TERRAIN MODELING FOR OPEN SPACE PROJECTS

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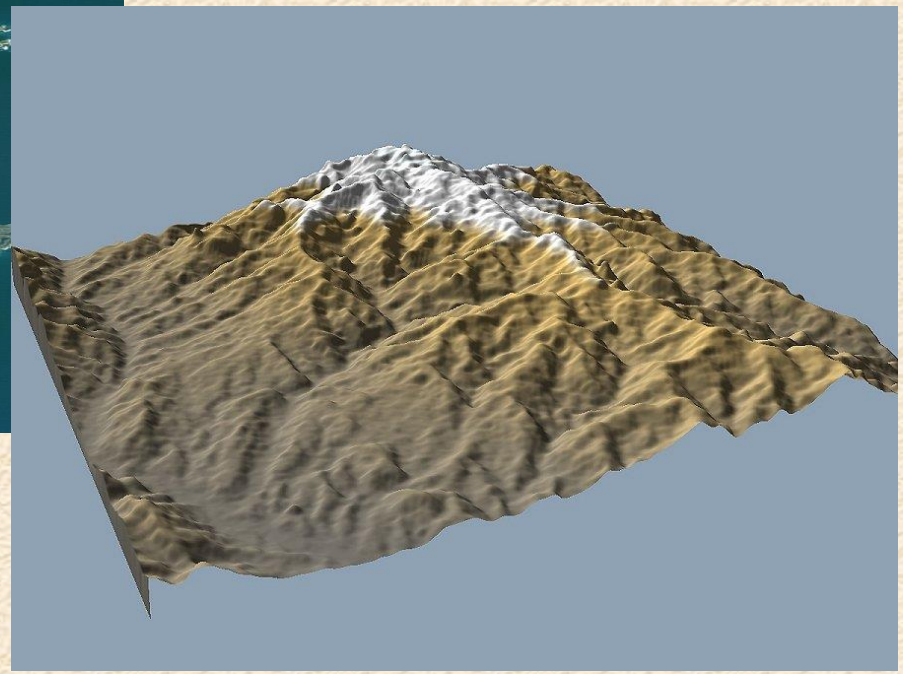
2018 Colorado Open Space Alliance Conference

Grand Junction, Colorado

STI OUTDOORS

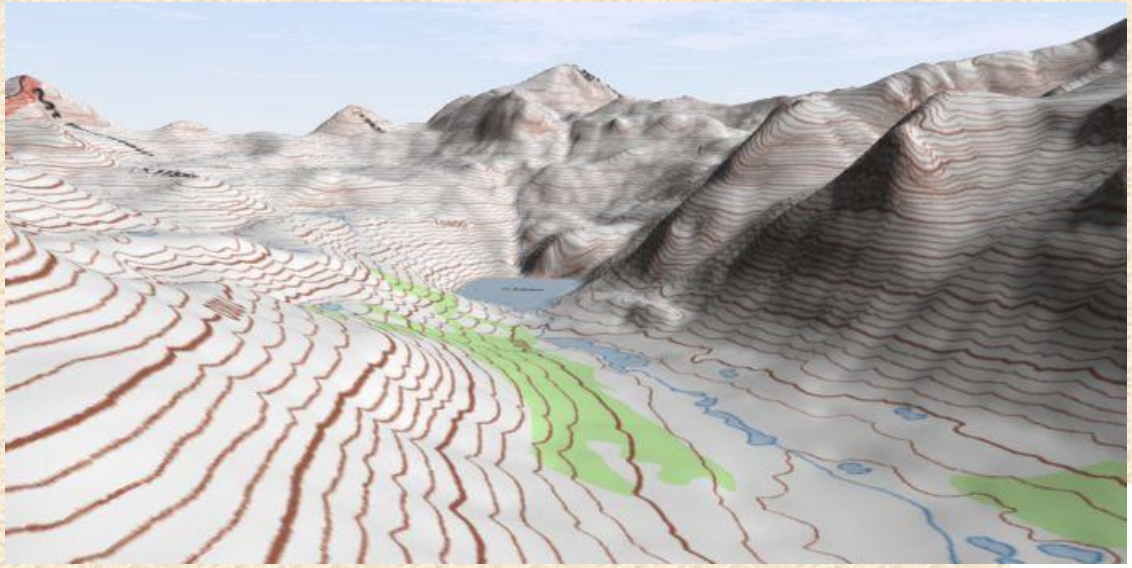
Why?

Visualization



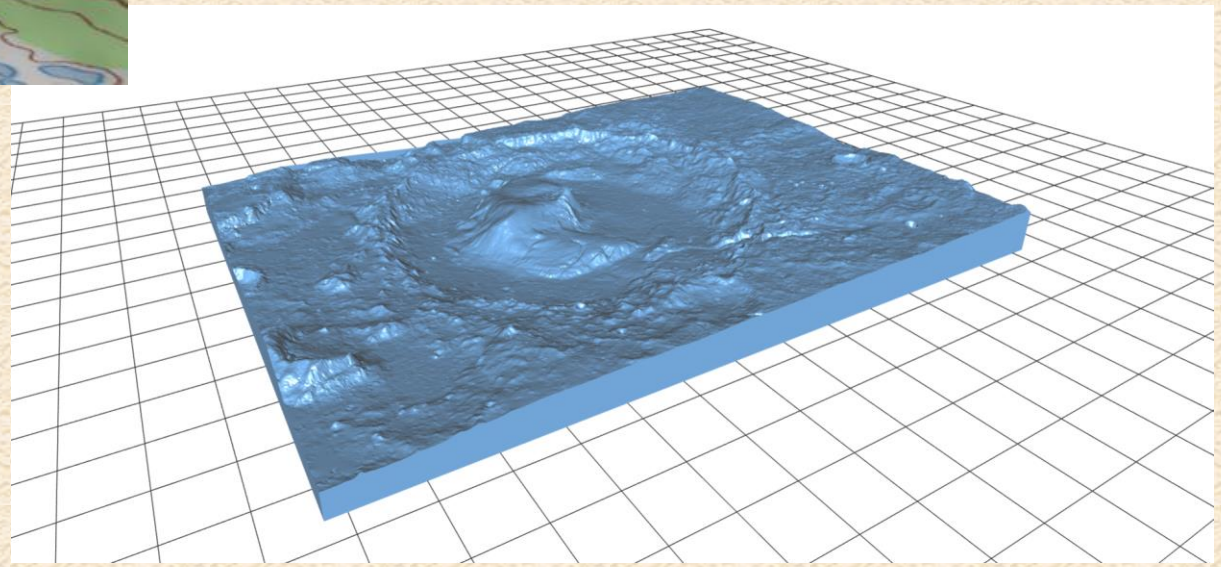
Analysis

What?



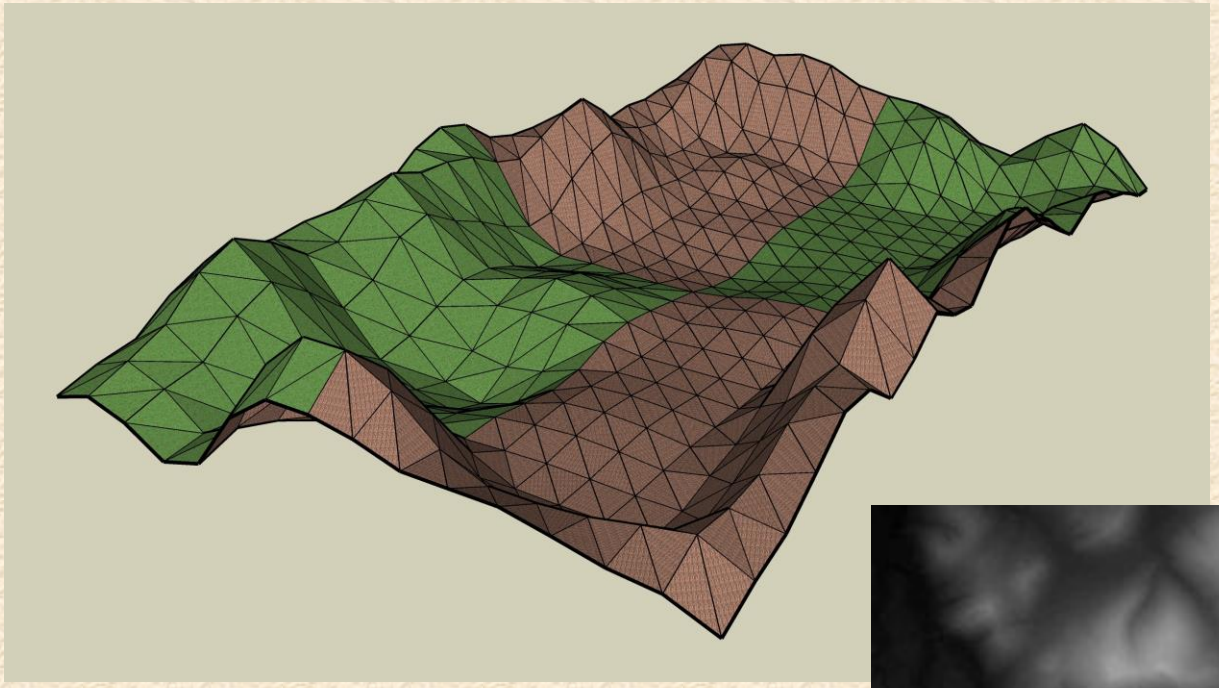
Topo drape on terrain model

Three dimensional representation of a terrain surface – typically the Earth



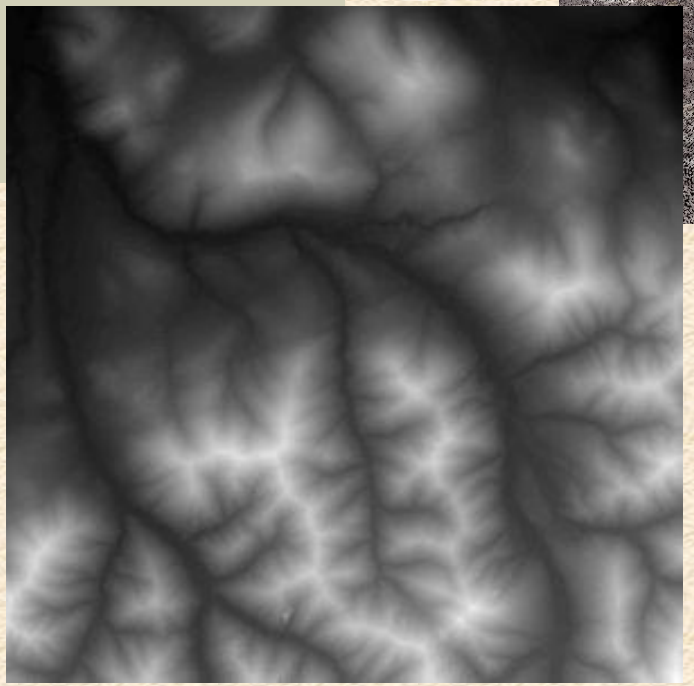
…… and sometimes Mars (source: NASA)

Terrain Model Types



TIN (Triangulated Irregular Network)

Point Cloud



DEM (Digital Elevation Model)

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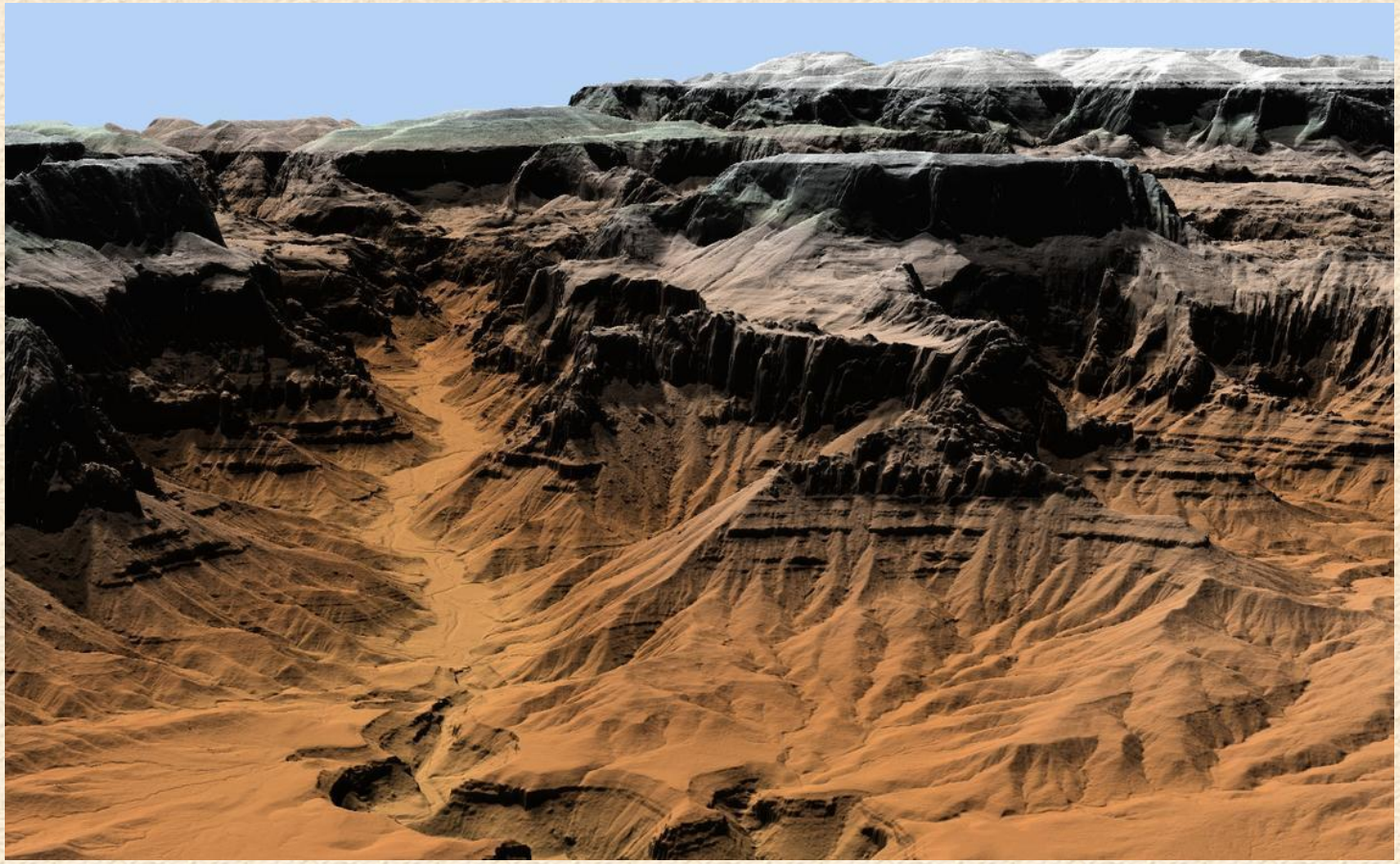
Digital Elevation Model (DEM)

