

Disaster Evacuation Safe Zones in Clackamas County, Oregon Analysis: Two Scenarios

- ▶ Part One: Mount Hood Eruption Scenario
- ▶ Part Two: Clackamas County Wildfire Scenario

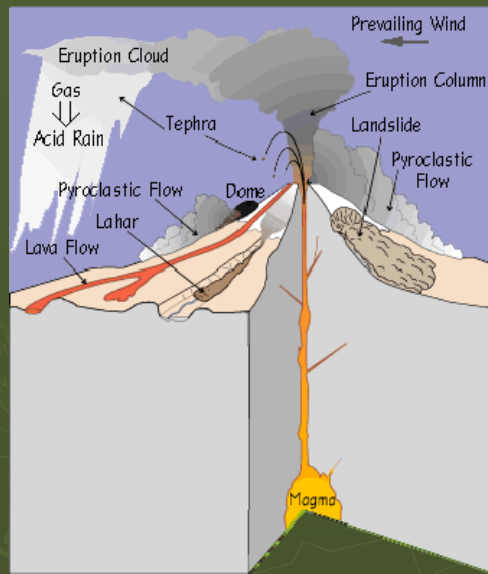
Goal: To determine safe areas to locate potential disaster evacuation centers

Mount Hood Eruption Safe Zones Goal

- ▶ Determine suitable safe areas for evacuation centers for communities affected by effects of Mount Hood eruption
- ▶ USGS recommends local agencies determine easily accessible gathering locations

Why Determine Safe Zones?

- ▶ Mt Hood is the presents the highest volcanic hazard to Clackamas County.
- ▶ This volcano has been relatively quiet, with about 1 major event every 100 years.
- ▶ Risk to life, drinking water sources, essential infrastructure



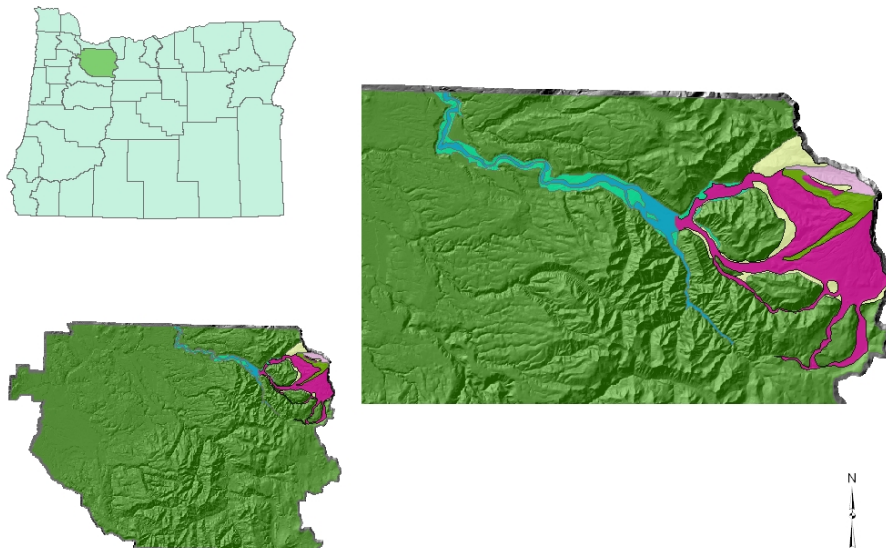
For this study hazards are:

- Pyroclastic flow
- Debris Landslide
- Lahar
- Lava flow

Does not include ash fall projections

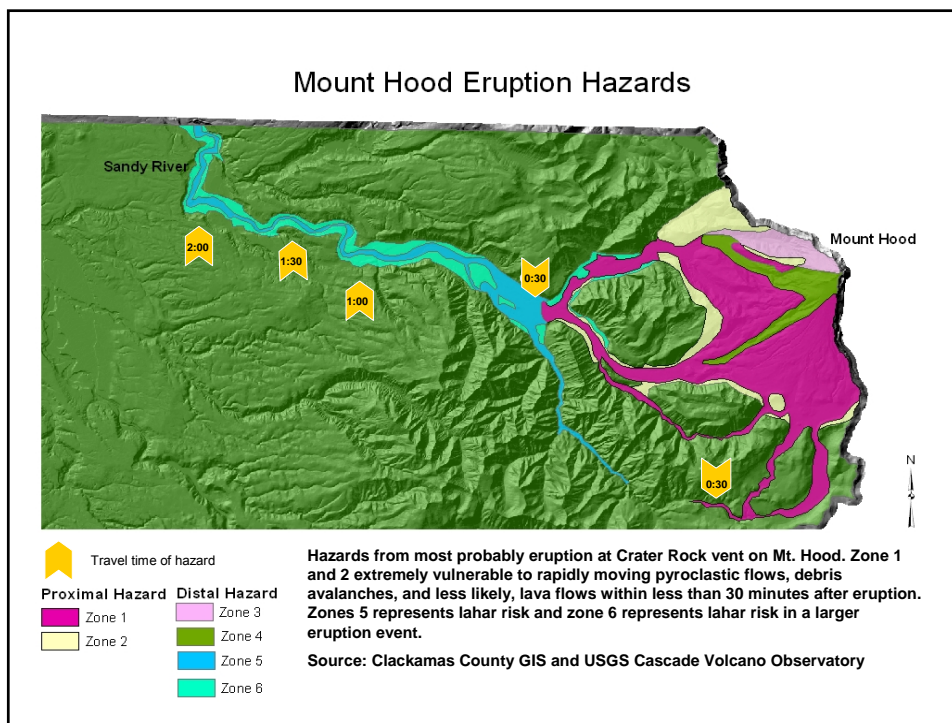
<http://volcanoes.usgs.gov/Hazards/What/hazards.html>

