Development of a Dust Hazard Interpretation from SSURGO Data

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Background

- The BLM California State Office approached NRCS for assistance in rating soils for dust emission potential from off-highway vehicles (OHV's)
- NRCS California soils staff requested assistance from the NRCS West National Technology Center soil scientist in the development of a dust emission potential soil interpretation using SSURGO data.

Prior Research – University of California, Davis

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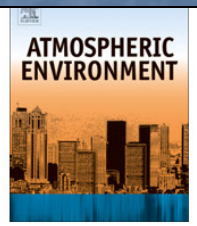

Soil water and particle size distribution influence laboratory-generated PM_{10}

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Laboratory System for Dust Generation from Soils

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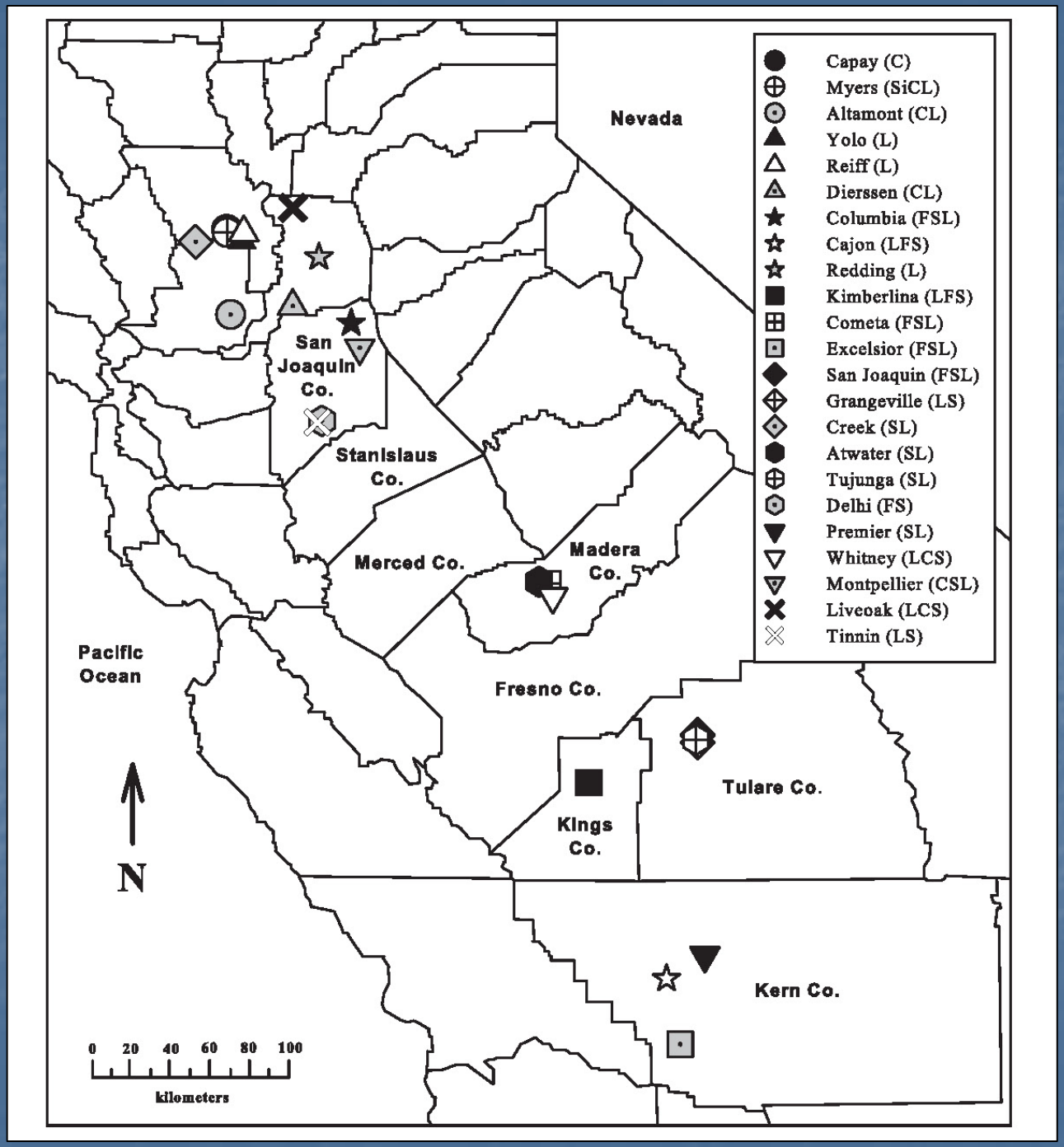
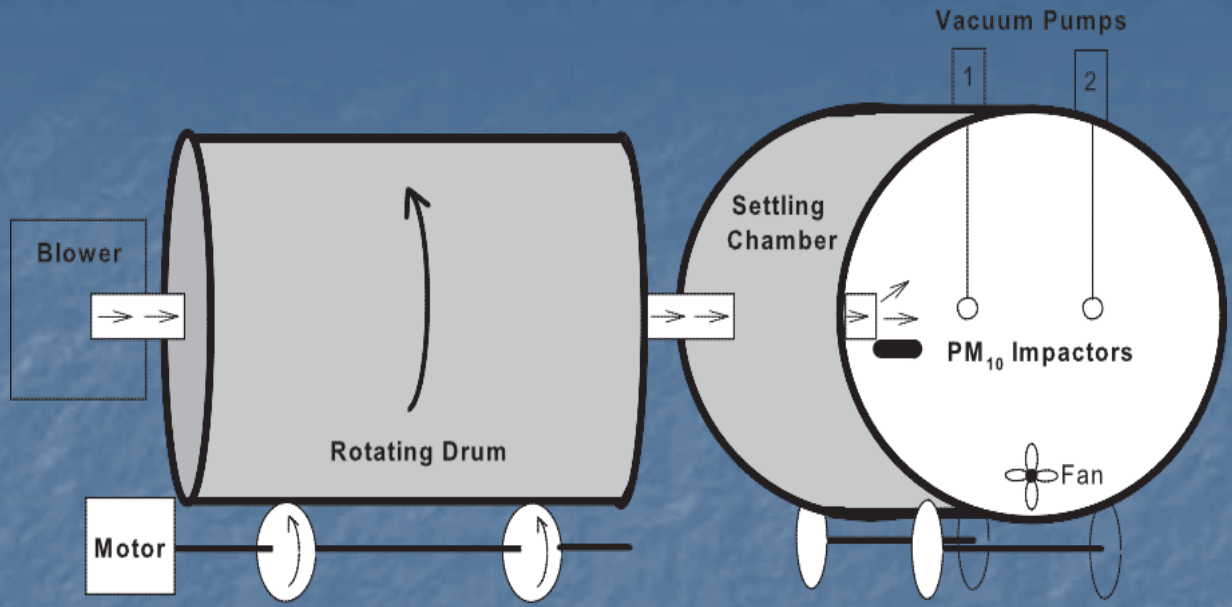
Samples were collected from the surface horizons of 23 soil series in the Central Valley of California.

