June 28, 1977	Feb. 17, 1988
Enterprise	Jan. 23, 1976	Feb. 17, 1988
Joseph	Dec. 5, 1975	Feb. 17, 1988
Lostine	Nov. 8, 1975	Feb. 17, 1988
Wallowa City	April 23, 1976	Feb. 17, 1988

(M) = no elevation determined; all Zone A, C and X.

Source: Federal Emergency Management Agency, Community Status Book Report

State-Owned/Leased and Critical and Essential Facilities

In 2014 the Department of Geology and Mineral Industries updated the 2012 Oregon NHMP inventory and analysis of State-owned/leased facilities and critical/essential facilities. Results from this report relative to Region 7 can be found in **Table 2-447**. The region contains 1.9% of the total value of State-owned/leased critical/essential facilities.

Table 2-447. Value of State-Owned/Leased Critical/Essential Facilities in Region 7

	Total Property Value (State Facilities)	Percent State Total
Oregon	$7,339,087,023	100%
Region 7	$139,508,917	1.9%
Baker	$35,831,967	0.5%
Grant	$17,494,768	0.2%
Union	$71,475,427	1.0%
Wallowa	$14,706,756	0.2%

Source: DOGAMI

Built Environment Trends and Issues

The trends within the built environment are critical to understanding the degree to which urban form affects disaster risk. Region 7 is largely a rural county with urban development focused along Interstate 84 and around the population centers of Baker City, Enterprise, John Day, and La Grande. Union County has the only growing urban and rural populations in the region. All counties in the region have higher percentages of mobiles compared to statewide numbers. Notably, about one quarter of all housing units in Grant County are mobile structures. Almost half the homes were built before 1970 and floodplain management standards, and 80% will built before 1990 and current seismic building standards. Because none of the region's FIRMs have been modernized or updated the area's maps are not as up to date as in other parts of the state. The region's share of state owned facilities are mostly within Union County.

2.3.7.3 Hazards and Vulnerability

Drought

Characteristics

Drought is a common occurrence in the northeastern portion of the state. Every county in this region has been impacted by drought on several occasions during the last twenty years. Winter snowpack conditions and spring rains combine to determine the water available in this region for meeting a variety of water needs. Extended drought conditions within this region can result in significant losses for agriculture, increased fire danger, and severely impacted tourism due to a lack of water in streams, lakes, and reservoirs.

Historic Drought Events

Table 2-448. Historic Droughts in Region 7

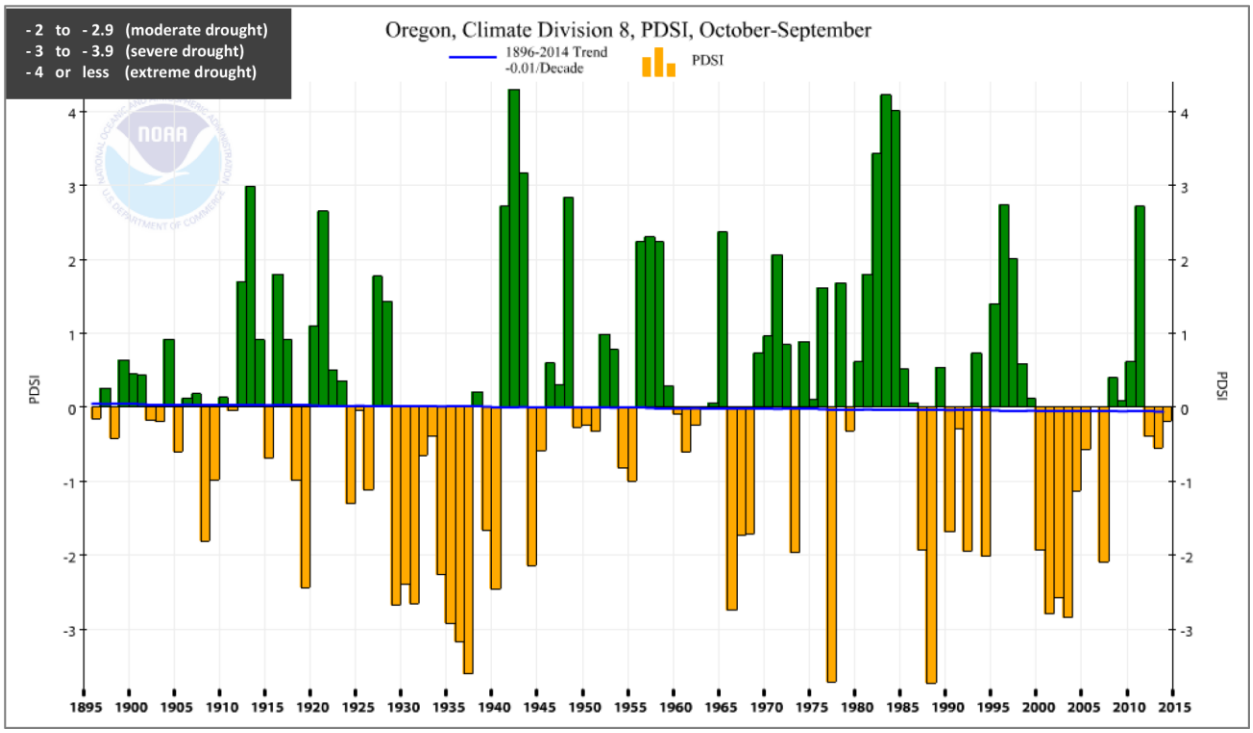
Year	Location	Description
1938-1939	statewide	the 1920s and 1930s, known more commonly as the Dust Bowl, were a period of prolonged mostly drier than normal conditions across much of the state and country
1977	N & S central Oregon; eastern Oregon	a severe drought for northeast Oregon
1994	Regions 4,5,6,7 8	in 1994, Governor's drought declaration covered 11 counties located within regions 4, 5, 6, 7, and 8
2002	southern and eastern Oregon	2001 drought declarations remain in effect for all counties, including Region 7's Baker, Union, and Wallowa Counties; Governor adds Grant County in 2002, along with five additional counties, bringing statewide total to 23 counties under a drought emergency.
2003	southern and eastern Oregon	Grant County 2002 declaration remains in effect through June 2003; Governor issues new declarations for Baker, Union, and Wallowa Counties, which are in effect through December 2003
2004	Region 5, 6, 7, and 8	Baker County receives Governor-declared drought emergency on June 2004, along with three other counties in neighboring regions
2005	Regions 5, 6, and 7; 13 counties affected	Baker and Wallowa County receive a Governor drought declaration; all Region 5 counties affected, and most of Region 6 affected
2007	Regions 6, 7,and 8	Grant, Baker, and Union Counties receive a Governor drought declaration; three other counties affected in neighboring regions
2013	Regions 5-8	Baker County receives a drought declaration, as well as four other counties in neighboring regions
2014	Regions 4,6, 7, and 8	Grant and Baker County receive drought declarations, including eight other counties in other regions

Source: Taylor, George and Raymond R Hatton (September 1999). The Oregon Weather Book: State of Extremes, and the Oregon Secretary of State's Archives Division. NOAA's Climate at a Glance. Western Regional Climate Center's Westwide Drought Tracker http://www.wrcc.dri.edu/wwdt. Personal Communication, Kathie Dello, Oregon Climate Service, Oregon State University.

Historic drought information can be obtained from the National Climatic Data Center, which provides historical climate data showing wet and dry conditions, using the Palmer Drought Severity Index (PDSI) that dates back to 1895. The Palmer Index is not the best indicator of water availability for Oregon as it does not account for snow or ice (delayed runoff), but it has the advantage of providing the most complete, long-term record. The following PDSI graph shows years where drought or dry conditions affected the north eastern area of Oregon (Climate Division 8).

Based on this index, 1936, 1937, 1977, and 1988 were severe drought years, while more than a dozen years in this record were moderate drought years.

Figure 2-210. Palmer Drought Severity Index for Region 7



Source: National Climatic Data Center,http://www.ncdc.noaa.gov/cag/

Probability and Vulnerability

As stated in the State Risk Assessment, **Section 2.2.2.4, Local and State Vulnerability Assessment Comparison**, different methods are used to assess risk at local and state levels. All methods employ history, probability, and vulnerability data to determine probability and vulnerability scores for each hazard. These scores identify high priority areas to which local and state governments can target mitigation actions. The challenge with these varied methodologies is that access to, interpretation of, and scale of the data is not necessarily the same at local and

state levels. As a result, local and state probability and vulnerability scores for a specific hazard in a specific community are not always the same. In some instances, probability and vulnerability scores are even quite different. The state recognizes these inconsistencies and has prioritized the analysis of local and state probability and vulnerability scores during the next plan update. A description of how the High (H), Moderate (M), and Low (L) scores in the local probability and vulnerability tables in this section were determined is provided in the State Risk Assessment **Section 2.2.2.2, Local Vulnerability Assessments**. The complete "OEM Hazard Analysis Methodology" is located in **Appendix 9.1.16**.

Probability

Local Assessment

Based on the OEM Hazard Analysis conducted by county emergency program managers the probability (High, Moderate, Low) that Region 7 will experience drought is depicted in **Table 2-449**. See the **State Risk Assessment** for background information on the OEM Hazard Analysis and scoring methodology.

Table 2-449. Local Probability Assessment of Drought in Region 7

	Baker	Grant	Wallowa	Union
Probability	H	H	H	H

Source: Oregon Office of Emergency Management, 2013 County Hazard Analysis Scores

State Assessment

Despite impressive achievements in the science of climatology, estimating drought probability and frequency continues to be difficult. This is because of the many variables that contribute to weather behavior, climate change and the absence of long historic databases.

Oregon has yet to undertake a comprehensive risk analysis for drought on a statewide basis, to determine probability or vulnerability for a given community. Considering historical statewide droughts and the number of drought declarations made in recent years, it is reasonable to assume that it is very likely that Region 7 will experience drought in the near future.

Vulnerability

Local Assessment

Based on the OEM Hazard Analysis conducted by county emergency program managers, the region's vulnerability (High, Moderate, Low) to drought is depicted in **Table 2-450**. See the **State Risk Assessment** for background information on the OEM Hazard Analysis and scoring methodology.

Table 2-450. Local Vulnerability Assessment of Drought in Region 7

	Baker	Grant	Wallowa	Union
Vulnerability	H	H	H	M

Source: Oregon Office of Emergency Management, 2013 County Hazard Analysis Scores

State Assessment

Oregon has not undertaken a comprehensive statewide analysis to identify which communities are most vulnerable to drought. However, based on a review of drought declarations issued by the Governor, Baker County could be considered one of the most vulnerable communities to drought and its related impacts. Since 1992, Baker County has been under an emergency drought declaration on eight different occasions: 1992, 2001 (remained in effect during 2002), 2003, 2004, 2005, 2007, and 2013. This is only second to Klamath County in Region 6.

