Mapping Current and Future Landslide Susceptibility with GIS for the Tualatin Mountains, Oregon, USA

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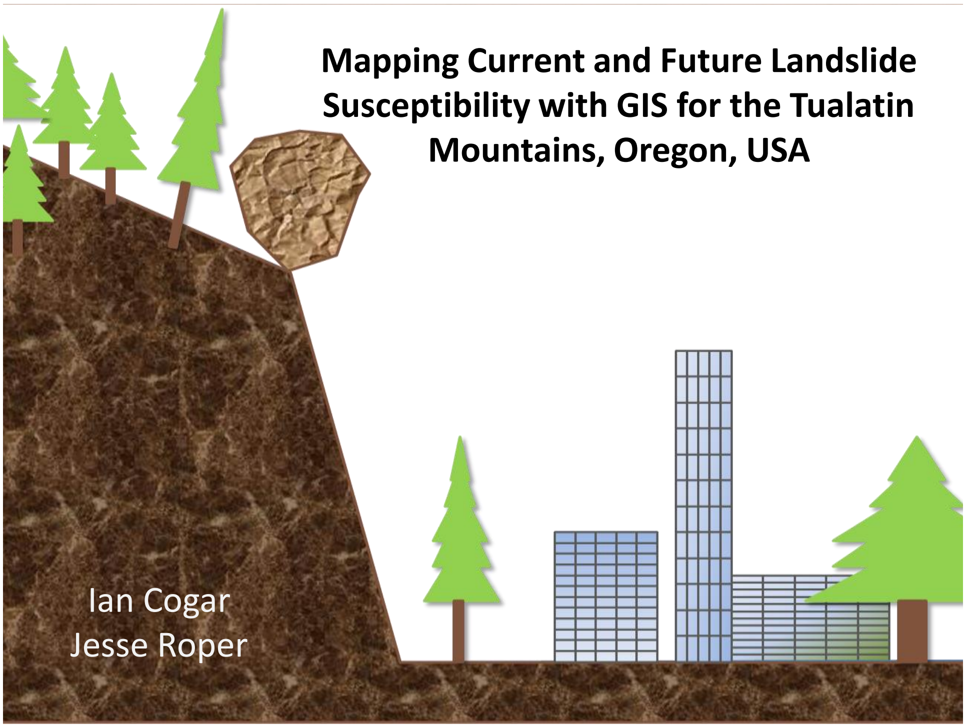


INTRODUCTION

Landslides are bad… but good

Avg. Annual Cost

- $2 billion and 20 – 50 fatalities nationally
- > $10 million in Oregon

Benefits

- Introduce essential components of salmonid habitat (e.g. sediment and LWD)
- Component of beneficial disturbance regimes—optimizing biodiversity

INTRODUCTION CONT'D

Estimated increases in precipitation due to climate change, and the inevitable pressures of urban growth, further emphasize the need for spatially explicit susceptibility indices.

STATEMENT OF PURPOSE

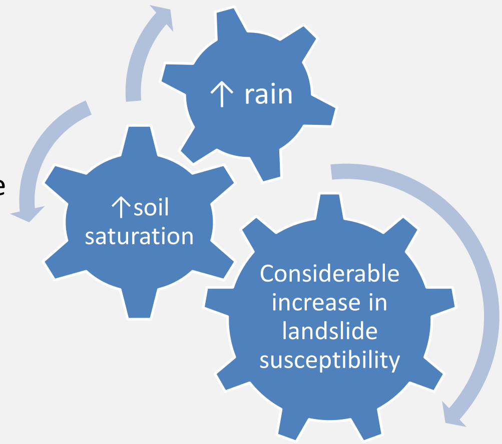
This study intended to create a landslide susceptibility index for the Tualatin Mountains west of Portland, Oregon, that synthesized geospatially variable data from historic landslide records, soil types, elevation, slope, land cover, and precipitation values.

