

Climate and land use drivers of dust and investigating implications for snowmelt and water resources in the Colorado River Basin

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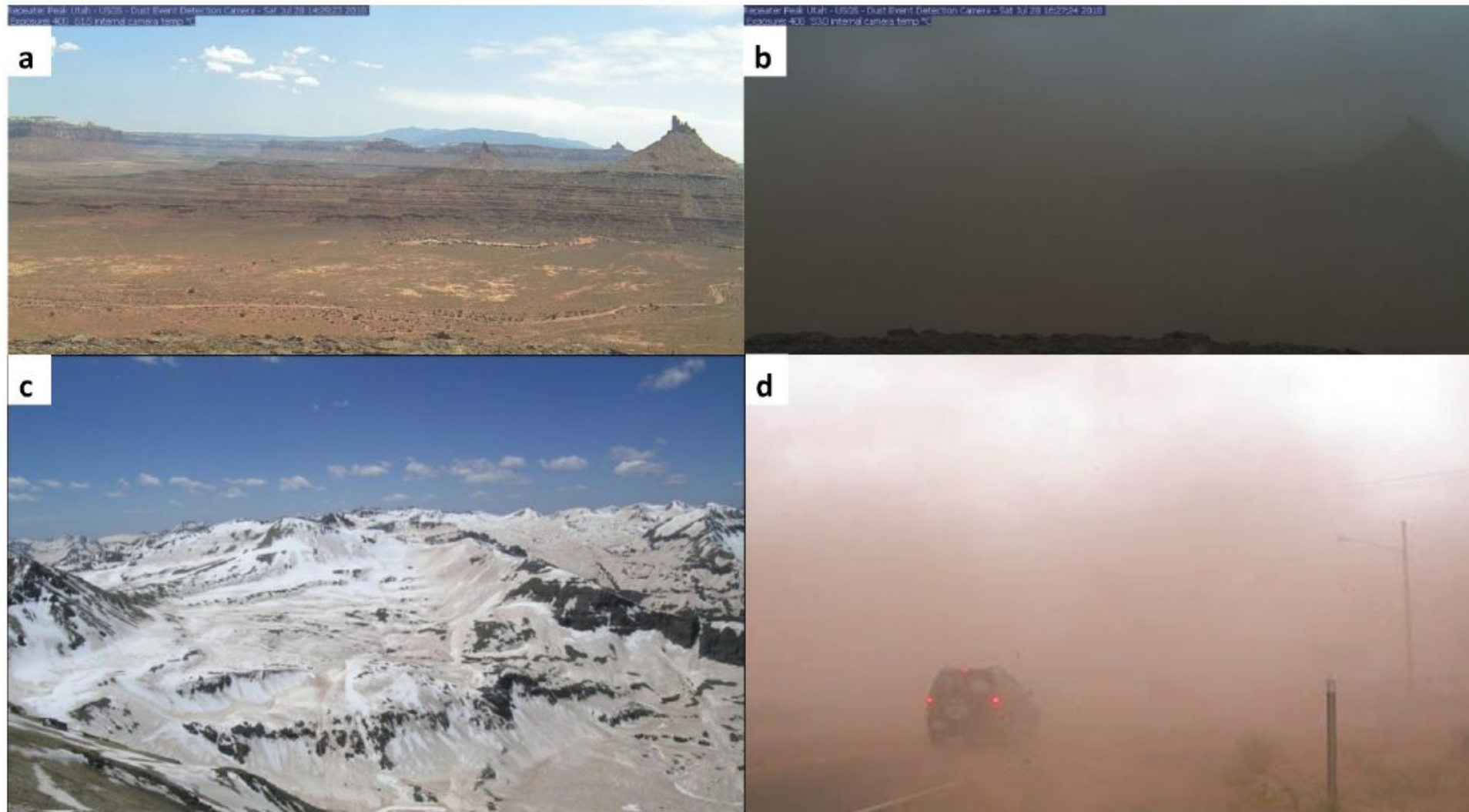


Fig. 5. Examples of dust impacts: dust storm impacting visibility near Canyonlands National Park, just prior (a) and after (b) dust event (28 July 2018); dust-on-snow event in the San Juan Mountains, Colorado (c); and low visibility on the highway near Moab, Utah (d).

