Building Resilience for Oregon's Next Great Subduction Earthquake

- Why worry about Cascadia earthquakes?
- How often and how large are Cascadia earthquakes?
- How do Cascadia earthquakes compare to the 2011 Tohoku earthquake?
- What controls earthquake vulnerability and risk?
- How vulnerable is Multnomah County?
- What are the likely consequences of a Cascadia earthquake in Multnomah County?
- How do we decrease our vulnerability and increase our resilience?

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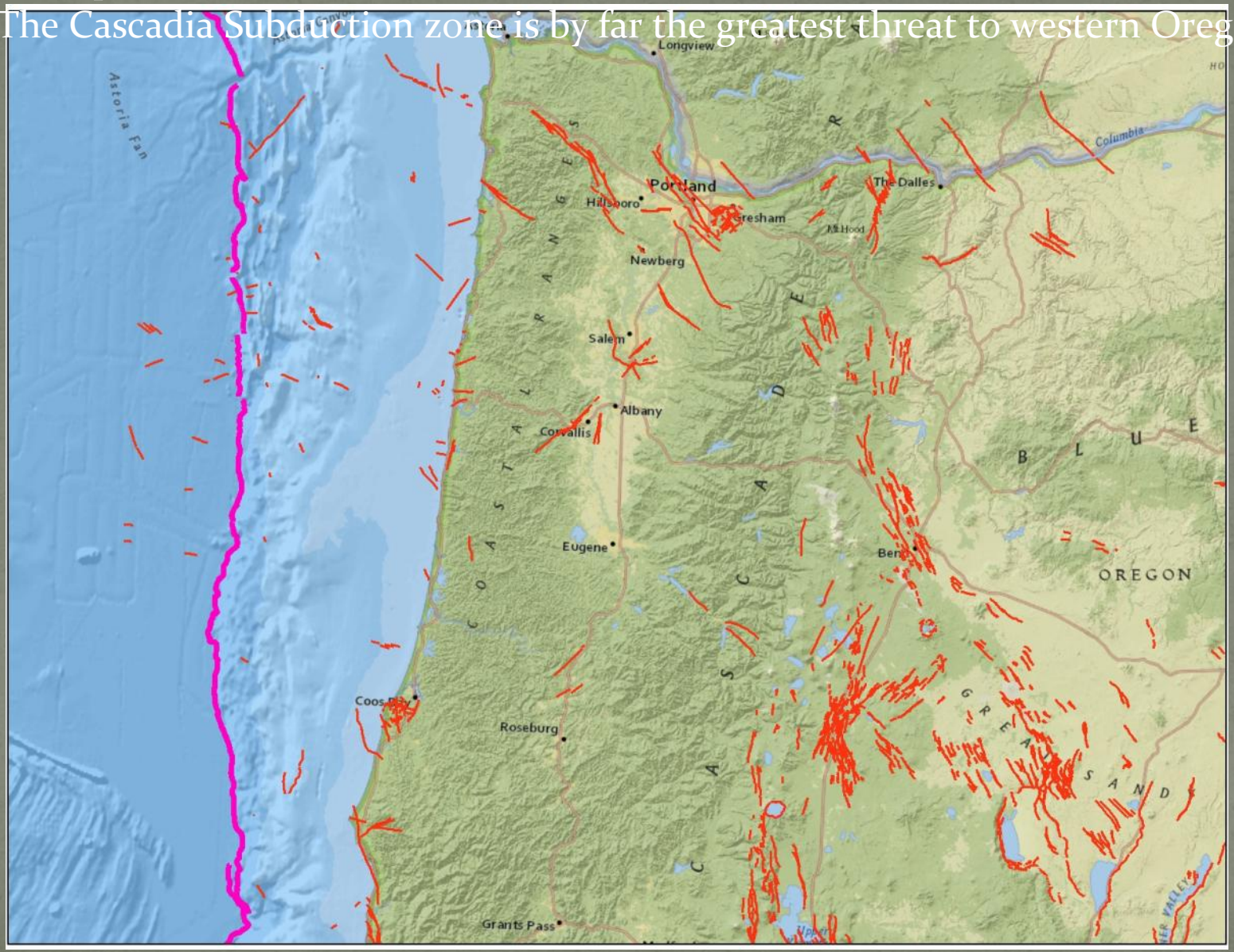
Although there are many faults that threaten Oregon with future earthquakes,