Clackamas County Study Area

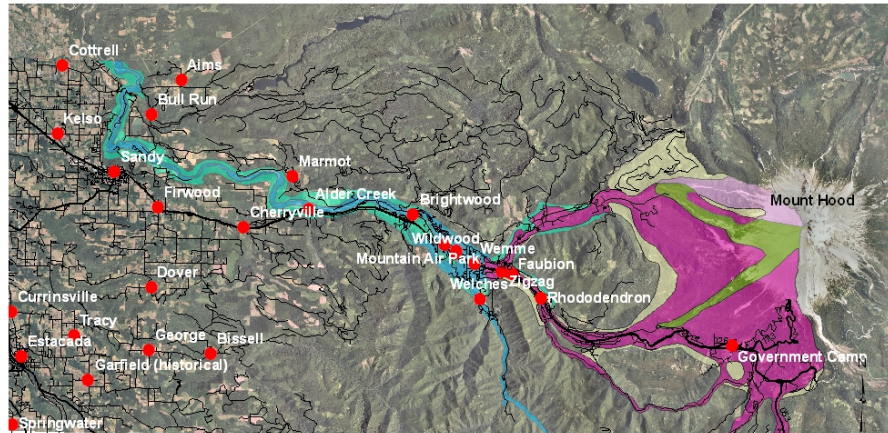


Step One: Gather Data

- ▶ Hazard map digitized from 2007 Clackamas County Mt. Hood hazard map based on USGS Mt. Hood hazard report in 2000
- ▶ Clackamas county schools and houses of worship created using IRS tax exempt records, geocoding, current update work for Geographic Names Information System
- ▶ Clackamas county DEM mosaiced together from Oregon N and Oregon NW DEM.



Mount Hood Eruption Hazards



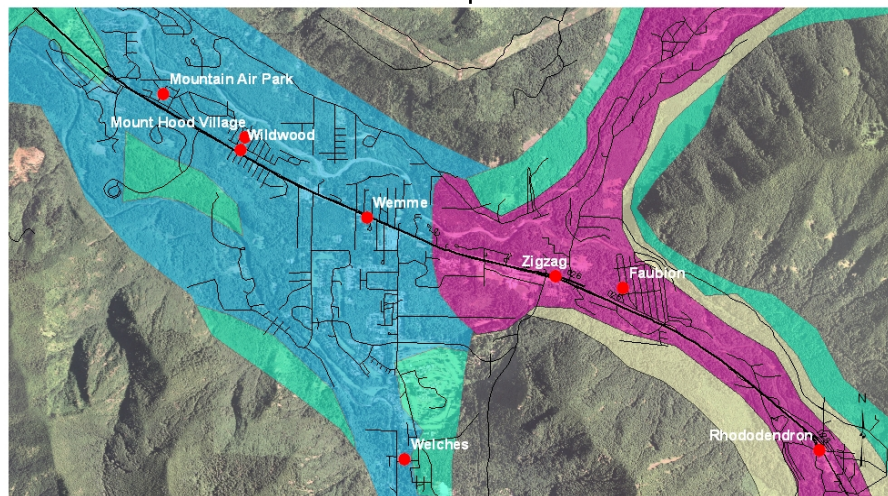
● Populated Places

Proximal Hazard **Distal Hazard**



Map of hazards of most likely eruption event from the Crater Rock vent on Mount Hood. Hazards include pyroclastic flows, debris avalanches, lahars, and least likely, lava flows. Zones delineated are subject to same hazards but represent different degrees of effects.