Textures ranged from clay to loamy coarse sand and fine sand.



UC Davis Laboratory Dust Generator



Equivalent Gravimetric Water Content

$$E_{GWC} = \frac{GWC_x}{GWC_{x(1500)}}$$

Where:

GWC_x = gravimetric water content of a soil "x" at a particular water treatment

$GWC_{x(1500)}$ = gravimetric water content of soil "x" at -1500 kPa

Equivalent Gravimetric Water Content for Dust Generator

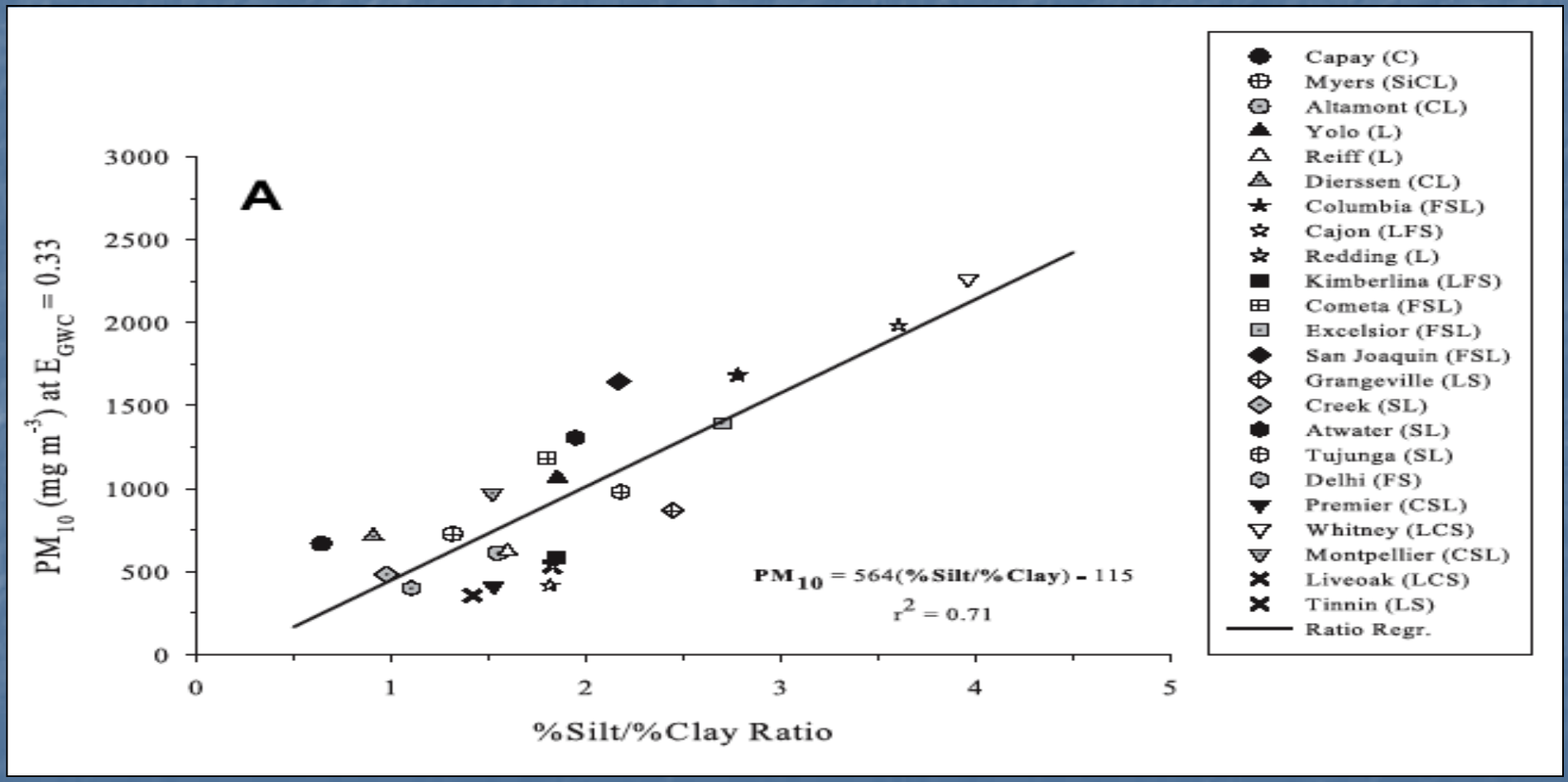
$$E_{GWC} = \frac{GWC_x}{GWC_{x(1500)}}$$