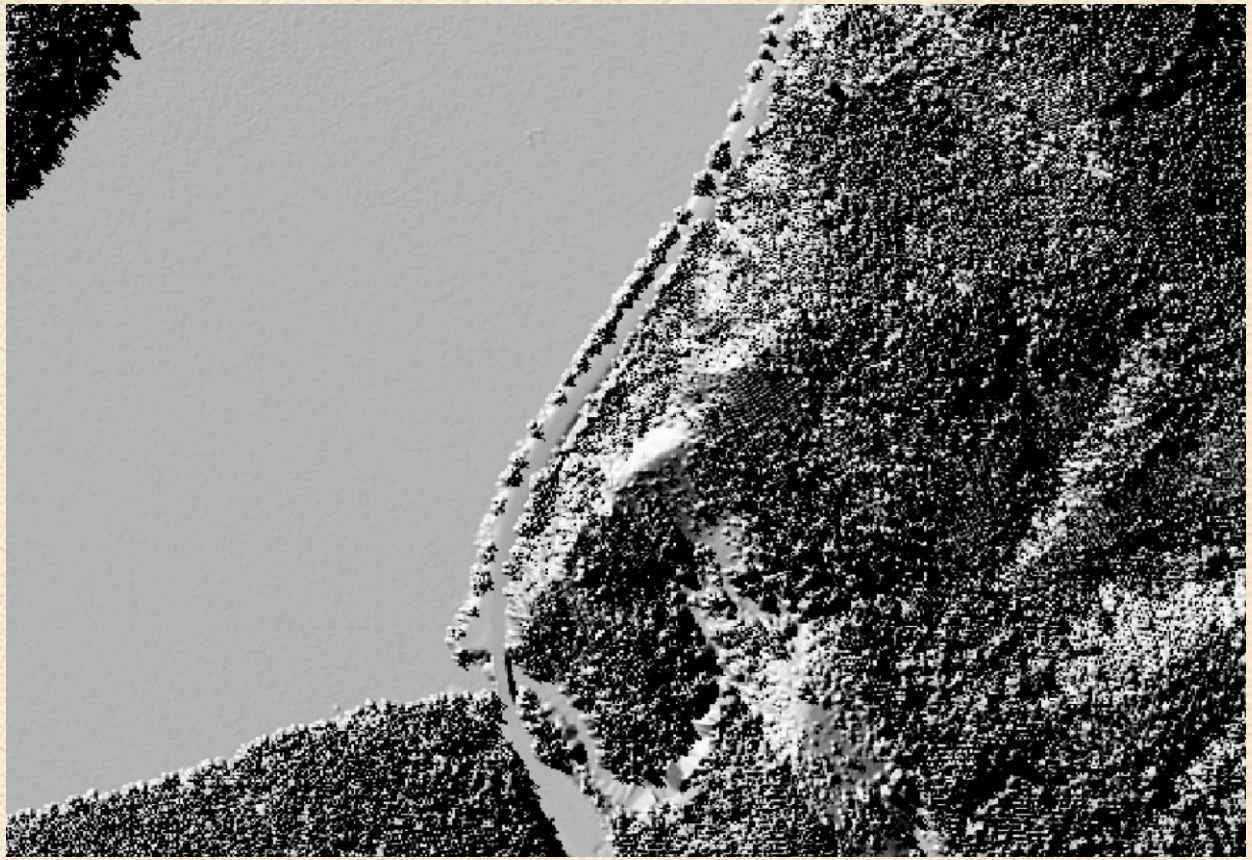
Bare-earth representation of terrain.



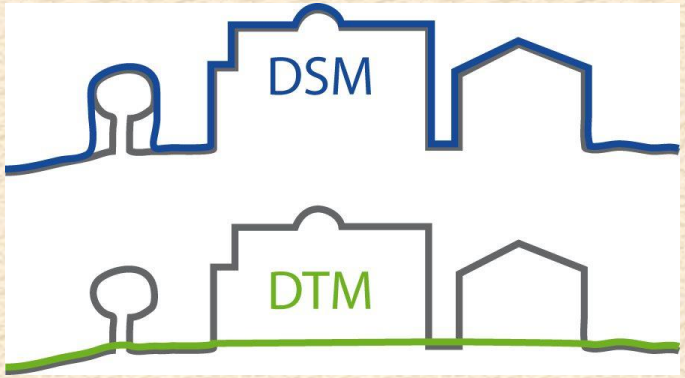
Zion National Park

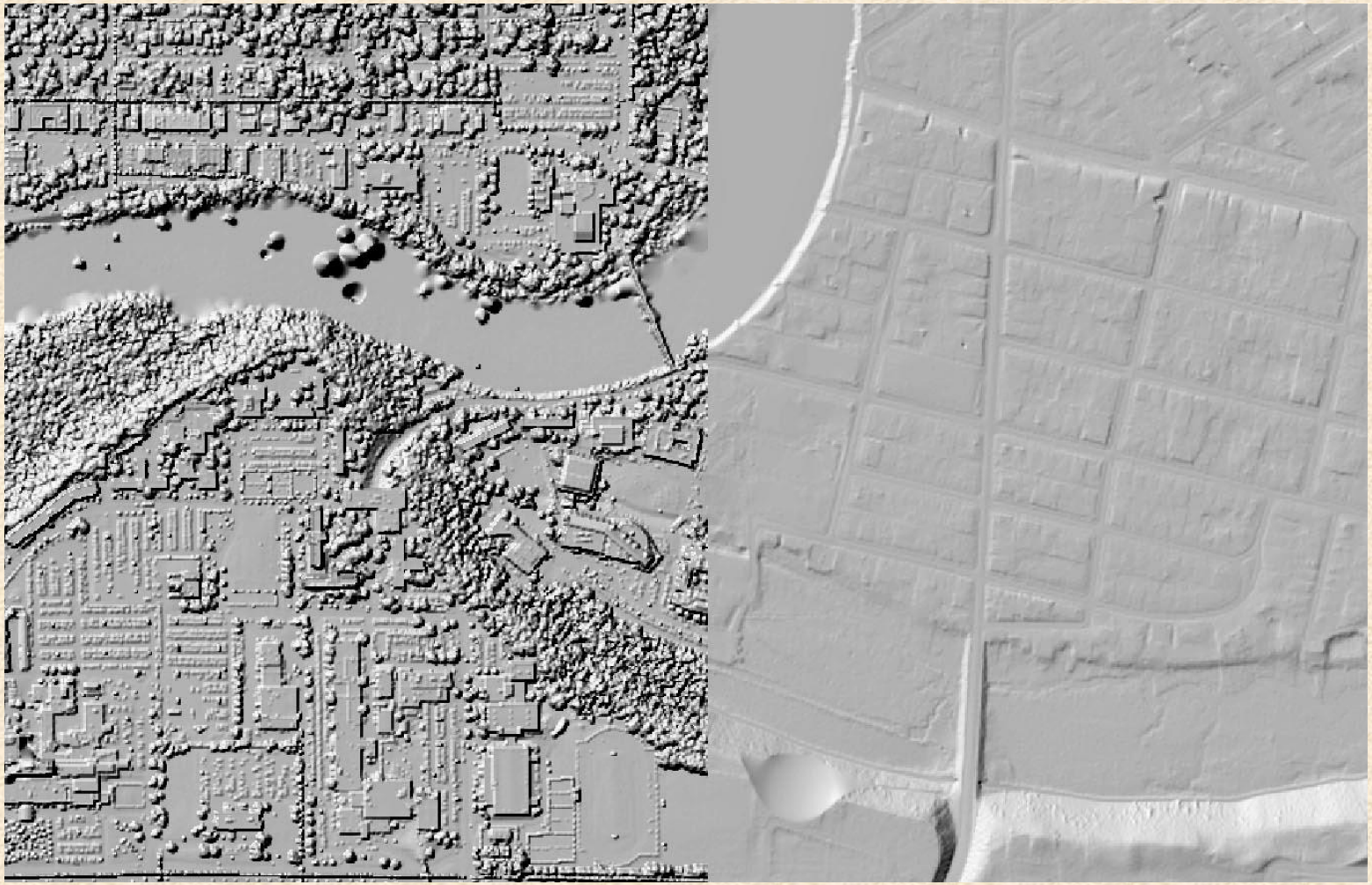
Digital Surface Model (DSM)

3D Representation of a surface



DSM vs. DTM

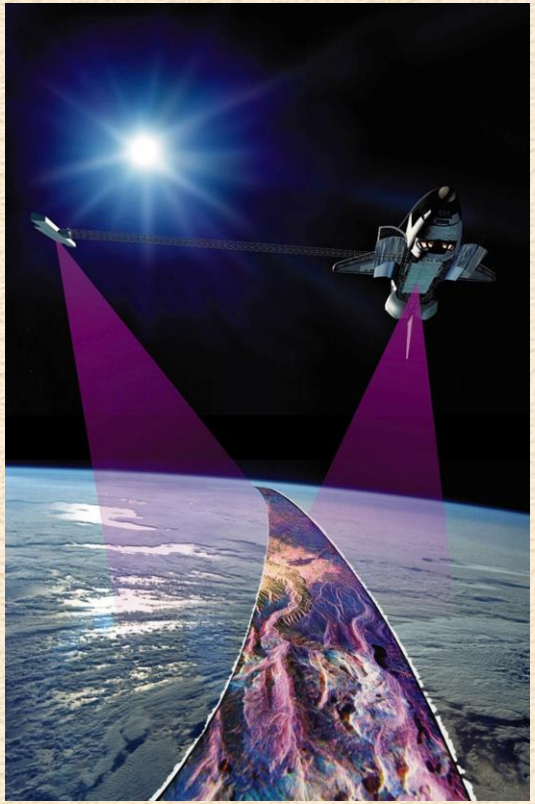




Digital Surface Model

Digital Terrain Model

How?



