Update on Geospatial Award: Objective 1 and Objective 2

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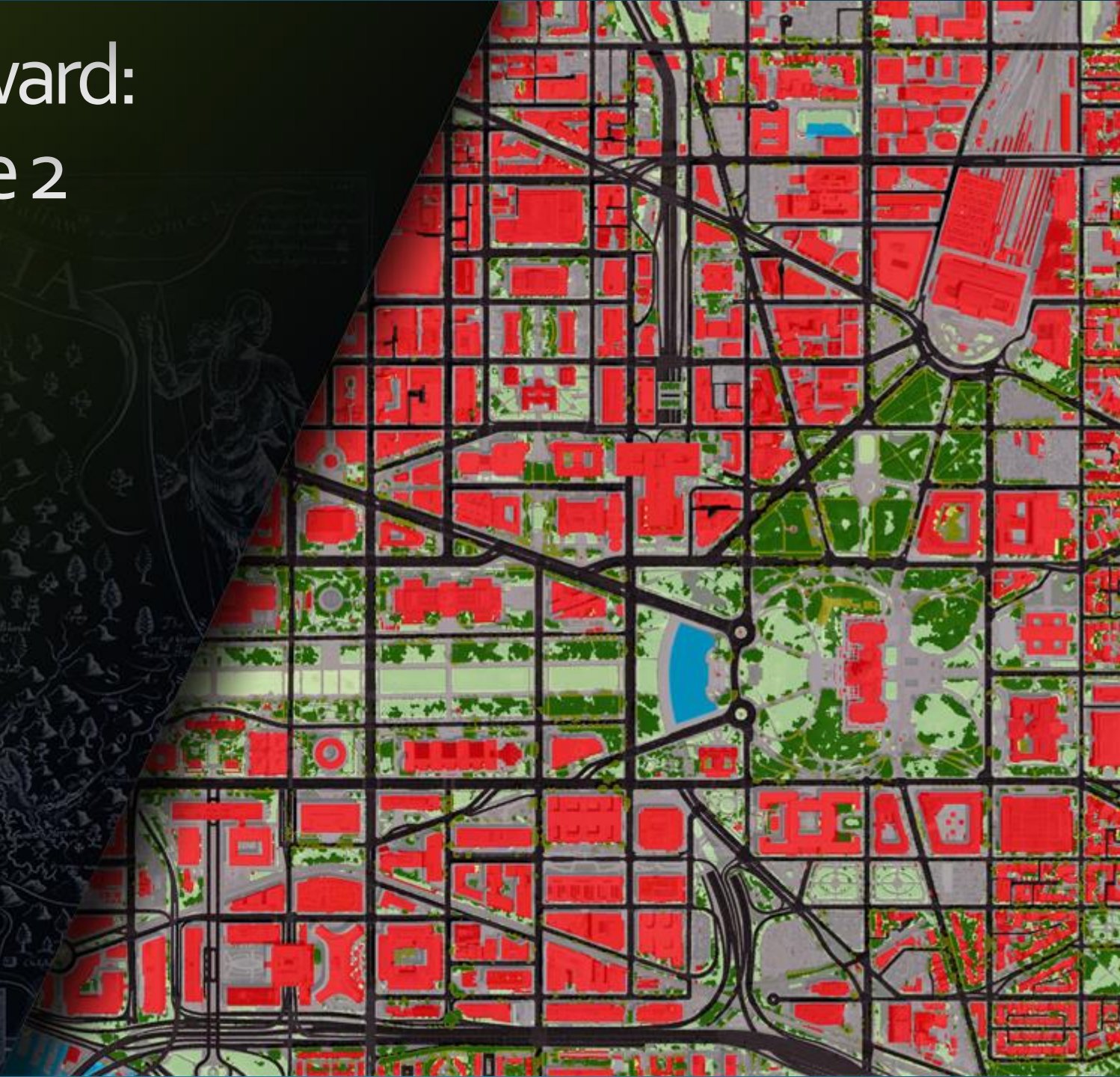

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EXPLORE. CONSERVE. INNOVATE.