The Cascadia Subduction zone is by far the greatest threat to western Oregon



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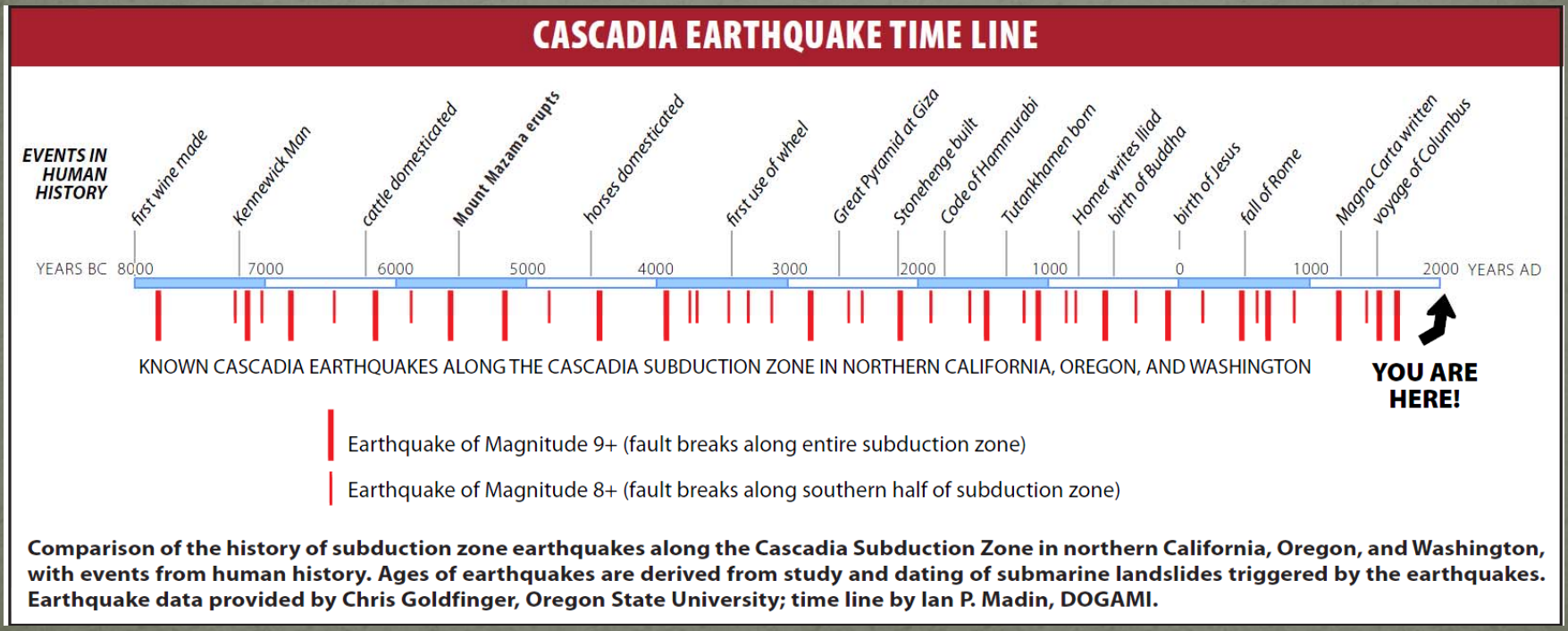
How likely is our next Cascadia Subduction earthquake?

The last 10,000 years of the geologic record includes:

- 19 certain great (~M 9) earthquakes
- 12 certain not-so-great (M 8.5-8.8) earthquakes
- 10 *likely* even-less-great (but still over M 8) earthquakes
- Average time between M 9 earthquakes is about 530 years, but can be as little as 100 or as great as 1000
- Chance of M 9 event in the next 50 years is 7-12% and the chance of any size Cascadia Subduction earthquake may be as high as 37% (your lifetime chance of a home fire is about 25%), so the next earthquake is <u>not</u> imminent



