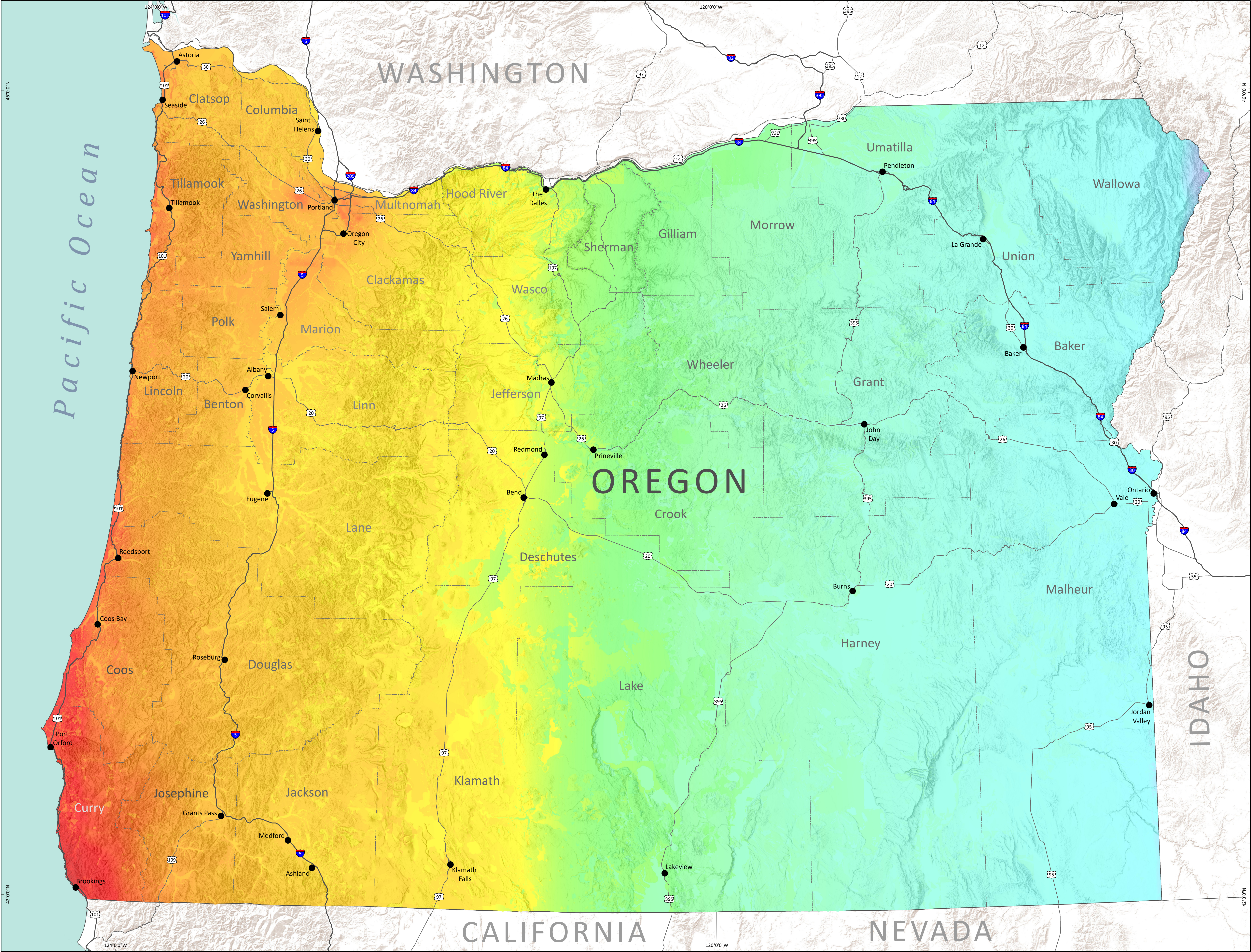




Perceived Shaking and Damage Potential, Cascadia Subduction Earthquake Model

Median shaking levels for an ensemble of 30 magnitude (Mw) 9 Cascadia Subduction zone earthquake scenarios

