

LiDAR and Its Application to Rangeland Management

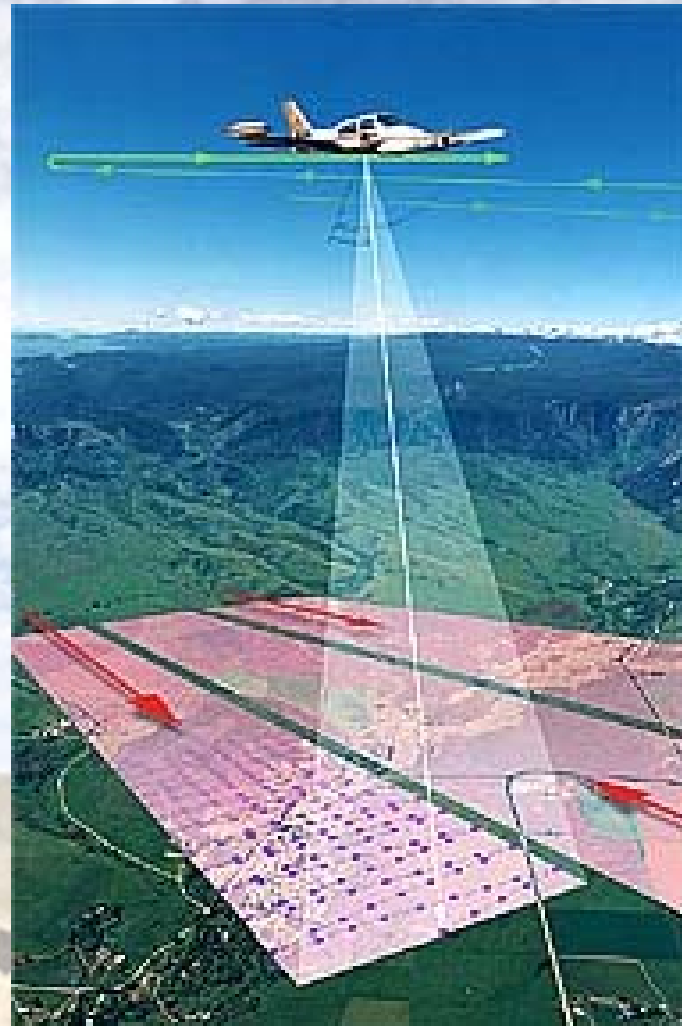
**August 11, 2003
Rangeland Remote Sensing Workshop
Idaho State University**

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ISU – Boise Center**



What is LiDAR?

- **L**ight **D**etection **A**nd **R**anging
- Scanning instrument mounted on airplane or satellite
- GPS used to determine instrument position and orientation



How Does LiDAR Work?

Determines distance using a pulse of
(laser) light

distance = speed of sound \times time

$d \approx 300$ meters $\rightarrow t \approx 1$ microsecond

$\Delta d \approx 30$ cm $\rightarrow \Delta t \approx 1$ nanosecond



Why Use LiDAR?



Advantages of LiDAR

- **High data density**
- **Easily cover large areas**
- **Can map remote and inaccessible areas**
- **Ground survey teams needed only for validation**

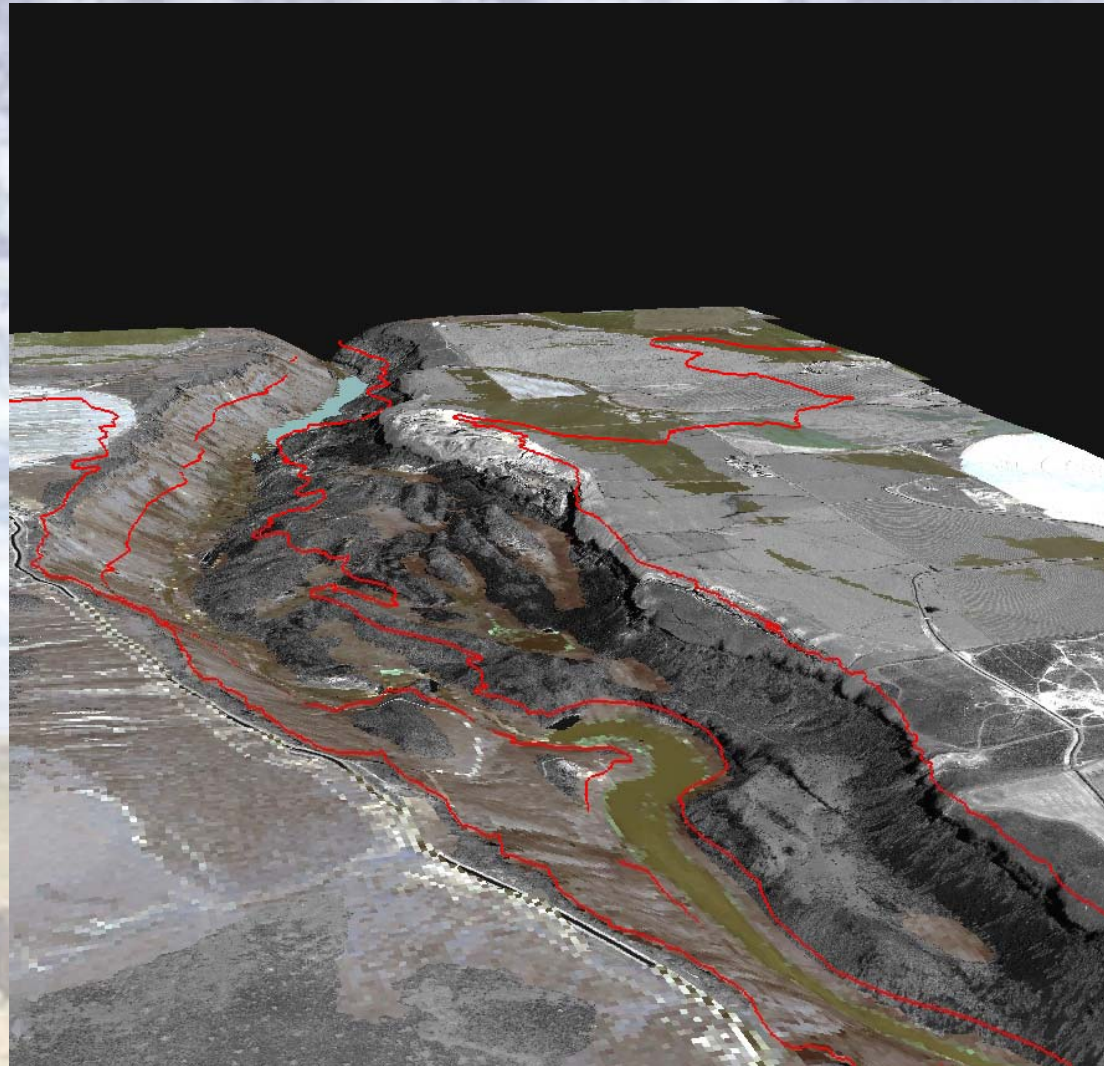


Some LiDAR Uses

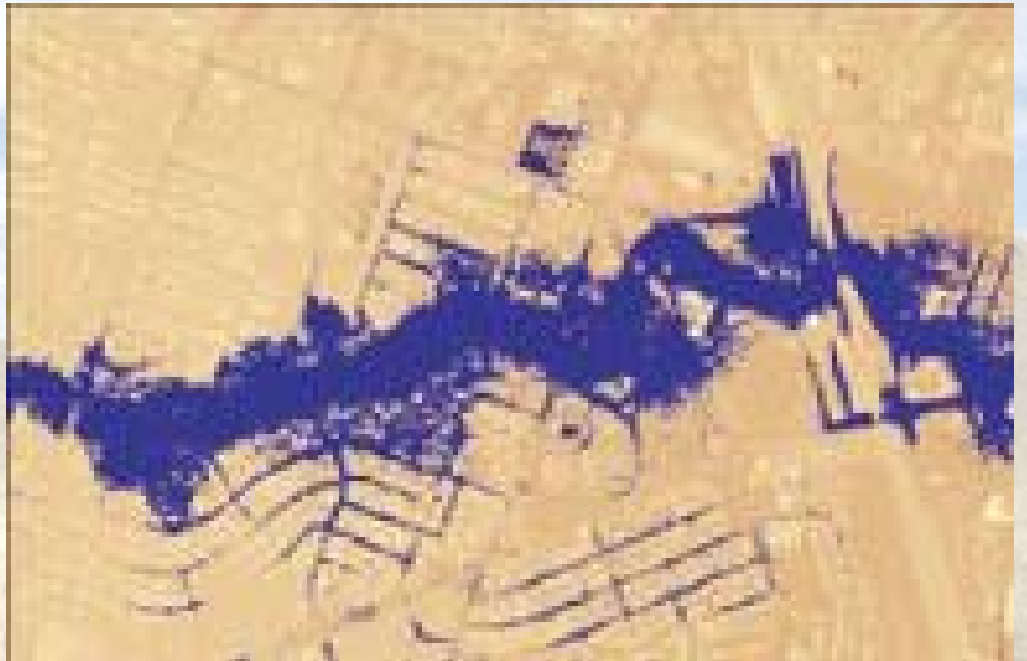
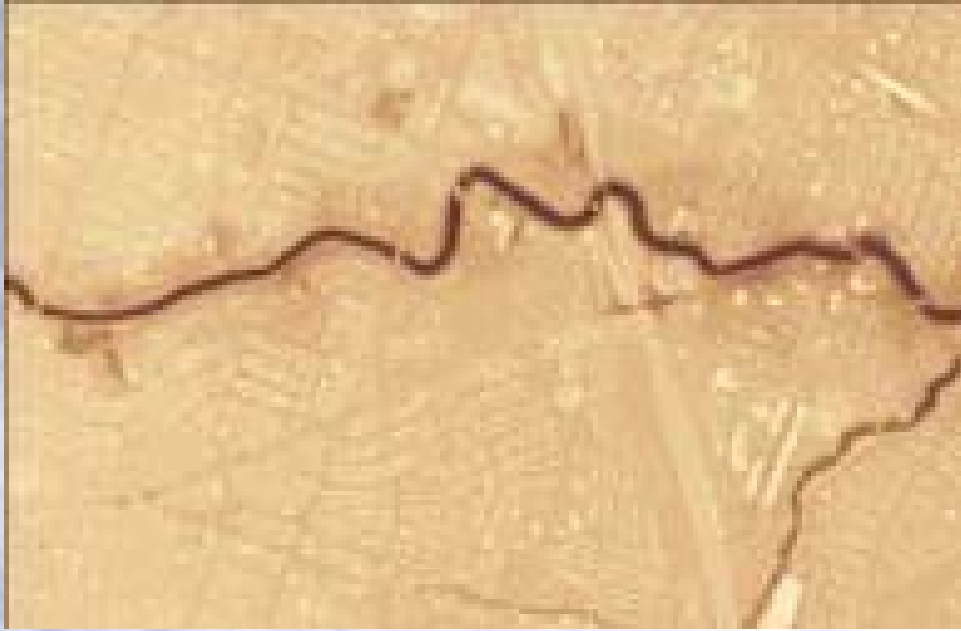
- **Elevation Maps**
- **Hydrology**
- **Vegetation Canopy**
- **Urban Studies**
- **Shoreline Monitoring**
- **Planetary Mapping**



