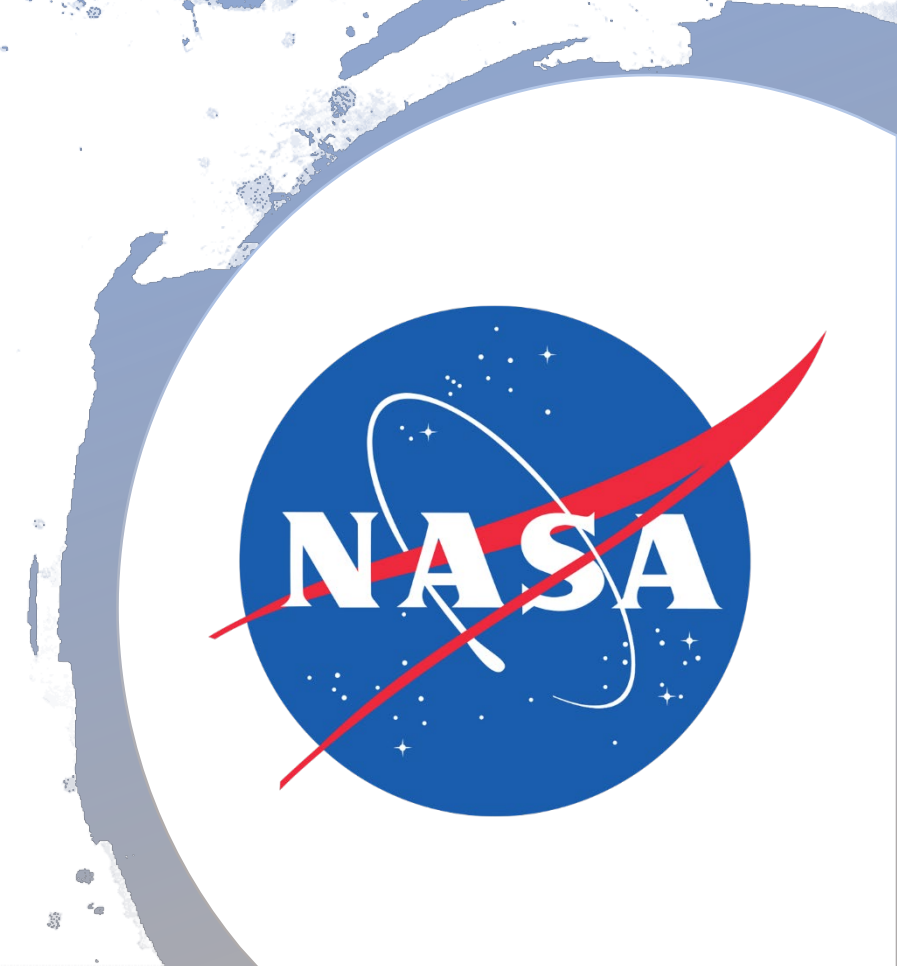


USFS – NASA Virtual Pitch Fest / June 2, 2020

Semi-Automated National Forest Landslide Mapping via LiDAR

By: Noel Ludwig, U.S. Forest Service



About Me

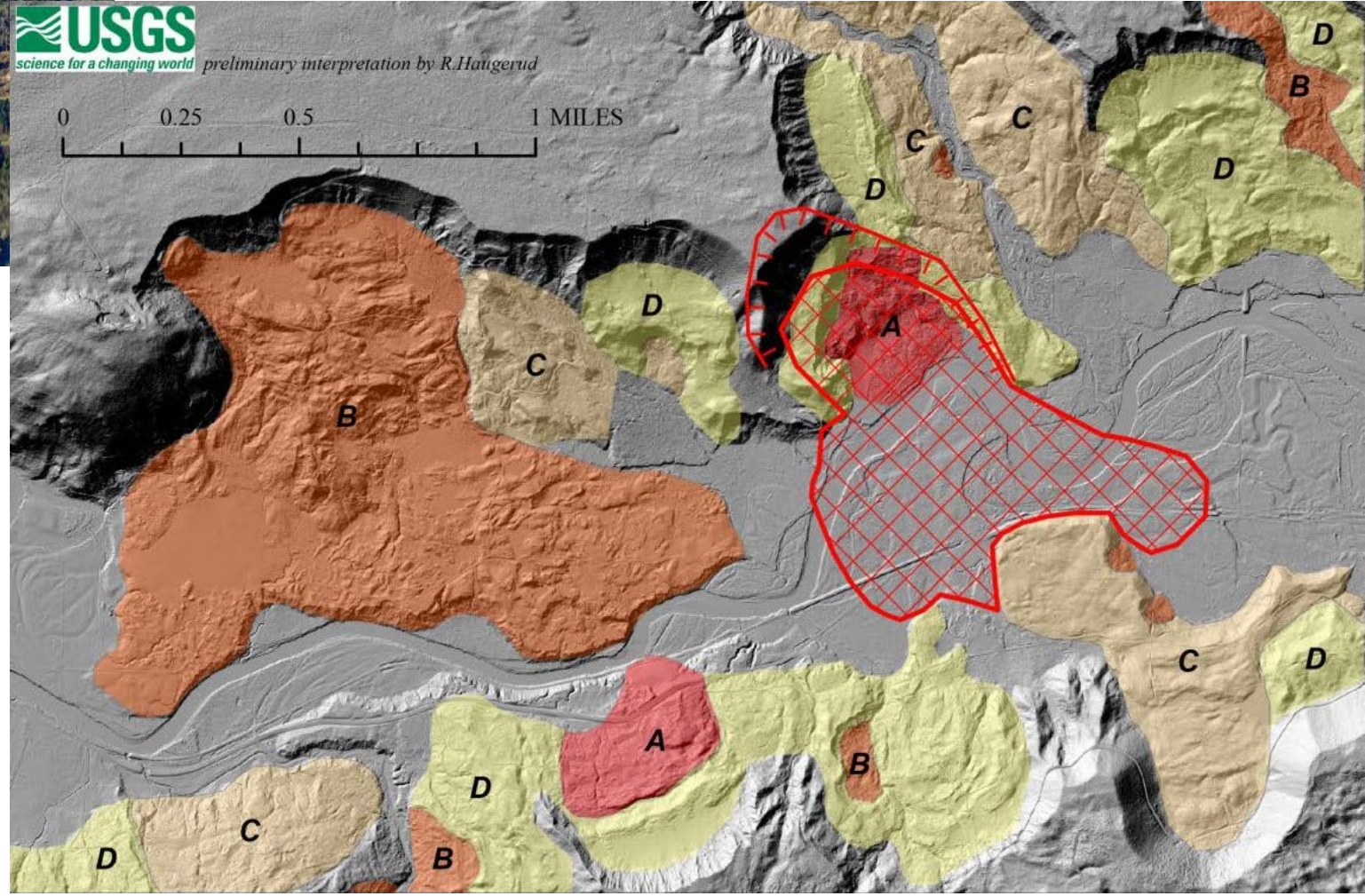
- BS and MS in Geology
- PhD, University of Hawai'i, in Physical Geography
- Served with BLM in CO and CA, with USFS in WA and CO

Current job focus: Mountain resort hydrology

Potential collaborators: Ben Leshchinsky and Michael Olsen, Oregon State University