Remote Sensing

Fixed Wing Aircraft

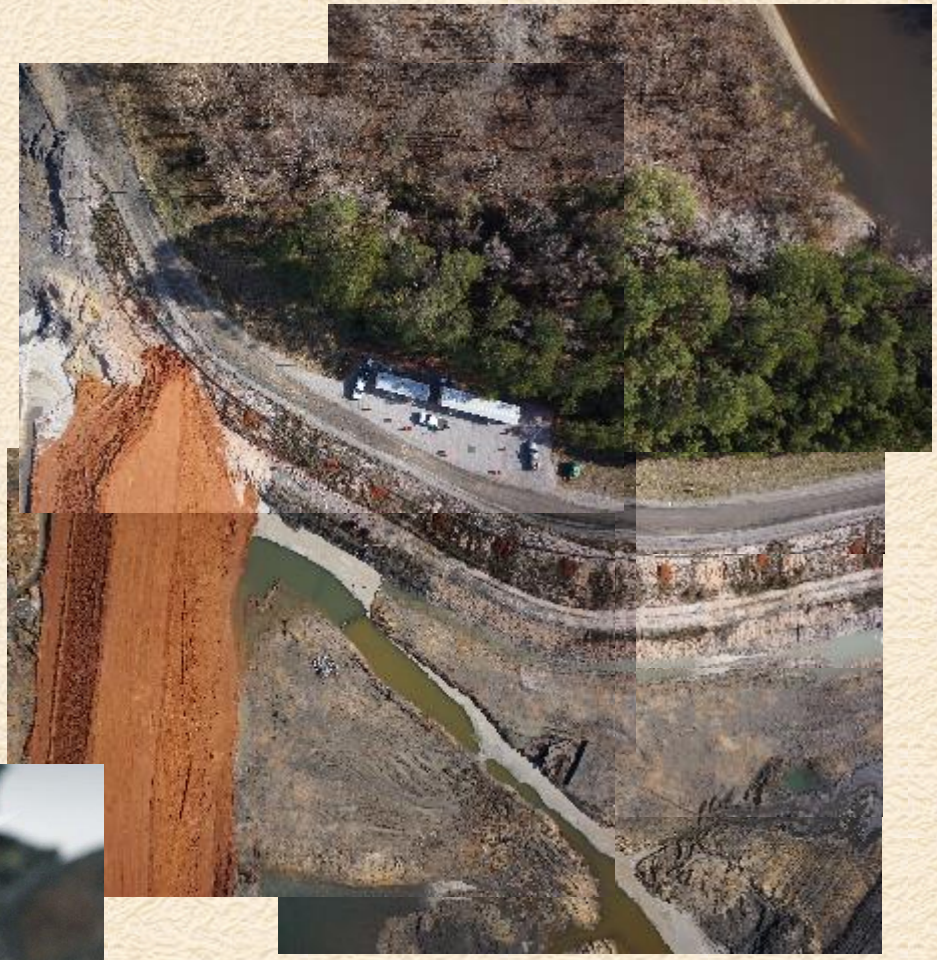
UAV

UAV

Structure from Motion (SfM)

Photogrammetric Range Imaging

- Derive 3D structure from 2D image sequencing
- Used to create point clouds



SfM Example

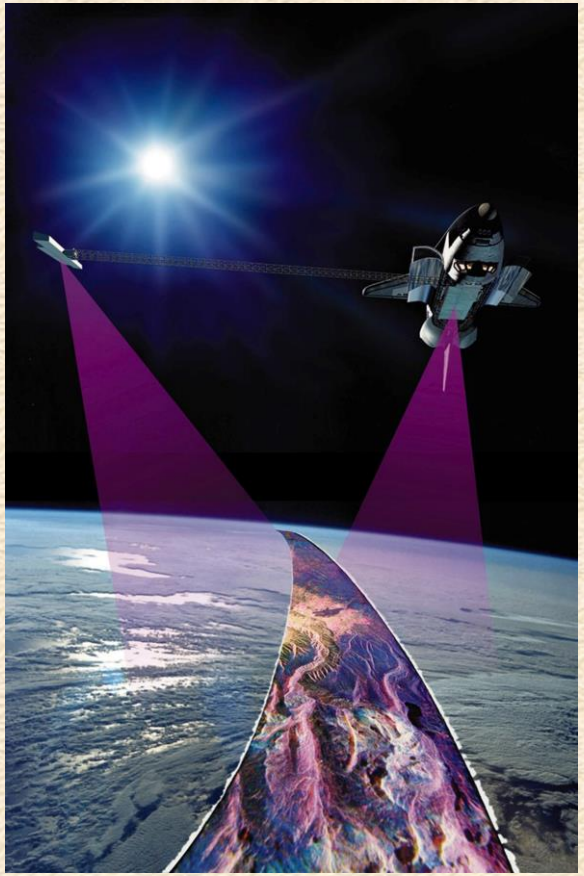
UAV derived point cloud

Remote Sensing

Cloud and vegetation / ground penetrating

- Lower resolution data, though collected frequently
- Great for smaller scale, landscape visuals & analysis

Landsat drape of SRTM terrain model

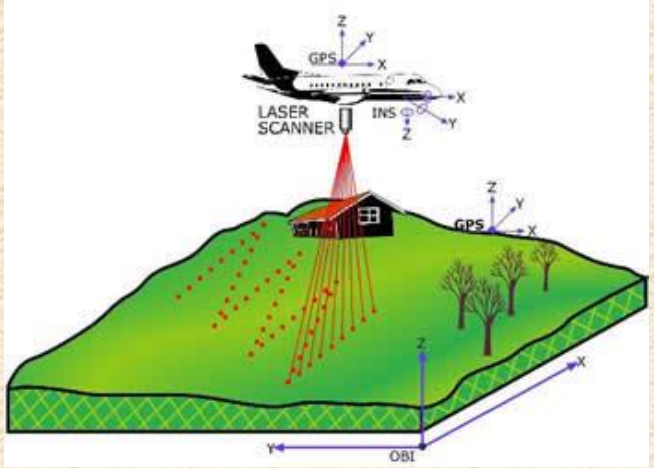


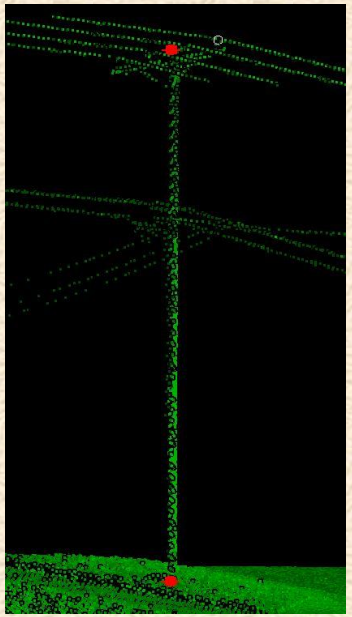
NASA SRTM
(Shuttle Radar Topography Mission)

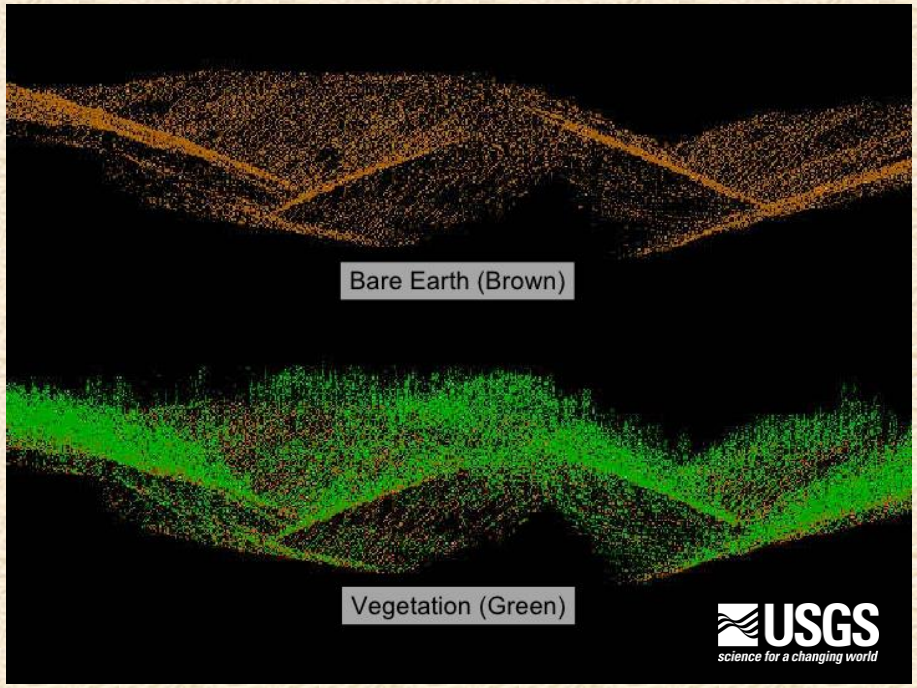
LiDAR

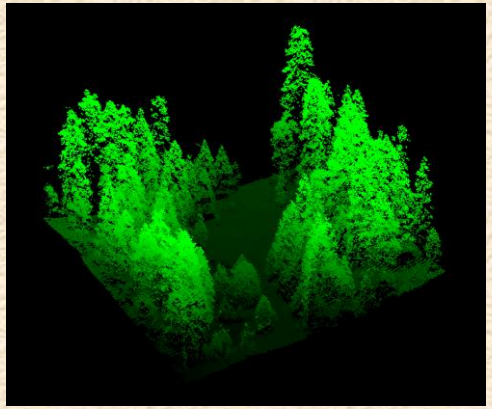
Light Detection and Ranging

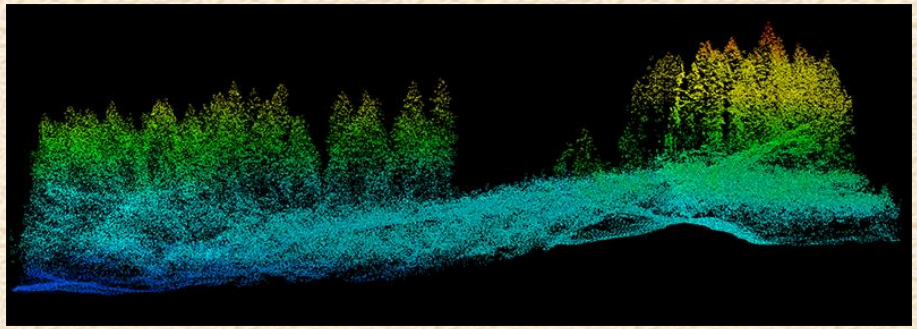
- Differences in reflected laser returns
- Classification of elevation points



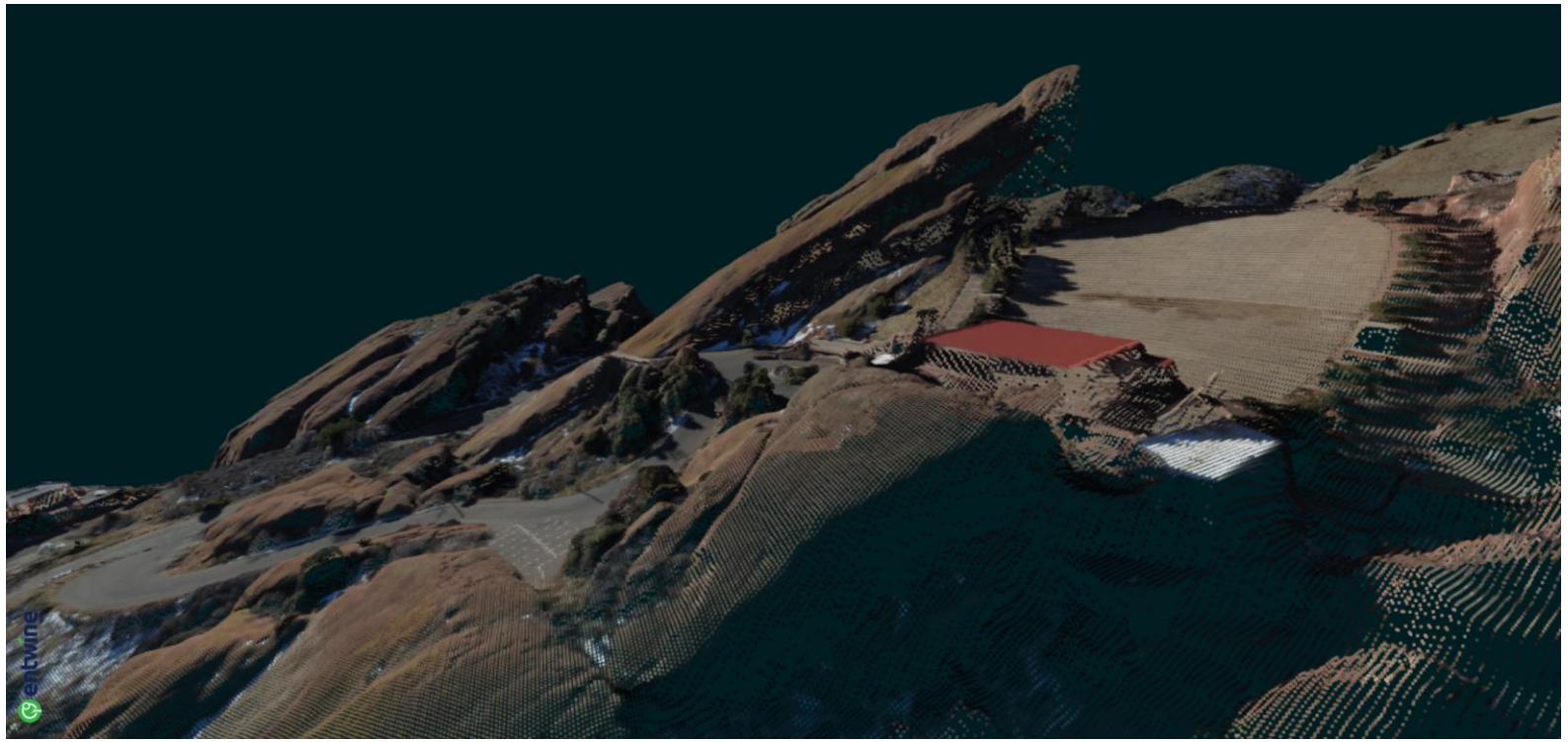








LiDAR Example



Red Rocks Amphitheater

Solutions: UAV - SfM

- $1000 - $3500
- FAA remote pilot license required
- Software $ Affordable
- Good for aerial photography & video too