$$= 0.33$$

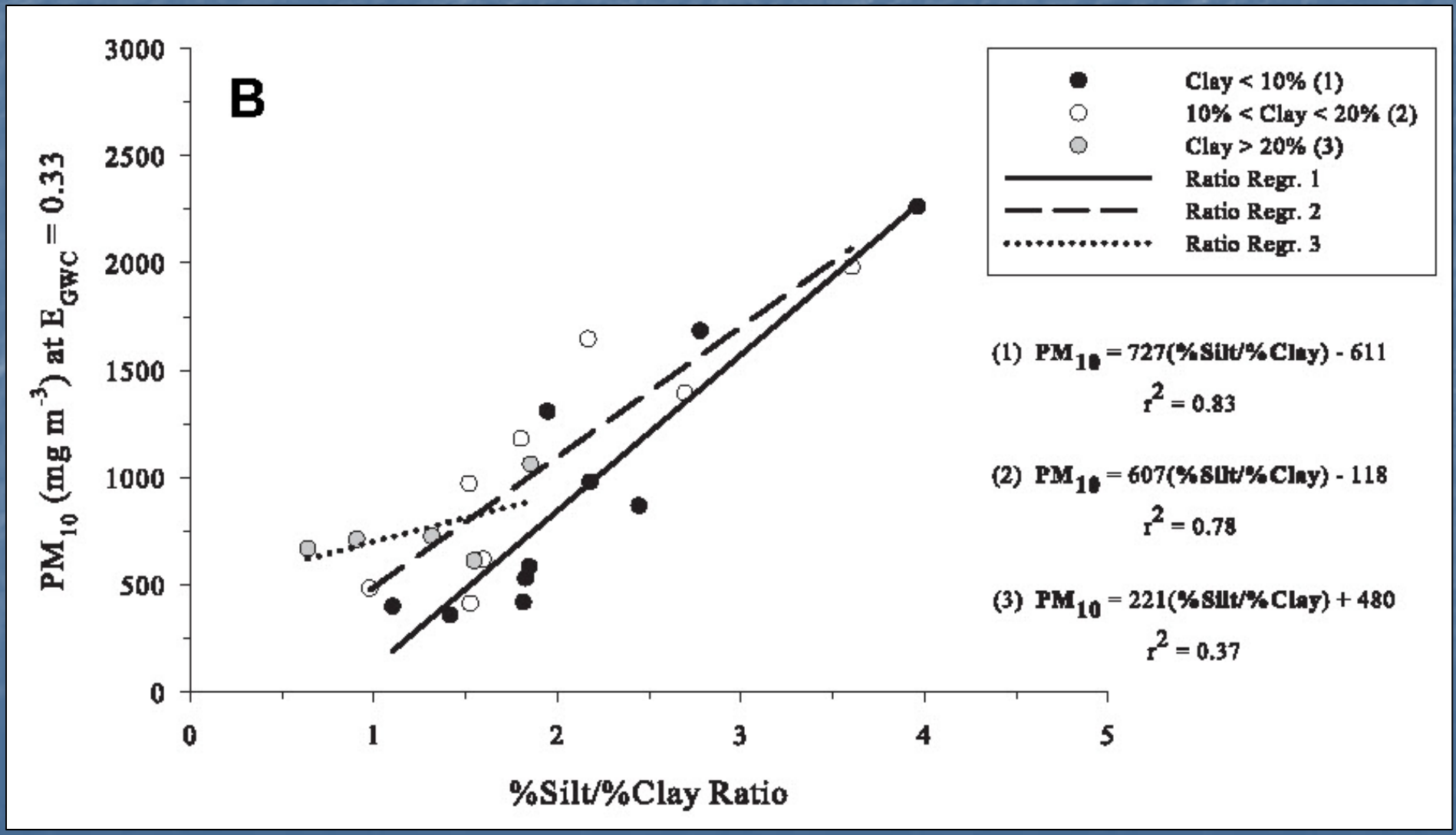
Covariance of PM_{10} Concentration with Various Soil Physical Parameters

Parameter	Covariance
Percent sand	-0.007
Percent very fine sand	0.01
Percent silt	0.09
Percent silt + very fine sand	0.11
Percent clay	-0.024
Percent < 100 μm (very fine sand and finer)	0.013
Percent ratio clay to ≤ 10 μm	-0.48
Percent ratio silt to clay	**0.71**
Weighted mean particle diameter	-0.001

