

USING GROUND BASED TERRESTRIAL LASER SCANNING TO MODEL ANTECEDENT TOPOGRAPHY

Coral Pink
Sand Dunes,
Kane County, Utah

Janna Rozar, David Wilkins, Nancy Glenn, Lucas Spaete
Boise State University
Department of Geosciences



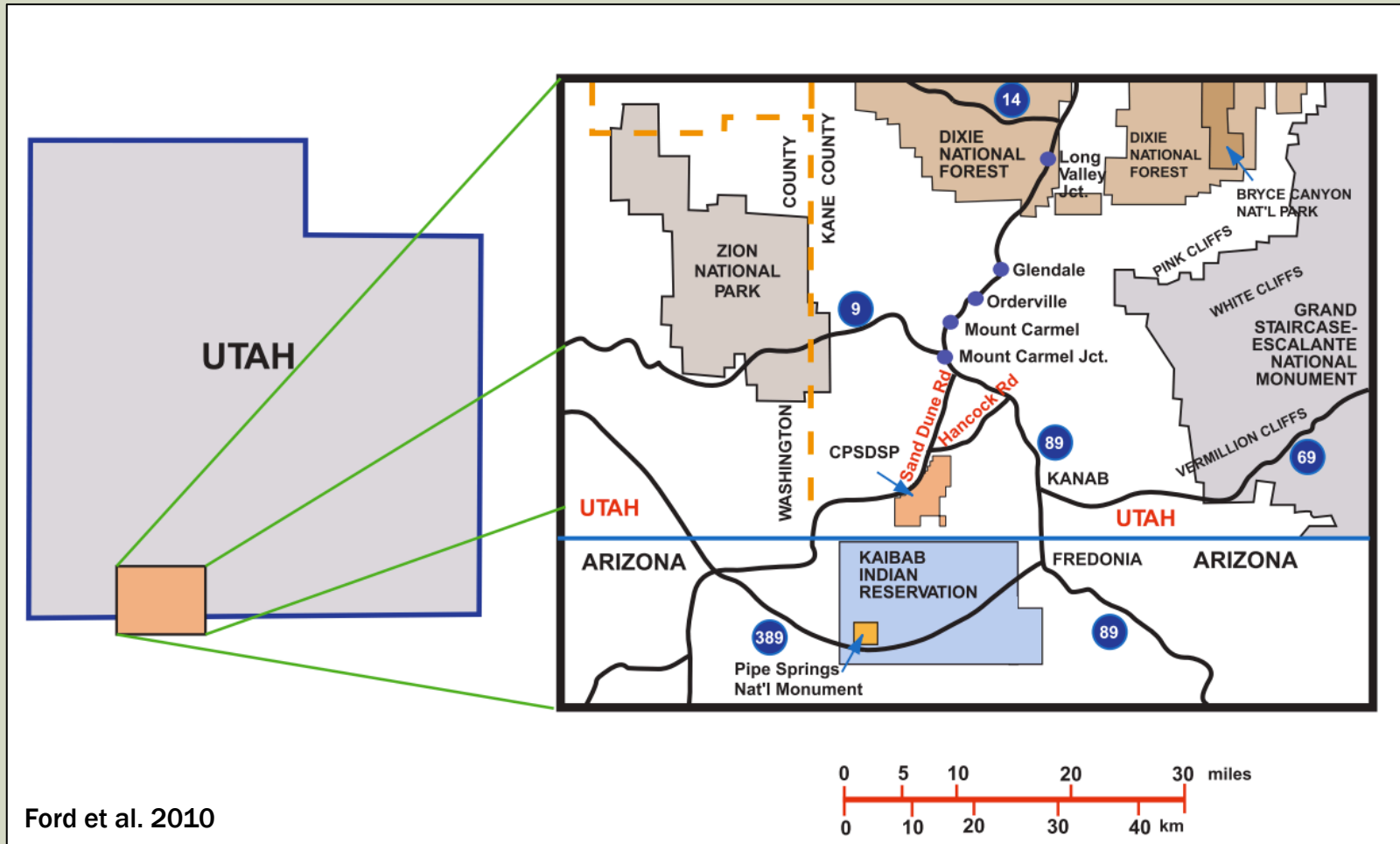
BOISE STATE UNIVERSITY

OUTLINE

- **THE LARGER PROJECT:** Structural controls on antecedent topography and geomorphic container at The Coral Pink Sand Dunes
- **THE METHODS:** Terrestrial Laser Scanning (TLS) in the field and in the lab
- **THE RESULTS:** DEMs and the model for antecedent topography at the Coral Pink Sand Dunes