1 map, **4 LSIs !!!**

But wait, there's more…

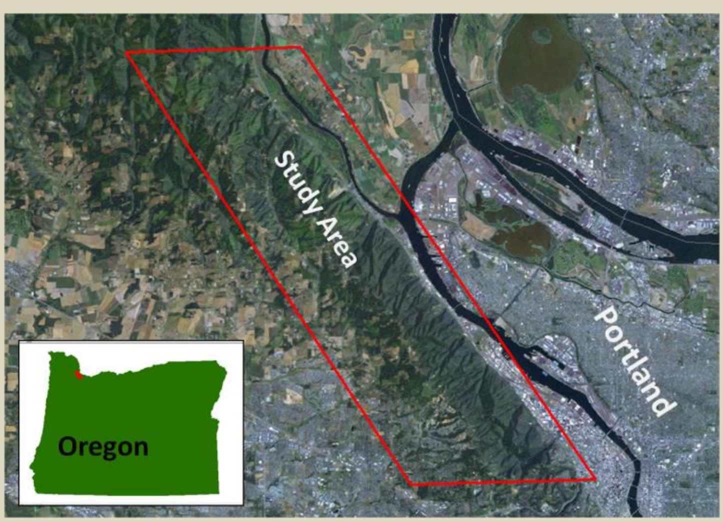
HYPOTHESIS

We expected to see considerable increases in landslide susceptibility for future projections caused by climate change induced increases in precipitation.



METHODS

-Study Area and Datasets



Study Area and Datasets Cont'd

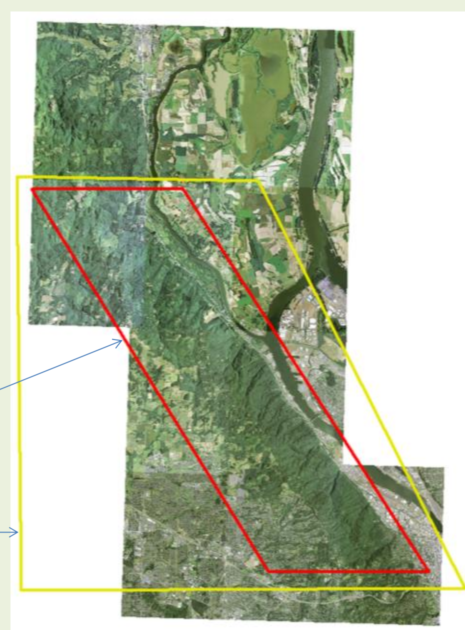
Layer	Source
Historic landslide Records	*Oregon Department of Geology and Mineral Industries: Statewide Landslide Information Database of Oregon, Release 2 (SLIDO-2). Retrieved online, Nov. 2013 at: http://www.oregongeology.org/slido/index.html*
Digital Elevation Model (DEM)	*Portland State University. Retrieved from: I:\Students\Data\GIS\Oregon\DEM\Oregon10mDEMs\nw*
Soil Type	*Soil Survey Staff. The Gridded Soil Survey Geographic (gSSURGO) Database for Oregon. United States Department of Agriculture, Natural Resources Conservation Service. Retrieved online, Nov. 2013, at: http://datagateway.nrcs.usda.gov/*
Slope	*Created from DEM*
Precipitation	*PRISM climate group at Oregon State University: United States average annual precipitation, 1981 – 2010. Retrieved online, Nov 2013 at: http://www.prism.oregonstate.edu/normals/*
Land Cover	*National Land Cover Database, 2006. Retrieved online, Nov. 2013, at: http://www.mrlc.gov/nlcd06_data.php*