Mount Hood Eruption Hazards



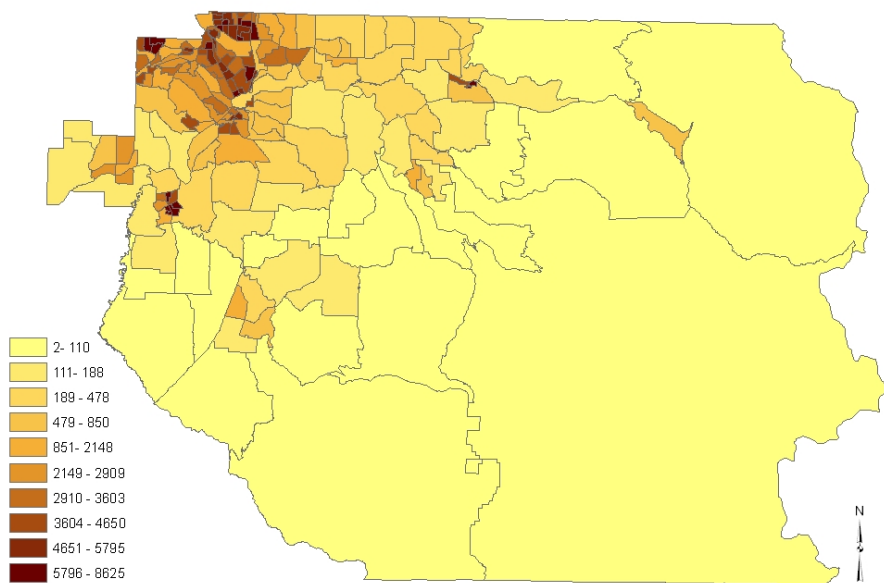
● Populated Places

Proximal Hazard **Distal Hazard**

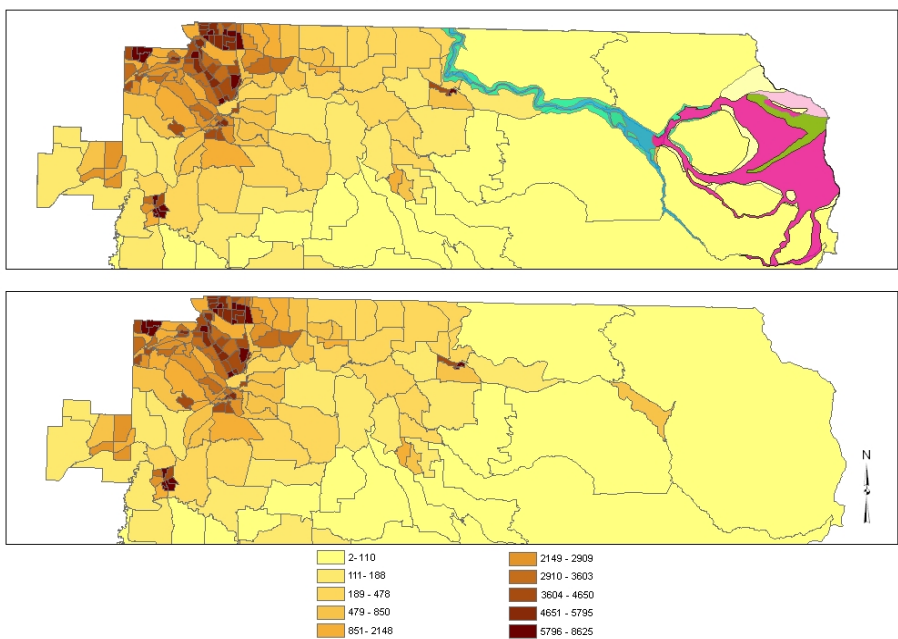


Map of hazards of most likely eruption event from the Crater Rock vent on Mount Hood. Hazards include pyroclastic flows, debris avalanches, lahars, and least likely, lava flows. Zones delineated are subject to same hazards but represent different degrees of effects.

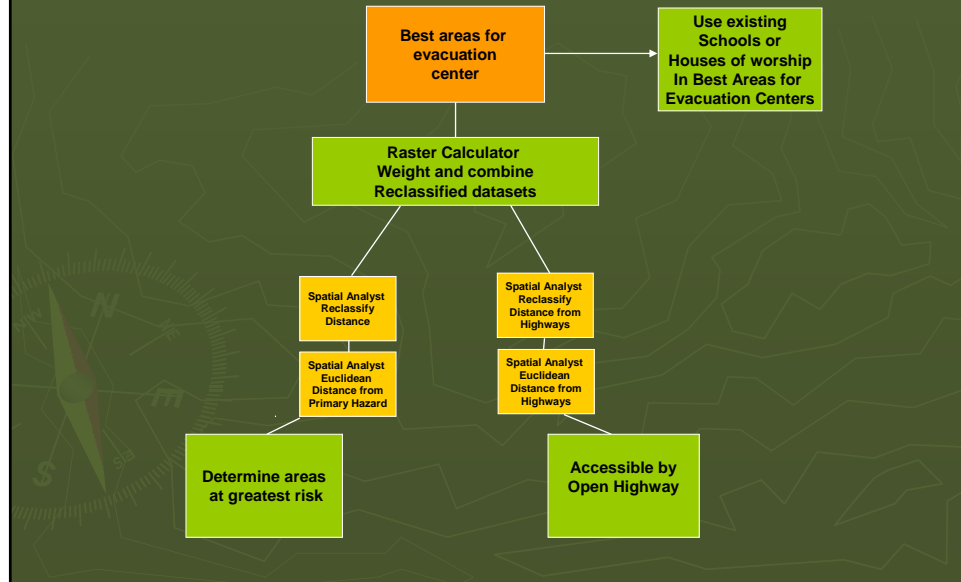
Clackamas County - US Census Tract
2004 Population per square mile



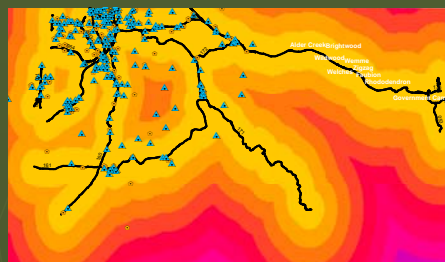
2004 Population per square mile
Affected by Mount Hood Hazards



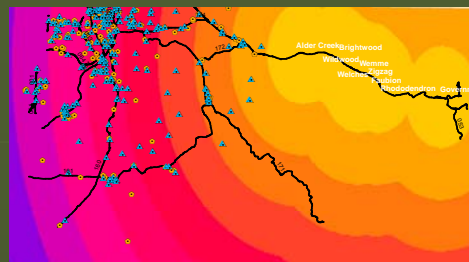
Steps to Safe Zones



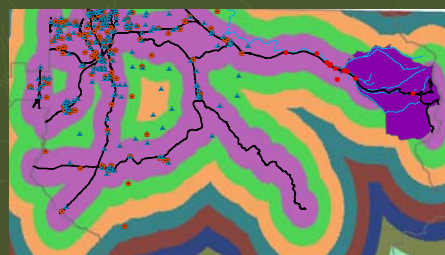
Steps to suitable areas for evacuation map



