Remote Site Evaluation for Cosmic Explorer

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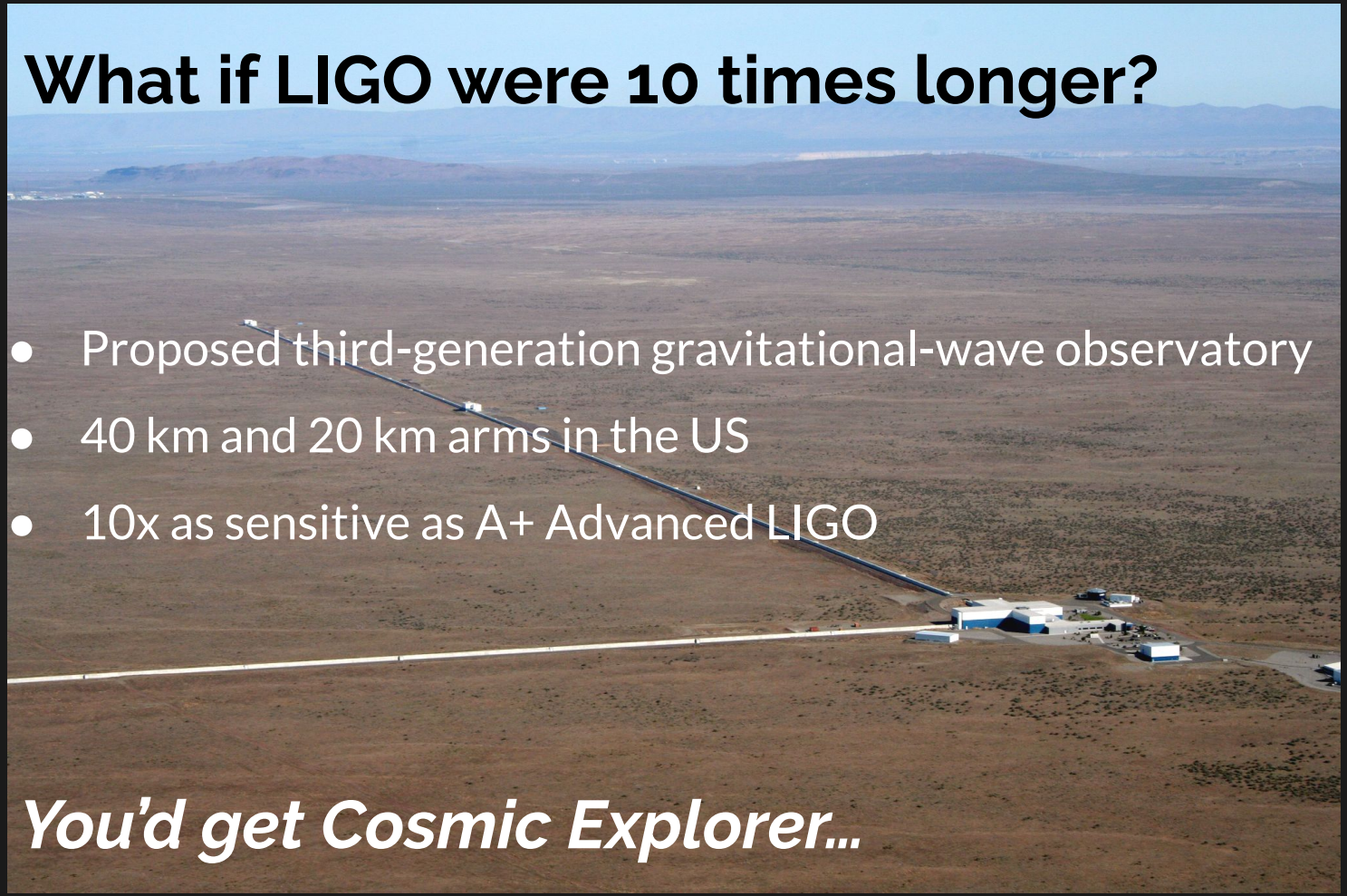
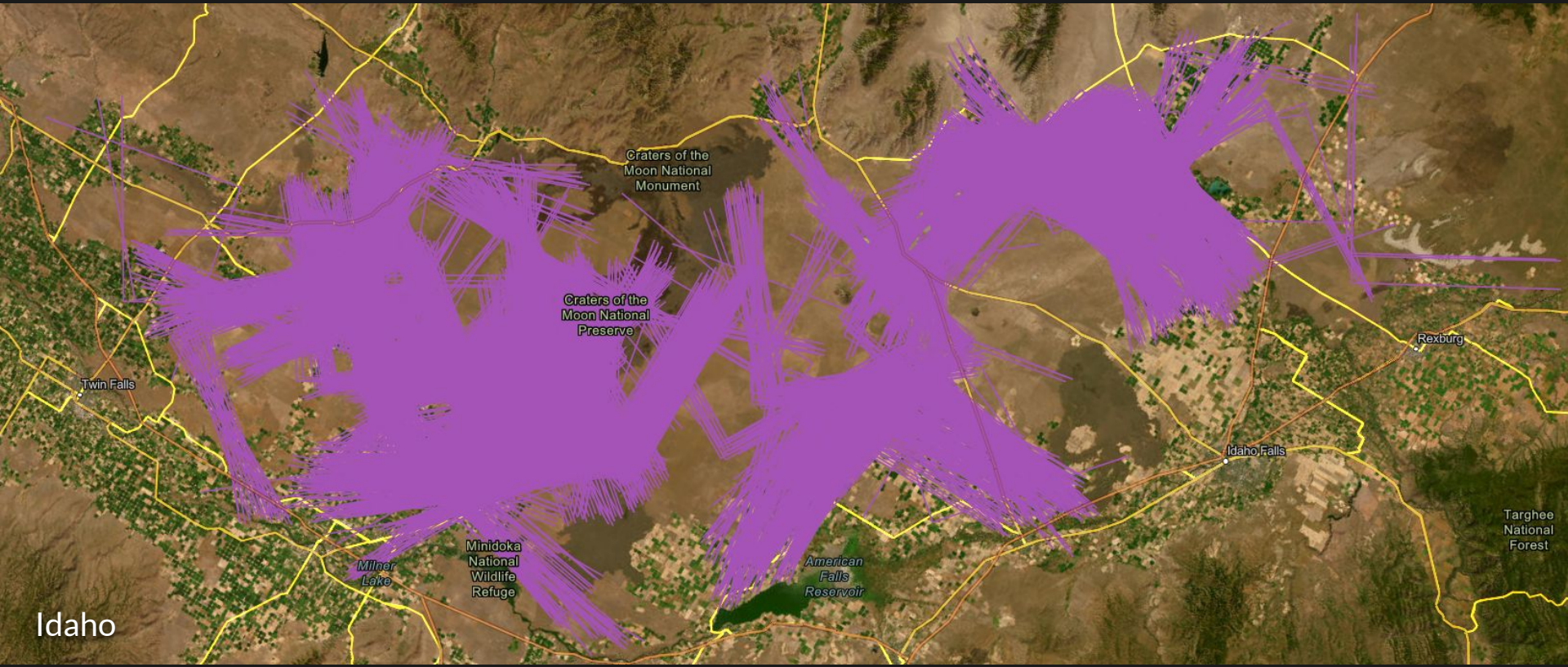
What if LIGO were 10 times longer?



