Landslide Risk Assessment in the Mountain State: Random Forest Modelling in Major Land Resource Areas Helps Surmount Gaps in the West Virginia Landslide Inventory and Better Align LiDAR-Based Mapping with Local Geologic Knowledge

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Session 194: Landslide Hazard Assessments & Risk Reduction: Data Collection & Modelling Challenges

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West Virginia Landslide Risk Assessment 2018-2021

Funded by FEMA Hazard Mitigation Grant Program & WV Division of Homeland Security & Emergency Preparedness

Step 1: Statewide digital landslide inventory

> 93,000 previously mapped landslides (WVGES, USGS, etc.)

> 65,000 more landslides mapped on LiDAR-based DEMs

Step 2: Susceptibility models built from LiDAR-based mapping

Separate model for each major NRCS Major Land Resource Area (MLRA) (≈ physiographic units) in West Virginia

* *MLRA 147 Northern Appalachian Ridges & Valleys Focus*

Random Forest Machine Learning: best predictive power (Maxwell *et al.* 2020, Remote Sensing v. 12 no. 486)

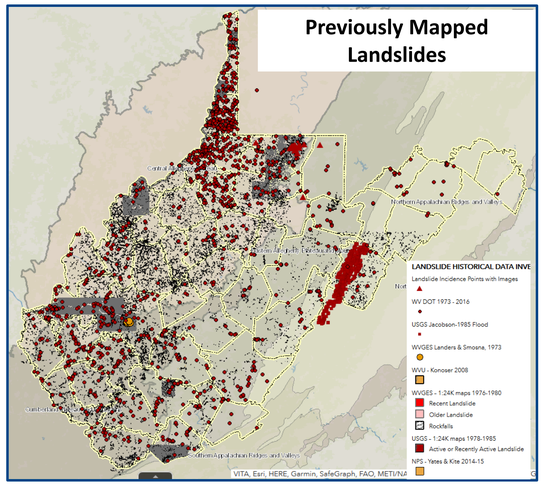
Strongest Correlations: Topographic Attributes

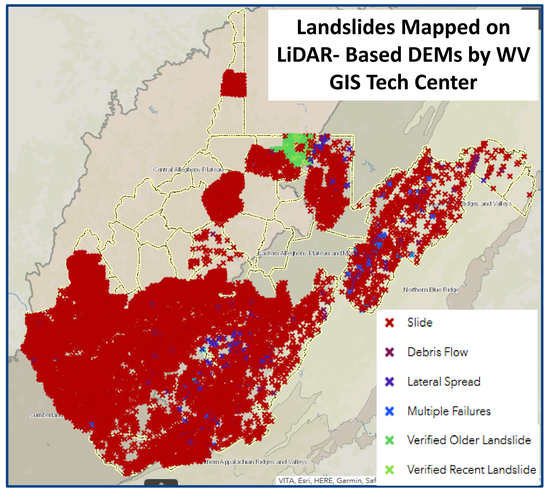
Geology has weaker correlations than Topography

Step 3: *Landslide Risk Model - in progress, not in this poster*

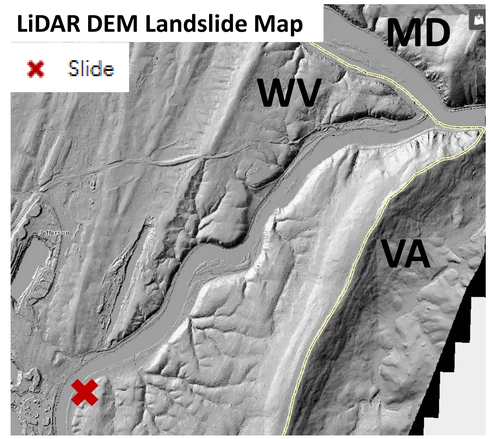
West Virginia Landslide Tool Inventory Images (October 2020)

https://wvu.maps.arcgis.com/apps/webappviewer/index.html?id=cb01c47cfa884309b4f38dcd7542f805/

