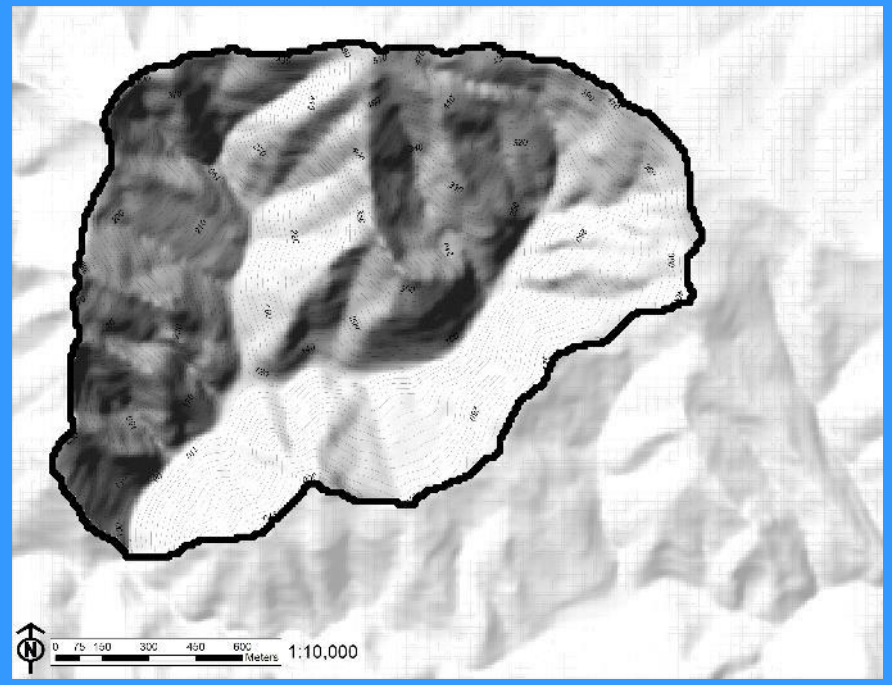
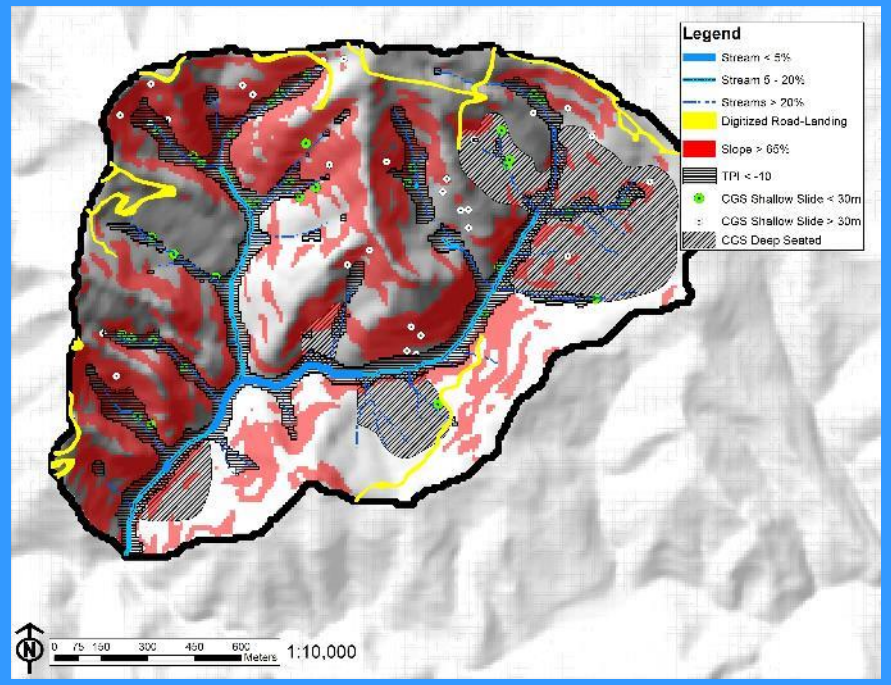
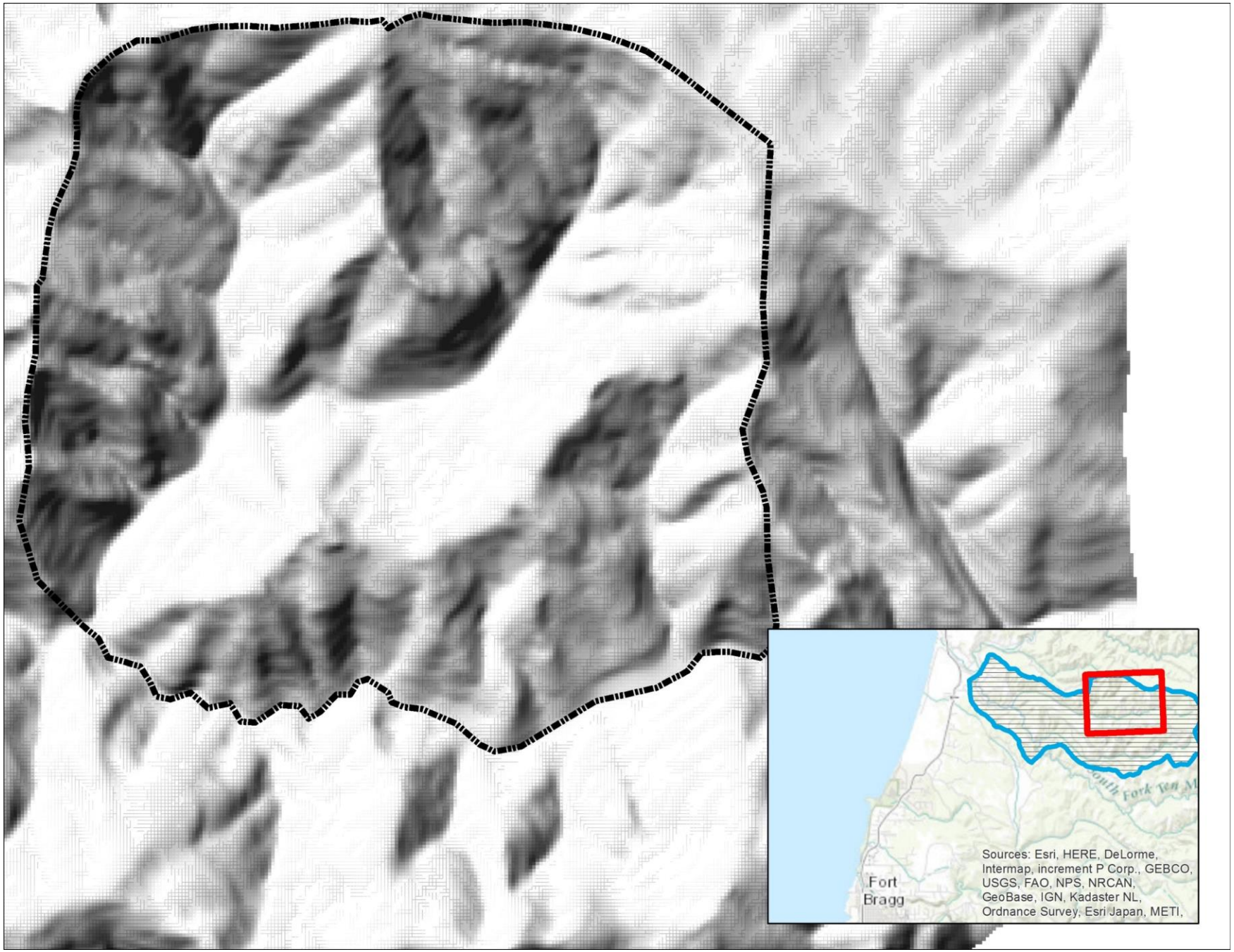
Modeling Pathway



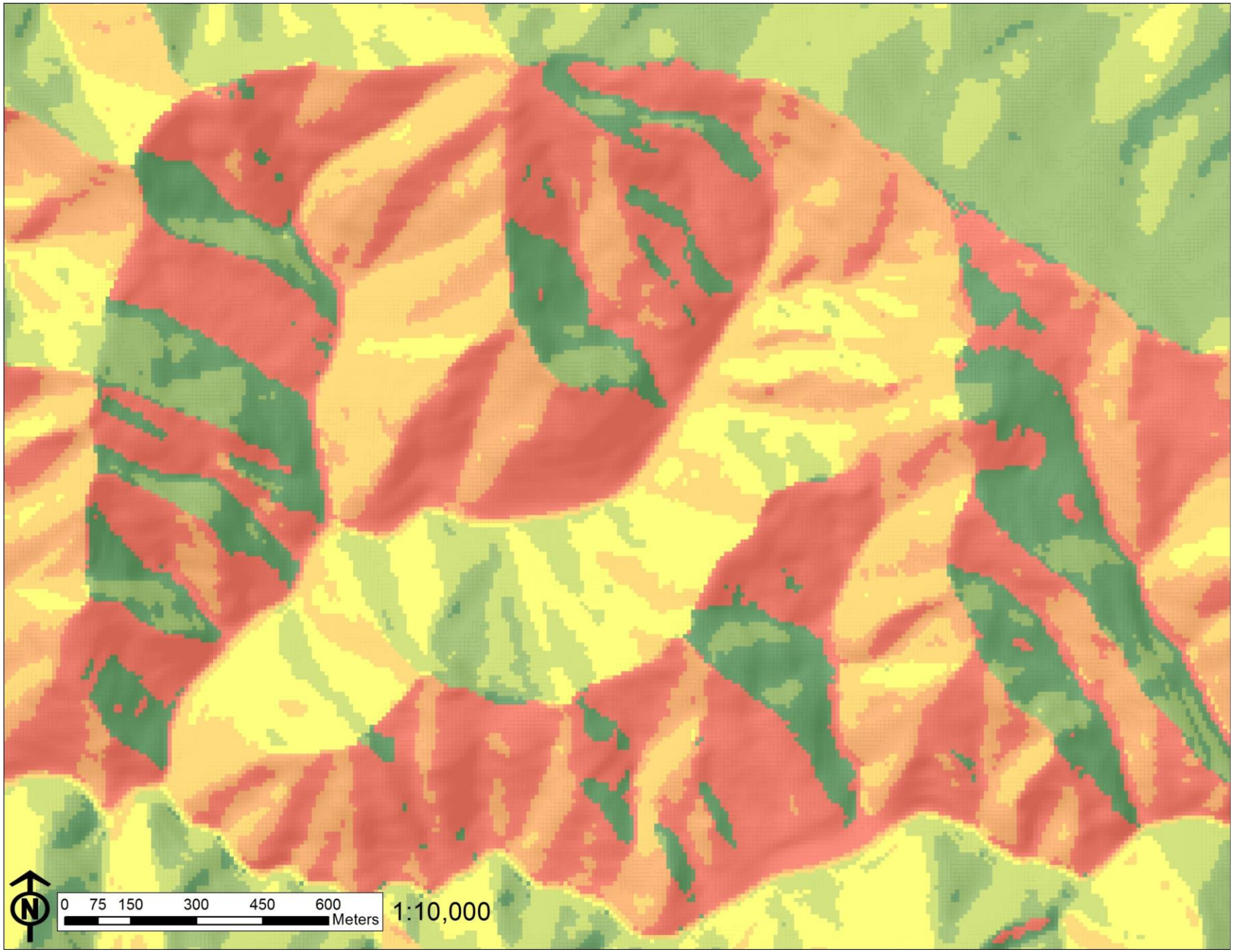




Scope area assessed within the watershed.