STUDY AREA

CORAL PINK SAND DUNES, UTAH



EXPLANATION

CPSDSP = Coral Pink Sand
Dunes State Park

● Normal fault, bar & ball on
down-thrown side

G - Gunlock fault

P - Paragonah fault

T - Toroweap, W - Washington

H - Hurricane fault

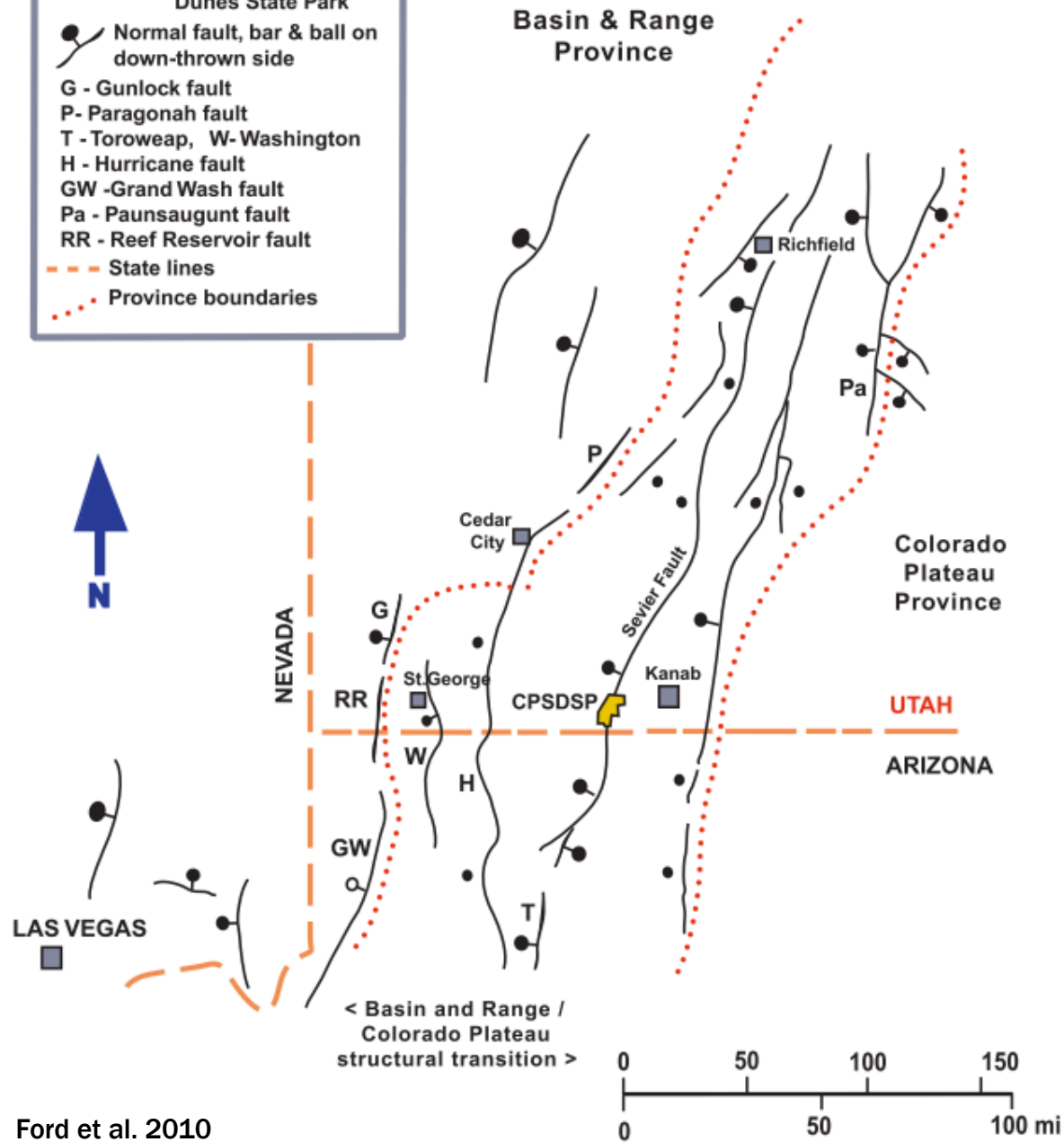
GW - Grand Wash fault

Pa - Paunsaugunt fault

RR - Reef Reservoir fault

--- State lines

... Province boundaries

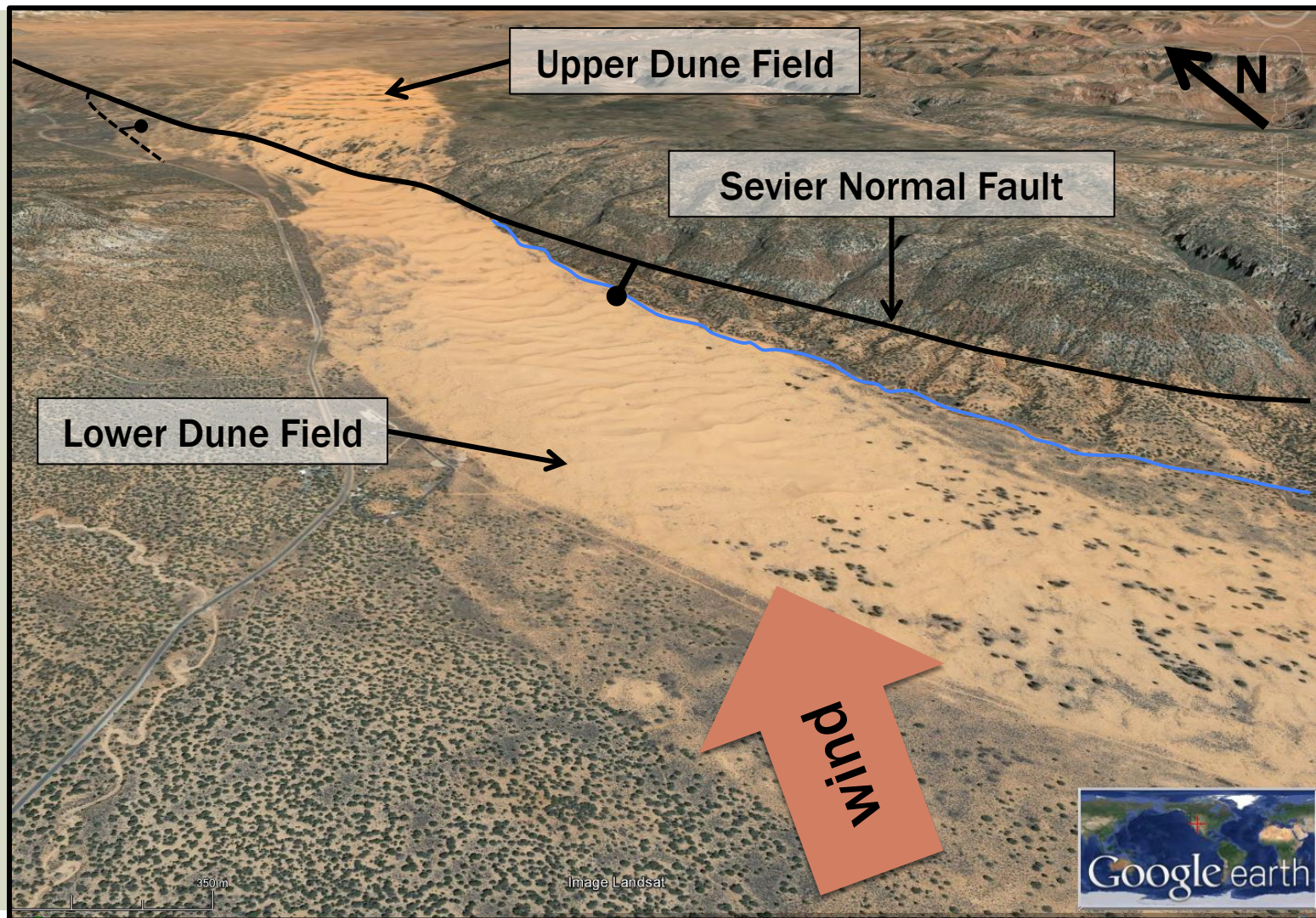


Ford et al. 2010



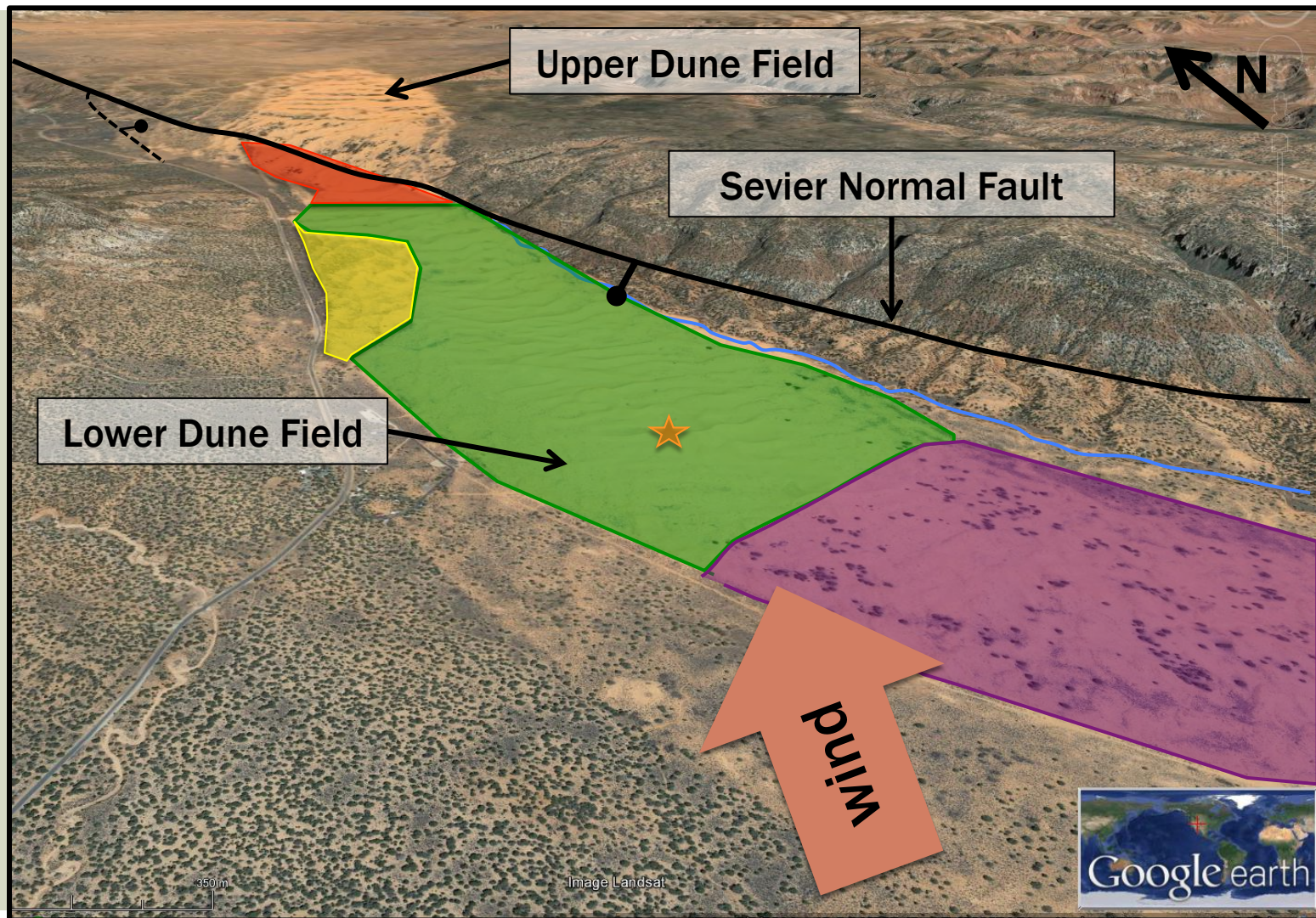
STUDY AREA

CORAL PINK SAND DUNES, UTAH



STUDY AREA

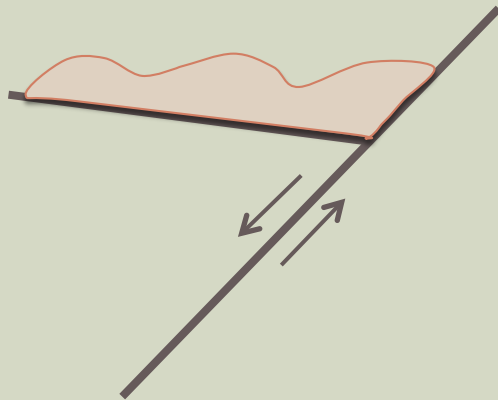
CORAL PINK SAND DUNES, UTAH



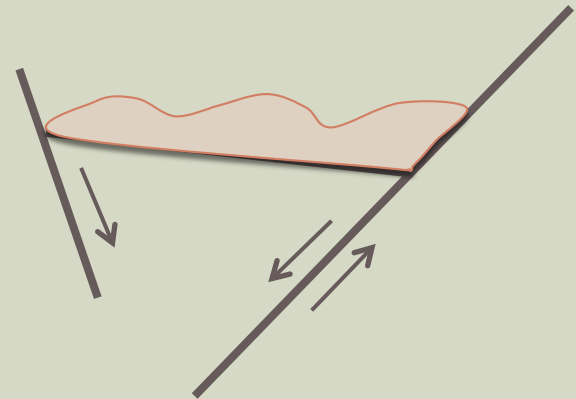
CORAL PINK SAND DUNES

HYPOTHESIS

TILTED BLOCK