Dust Storms

Characteristics

The characteristics of dust storms in Region 7 are well described in the State Risk Assessment, **Dust Storms** section. There is little about the dust storms in this region that differs from the general description, except to note that agricultural practices likely play less of a role here than in Region 5. There are six examples of significant dust storms in this region that impacted Baker and Union Counties (**Table 2-451**).

Historic Drought Events

Table 2-451. Historic Dust Storms in Region 7

Date	Location	Description
Aug. 1905	Wallowa County	a dust storm described as "without a doubt the worst ever known in the history of the county" was said to be "the natural result of the long dry spell… there having been no rain since June" (Wallowa County Chieftain [Enterprise, Oregon], August 31, 1905)
May 1997	Union County	"blowing dust caused a three-car accident on Highway 82 between Island City and Imbler" (https://www.ncdc.noaa.gov/stormevents/eventdetails.jsp?id=5597949)
Mar. 2004	Union County	"Sustained wind speeds between 20 and 30 mph kicked up blowing dust in the Grande Ronde Valley. Hunter Road and Booth Lane were closed due to low visibility caused by the dust storm." (https://www.ncdc.noaa.gov/stormevents/eventdetails.jsp?id=5388550)
Jan. 2008	Baker and Union Counties	ODOT closed the freeway's westbound lanes between Baker City and La Grande about noon because of blowing snow, dust, and debris that created near-zero visibility in the Ladd Canyon area east of La Grande, leading to motor vehicle crashes
Dec. 2012	Union County	"The winds kicked up a dust storm in the Grande Ronde Valley near La Grande that was moderated slightly by patches of snow." (Plus Media Solutions, December 21, 2012)
Sept. 2013	Baker County	Dust storm occurs in and near Baker City.

Source: Daily Mail, September 16, 2013; YouTube, Fredrik Anderson, September 12, 2013

Probability and Vulnerability

As stated in the State Risk Assessment, **Section 2.2.2.4, Local and State Vulnerability Assessment Comparison**, different methods are used to assess risk at local and state levels. All methods employ history, probability, and vulnerability data to determine probability and vulnerability scores for each hazard. These scores identify high priority areas to which local and state governments can target mitigation actions. The challenge with these varied methodologies is that access to, interpretation of, and scale of the data is not necessarily the same at local and state levels. As a result, local and state probability and vulnerability scores for a specific hazard in a specific community are not always the same. In some instances, probability and vulnerability scores are even quite different. The state recognizes these inconsistencies and has prioritized the analysis of local and state probability and vulnerability scores during the next plan update. A description of how the High (H), Moderate (M), and Low (L) scores in the local probability and vulnerability tables in this section were determined is provided in the State Risk

Assessment **Section 2.2.2.2, Local Vulnerability Assessments**. The complete "OEM Hazard Analysis Methodology" is located in **Appendix 9.1.16**.

Probability

Local Assessment

Based on the OEM Hazard Analysis conducted by county emergency program managers the probability (High, Moderate, Low) that Region 7 will experience dust storms is depicted in **Table 2-452**. In some cases, counties either did not rank a particular hazard or did not find it to be a significant consideration, noted with a dash (—). See the **State Risk Assessment** for background information on the OEM Hazard Analysis and scoring methodology.

Table 2-452. Local Probability Assessment of Dust Storms in Region 7

	Baker	Grant	Wallowa	Union
Probability	M	—	—	L

Source: Oregon Office of Emergency Management, 2013 County Hazard Analysis Scores

State Assessment

The fact that three of the six storms noted occurred within the most recent 10 years of record suggests that the probability of these events may be increasing in Region 7. This would benefit by more research.

Vulnerability

Local Assessment

Based on the OEM Hazard Analysis conducted by county emergency program managers, the region's vulnerability (High, Moderate, Low) to dust storms is depicted in **Table 2-453**. In some cases, counties either did not rank a particular hazard or did not find it to be a significant consideration, noted with a dash (—). See the **State Risk Assessment** for background information on the OEM Hazard Analysis and scoring methodology.

Table 2-453. Local Vulnerability Assessment of Dust Storms in Region 7

	Baker	Grant	Wallowa	Union
Vulnerability	M	—	—	L

Source: Oregon Office of Emergency Management, 2013 County Hazard Analysis Scores

State Assessment

Of all four counties in the region, Baker County is most vulnerable to dust storms. Union County is also vulnerable.

Poor visibility leading to motor vehicle crashes is the worst potential impact of these storms; often these crashes result in fatalities and major injuries. Other impacts include poor air quality, including dust infiltration of equipment and engines, loss of productive soil, and an increase in fine sediment loading of creeks and rivers.

Earthquake

Characteristics

The geographical position of this region makes it susceptible to earthquakes from two sources. The two sources are 1) shallow crustal events within the North America Plate, and 2) volcanic-earthquakes.

Region 7 contains high mountains and broad inter-mountain valleys. Although there is abundant evidence of faulting, seismic activity is low when compared with other areas of the state. Baker County probably has the most recorded seismic activity in the region. Not surprisingly, it appears to occur in the vicinity of Hells Canyon, an area with a complex geologic history. Several significant earthquakes have occurred in the region; the 1913 Hells Canyon, the 1927 and 1942 Pine Valley - Cuddy Mountain, the 1965 John Day (M4.4), and the 1965 and 1966 Halfway (M4.3 and 4.2) (**Table 2-454**).

There are also a few identified faults in the region (in Union County) that have been active in the last 20,000 years. The region has also been shaken historically by crustal earthquakes and prehistorically by subduction zone earthquakes centered outside the area (**Table 2-454**). All considered, there is good reason to believe that the most devastating future earthquakes would probably originate along shallow crustal faults in the region.

Historic Earthquake Events

Table 2-454. Significant Earthquakes in Region 7

Date	Location	Magnitude (M)	Remarks
Approximate Years 1400 BCE* 1050 BCE 600 BCE 400 CE 750 CE 900 CE	offshore, Cascadia Subduction Zone	probably 8-9	these are the mid-points of the age ranges for these six events
Jan. 1700	offshore, Cascadia Subduction Zone	~9.0	generated a tsunami that struck Oregon, WA, and Japan; destroyed Native American villages along the coast
Oct. 1913	Hells Canyon, Oregon	VI	damage unknown
Apr. 1927	Pine Valley-Cuddy Mountain, Oregon	V	damage unknown
June 1942	Pine Valley-Cuddy Mountain, Oregon	V	damage minor
Aug. 1965	John Day, Oregon	4.4	damage unknown
Nov. 1965	Halfway, Oregon	4.3	damage unknown
Dec. 1966	Halfway, Oregon	4.2	damage unknown

*BCE: Before Common Era

Sources: 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 Back at Oregon's Earthquake History, 1841-1994, *Oregon Geology*.

Probability and Vulnerability

As stated in the State Risk Assessment, **Section 2.2.2.4, Local and State Vulnerability Assessment Comparison**, different methods are used to assess risk at local and state levels. All methods employ history, probability, and vulnerability data to determine probability and vulnerability scores for each hazard. These scores identify high priority areas to which local and state governments can target mitigation actions. The challenge with these varied methodologies is that access to, interpretation of, and scale of the data is not necessarily the same at local and state levels. As a result, local and state probability and vulnerability scores for a specific hazard in a specific community are not always the same. In some instances, probability and vulnerability scores are even quite different. The state recognizes these inconsistencies and has prioritized the analysis of local and state probability and vulnerability scores during the next plan update. A description of how the High (H), Moderate (M), and Low (L) scores in the local probability and vulnerability tables in this section were determined is provided in the State Risk Assessment **Section 2.2.2.2, Local Vulnerability Assessments**. The complete "OEM Hazard Analysis Methodology" is located in **Appendix 9.1.16**.

Probability

Local Assessment

Based on the OEM Hazard Analysis conducted by county emergency program managers, the probability (High, Moderate, Low) that Region7 will experience earthquakes is depicted **Table 2-455**. See the **State Risk Assessment** for background information on the OEM Hazard Analysis and scoring methodology.

Table 2-455. Local Probability Assessment of Earthquakes in Region 7

	Baker	Grant	Wallowa	Union
Probability	M	L	L	L

Source: Oregon Office of Emergency Management, 2013 County Hazard Analysis Scores