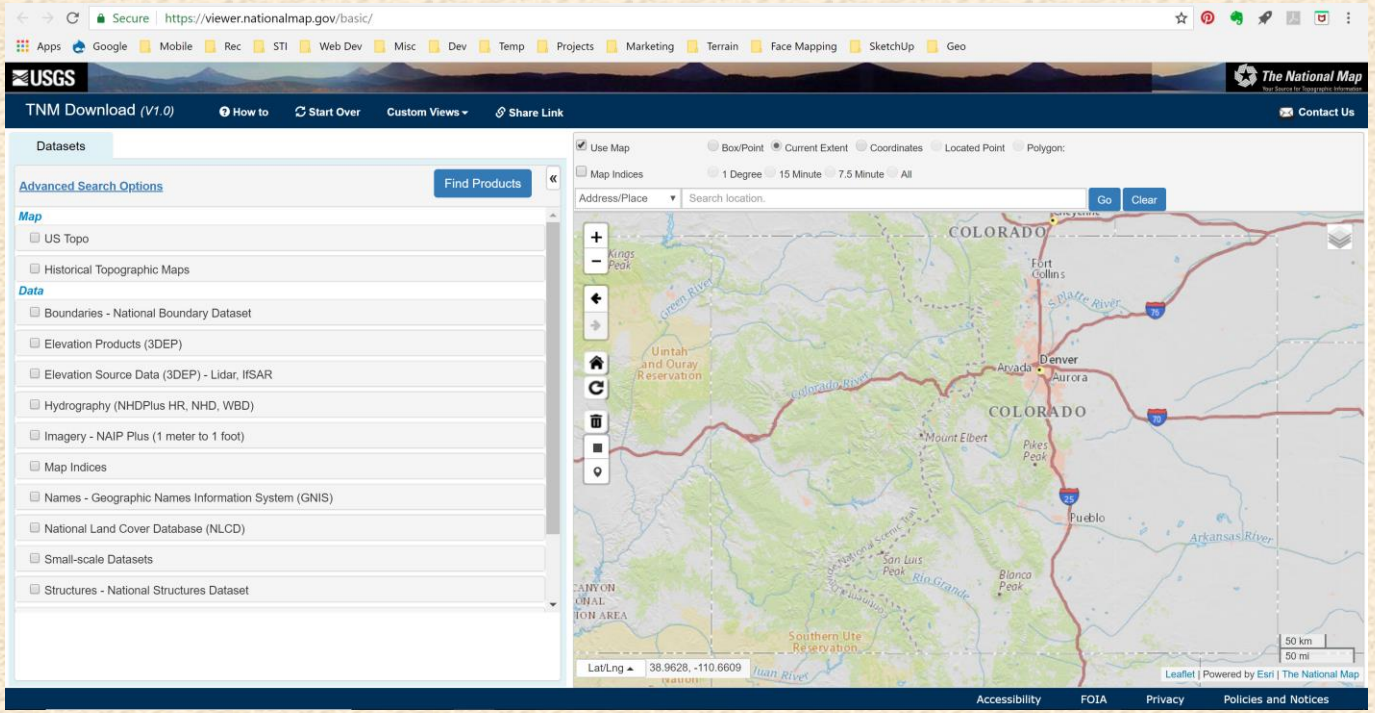
Solutions: UAV - LiDAR

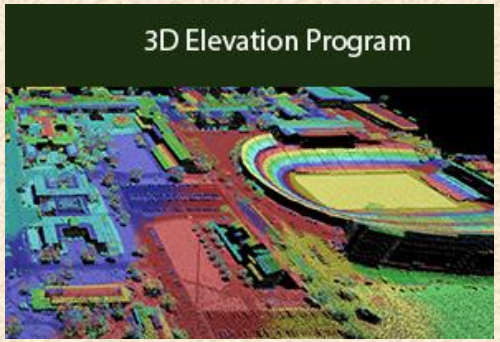
- $100K to $350K
- Full FAA pilot license required
- Air Traffic Control (ATC) communications
- Software $$$
- Best bet = contract out

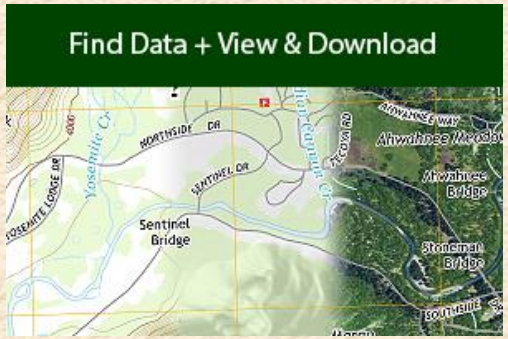
Credit: Skyline UAV, NSW

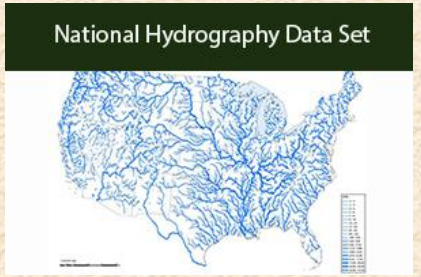
Best Open Data Source

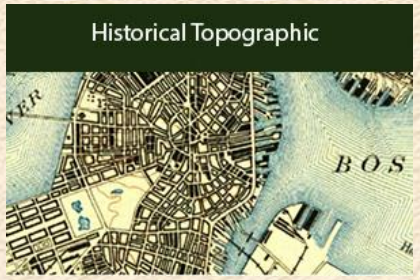
The National Map
Your Source for Topographic Information











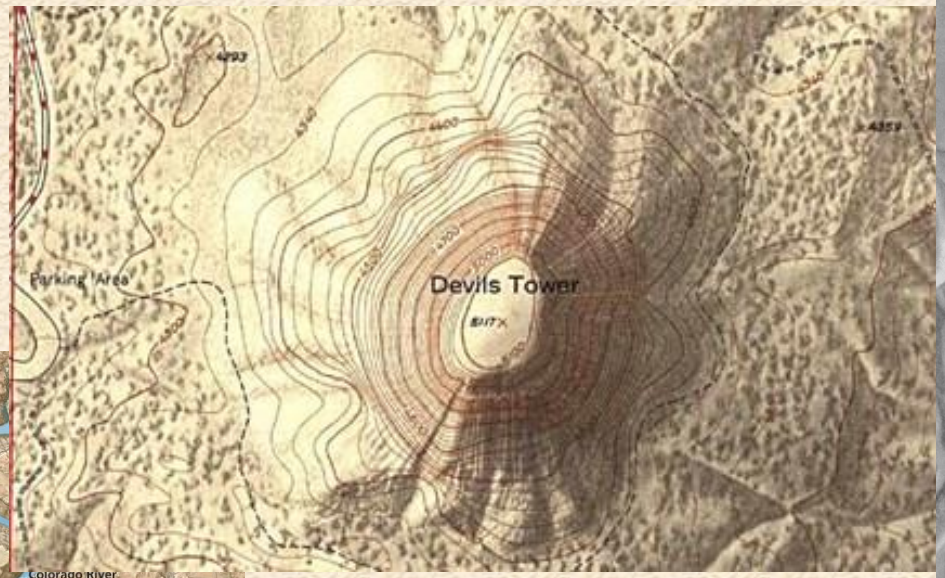
STI OUTDOORS

Why?

Conceptual design visualizations

Credit: Our partners at DHM Design

Shaded relief for visualization



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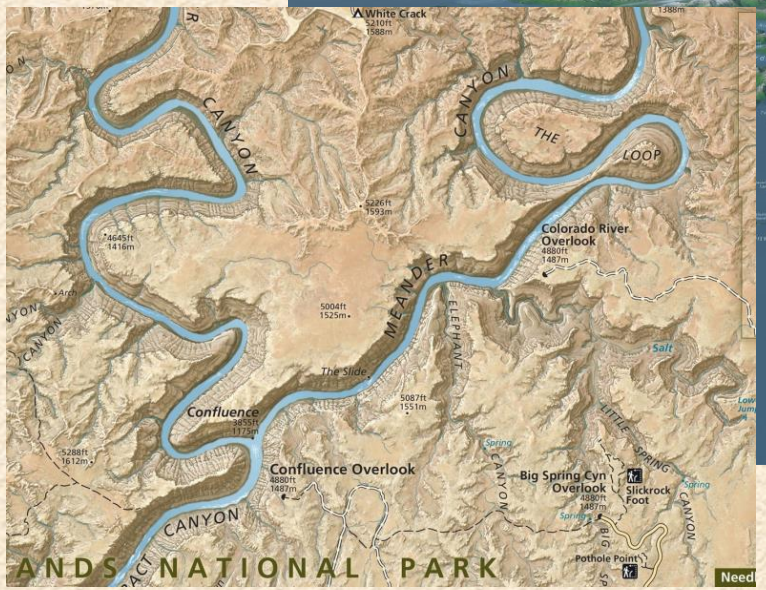
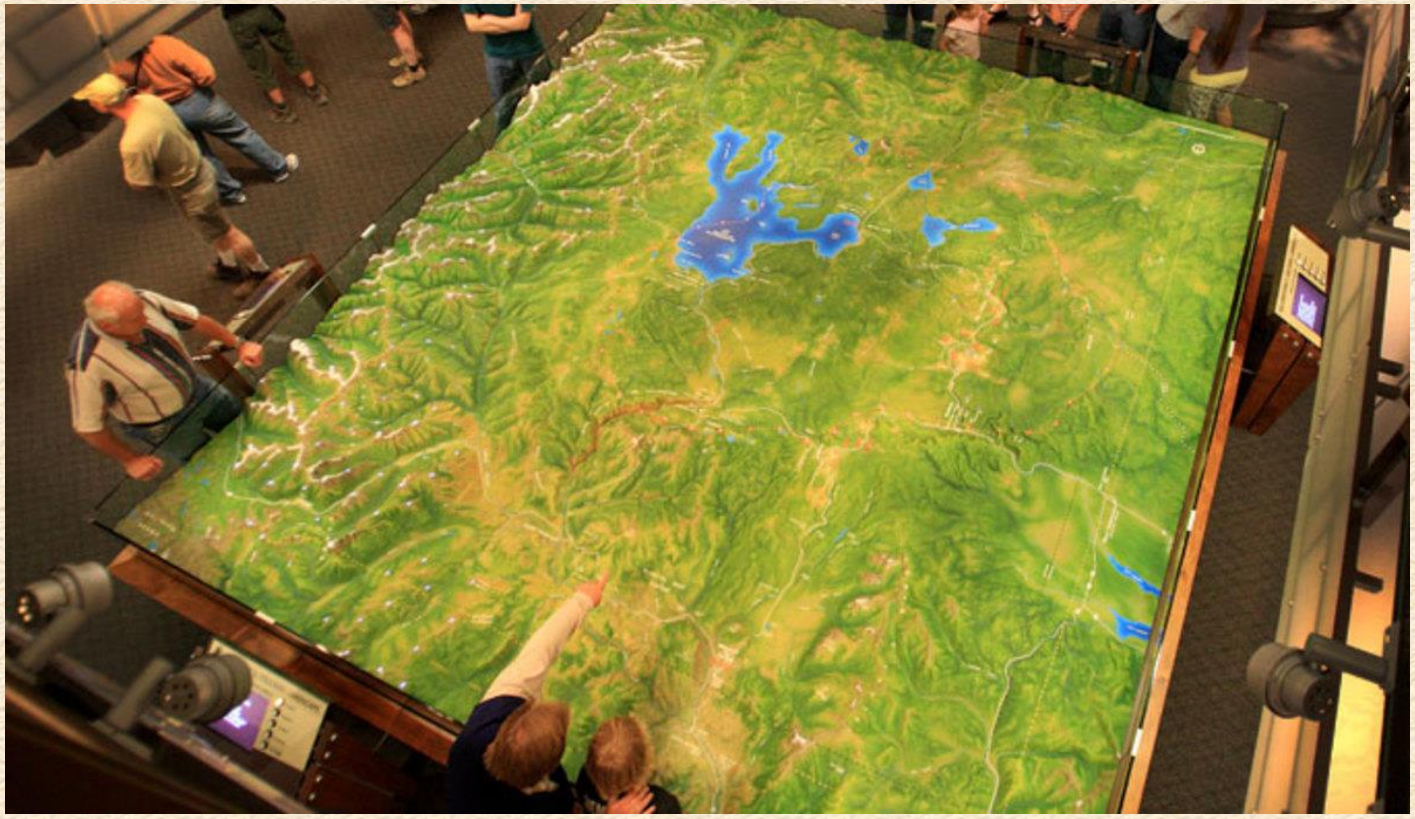
Education – maps & kiosks