Background: 2014 Oso Landslide, Washington



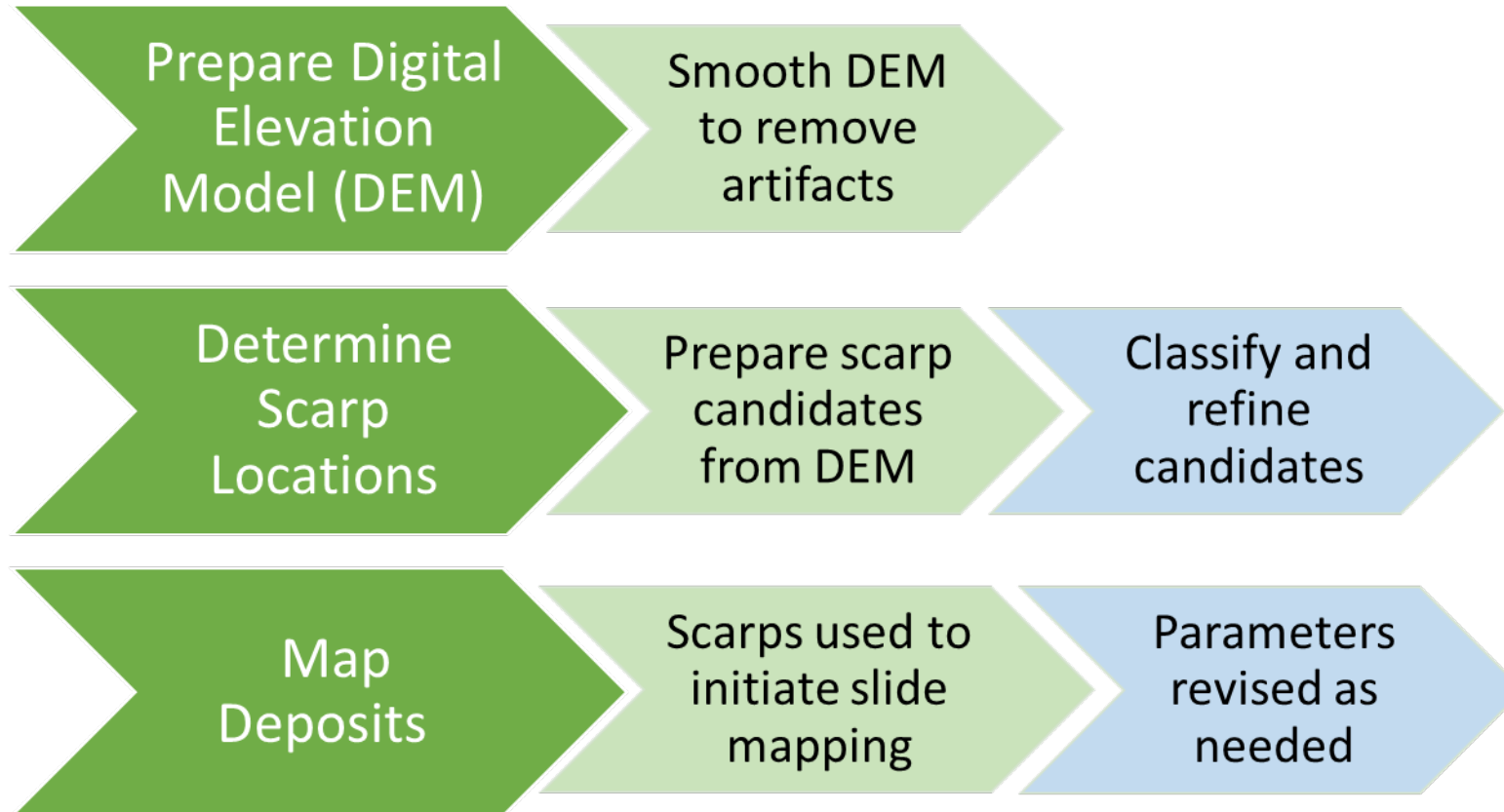
- Reactivation of old landslide in an area full of old slides.
- LiDAR data used to map and date slides based on surface roughness.
- Obvious headscarps aided mapping.