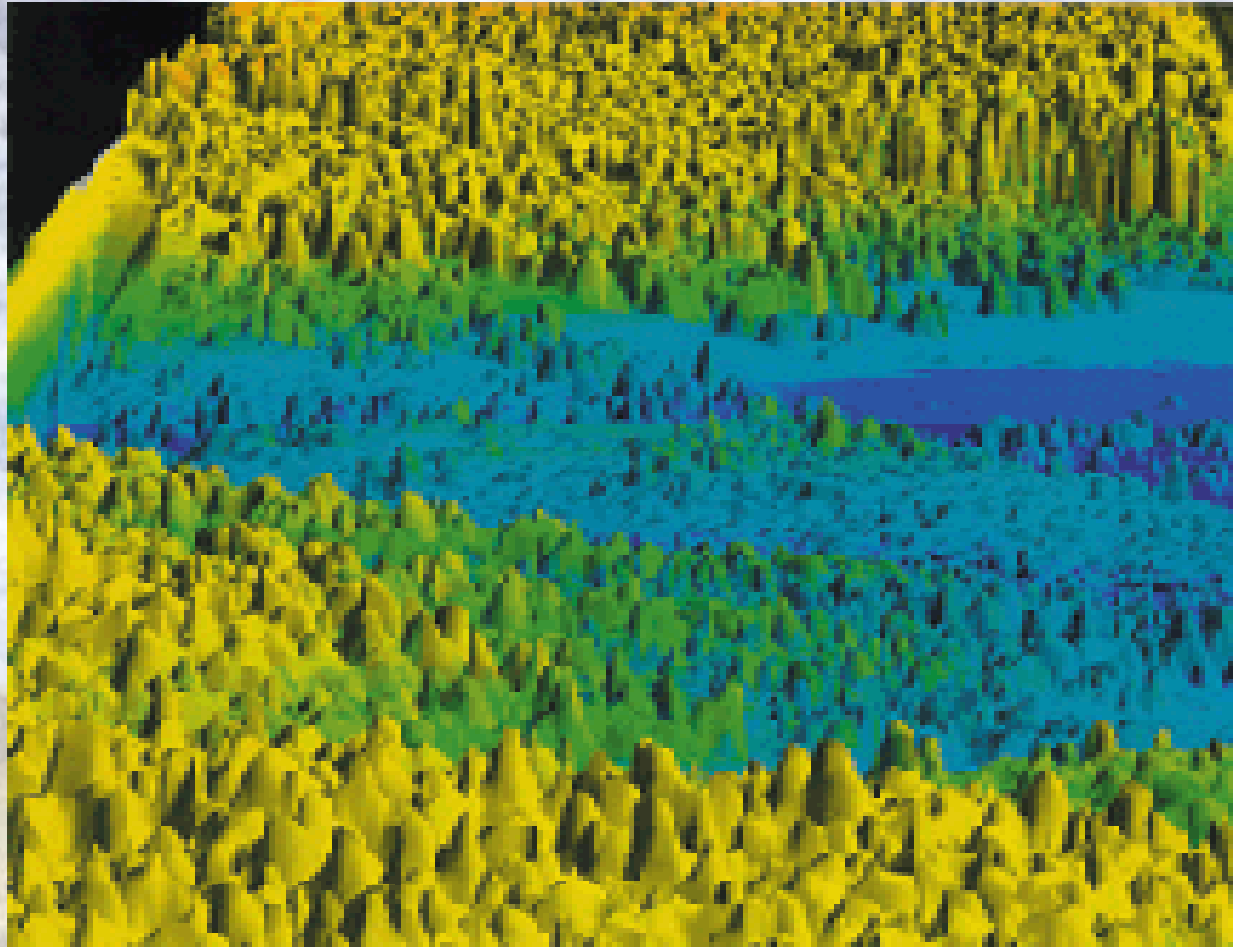
Elevation



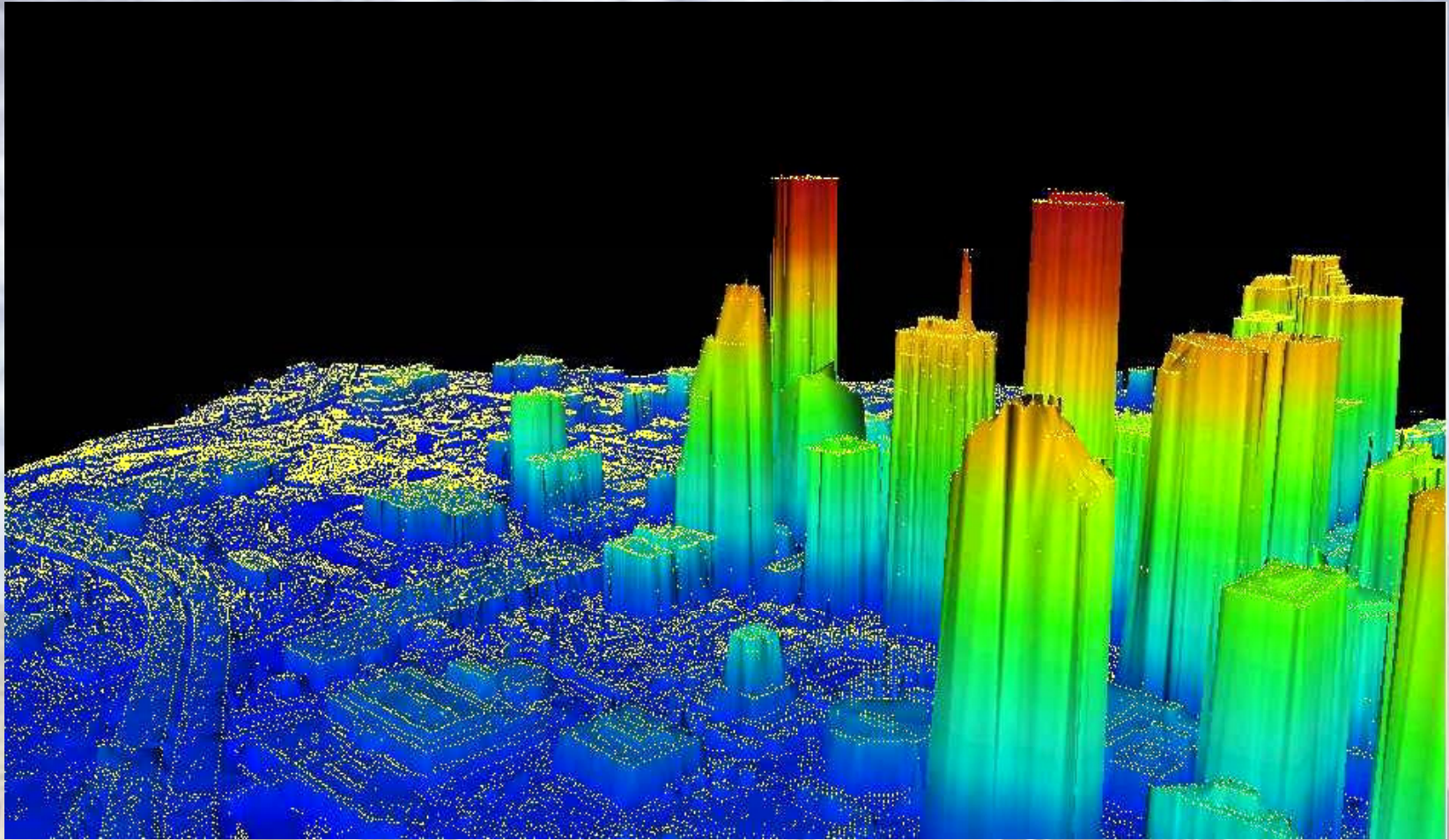
Hydrology



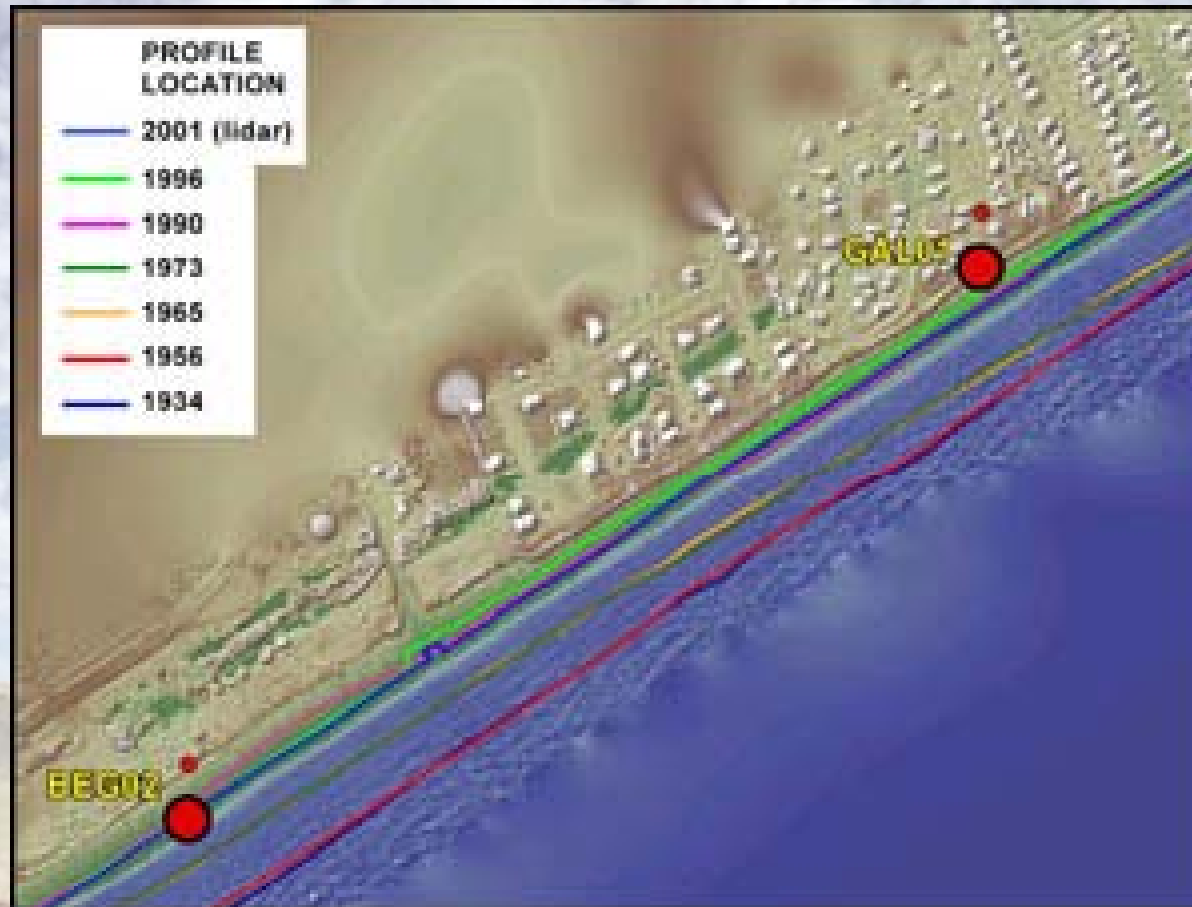
Vegetation Canopy