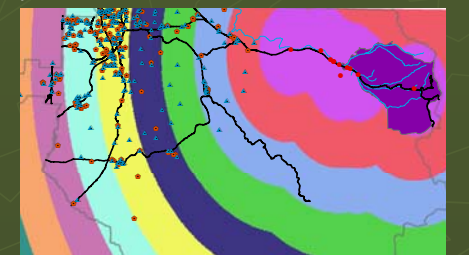
Euclidean Distance from highway



Euclidean Distance from populated places in hazard zones



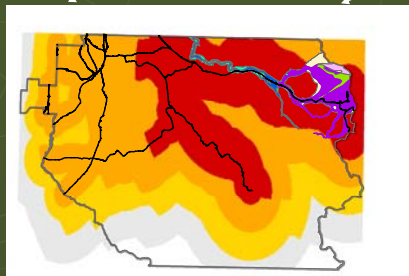
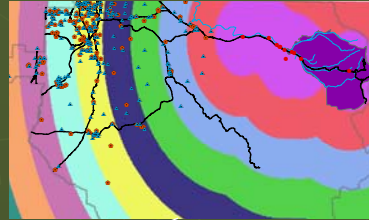
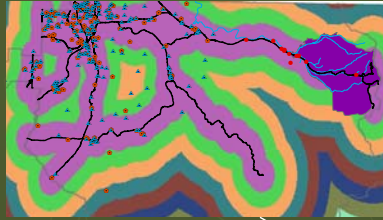
Reclassify distance from highway



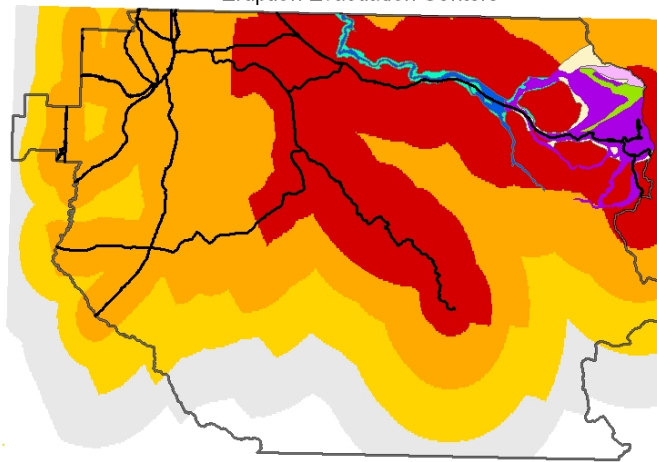
Reclassify distance from populated places in hazard zone

Steps to suitable areas for evacuation map

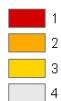
Raster Calculator: weight and combine
Distance from hazard and Distance from
Highway datasets



Clackamas County Suitable Areas for Mount Hood Eruption Evacuation Centers



Suitable Areas
1 = least suitable
4 = most suitable

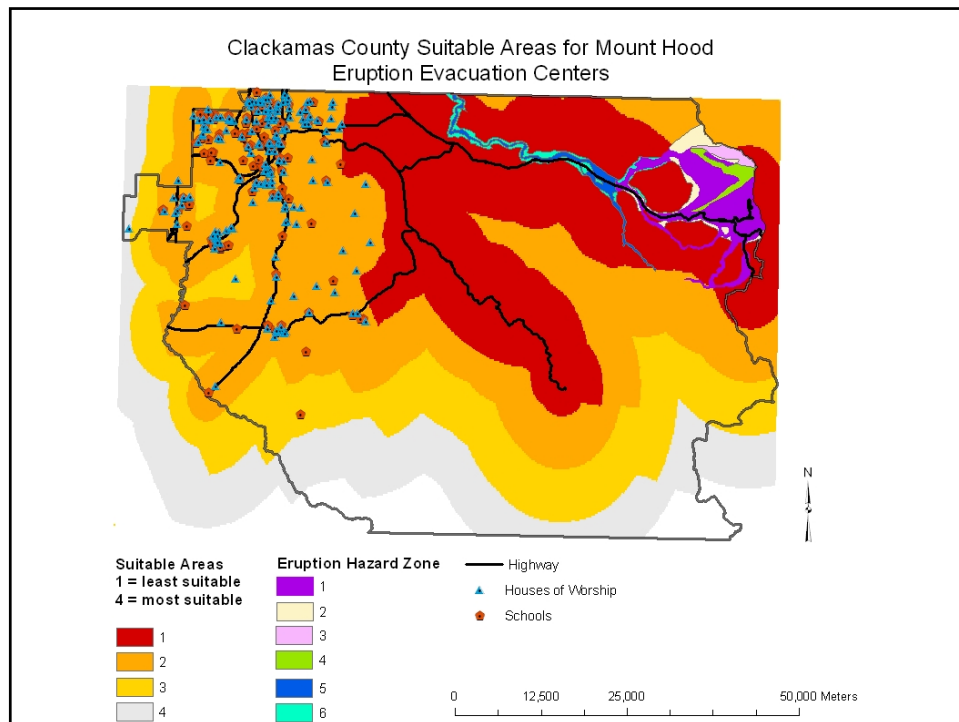


Eruption Hazard Zone



Highway

0 12,500 25,000 50,000 Meters



Conclusion

- ▶ Final output: 301 possible evacuation centers
- ▶ Recommend further site analysis include:
 1. Transportation routes and accessibility
 2. Evacuation center analysis to determine ability to handle evacuees
 3. Ash fall projections

