Locating Abandoned Mines Using Processed Lidar Data

An Exercise in Extracting Determined Value Sets Using Known Data Locations.

Geog593
Christopher Rowlette
Wayne Coffey

Intended Purpose of Analysis

- Currently DOGAMI has endeavored to extract abandoned mine data across Oregon for inventory purposes.
- No methodology has yet been established to accurately and efficiently build an inventory (visual analysis only).
- By exploring existing data sets for patterns in slope configurations and possibly curvature we will attempt to extract a abandoned mine signature to apply across larger areas.

Methodology and Data

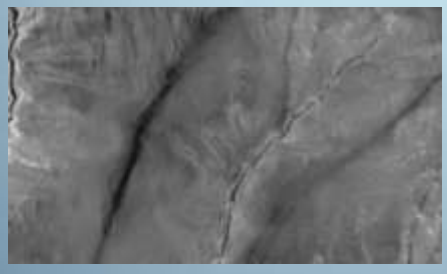
- **Methodology**
- Establish a study area
- Utilize filtering mechanism
- Construct algorithm
- Apply to separate test area

- **Data Utilized**
- Point locations of abandoned mines.
- Slope data extracted from LiDAR DEM. (Raw DEM not permitted)
- Stream layers. (digitized for better accuracy)
- County Boundaries.

Study Area

Test Area

- Marion County, OR—Opal Creek Wilderness Area

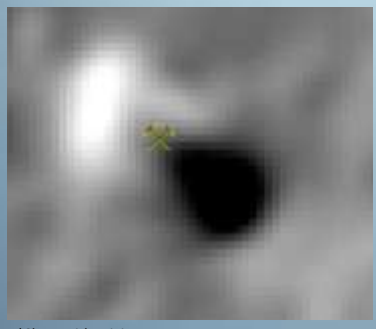


- Area was chosen for its topographic uniformity with regards to mine locations.

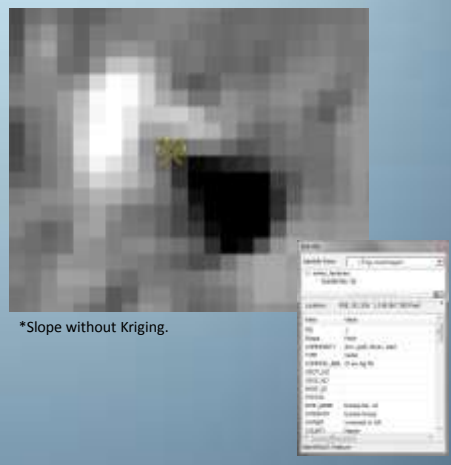
Opal Creek Wilderness Area

Tools Used to Explore and Extract Mine Signature

- Interpolation: Kriging/Spline?
- How to distinguish high slope against low slope.



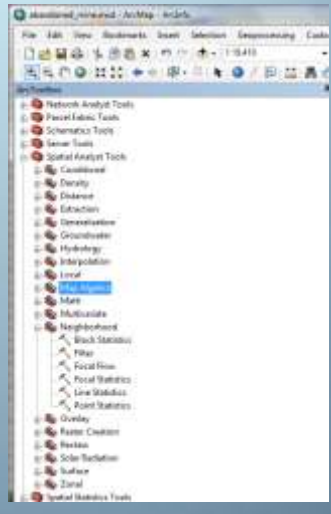
*Slope with Kriging.



*Slope without Kriging.

Narrowing Options

- Filtering?
- Neighborhood Toolset
- Focal Statistics, Filter, & Focal Flow



Tools Tried, But Not Used

- **Filter**

  -- Low pass filter could be used, but the output would be to similar to that of the focal statistics outcome.

  -- The high pass filter's edges were so enhanced and sharpe that there was no distinction with regards to slope percentages.

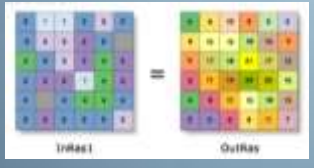
- **Focal Flow**

  --The eight immediate neighbors of each cell are evaluated to determine the flow. When performed the flow gave no distinction of slope that would be beneficial.