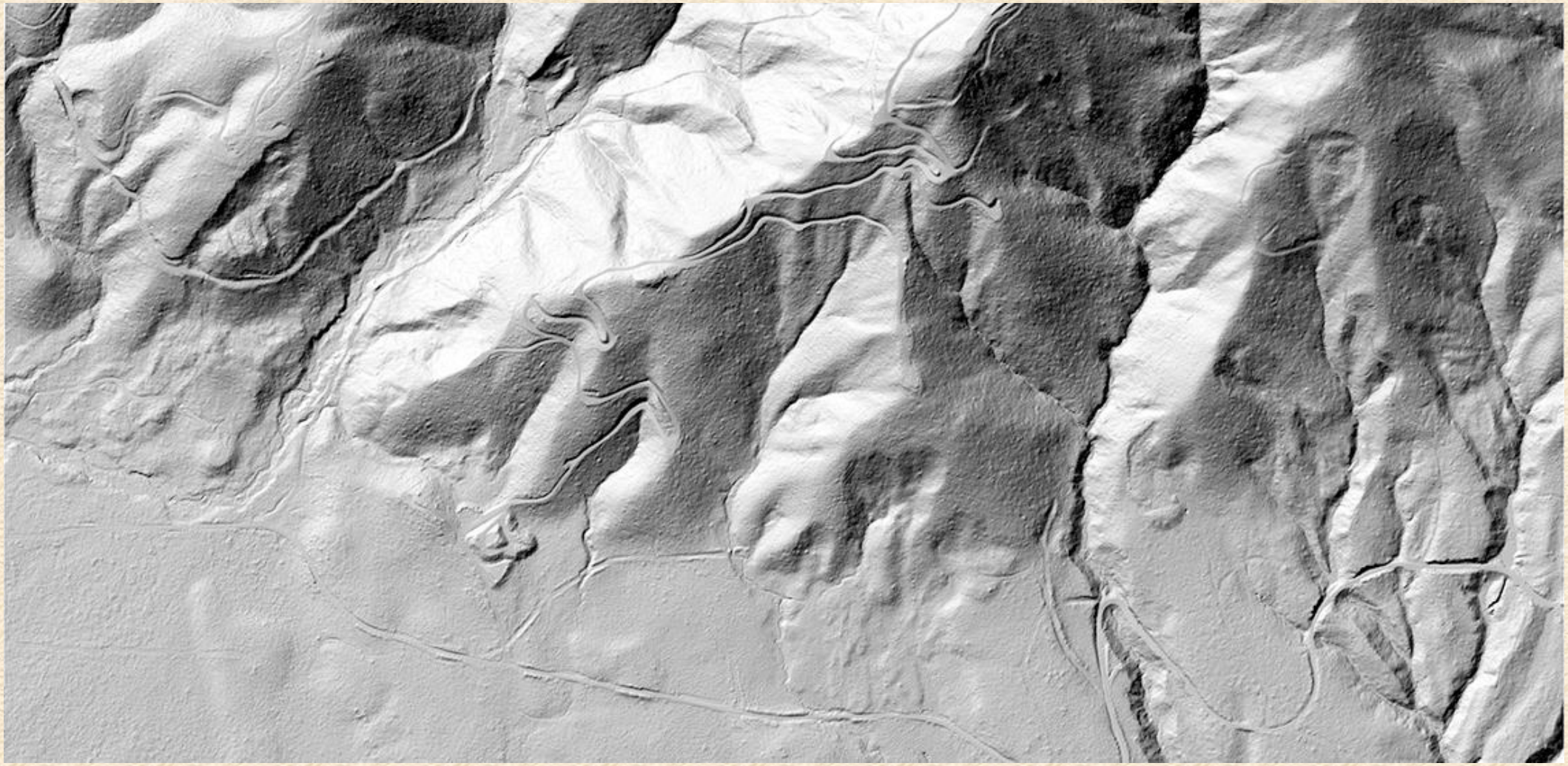


Credit: Tom Patterson – National Park Service

Education – solid terrain models (3D printing)

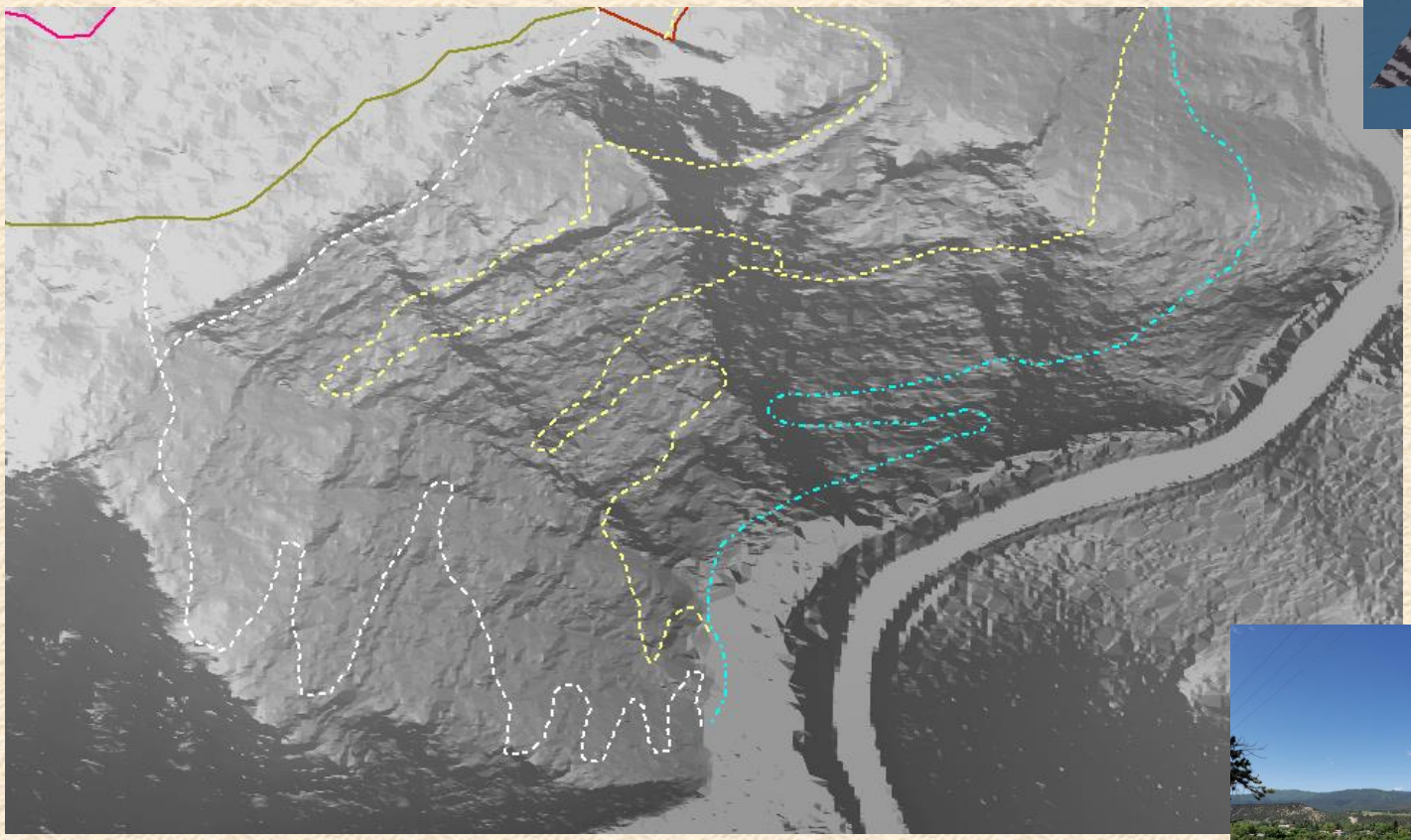


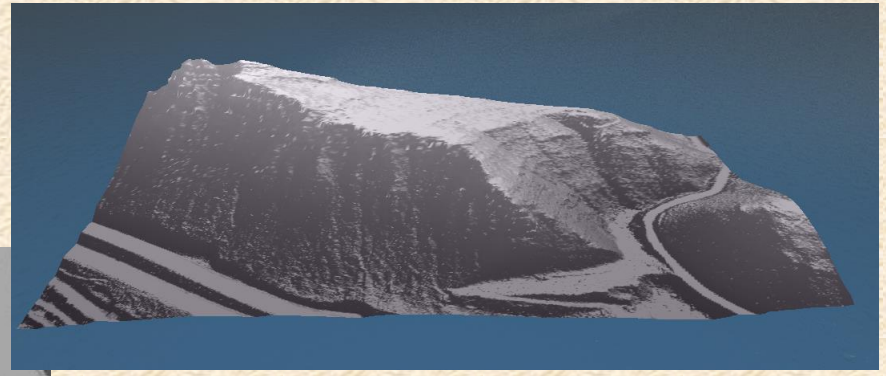
Inventory mapping for areas of dense foliage



LiDAR derived terrain - this area actually covered in dense forest – Example c/o USGS & State of Washington

Design Example #1 – slope characterization for recreagtional trail development





Red Hill Project

Town of Carbondale

Aspen Valley Land Trust

Roaring Fork Outdoor Volunteers

Bureau of Land Management

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Design & Planning Example #2 – grade characterization

Trails Utah -
Great Western Trail

Topo created in
Global Mapper using 1/9
Arc Second DEM

Conceptual trail created
in QGIS

GPS field data

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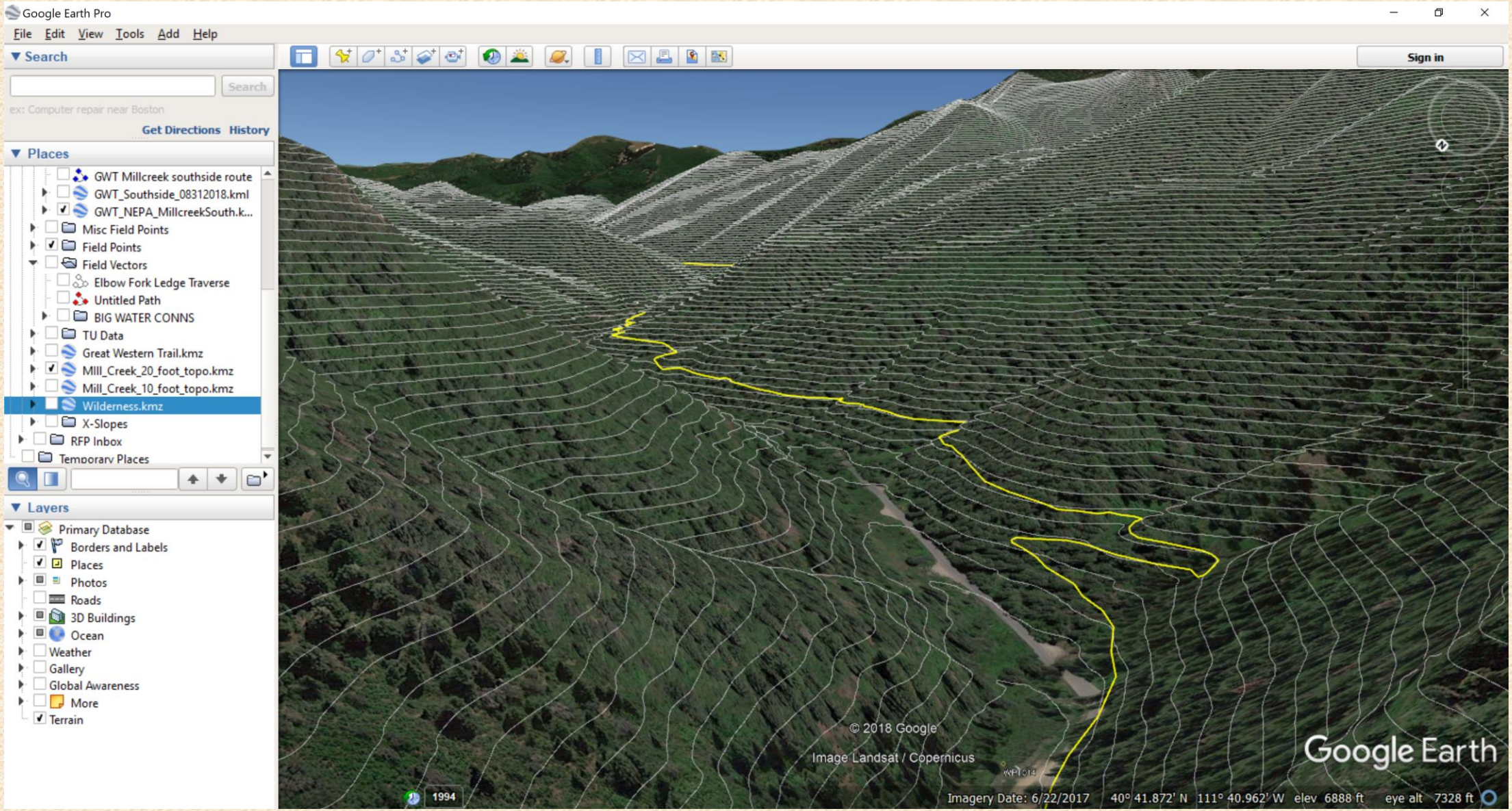