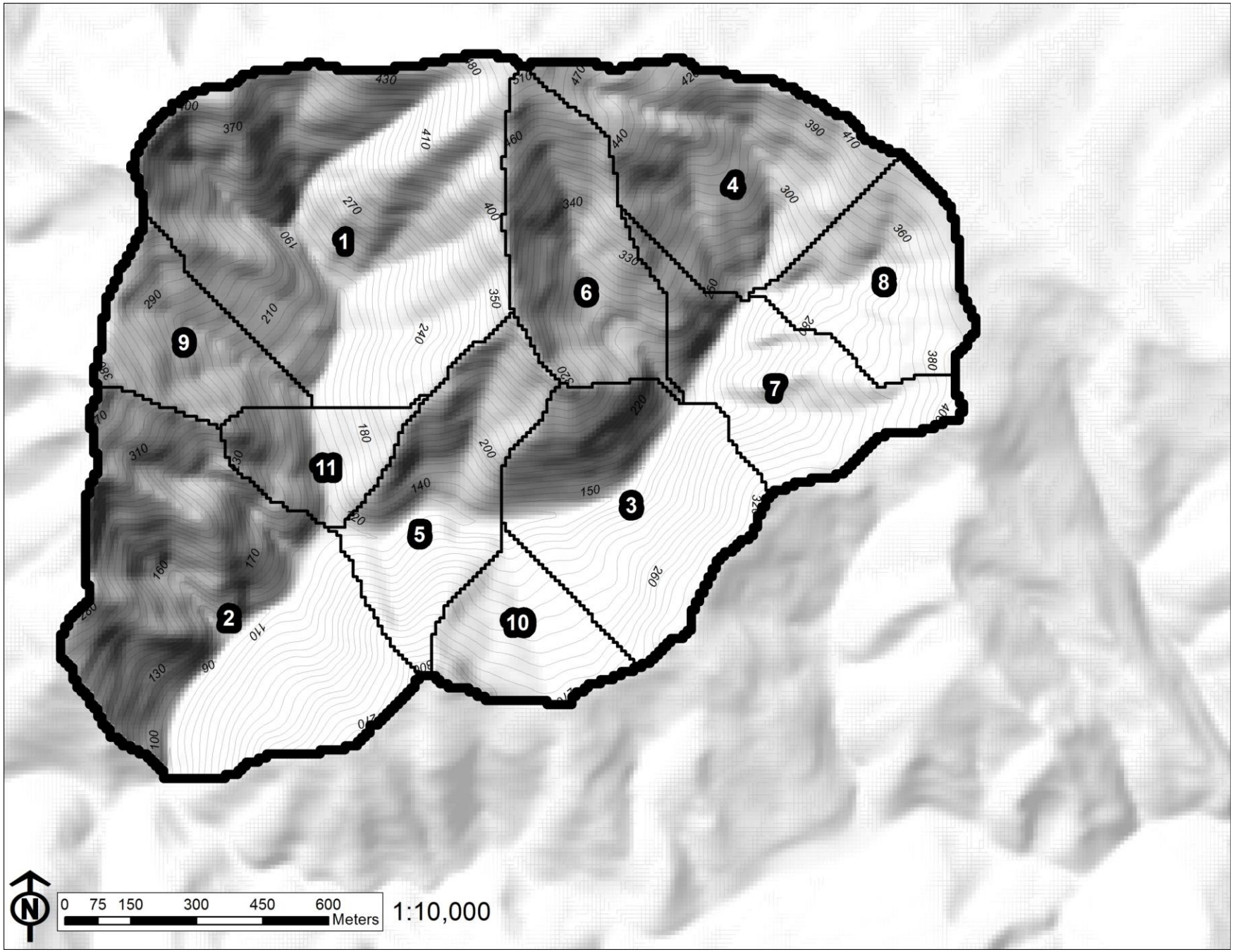
Simple ArcGIS analysis

- Standard ArcGIS or open source methods and tools
- Commonly used methodology and classifications from literature
- Public data
  - 10m DEM
  - ~1m NAIP imagery
  - CGS/CALFIRE spatial data
    - Timber Harvest Plan shapefiles and data
    - Shallow and deep seated slides

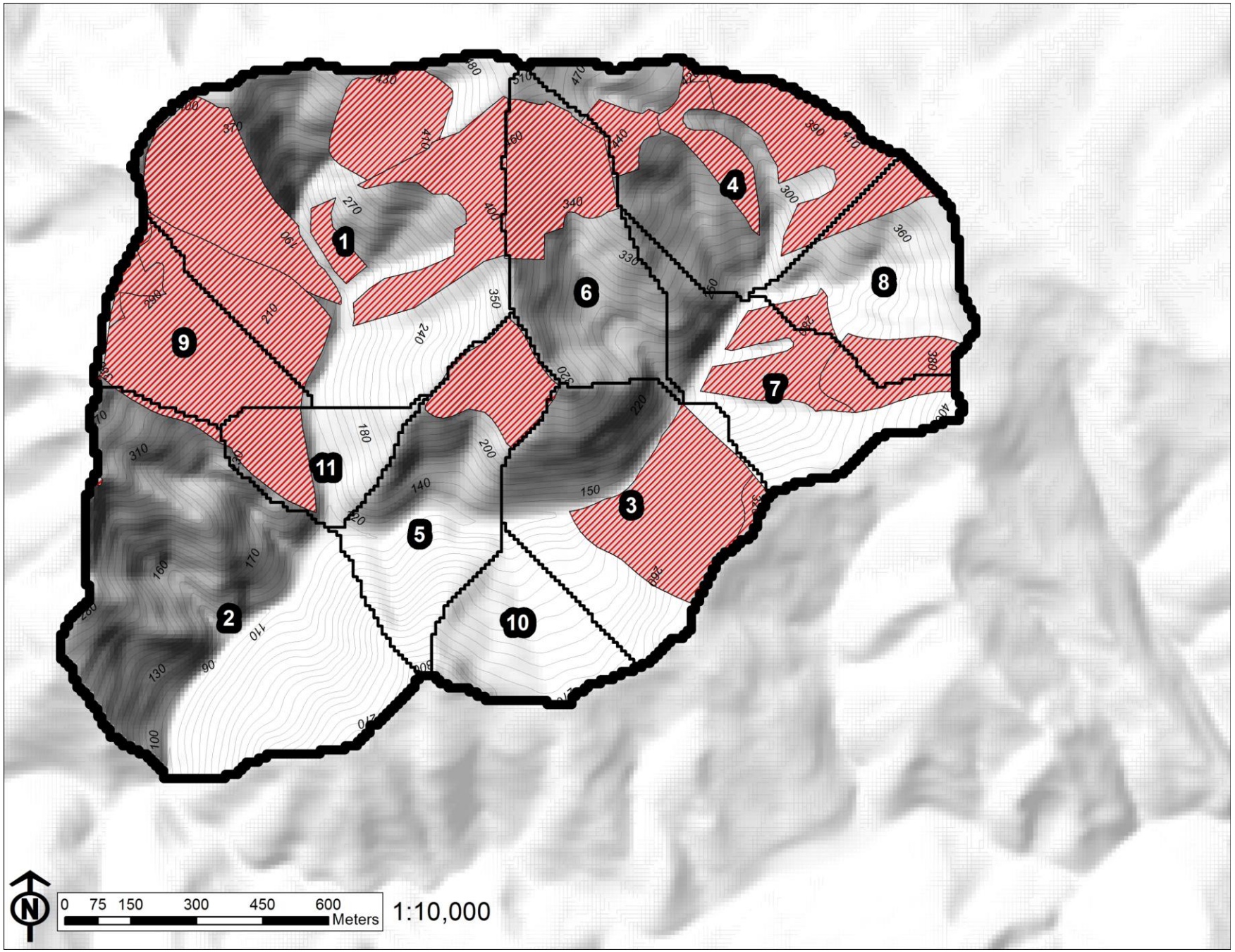


TauDEM (Terrain analysis using digital elevation model) (Tarboton et al., 1992)

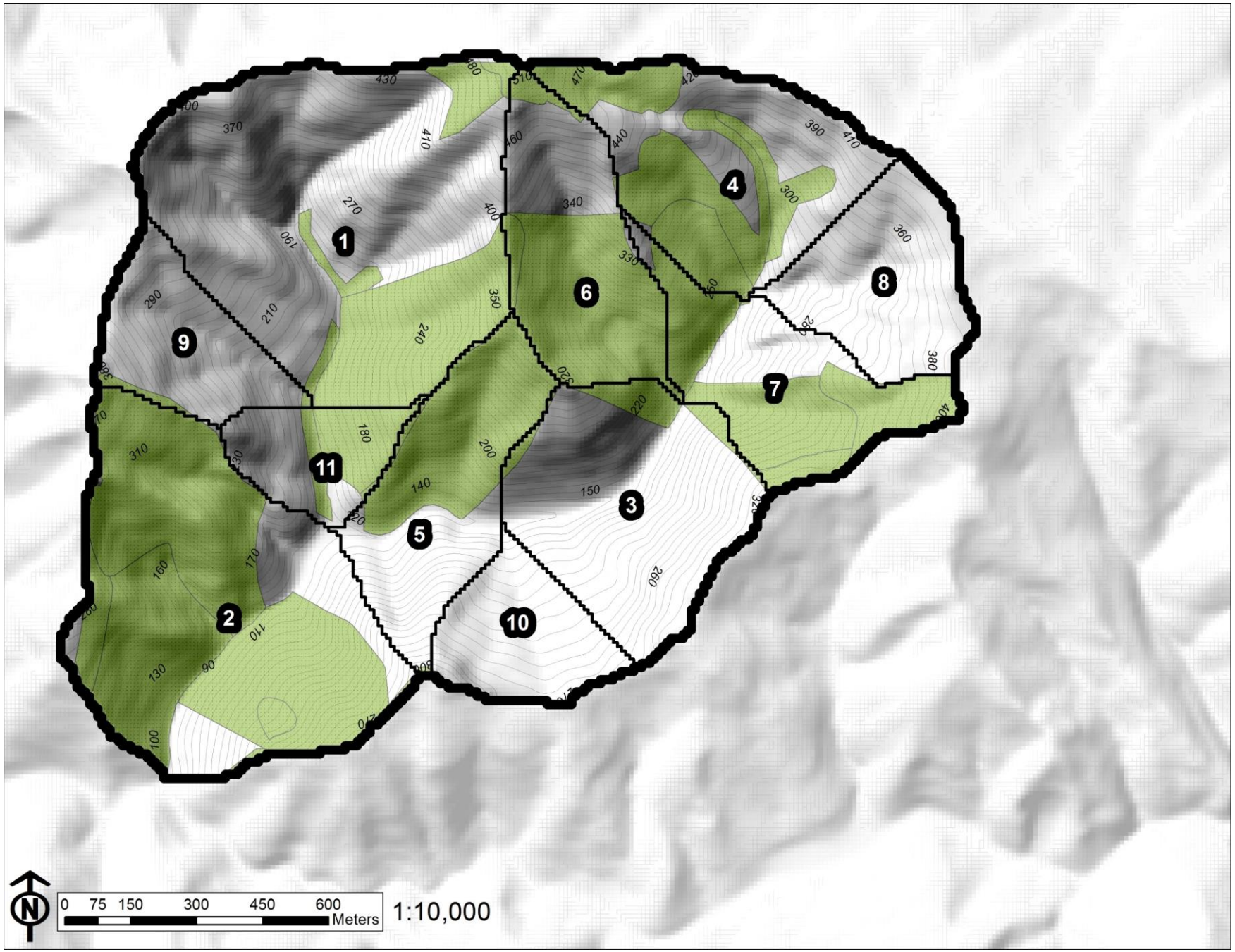
- Determines flow direction and contributing area to each cell