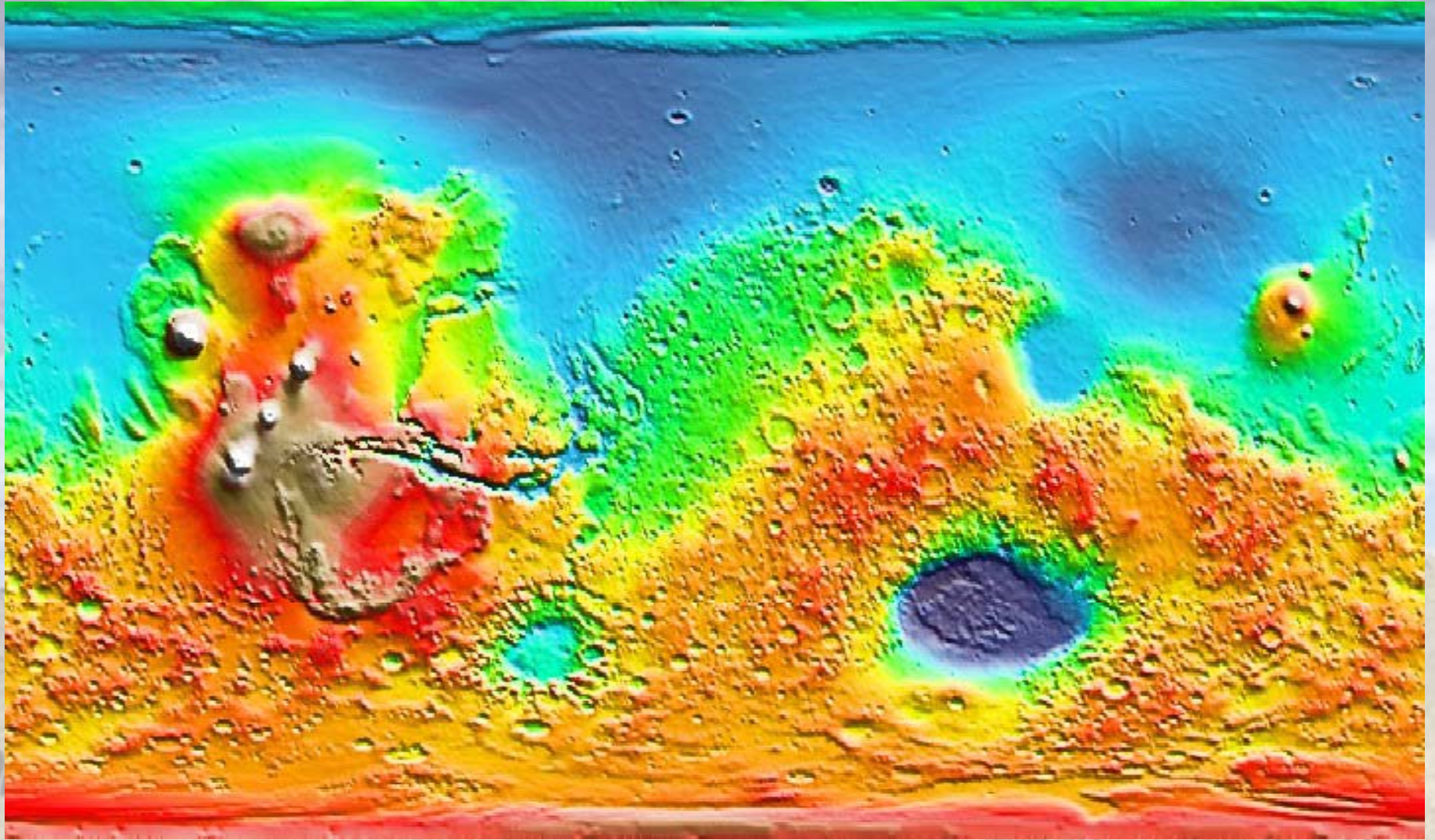
Urban Studies



Shoreline Monitoring



Planetary Mapping

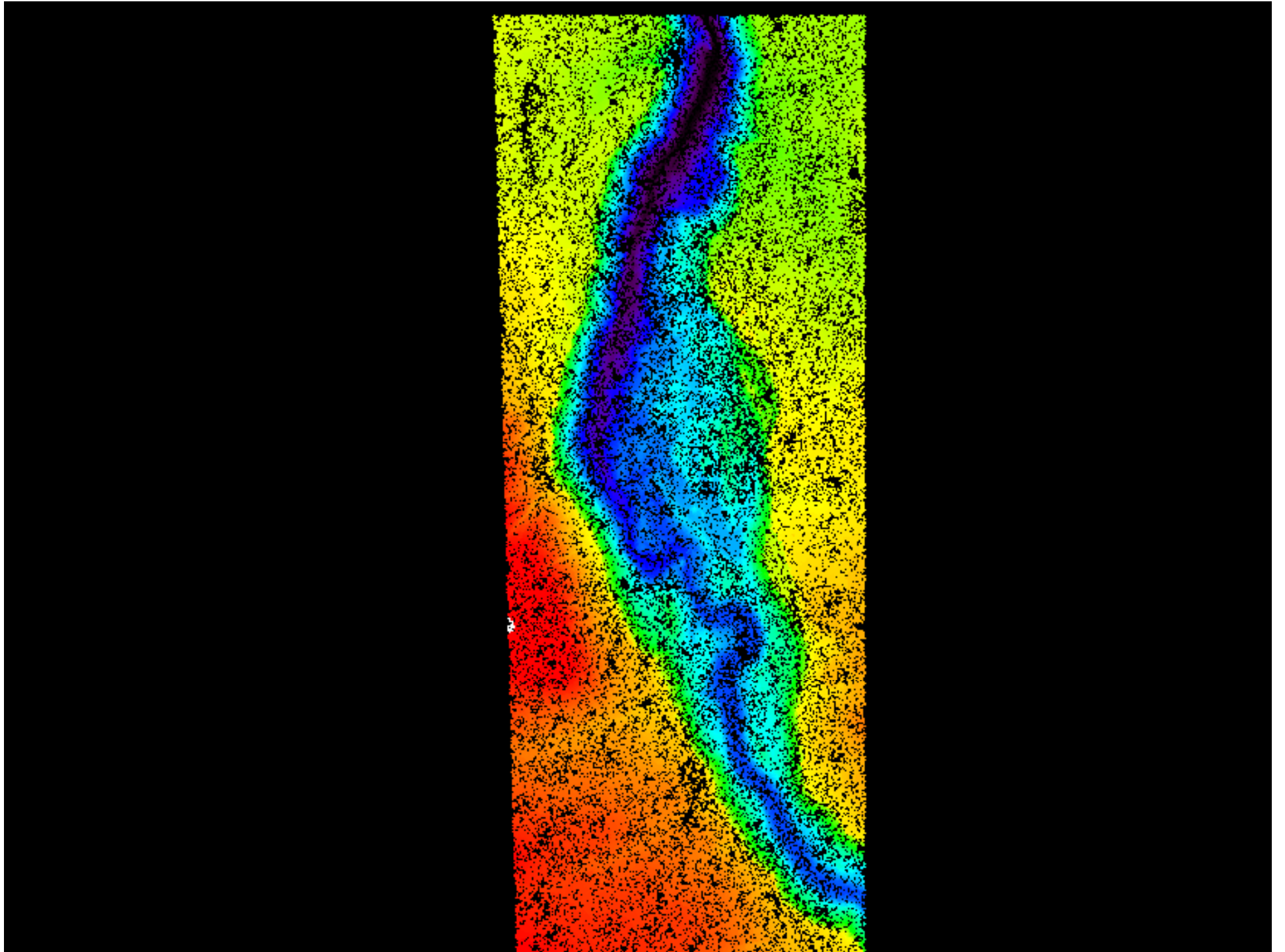


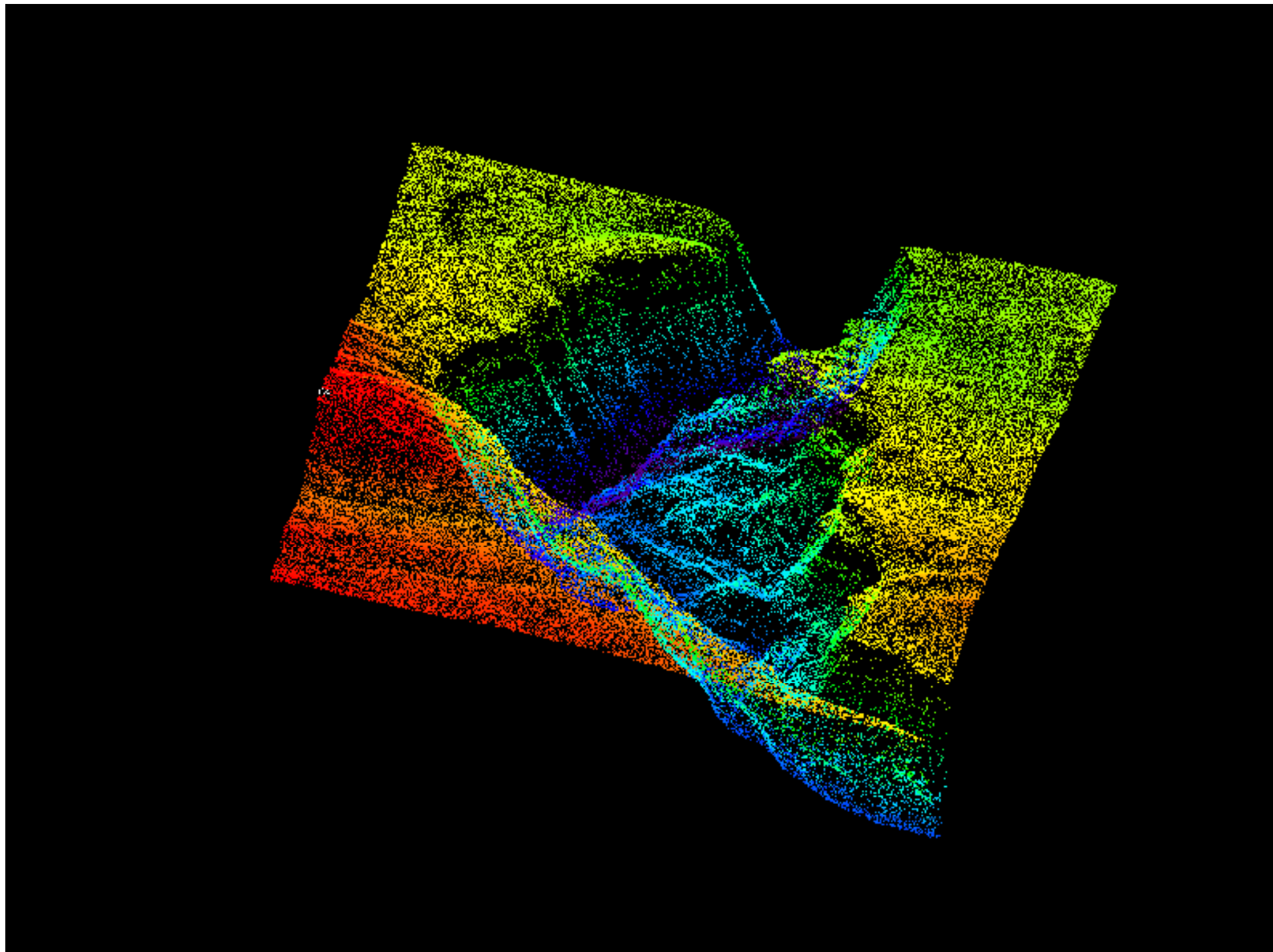