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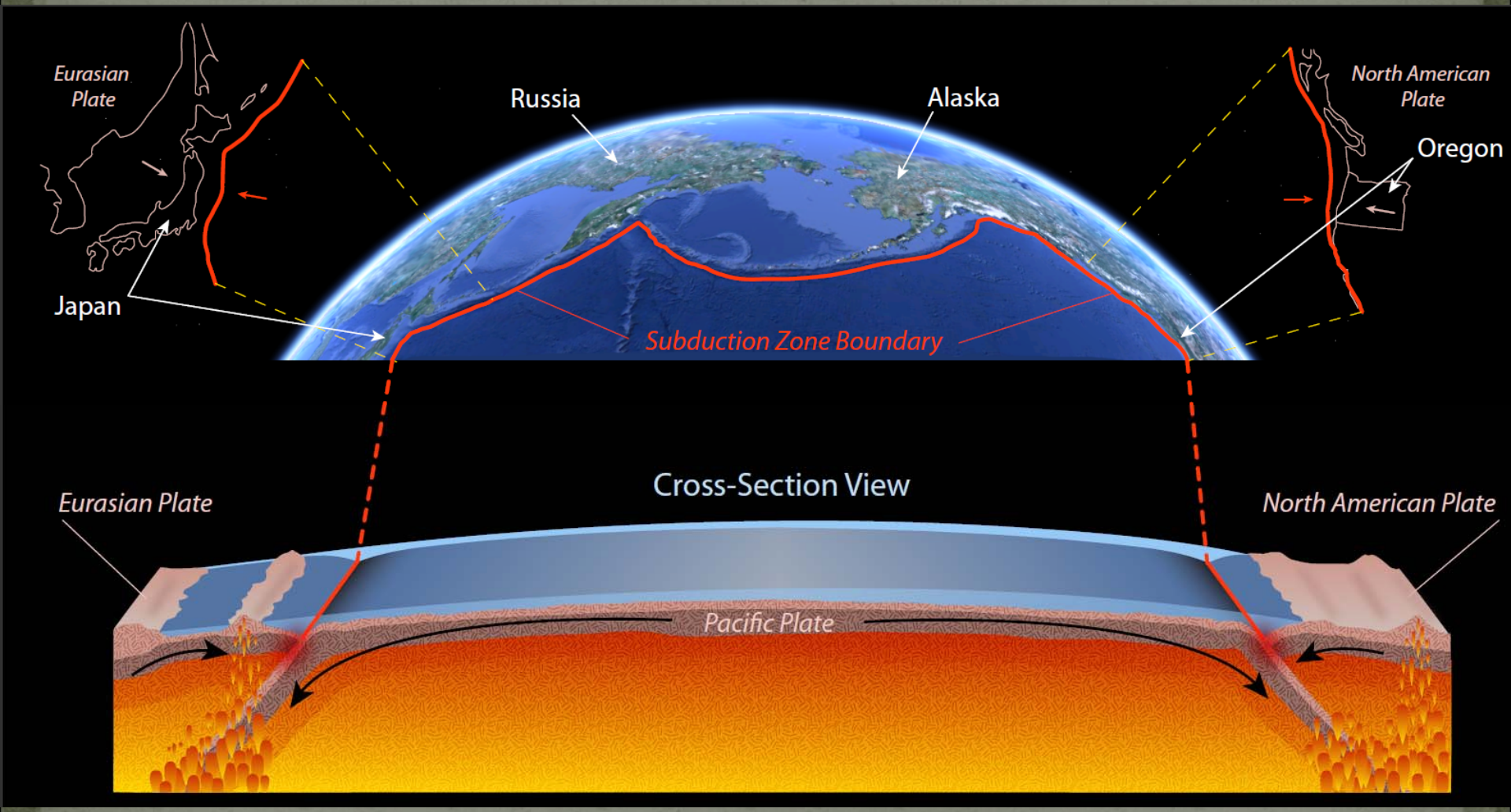
Oregon is a geologic mirror-image of Northern Japan. In both places, the Pacific Ocean floor is sliding beneath the adjacent continents along giant faults called subduction zones. *(Graphic by Dan Coe, DOGAMI)*



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The impact of the 2011 Japan earthquake

Almost 16,000 dead and almost 4,000 missing
Almost 6,000 injuries
300,000 homes destroyed
600,000 homes damaged
But…
92% of deaths were due to tsunami (drowning) and about 676,000 of the damaged buildings were in the tsunami inundation zone.

As great as the damage was, well designed structures meant that the impact was largely due to the tsunami. Decades of good seismic design and construction made a huge difference.

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What controls earthquake damage?