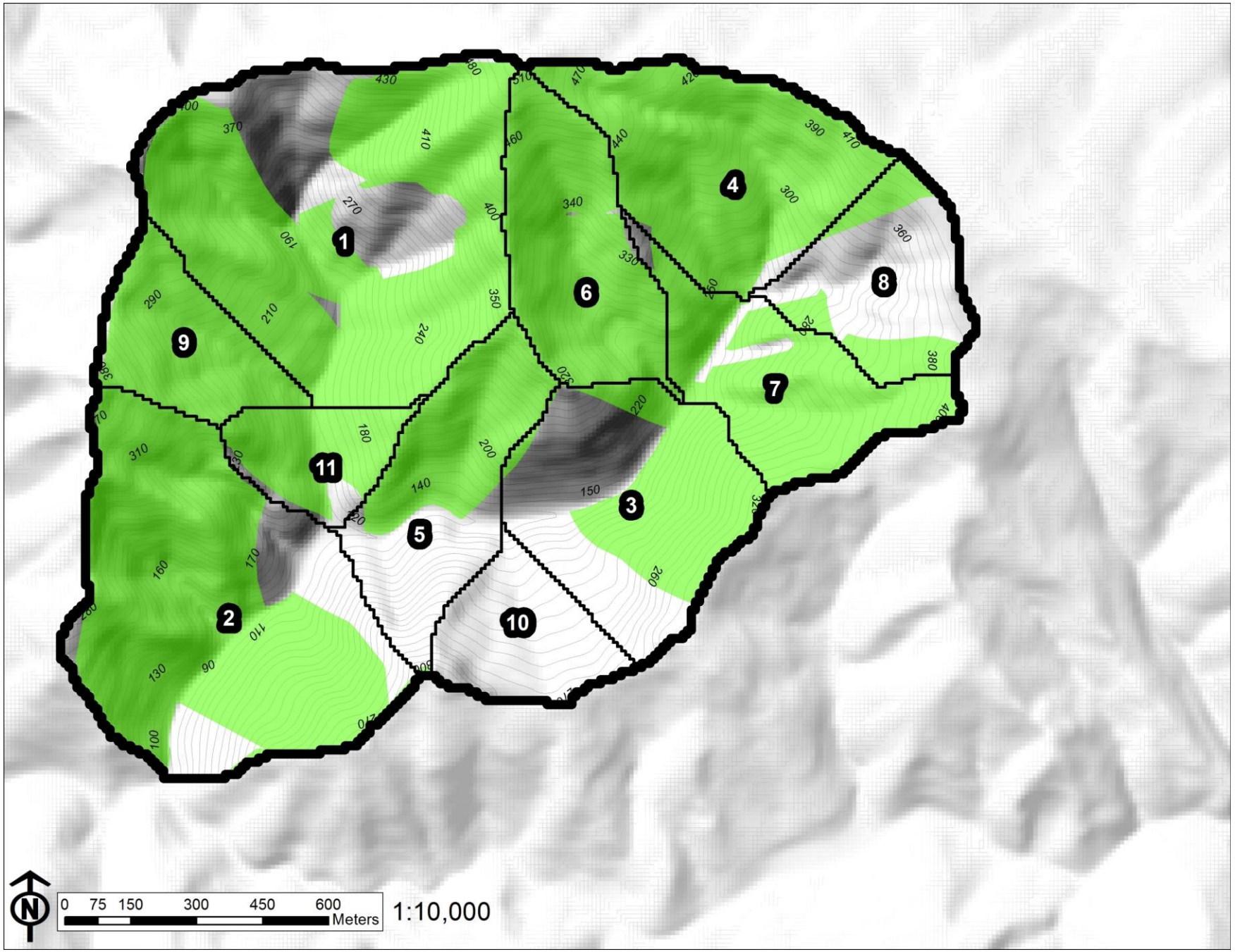
- 10 ha area used to delineate a catchment
- Catchments connected to single outlet form the watershed
- 11 catchments
- ~ 248 ha watershed



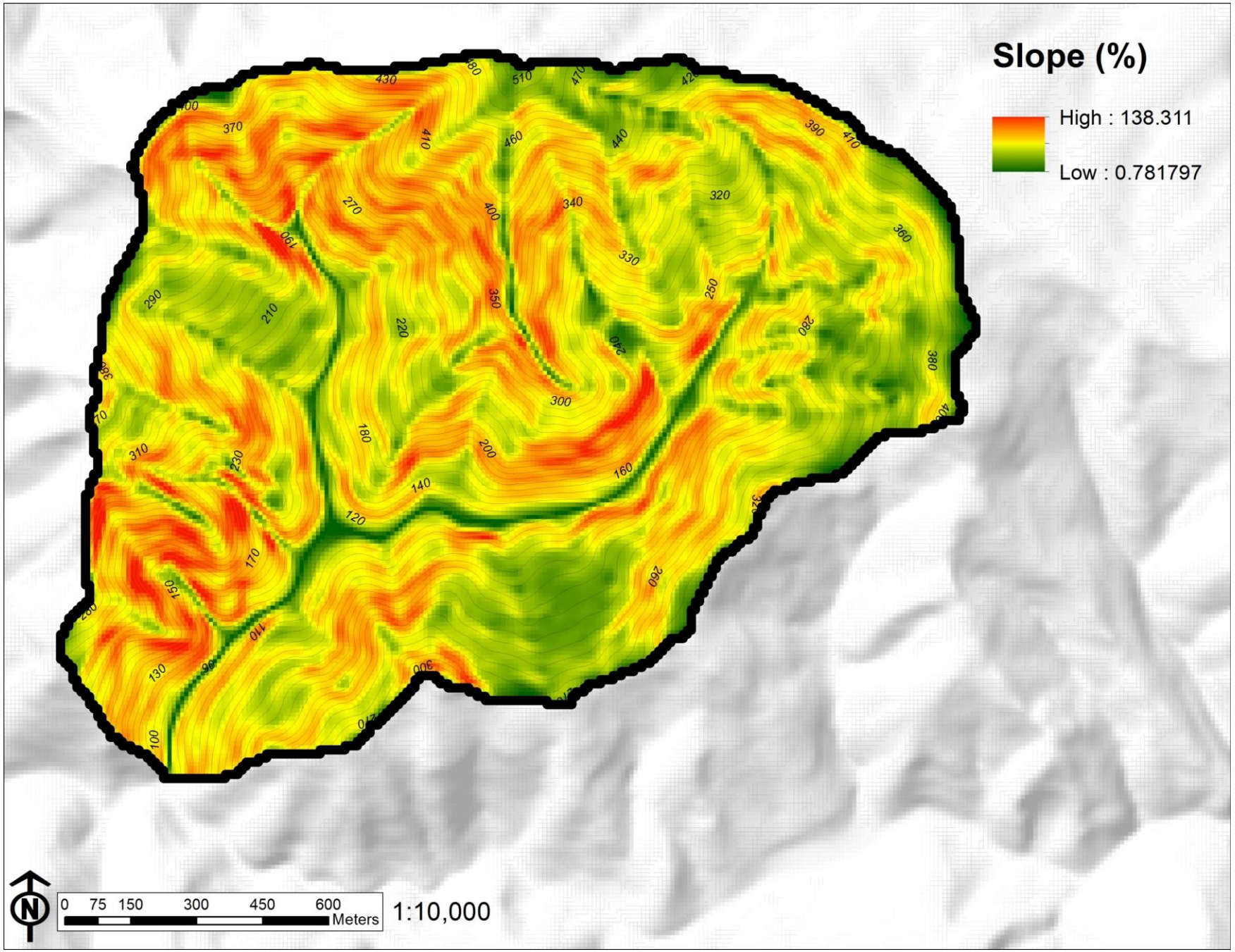
- Clear cut THP's
- 2% average across entire watershed per year (1990 to 2013)



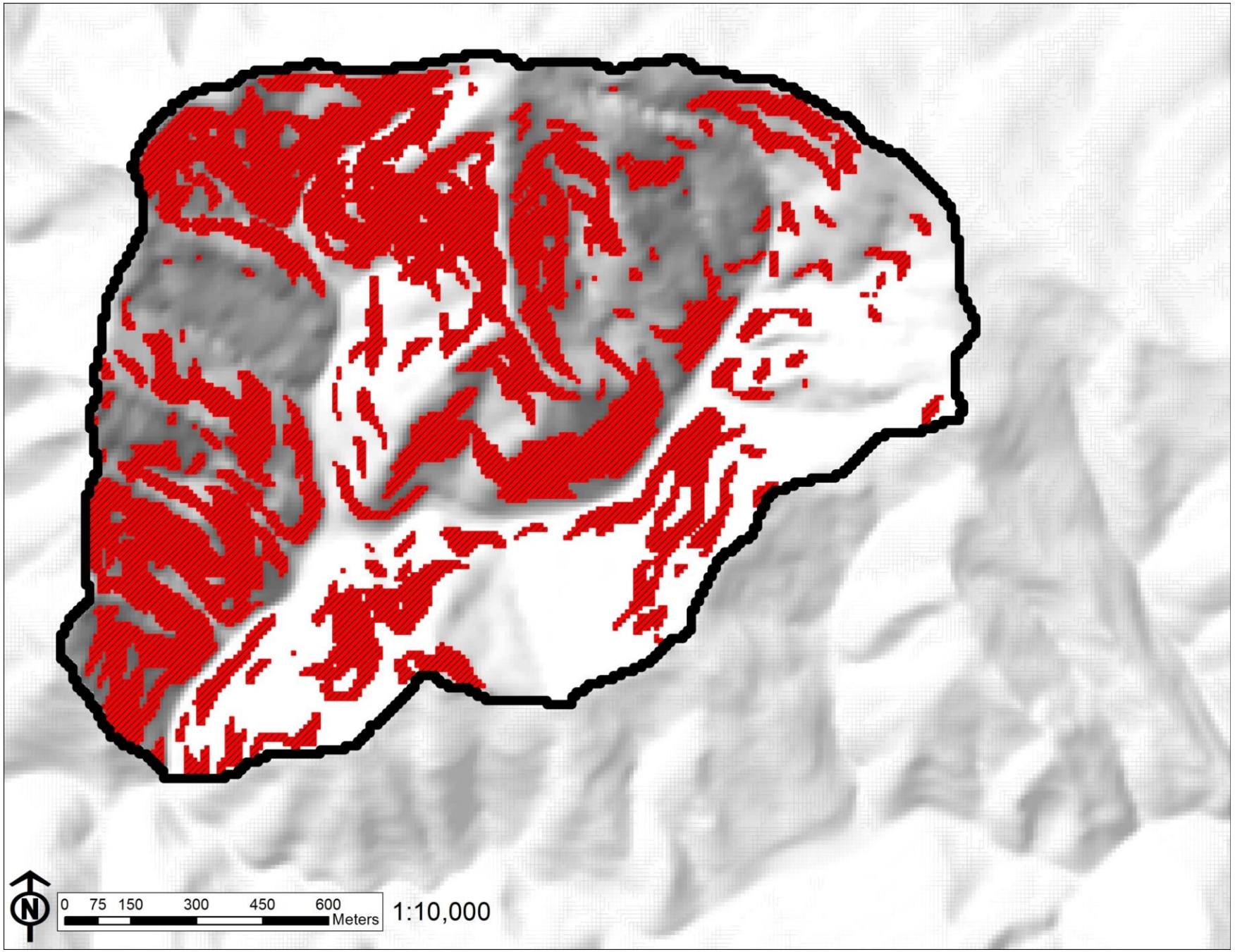
- Non-clear cut THP's
- 2% average across entire watershed per year (1990 to 2013)