State Assessment

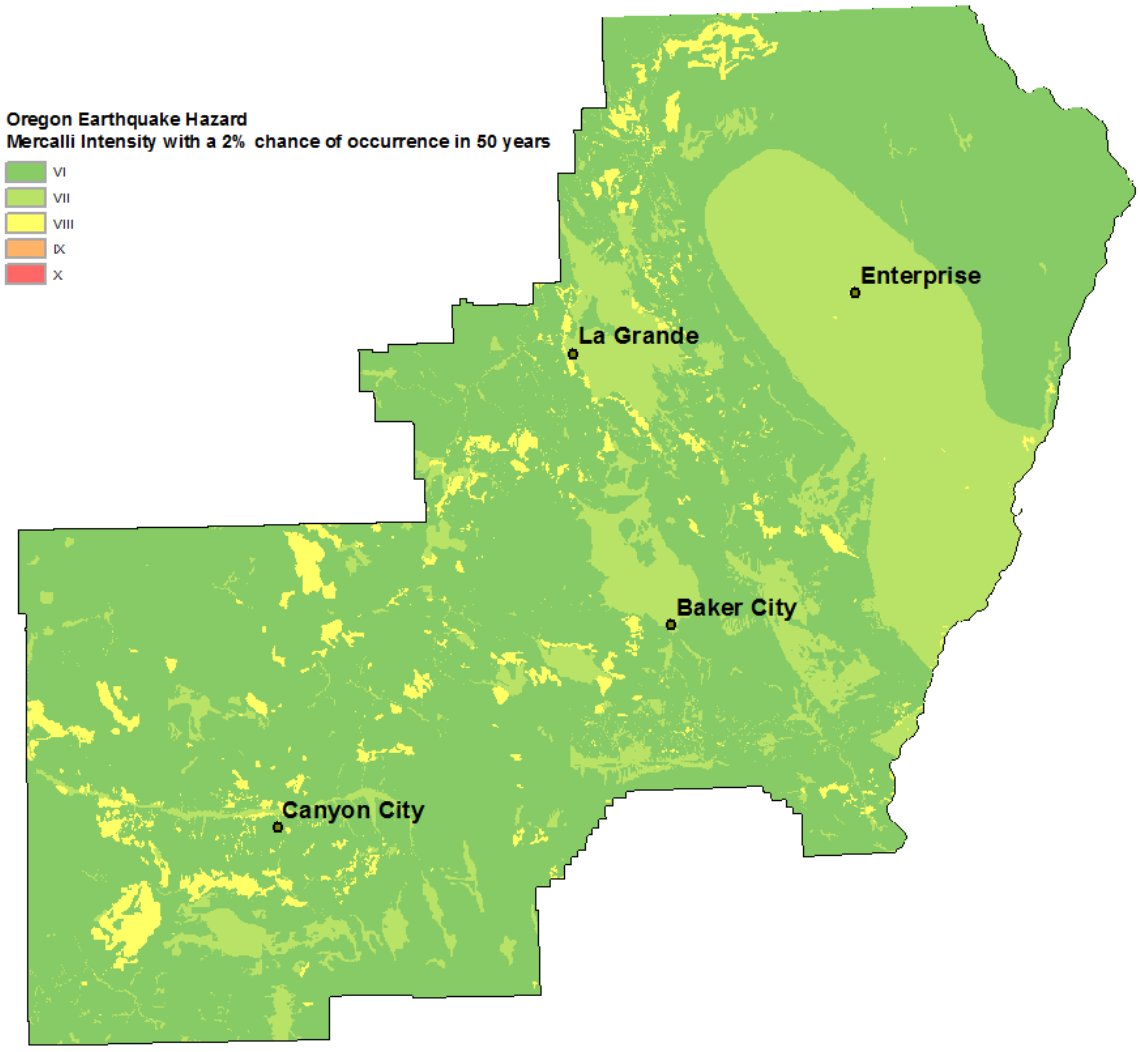
The probability of damaging earthquakes varies widely across the state. In Region 7, the hazard is dominated by local faults and background seismicity. We define the probability of earthquake hazards occurring in Oregon in the following two ways.

The probabilistic hazard for Region 7 is depicted in **Figure 2-211**. This map shows the expected level of earthquake damage that has a 2% chance of occurring in the next 50 years. This map is based on the 2008 USGS National Seismic Hazard Map and has been adjusted to account for the effects of soils following the methods of Madin and Burns (2013). In this case, the strength of shaking, calculated as peak ground acceleration and peak ground velocity, is expressed as Mercalli intensity, which describes the effects of shaking on people and structures, and is more readily understandable for a general audience. These maps incorporate all that is known about the probabilities of earthquake on all Oregon faults, including the Cascadia Subduction Zone.

For Oregon west of the crest of the Cascades, the Cascadia subduction zone is responsible for most of the hazard shown in **Figure 2-211**. The paleoseismic record includes 18 M 8.8–9.1 megathrust earthquakes in the last 10,000 years that affected the entire subduction zone. The

return period for the largest earthquakes is 530 years, and the probability of the next such event occurring in the next 50 years ranges from 7 to 12%. An additional 10–20 smaller M 8.3–8.5 earthquakes only affected the southern half of Oregon and northern California. The average return period for these is about 240 years, and the probability of a small or large subduction earthquake occurring in the next 50 years is 37–43%.

Figure 2-211. Region 7 Probabilistic Earthquake Hazard



Color zones show the maximum level of earthquake shaking and damage (Mercalli Intensity Scale) expected with a 2% chance of occurrence in the next 50 years. A simplified explanation of the Mercalli levels is:

VI	Felt by all, weak buildings cracked
VII	Chimneys break, weak buildings damaged, better buildings cracked
VIII	Partial collapse of weak buildings, unsecured wood frame houses move
IX	Collapse and severe damage to weak buildings, damage to wood-frame structures
X	Poorly built structures destroyed, heavy damage in well-built structures

Source: Madin and Burns (2013)

Vulnerability

Local Assessment

Based on the OEM Hazard Analysis conducted by county emergency program managers, the region's vulnerability (High, Moderate, Low) to earthquakes is depicted in **Table 2-456**. See the **State Risk Assessment** for background information on the OEM Hazard Analysis and scoring methodology.

Table 2-456. Local Vulnerability Assessment of Earthquakes in Region 7

	Baker	Grant	Wallowa	Union
Vulnerability	M	M	L	H

Source: Oregon Office of Emergency Management, 2013 County Hazard Analysis Scores

State Assessment

Region 7 is considered moderately vulnerable to earthquake hazards due to earthquake-induced landslides, liquefaction, and ground shaking.

In 2007, DOGAMI (Lewis, 2007) completed a rapid visual screening (RVS) of educational and emergency facilities in communities across Oregon, as directed by the Oregon Legislature in Senate Bill 2 (2005). RVS is a technique used by the Federal Emergency Management Agency (FEMA), known as FEMA 154, to identify, inventory, and rank buildings that are potentially vulnerable to seismic events. DOGAMI surveyed a total of 3,349 buildings, giving each a 'low,' 'moderate,' 'high,' or 'very high' potential of collapse in the event of an earthquake. It is important to note that these rankings represent a probability of collapse based on limited observed and analytical data and are therefore *approximate* rankings (Lewis, 2007). To fully assess a building's potential of collapse, a more detailed engineering study completed by a qualified professional is required, but the RVS study can help to prioritize which buildings to survey. Results are found in **Table 2-457**, **Table 2-458**, and **Table 2-459**.

Table 2-457 shows the number of school and emergency response buildings surveyed in each county with their respective rankings.

Table 2-457. Buildngs with Their Collapse Potential in Region 7

County	Level of Collapse Potential			
	Low (< 1%)	Moderate (>1%)	High (>10%)	Very High (100%)
Baker	4	15	6	8
Grant	12	2	15	17
Union	10	6	14	24
Wallowa	10	2	10	3

Source: Lewis (2007)

Table 2-458. Projected Dollar Losses in Region 7, based on a M8.5 Subduction Event and a 500-Year Model

	Economic Bae in Thousands (1999)	Greatest Absolute Loss in Thousands (1999) from a (M) 8.5 CSZ Event	Greatest Absolute Loss in Thousands (1999) from a 500-Year Event
Baker County	$943,000	Less than $1,000	$13,000
Grant County	$415,000	Less than $1,000	$3,000
Union County	$1,237,000	Less than $1,000	$9,000
Wallowa County	$444,000	Less than $1,000	$8,000

Source: Wang and Clark (1999)

Table 2-459. Estimated Losses in Region 7, Associated with a 500-Year Model

	Baker	Grant	Union	Wallowa	Remarks
Injuries	3	0	1	1	
Deaths	0	0	0	0	
Displaced households	10	0	1	1	
Operational the day after the quake:					N/A*: The 500-year model includes several earthquakes; the number of facilities operational the day after the earthquake cannot be calculated.
Fire stations	N/A*	N/A*	N/A*	N/A*	
Police stations	N/A	N/A	N/A	N/A	
Bridges	N/A	N/A	N/A	N/A	
Economic losses to:					The HAZUS run that produced the data in this table did not account for unreinforced masonry buildings.
Highways	$5 mil	$3 mil	$1 mil	0	
Airports	$2 mil	$2 mil	$618,000	$3 mil	
Communications	$1,000	$469,900	$$479,000	$116,000	
Debris generated (thousands of tons)	8	1	5	4	

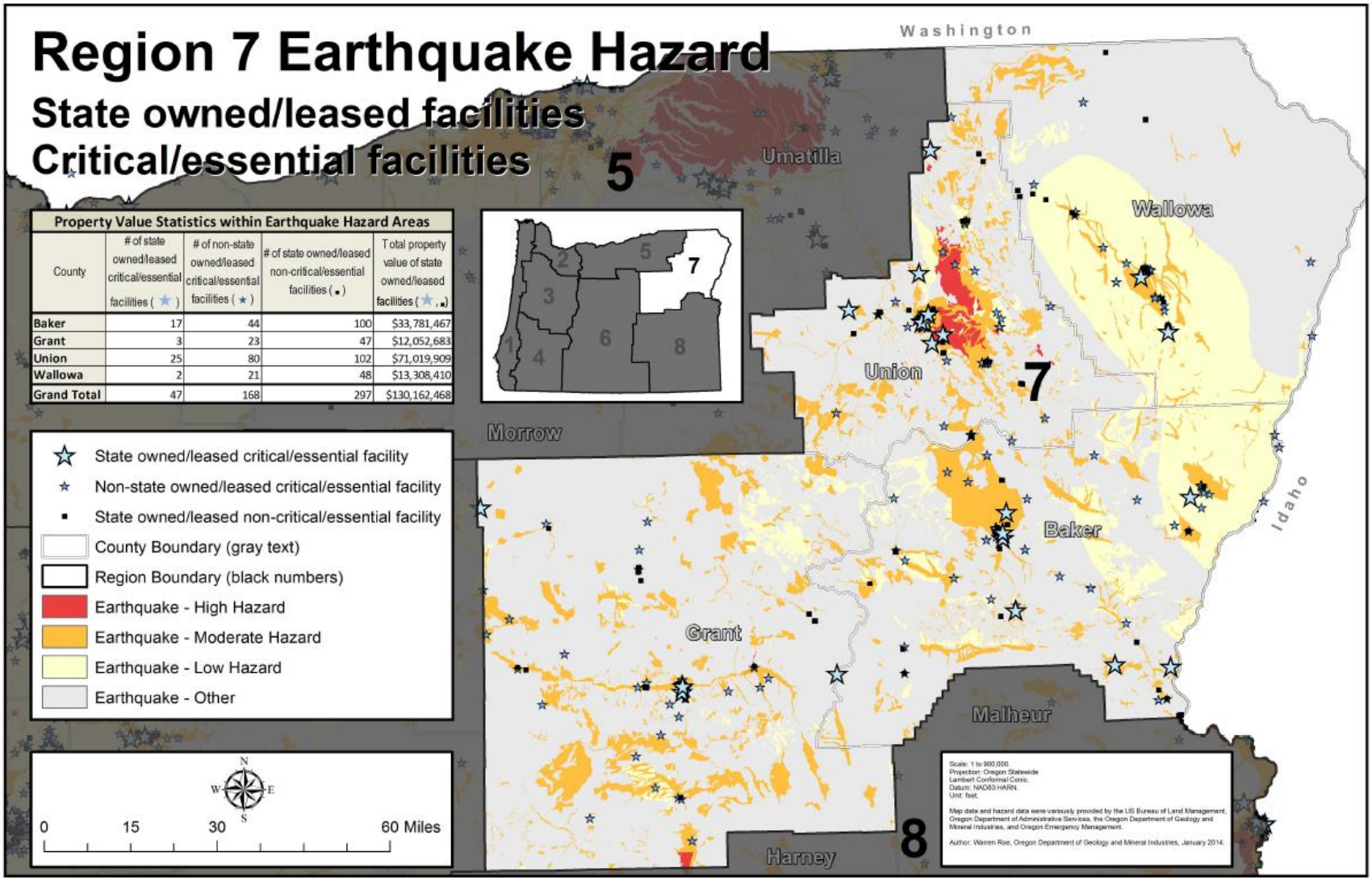
Source: Wang and Clark (1999)

STATE-OWNED/LEASED FACILITIES AND CRITICAL AND ESSENTIAL FACILITIES

The following information is based on a State facility and critical/essential facility vulnerability assessment update completed by DOGAMI in 2014. See the State Risk Assessment, **Oregon Vulnerabilities** section for more information.