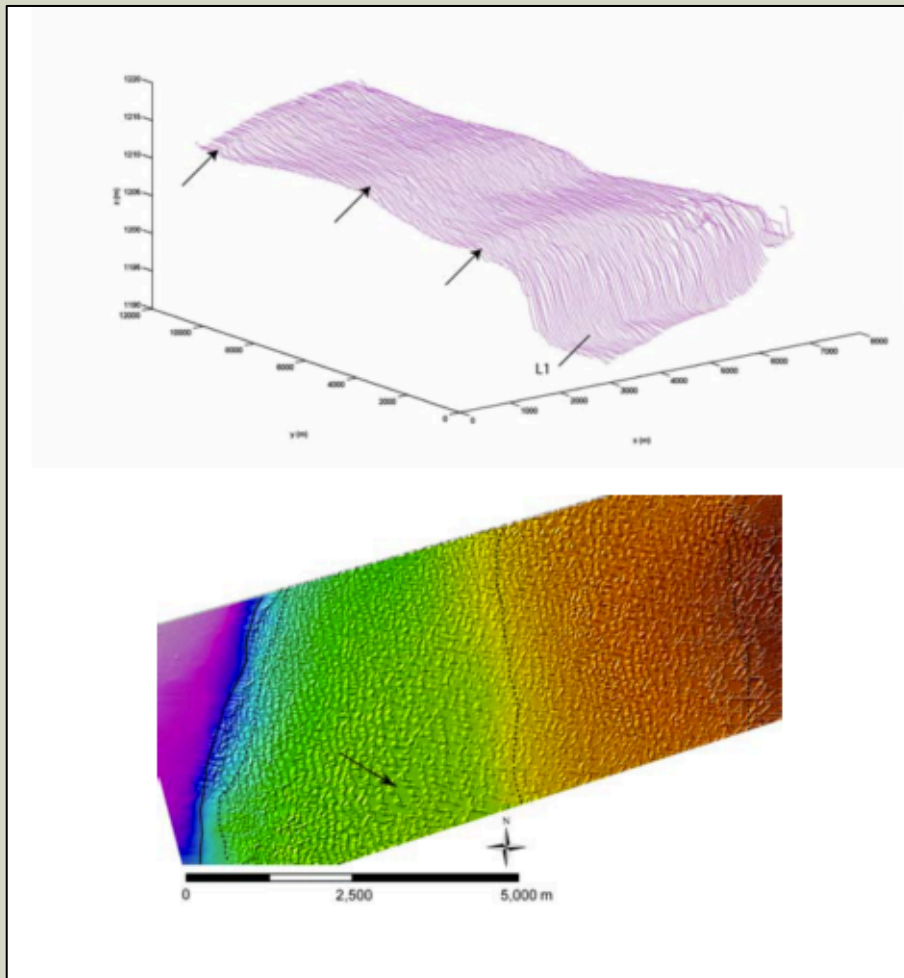


FAULT SPLAY/ GRABEN

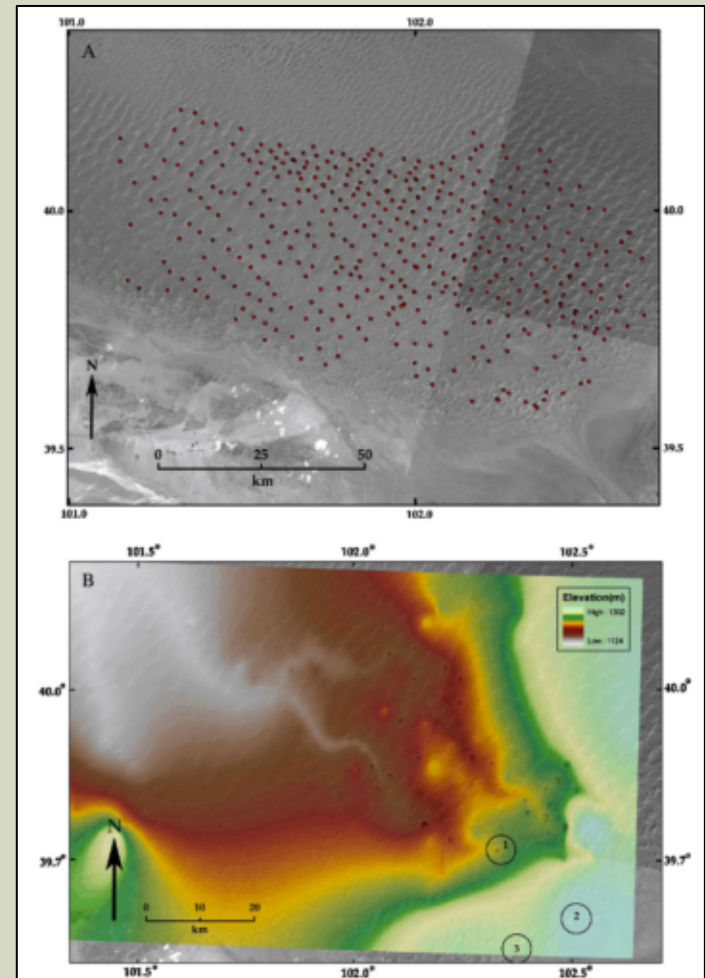


DUNE FIELD ANTECEDENT TOPOGRAPHY

PREVIOUS STUDIES



Ewing and Kocurek, 2008



Yang, et al. 2011

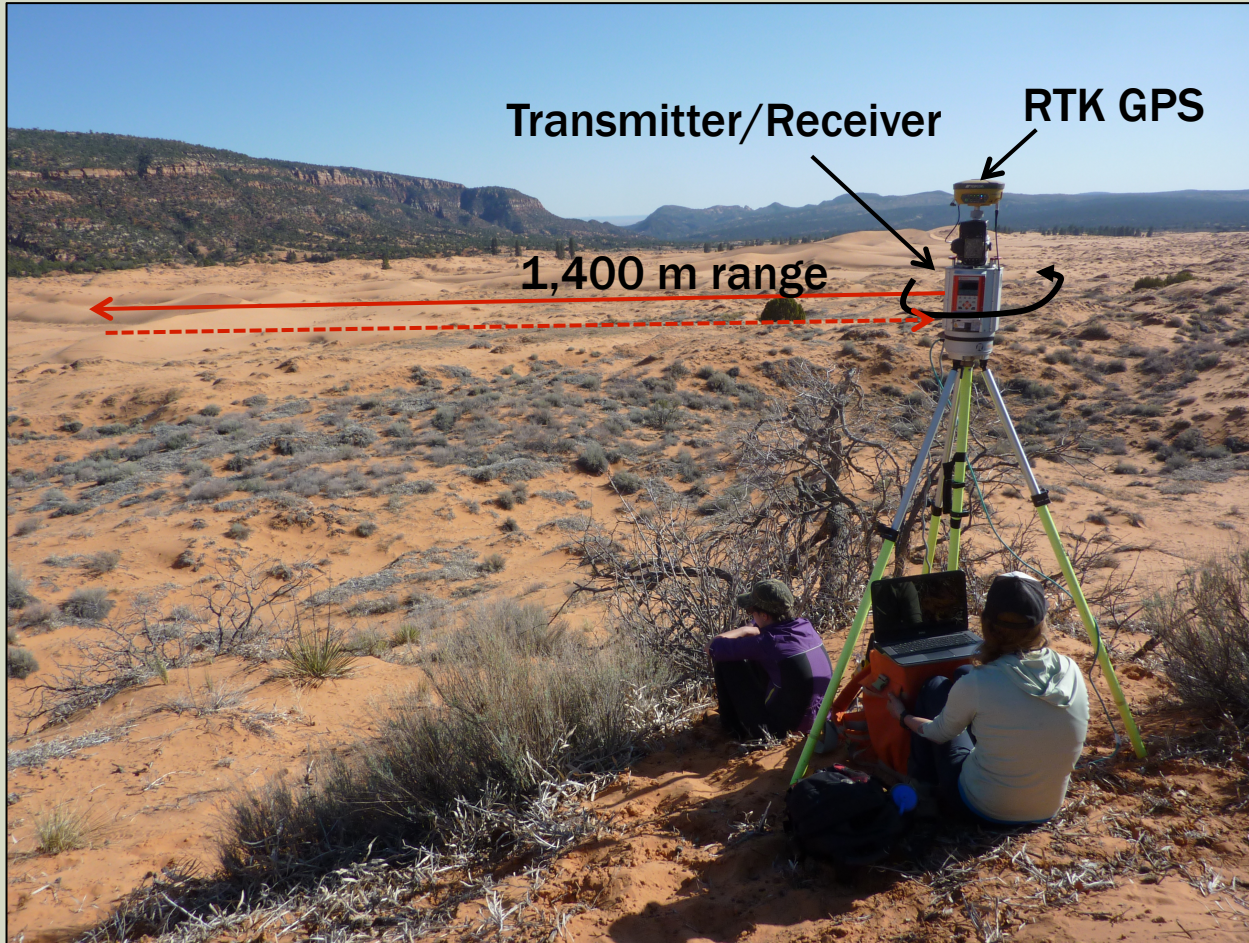
METHODS

1. Use Terrestrial Laser Scanning (TLS) to create **high resolution DEM** and ArcGIS to model **geomorphic container** and **antecedent topography**
2. Use Ground Penetrating Radar (GPR) **to image dune-bedrock interface** and identify **structural controls**
3. Determine relationships between **antecedent topography, geomorphic container, and dune patterning**

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TERRESTRIAL LASER SCANNER IN THE FIELD