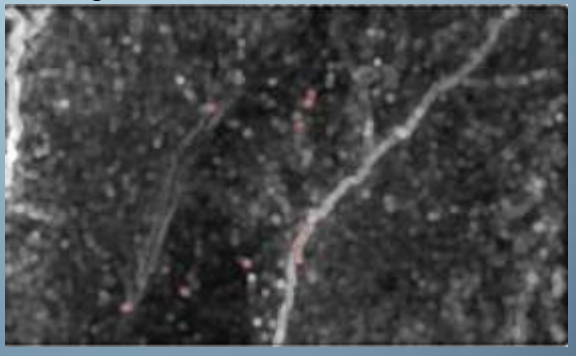
  --Several thresholds were tried.

Results First Run

- **Focal Statistics**: Calculates for each input cell location a statistic of the values within a specified neighborhood around it.
- Rectangle, circular, and wedge.
- Neighborhood trial: 3, 5, 9, 11, & 15 cells performed.
- **Circular: Radius of 11 cells.**
- **Statistics Type: Range,** Focal Range = Focal Maximum – Focal Minimum



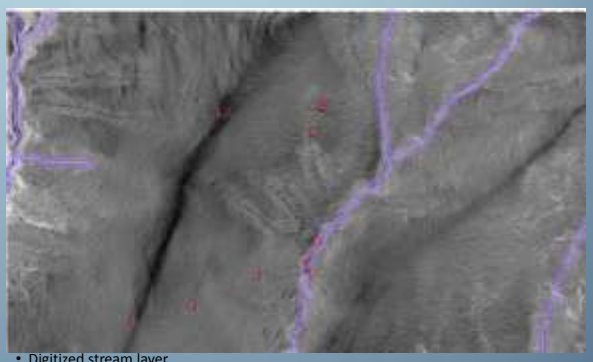
- Focal Statistics Illustration.



Filtering Noise

- **Digitize streams**: Streams did not line up geographically.
- The largest slope percentages are within 50ft of both sides of stream beds within the test area.
- Stream and stream slope buffers. (50ft)

- Original stream layer.

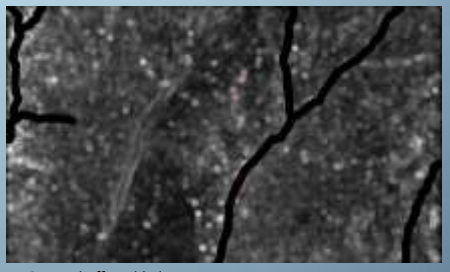


- Digitized stream layer.

50ft Buffer: Raster Conversion/Reclass

- Focal Statistics: Circular, Radius 11 Cells
- Stream buffer is deleted from test area using raster calculator (multiply function); includes a no data value.

- Reclassed digitized stream buffer.



- Stream buffer added to test area raster as no data.

Scientific Method

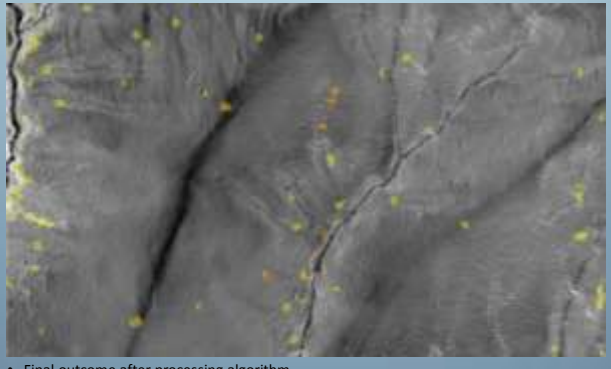
- Seven mines were specifically chosen due to topographic and land use likeness.
- High and low slope percentages were based strictly on these seven chosen mine locations. **(38% low – 48% high)**
- Raster Calculator utilized:

  Con((FocalStatistics("slp_testarea", NbrCircle (11,"CELL"), "RANGE", "NODATA") * "tst_rvrbufrc") < 48,1,0) * Con((FocalStatistics("slp_testarea", NbrCircle (11,"CELL"), "RANGE", "NODATA") * "tst_rvrbufrc") > 38,1,0)

Map Algebra Results

- Greater than 38% slope; Con(flc_slp11rc>38,1,0)

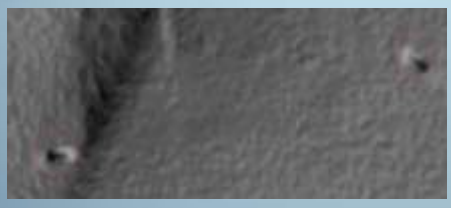
- Less than 48% slope; Con(fcl_slp11rc<48,1,0)

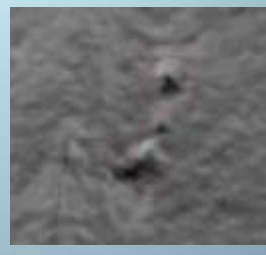


- Final outcome after processing algorithm.