Total energy release (magnitude)

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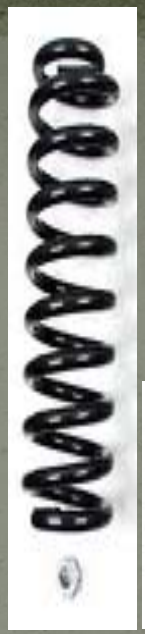
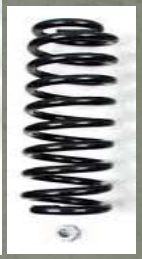
Distance from epicenter or fault

X



Site amplification



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Liquefaction or landslides

X

Structural vulnerability

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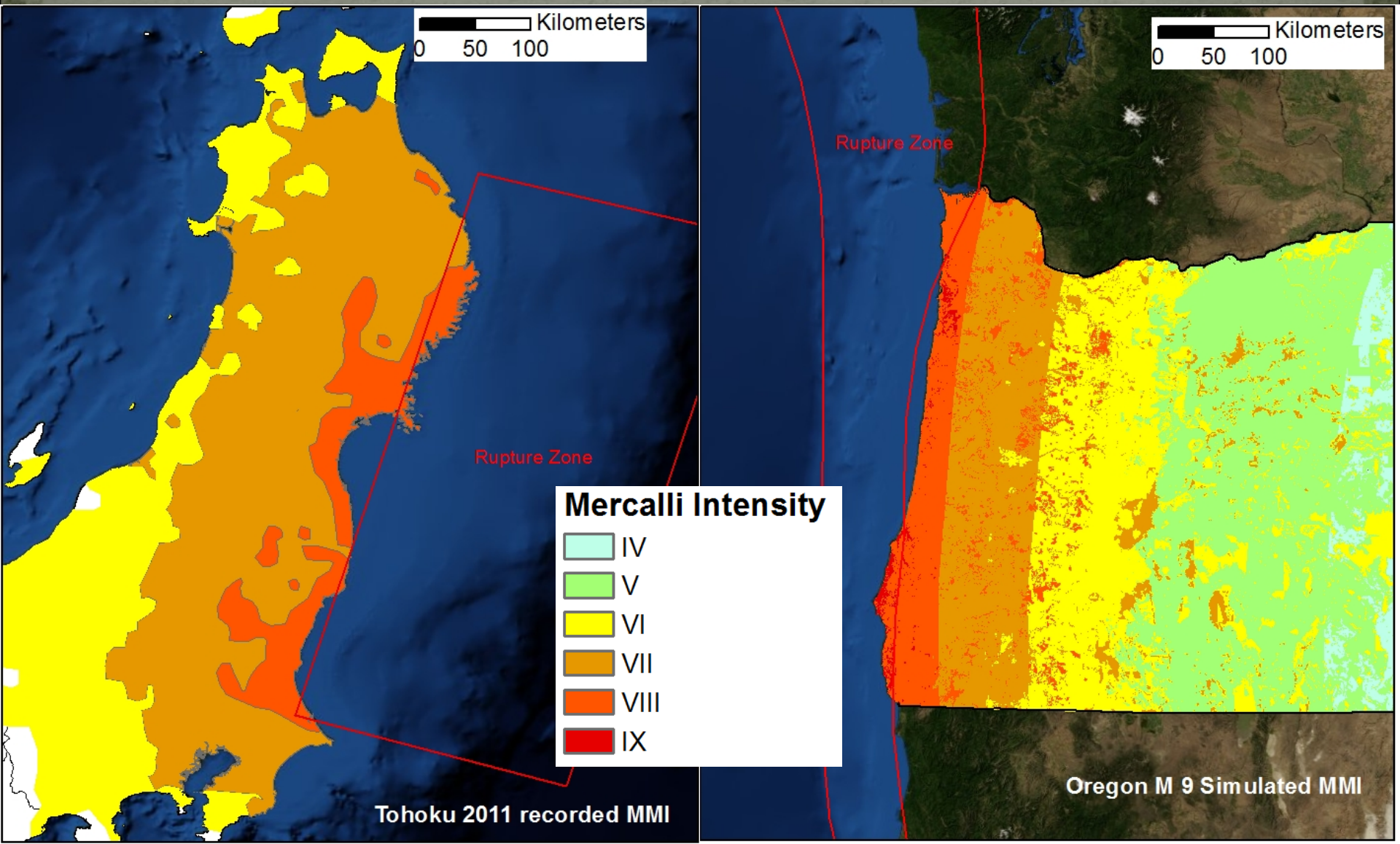
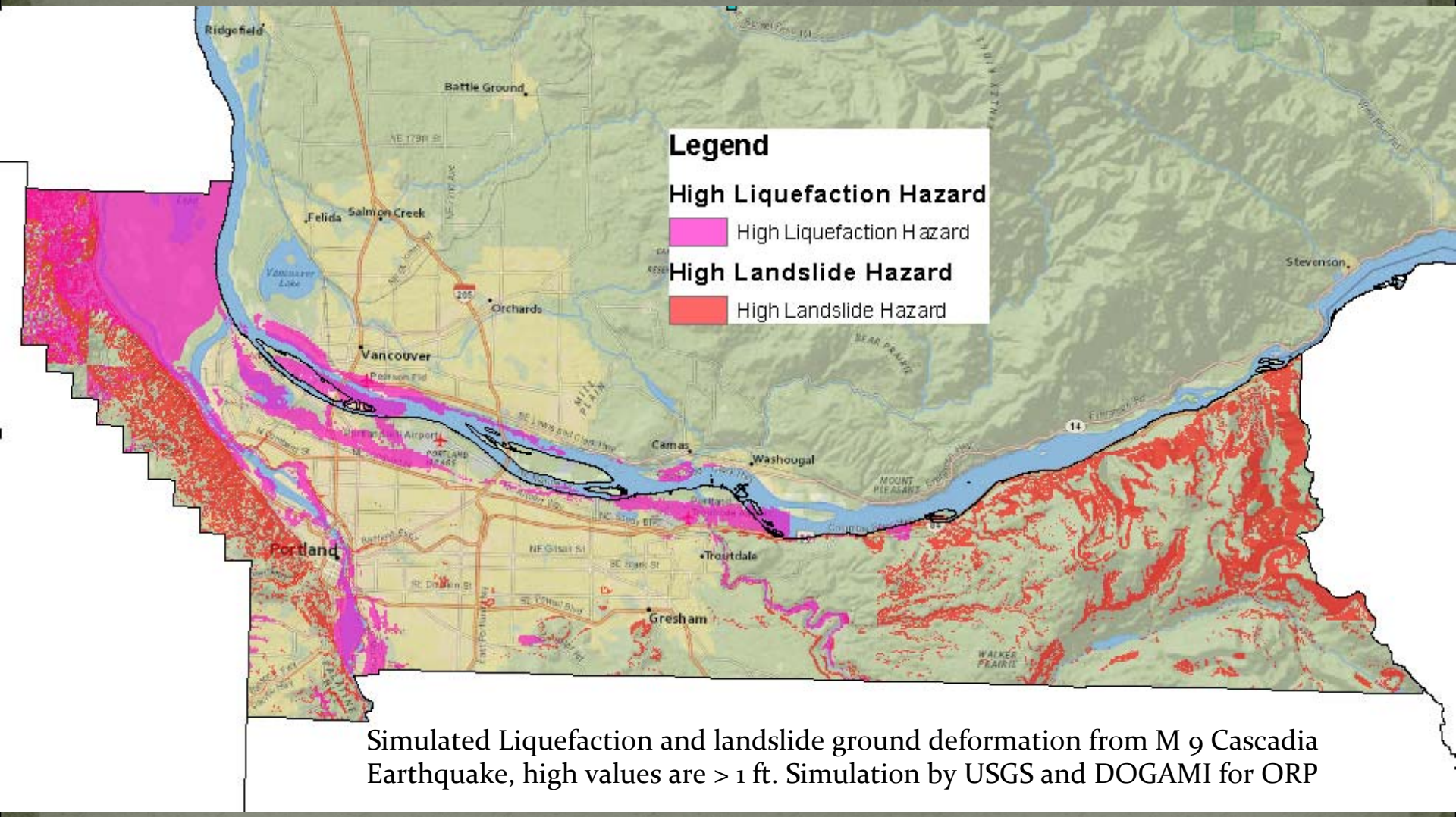
Damage

Simulated M 9 ground shaking for a M 9.0 Cascadia earthquake is broadly comparable to values recorded in the 2011 Tohoku earthquake.