RIEGL VZ-1000

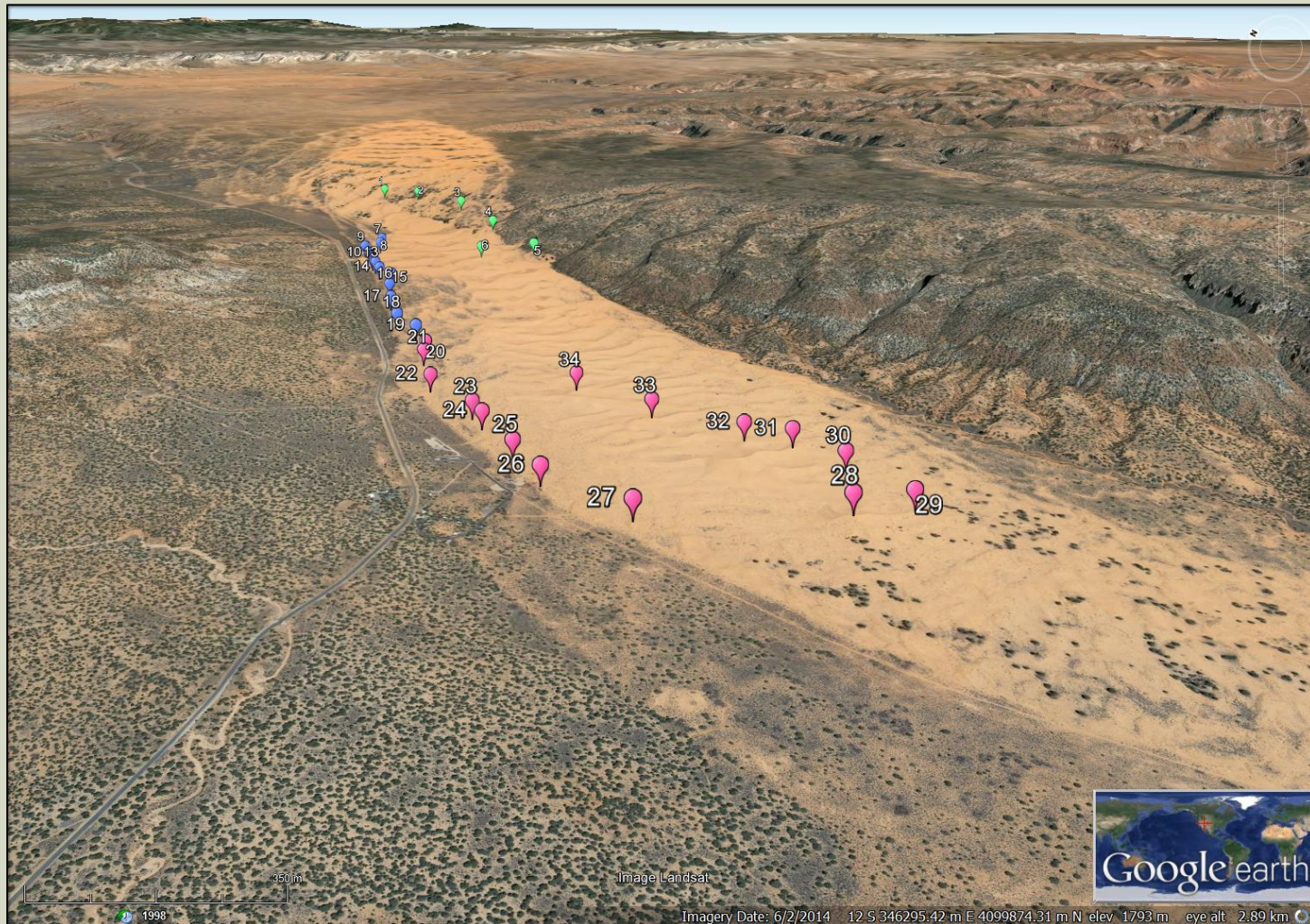
TERRESTRIAL LASER SCANNER IN THE FIELD



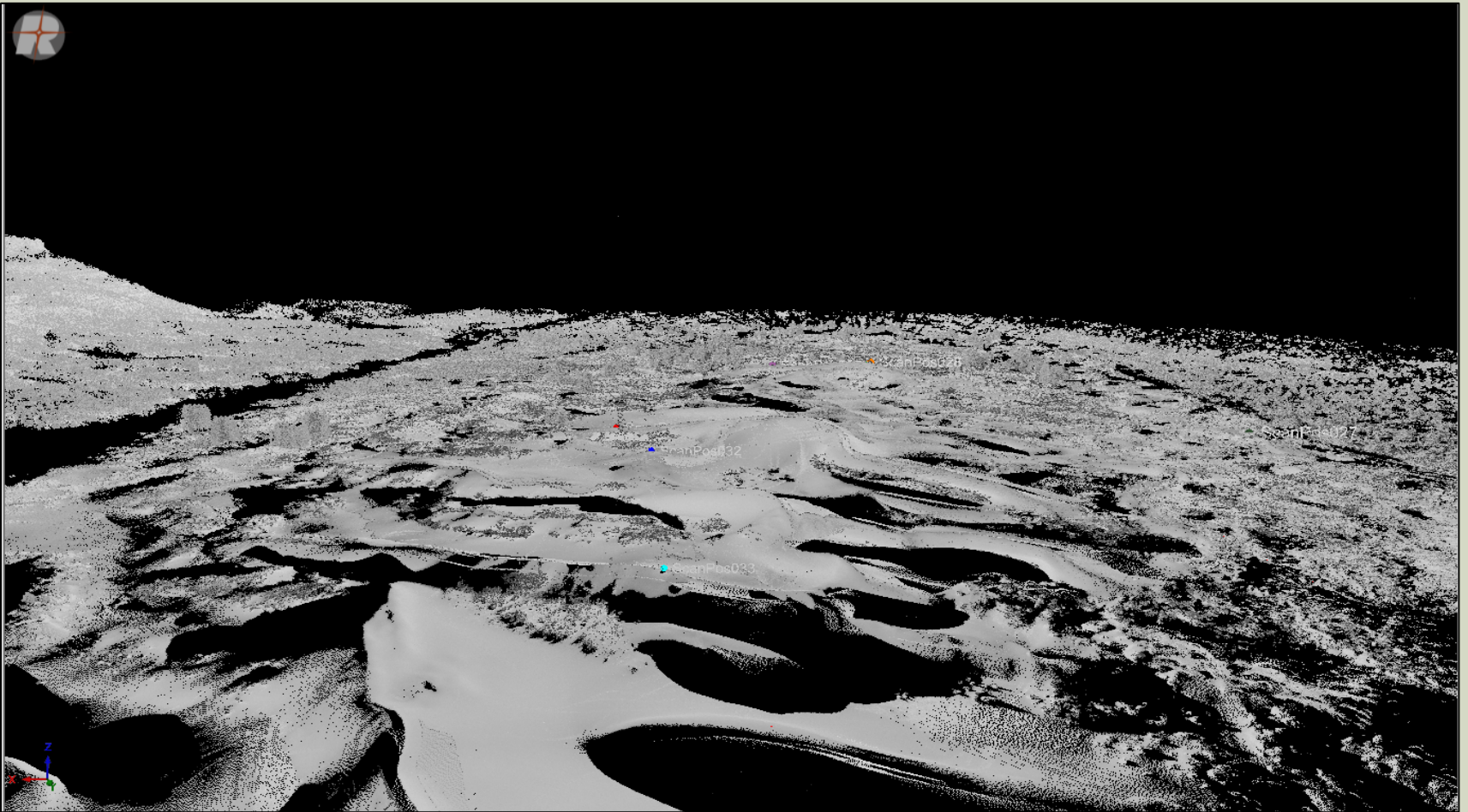
TERRESTRIAL LASER SCANNER IN THE FIELD



TERRESTRIAL LASER SCANNER SCAN POSITIONS



TERRESTRIAL LASER SCANNER IN THE LAB



TERRESTRIAL LASER SCANNER IN THE LAB



RiSCAN Pro

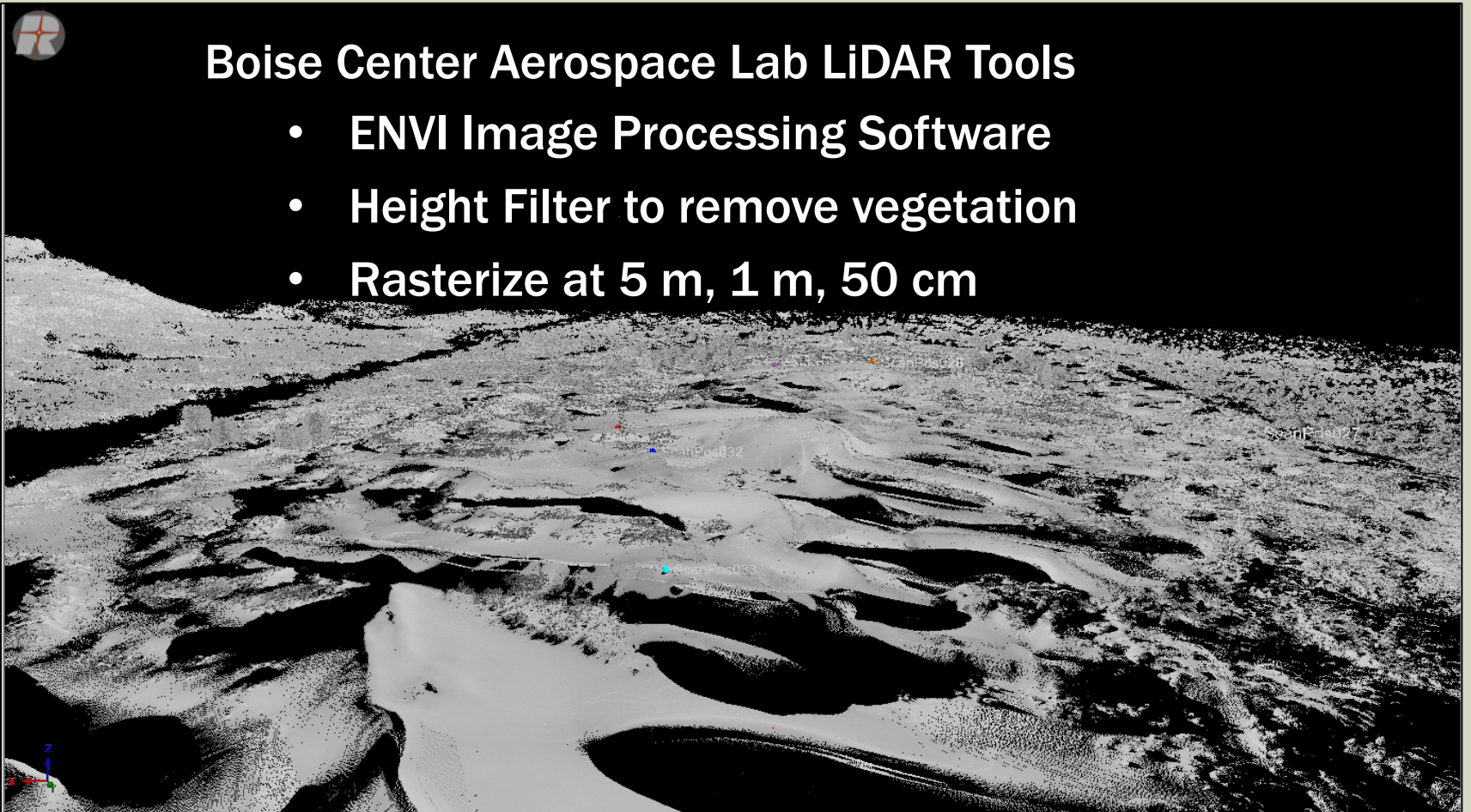
- Deviation Filter – removes least accurate returns
- 1 cm Octree Filter – removes redundant points
- Total Points: **259,464,196**