- Proposed third-generation gravitational-wave observatory
- 40 km and 20 km arms in the US
- 10x as sensitive as A+ Advanced LIGO

You'd get Cosmic Explorer...

Several hundred sites identified using topological data!



Remote evaluation saves resources/time

We look for:

- 40 km of land clearance
- Anthropogenic sources of noise
  - Vehicles
  - Rail lines
  - Roads
  - Powerlines

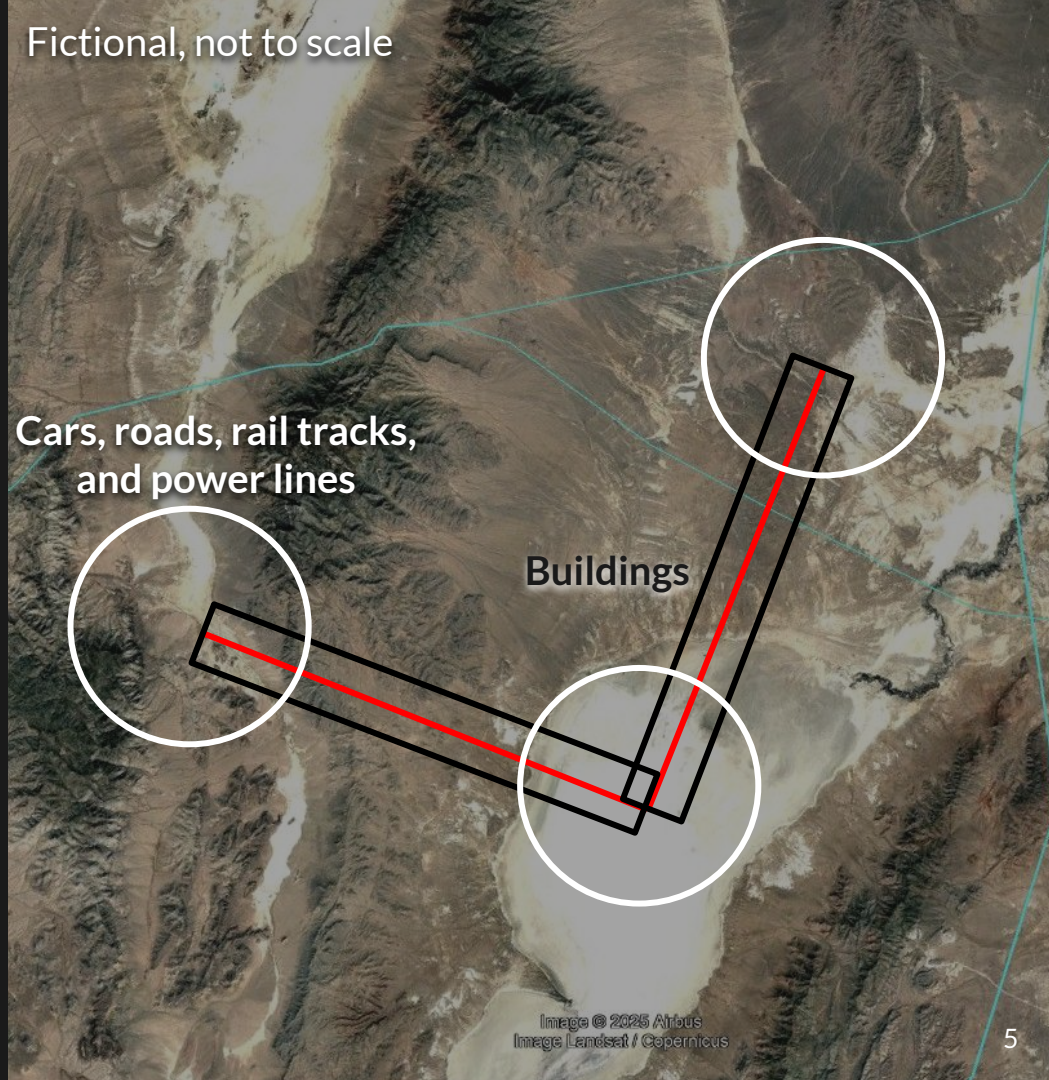
Visual Evaluation of Sites

Used Google Earth Pro to survey

7 potential sites

Painstaking and prone to error

Need something scalable and efficient



Finding a GIS solution

Challenges with training our own deep learning model

Pretrained ArcGIS models

- Computing power
- Input resolution
- Accuracy

Switching gears again...