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CBP Proposal

Objective 1: Land Cover Updates

- Partnering with University of Vermont

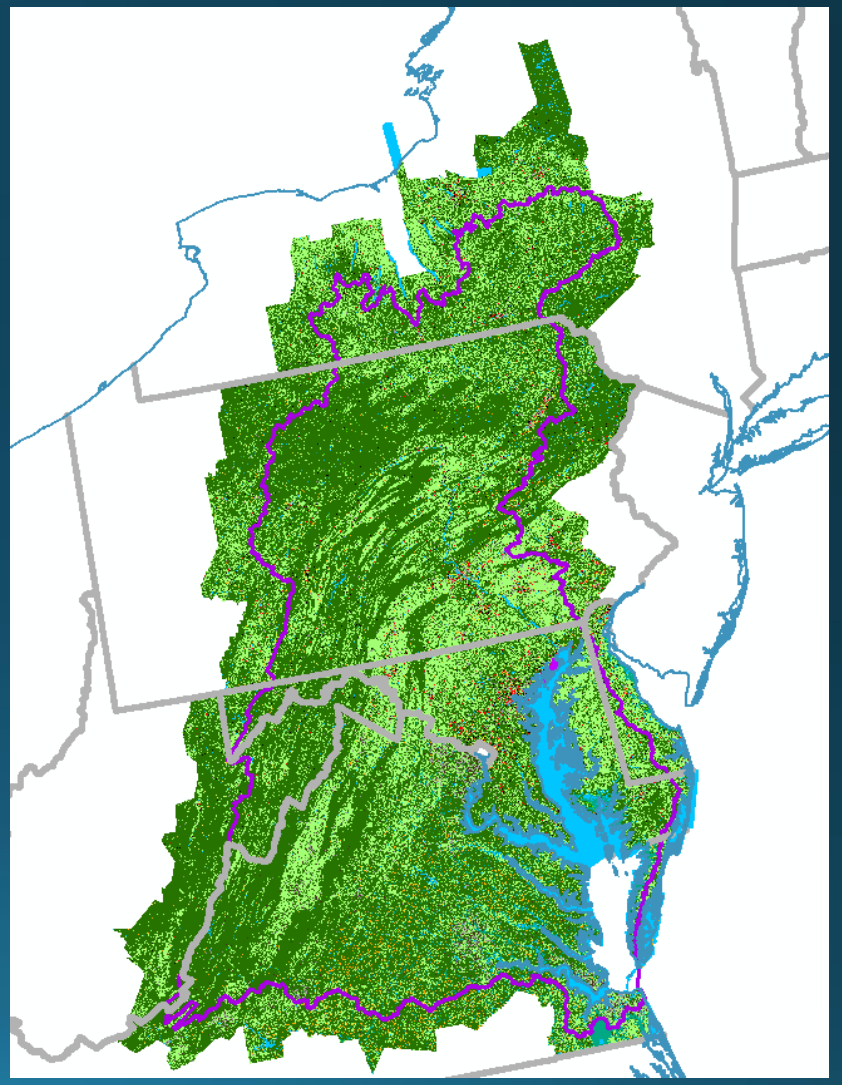
Objective 2: Hydrology & Ditches

- Partnering with UMBC

Objective 3: BMP Mapping & Tracking

- Partnering with Chesapeake Commons and Drexel University

Objective 4: General Geospatial Support



Objective 1: Long-term Land Cover/Land Use Monitoring Program Development and Implementation

Partnership

Chesapeake Bay Program

Science. Restoration. Partnership.

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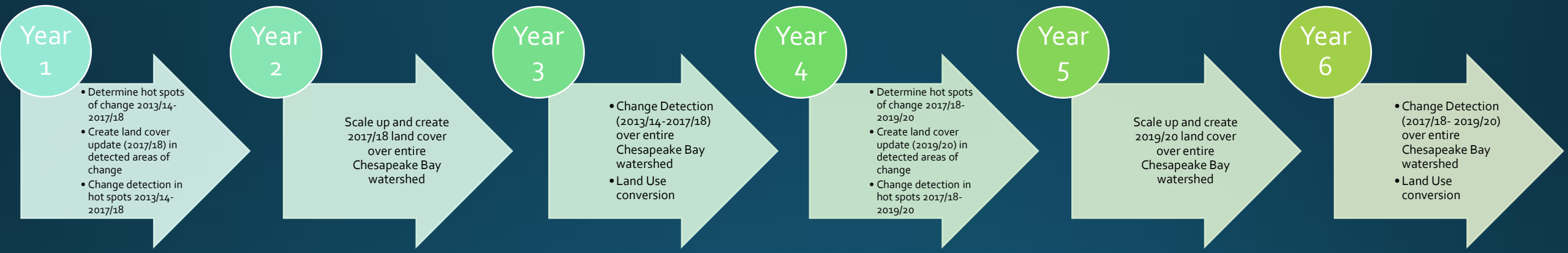
University of Vermont