Of 5,693 State facilities evaluated, 344 totaling $130 million worth of property fall into an earthquake hazard zone in Region 7 (**Figure 2-212**). Among the 1,141 critical/essential State facilities, 47 are in an earthquake hazard zone in Region 7. Additionally, 168 non-State critical/essential facilities in Region 7 are located in an earthquake hazard zone.

Figure 2-212. State-Owned/Leased Facilities and Critical/Essential Facilities in an Earthquake Zone in Region 7



Source: DOGAMI

SEISMIC LIFELINES

According to the Oregon Department of Transportation's (ODOT) Oregon Seismic Lifeline Report (OSLR), the projected impacts of a CSZ event are considered negligible in this part of the state. Therefore, this region was not part of the OSLR study. However, ODOT did provide the following descriptions of general impacts a CSZ would have on Region 8's seismic lifelines, and the region's overall vulnerability.

REGIONAL IMPACT. Within this region, adverse impacts from the CSZ event and secondary hazards (landslides, liquefaction, etc.) are not anticipated, but damage to I 84 to the west and damage to the Columbia River's freight functions could impact the region's economy.

REGIONAL LOSS ESTIMATES. Losses in this Region are expected to be nonexistent to low locally. Economic disruption from major losses in the larger markets of the state will affect the economy in this Region.

MOST VULNERABLE JURISDICTIONS. Vulnerability of this whole region to a CSZ event is low. Loss of life, property and business are not expected to be issues in this area. However, impacts to import and export infrastructure and basic supply lines could have short to mid-term economic impacts. With an intact surface transportation system to the east, adaptation is expected to be relatively easy.

Flood

Characteristics

The Blue Mountain area of northeastern Oregon is quite distinct from the rest of the state in landform and climate. Nevertheless, its principal flood problems are similar to those found elsewhere in Oregon. The most damaging floods have occurred during the winter 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).

Historic Flood Events

Table 2-460. Significant Historic Floods Affecting Region 7

Date	Location	Description	Type of Flood
1894*	NE Oregon	widespread flooding	not recorded
1910*	NE Oregon	widespread flooding	not recorded
1917*	NE Oregon	widespread flooding	not recorded
1932*	NE Oregon	widespread flooding	not recorded
1935*	NE Oregon	widespread flooding	not recorded
May 1948	Columbia Basin / NE Oregon	unusually large mountain snow melt produced widespread flooding	snow melt
Dec. 1955 - Jan. 1956	Snake and Columbia basins	warm rain melted snow; runoff on frozen ground	rain on snow
Dec. 1964	entire state	widespread, very destructive flooding; warm rain, melted snow; runoff on frozen ground	rain on snow
Jan. 1974	much of state	warm rain / melted snow / runoff on frozen ground	rain on snow
Feb. 1986	entire state	warm rain / melted snow / runoff on frozen ground	rain on snow
June 1986	Wallowa County	severe thunderstorm / rain and hail / flash flooding	thunderstorm
May 1991	Union and Baker Counties	warm rain / melted snow; considerable damage to cropland and highways; a number of bridges destroyed	rain on snow
May 1998	eastern and central Oregon	persistent rains; widespread damage	rain on snow
July 2004	Union	$5,000 in property damage	
May 2008	Union andWallowa Counties	flooding along Catherine Creek and Grande Ronde River damaged roads in Union County, causing $30,000 in damages; in Wallowa County the Imnaha River crested above flood stage	rain on snow
May 2011	Grant and Union Counties	heavy rainfall on above-average snowpack caused flooding to low lying areas of Grant and Union Counties; over $2.6 in property damage	rain on snow

Source: Taylor and Hatton (1999)

Source: Taylor and Hannon, 1999, The Oregon Weather Book, pp.96-103; and FEMA, Baker County Flood Insurance Study (FIS), 06/03/88; FEMA, Grant County Flood Insurance Study (FIS) 05/18/82; FEMA, Union County Flood Insurance Study (FIS), 04/03/96; FEMA, Wallowa County Flood Insurance Study (FIS), 02/17/88.

Source: Hazards & Vulnerability Research Institute (2007). The Spatial Hazard Events and Losses Database for the United States, Version 5.1 [Online Database]. Columbia, SC: University of South Carolina. Available from http://www.sheldus.org

Source: U.S. Department of Commerce. National Climatic Data Center. Available from http://www4.ncdc.noaa.gov/cgi-win/wwcgi.dll?wwevent~storms

Table 2-461. Principal Flood Sources by County in Region 7

Baker County	Grant County	Union County	Wallowa County
Powder River	North Fork John Day River	Grande Ronde River	Wallowa River
Old Settler's Slough	South Fork John Day River	Catherine Creek	Minam River
Pine Creek	Middle Fork John Day River	North Powder River	Lostine River
Eagle Creek	Canyon Creek	Little Creek	Grande Ronde River
Summit Creek	Cottonwood Creek	Gekeler Slough	Wenaha River
Rock Creek	Prairie Creek	Taylor Creek	Imnaha River
Mill Creek		Fresno Creek	Hurricane Creek
Marble Creek		Clark Creek	Prairie Creek
Stices Gulch		Indian Creek	
Snake River		Wolf Creek	
Burnt River			

Sources: FEMA, Baker County Flood Insurance Study (FIS), 06/03/88; FEMA, Grant County Flood Insurance Study (FIS) 05/18/82; FEMA, Union County Flood Insurance Study (FIS), 04/03/96; FEMA, Wallowa County Flood Insurance Study (FIS), 02/17/88.

Probability and Vulnerability

As stated in the State Risk Assessment, **Section 2.2.2.4, Local and State Vulnerability Assessment Comparison**, different methods are used to assess risk at local and state levels. All methods employ history, probability, and vulnerability data to determine probability and vulnerability scores for each hazard. These scores identify high priority areas to which local and state governments can target mitigation actions. The challenge with these varied methodologies is that access to, interpretation of, and scale of the data is not necessarily the same at local and state levels. As a result, local and state probability and vulnerability scores for a specific hazard in a specific community are not always the same. In some instances, probability and vulnerability scores are even quite different. The state recognizes these inconsistencies and has prioritized the analysis of local and state probability and vulnerability scores during the next plan update. A description of how the High (H), Moderate (M), and Low (L) scores in the local probability and vulnerability tables in this section were determined is provided in the State Risk Assessment **Section 2.2.2.2, Local Vulnerability Assessments**. The complete "OEM Hazard Analysis Methodology" is located in **Appendix 9.1.16**.

Probability

Local Assessment

Based on the OEM Hazard Analysis conducted by county emergency program managers, the probability (High, Moderate, Low) that Region 7 will experience flooding is depicted in **Table 2-462**. See the **State Risk Assessment** for background information on the OEM Hazard Analysis and scoring methodology.

Table 2-462. Local Probability Assessment of Flooding in Region 7

	Baker	Grant	Wallowa	Union
Probability	**H**	**H**	**H**	**H**

Source: Oregon Office of Emergency Management, 2013 County Hazard Analysis Scores

State Assessment

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. These periods of flooding coincide with La Niña conditions, during the winter months of which, very moist subtropical air follows a heavy, wet snowfall. Climate records indicate that La Niña conditions occur on average about every 3 to 6 years (as do their counterpart, El Niño events). Climatologists speculate that Oregon has moved from a long-term El Niño period (1975–1994) with milder, drier air, to a long-term La Niña period, characterized by cool, wet weather, abundant snow, and floods. A historical overview of flooding is shown in **Table 2-460**.

All of the Region 7 counties have Flood Insurance Rate (FIRM) maps; however, old maps do not reflect present flood conditions. The most recent FIRM maps are as follows:

- Baker - June 3, 1988
- Grant - May 18, 1982
- Union - April 3, 1996
- Wallowa - February 17, 1988

Vulnerability

Local Assessment

Based on the OEM Hazard Analysis conducted by county emergency program managers the region's vulnerability (High, Moderate, Low) to flooding is depicted in **Table 2-463**. See the **State Risk Assessment** for background information on the OEM Hazard Analysis and scoring methodology.

Table 2-463. Local Vulnerability Assessment of Floods in Region 7

	Baker	Grant	Wallowa	Union
Vulnerability	M	H	M	H

Source: Oregon Office of Emergency Management, 2013 County Hazard Analysis Scores

State Assessment

The Oregon Department of Land Conservation and Development (DLCD) created a countywide flood vulnerability index by compiling data from NOAA's Storm Events Database and from FEMA's National Flood Insurance Program. Data were calculated statewide for the period 1978 through 2013 for five input datasets: number of events, structure and crop damage estimates in dollars and NFIP claims number and dollar amounts. The mean and standard deviation were calculated for each input. Then, each county was assigned a score ranging from 0 to 3 for each of these inputs according to **Table 2-464**.

Table 2-464. Scoring for Vulnerability Index

Score	Description
3	county data point is greater than 2.5 times standard deviation for the input dataset
2	county data point is greater than 1.5 times standard deviation for the input dataset
1	county data point is within standard deviation
0	no data reported

Source: DLCD

DLCD summed the scores for each of the five inputs to create a county-by-county vulnerability index. The maximum possible score is 15. A score over 6 indicates that at least one variable significantly exceeds average values.

The counties in this region all received a flood vulnerability score of 5. These are all very low population counties, so the low vulnerability score may be misleading with respect to a flood's effect on the population centers in the region.

FEMA has identified two Repetitive Loss properties in Region 7, none of which are Severe Repetitive Loss properties (FEMA NFIP BureauNet, http://bsa.nfipstat.fema.gov/, accessed 12/1/2014).