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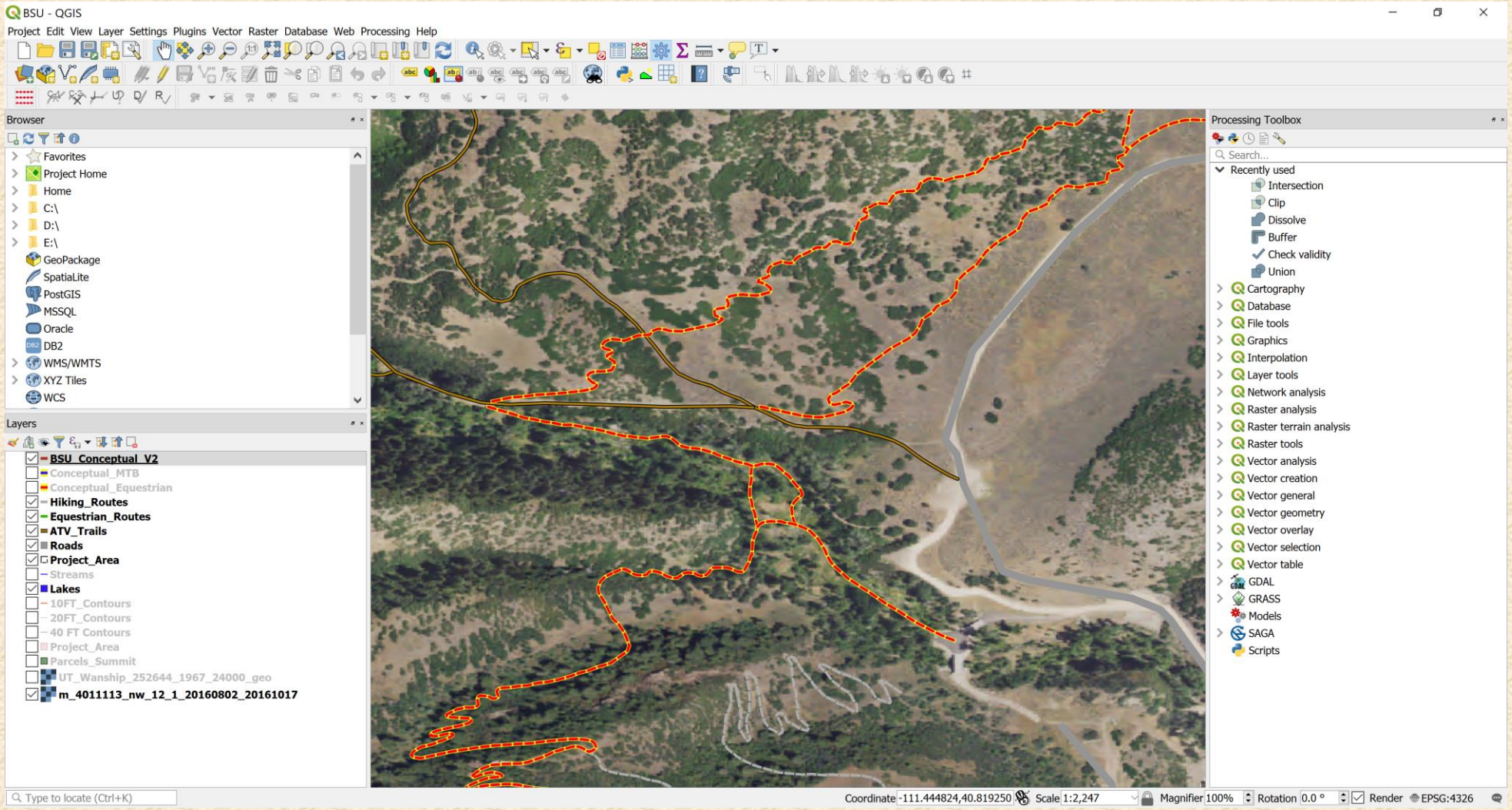
Design & Planning Example #3 – line of sight analysis for facility construction



Base trails data and lodge construction site within QGIS

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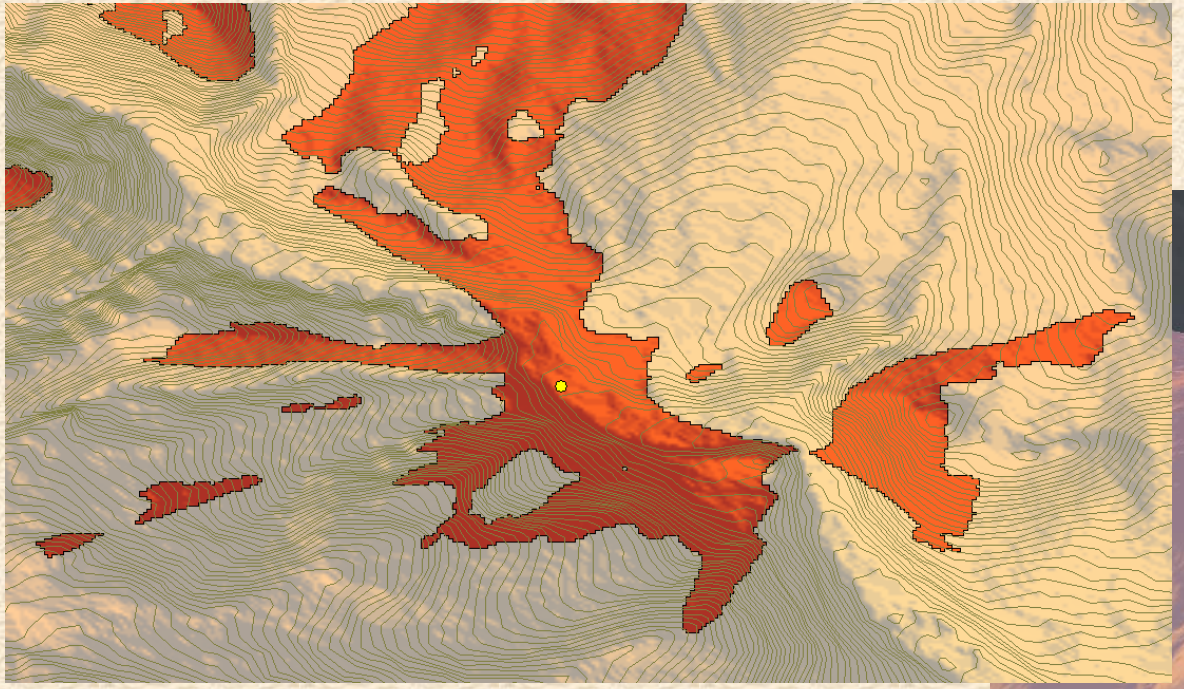
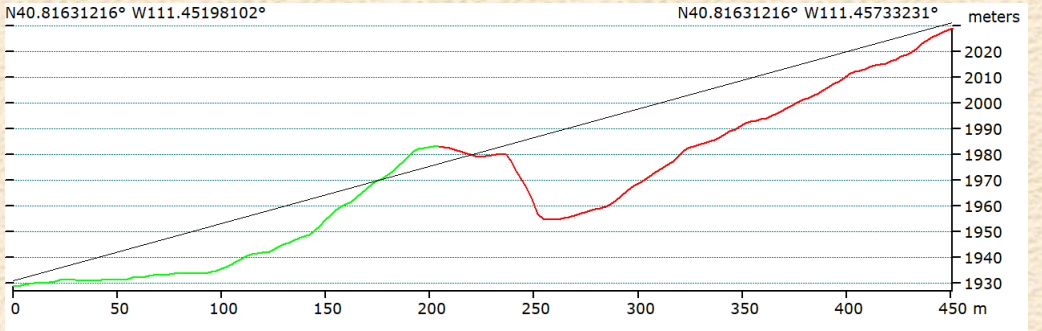
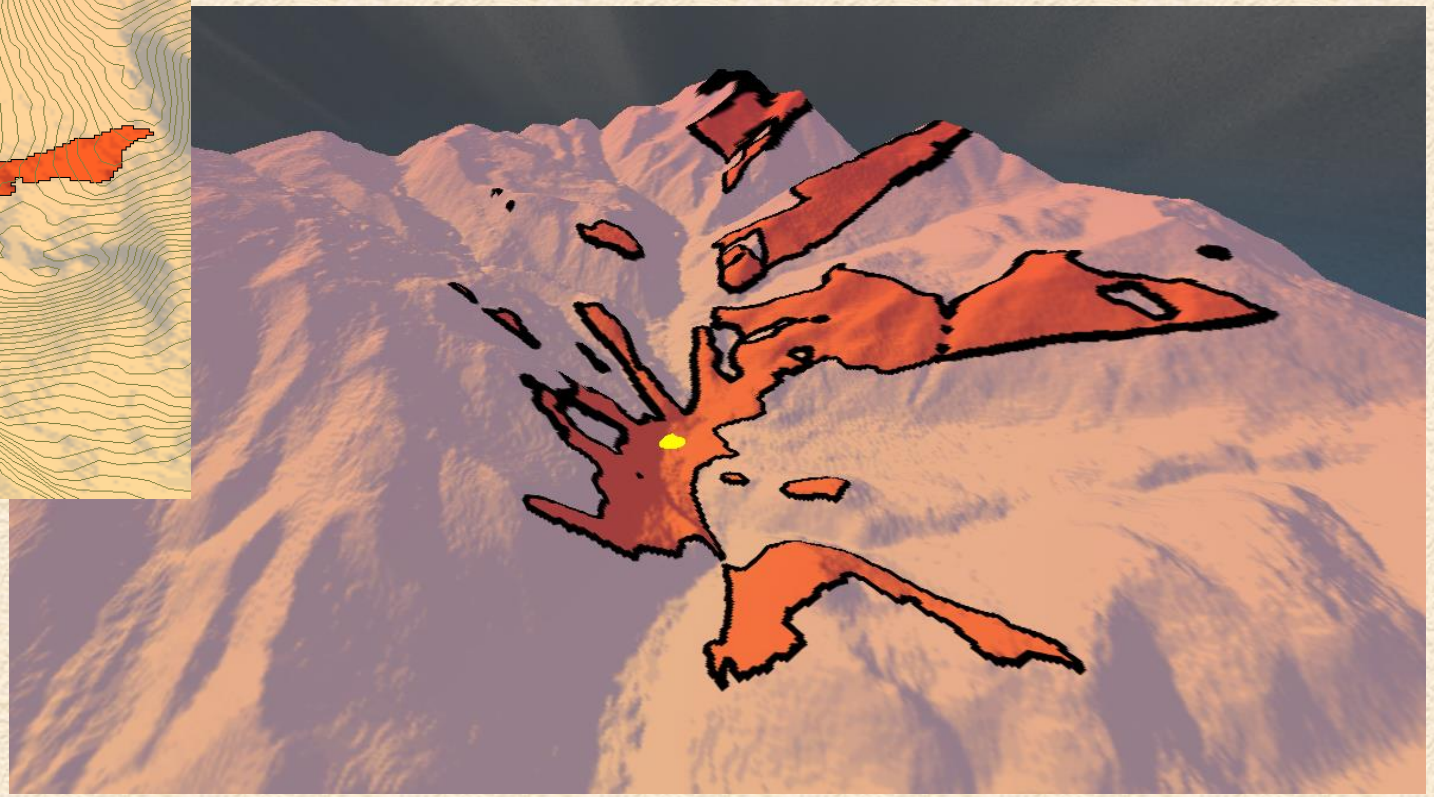
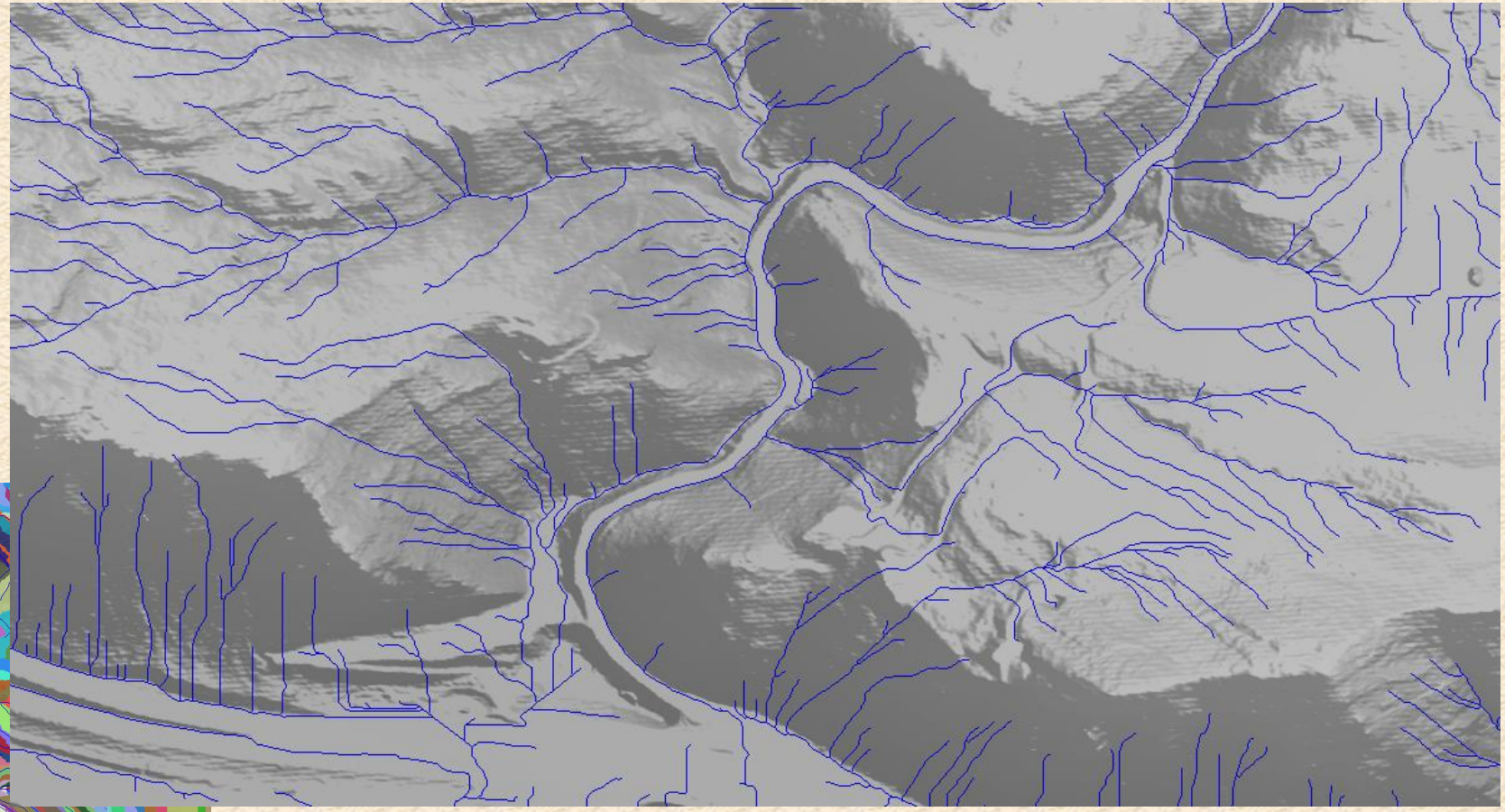