Buildings

Transportation

Spatial Filtering

Publicly available vector datasets

```
Total buildings within extent: 66 building(s)
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Total gravel roads within extent: 566.94 km
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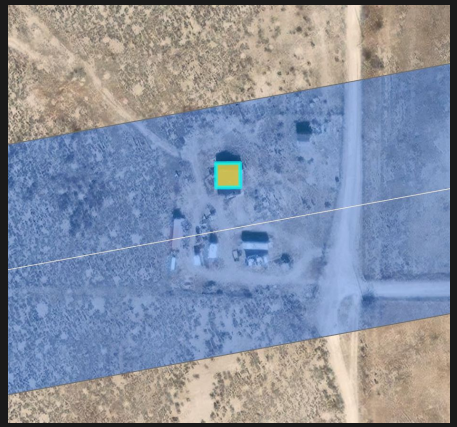
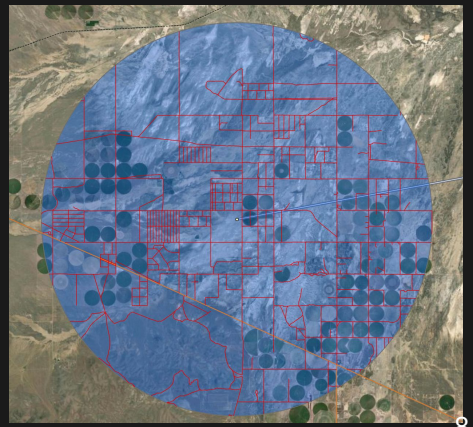




We are collaborators...

We are collaborators...

- The problem
  - Cost for a large collaboration
  - Web-based sharing
  - Large-scale, automated workflows

GitHub repository

- The solution → **API for ArcGIS in Python**
  - Libraries for scripting and automation of spatial analysis
  - Sharing within and between organizations
  - Accessible