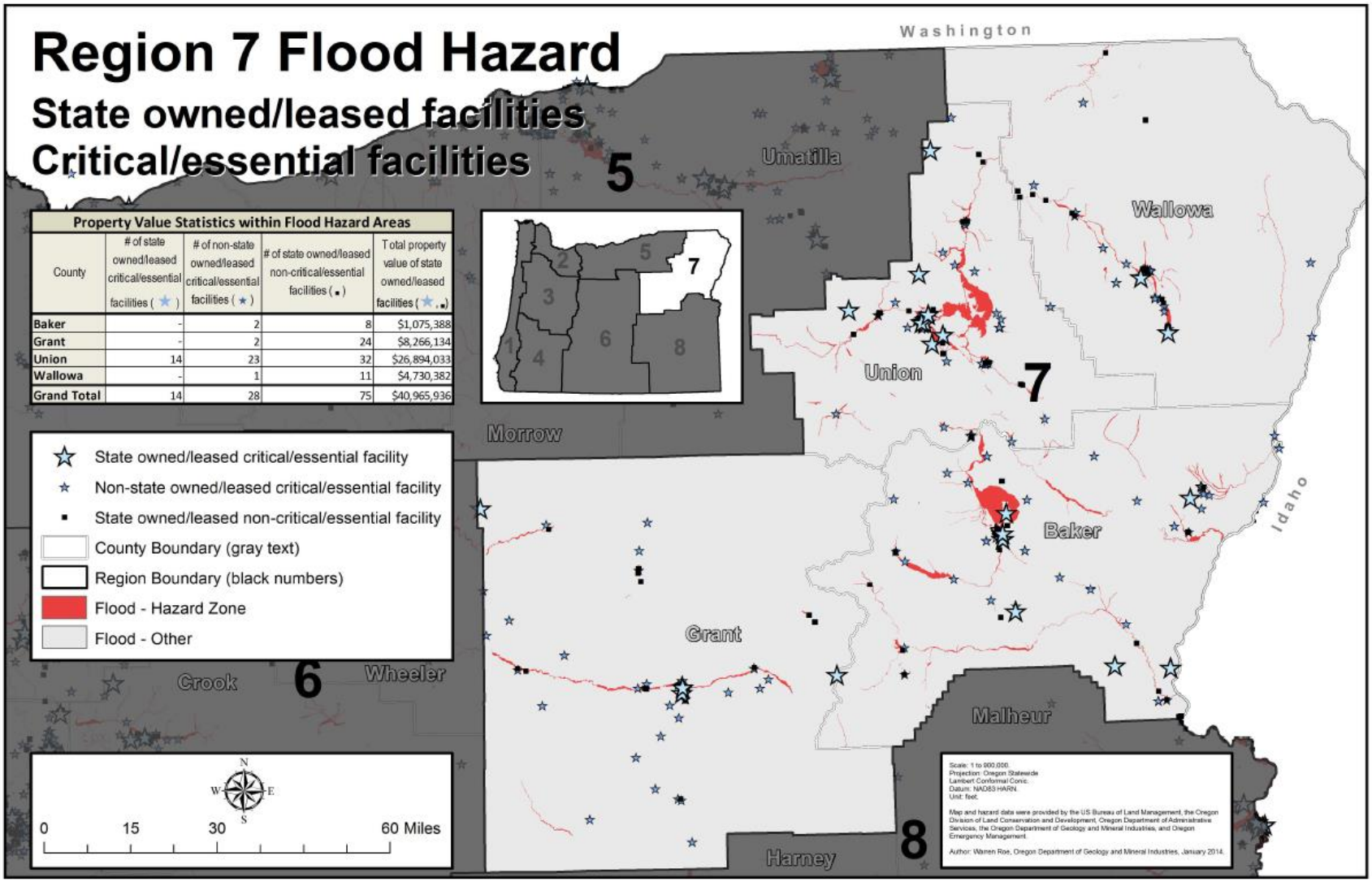
Communities can reduce the likelihood of damaging floods by employing floodplain management practices that exceed NFIP minimum standards. DLCD encourages communities that adopt such standards to participate in FEMA's Community Rating System (CRS), which results in reduced flood insurance costs. This region has no CRS communities.

STATE-OWNED/LEASED FACILITIES AND CRITICAL AND ESSENTIAL FACILITIES

The following information is based on a State facility and critical/essential facility vulnerability assessment update completed by DOGAMI in 2014. See the State Risk Assessment, **Oregon Vulnerabilities** section for more information.

Of the 5,693 State facilities evaluated, 89 are currently located within a flood hazard zone in Region 7 and have an estimated total value of $41 million (**Figure 2-213**). Of these, 14 are identified as a critical or essential facility. An additional 28 non-state owned/leased critical/essential facilities are located in a flood hazard zone in Region 7.

Figure 2-213. State-Owned/Leased Facilities and Critical/Essential Facilities in a Flood Hazard Area in Region 7



Source: DOGAMI

Landslide

Characteristics

Landslides occur throughout this region of the state, although areas with steeper slopes, weaker geology, and higher annual precipitation tend to have more landslides. In general, the Blue Mountains and Wallowa Mountains have a moderate to high incidence of landslides. On occasion, major landslides occur on US or State Highways that sever these major transportation routes (including rail lines) causing temporary but significant economic damage.

Landslides occur throughout Region 7, but to a much lesser extent than in western Oregon. In general, northeastern Oregon soil profiles are shallow and rainfall is less frequent and intense than in the western portion of the state. Most Region 7 landslides occur within the Interstate 84 corridor, State Highways 82 (Union County), 86 (Baker County), 19 (Grant County), and 3 (Wallowa County). Notable slides include the 1984 Hole-in-the-Wall slide, which dammed the Powder River (Baker County) and the often-troublesome Whopper Slide near Elgin (Union County). There is a record of landslide-associated fatalities in this region: In 1928, two people were killed in a landslide while working on a railroad near Baker City.

Historic Landslide Events

Table 2-465. Significant Landslides in Region 7

Date	Location	Description
May 2003	Grant County, Oregon	Property damage: $1,000

Source: Hazards & Vulnerability Research Institute (2007). The Spatial Hazard Events and Losses Database for the United States, Version 5.1 [Online Database]. Columbia, SC: University of South Carolina. Available from http://www.sheldus.org.

Probability and Vulnerability

As stated in the State Risk Assessment, **Section 2.2.2.4, Local and State Vulnerability Assessment Comparison**, different methods are used to assess risk at local and state levels. All methods employ history, probability, and vulnerability data to determine probability and vulnerability scores for each hazard. These scores identify high priority areas to which local and state governments can target mitigation actions. The challenge with these varied methodologies is that access to, interpretation of, and scale of the data is not necessarily the same at local and state levels. As a result, local and state probability and vulnerability scores for a specific hazard in a specific community are not always the same. In some instances, probability and vulnerability scores are even quite different. The state recognizes these inconsistencies and has prioritized the analysis of local and state probability and vulnerability scores during the next plan update. A description of how the High (H), Moderate (M), and Low (L) scores in the local probability and vulnerability tables in this section were determined is provided in the State Risk Assessment **Section 2.2.2.2, Local Vulnerability Assessments**. The complete "OEM Hazard Analysis Methodology" is located in **Appendix 9.1.16**.

Probability

Local Assessment

Based on the OEM Hazard Analysis conducted by county emergency program managers, the probability (High, Moderate, Low) that Region 7 will experience landslides is depicted in **Table 2-466**. See the **State Risk Assessment** for background information on the OEM Hazard Analysis and scoring methodology.

Table 2-466. Local Probability Assessment of Landslides in Region 7

	Baker	Grant	Wallowa	Union
Probability	H	H	M	L

Source: Oregon Office of Emergency Management, 2013 County Hazard Analysis Scores

State Assessment

Landslides are found in every county in Oregon. There is a 100% probability of landslides occurring in this region in the future. Although we do not know exactly where and when they will occur, they are more likely to happen in the general areas where landslides have occurred in the past. Also, they will likely occur during heavy rainfall events or during a future earthquake.

Vulnerability

Local Assessment

Based on the OEM Hazard Analysis conducted by county emergency program managers, the region's vulnerability (High, Moderate, Low) to landslides is depicted in **Table 2-467**. See the **State Risk Assessment** for background information on the OEM Hazard Analysis and scoring methodology.

Table 2-467. Local Vulnerability Assessment of Landslides in Region 7

	Baker	Grant	Wallowa	Union
Vulnerability	M	M	L	L

Source: Oregon Office of Emergency Management, 2013 County Hazard Analysis Scores