TERRESTRIAL LASER SCANNER IN THE LAB

Boise Center Aerospace Lab LiDAR Tools

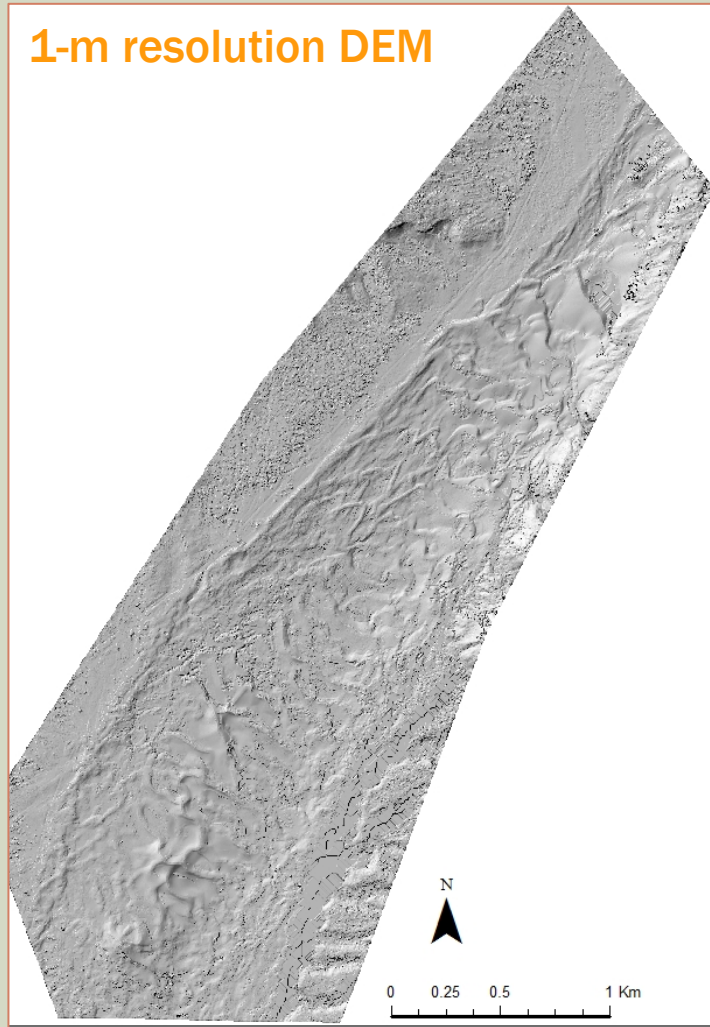
- ENVI Image Processing Software
- Height Filter to remove vegetation
- Rasterize at 5 m, 1 m, 50 cm