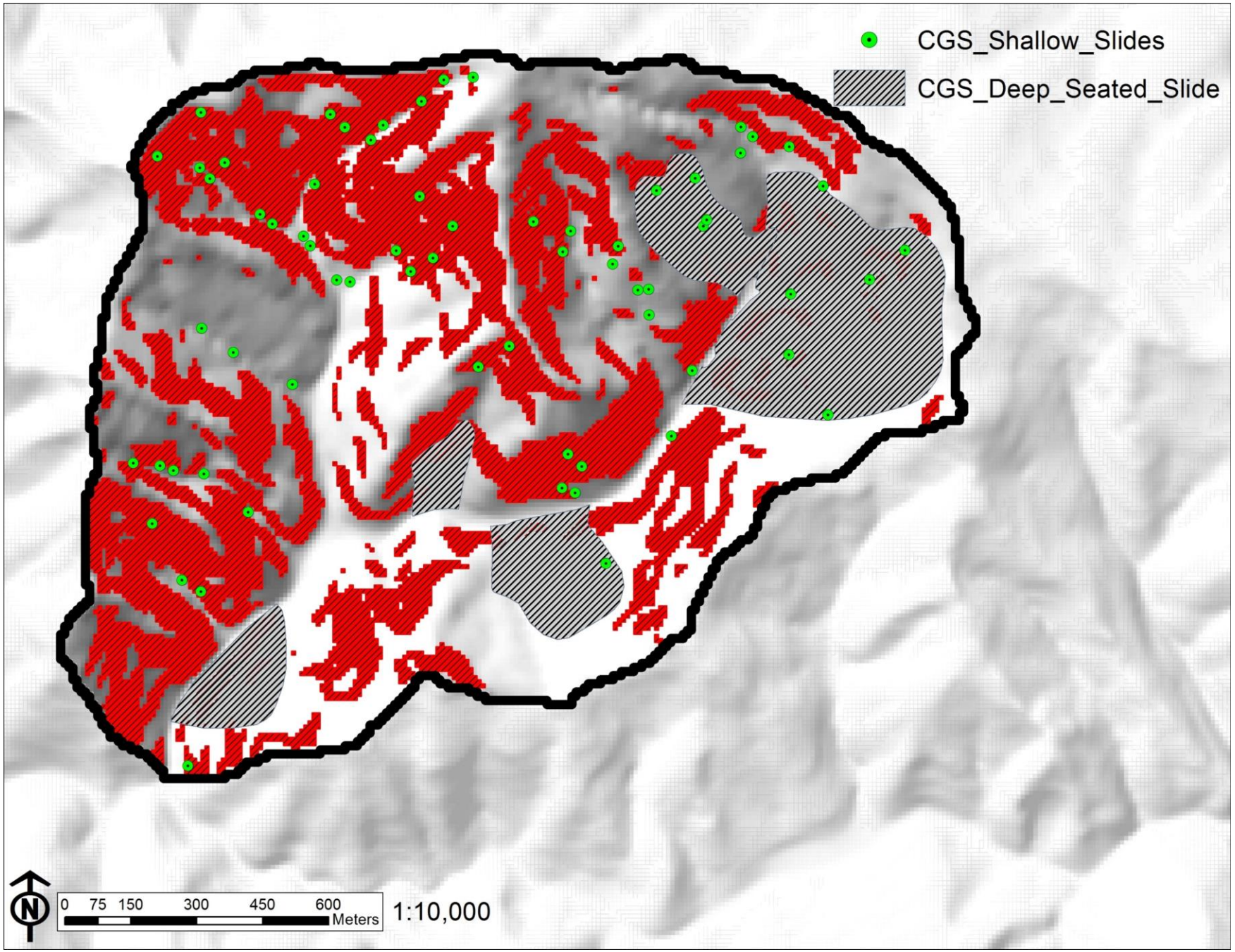
- Total footprint of THP's in watershed and catchments (some overlap each other over consecutive years)



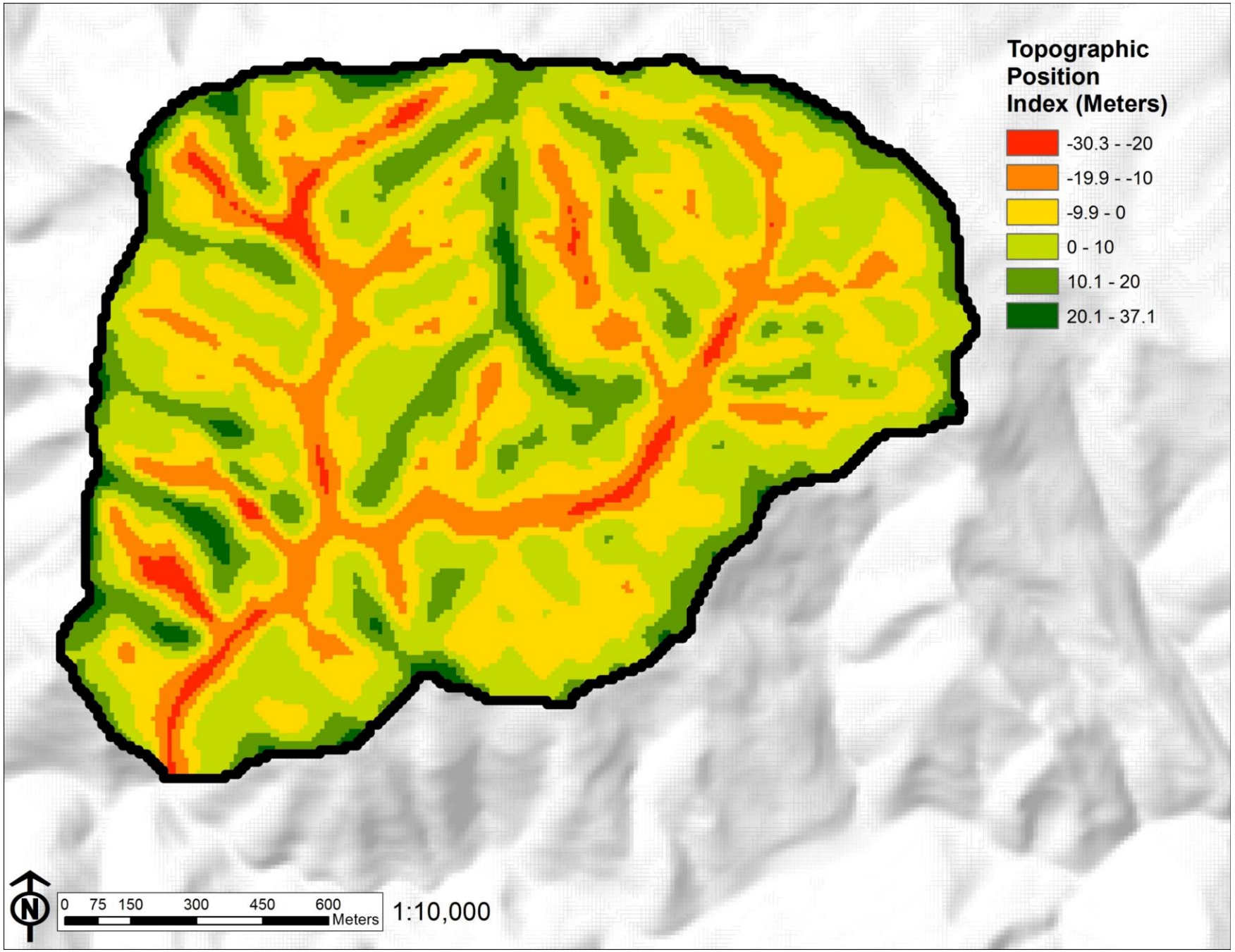
- Percent slope



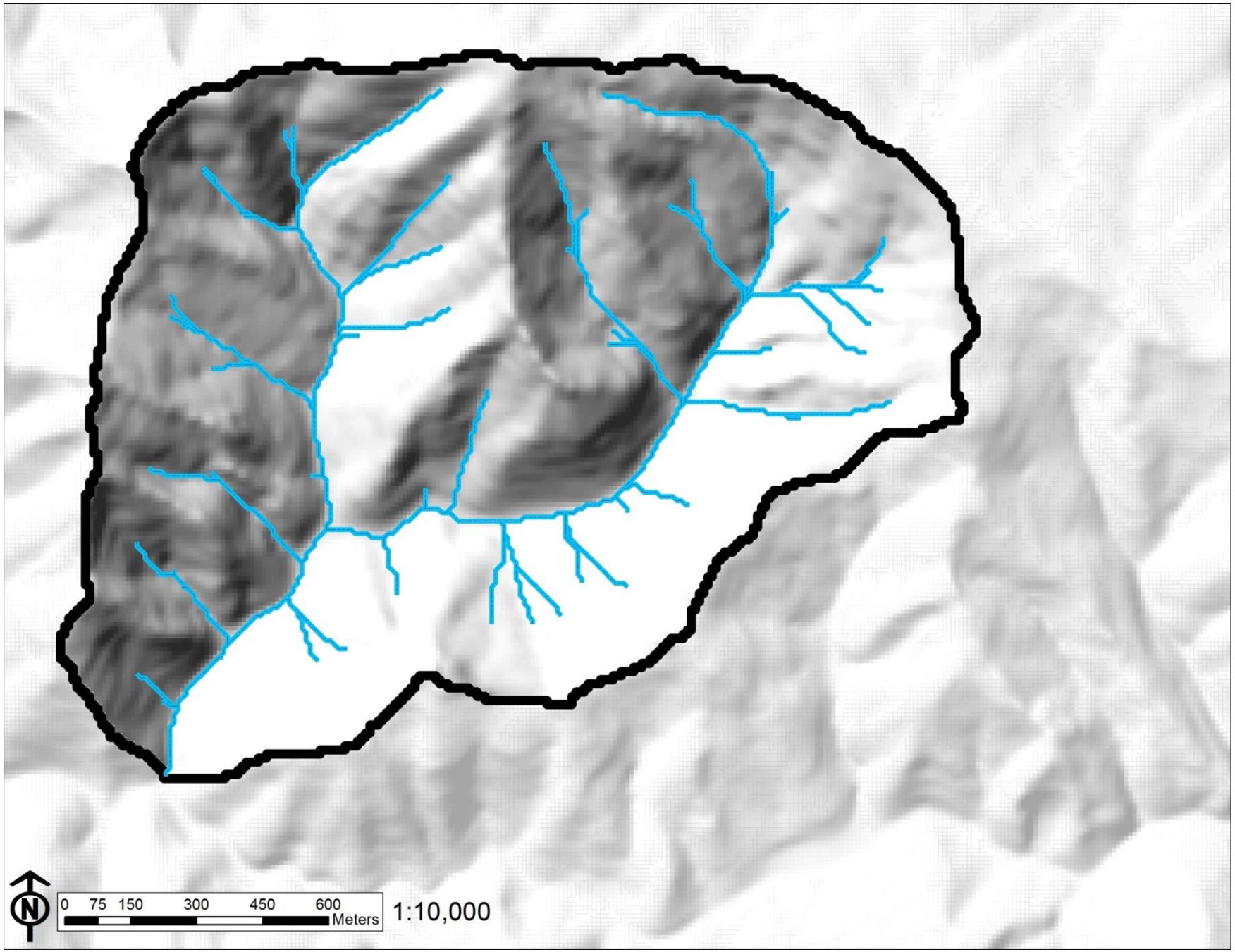
- Slopes over 65%
- Threshold for shallow mass wasting?