2021



Background
This map is part of a new database of seismic hazard data for Oregon published by the Oregon Department of Geology and Mineral Industries. The map shows the median shaking levels (expressed as peak ground velocity [PGV]) expected from a suite of 30 magnitude (Mw) 9 Cascadia subduction zone earthquake simulations developed by the U.S. Geological Survey (USGS) (Wirth and others, 2021). In this map the modeled PGV values are shown in units of Instrumental Intensity (Worden and others, 2020) based on Modified Mercalli Intensity scale (USGS, 2021a, b). The Modified Mercalli Intensity scale describes shaking strength on the basis of effects on people, objects, and buildings. Instrumental Intensity links Modified Mercalli Intensity to specific levels of recorded or modeled ground shaking and adds simple descriptions of perceived shaking and damage potential. The shaking levels induce local amplification of shaking based on the updated National Earthquake Hazards Reduction Program (NEHRP) site class map in the accompanying report. See report for details.

Source Data
Shaking and damage potential data from this report is based on a 2021 USGS magnitude (Mw) 9 Cascadia ensemble shaking model (Wirth and others, 2021). State and county boundaries and city locations are from the U.S. Census and USGS. Base map imagery is from the Environmental Systems Research Institute (ESRI), USGS, and National Oceanic and Atmospheric Administration (NOAA).

References
U.S. Geological Survey (USGS). 2021a. The Modified Mercalli Intensity (MMI) scale assigns intensities as ... [web page]. <https://www.usgs.gov/media/images/modified-mercalli-intensity-mmi-scale-signs-intensities>, accessed 1/21/21.
U.S. Geological Survey (USGS). 2021b. Modified Mercalli Intensity Scale ... [web page]. <https://www.usgs.gov/media/images/modified-mercalli-intensity-scale>, accessed 5/28/21.
Wirth, E.A., Grant, A., Marafi, N.A., and Frankel, A.D., 2021, Ensemble ShakeMaps for magnitude 9 earthquakes on the Cascadia Subduction Zone: Seismol. Res. Lett., v. 92, no. 1, 99–211.
Worden, C.B., Thompson, E.M., Hearne, M., and Wald, D.J., 2020, ShakeMap Manual Online: technical manual, user's guide, and software guide: U. S. Geological Survey: <http://usgs.github.io/shakemap/>, <https://doi.org/10.5066/77D21VPQ>.

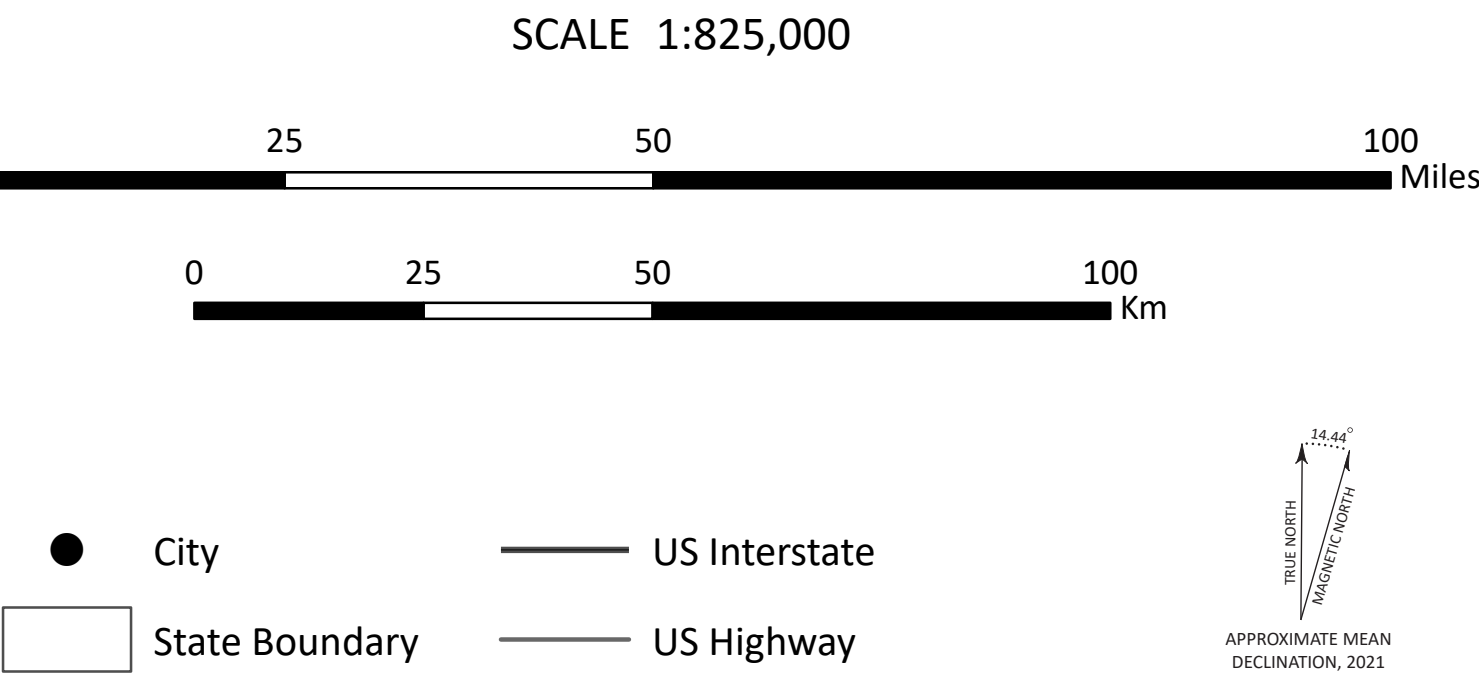
Projection: Oregon Statewide Lambert Conformal Conic, Unit: International Feet, Horizontal Datum: NAD 1983; 2011.