References

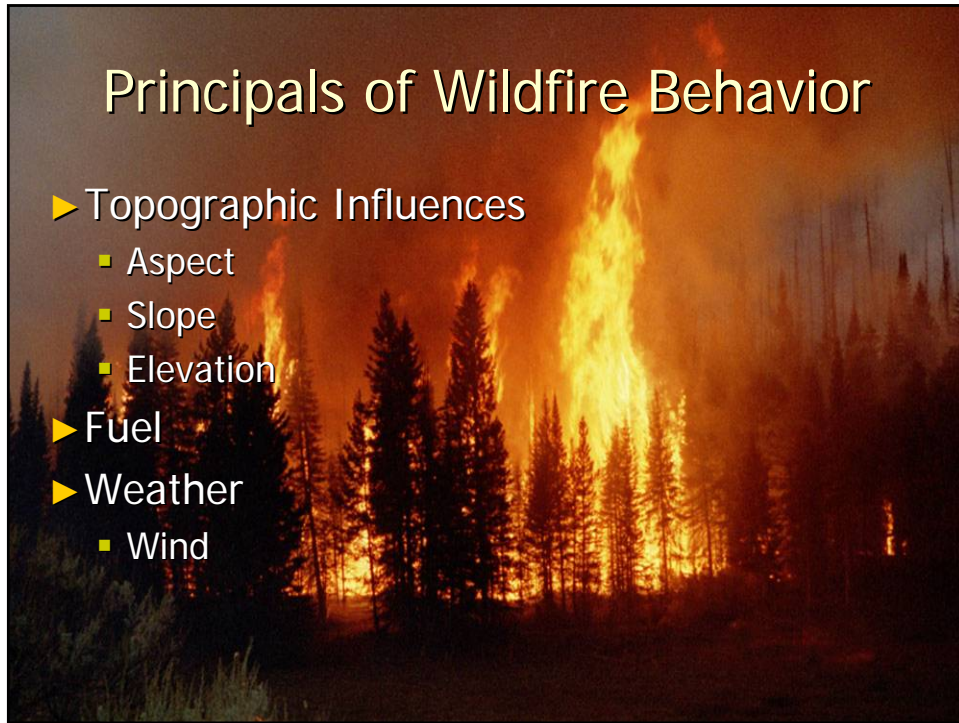
- ▶ Clackamas NHMP 2007 Update, Section 12, 63-69, <http://www.clackamas.us/docs/emergency/s12.pdf>
- ▶ Hazard layer digitized from "Clackamas County Mount Hood Hazards" Map, Clackamas County GIS, Jim Lugosi, May 29, 2007
- ▶ Clackamas school, houses of worship, and populated places data, USGS, -Geographic Names Information System, 2008. Available at http://geonames.usgs.gov/domestic/download_data.htm
- ▶ Clackamas Digital Elevation Model 10 meter, mosaic from Oregon N and NW DEM downloaded from <https://home.oit.pdx.edu/resources/students/Data/GIS/Oregon/DEM/>
- ▶ ½ meter ortho imagery, usgs
- ▶ Clackamas county boundary, Bureau of Land Management, available at <http://www.oregon.gov/DAS/EISPD/GEO/alphalist.shtml>
- ▶ Roads data and census data, Street Map Pro
- ▶ USGS Volcano Hazards Program, available at <http://volcanoes.usgs.gov/About/Highlights/MtHood/MtHood.html>

Disaster Evacuation Safe Zone Analysis for Clackamas County, Oregon

Part 2: Wildfires
By Kathy Jepson

Principals of Wildfire Behavior

- ▶ Topographic Influences
 - Aspect
 - Slope
 - Elevation
- ▶ Fuel
- ▶ Weather
 - Wind

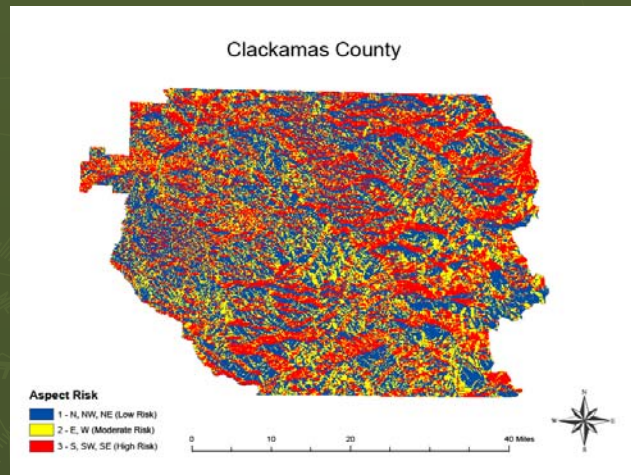


Aspect

- ▶ Exposure to Sunlight
- ▶ Fuels



Aspect

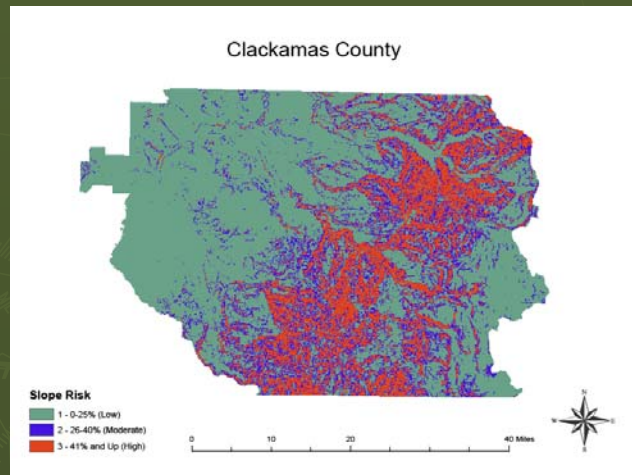


Slope

- ▶ Steeper slopes burn faster.
- ▶ > 40% slopes provide for rapid rates of fire movement.