METHODS

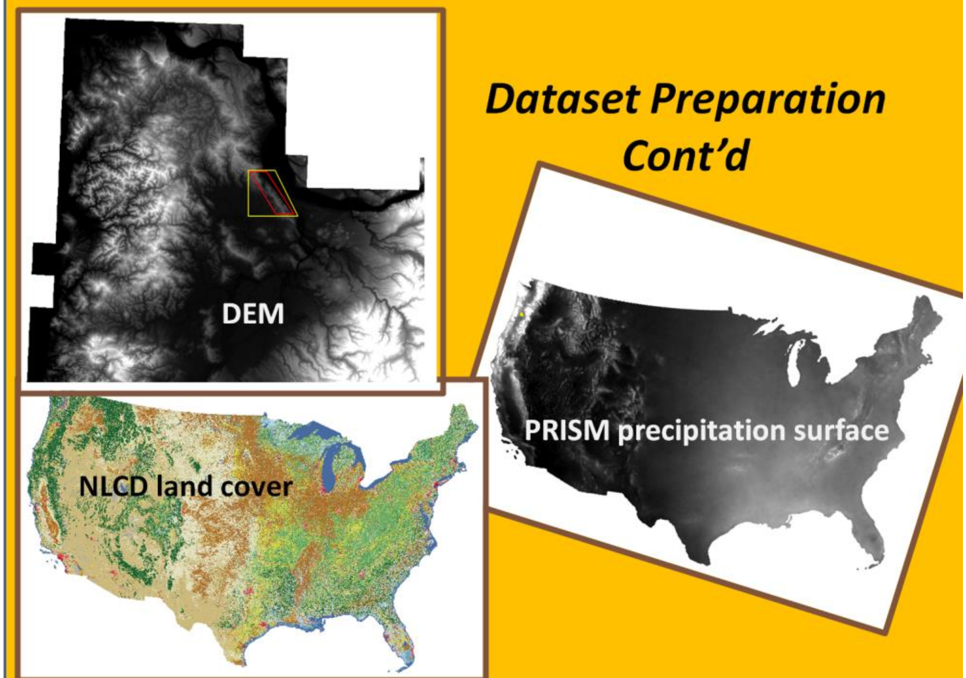
-Dataset Preparation

1. Create polygon feature to define extent of all future raster analysis.

2. Convert historic landslide points from vector to raster using *Point to Raster* tool.



Dataset Preparation Cont'd



Dataset Preparation Cont'd

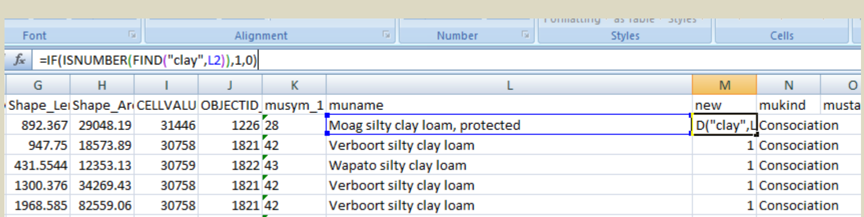
3. The quantification of qualitative values

Land cover

IF	Open water	Developed land	Forested or shrub	Grass/crop land	Barren land
THEN	0	1	2	3	4

Soils

IF	Clay	Loam	Silt	Sand
THEN	1	2	3	4



G	H	I	J	K	L	M	N	O
Shape_Le	Shape_Ar	CELLVALU	OBJECTID_	musym_1	muname	new	mukind	musta
892.367	29048.19	31446	1226	28	Moag silty clay loam, protected	D("clay",L	Consociation	
947.75	18573.89	30758	1821	42	Verboort silty clay loam	1	Consociation	
431.5544	12353.13	30759	1822	43	Wapato silty clay loam	1	Consociation	
1300.376	34269.43	30758	1821	42	Verboort silty clay loam	1	Consociation	
1968.585	82559.06	30758	1821	42	Verboort silty clay loam	1	Consociation	

Dataset Preparation Cont'd

4. Reclassification of quantitative values

   Precipitation
   Slope
   Land Cover
   Soil Type
   Historic Landslide Points

   All are now quantitative

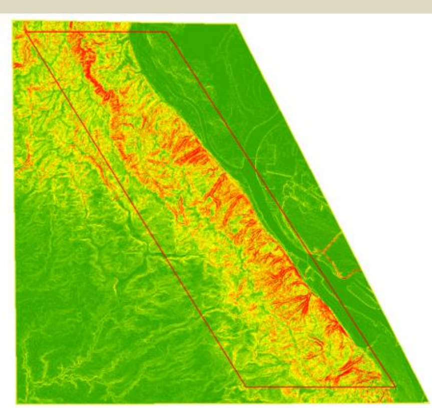
$$(cell\_value) \div (Max\_cell\_value) = new\_value,$$

where

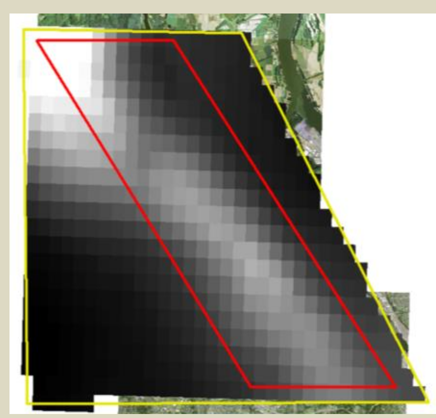
$$0 \le (new\_value) \le 1$$

Dataset Preparation Cont'd

5. Re-sampling to achieve consistent cell size



VS.