Software: Esri ArcGIS® 10.7.1 and Adobe® Illustrator® 2021.

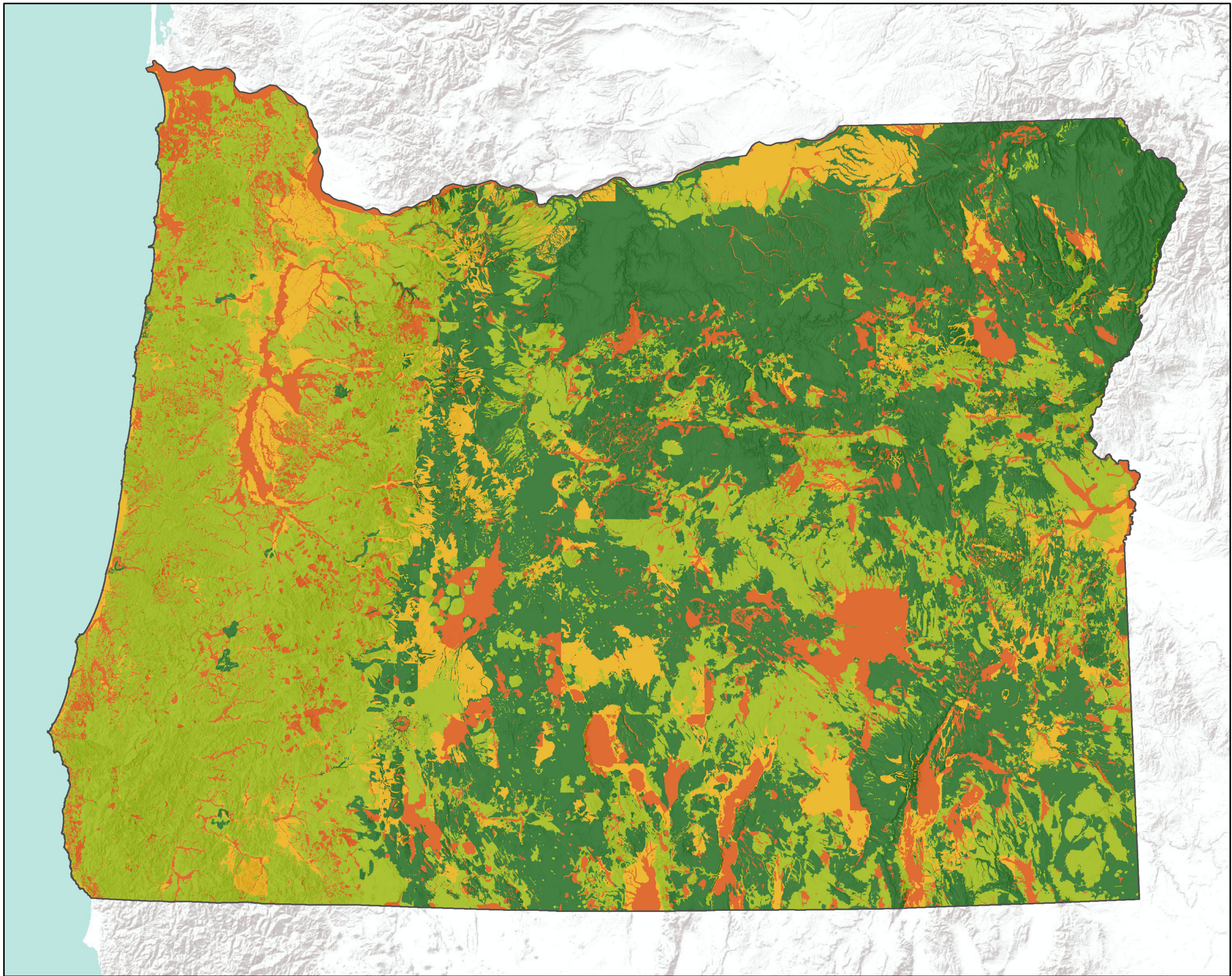
Cartography: Jon J. Franczyk

Modified Mercalli Intensity Scale (modified from USGS, 2021a, b)

Intensity Scale	Perceived Shaking	Potential Damage	Effects on People	Effects on Objects	Effects on Buildings	Effects on Environment
I	Not felt	None	Felt only by very few under especially favorable conditions.			
II	Weak	None	Felt by a few at rest, especially on upper floors of buildings.	Delicately suspended objects may swing.		
III	Weak	None	Felt by some indoors, especially on upper floors of buildings; vibrations similar to passing of a truck; duration estimated.	Parked cars may rock slightly; hanging objects may swing appreciably.		
IV	Light	None	Felt indoors by many; outdoors by few; some awakened at night. Sensation like heavy truck striking building.	Dishes, windows, and doors disturbed; parked cars rock noticeably.	Walls creak, windows rattle.	
V	Moderate	Very Light	Felt by nearly everyone; many awakened; frightened a few.	Pictures swing, some dishes and windows broken; unstable objects overturned.	Some cracked walls and windows.	Trees and bushes noticeably shaken.
VI	Strong	Light	Felt by all; many frightened; some move unsteadily.	Many objects fall from shelves; some heavy furniture moved.	Damage slight; some fallen plaster, broken windows, and damaged chimneys.	Some fall of tree limbs and tops; isolated rocks, landslides, and liquefaction more severe and widespread.