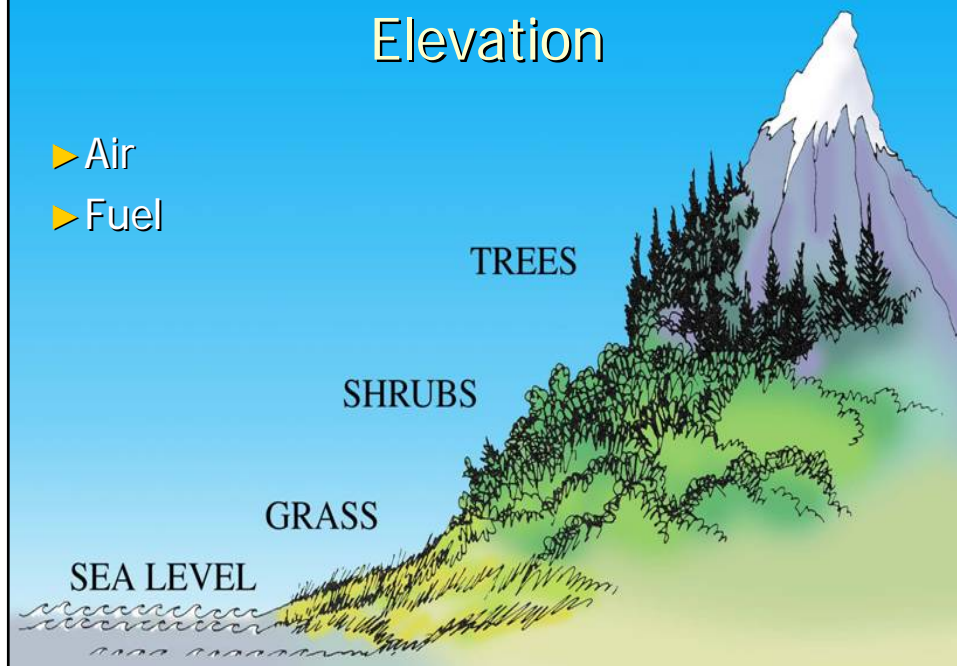


Slope

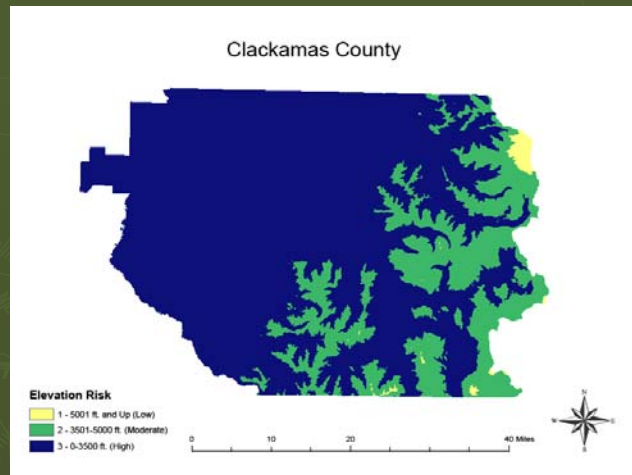


Elevation

- ▶ Air
- ▶ Fuel

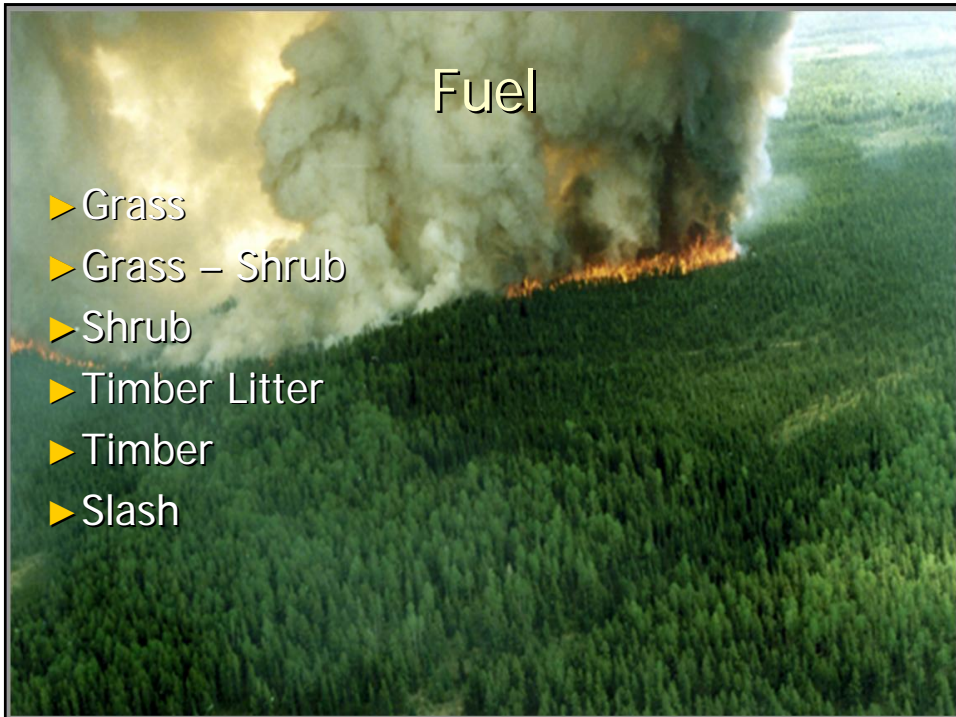


Elevation



Fuel

- ▶ Grass
- ▶ Grass – Shrub
- ▶ Shrub
- ▶ Timber Litter
- ▶ Timber
- ▶ Slash



Grass

Combination of Grass and Grass-Shrub



Shrub

Combination of Shrub and Timber Litter

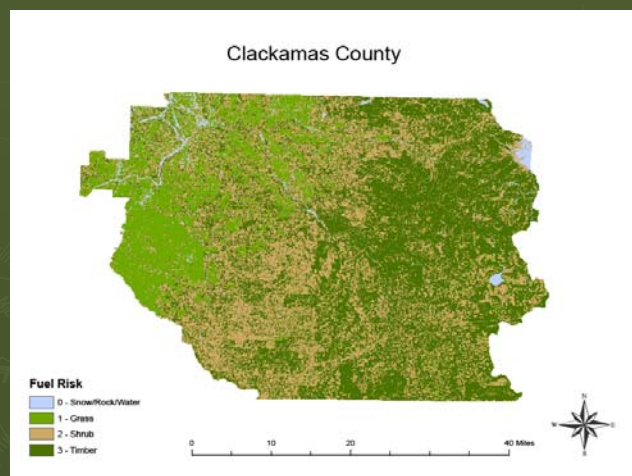


Timber

Combination of Timber and Slash