Covariance of PM_{10} Concentration with %Silt / % Clay Ratio – All Soils



Covariance of PM_{10} Concentration with %Silt / % Clay Ratio – Separated by Clay Contents <10, 10-20, >20%



Covariance of PM_{10} Concentration with %Silt / % Clay Ratio

- < 10 Percent Clay

  $PM_{10} = 727(\%\ silt\ /\ \%\ clay) - 611$ $r^2 = 0.83$

- 10 – 20 Percent Clay

  $PM_{10} = 607(\%\ silt\ /\ \%\ clay) - 118$ $r^2 = 0.78$

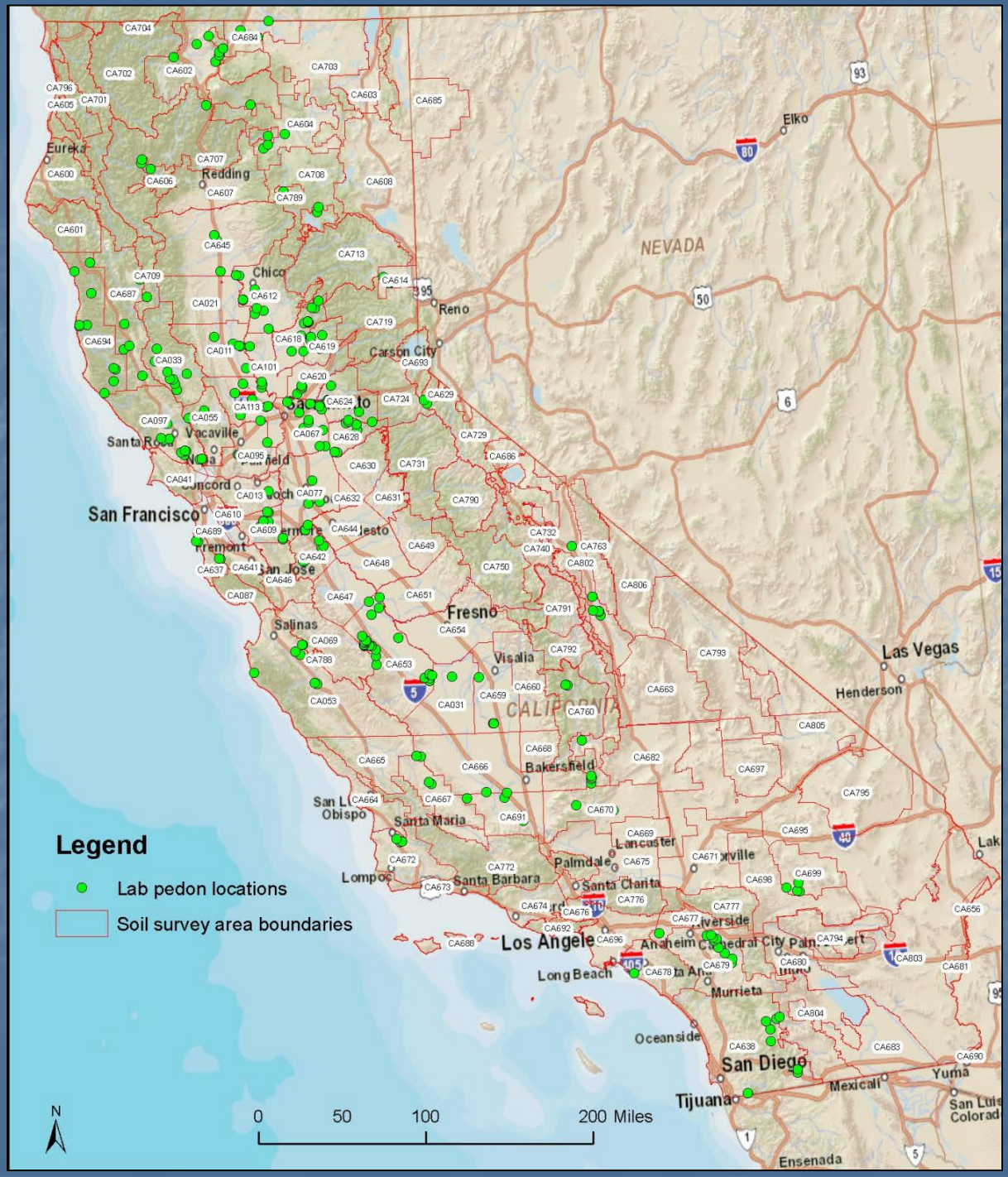
- > 20 Percent Clay

  $PM_{10} = 221(\%\ silt\ /\ \%\ clay) - 480$ $r^2 = 0.37$

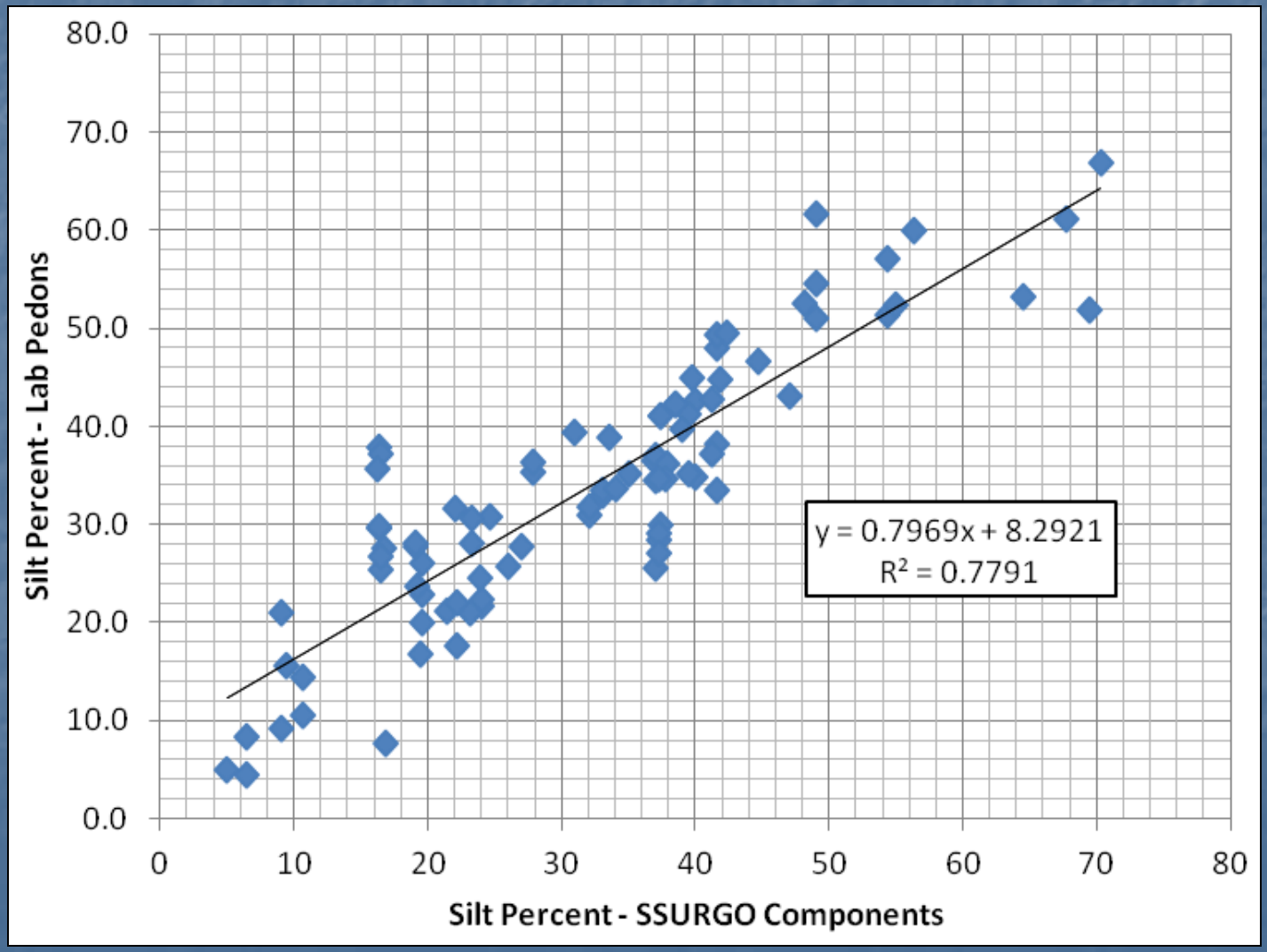
Development of Dust Hazard Interpretation using UC Davis Research Results

- Compare particle-size data from the National Soil Survey Lab to SSURGO particle-size data for soil mapunit components
- Test the dust hazard ratings in selected soil survey areas in Southern California