Spatial Analysis Lab

Work Plan Overview



Change Detection

University of Vermont Spatial Analysis Lab

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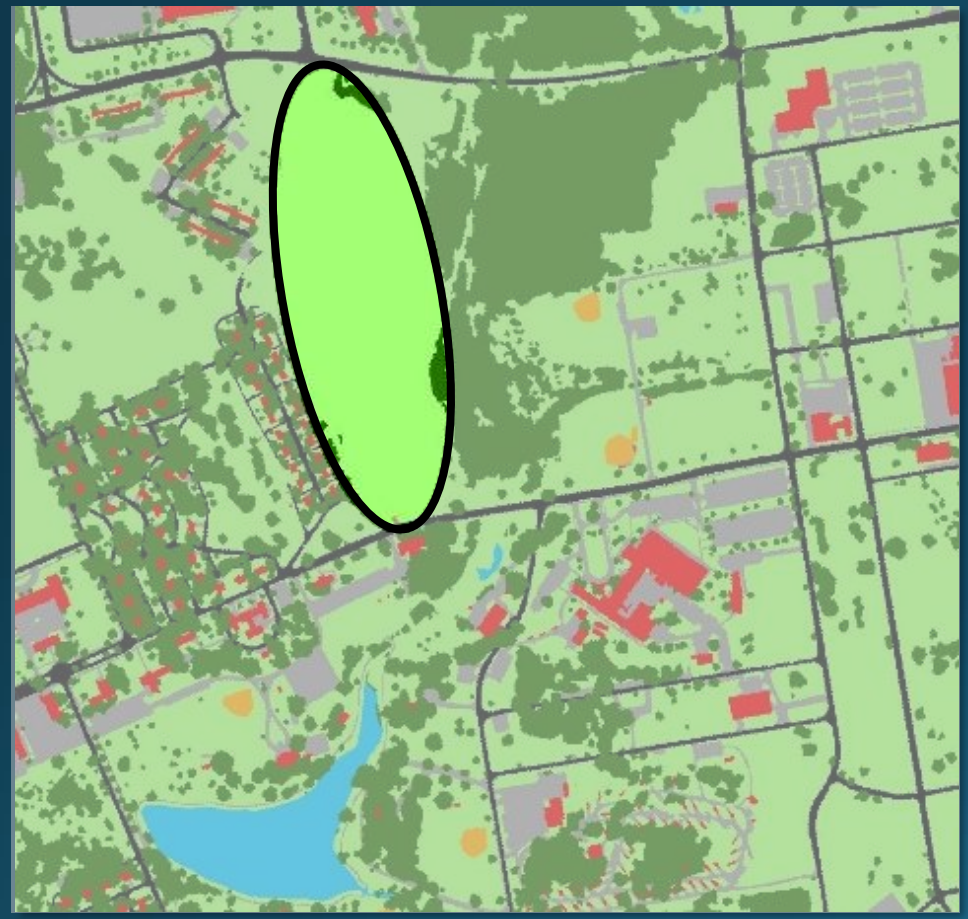
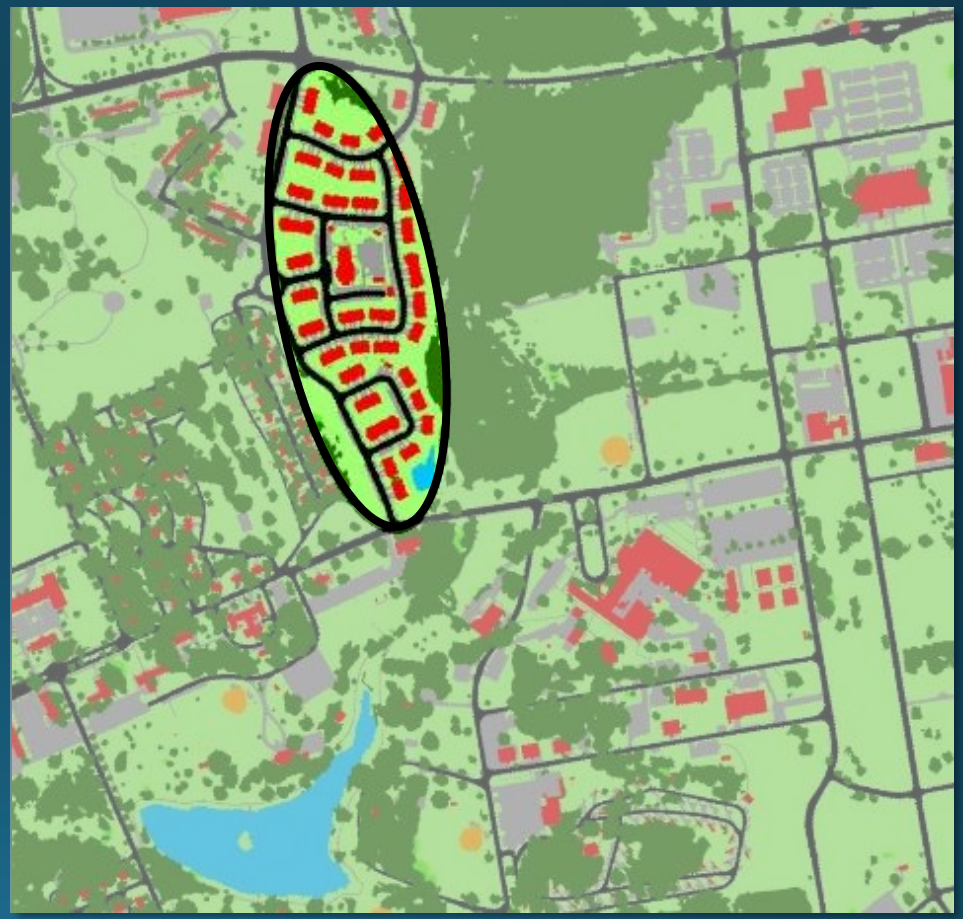