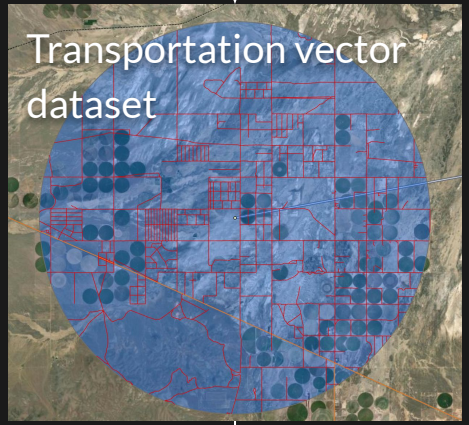
API Framework

KMLs of clusters with several thousand sites

Building identification, counts, and coordinates to csv

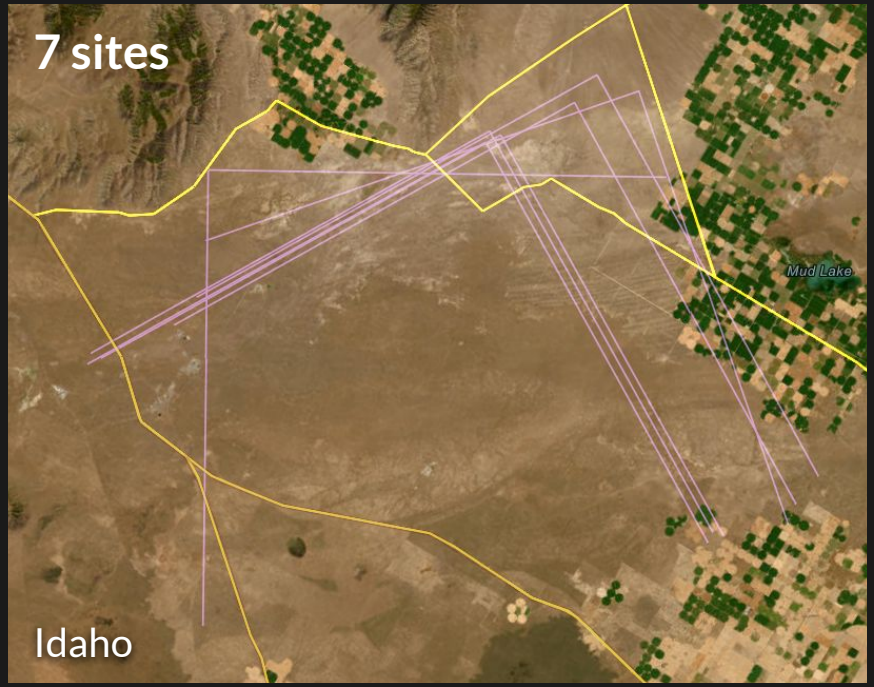
Building identification, counts, and coordinates to csv

New KMLs of sites with no buildings

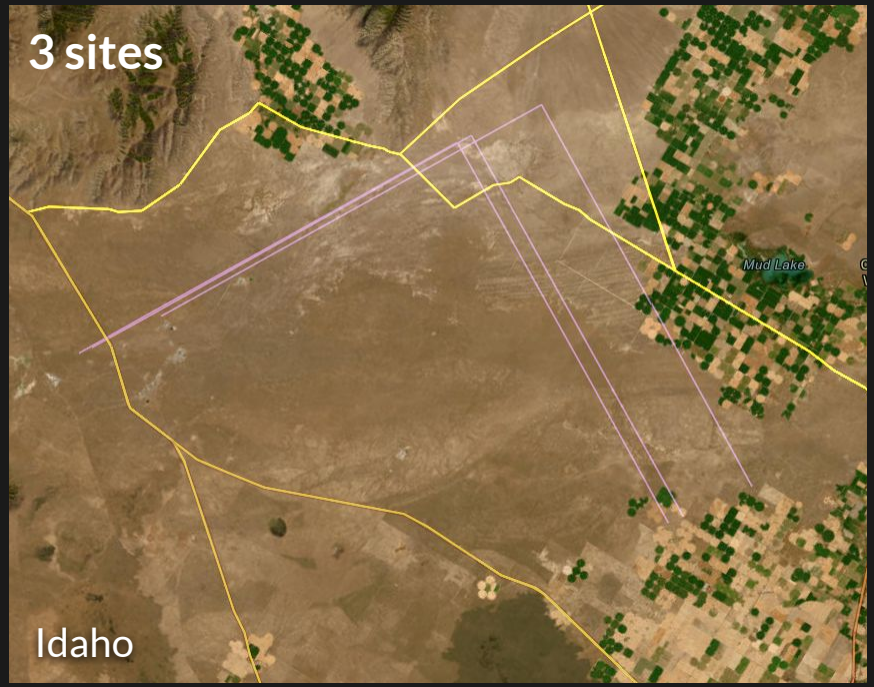


Mapping kilometers of transportation lines to csv

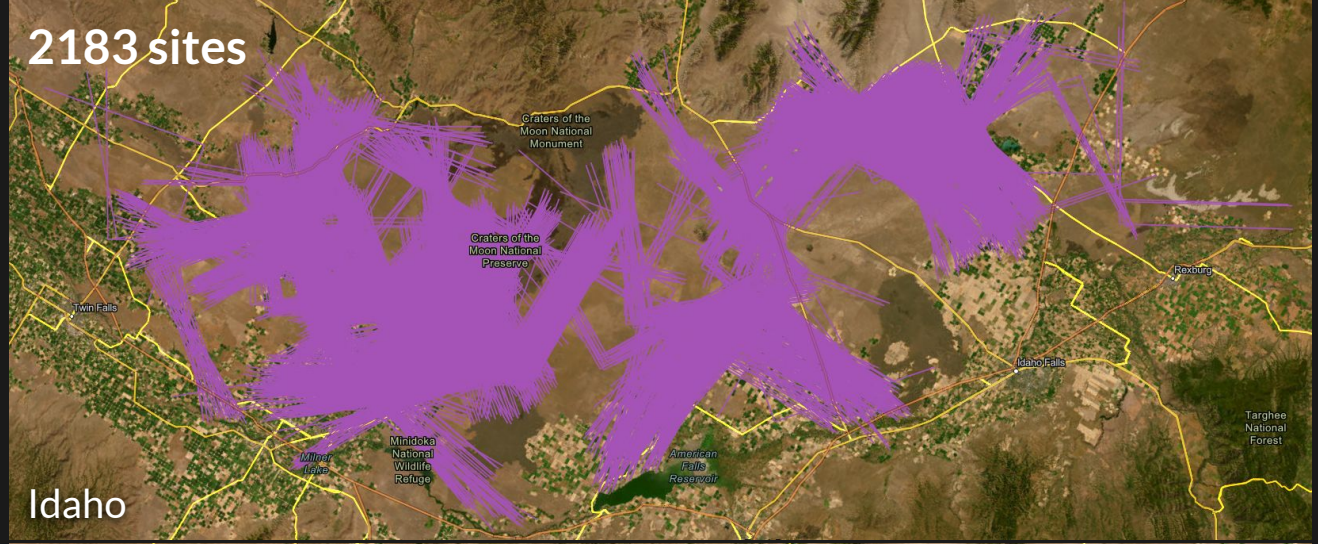
Filtered KMLs

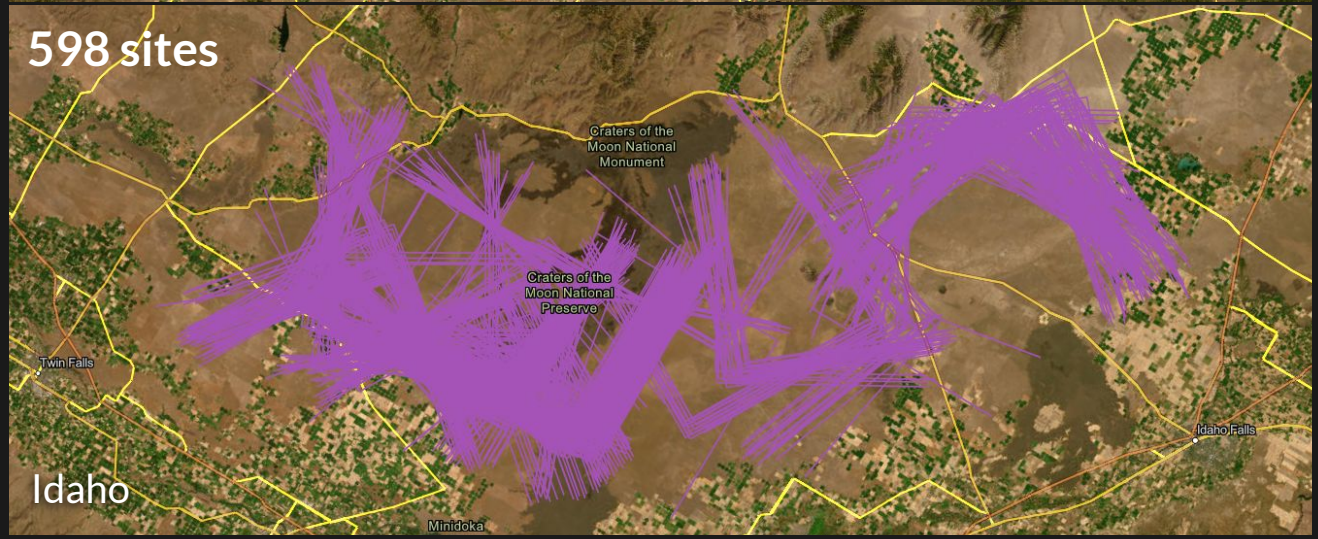


All sites in a cluster



Filtered to those with no buildings


2183 sites
Craters of the Moon National Monument
Craters of the Moon National Preserve
Rexburg
Twin Falls
Idaho Falls
Targhee National Forest
Minidoka National Wildlife Refuge
Milner Lake
American Falls Reservoir
Idaho


598 sites
Craters of the Moon National Monument
Craters of the Moon National Preserve
Twin Falls
Idaho Falls
Idaho
Minidoka

Where do we go from here?

- The API is the first filter in the narrowing down of sites

Cluster → sites with no buildings → new KML → km of roads near stations

- Faster and accurate than visual inspection, reducing time for initial site assessment
- This framework can be adapted for automation of further stages
  - Measuring distances between stations and sources of noise
  - Mapping power lines

Bigger picture!

- On-site testing with seismometer and magnetometer kits
  - Tested them this summer
  - Improved instruction manual
  - Measurements in Idaho on identified sites