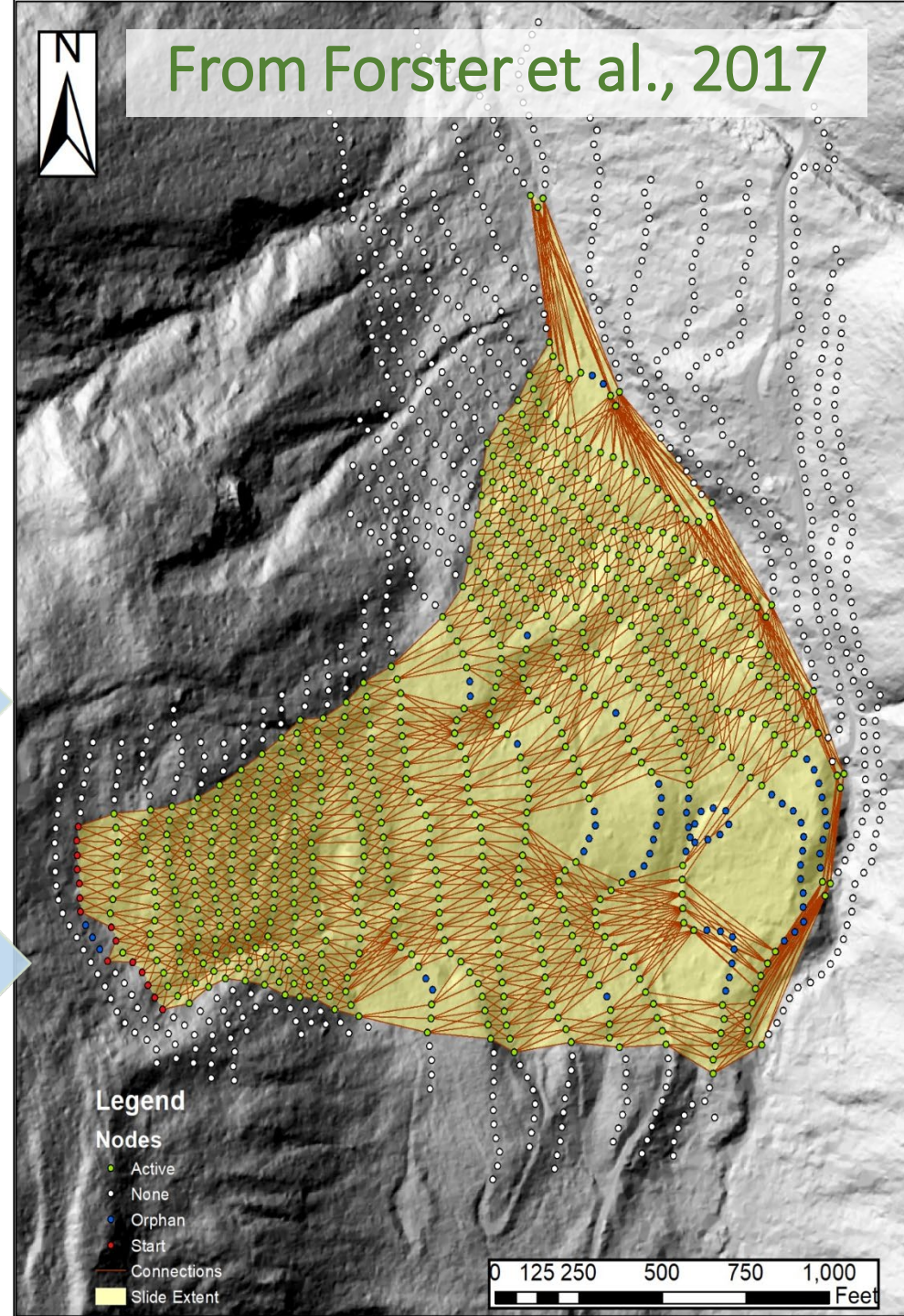
Issue and Need

- Existing landslides tend to be highest-risk areas for future instability.
- In forests, mapping of slides is challenging, time-consuming, and expensive.
- Need accurate maps of slides across national forests to better protect human safety and resources at risk.
- Current mapping is based on manual surveys & photogrammetry. Often insufficient resolution or consistency to map slides on a landscape scale.
- Various algorithms have been developed to perform semi-automatic (managed) computer mapping of slides via LiDAR data.

Example: Contour Connection Method (CCM) (Leschinsky et al., 2015)