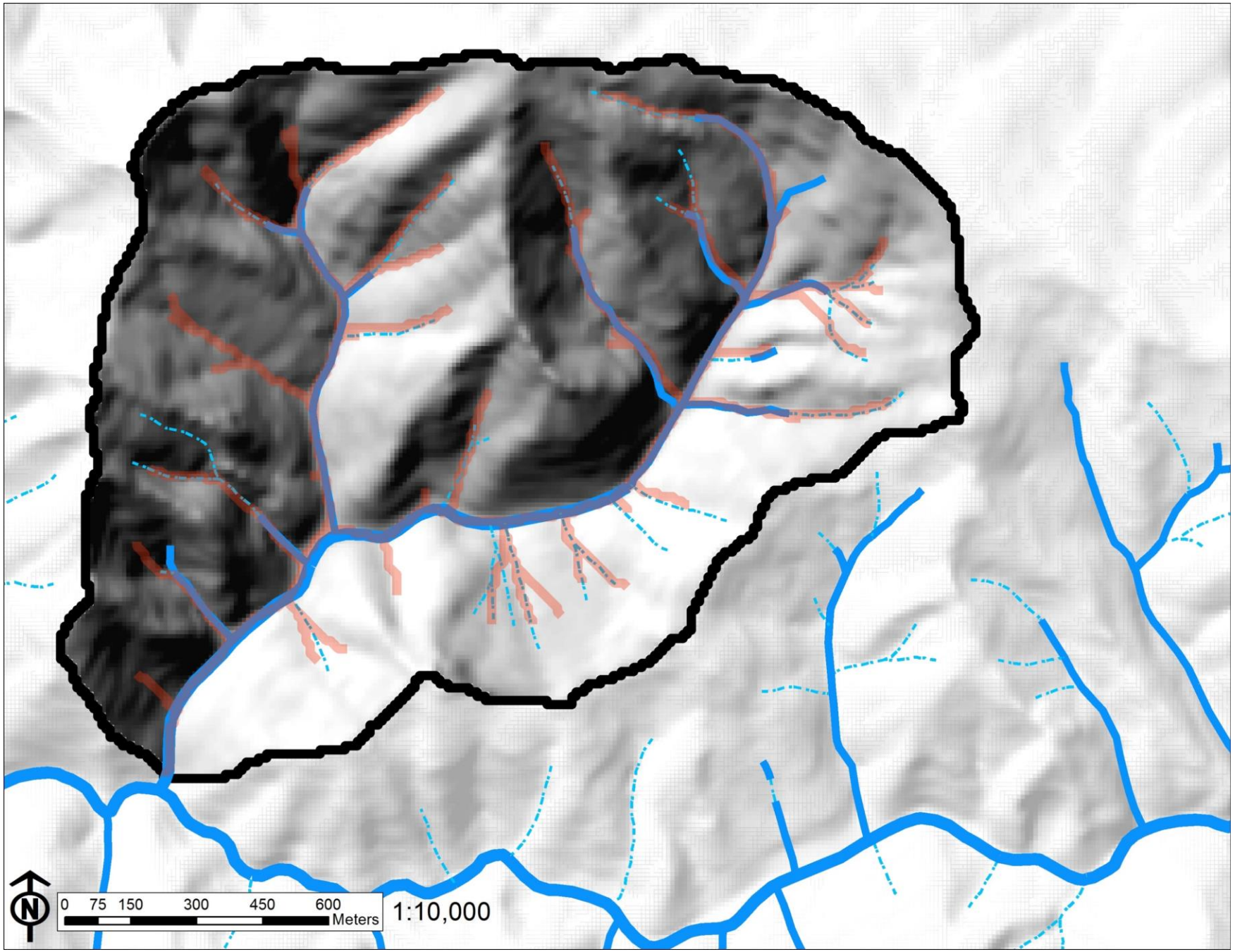
- Shallow slide and deep seated slide data from CGS
- Overlaid on slopes > 65%



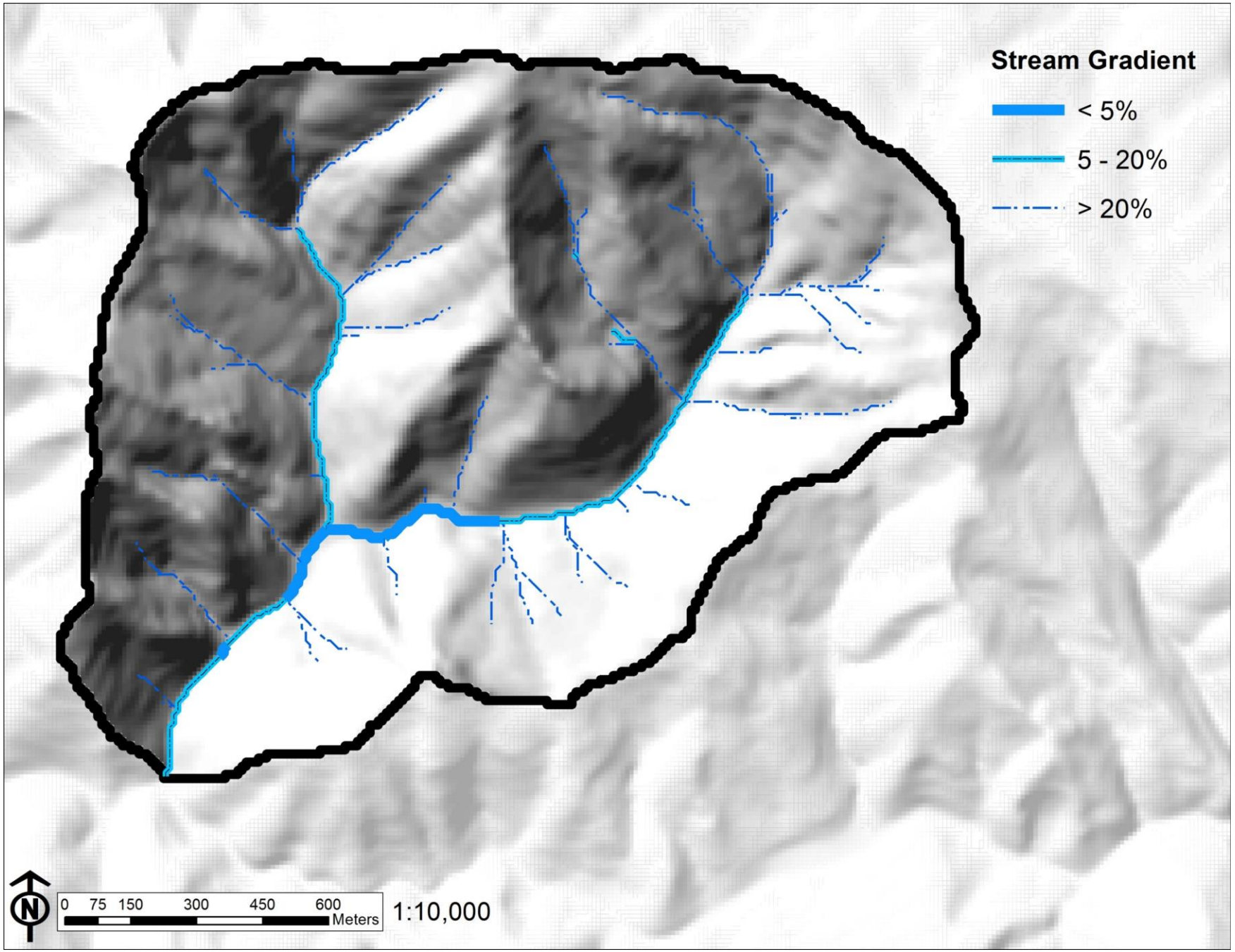
- Topographic Position Index (Jenness, 2013)
- Measurement of each cell relative to surrounding cells
- User defined thresholds
  - 10 cell (100 m) radius circle used here



- Drainage network delineated using 10,000 m^2 threshold
- Based on the DEM

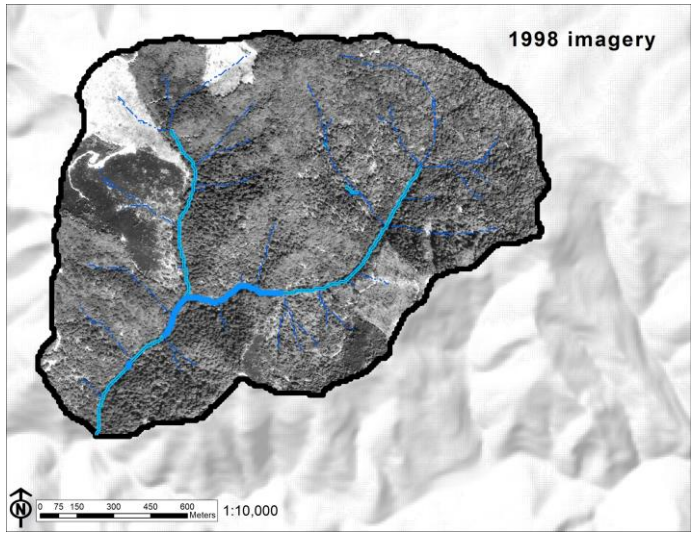


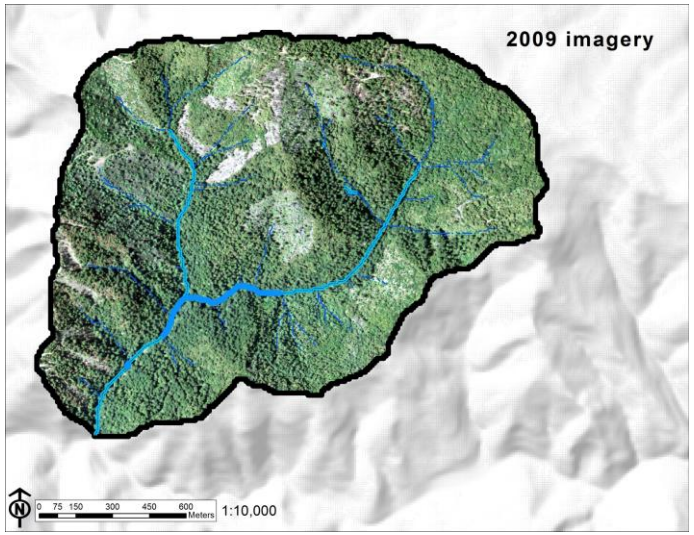
- CalFire stream shapefile
  - Class 1/2/3 shown
- Drainage network is transparent red line



- Drainage network by channel gradient
- < 5% - Depositional
- 5-20% - Transitional / delivery
- >20 – Erosional / source

- (Adopted from WA State Watershed Analysis guide [2011] and Benda et al., 2005)


1998 imagery
0 75 150 300 450 600
Meters
1:10,000


2009 imagery
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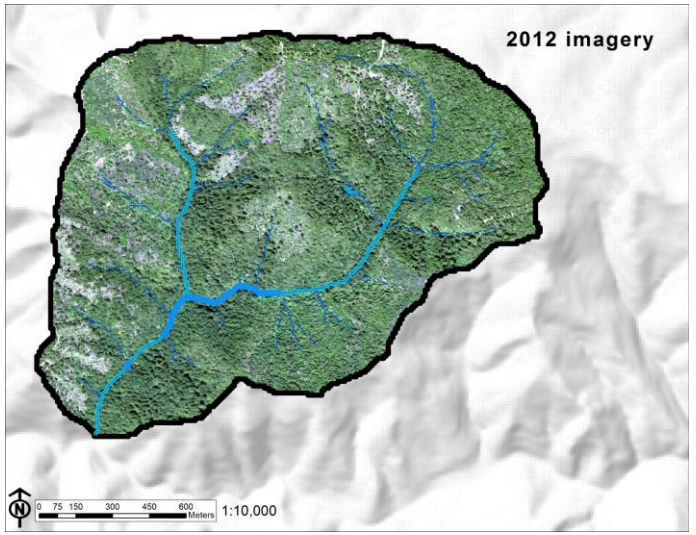
Meters
1:10,000