View-shed / line-of-sight analysis

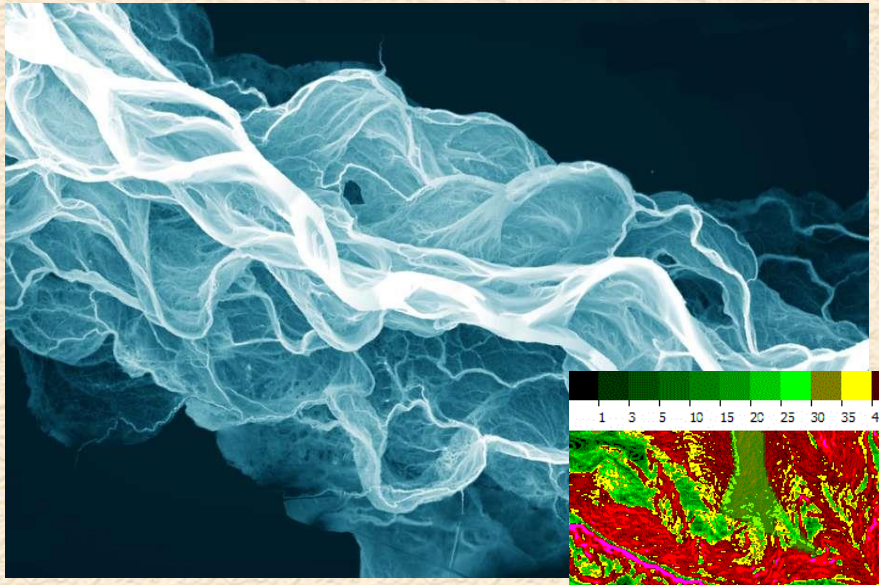
Hydrology



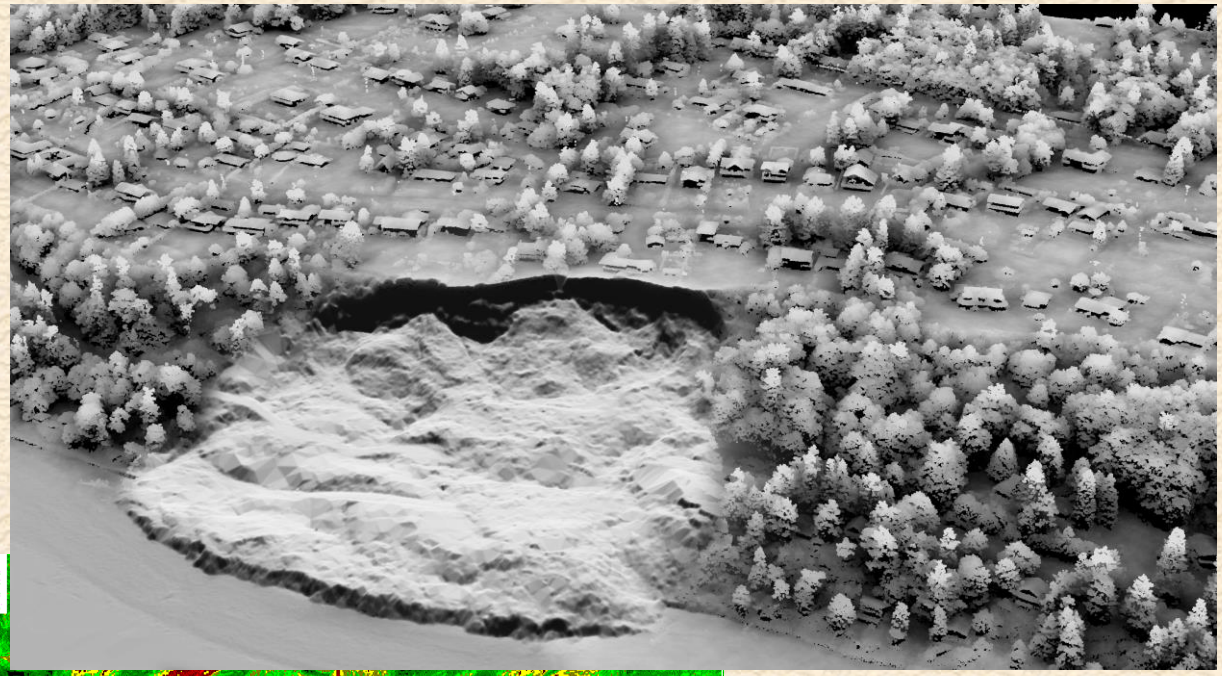
Sub basin drainage network analysis

Basin analysis

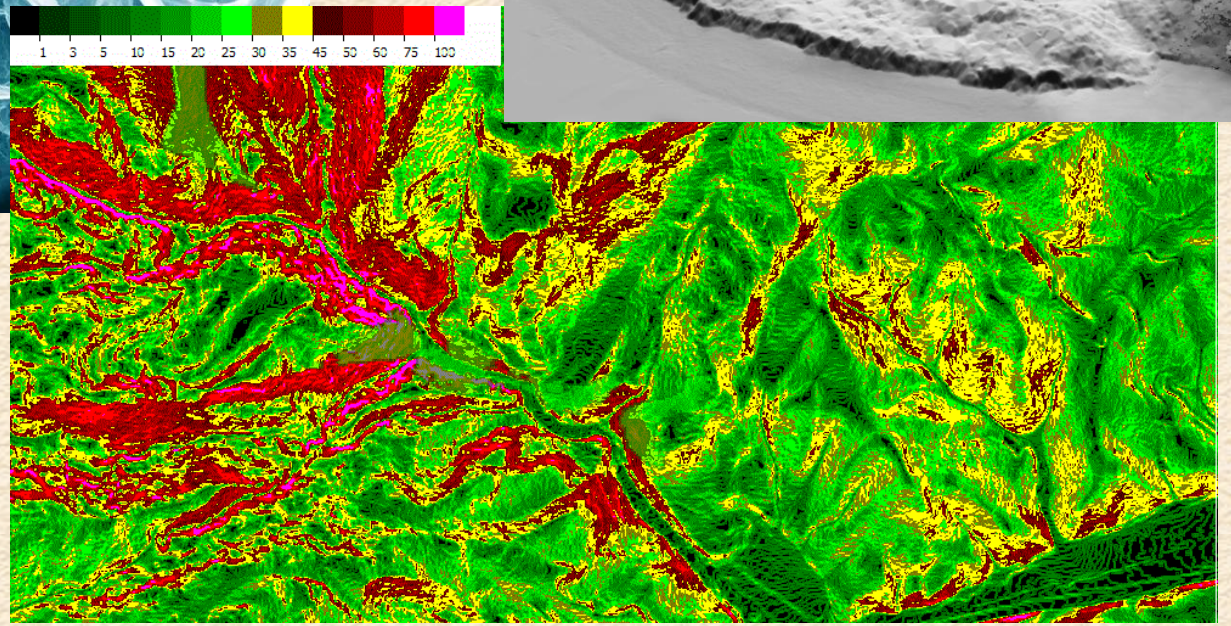
Risk Management



Floodplain Mapping

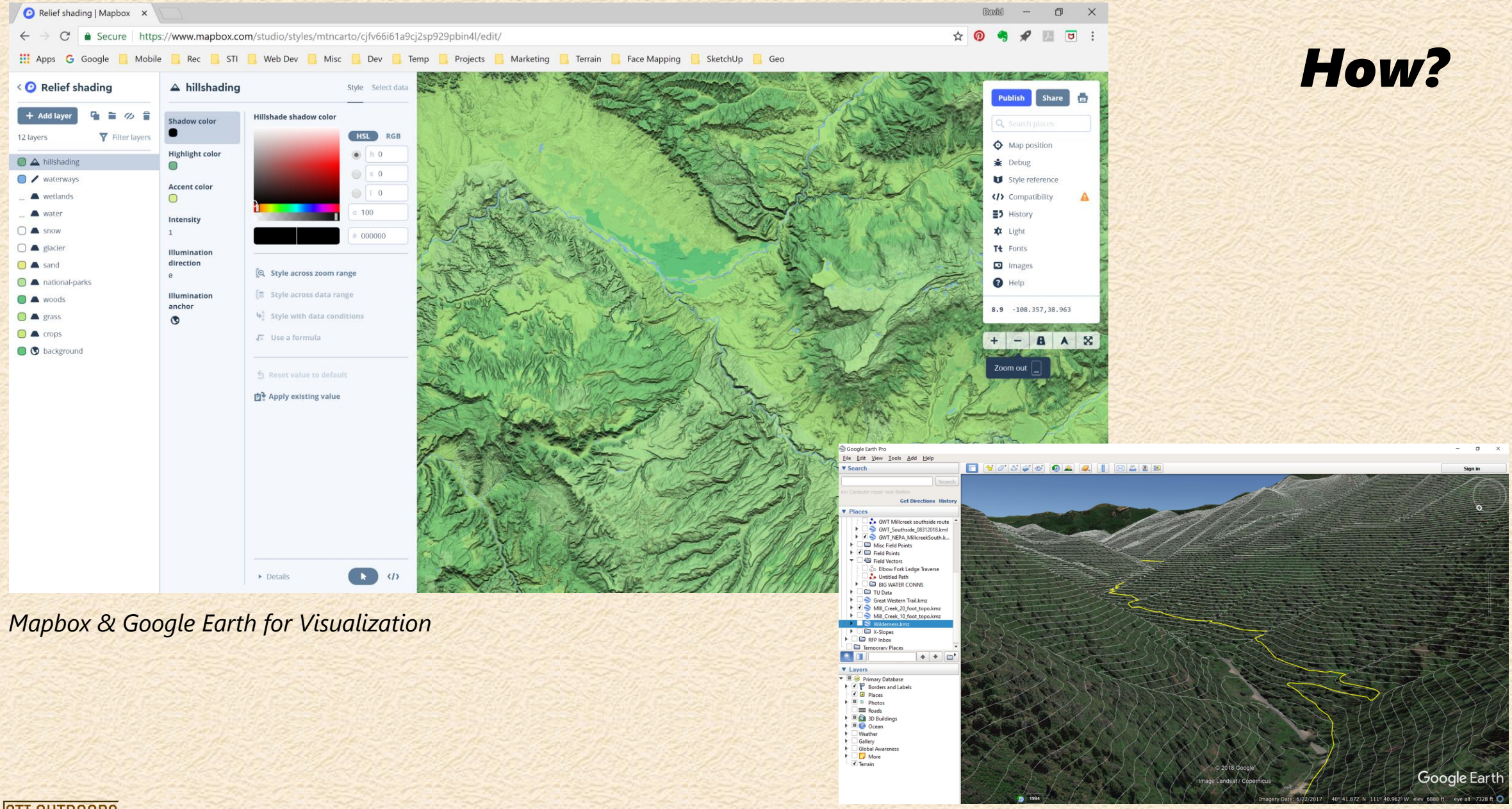


Landslides



Slope analysis for rockfall areas

How?