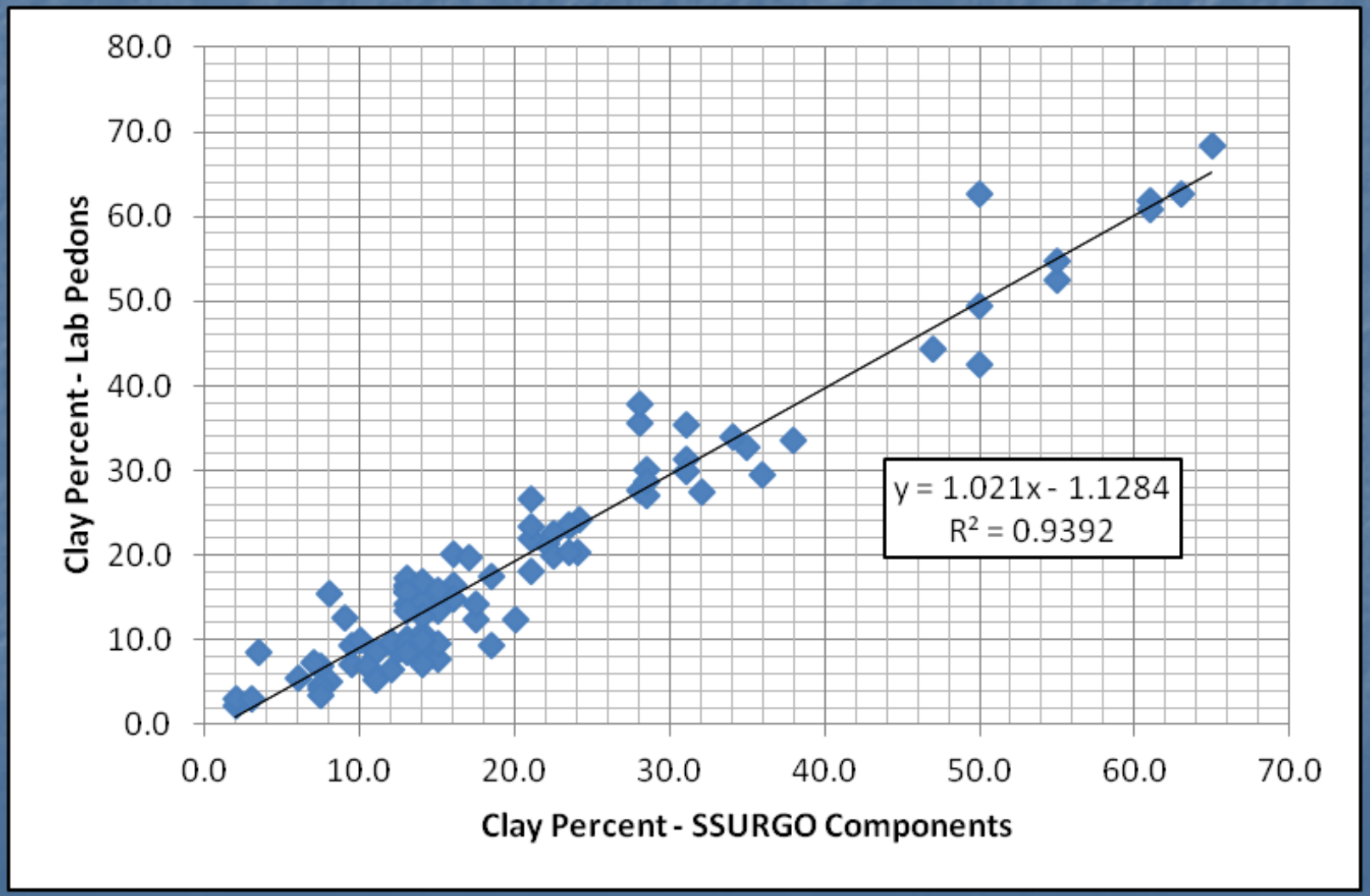
Lab pedons where the correlated taxon name matches a component name in the SSURGO polygon where it is located, and the lab texture of the surface horizon matches the SSURGO component surface texture (225 pedons)



Correlation of Lab Measured **Silt** to SSURGO Mapunit Component **Silt** – 90 pedons in Central and Southern California (surface horizons)



Correlation of Lab Measured **Clay** to SSURGO Mapunit Component **Clay** – 90 pedons in Central and Southern California (surface horizons)