2012 imagery
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Meters
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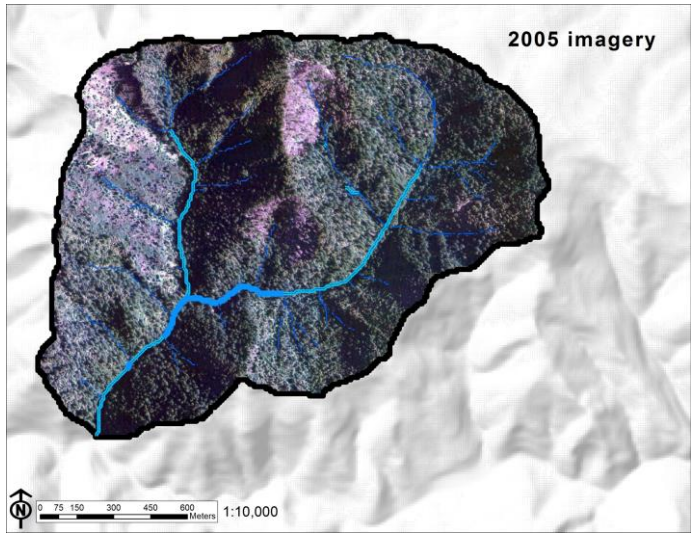
2005 imagery
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Meters
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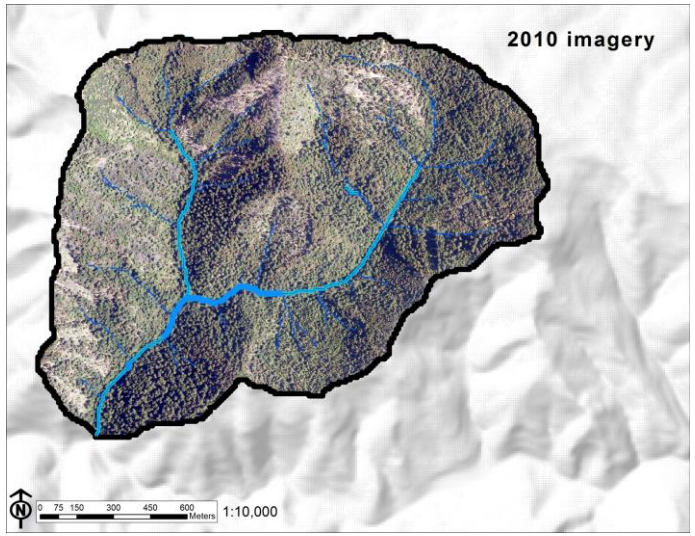
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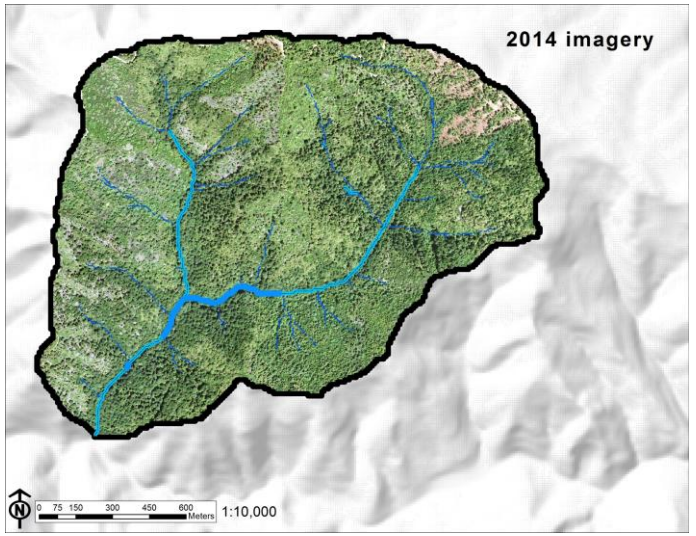
2014 imagery
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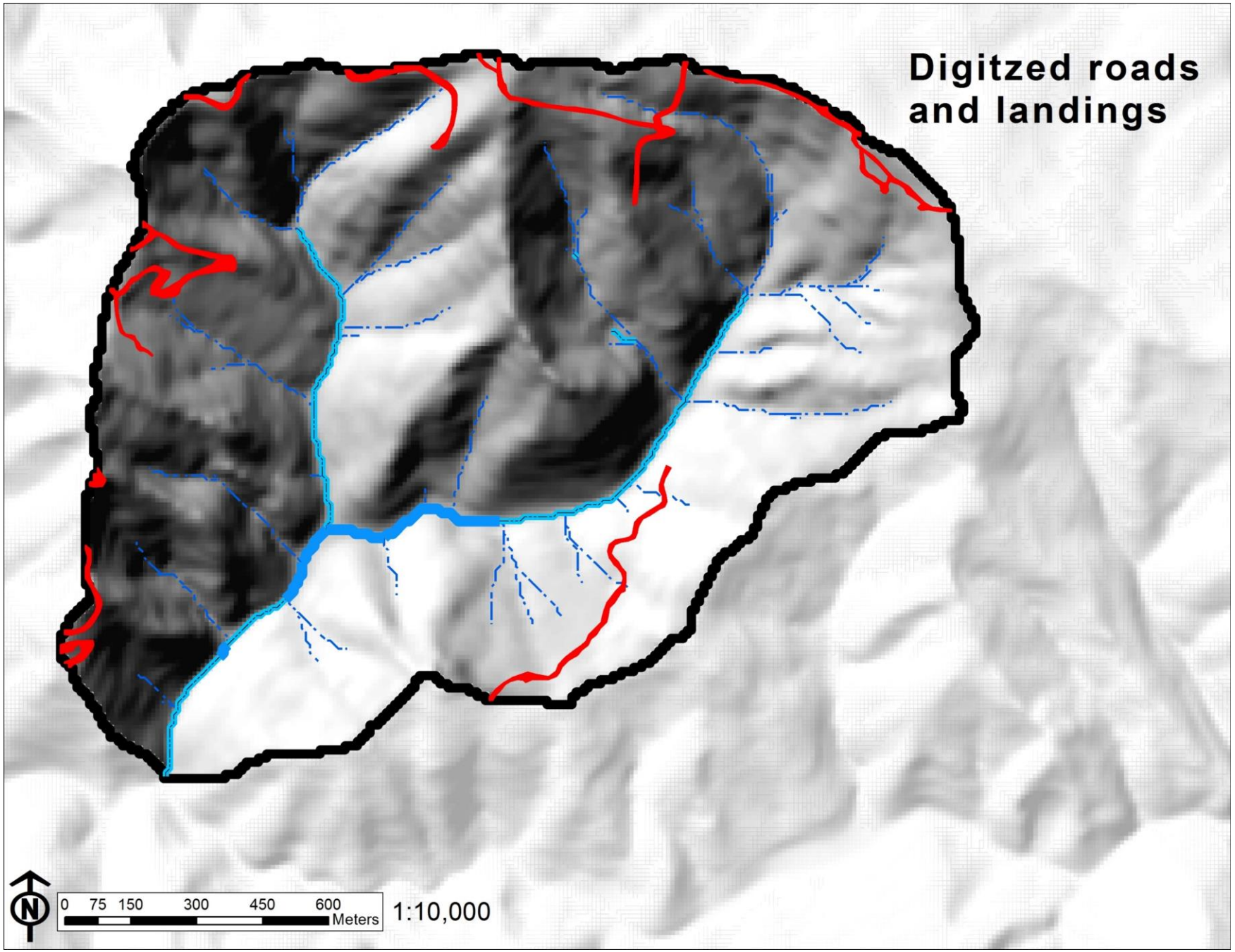
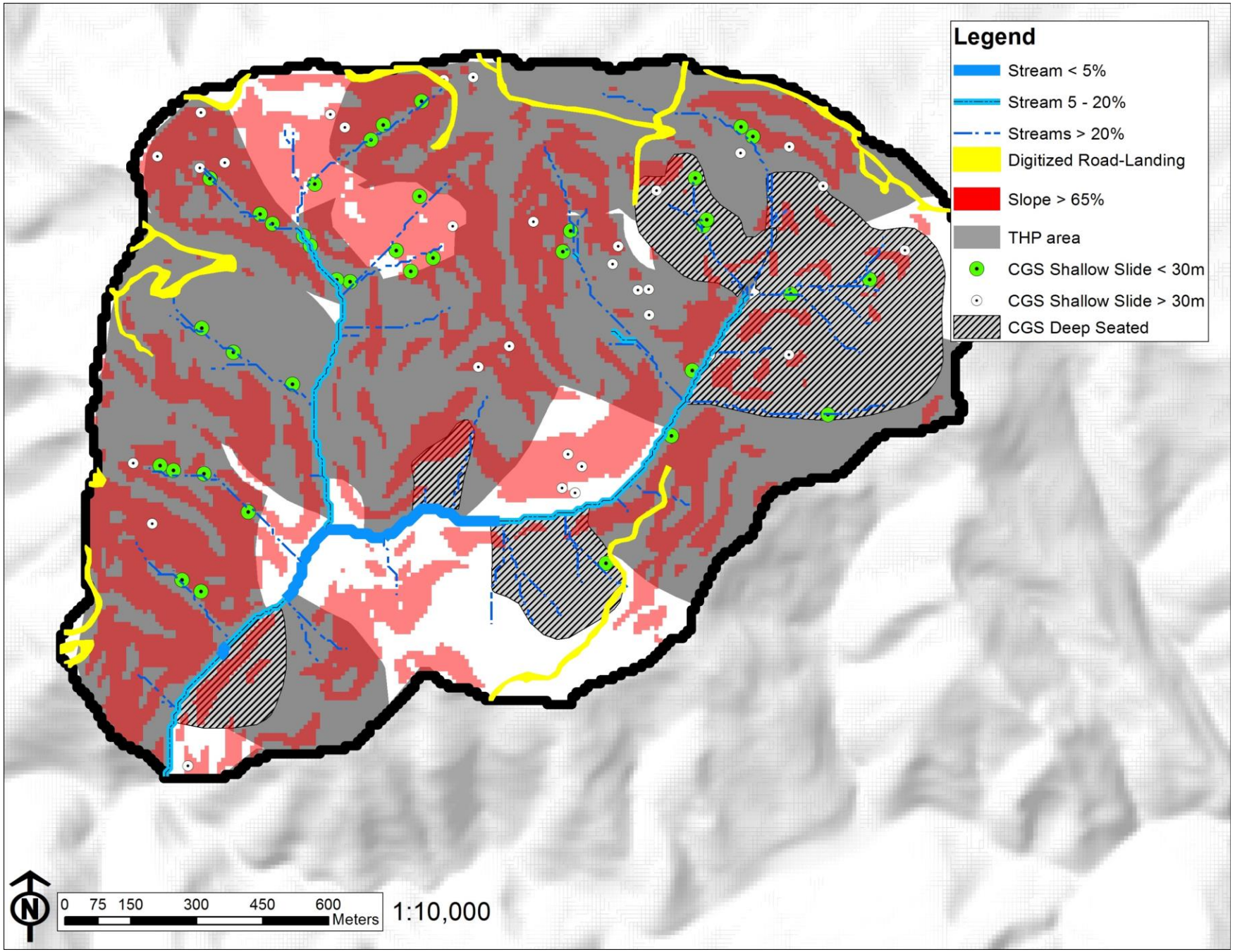
Meters
1:10,000