Data Processing

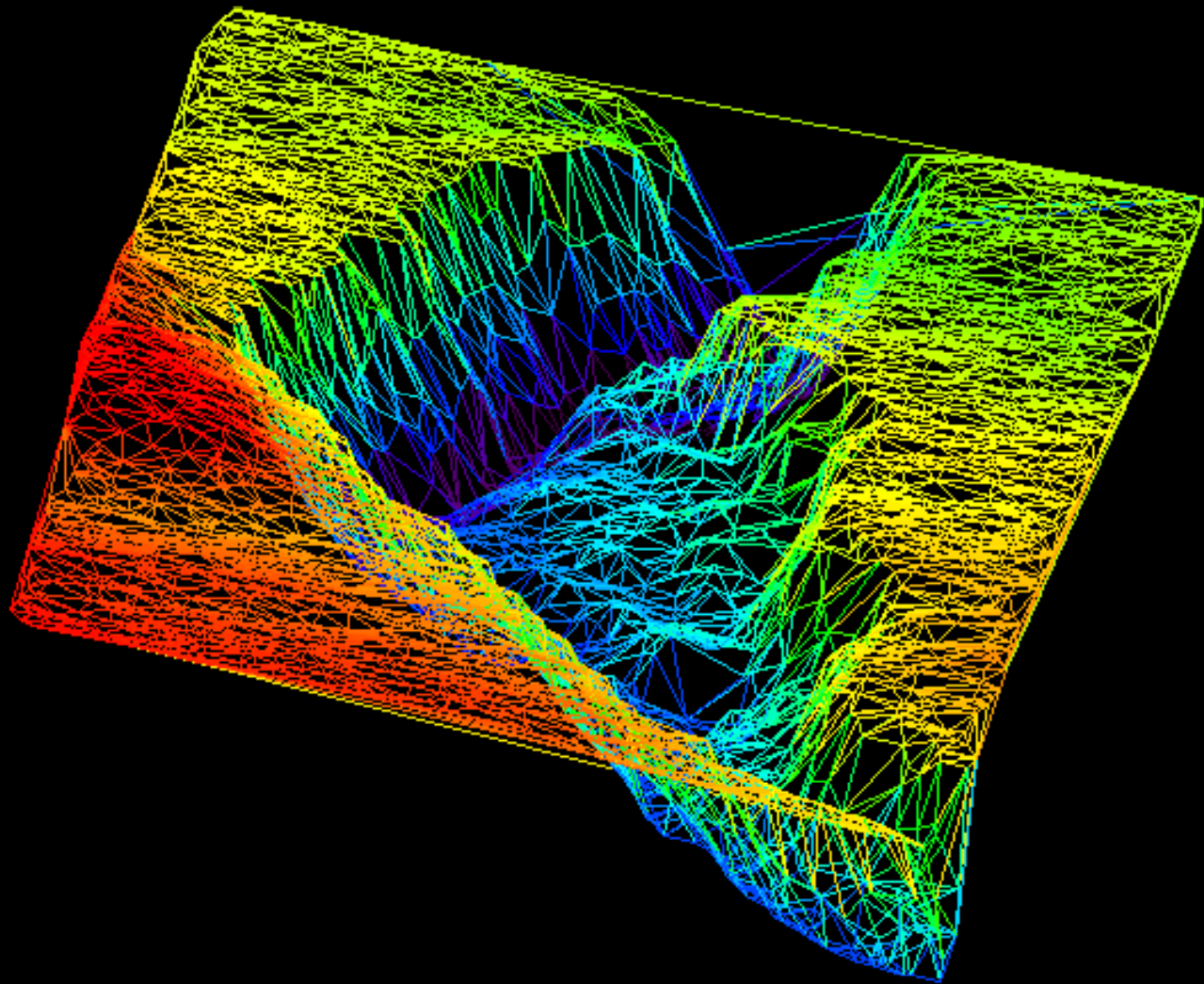
- **Validation through the use of Ground Control Points (GCPs)**
- **Interpolate irregularly-spaced data to uniform grid**