2007



2013

Land Cover Update

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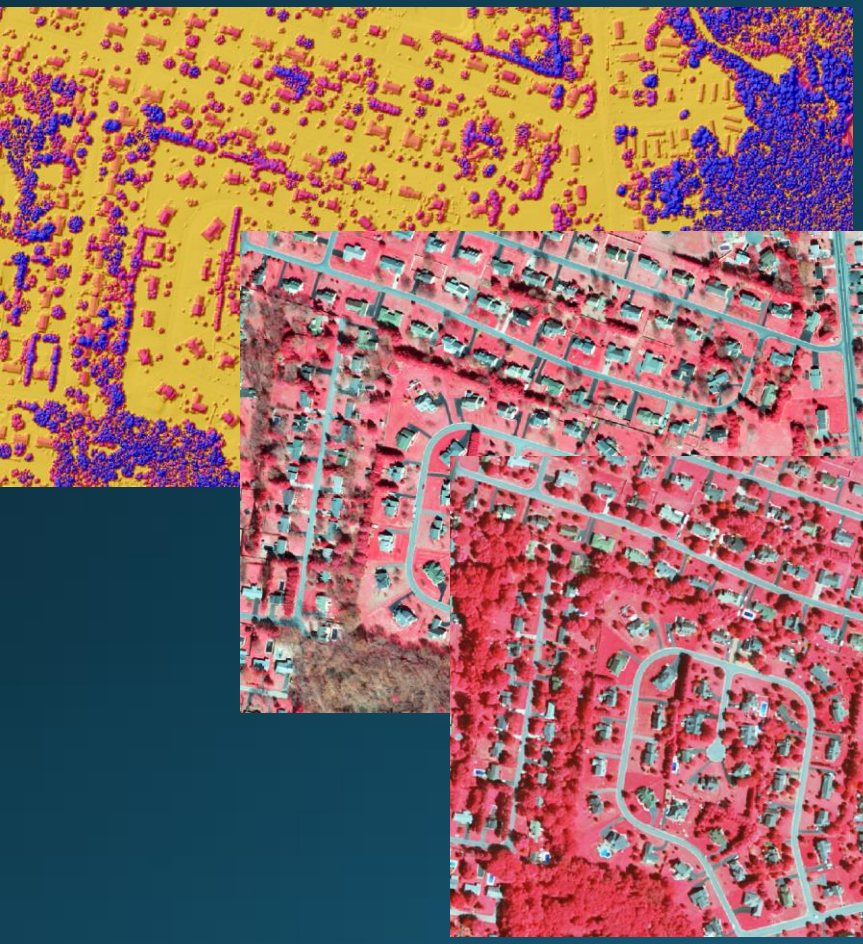

- Background
- Barren
- Low Vegetation
- Other Impervious
- Roads
- Scrub-Shrub
- Structures
- Tree Canopy
- Tree Canopy Over Other Impervious
- Tree Canopy Over Roads
- Tree Canopy Over Structures
- Water
- Wetlands (emergent)

Land Use Conversion

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2013 NAIP Imagery

2013 Land Cover

- Water
- Wetlands
- Forest
- Shrubland
- Herbaceous Vegetation
- Barren
- Structures
- Impervious
- Roads
- Tree Canopy over Structures
- Tree Canopy over Impervious Surfaces
- Tree Canopy over Impervious Roads

2013 Land Use

- Impervious, Road
- Impervious, Non-Road
- Tree Canopy over Impervious
- Water
- Tidal Wetlands
- Floodplain Wetlands
- Other Wetlands
- Forest
- Tree Canopy over Turf
- Mixed Open
- Fractional Turf (small)
- Fractional Turf (med)
- Fractional Turf (large)
- Fractional Impervious
- Turf Grass
- Agriculture

Determine secondary classes

Original 12 Classes

Potential secondary classes:

- Aquaculture
- Submerged Aquatic Vegetation
- Deciduous vs. Evergreen
- Nursery
- Orchard
- Center Pivot
- Grass Filter Strips
- Vineyard
- Pasture
- Greenhouses
- Animal operations
- Wetlands (additional classifications)

What classes matter to you?

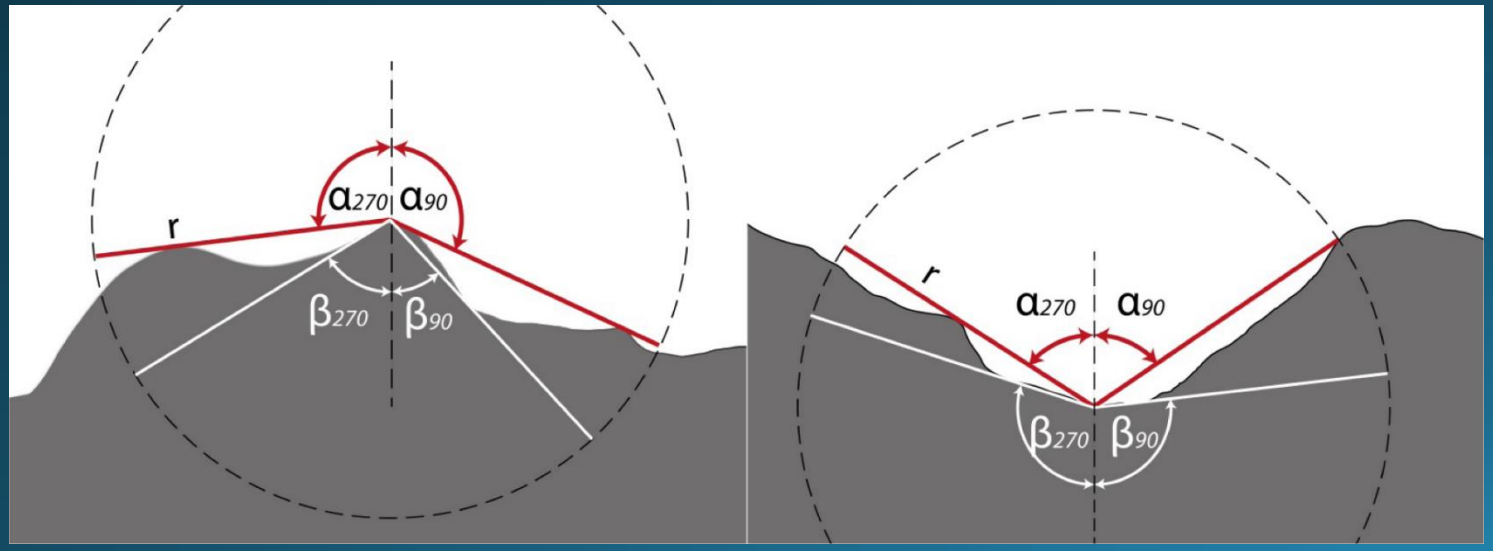
Objective 2: Hydrology Mapping Supporting Targeted Restoration and Protection