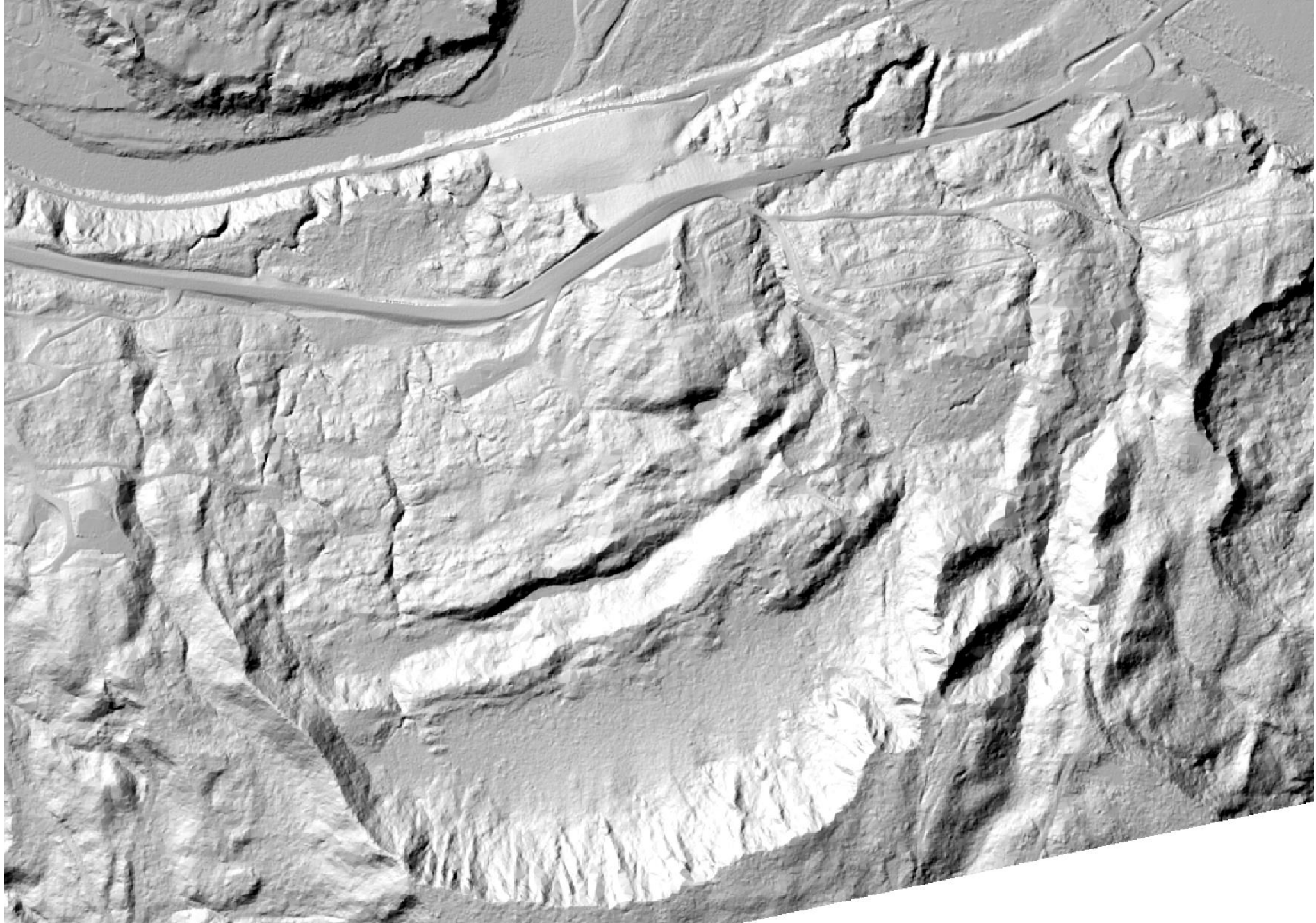


- Final products are converted to GIS layers.

