Can we improve dust prediction using new metrics of desert soil stability?

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USDA
United States Department of Agriculture
Natural Resources
Conservation Service

Improving Dust Prediction

1. *Phase 1*: Intensive sampling near Picacho Peak (MM 223-225) to identify and "calibrate" best soil predictors of dust emission multiple times during the year

2. *Phase 2*: Extensive sampling across Arizona to test broad applicability of dust predictors

Improving Dust Prediction

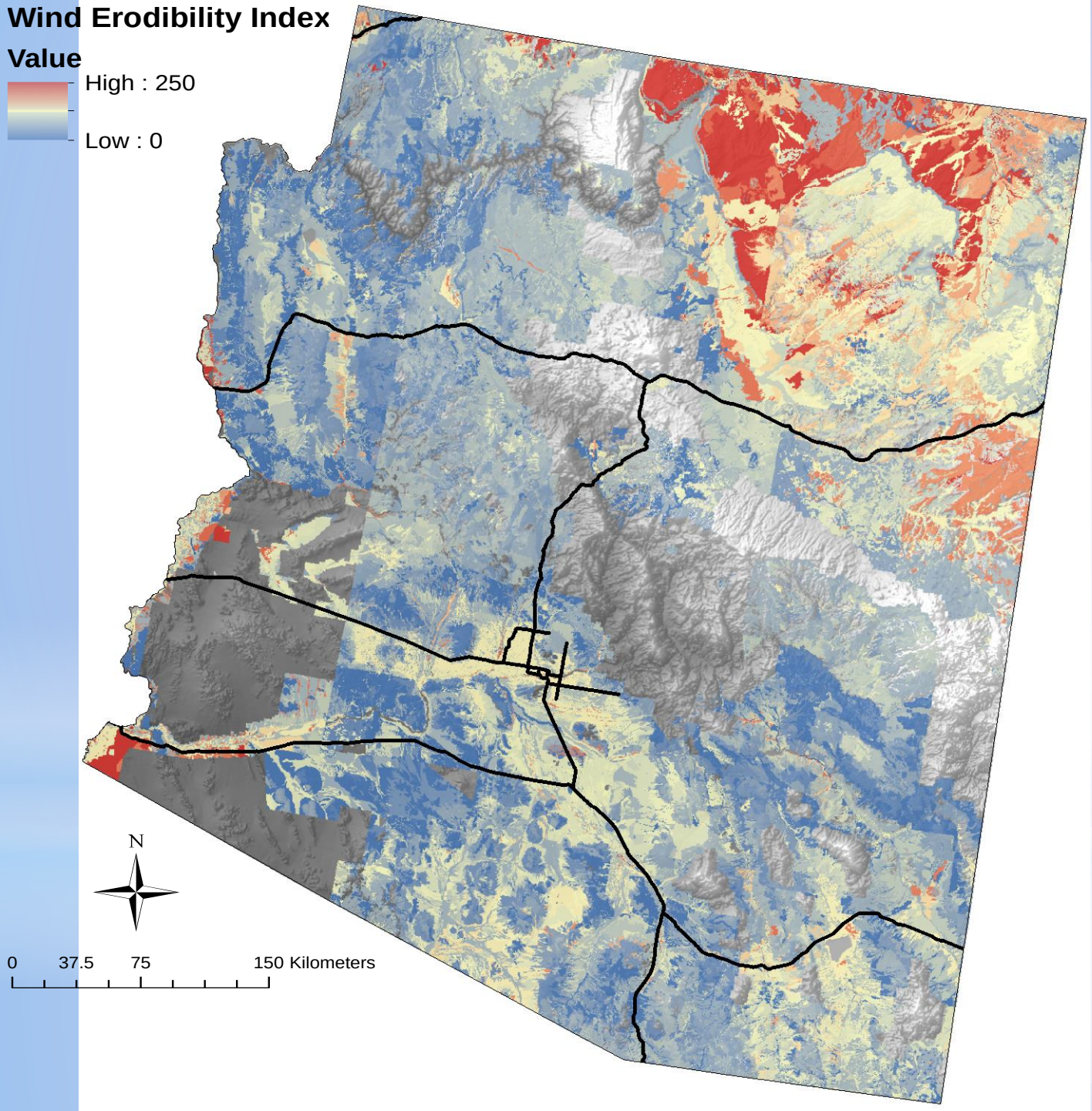
3. *Anticipated products*:

a) New **Dust Risk Index** based on actual dust emission and new mechanistic predictors that can be integrated with geospatial data and dust models.