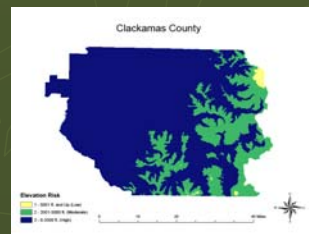
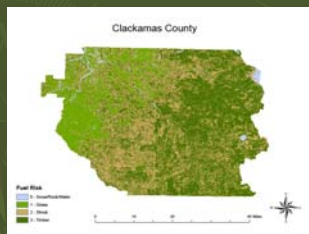
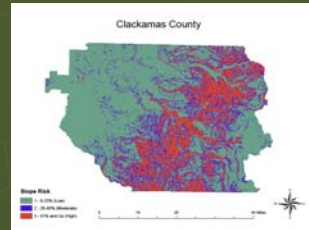
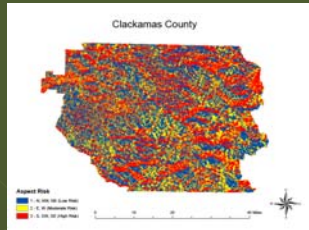


Fuel

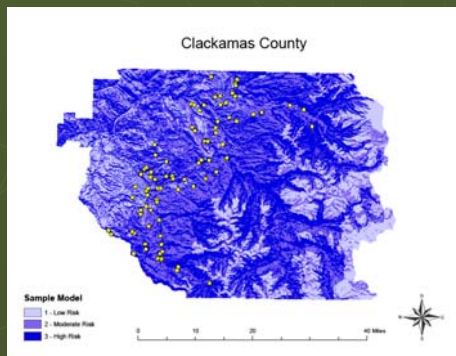
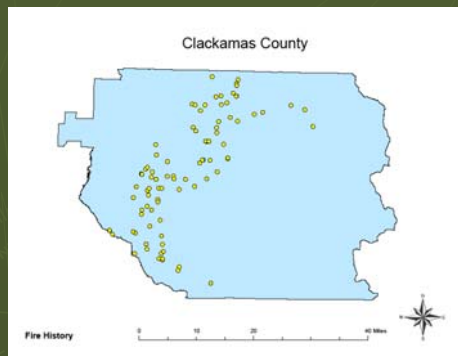


Combined Risk =

$$(\text{Aspect} * \text{weight}) + (\text{Slope} * \text{weight}) + (\text{Fuel} * \text{weight}) + (\text{Elevation} * \text{weight})$$