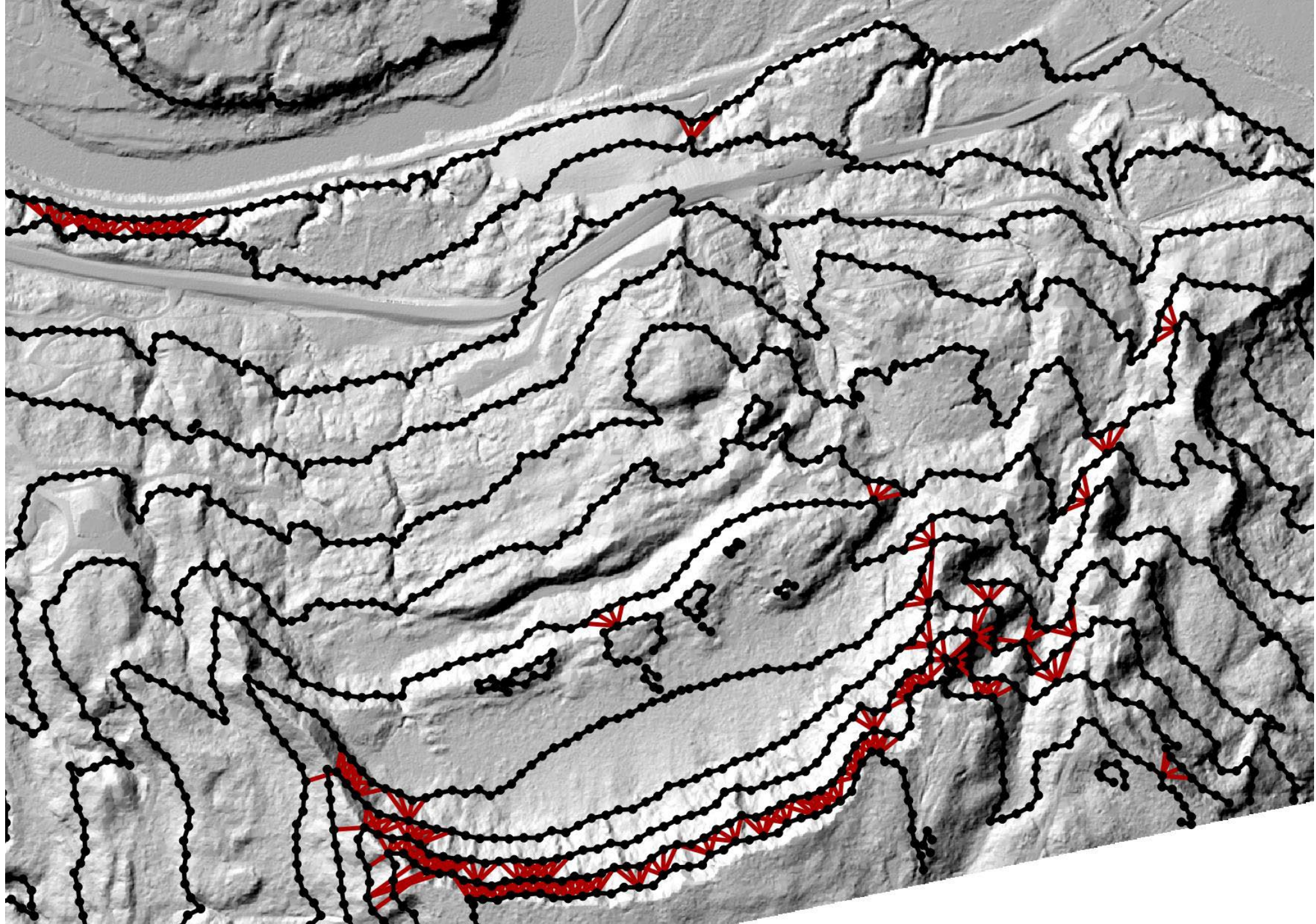


CCM Example