b) Set of **guidelines** for NRCS to incorporate “ground truthed” dust risk into Ecological Site Description (ESD) framework for scaling up.

c) New **map** identifying current and future high-risk landscapes to target dust monitoring, warning, and mitigation.

d) Scientific **publications** to improve our understanding of potential dust production sites and communicate findings to stakeholders.



Wind erodibility index (WEI) from the Arizona gSSURGO database. WEI values reported are component weighted averages by map unit; note incomplete gSSURGO coverage, background is 30 m DEM, and national highway system overlay.

WEI is based on:

- Soil texture
- Dry soil aggregates
- Total soil organic carbon
- Calcium carbonate

WEI is not based on:

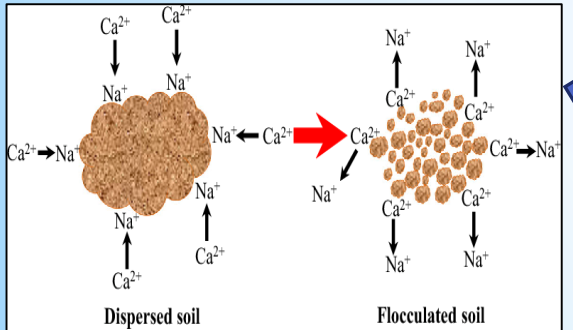
- Soil or plant biology
- Actual measurements of dust emission

Developing new mechanistic predictors of soil stability and susceptibility to wind erosion

1. Soil water content

2. Water-stable soil aggregates

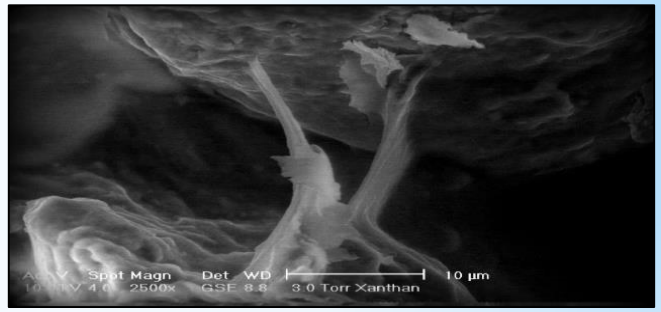
3. Dispersible soil cations



Measured dust production and threshold friction velocity

?