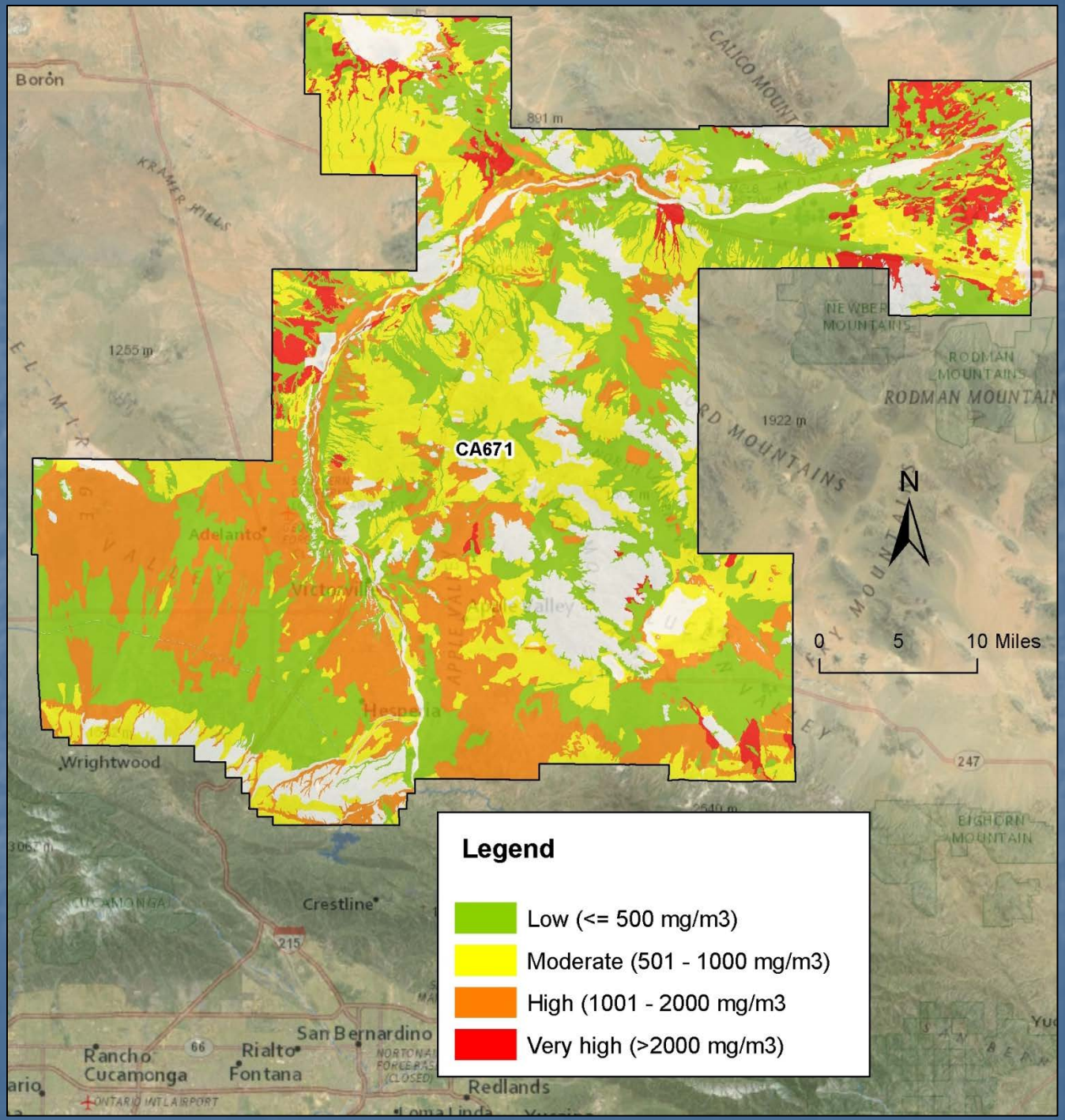


Next Step – Calculate Predicted PM_{10} Emissions from SSURGO Components using Equations from UC Davis Research

Map Unit Name	Component Name	Weighted Average Silt Content (%) 0-15 cm	Weighted Average Clay Content (%) 0-15 cm	Silt to Clay Ratio 0 - 15 cm	Predicted PM-10 Dust Emissions - UC Davis Dust Generator (mg/m^3)
ARIZO GRAVELLY LOAMY SAND, 2 TO 9 PERCENT SLOPES	Arizo	17.0	2.5	6.8	4,333
ARRASTRE-ROCK OUTCROP COMPLEX, 30 TO 50 PERCENT SLOPES	Arrastre	23.0	11.0	2.1	1,151
AVAWATZ-OAK GLEN ASSOCIATION, GENTLY SLOPING*	Avawatz	23.7	7.5	3.2	1,686
AVAWATZ-OAK GLEN ASSOCIATION, GENTLY SLOPING*	Oak Glen	19.6	13.0	1.5	797
BOUSIC CLAY	Bousic	29.0	47.8	0.6	614
BRYMAN LOAMY FINE SAND, 0 TO 2 PERCENT SLOPES	Bryman	16.1	6.0	2.7	1,340
BRYMAN SANDY CLAY LOAM, 0 TO 2 PERCENT SLOPES	Bryman	18.3	21.5	0.9	668
BRYMAN-CAJON ASSOCIATION, ROLLING*	Bryman	1.4	4.5	0.3	0
BRYMAN-CAJON ASSOCIATION, ROLLING*	Cajon	1.5	2.5	0.6	0

Draft Dust Hazard Ratings for the San Bernardino County, California Soil Survey Area

Based on weighted average total silt and total clay in the 0-15 cm depth for the dominant component