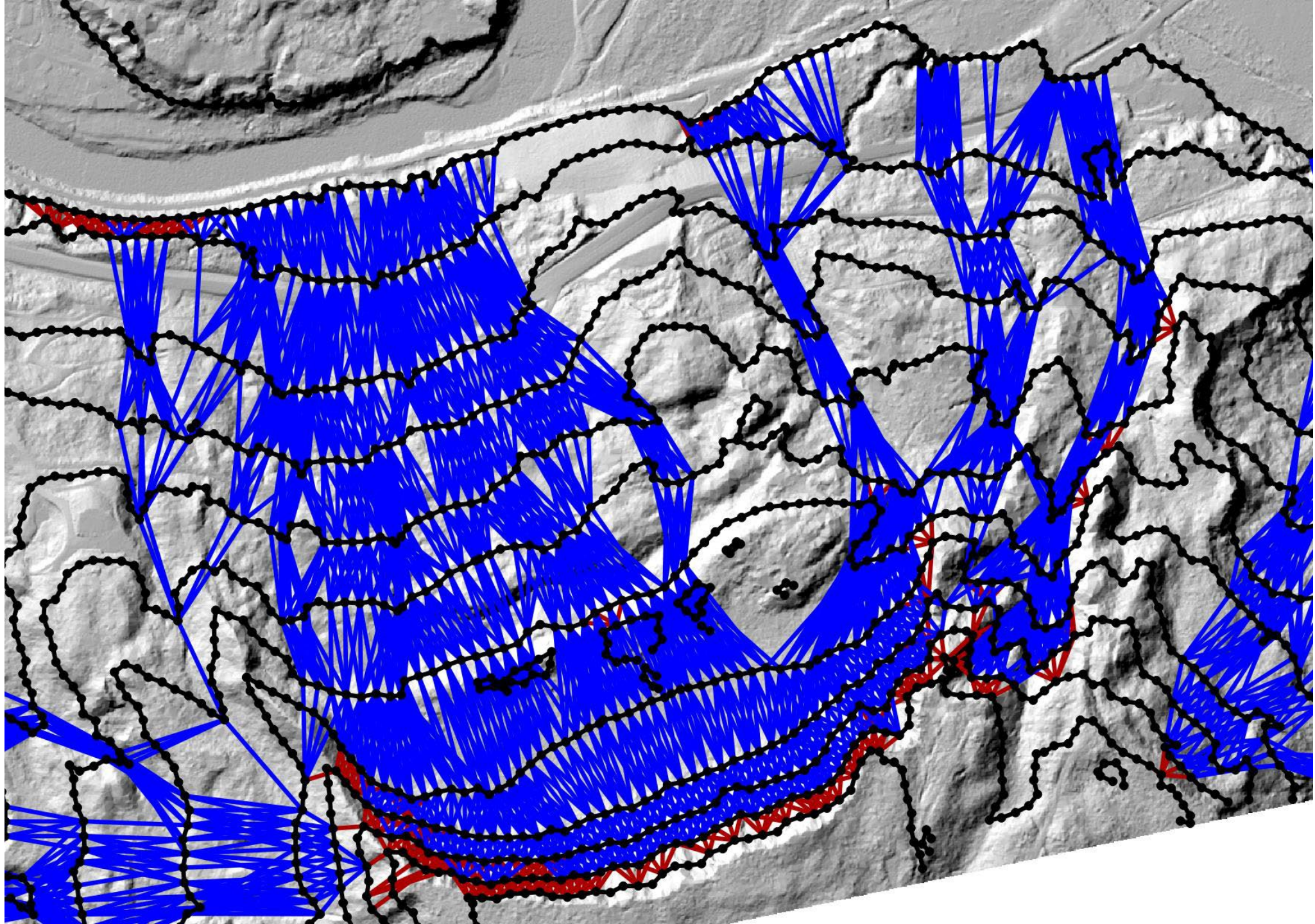
1. LiDAR data smoothed to 20-ft resolution