Checking Weight

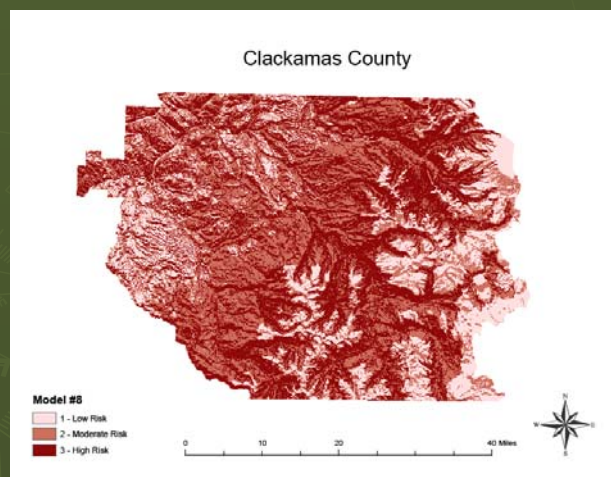


Weight Models

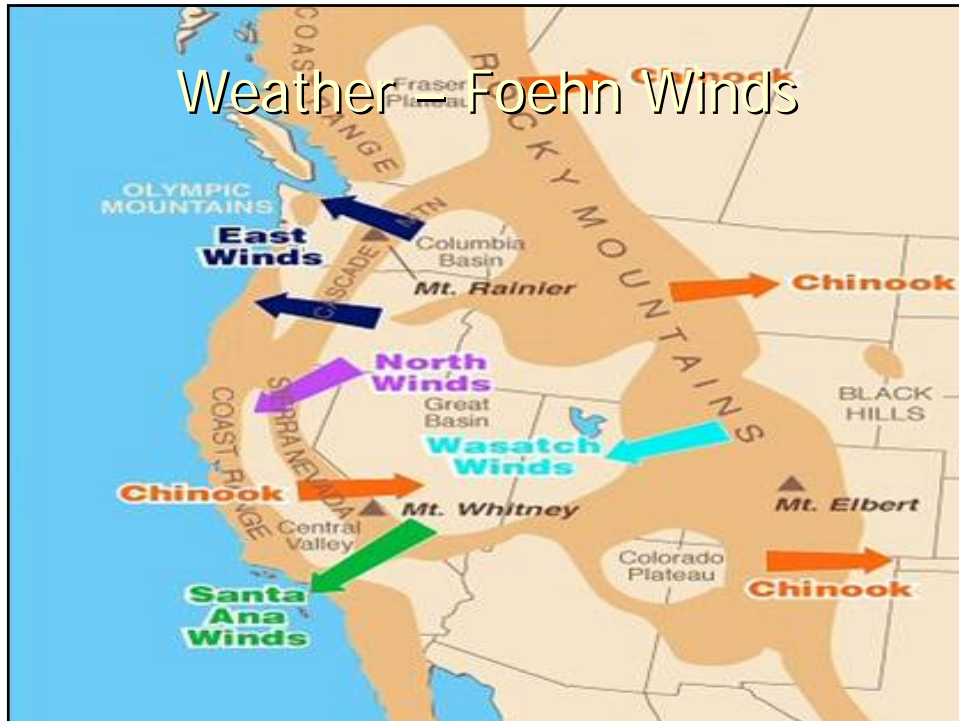
Model#	1 AHP	2 AHP	3 equal	4	5	6	7	8	9	10
Fuel	0.17	0.04	0.25	0.1	0.15	0.15	0.2	0.1	0.15	0.2
Elevation	0.1	0.53	0.25	0.5	0.4	0.4	0.55	0.5	0.5	0.35
Slope	0.58	0.26	0.25	0.25	0.25	0.2	0.1	0.15	0.1	0.2
Aspect	0.15	0.17	0.25	0.15	0.2	0.25	0.15	0.25	0.25	0.25
Results out of 88										
(low) 1	56	0	14	14	23	23	14	13	14	31
(mod) 2	28	59	43	65	58	46	45	37	57	51
(high) 3	4	29	31	9	7	19	29	38	17	6
Model#	11	12	13	14	15	16	17	18	19	20
Fuel	0.3	0.1	0.08	0.07	0.07	0.05	0.05	0	0.05	0.24
Elevation	0.4	0.5	0.5	0.51	0.51	0.6	0.45	0.65	0.55	0.42
Slope	0.15	0.25	0.17	0.2	0.13	0.1	0.2	0.15	0.15	0.07
Aspect	0.15	0.15	0.25	0.22	0.29	0.25	0.3	0.2	0.25	0.28
Results out of 88										
(low) 1	22	13	22	0	13	0	34	0	0	23
(mod) 2	49	66	38	60	48	51	26	60	50	38
(high) 3	17	9	28	28	27	37	28	28	38	27

Good Model

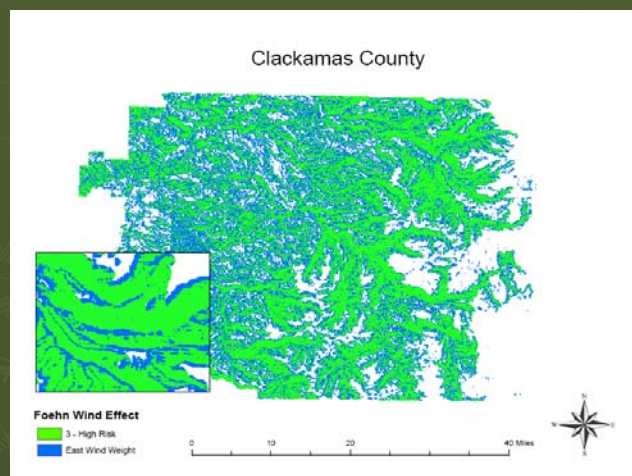
- Model #8: 1. 13 (15%) 2. 37 (42%) 3. 38 (43%)



Weather — Foehn Winds

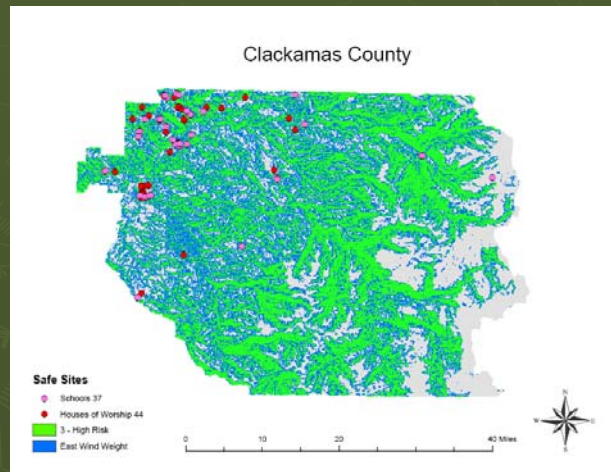


Wind



Safe Locations

(Out of 350 possible schools and houses of worship)



Questions?

References:

- Geo Spatial Data Library. www.oregon.gov/DAS/EISPD/Geo/alphabet.html
- Introduction to Wildland Fire Behavior. National Wildfire Coordinating Group. 2006
- Oregon Department of Forestry Molalla Unit. Fire History Data
- Paul, Chris. Protection Supervisor. Oregon Department of Forestry Molalla Unit. RLIS. November 2007
- USGS – Geographic Names Information System. Clackamas Schools and Houses of Worship data. 2008. http://geonames.usgs.gov/domestic/download_data.htm
- Wikipedia. Foehn Winds Information. www.wikipedia.com