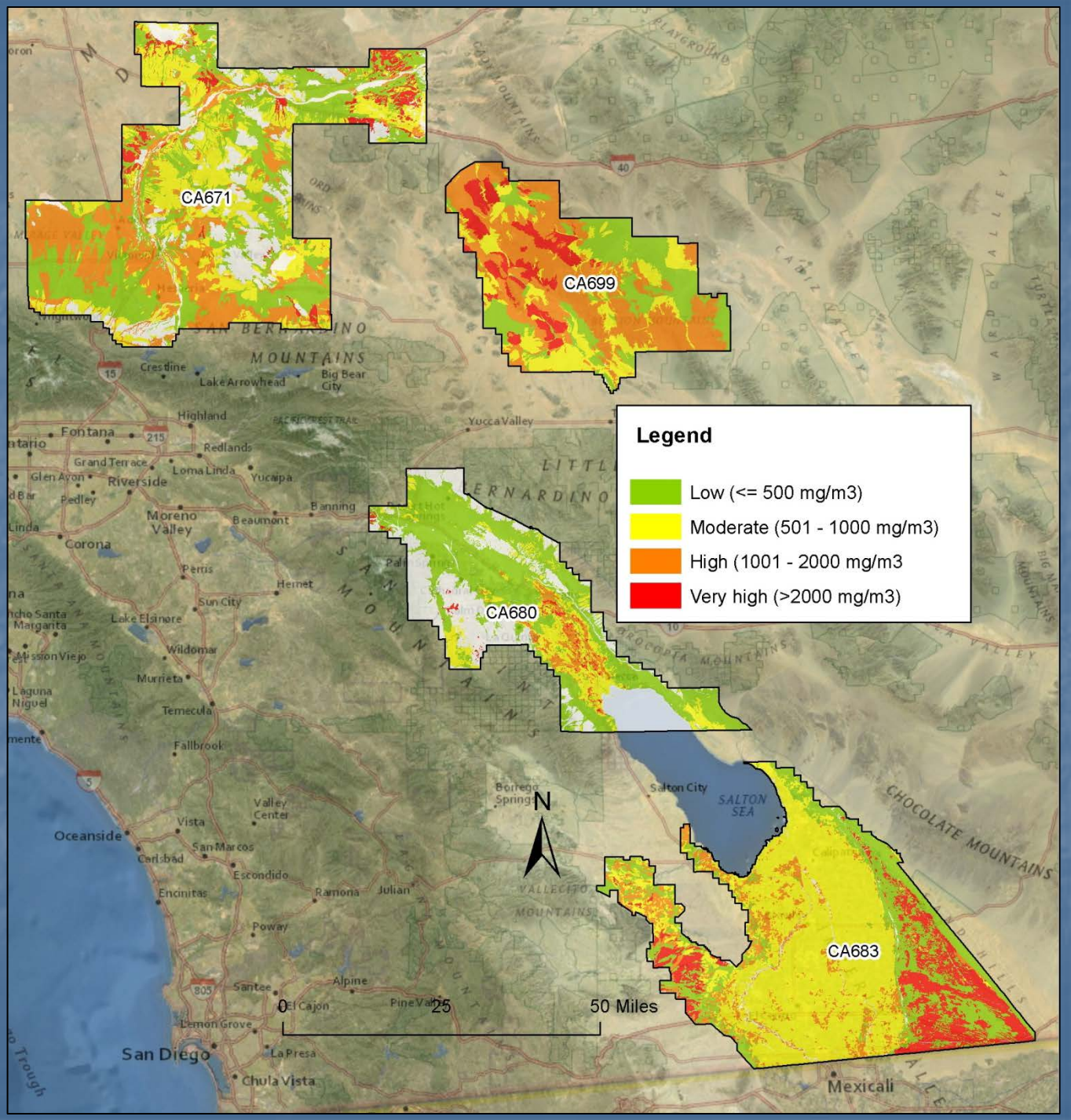
Draft Dust Hazard Ratings

CA671 – San Bernardino County, California, Mojave River Area

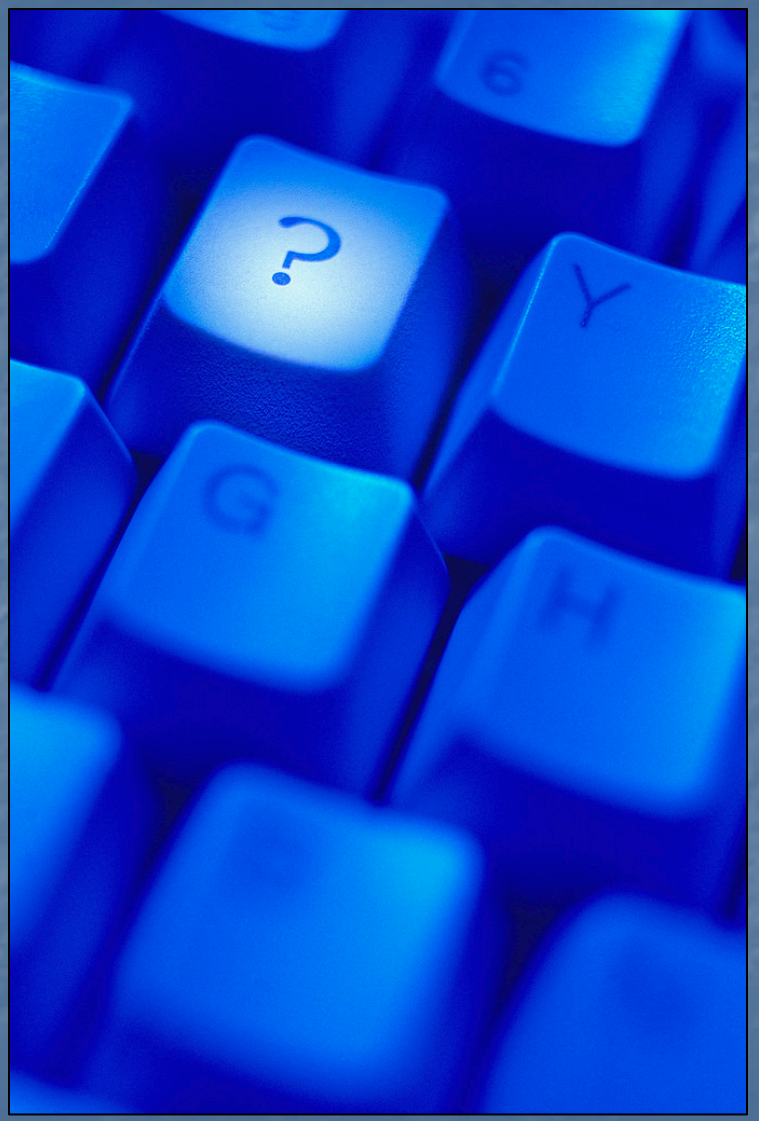
CA680 - Riverside County, Coachella Valley Area, California

CA683 - Imperial County, California, Imperial Valley Area

CA699 - Marine Corps Air Ground Combat Center at Twentynine Palms, California



Conclusions

- The UC Davis dust generator methodology shows promise in predicting dust hazard potential using SSURGO data.
- Where clay and silt fractions are very low, more sampling and testing should be conducted to determine the validity of the calculations in relation to the actual dust emissions.
- An adjustment for soils with high sand content may be a consideration, depending on the results of additional analysis.

Questions ???