Shaking simulation by USGS and DOGAMI for Oregon Resilience Plan



Multnomah County has widespread vulnerability to earthquake-induced ground deformation



Simulated Liquefaction and landslide ground deformation from M 9 Cascadia Earthquake, high values are > 1 ft. Simulation by USGS and DOGAMI for ORP

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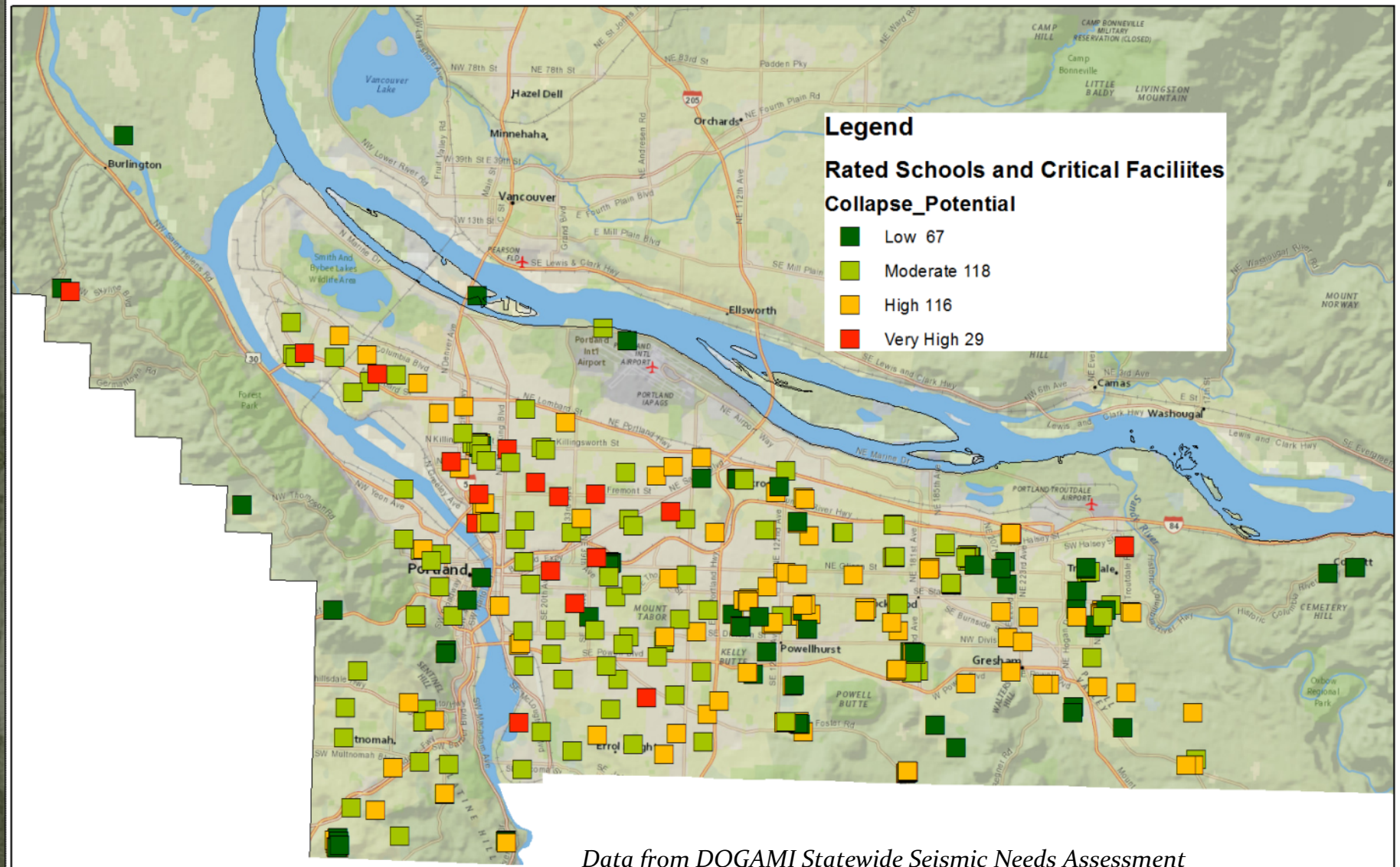
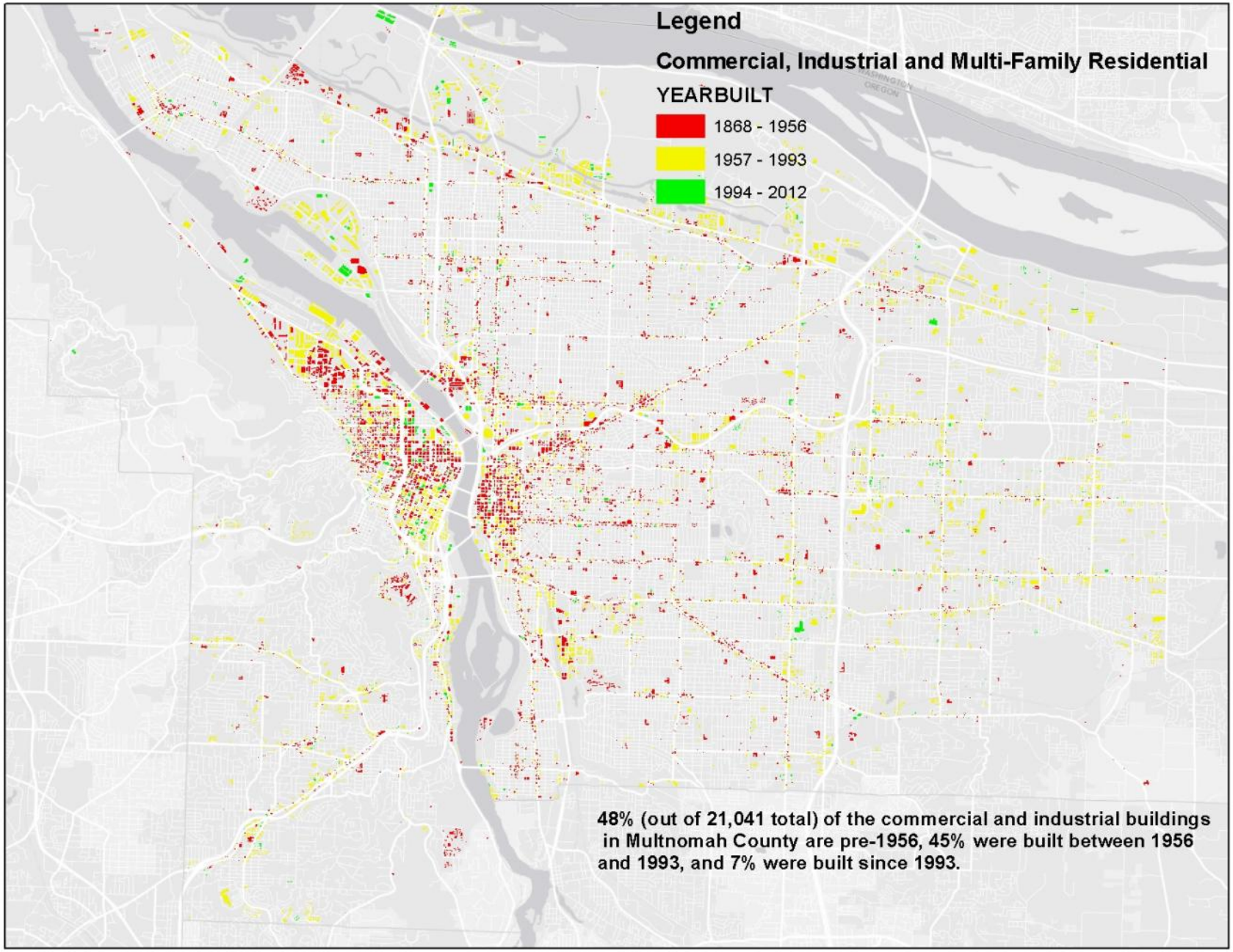
Multnomah County has many highly vulnerable critical buildings and schools.
Buildings designed before 1956 did not consider earthquakes in their design. Subduction zone earthquakes have only been considered in design since 1993.
Even today, the building code earthquake design goal is to protect the lives of the building occupants, not to ensure that the building will be useable after the earthquake.