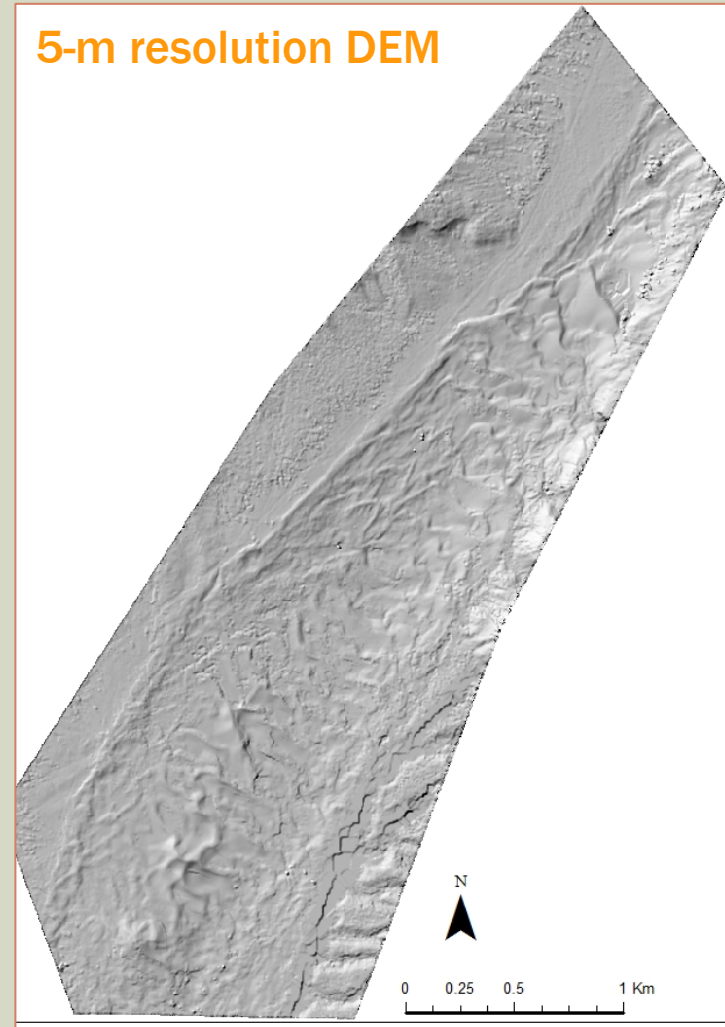
RESULTS

BARE EARTH DIGITAL ELEVATION MODELS

1-m resolution DEM



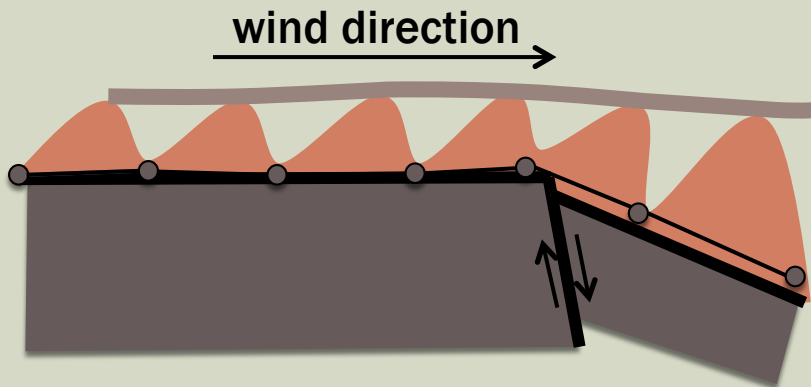
5-m resolution DEM



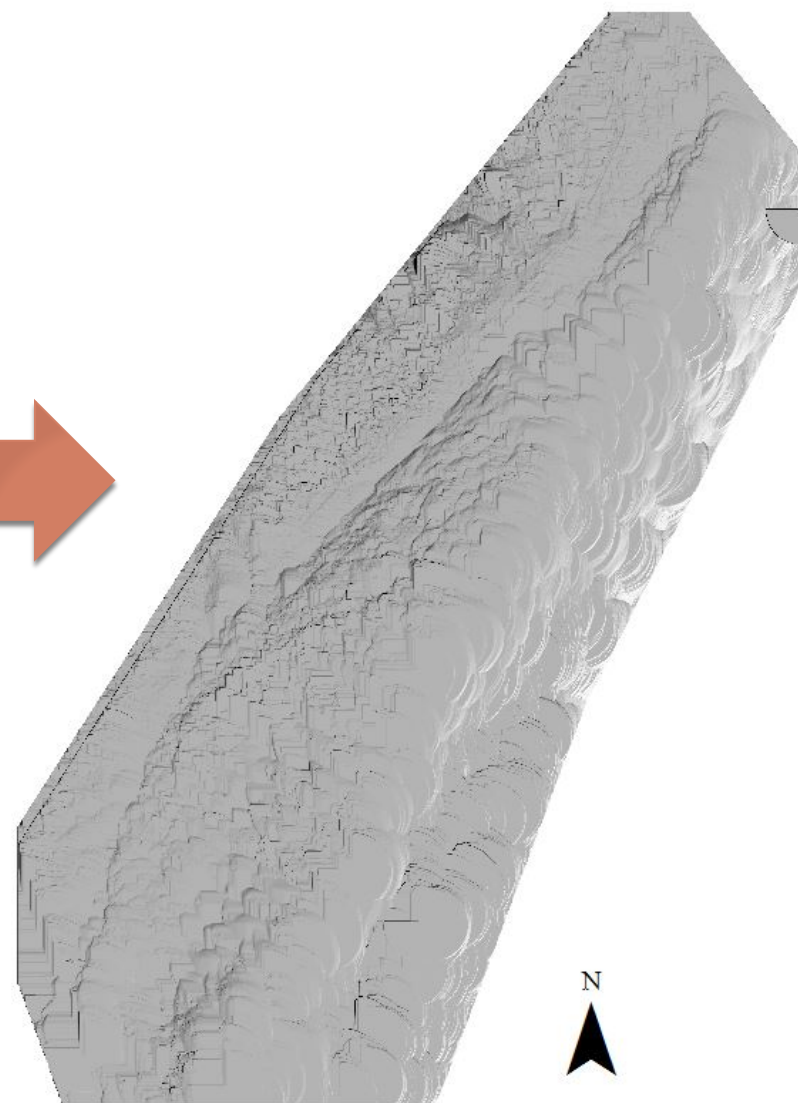