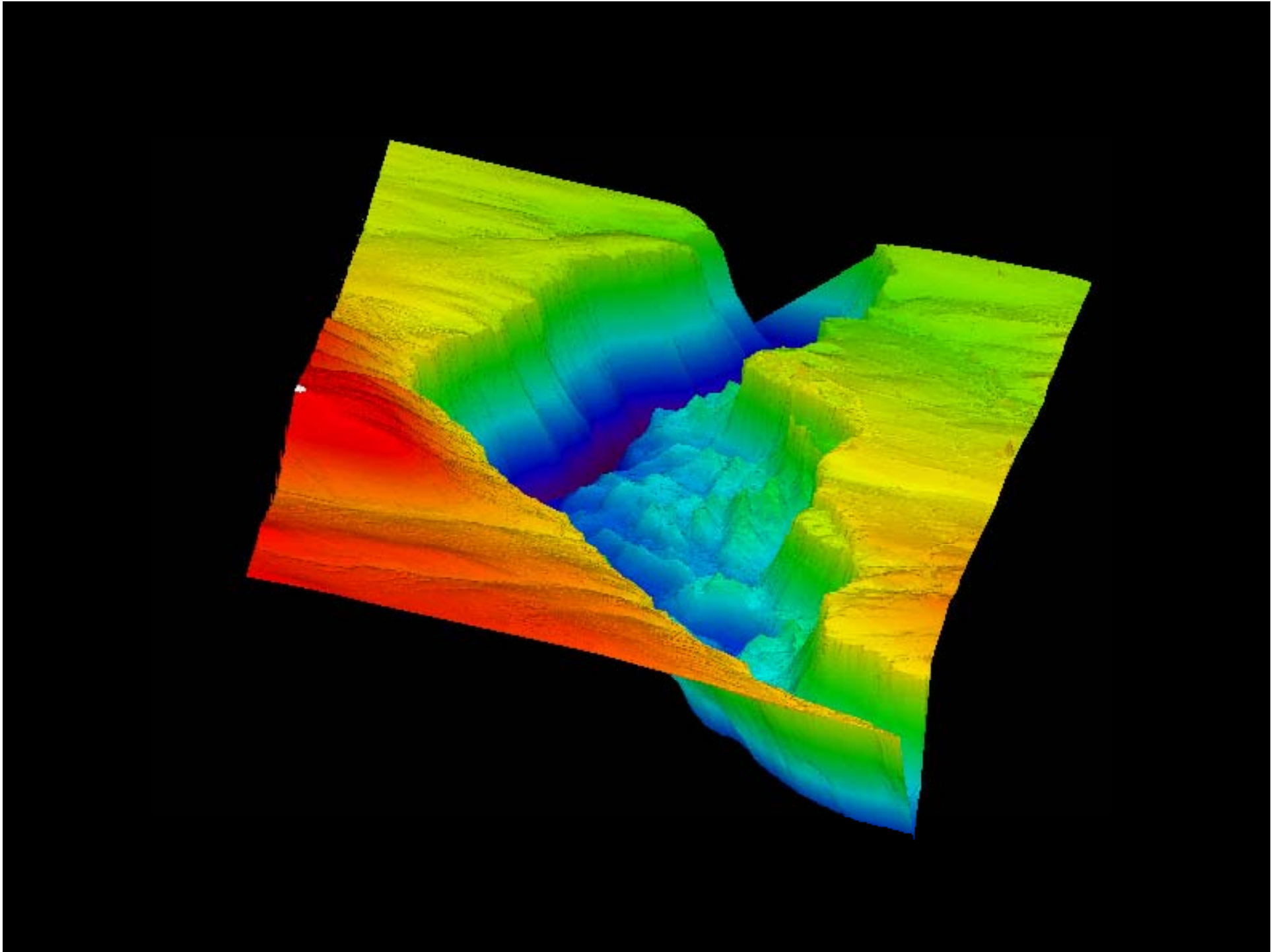






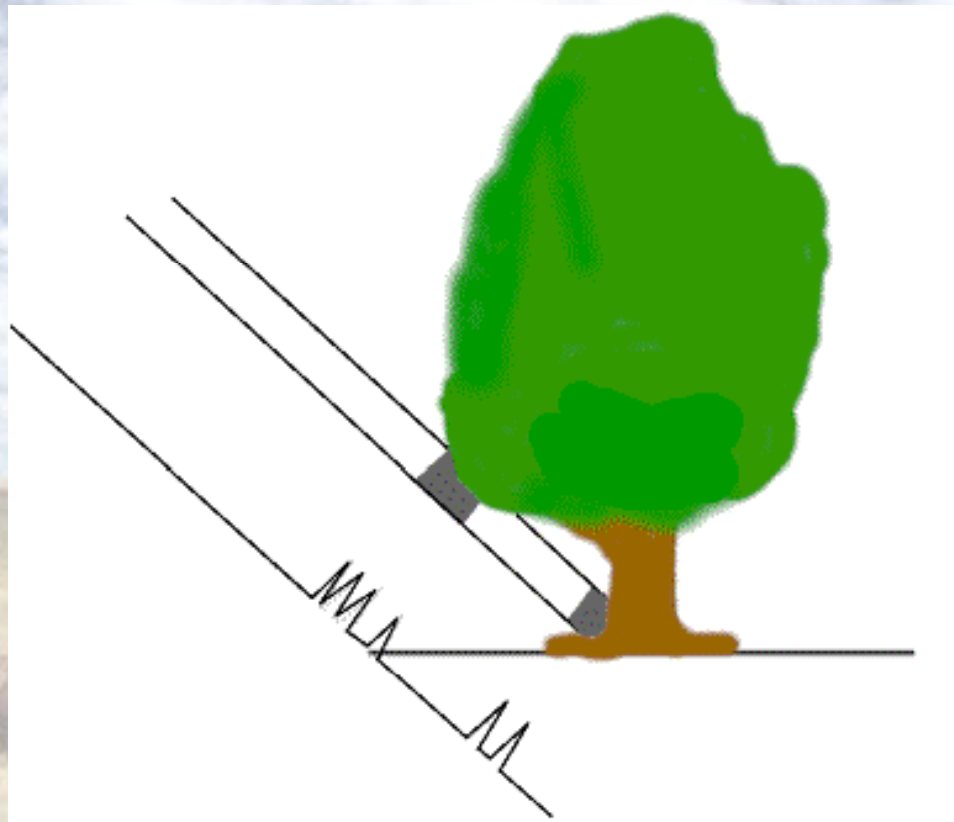


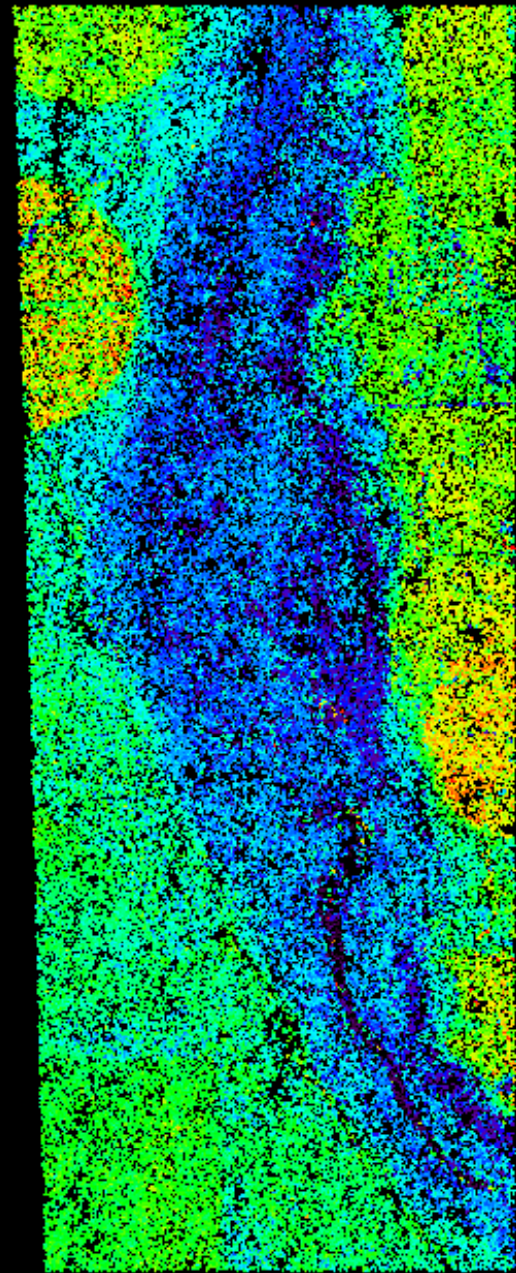
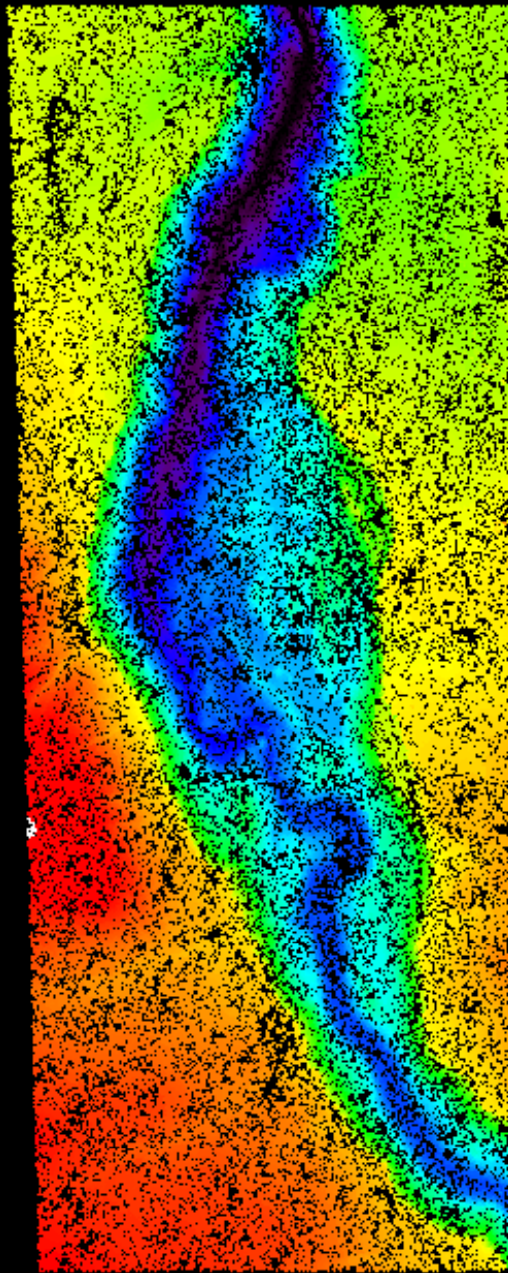




Data Characteristics

- Intensity
- Multiple pulses





Drawbacks

- **Need good weather**
 - High visibility
 - Data quality depends on platform stability
- **Difficult to detect surface through dense vegetation**
- **Large data files**
 - One meter spacing means one million points per square kilometer



Products

- **Raw data**
- **DEM**
- **Contour maps**
- **Breaklines**
- **Extracted Features**
- **Intensity**



Providers and Cost

Airborne1 (Los Angeles, California)

www.airborne1.com

Horizons (Rapid City, South Dakota)

www.horizonsinc.com

Terrapoint (Houston, Texas)

www.terrapoint.com

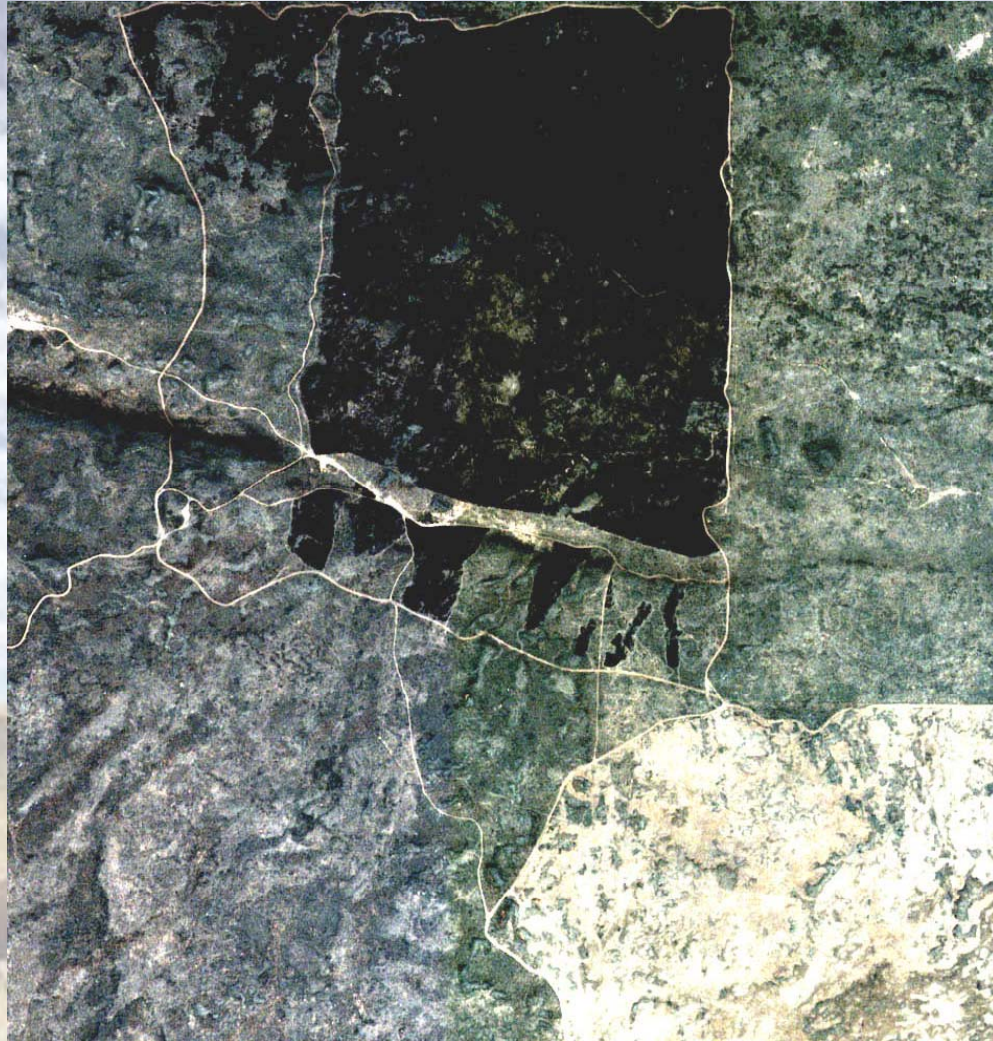
**Cost: few dollars per acre
(over a thousand dollars per square mile)**