Data from DOGAMI Statewide Seismic Needs Assessment



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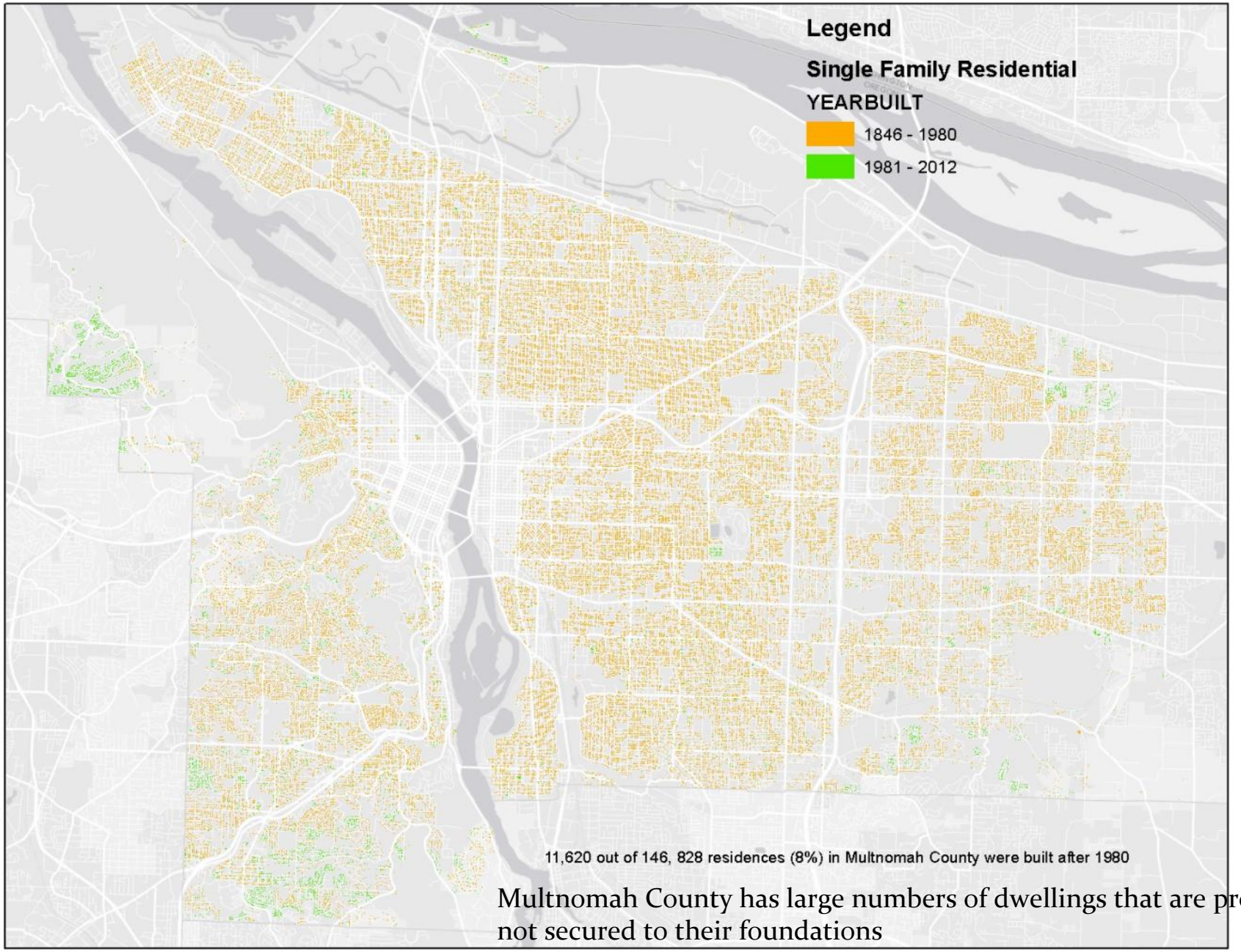
Multnomah County has large numbers of commercial buildings with inadequate seismic design.



Multnomah County has large numbers of dwellings that are probably not secured to their foundations

Estimated impacts of M 9 Cascadia Subduction Earthquake
Recovery time for lifeline systems

For I-5 corridor communities:

- State Highways 3-12 months for priority routes, 1-3 years all others
- Airports 3-6 months
- Critical buildings 2-4 months, longer for hospitals
- Drinking Water 1 year
- Sewer system 1-3 years
- Electricity, Natural Gas 3-6 months
- Petroleum fuels 6-12 months.

➢ **Businesses will start to leave after one month without services**

Source: Oregon Resilience Plan Preliminary Results

Increasing resilience by decreasing vulnerability

For tomorrow's earthquake, we need good emergency management planning.
For the next generation's earthquake we need to:

- Inventory/assess vulnerability
- Ensure that new construction be able to come through a Cascadia earthquake with minimal downtime
- Retrofit critical facilities
- Retrofit residential buildings
- Address non-critical or commercial/industrial structures with replacement, retrofit or crossed fingers