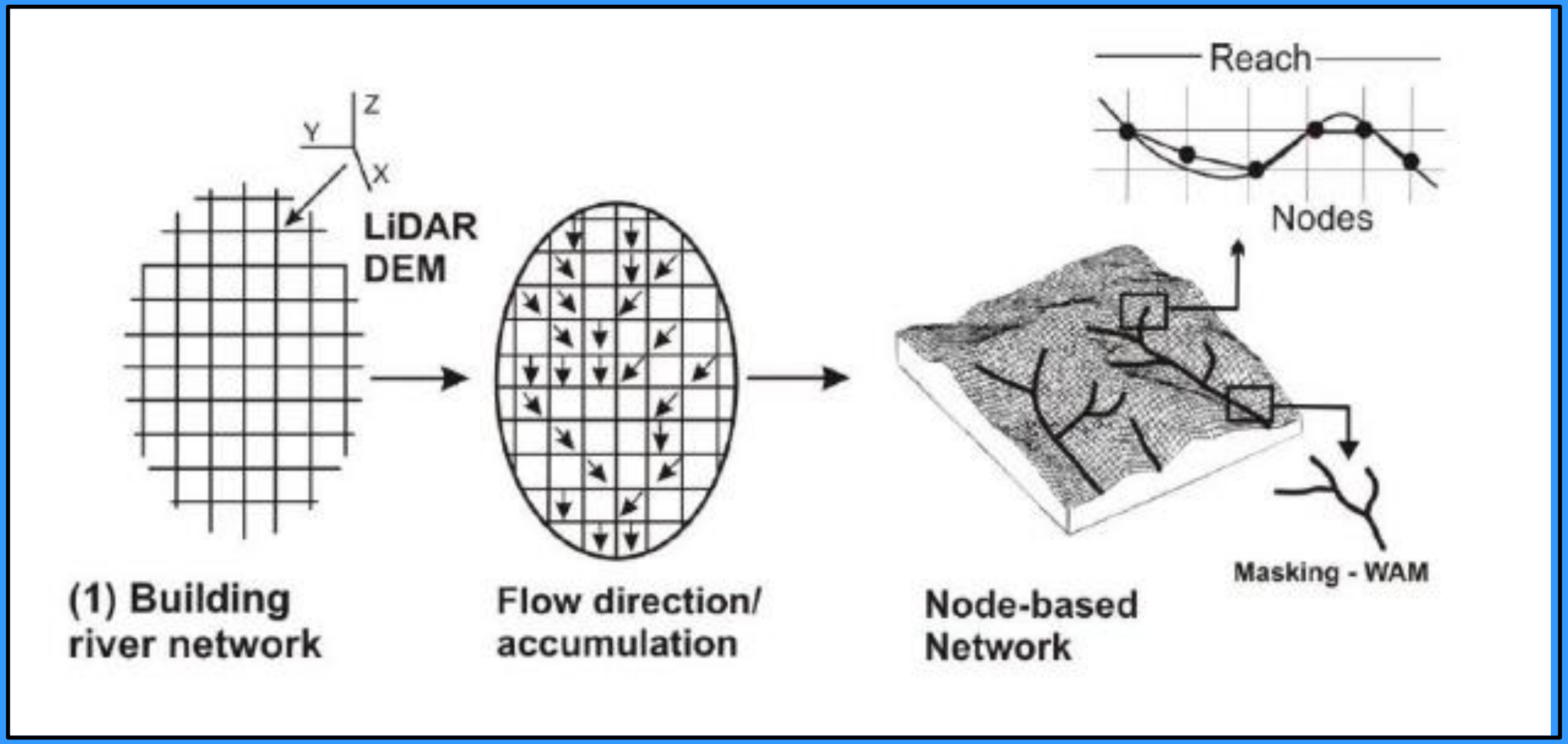


- Visual estimate of constructed roads and landings from NAIP imagery



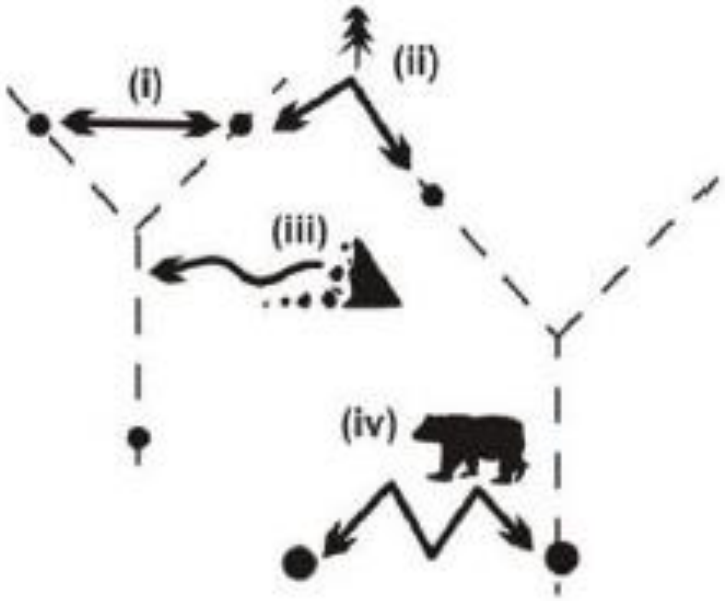
- Begin overlaying layers to make an assessment for specific criteria
- THP's, steep slopes, slide areas, channel gradients – ID areas of possible sediment transport and deposition
  - LWD recruitment needed?

NetMap – Analytical Capabilities



(Benda and Andras, 2017)

NetMap – Analytical Capabilities



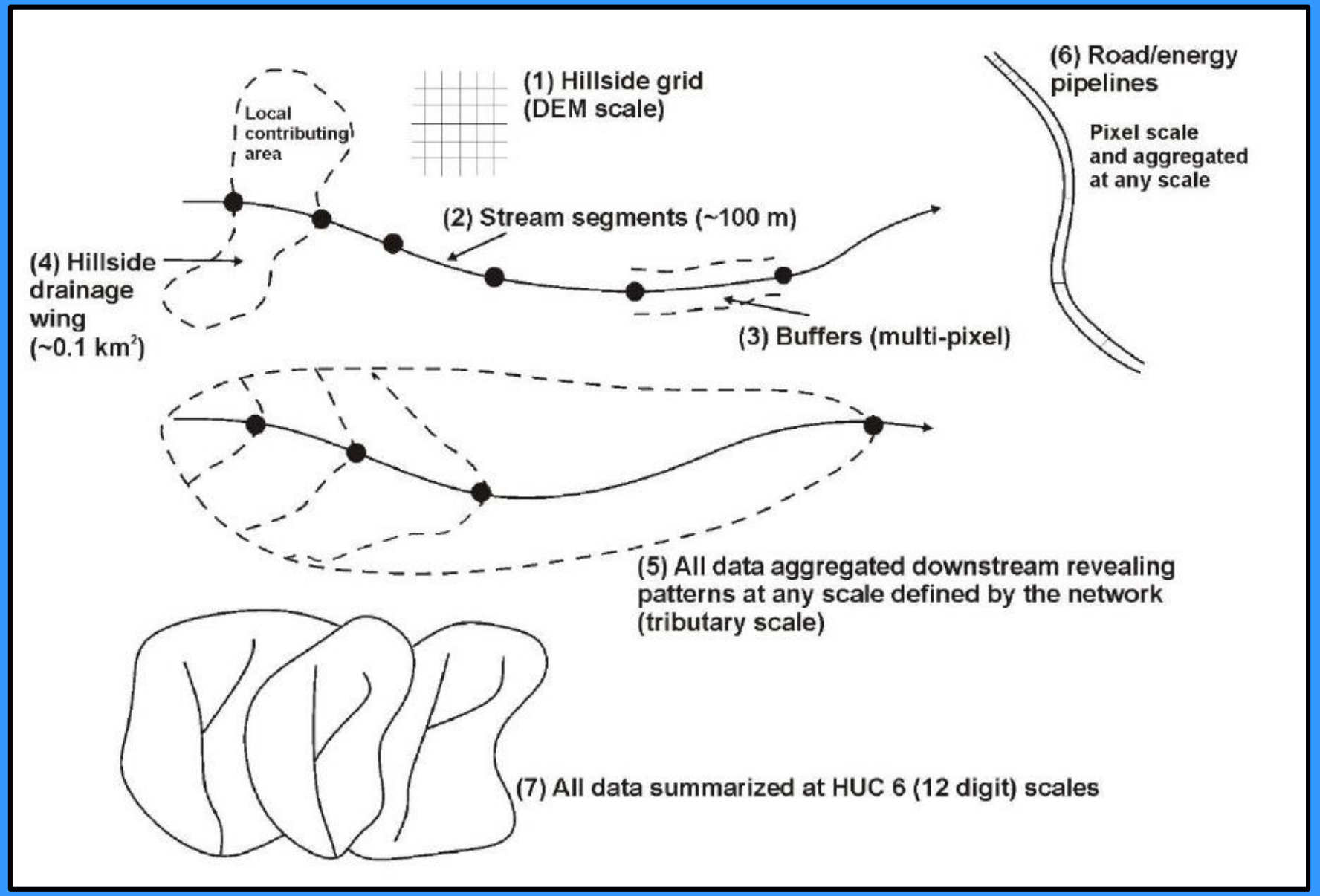
(2) Connecting

(3) Routing

(4) Discretizing

(Benda and Andras, 2017)

Scalable Analysis



(Benda and Andras, 2017)

NetMap's Shared Analysis Tools

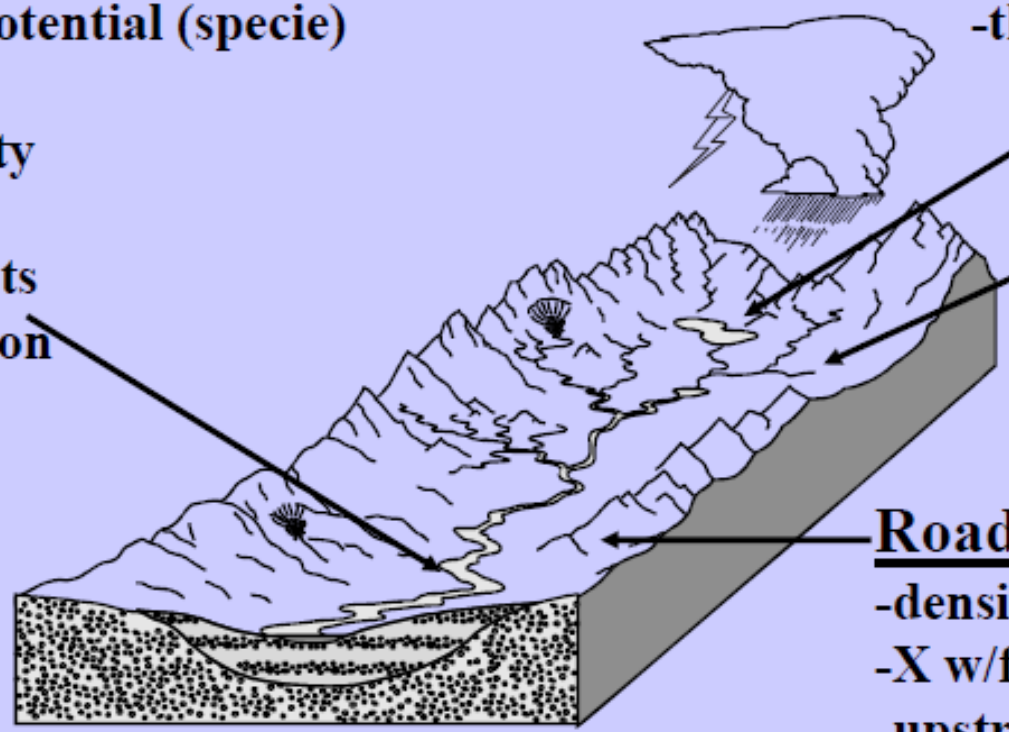
(ArcMap 9.3, 10)

Aquatic habitat indices

-intrinsic potential (specie)
-core areas
-connectivity
-diversity
-bio-hotspots
-classification

Watershed Processes

-erosion/sediment supply
-LWD supply
-thermal loading/temp



Vegetation

-forest age
-fire risk
-burn severity

Roads

-density (multi-scale)
-X w/fish
-upstream hab. length/quality
-stability
-drainage diversion
-surface erosion