Idaho Rangeland Examples

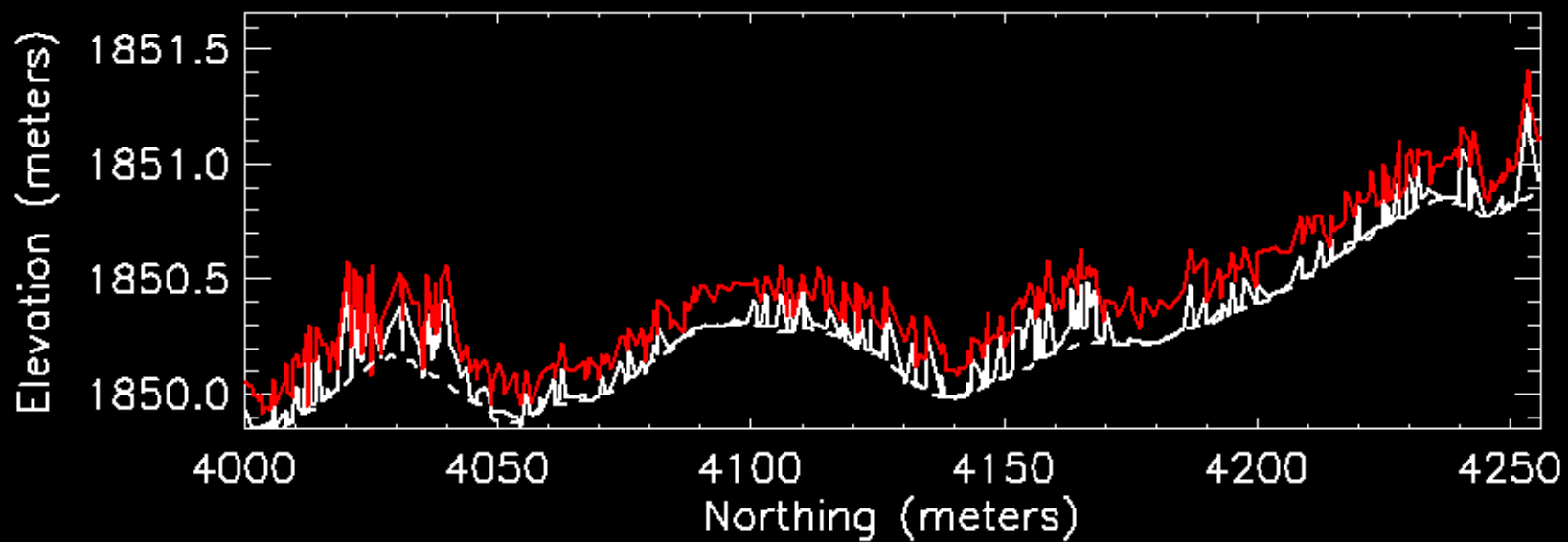
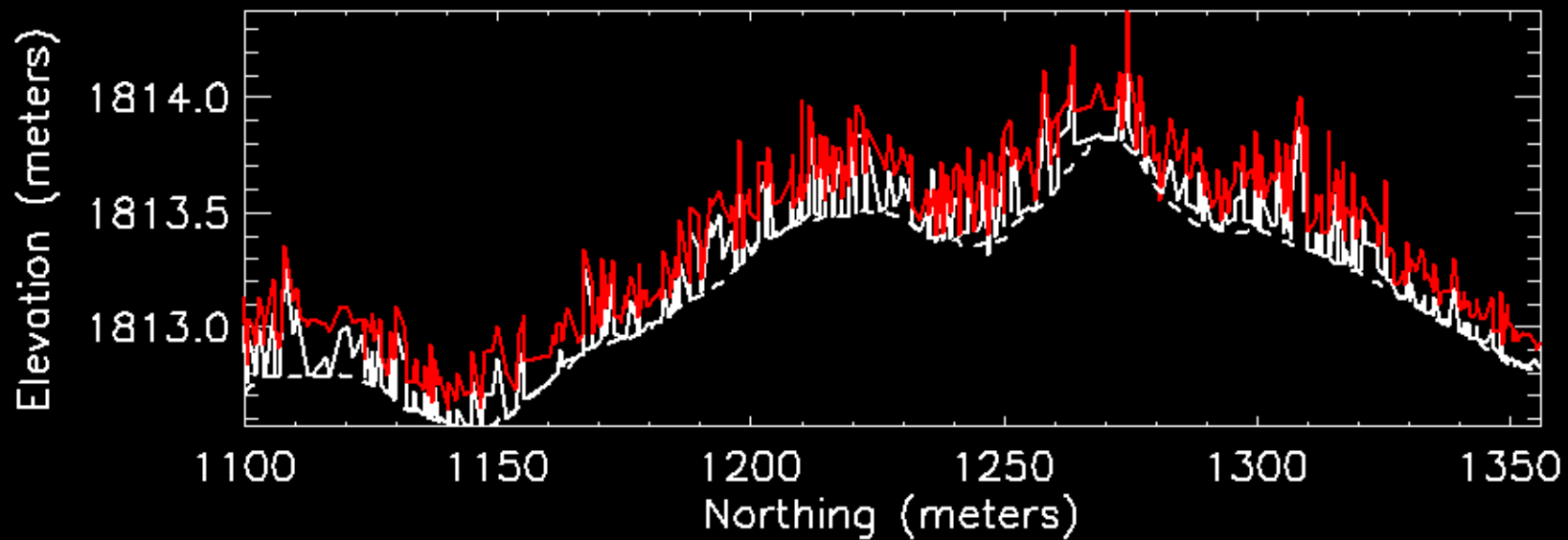
- **Sheep Station**
 - Burn, vegetation monitoring
- **Salmon Falls**
 - Hydrology
- **INEEL Dunes**
 - Aeolian transport