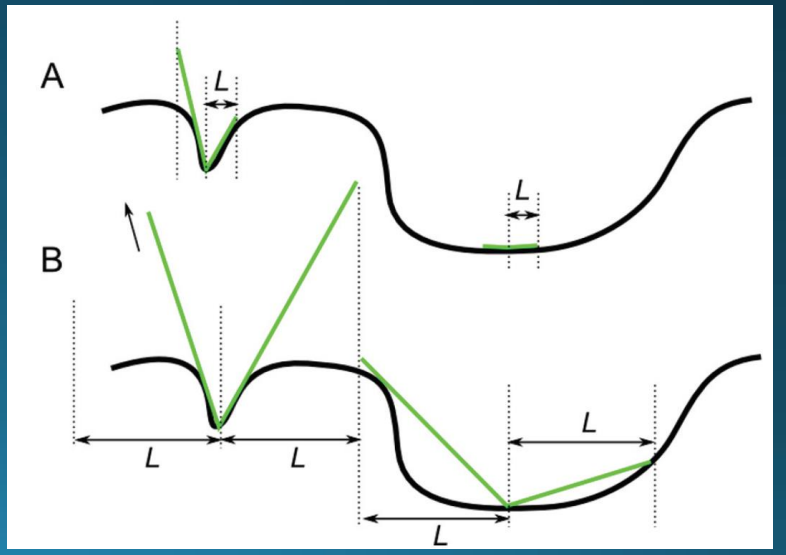
What is geomorphon?

- Terrain classification algorithm developed by Jasiewicz and Stepinski (2013)
- Operates based on line-of-sight principles
- Classifies terrain into discrete, constituent features
- Like land cover but for terrain

Underlying principles

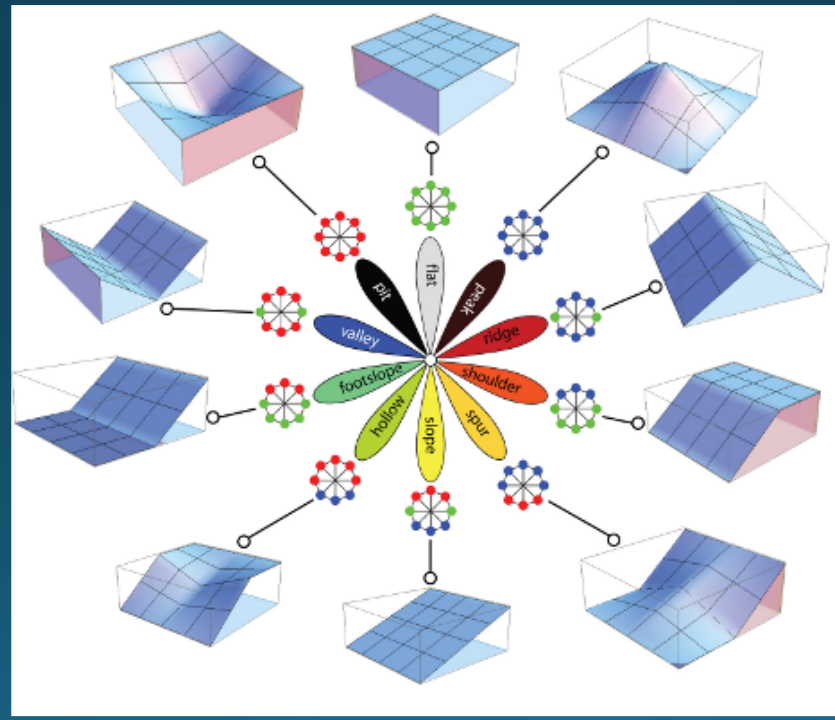
- Operates on line-of-sight principles within a search radius, *L*
- Integrates *zenith* angle, measured above ground (i.e. positive openness) and *nadir* angle, measured below ground (i.e. negative openness)
- Allows for identification of features at multiple scales