2. Scarps
identified,
converted to lines



3. Landslide
runouts mapped

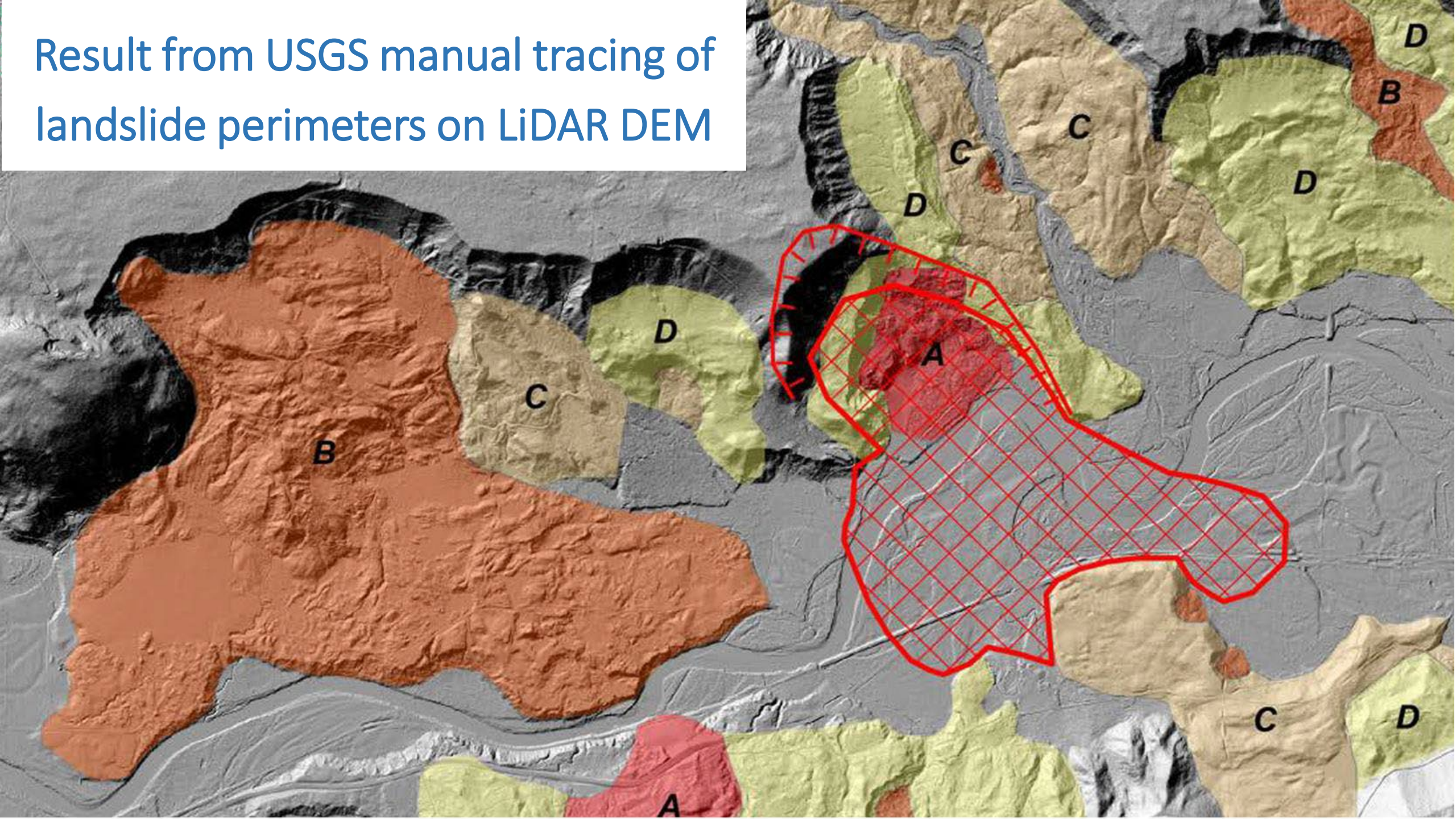


Oso Landslide area before 2014 event

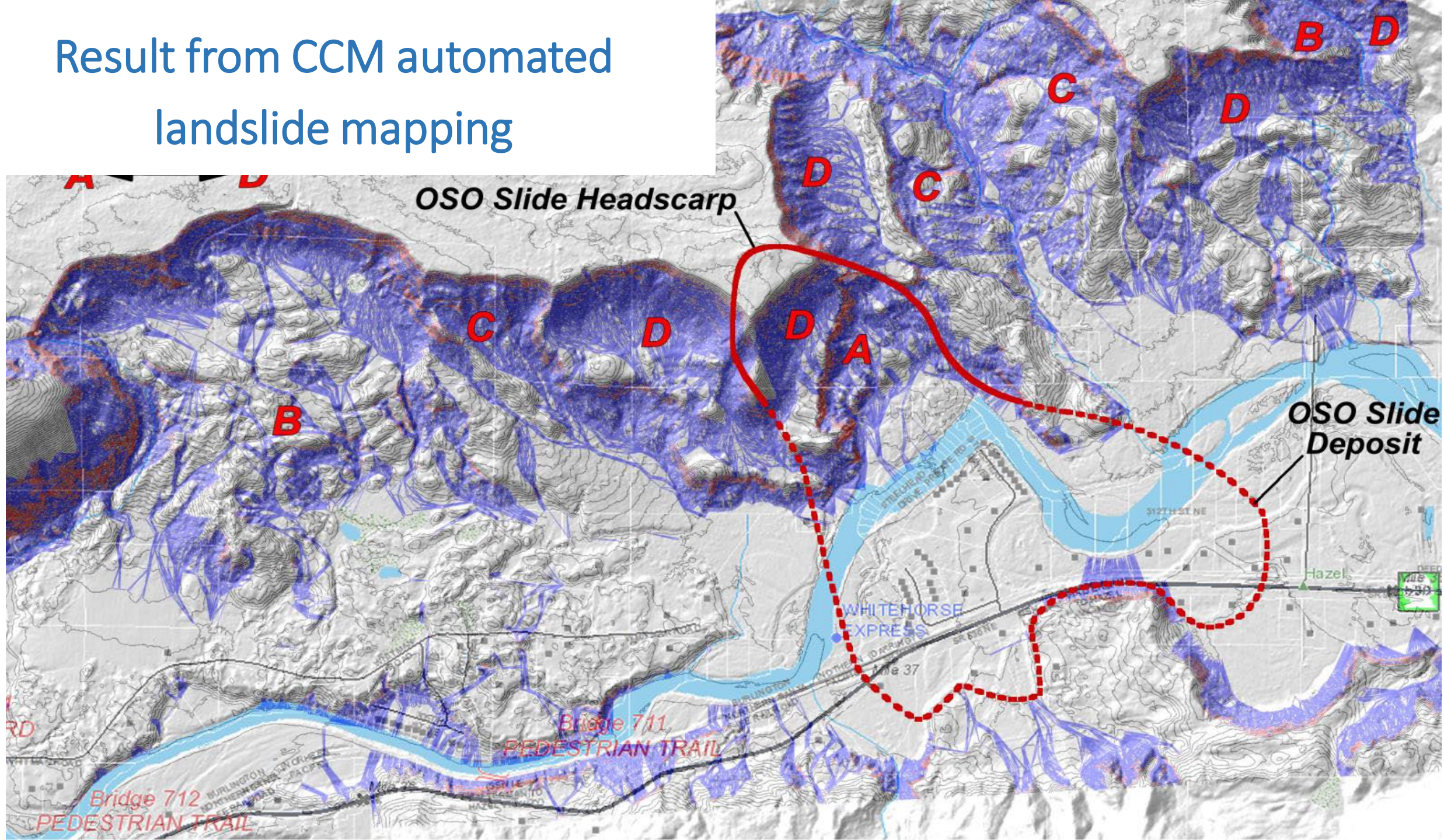
Scarp of a 2006 landslide →



Result from USGS manual tracing of
landslide perimeters on LiDAR DEM



Result from CCM automated landslide mapping





Conclusions

- LiDAR is an excellent tool for mapping landslides, but a semi-automated algorithm is needed to efficiently map on a landscape scale.
- Such methods have been developed by universities (OSU, OU, UNM), states (OR, WA), and the USGS, and tested on forest lands, with mixed but promising results.
- Slides can be further classified into age classes and landslide types.
- Proposing here a review of available LiDAR-based mapping methods and the application of one to broad-scale mapping of landslide deposits across National Forest System lands.



Thank You!