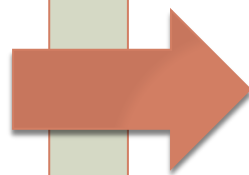
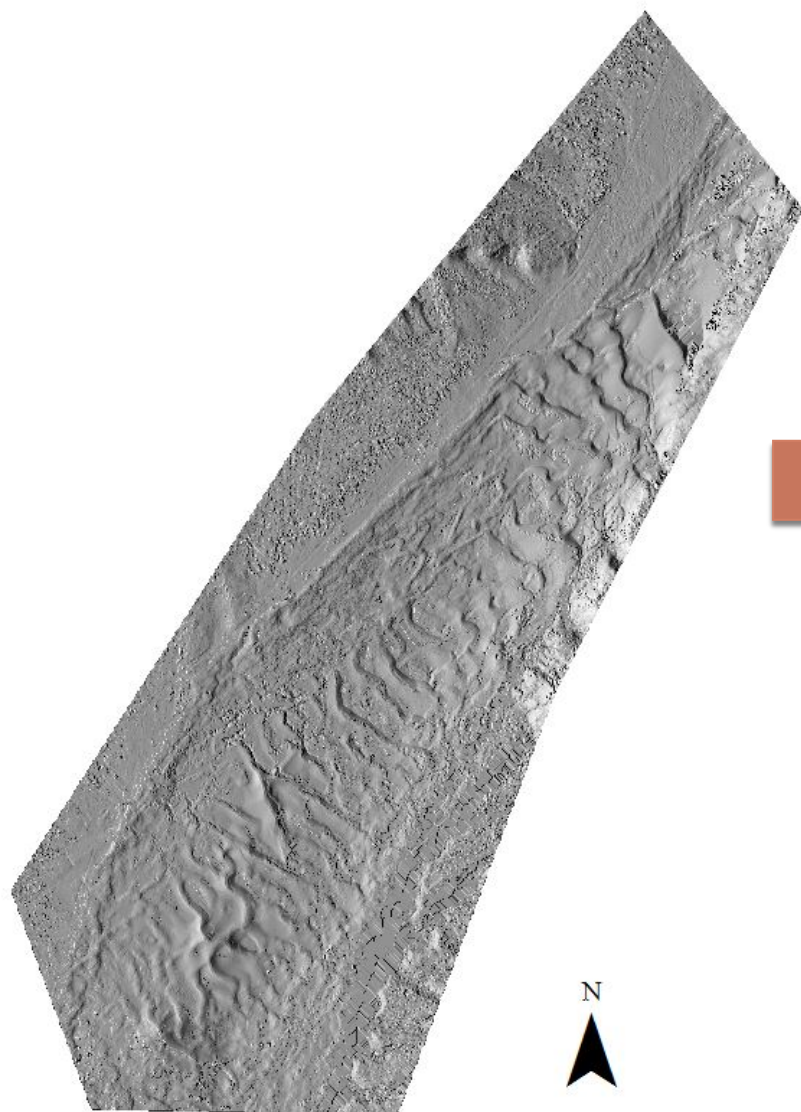
FINDING THE TREND OF ANTECEDENT TOPOGRAPHY

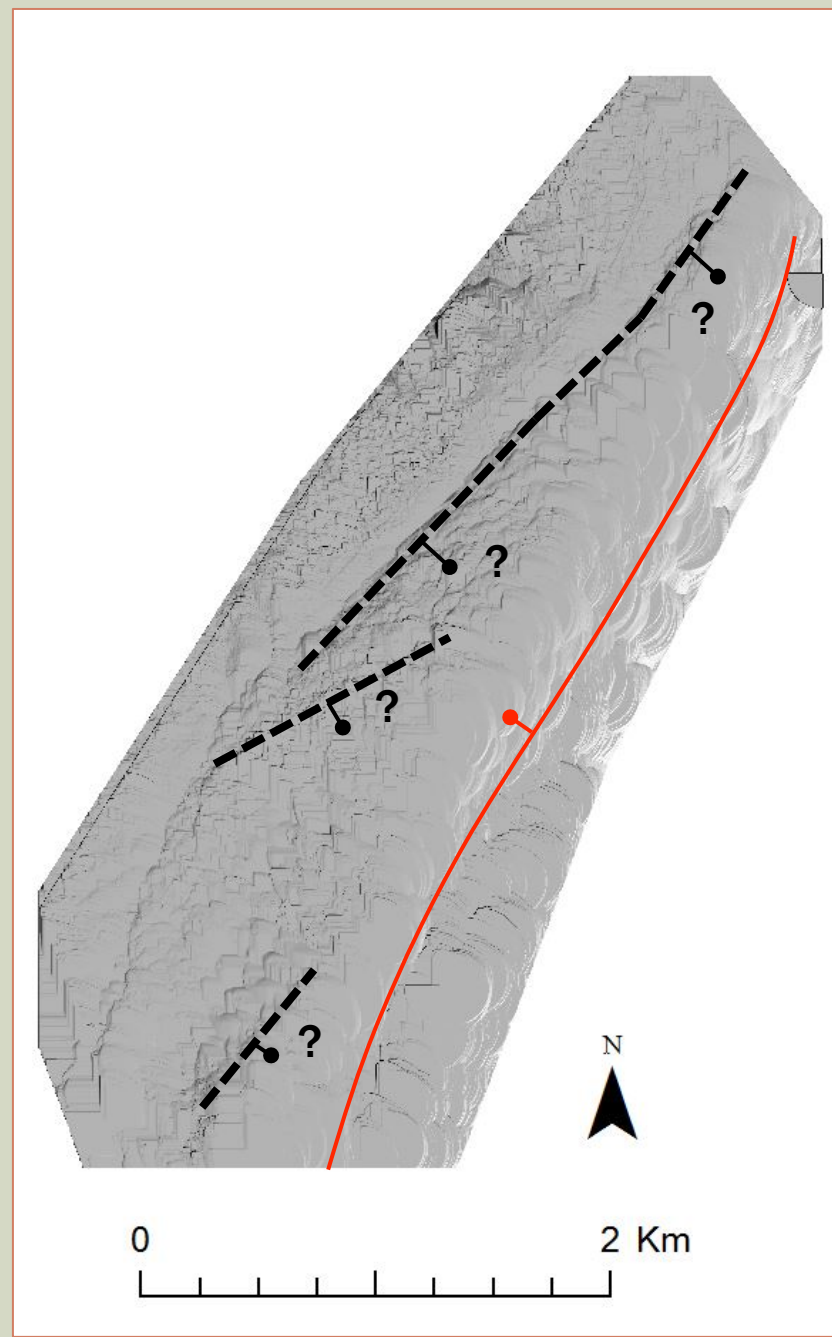
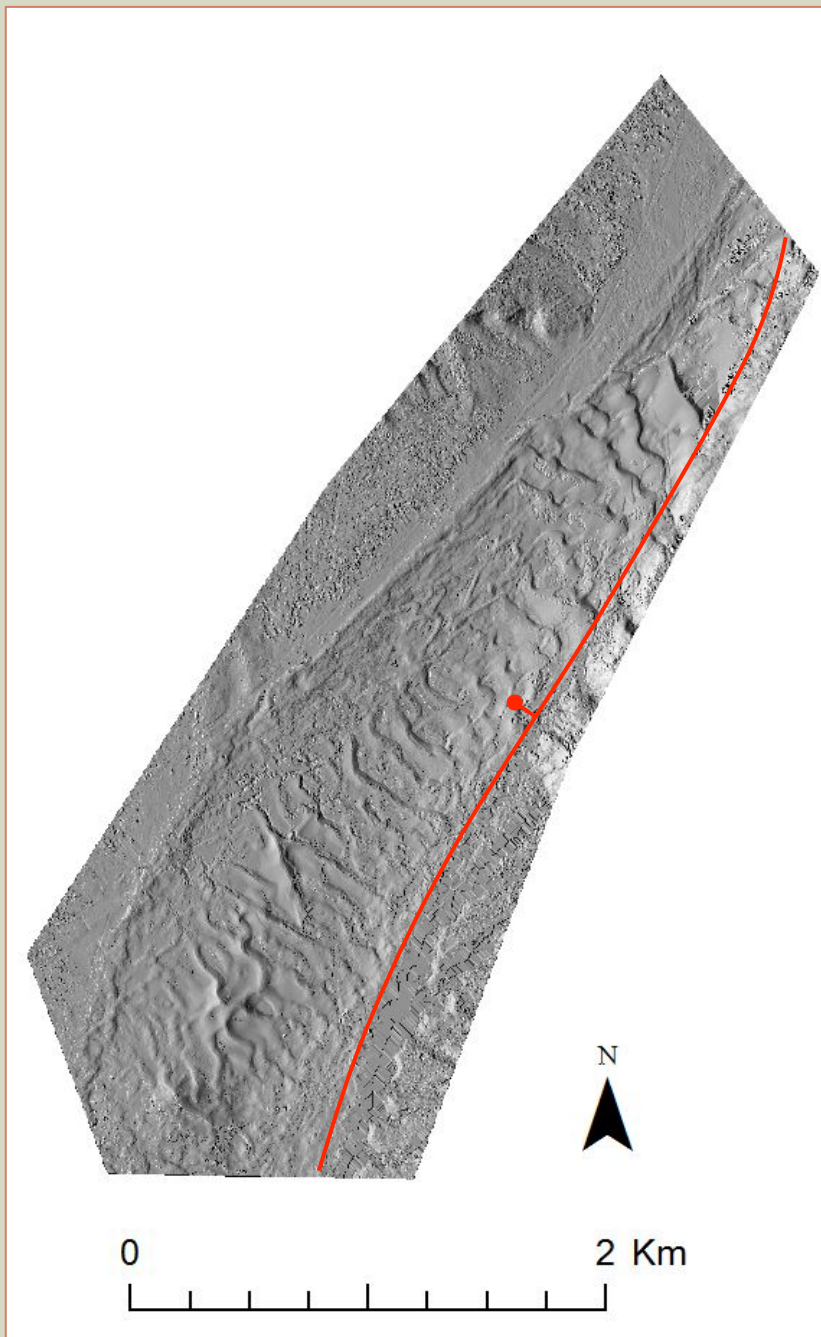
ArcGIS Focal Statistics Analysis