State Assessment

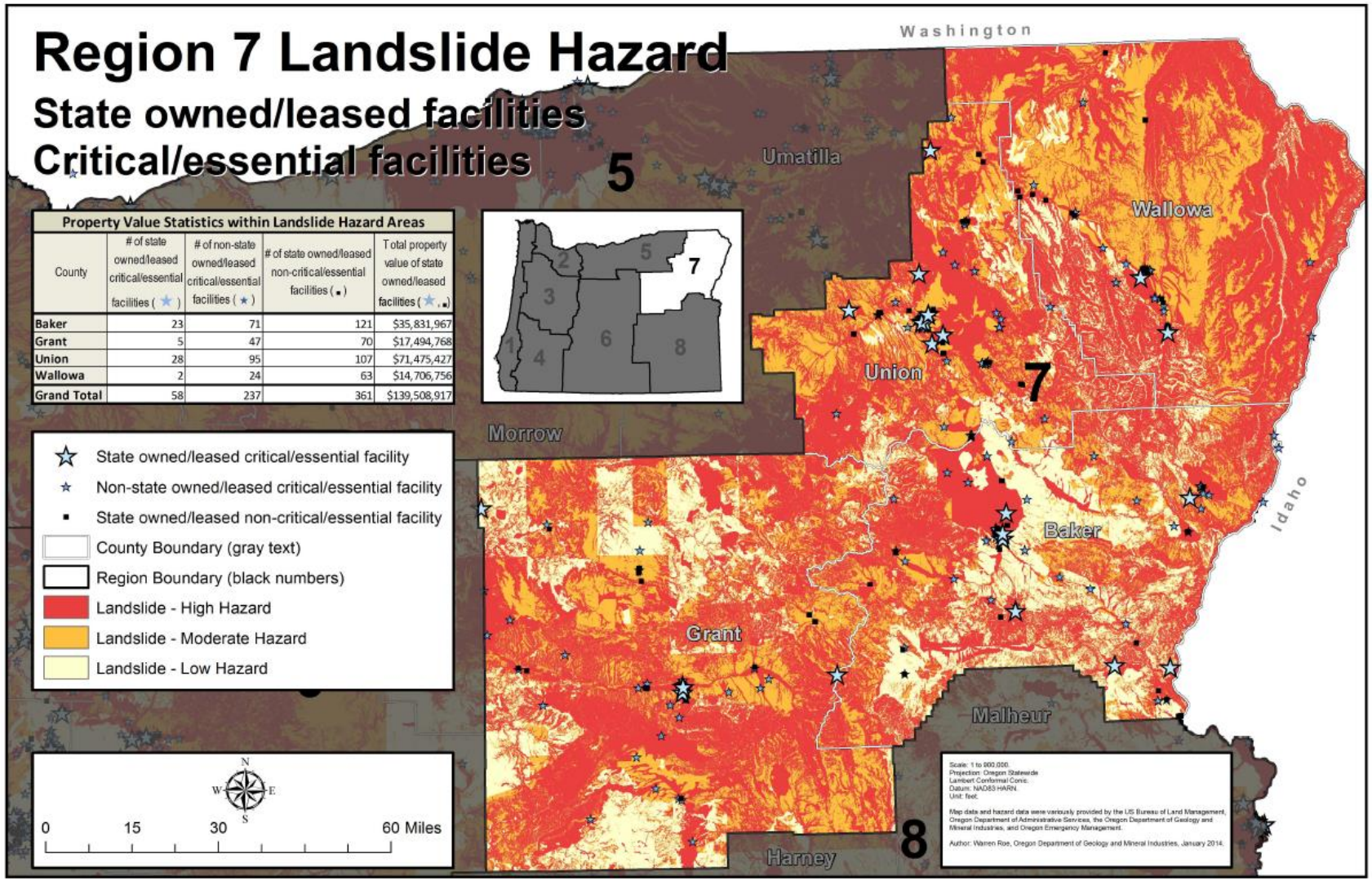
Although there are fewer historic landslides in this region than most others, the SLIDO-2 landslide inventory has many existing landslides which indicate a moderate to high hazard. For example Baker, Union, and Grant Counties all have around 500 mapped landslides in SLIDO-2. The communities within these counties, which are also in areas of steeper slopes, will likely have the highest vulnerability.

STATE-OWNED/LEASED FACILITIES AND CRITICAL AND ESSENTIAL FACILITIES

The following information is based on a State facility and critical/essential facility vulnerability assessment update completed by DOGAMI in 2014. See the State Risk Assessment, **Oregon Vulnerabilities** for more information.

Of the 5,693 State facilities evaluated, 419 are located within landslide hazard areas in Region 7, totaling $139.5 million (**Figure 2-214**). This includes 58 critical or essential facilities. An additional 237 critical/essential facilities, not owned/leased by the state, also reside within a landslide hazard zone in Region 7.

Figure 2-214. State-Owned/Leased Facilities and Critical/Essential Facilities in a Landslide Hazard Zone in Region 7



Source: DOGAMI

Volcano

Characteristics

The volcanic Cascade 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 volcanic ash. This fine-grained material, blown aloft during a volcanic eruption, can travel many miles from its source. For example, during the May 1980, Mount St. Helens eruption, the cities of Yakima (80 miles away) and Spokane (150 miles away), Washington, were inundated with ash. Ash 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.

Ash fall deposition is largely controlled by the prevailing wind direction. The predominant wind pattern over the Cascade Range is from the west to the east. Previous eruptions documented in the geologic record indicate most ash fall drifting to and settling in areas to the east of the Cascade volcanoes.

Historic Volcanic Events

Table 2-468. Historic Volcanic Events in Region 7

Date	Location	Description
May 1980	northeast Oregon	trace amounts of ash fall from Mount St. Helens

Source: Reports of local geologists present in northeast Oregon in May of 1980.

Probability and Vulnerability

As stated in the State Risk Assessment, **Section 2.2.2.4, Local and State Vulnerability Assessment Comparison**, different methods are used to assess risk at local and state levels. All methods employ history, probability, and vulnerability data to determine probability and vulnerability scores for each hazard. These scores identify high priority areas to which local and state governments can target mitigation actions. The challenge with these varied methodologies is that access to, interpretation of, and scale of the data is not necessarily the same at local and state levels. As a result, local and state probability and vulnerability scores for a specific hazard in a specific community are not always the same. In some instances, probability and vulnerability scores are even quite different. The state recognizes these inconsistencies and has prioritized the analysis of local and state probability and vulnerability scores during the next plan update. A description of how the High (H), Moderate (M), and Low (L) scores in the local probability and vulnerability tables in this section were determined is provided in the State Risk Assessment **Section 2.2.2.2, Local Vulnerability Assessments**. The complete "OEM Hazard Analysis Methodology" is located in **Appendix 9.1.16**.

Probability

Local Assessment

Based on the OEM Hazard Analysis conducted by county emergency program managers, the probability (High, Moderate, Low) that Region 7 will experience volcanic hazards is depicted in **Table 2-469**. In some cases, counties either did not rank a particular hazard or did not find it to be a significant consideration, noted with a dash (—). See the **State Risk Assessment** for background information on the OEM Hazard Analysis and scoring methodology.

Table 2-469. Local Probability Assessment of Volcanic Activity in Region 7

	Baker	Grant	Wallowa	Union
Vulnerability	L	L	L	L

Source: Oregon Office of Emergency Management, 2013 County Hazard Analysis Scores

State Assessment

Mount St. Helens remains a probable source of air borne ash as shown in the map below. 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, Washington during the 1980 eruption and again in 2004.

The eruptive history of the nearby Cascade volcanoes to this region can be traced to late Pleistocene times (approximately 700,000 years ago) and will no doubt continue. But the central question remains: When? The most recent series of events at Newberry Volcano, which occurred about 1,300 years ago, consisted of lava flows and ash fall. Newberry Volcano's recent history also includes pyroclastic flows and numerous lava flows. Volcanoes in the Three Sisters region, such as Middle and South Sister, and Crater Lake have also erupted explosively in the past. These eruptions have produced pyroclastic flows, lava flows, lahars, debris avalanches, and ash. Any future eruptions at these volcanoes would most likely resemble those that have occurred in the past.

Geoscientists have provided some estimates of future activity in the vicinity of Newberry Caldera and its adjacent areas. They estimate a 1 in 3,000 chance that some activity will take place in a 30-year period. The estimate for activity at Crater Lake for the same time period is significantly smaller at 0.003 to 0.0003. In the Three Sisters region, the probability of future activity is roughly 1 in 10,000 but any restlessness would greatly increase this estimate.

The location, size, and shape of the area affected by ash are determined by the vigor and duration of the eruption and the wind direction. Because wind direction and velocity vary with both time and altitude, it is impossible to predict the direction and speed of ash transport more than a few hours in advance (Walder et al., 1999). Mount St. Helens is about 250 air miles from the City of Enterprise (Wallowa County), consequently placing that community at risk. Mount 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 ash accumulation within the Region 7 counties, from any Cascade volcano, is about 1 in 5,000 (Sherrod et al., 1997).

Vulnerability

Local Assessment

Based on an analysis of risk conducted by county emergency program managers, usually with the assistance of a team of local public safety officials, the region's vulnerability to volcanic activity is depicted in **Table 2-470**. In some cases, counties either did not rank a particular hazard or did not find it to be a significant consideration, noted with a dash (—). See the **State Risk Assessment** for background information on the OEM Hazard Analysis and scoring methodology.

Table 2-470. Local Vulnerability Assessment of Volcanic Activity in Region 7

	Baker	Grant	Wallowa	Union
Vulnerability	L	H	L	L

Source: Oregon Office of Emergency Management, 2013 County Hazard Analysis Scores

State Assessment

The region's vulnerability to the effects of volcanic eruptions are low. Areas within Region 7 could be affected by distal ash fall from Cascade volcanic eruptions. Most of the people and infrastructure are located in one of the major cities in the region which are located along an interstate (I-84) and/or the regional highways (Hwy 26 and Hwy 395). The most vulnerable communities to volcano-related hazards in the region are La Grande, Baker City, and John Day.

Wildfire

Characteristics

The area has a significant history of human caused fires in the Region 7. In addition, the prevalence of summer thunderstorms in the mountainous and timbered regions of eastern Oregon suggests the potential for lightning-caused fires. Most areas do not have structural fire protection available and some areas do not even have wildland fire protection.

While the rates of urban and rural residential development have declined statewide, they have increased in Eastern Oregon's non-federal forests, potentially impacting fire protection capability. There are now three times as many dwellings on non-federal wildland forest in Eastern Oregon as in 1975. Dwelling density is increasing at a faster rate in Eastern Oregon's fire-prone privately-owned forests than in western Oregon's private forests. Communities vary in development, ranging from homes with city services to seasonal use recreational cabins. Many are isolated clusters of private timberland have been bought and developed into home sites and recreational communities.

Historic Wildfire Events

Table 2-471. Significant Wildfires in Region 7

Year	Name of Fire	Location	Acres Burned	Remarks
1986	Clear	Baker, Grant, Union	6,000	lightning caused (?)
1988	Turner	Baker, Union, Grant	8,000	
1989	Dooley Mountain	Baker		
1989	Stices Gulch	Baker		
1996	Sloan's Ridge	Baker, Grant	10,000	
1996	Wildcat	Grant	10,303	
1999	Cummings Creek	Grant		
2000	Carrol Creek	Grant	3,197	
2000	Thorn	Wallowa	4035	
2001	Monument Complex	Grant		
2001	Horse Creek	Wallowa	16,309	
2002	Malheur Complex/Flagtail	Grant	21,641	
2003	Lightning Creek Complex	Wallowa	16,028	1 structure was lost
2007	Battle Creek Complex	Wallowa	79,299	
2007	Cottonwood Creek	Wallowa	8,100	
2013	Grouse Mountain	Grant	12,076	threatened the town of John Day

Sources: Wallowa-Whitman National Forest (Baker City), 2002; Oregon Department of Forestry, 2013

Probability and Vulnerability

As stated in the State Risk Assessment, **Section 2.2.2.4, Local and State Vulnerability Assessment Comparison**, different methods are used to assess risk at local and state levels. All methods employ history, probability, and vulnerability data to determine probability and vulnerability scores for each hazard. These scores identify high priority areas to which local and state governments can target mitigation actions. The challenge with these varied methodologies is that access to, interpretation of, and scale of the data is not necessarily the same at local and state levels. As a result, local and state probability and vulnerability scores for a specific hazard in a specific community are not always the same. In some instances, probability and vulnerability scores are even quite different. The state recognizes these inconsistencies and has prioritized the analysis of local and state probability and vulnerability scores during the next plan update. A description of how the High (H), Moderate (M), and Low (L) scores in the local probability and vulnerability tables in this section were determined is provided in the State Risk Assessment **Section 2.2.2.2, Local Vulnerability Assessments**. The complete "OEM Hazard Analysis Methodology" is located in **Appendix 9.1.16**.