Creating a Landslide Susceptibility Index (LSI)

Historic Landslide Points

Precipitation

Land Cover

Soil Type

Slope

LSI

Creating Future Landslide Susceptibility Indices

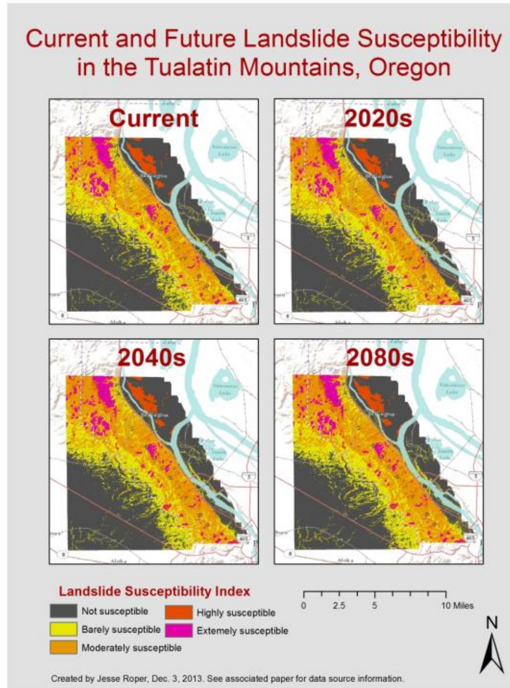
Raster Calculator

Current Precip × Multiplier = Future Precip

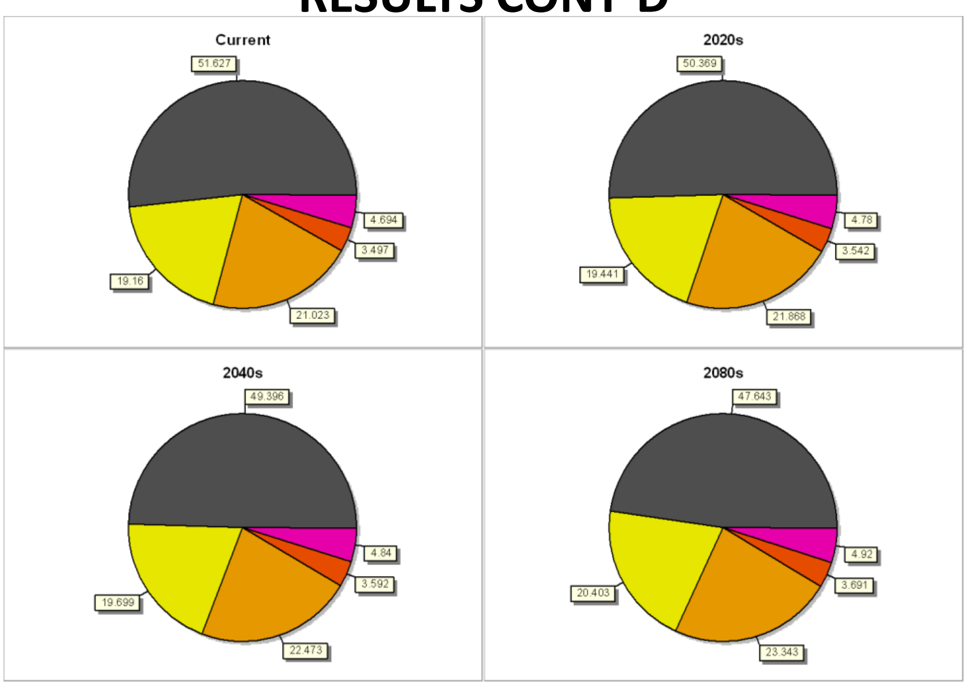
	Percent Change	Multiplier Value
2020s	+1.3	1.013
2040s	+2.3	1.023
2080s	+3.8	1.038

Estimated changes in precipitation are based on estimates from Mote and Salathe (2010), and Littell et al. (2011).