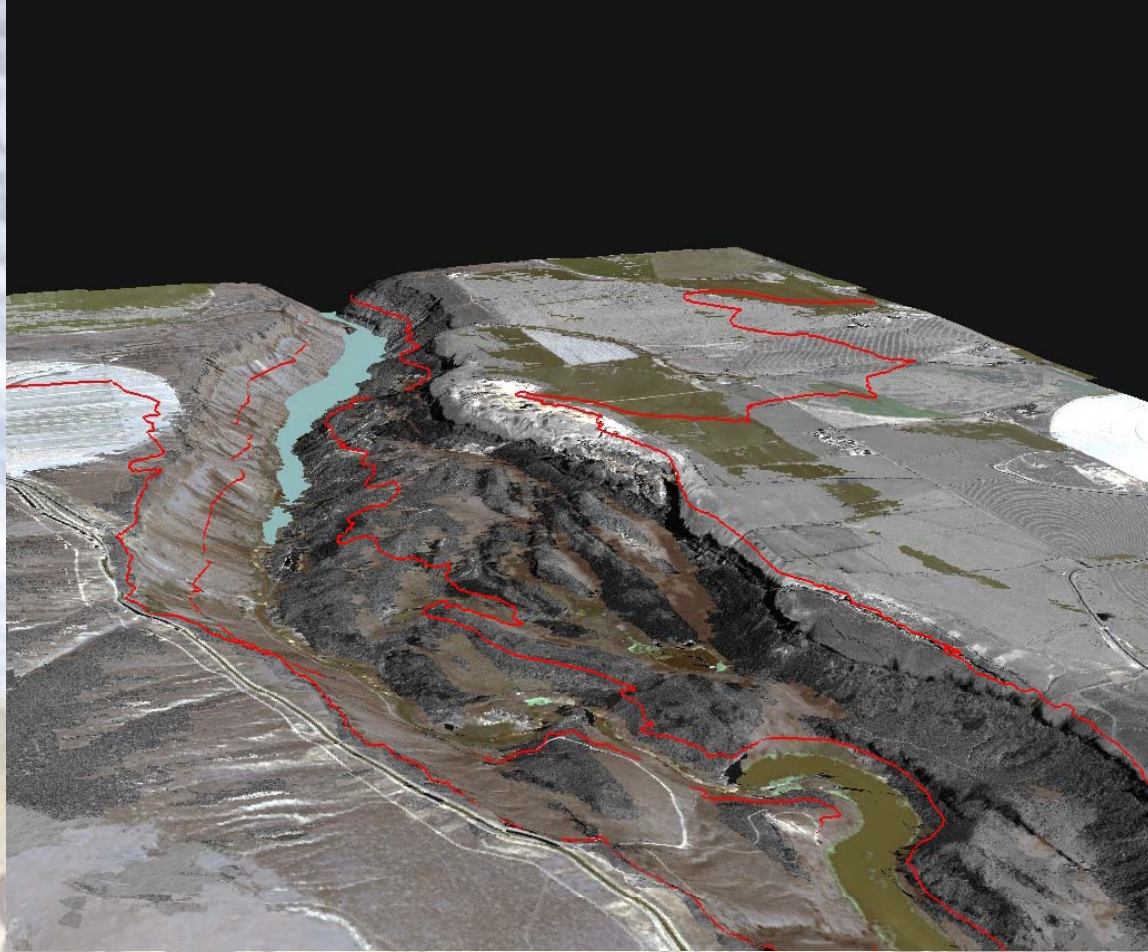
Sheep Station

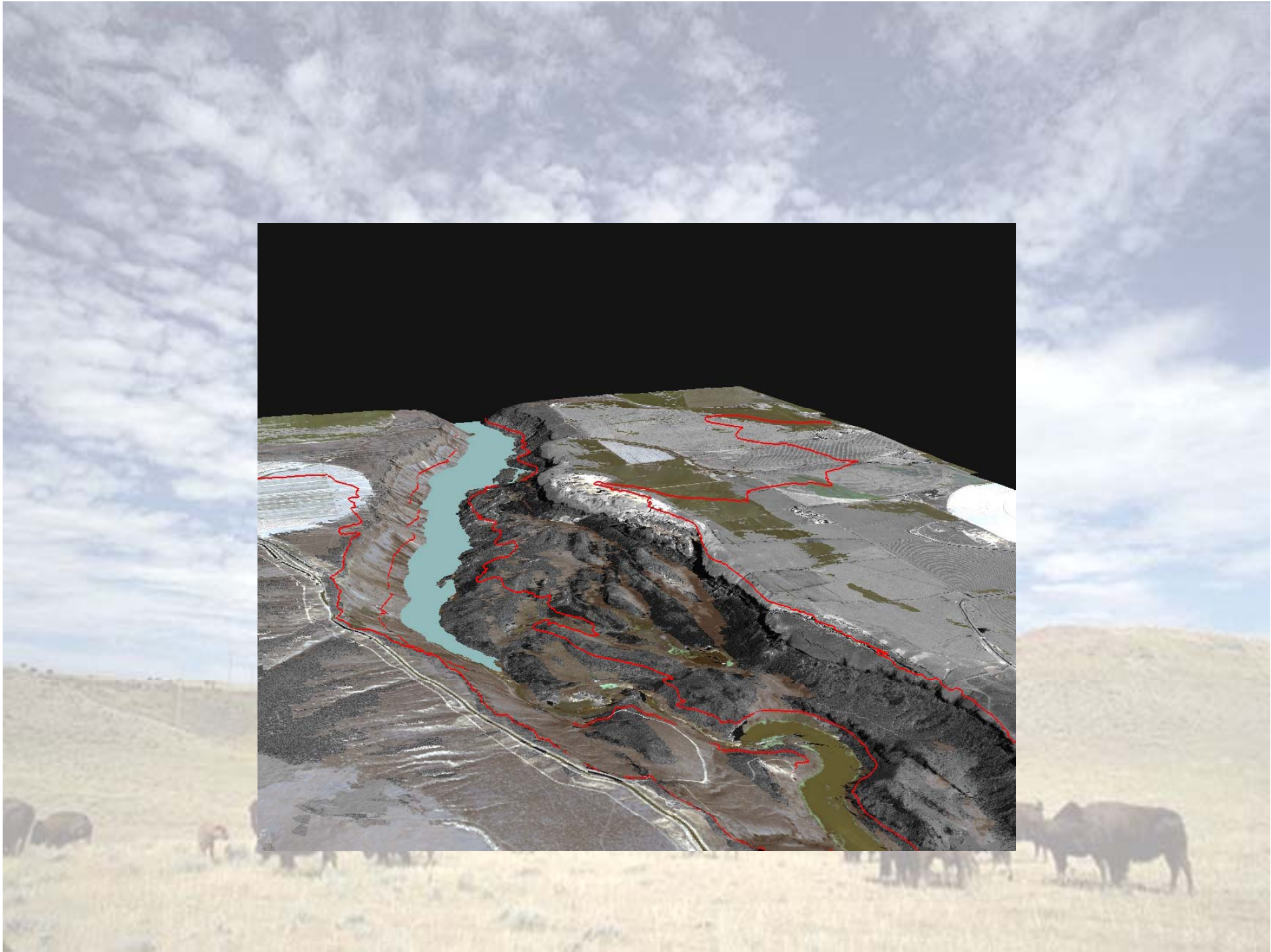


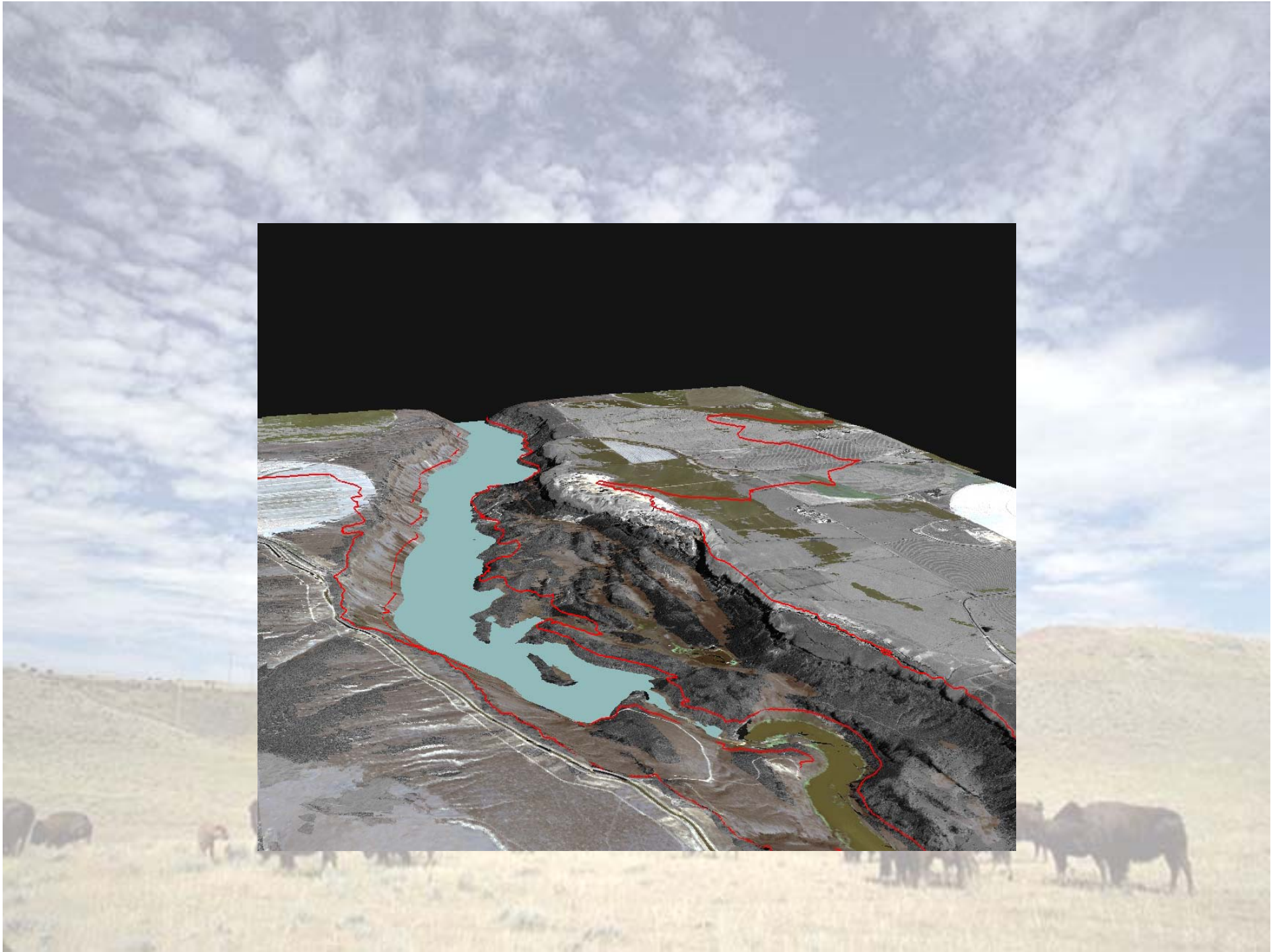