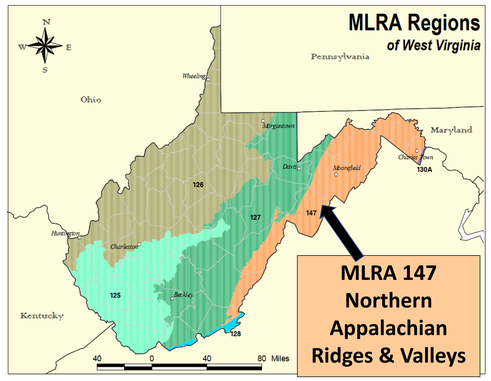




Known Landslide Issues exist near Harpers Ferry, but mapping shows only one landslide



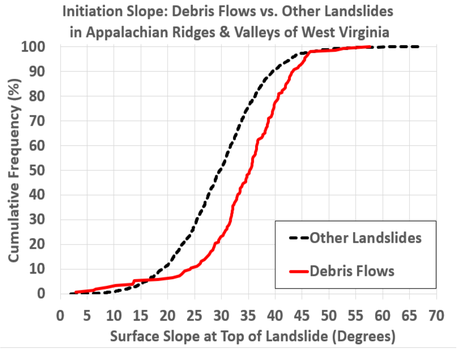
Northern Appalachian Ridges & Valleys + bits of Blue Ridge & Southern Appalachian Ridges & Valleys



MLRA Map by Jim Thompson, WVU

https://jamesthompson.plantandsoil.wvu.edu/files/d/edafb843-93e2-4cc7-9287-b0e95519585f/mlraregionsmap.pdf

Topographic Attributes (e.g. Slope & Slope Area Ratio) show very strong correlation to landslide initiation points

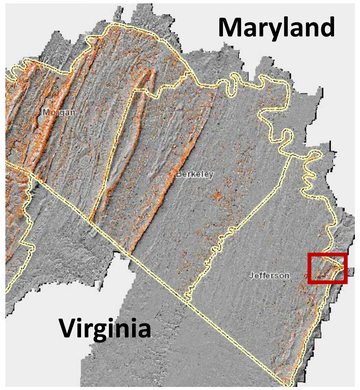


80 % of Landslides Initiate on 20-40° slopes

80 % of Debris Flows Initiate on 25-45° slopes

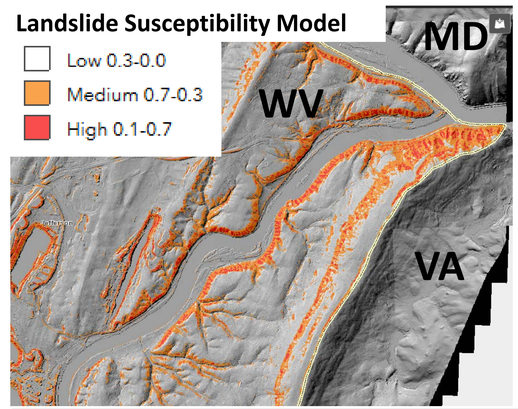
Geology is Significant WVGES Geological Map Unit	Slide Count	Debris Flow %	Slides /100 Mi²
Alluvium	10	0	11
Price = Pocono Group	67	4	35
Hampshire Fm.	107	3	22
Chemung Group	**210**	2	34
Brallier Fm. & Harrell Shale	**228**	0	56
Middle Devonian shale	140	1	34
Oriskany SS & Huntersville Chert	**210**	11	75
Oriskany & Helderberg, undivided	23	4	68
Helderberg Group	79	**23**	79
Tonoloway, Wills Crk. & W'msport	130	11	73
McKenzie Fm. & Clinton Group	**301**	5	**191**
Tuscarora Sandstone	96	**34**	**134**
Juniata & Oswego Fm.	27	**48**	59
Martinsburg & Reedsville	139	14	**102**
Cambro-Ordovician carbonates	20	0	6
Overall Ridges & Valleys	1799	8	50

Random Forest Susceptibility Model, WV Eastern Panhandle



West Virginia Landslide Tool Image (October 2020)

Model Predicted Medium to High Susceptibility based on correlations elsewhere in MLRA



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