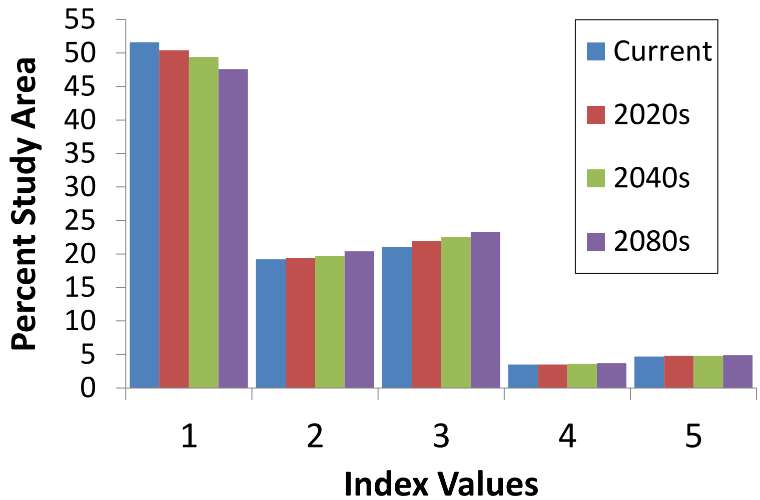
RESULTS



RESULTS CONT'D



RESULTS CONT'D



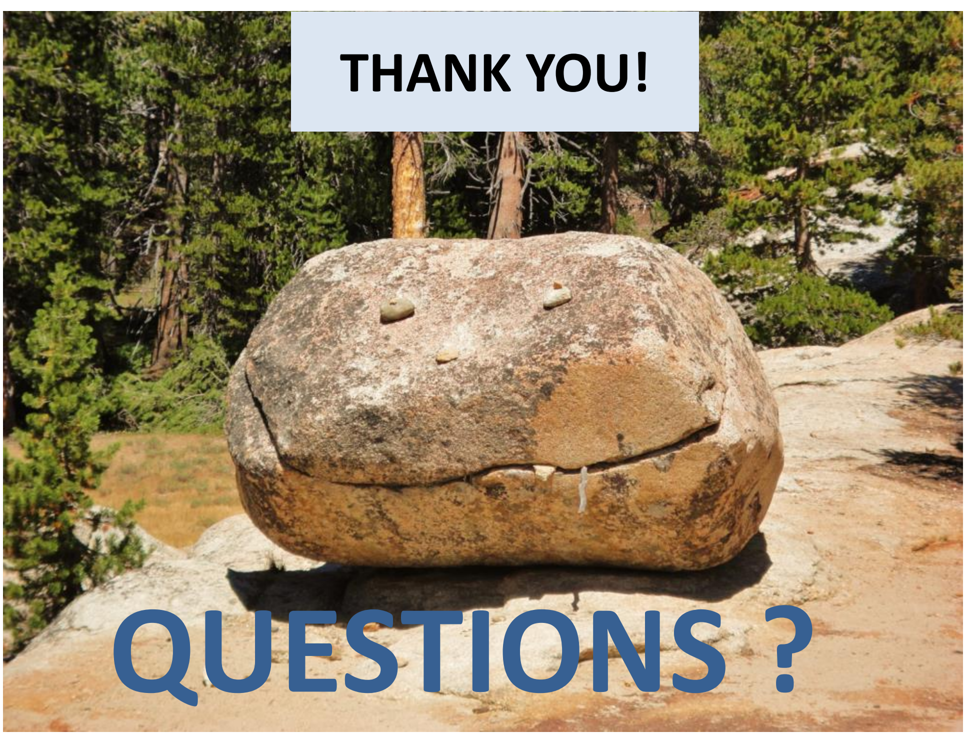
DISCUSSION

~~**Hypothesis**: Increased precipitation will cause considerable increase in landslide susceptibility~~

DISCUSSION CONT'D

Improvements:

- Include other dynamic causative factors
  - E.g. land use change as a function of population growth.
- Optimize accuracy by researching the best weighting techniques.



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