- Wedge-shaped window
- Radius = 150 pixels = 150 m
- MINIMUM



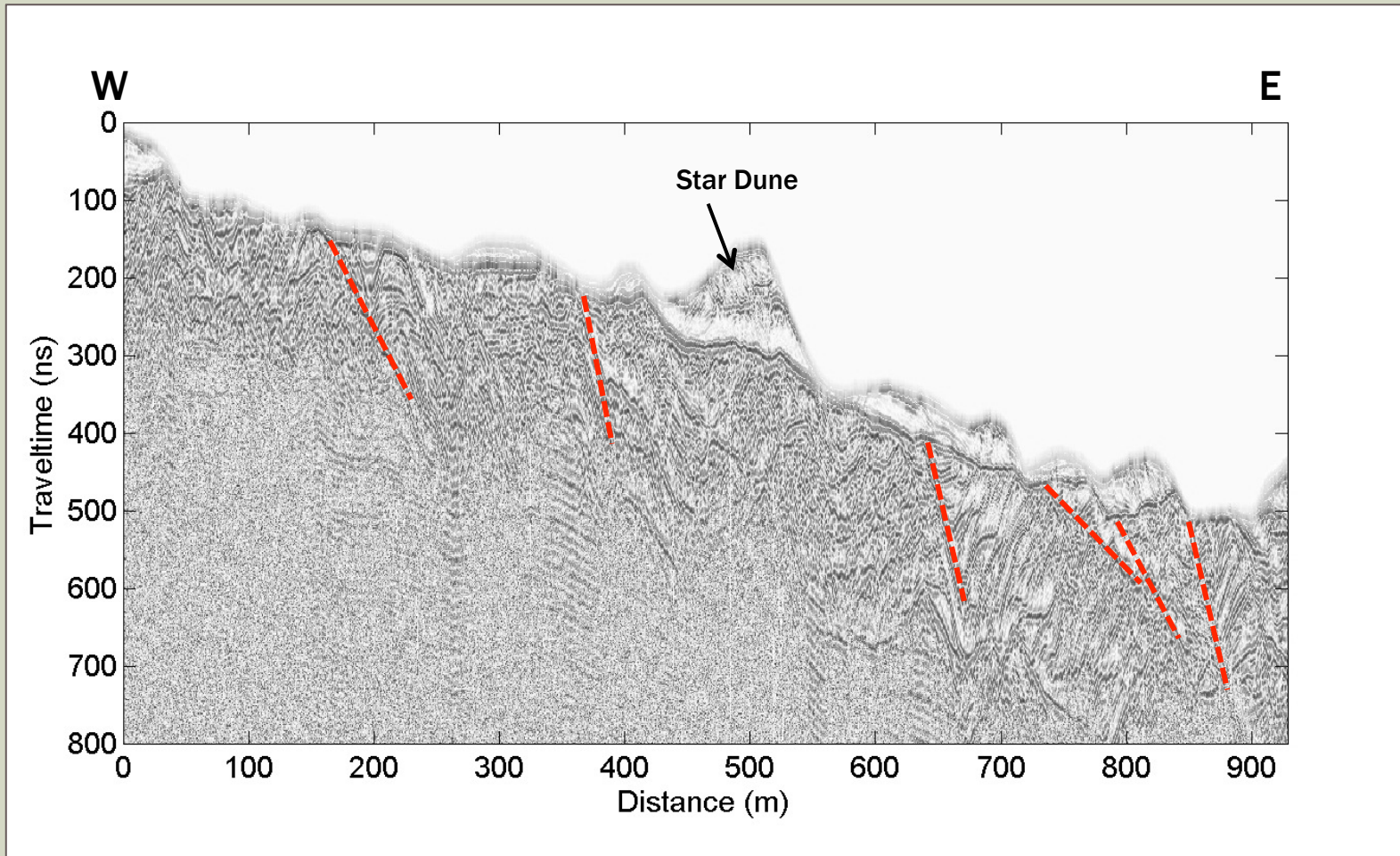
7	7	6	2	1	1	2	3	1	1
9	7	6	3	2	2	3	2	3	2
5	8	7	4	7	6	4	3	3	3
6	6	8	7	8	8	3	5	4	4
5	7	8	7	7	9	8	6	5	6
4	6	7	8	9	8	6	7	6	7
5	6	5	7	9	9	8	8	8	8
3	3	5	6	7	8	9	7	8	7
2	2	4	6	5	6	8	8	9	9
1	3	4	2	5	6	7	7	7	8





NEXT STEP

GROUND PENETRATING RADAR



SUMMARY

- The Coral Pink Sand Dunes may be contained in a graben and this structural control may contribute to dune patterning
- TLS is capable of producing high-resolution DEMs for small scale dune fields
- GPR is looking promising for locating structural controls
- For more GPR fun see my poster at AGU!



THANK YOU!



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Personal and Technical Support

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- **Field Team:** Claire Ostwald, Cody Black, Amy Cutter, Shyloh Cutter, Ian Privette

QUESTIONS?