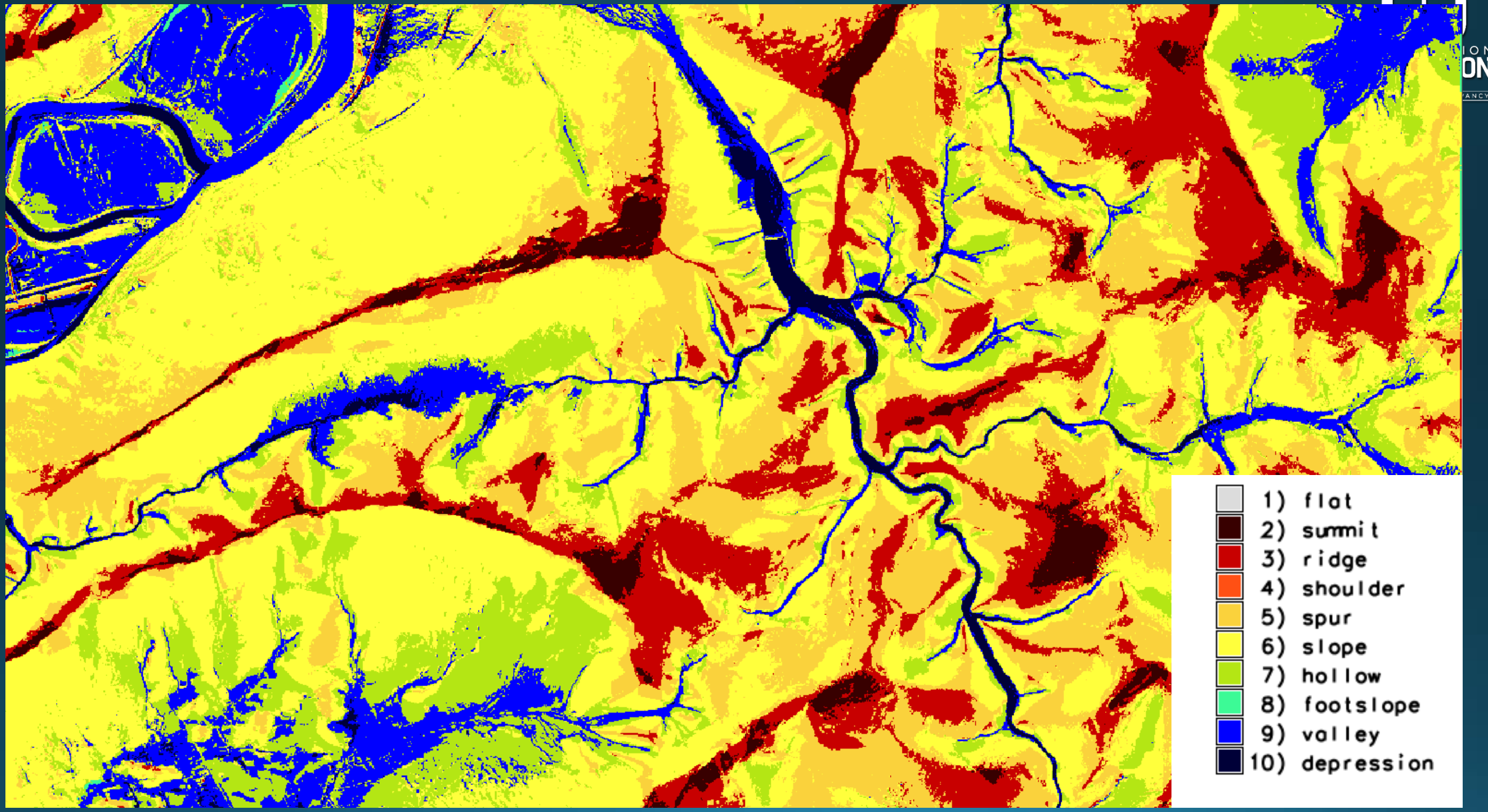


Ternary patterns

- Maximum zenith and nadir angles are identified along 8 cardinal directions surrounding focal cell
- Orientation and elevation relative to focal cell are combined into a ternary code
- Ternary codes are aggregated into 10 most common landforms



+ \ −	0	1	2	3	4	5	6	7	8
0	FL	FL	FL	FS	FS	VL	VL	VL	PT
1	FL	FL	FS	FS	FS	VL	VL	VL	—
2	FL	SH	SL	SL	HL	HL	VL	—	—
3	SH	SH	SL	SL	SL	HL	—	—	—
4	SH	SH	SP	SL	SL	—	—	—	—
5	RI	RI	SP	SP	—	—	—	—	—
6	RI	RI	RI	—	—	—	—	—	—
7	RI	RI	—	—	—	—	—	—	—
8	PK	—	—	—	—	—	—	—	—