VII	Very Strong	Moderate	Frightens most; some lose balance.	Heavy furniture overturned.	Damage negligible in buildings of good design and construction; slight to moderate damage in well-built ordinary structures; considerable damage in poorly built structures; weak chimneys broken at roofline; unbraced parapets fall.	
VIII	Severe	Moderate/Heavy	Many find it difficult to stand.	Fall of chimneys, factory stacks, columns, monuments, walls. Very heavy furniture moves conspicuously.	Damage slight in specially designed structures; considerable damage in ordinary substantial buildings with partial collapse. Damage great in poorly built structures.	
IX	Violent	Heavy	Some forcibly thrown to the ground.		Damage considerable in specially designed structures; well-designed frame structures thrown out of plumb. Damage is great in substantial buildings, with partial collapse. Buildings shifted off foundations.	
X	Extreme	Very Heavy			Some well-built wooden structures destroyed; most masonry and frame structures destroyed with foundations. Rails bent.	



Location Map



National Earthquake Hazard Reduction Program (NEHRP) Soil Classes

This map shows the distribution of NEHRP site classes (see report, Section 2) used to make the Perceived Shaking and Damage Potential map. Different geologic materials are assigned to one of four NEHRP classes (B, C, D, or E) which determine how ground shaking will be amplified during an earthquake. The fine-scale and sharp changes in the Perceived Shaking and Damage Potential map result from changes in the geology that is used to assign the NEHRP classes.

General Description (Soil Classes in Parentheses)

- Rock (B)
- Dense Soil or Soft Rock (C)
- Stiff Soil (D)
- Soft Clay or Soft Soil (E)