4. Soil microbial “glues”

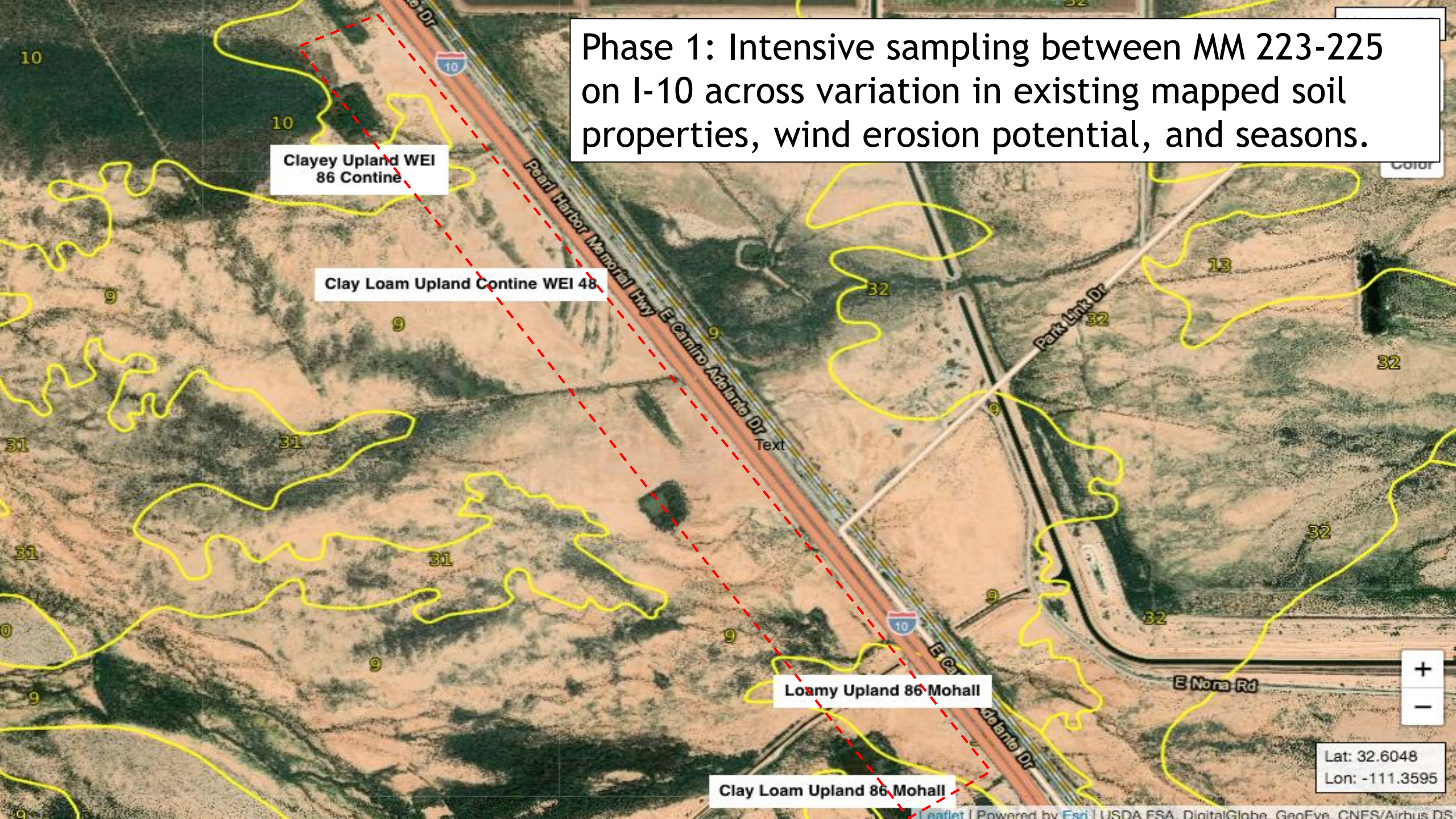


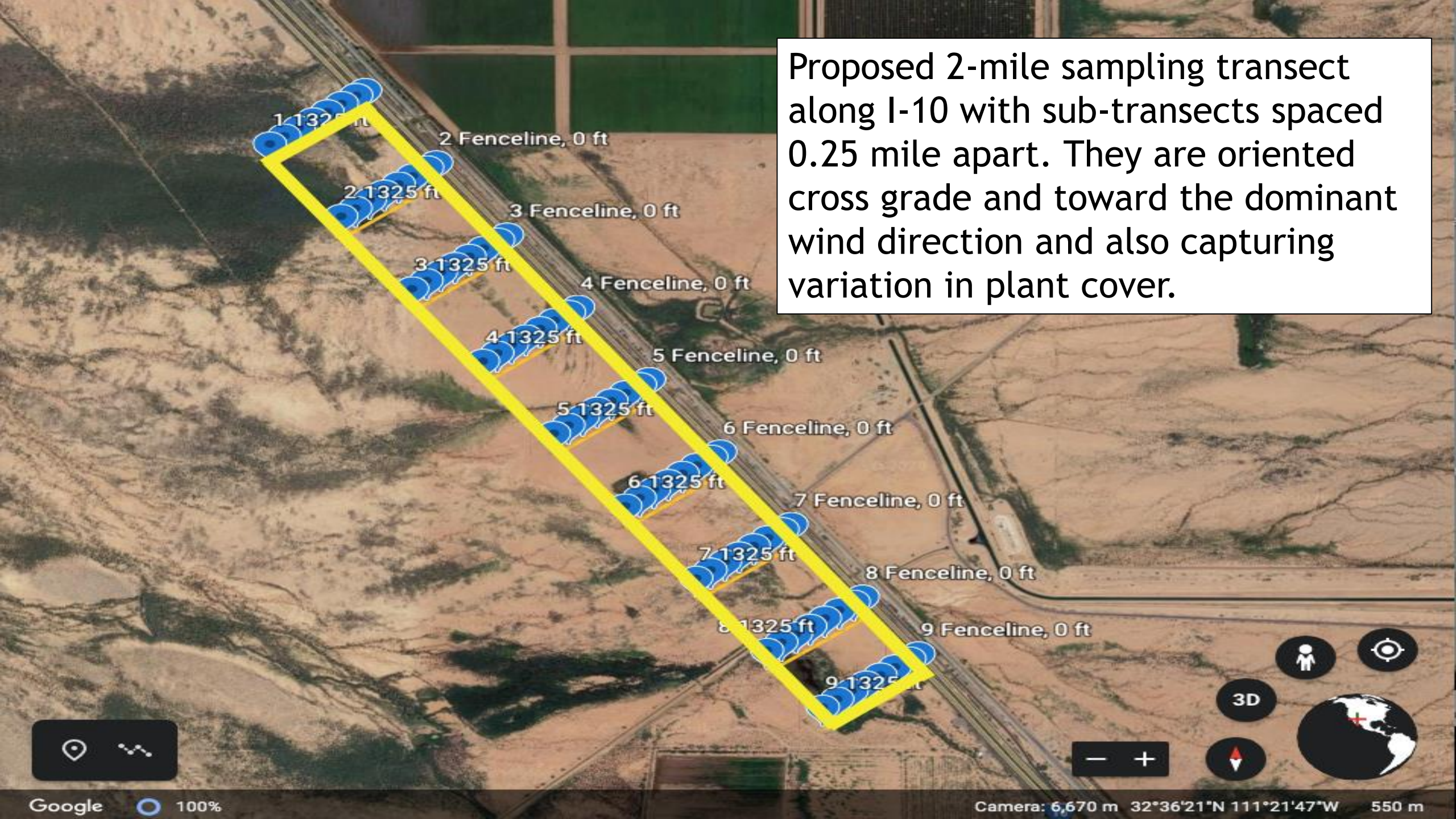
5. Soil biocrust cover and type

6. Plant species/population dynamics

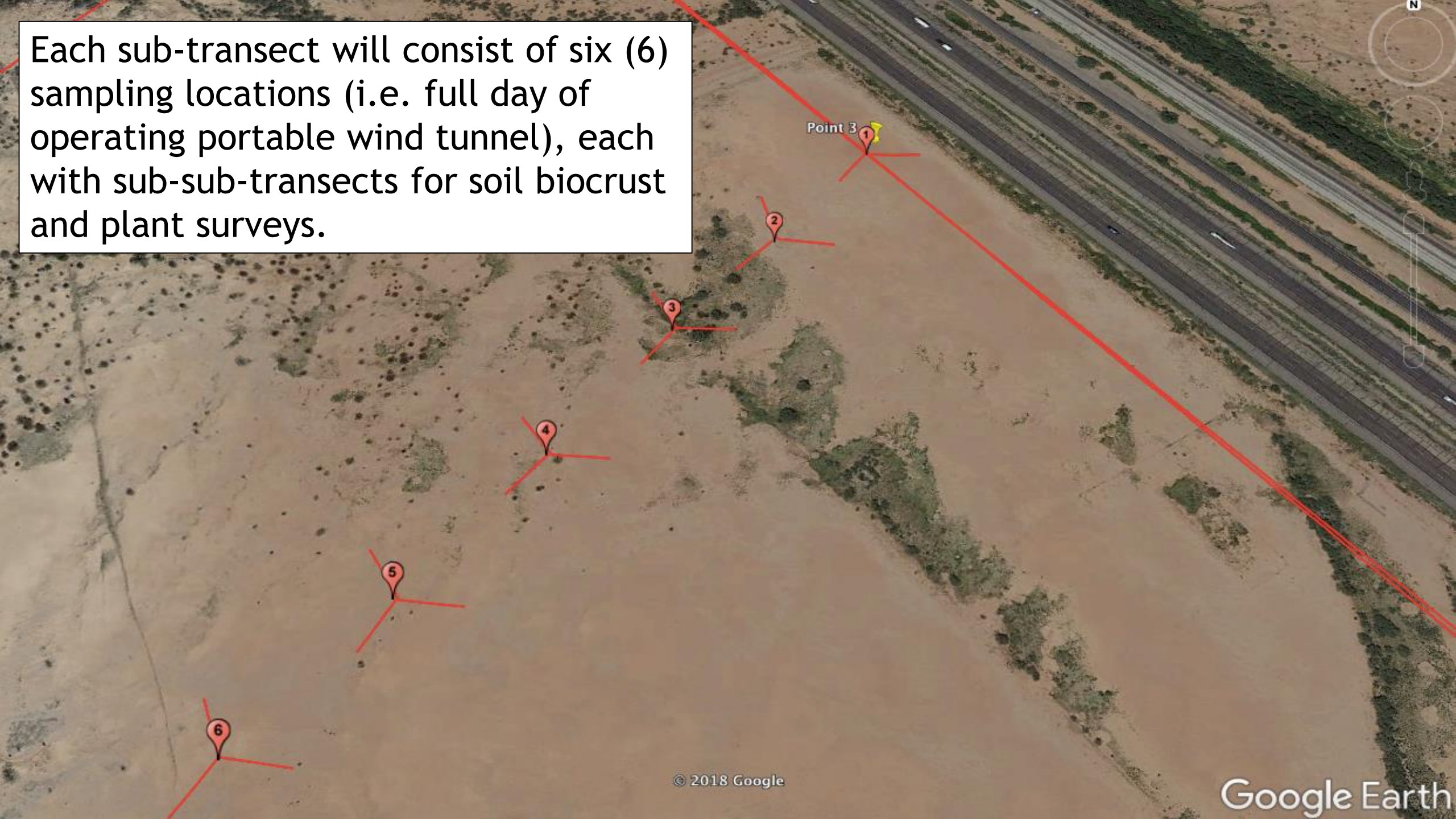
Points show where the dust-related crashes were greater than 5% of the total crashes according to ADOT data.

★ >5% of crashes due to dust


Phase 1: Intensive sampling between MM 223-225 on I-10 across variation in existing mapped soil properties, wind erosion potential, and seasons.
Clayey Upland WEI 86 Contine
Clay Loam Upland Contine WEI 48
Loamy Upland 86 Mohall
Clay Loam Upland 86 Mohall
Pearl Harbor Memorial Hwy
E Camino Adelante Dr
Park Link Dr
E Nora Rd
Text
Lat: 32.6048
Lon: -111.3595
Leaflet | Powered by Esri | USDA FSA, DigitalGlobe, GeoEye, CNES/Airbus DS



Proposed 2-mile sampling transect along I-10 with sub-transects spaced 0.25 mile apart. They are oriented cross grade and toward the dominant wind direction and also capturing variation in plant cover.


Each sub-transect will consist of six (6) sampling locations (i.e. full day of operating portable wind tunnel), each with sub-sub-transects for soil biocrust and plant surveys.
Point 3
1
2
3
4
5
6
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*Future Data Analyses

One Possibility:

- Regression with dust emission/threshold friction velocity on the y-axis and all potential predictors on the x-axis.
  - High R2 values and steep slopes will indicate the strongest predictors.
- We can run multiple analysis to identify the best combination of predictors.

- **Anticipated results from data analyses:**

- To build and calibrate a model for Picacho Peak that can be used at other locations.

- To identify an inexpensive proxy for actual dust emission.

- **As a land manager would you rather:**

- Rely on a simple procedure (ie. wet sieving, dispersible cation test…) OR continue using the more complex measurements required for WEI?

*Feedback Requested

* For any land managers or stakeholders working with land managers, will more accurate methods to predict dust be relevant/useful to the decisions you have to make regarding land use?

* Do you have any relevant observations from experience with dust in Arizona that you would like to see answered or addressed in this project?

* Any other feedback is greatly appreciated!