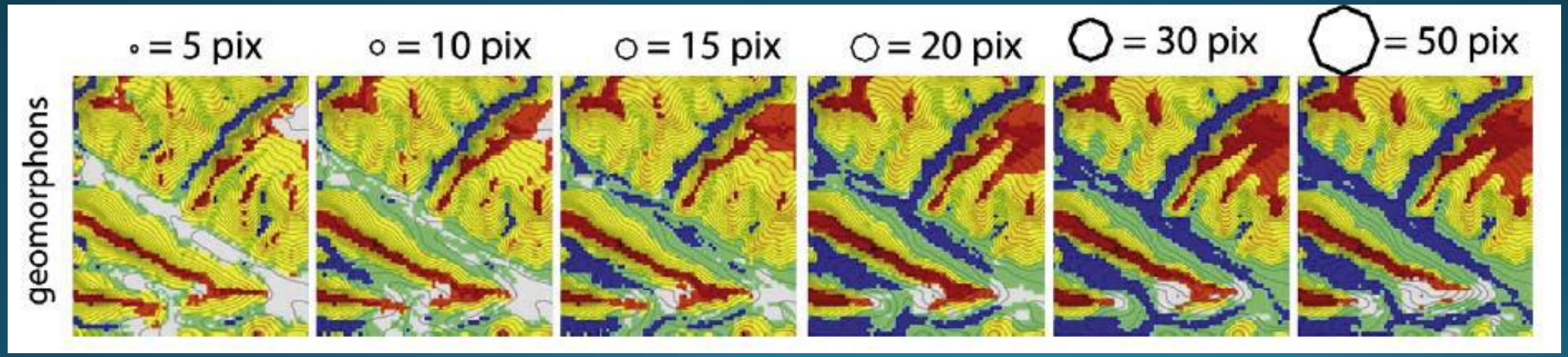

1) flat
2) summit
3) ridge
4) shoulder
5) spur
6) slope
7) hollow
8) footslope
9) valley
10) depression

Parameters

- Outer search radius
- Inner search radius
- Flatness threshold
- Many optional outputs including relative elevation, maximum elevation difference, length, width, azimuth, and others

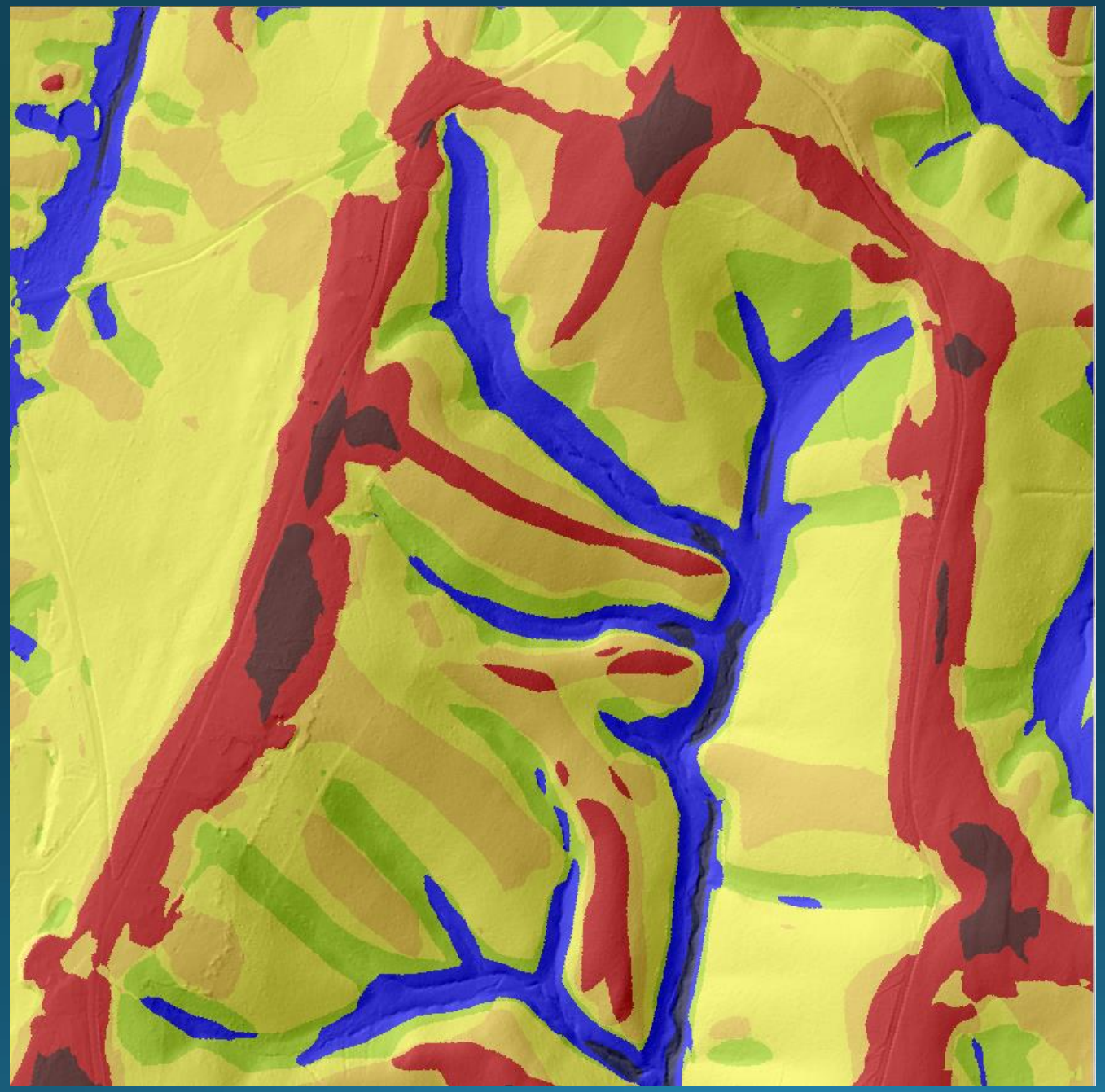
Search radii

- Search radii control how features will be identified
- Could theoretically be infinitely large to capture features at all scales; in reality there is a point of diminishing returns
- Inner search radius – cells immediately surrounding focal cell out to this distance will be ignored (useful to further manipulate output)