Probability

Local Assessment

Based on an analysis of risk conducted by county emergency program managers, the probability (High, Moderate, Low) that Region 7 will experience wildfires is depicted in **Table 2-472**. See the **State Risk Assessment** for background information on the OEM Hazard Analysis and scoring methodology.

Table 2-472. Local Probability Assessment of Wildfire in Region 7

	Baker	Grant	Wallowa	Union
Probability	H	H	H	H

Source: Oregon Office of Emergency Management, 2013 County Hazard Analysis Scores

State Assessment

A combination of climate, fuels and terrain make this region prone to wildfire. The poor ecological health of the forested ecosystem, particularly in the greater Blue Mountains area, is well documented in federal and scientific reports. Past timber management practices, fire exclusion, the subsequent buildup of forest fuels have significantly changed the vegetation composition in this region over time. The simplification of stand structure (unnaturally dense) and shift in species composition over time, combined with low precipitation and competition for limited water and nutrients, increases the probability of insect, disease epidemics, and large-scale fire.

This area has a significant amount of lightning storms that pass through during the summer and fall months, starting many fires that can easily strain wildland firefighting resources. With the drying of fuels over time and the low relative humidity factored in, the probability for large fires can significantly increase during these lightning events. The number of days per season that forest fuels are capable of producing a significant fire event is also important to consider.

Over three quarters of all fire starts are attributed to lightning, with a higher percentage of lightning starts on the public lands than the private lands. ODF reports a slightly higher percentage of human causes where human activity is more prevalent.

Vulnerability

Local Assessment

Based on the OEM Hazard Analysis conducted by county emergency program managers, the region's vulnerability (High, Moderate, Low) to wildfire is depicted in **Table 2-473**. See the **State Risk Assessment** for background information on the OEM Hazard Analysis and scoring methodology.

Table 2-473. Local Vulnerability Assessment of Wildfire in Region 7

	Baker	Grant	Wallowa	Union
Vulnerability	H	H	H	H

Source: Oregon Office of Emergency Management, November 2013, County Hazard Analysis Scores

State Assessment

Based on data from the 2013 West Wide Wildfire Risk Assessment, in Region 7, Grant, Union and Wallowa Counties have high percentages of wildland acres subject to Fire Risk, Fire Effects, and Fire Threat, making them especially vulnerable.

In addition, each year a significant number of people build homes within or on the edge of the forest (urban-wildland interface), thereby increasing wildfire hazards. These communities have been designated "Interface Communities" and included in **Table 2-474**.

A large wildfire could eliminate valuable timber or rangeland for grazing, which might affect local businesses and industry. Recreational areas that draw tourists to the area would also be impacted. Wildlife habitat and diversity, as well as threatened and endangered species of fish, wildlife, and plant life could be wiped out or severely harmed in the long-term depending on the intensity of the wildfire. Water quality could be impacted if a moderate to high intensity wildfire burned through watersheds, affecting the health of fish and wildlife as well as domestic water supplies for residents.

Many communities in this area are located a long distance from fire stations, which will result in longer response times. There are areas with single road access that could impair ingress and egress during emergencies, and many homes do not have defensible space and would be difficult to protect from and oncoming fire.

The area is characterized as having heavy fuel loading on forestlands with a high potential for crown fires, which are very difficult to extinguish. The slopes are steep, and carry fire quickly to upland flashy fuels and crowns. Ignition potential is also high, as there are many recreators that visit the area. Response efforts are further hindered by the lack of water resources in the most vulnerable locations.

Table 2-474. Wildland-Urban Interface Communities by County in Region 7

Baker	Grant	Union	Wallowa
Anthony Lakes Resort	Austin	Camp Elkanah	Alder
Baker Valley	Bates	Cove	Eden
Bourne	Canyon City	Elgin	Enterprise
Cornucopia	Dayville	Hilgard	Flora
Durkee	Granite	Kamela	Freezeout Cr
Greenhorn	John Day	Medical Springs	Grouse
Halfway / Pine Valley	Long Creek	Morgan Lake	Hurricane grange
Keating	Monument	Mt. Emily	Imnaha River Woods
Powder River	Mount Vernon	Palmer Junction	Imnaha
Rattlesnake Estates	Prairie City	Perry	Joseph
Richland	Seneca	S. Fk. Catherine Cr	Lostine
Sparta		Starkey	Minam
Stices Gulch		Union	Prairie Cr
Sumpter / Sumpter Valley			Promise
			S. Fork Lostine R. Subdiv.
			Ski Run / Ski Run Road
			Troy
			Wallowa Lake Basin
			Wallowa Slope / Canyon

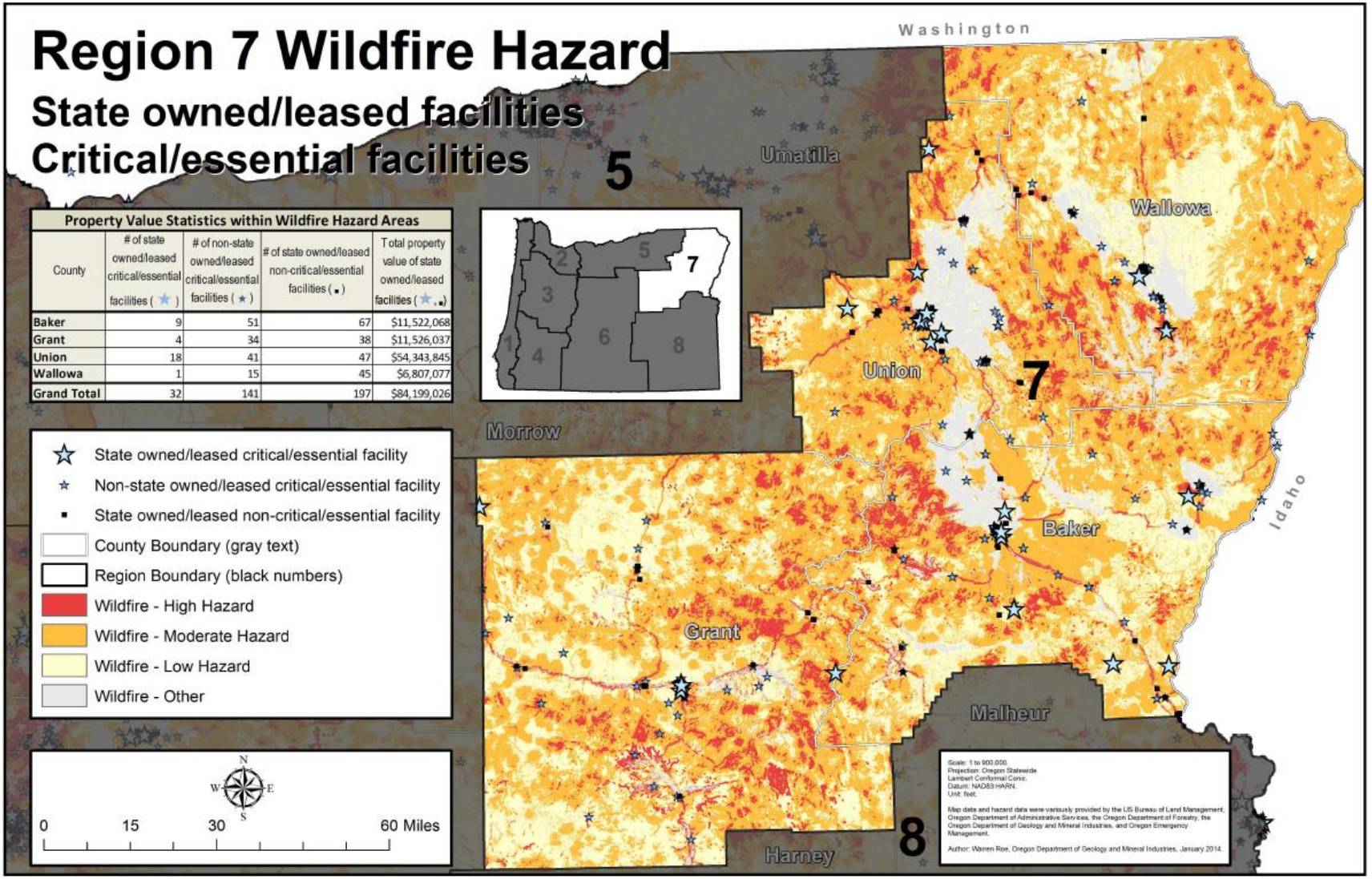
Source: Oregon Dept. of Forestry Statewide Forest Assessment September, 2006

STATE-OWNED/LEASED FACILITIES AND CRITICAL AND ESSENTIAL FACILITIES

The following information is based on a State facility and critical/essential facility vulnerability assessment update completed by DOGAMI in 2014. See the State Risk Assessment, **Oregon Vulnerabilities** for more information.

Of the 5,693 State facilities evaluated, 229 are within a wildfire hazard zone in Region 7 and total roughly $84 million in value (**Figure 2-215**). Among those, 32 are state critical/essential facilities. An additional 141 non-State critical/essential facilities are also located in Region 7.

Figure 2-215. State-Owned/Leased Facilities and Critical/Essential Facilities in a Wildfire Hazard Zone in Region 7



Source: DOGAMI

Windstorm

Characteristics

Extreme winds (other than tornadoes) are experienced in all of Oregon's eight regions. The most persistent high winds occur along the Oregon Coast and the Columbia River Gorge, so much so that these areas have special building code standards. This is not the case in the Blue Mountains, although high winds in the inter-mountain valleys are not uncommon. For example, the residents of Union County's Grande Ronde Valley caution newcomers about living in the vicinity of Ladd Canyon, which is known for its high winds.