Salmon Falls



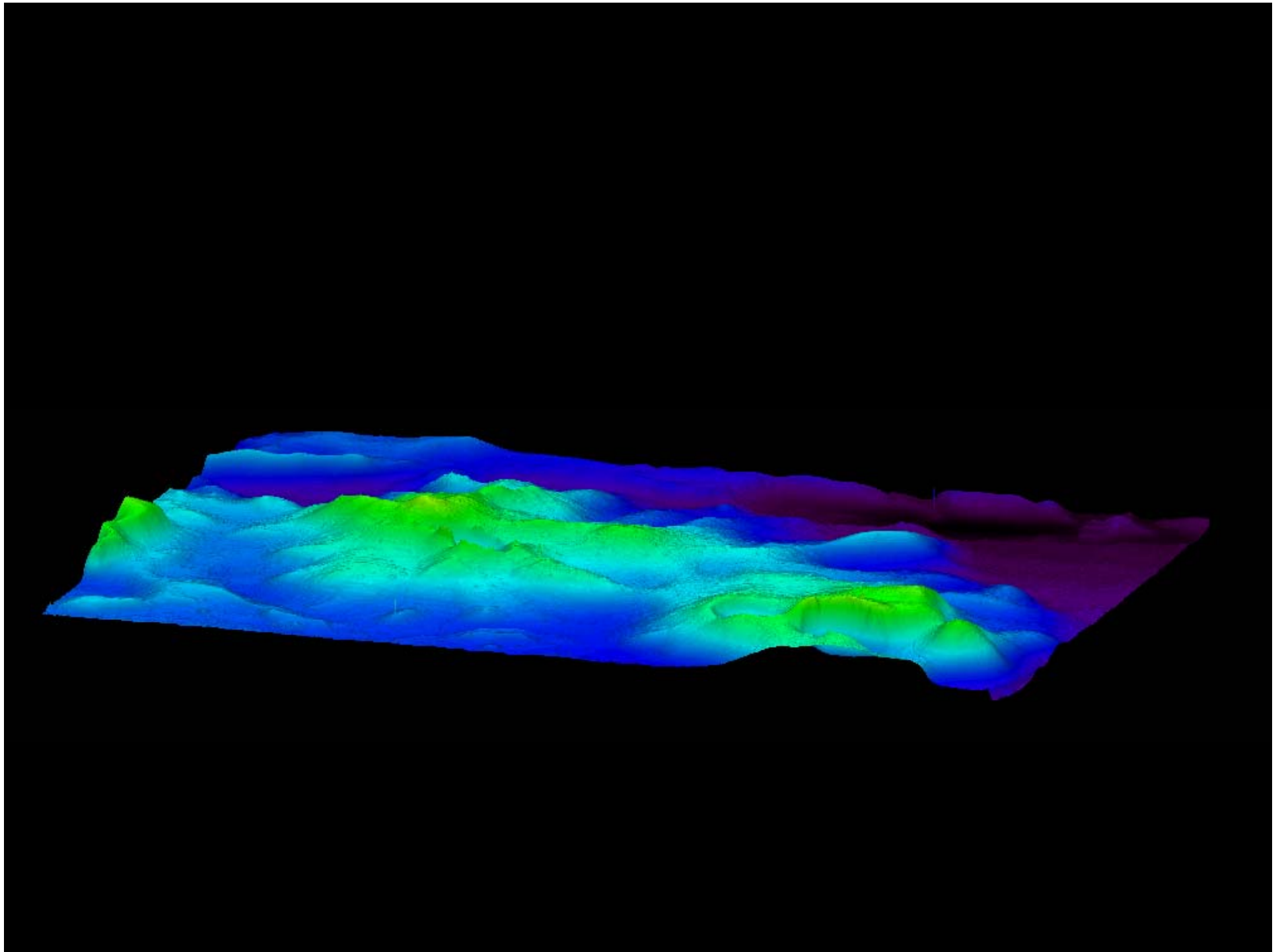




INEEL Dunes







Questions?

...where the deer and the antelope play.