Application: stream valleys

- Stream valleys are generally large features – can be readily identified using 10-m or coarser DEM, LiDAR not necessary
- Outer search radius large enough to include valley walls but not excessively large
- Moderate skip radius can be used to prevent local irregularities in DEM from interfering with sightlines to valley walls
- Result: valley walls are the dominant features along sightlines thus resulting in stream valleys being classified as “Valley” or “Hollow”



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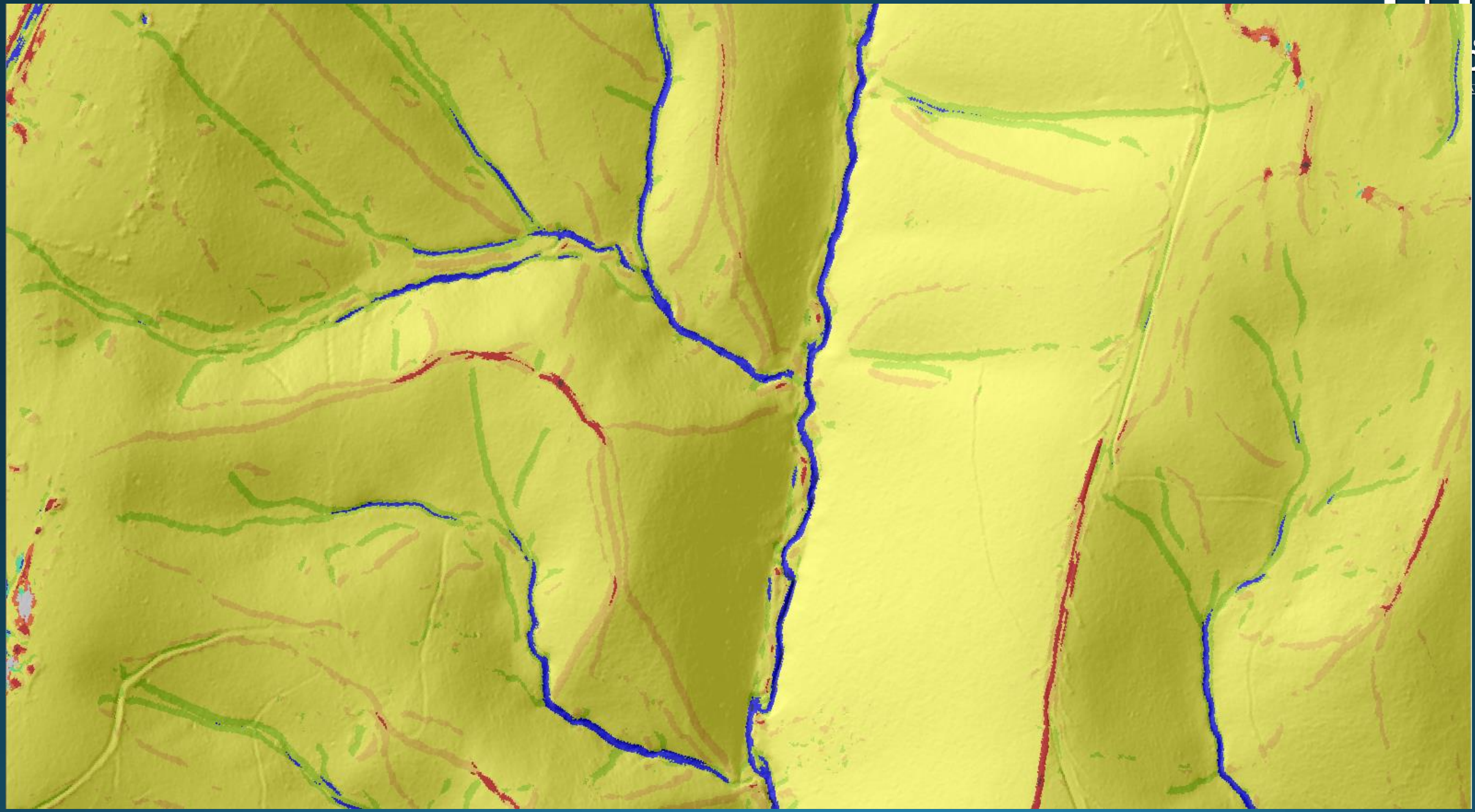
Application: stream channels

- Greater level of detail in LiDAR DEM advantageous
- Outer search radius does not need to be large; wide enough to cover channels but not much more
- No skip radius; ensure that pixels immediately surrounding focal cell are analyzed
- Result: algorithm is "tricked" into thinking channel banks are valley walls because it can't see much further, stream channels classified as "Valley", much of the remaining landscape classified as "Slope"



Resources

- Jasiewicz, J., & Stepinski, T. F. (2013). Geomorphons—a pattern recognition approach to classification and mapping of landforms. *Geomorphology*, *182*, 147-156.
- Stepinski, T. F., Jasiewicz, J. (2011) Geomorphons - a new approach to classification of landforms. *Geomorphometry Conference, Redlands CA*

- Online web app: http://sil.uc.edu/geom/app
- GRASS GIS extension: *https://grass.osgeo.org/grass74/manuals/addons/r.geomorphon.html*
- Fun video: https://www.youtube.com/watch?v=HQ_0Ar2sOoQ

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