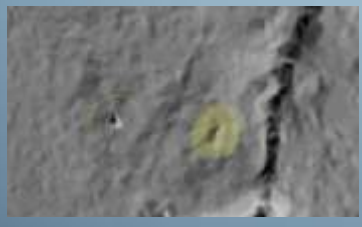
Visual Comparison

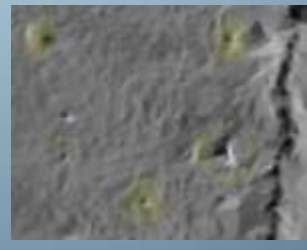
- How do the known mines match up with locations that have similar slope percentages, land use impressions, and cell configurations?
- **Known mine locations.**





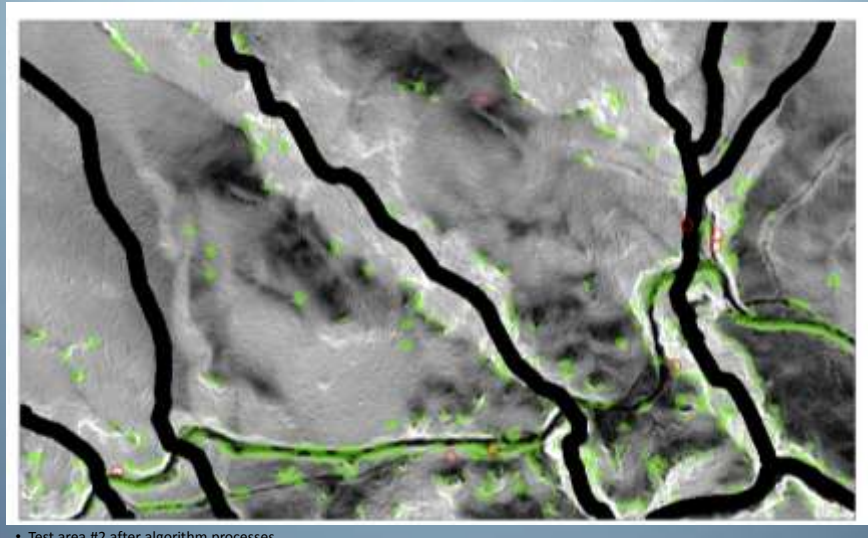
- **Possible abandoned mines.**





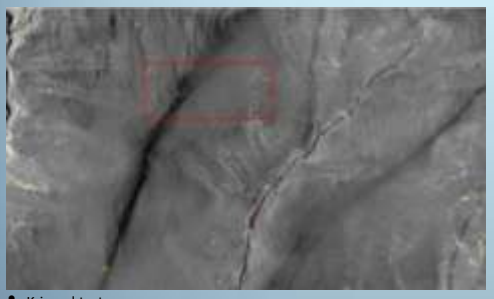
Further Testing

- Con((FocalStatistics("slp_testarea2", NbrCircle (11,"CELL"), "RANGE", "NODATA") * "tst_rvrbufrc") < 48,1,0) * Con((FocalStatistics("slp_testarea2", NbrCircle (11,"CELL"), "RANGE", "NODATA") * "tst_rvrbufrc") > 38,1,0)

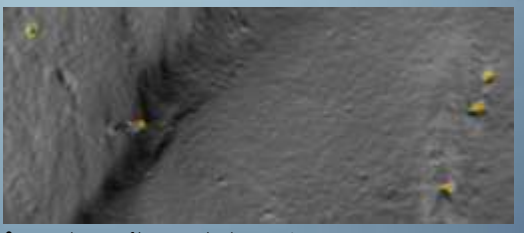


- Test area #2 after algorithm processes.

Krigged Test Area Using Algorithm



- Krigged test area.



- Inset; close up of known and unknown mines.

Future Analysis

- DEM (1m)
- Use of Curvature Tool.
- Utilization of Multivariate tools.
- Further in-depth testing using combinations of other neighborhood and interpolation tools.

References

- DOGAMI; Portland Office
- http://flamingovic.wordpress.com (photos)
- http://www.ruaux.net (photos)
- http://maps.google.com
- Oregon Geospatial Data Clearinghouse, http://www.oregon.gov/DAS/EISPD/GEO/sdlibrary.shtml
- ESRI, http://www.esri.com/software/arcgis/eval-help/index.html

Questions??