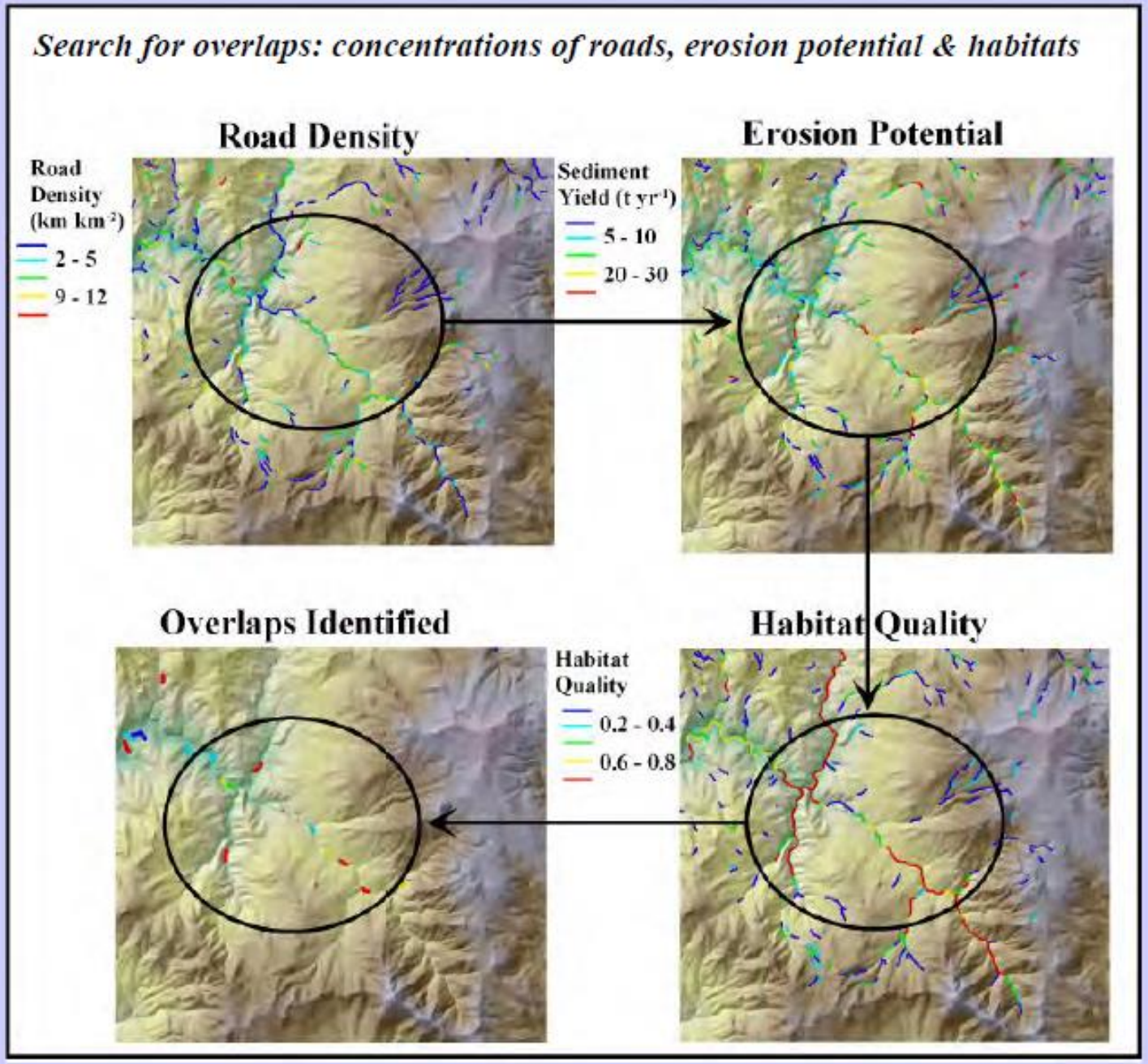
Query/Overlap tools & others

-menu driven: search & prioritize
e.g., high erosion w/best habitat,
high road density + high
erosion + sensitive habitat

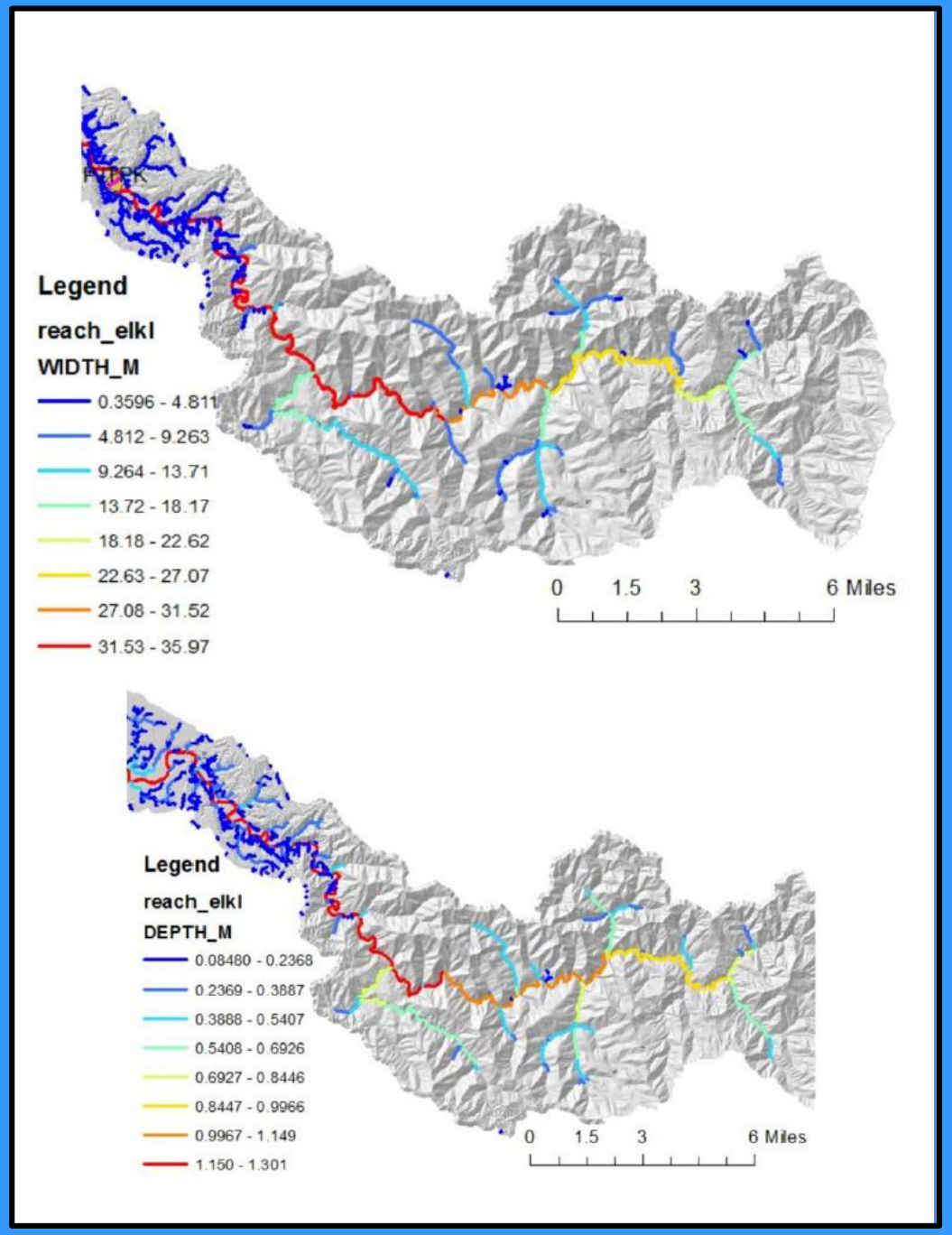
Google Earth Interface/hyperlinked tech help

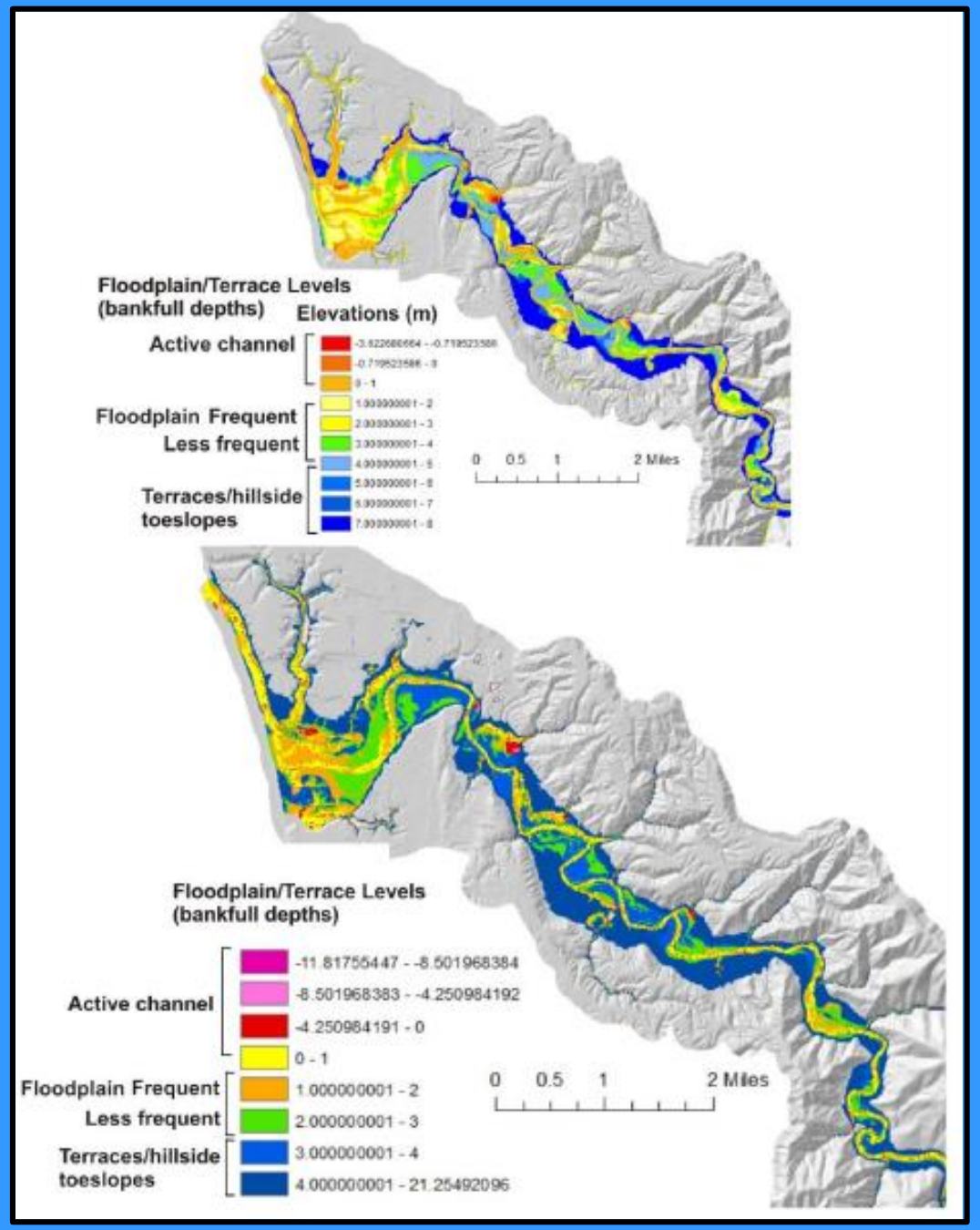
(Benda, 2011)

Link road density with hillslope erosion potential and habitat sensitivity



(Benda, 2011)





(Benda and Andras, 2017)