Mapbox & Google Earth for Visualization

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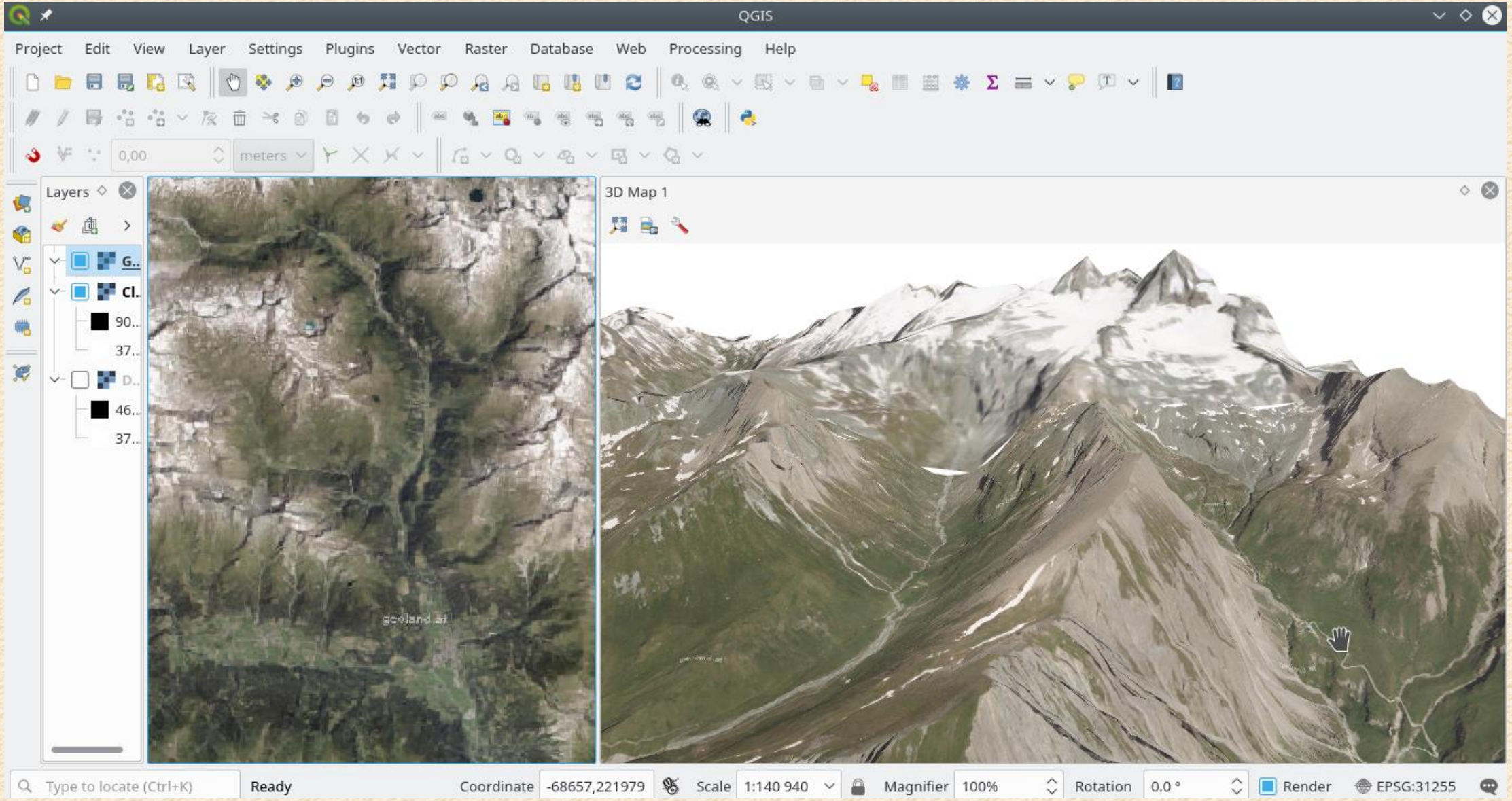
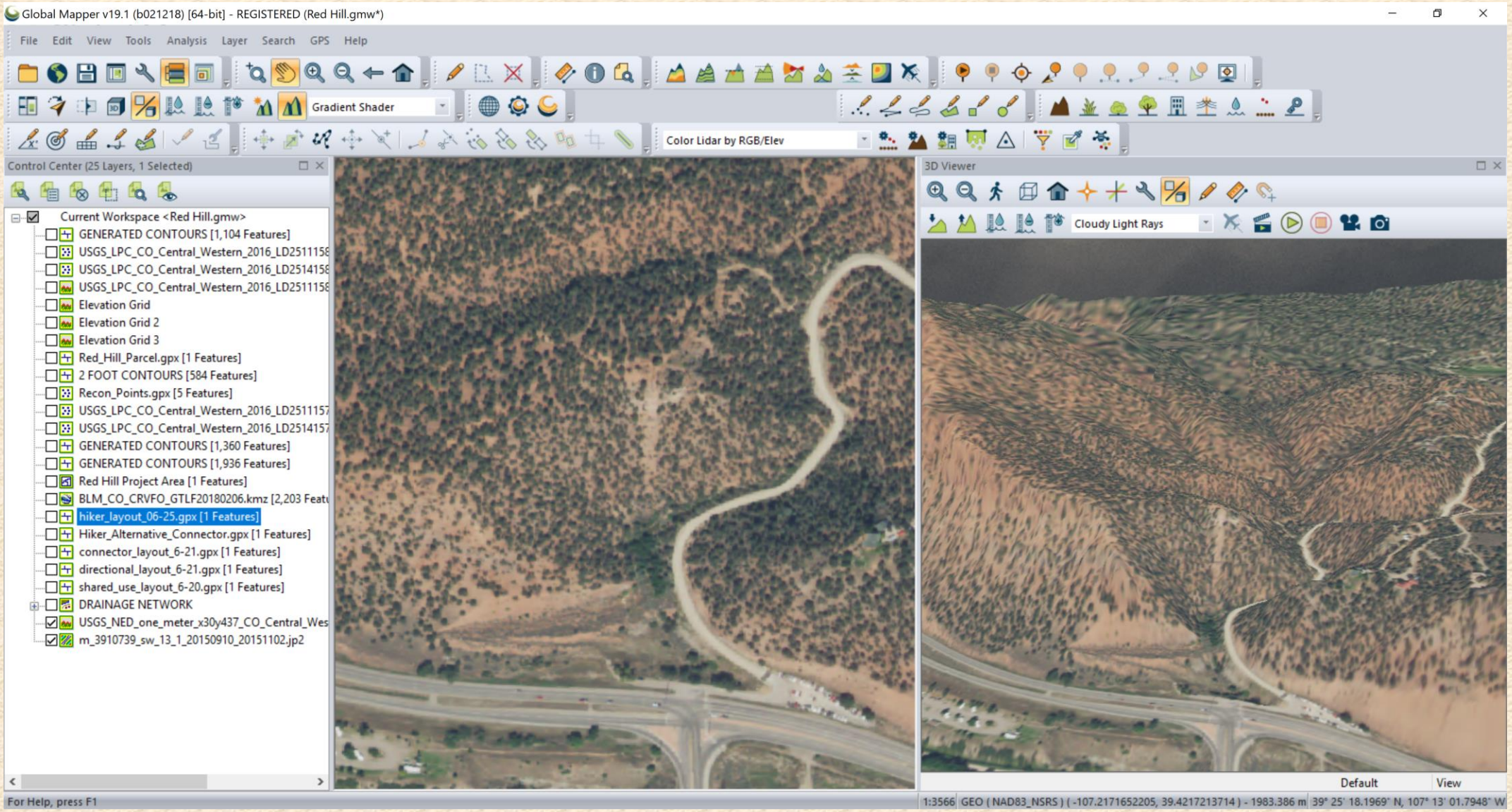
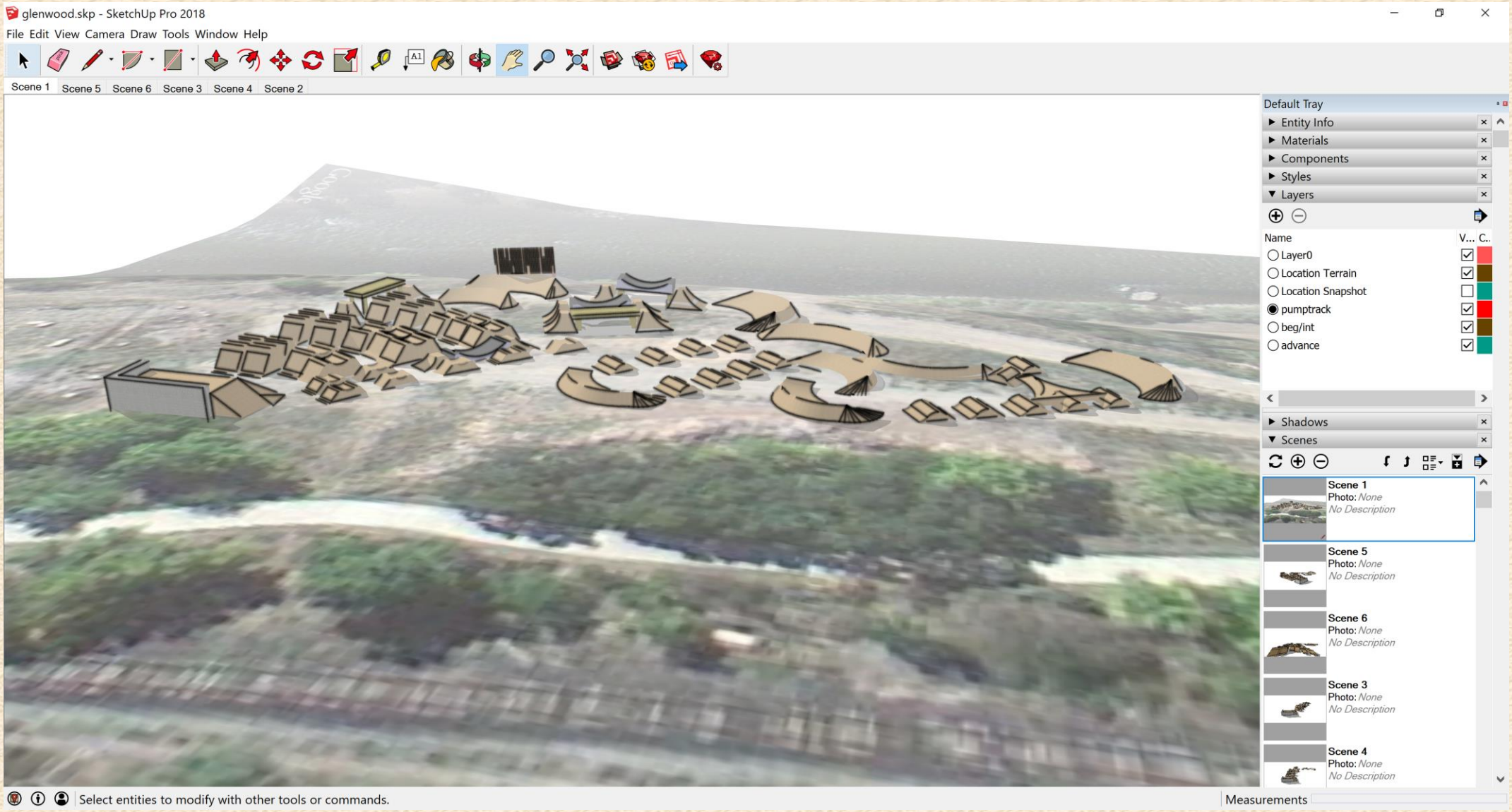


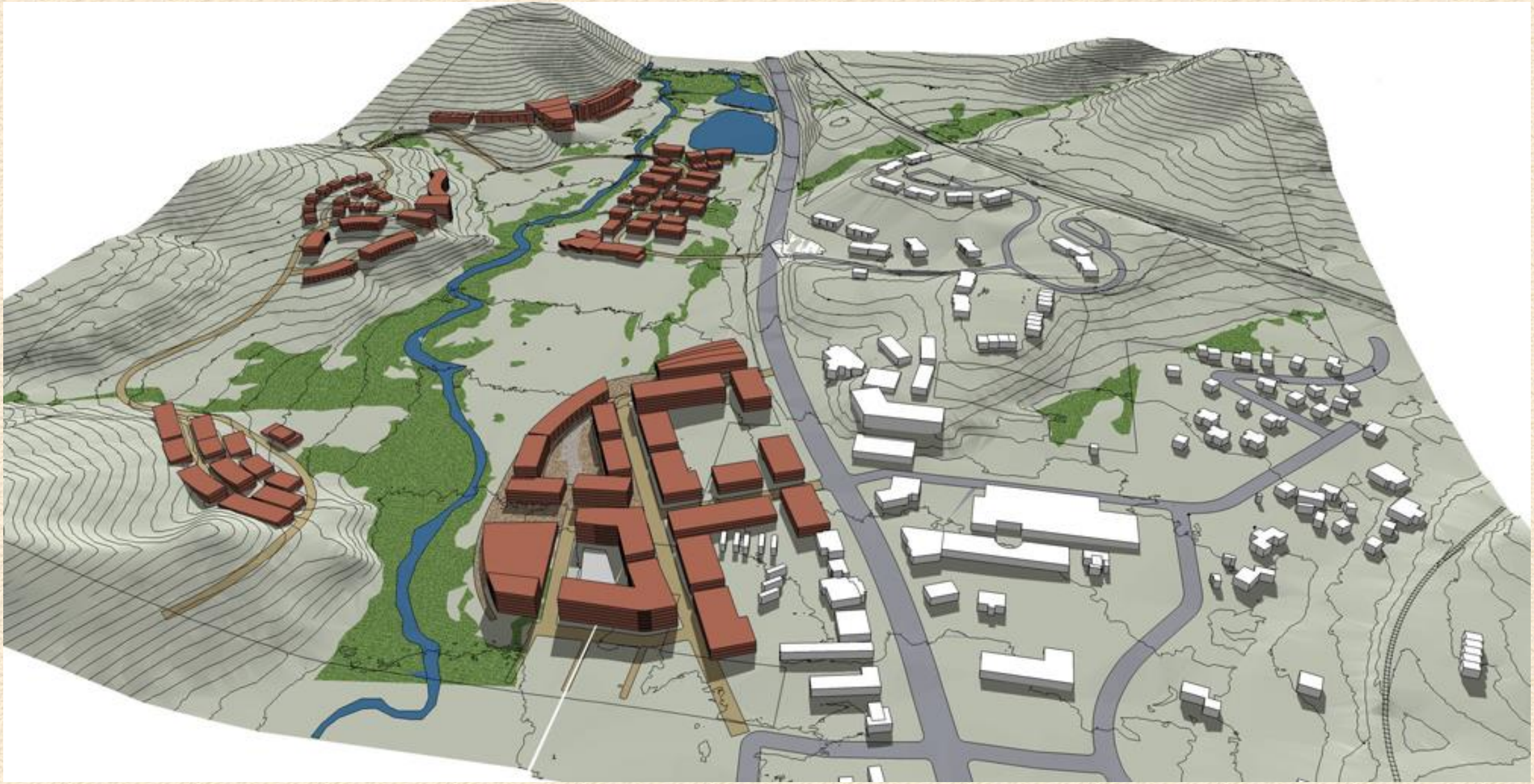
QGIS for spatial analysis and terrain visualization



Global Mapper



SketchUp Pro for bike park or pocket park design



SketchUp for park integration with dispersed development design. Credit: Daniel Tal, DHM Design

Questions?

Contact: david.barnett@singletracktrails.com
Websites: www.singletracktrails.com & www.sti-outdoors.com