Historic Windstorm Events

Table 2-475. Historic Windstorms in Region 7

Date	Affected Area	Characteristics
Apr. 1931	northeast Oregon	unofficial wind speeds reported at 78 mph; damage to fruit orchards and timber
Nov. 10-11, 1951	statewide	widespread damage; transmission and utility lines; wind speed 40–60 mph; gusts 75–80 mph
Dec. 1951	statewide	wind speed 60 mph in Willamette Valley; 7-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
Nov. 1958	statewide	wind speeds at 51 mph with 71-mph gusts; every major highway blocked by fallen trees
Oct. 1962	statewide	Columbus Day Storm; Oregon's most destructive storm to date; 116-mph winds in Willamette Valley; estimated 84 houses destroyed, with 5,000 severely damaged; total damage estimated at $170 million
Mar. 1971	most of Oregon	greatest damage in Willamette Valley; homes and power lines destroyed by falling trees; destruction to timber in Lane County
Jan. 1986	northeast Oregon	wind gusts 80–90 mph; heavy drifting snow in Ladd Canyon (Union County)
Dec. 1990	Wallowa County	severe wind storm
Mar. 1991	northeast Oregon	severe wind storm
Dec. 1991	northeast Oregon	severe wind storm
Dec. 1992	northeastern mtns., Oregon	severe wind storm
May 2003	Union County	$1,000 in property damage
June 2003	Wallowa County	$1,000 in property damage
July 2003	Union County	$30,000 in property damage
Oct. 2003	Wallowa County	$1,000 in property damage
Oct. 2003	Union County	$2,000 in property damage
Jan. 2004	Grant and Wallowa Counties	$500 in property damage
Feb. 2004	Union	$1,000 in property damage
Mar. 2004	Union County	$200 in property damage
July 2004	Union County	$300,000 in property damage
Nov. 2004	Union County	$1,000 in property damage
Jan. 2005	Union County	$10,000 in property damage
Nov. 2005	Union County	$100 in damages from a strong wind storm
Nov. 2006	Union and Wallowa Counties	$35,000 in damages from a wind storm with wind speeds measured at 80 mph; Morrow and Umatilla Counties also affected, causing a total storm damage of $70,000
Nov. 2007	Wallowa County	$500,000 in damages from a windstorm near Wallowa Lake State Park
July 2011	Union County	$2,000 in property damage

Sources: Taylor and Hatton (1999); Hazard Mitigation Team Survey Report, *Severe Windstorm in Western Oregon*, February 7, 2002 (FEMA-1405-DR-OR); Hazards & Vulnerability Research Institute (2007), The Spatial Hazard Events and Losses Database for the United States, Version 5.1 [Online Database], Columbia, SC: University of South Carolina, http://hvri.geog.sc.edu/SHELDUS/.

Probability and Vulnerability

As stated in the State Risk Assessment, **Section 2.2.2.4, Local and State Vulnerability Assessment Comparison**, different methods are used to assess risk at local and state levels. All methods employ history, probability, and vulnerability data to determine probability and vulnerability scores for each hazard. These scores identify high priority areas to which local and state governments can target mitigation actions. The challenge with these varied methodologies is that access to, interpretation of, and scale of the data is not necessarily the same at local and state levels. As a result, local and state probability and vulnerability scores for a specific hazard in a specific community are not always the same. In some instances, probability and vulnerability scores are even quite different. The state recognizes these inconsistencies and has prioritized the analysis of local and state probability and vulnerability scores during the next plan update. A description of how the High (H), Moderate (M), and Low (L) scores in the local probability and vulnerability tables in this section were determined is provided in the State Risk Assessment **Section 2.2.2.2, Local Vulnerability Assessments**. The complete "OEM Hazard Analysis Methodology" is located in **Appendix 9.1.16**.

Probability

Local Assessment

Based on the OEM Hazard Analysis conducted by county emergency program managers, the probability (High, Moderate, Low) that Region 7 will experience windstorms is depicted in **Table 2-476**. In some cases, counties either did not rank a particular hazard or did not find it to be a significant consideration, noted with a dash (—). See the **State Risk Assessment** for background information on the OEM Hazard Analysis and scoring methodology.

Table 2-476. Local Probability Assessment of Windstorms in Region 7

	Baker	Grant	Wallowa	Union
Probability	H	H	H	H

Source: Oregon Office of Emergency Management, 2013 County Hazard Analysis Scores

State Assessment

The 100-year storm in Region 7 is defined as one-minute average winds of 90 mph. A 50 year storm is one-minute average winds of 80 mph. The 25-year event consists of average winds of 70 mph.

Vulnerability

Local Assessment

Based on the OEM Hazard Analysis conducted by county emergency program managers, the region's vulnerability (High, Moderate, Low) to windstorm is depicted in **Table 2-477**. In some cases, counties either did not rank a particular hazard or did not find it to be a significant consideration, noted with a dash (—). See the **State Risk Assessment** for background information on the OEM Hazard Analysis and scoring methodology.

Table 2-477. Local Vulnerability Assessment of Windstorms in Region 7

	Baker	Grant	Wallowa	Union
Vulnerability	H	H	M	H

Source: Oregon Office of Emergency Management, 2013 County Hazard Analysis Scores

State Assessment

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 also is 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.

Fallen trees are especially troublesome. They can block roads and rails for long periods, which can affect emergency operations. In addition, up-rooted or shattered trees can down power and/or utility lines and effectively bring local economic activity and other essential facilities to a standstill. Much of the problem may be attributed to a shallow or weakened root system in saturated ground. Many roofs have been destroyed when uprooted trees growing next to a house fall during a windstorm. In some situations, strategic pruning may be the answer. Prudent counties will work with utility companies to identify problem areas and establishing a tree maintenance and removal program.

Winter Storm

Characteristics

Severe winter weather in Region 7 can be characterized by extreme cold, snow, ice, and sleet. There are annual winter storm events in Region 7 with an average of 24 inches of snow; most communities are prepared for them. In the elevated areas of the Wallowa Mountains severe winter storms are more frequent and the snow fall is much heavier. Moderate to heavy snow fall is prepared for and expected on an annual basis in this region. Heavier snow fall is expected and planned for in the areas of the Wallowa Mountains of the region as the elevation gets higher.

Historic Winter Storm Events

Table 2-478. Severe Winter Storms in Region 7

Date	Location	Remarks
Dec. 1861	entire state	storm produced 1–3 feet of snow throughout Oregon
Dec. 1892	northern counties, Oregon	15–30 inches of snow fell throughout the northern counties
Jan. 1916	entire state	two storms; heavy snowfall, especially in mountainous areas
Jan. and Feb. 1937	entire state	deep snow drifts
Jan. 1950	entire state	record snow falls; property damage throughout state.
Mar. 1960	entire state	many automobile accidents; two fatalities
Jan. 1969	entire state	heavy snow throughout state
Jan. 1980	entire State	series of string storms across state; many injuries and power outages
Feb. 1985	entire state	2 feet of snow in northeast mountains; downed power lines; fatalities reported
Feb. 1986	northeast mountains, Oregon	heavy snow; school closures; traffic accidents; broken power lines
Dec. 1988	northeast mountains, Oregon	three blizzards in a 4-week period; 15-foot drifts; wind over 60 mph
Feb. 1990	entire state	heavy snow throughout state
Jan. 1994	northeast mountains, Oregon	heavy snow throughout region
Jan. 1998	northeast Oregon	heavy snow throughout region
Winter 1998-99	entire state	one of the snowiest winters in Oregon history (snowfall at Crater Lake: 586 inches)
Jan. 2004	Union County	one fatality

Source: Taylor and Hatton (1999).

Source: Hazards & Vulnerability Research Institute (2007). The Spatial Hazard Events and Losses Database for the United States, Version 5.1 [Online Database]. Columbia, SC: University of South Carolina.

Probability and Vulnerability

As stated in the State Risk Assessment, **Section 2.2.2.4, Local and State Vulnerability Assessment Comparison**, different methods are used to assess risk at local and state levels. All methods employ history, probability, and vulnerability data to determine probability and vulnerability scores for each hazard. These scores identify high priority areas to which local and state governments can target mitigation actions. The challenge with these varied methodologies

is that access to, interpretation of, and scale of the data is not necessarily the same at local and state levels. As a result, local and state probability and vulnerability scores for a specific hazard in a specific community are not always the same. In some instances, probability and vulnerability scores are even quite different. The state recognizes these inconsistencies and has prioritized the analysis of local and state probability and vulnerability scores during the next plan update. A description of how the High (H), Moderate (M), and Low (L) scores in the local probability and vulnerability tables in this section were determined is provided in the State Risk Assessment **Section 2.2.2.2, Local Vulnerability Assessments**. The complete "OEM Hazard Analysis Methodology" is located in **Appendix 9.1.16**.

Probability

Local Assessment

Based on the OEM Hazard Analysis conducted by county emergency program managers, the probability (High, Moderate, Low) that Region 7 will experience winter storms is depicted in **Table 2-479**. See the **State Risk Assessment** for background information on the OEM Hazard Analysis and scoring methodology.

Table 2-479. Local Probability Assessment of Winter Storms in Region 7

	Baker	Grant	Wallowa	Union
Probability	H	H	H	H

Source: Oregon Office of Emergency Management, 2013 County Hazard Analysis Scores

State Assessment

Winter storms occur annually in Region 7. Based on historical events severe winter storms may impact the region approximately every four years. We can expect to have continued annual storm events in this region however there is no statistical data available other than the historical events that have occurred to base these judgments on. There is no statewide program to study the past, present and potential future impacts of winter storms in the state of Oregon at this time.

Vulnerability

Local Assessment

Based on the OEM Hazard Analysis conducted by county emergency program managers, the region's vulnerability (High, Moderate, Low) to winter storms is depicted in **Table 2-480**. See the **State Risk Assessment** for background information on the OEM Hazard Analysis and scoring methodology.

Table 2-480. Local Vulnerability Assessment of Winter Storms in Region 7

	Baker	Grant	Wallowa	Union
Vulnerability	H	H	M	H

Source: Oregon Office of Emergency Management, 2013 County Hazard Analysis Scores

State Assessment

Region 7 counties are known for cold, snowy winters. This region is a gateway for neighboring states Washington and Idaho; and for the commodity flow to those states. In general, the region is prepared for winter storm events, and those visiting the region during the winter usually come prepared. However, there are occasions when preparation cannot meet the challenge. Drifting, blowing snow has often brought highway traffic to a standstill. Also, windy, icy conditions have often closed mountain passes and canyons to certain classes of truck traffic. In these situations, travelers must seek accommodations, sometimes in communities where lodging is very limited. Local residents also experience problems. During the winter, heating, food and the care of livestock and farm animals are everyday concerns. Access to farms and ranches can be extremely difficult and present a serious challenge to local emergency managers.