Big Springs Number Eight (BSNE) Monitoring

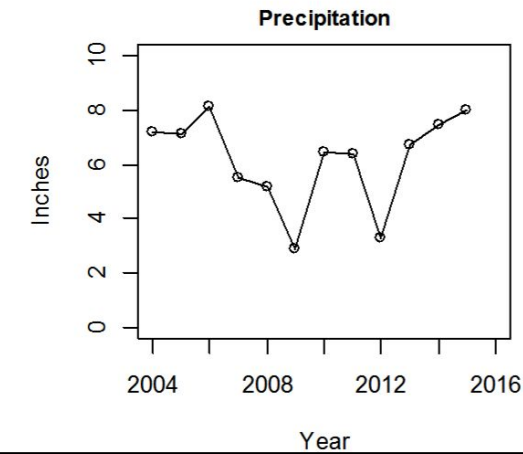
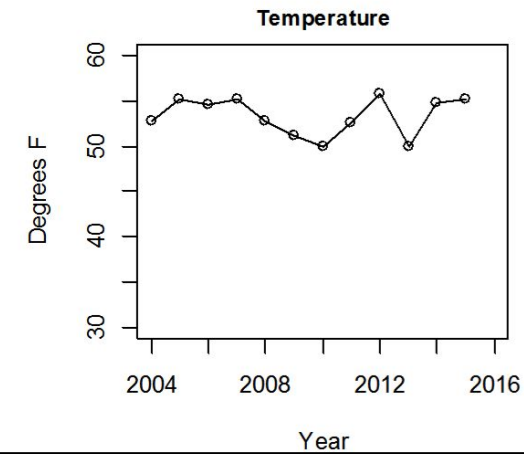
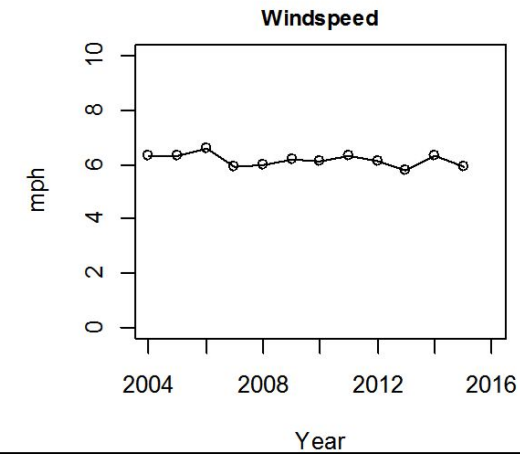
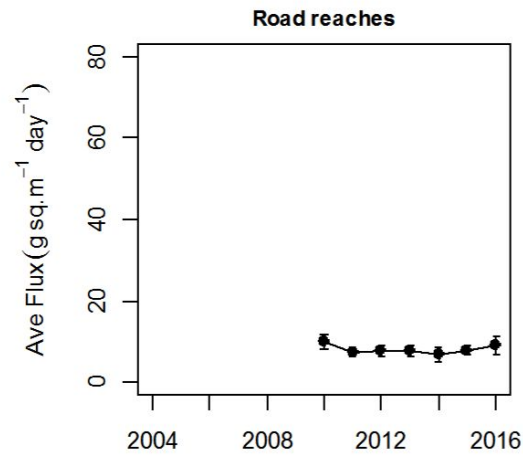
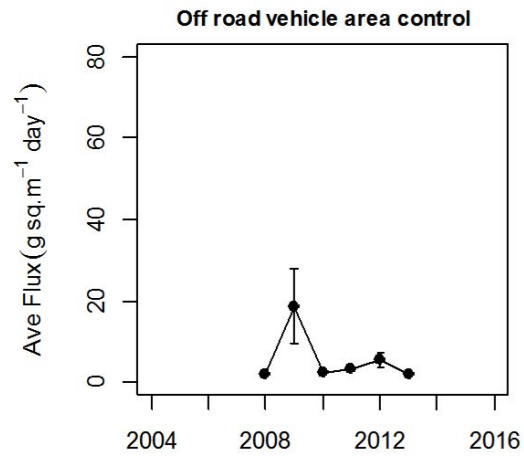
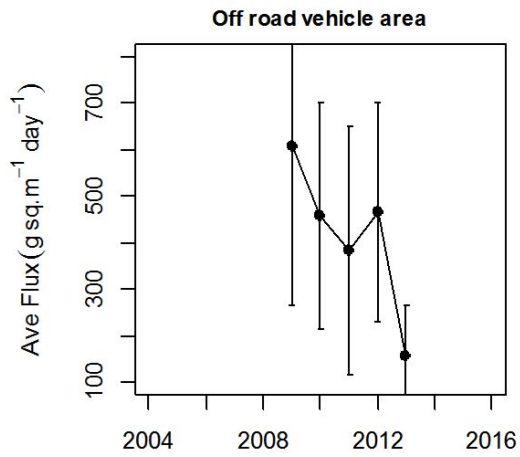
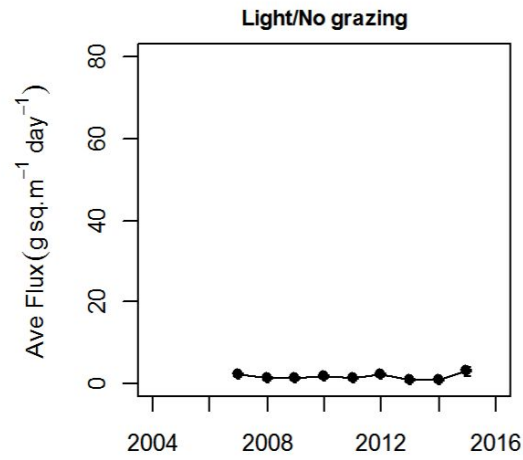
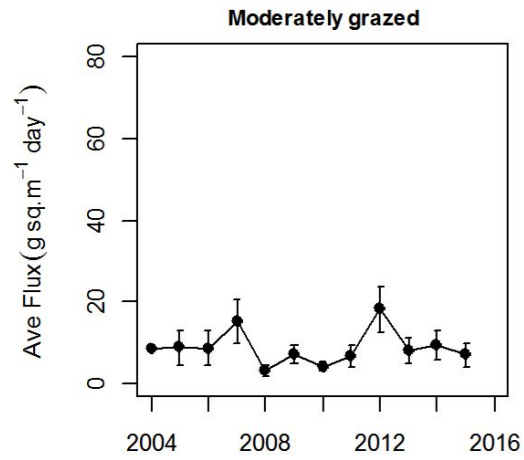
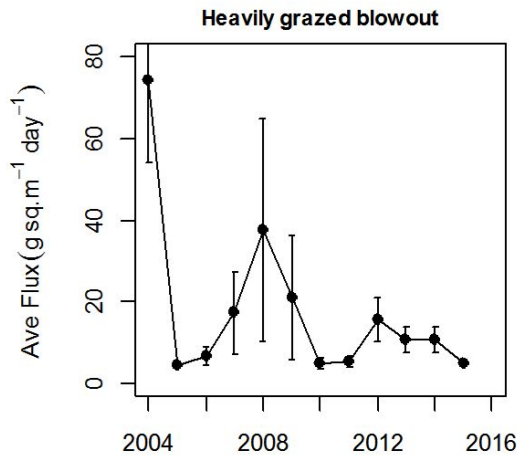
Moab Regional Network:

- 126 Rangeland BSNE towers
 - Ongoing, sites have been added and changed since 1990s
- 33 Road BSNE towers
 - 2010-2016; sites added in 2013
- 2 OHV site BSNE towers
 - 2007-2013; near Hanksville, UT
- 29 Reclaimed Oil and Gas Well Pads
 - 2017- present
 - Sampled across range of soil, vegetation, and time since abandonment.

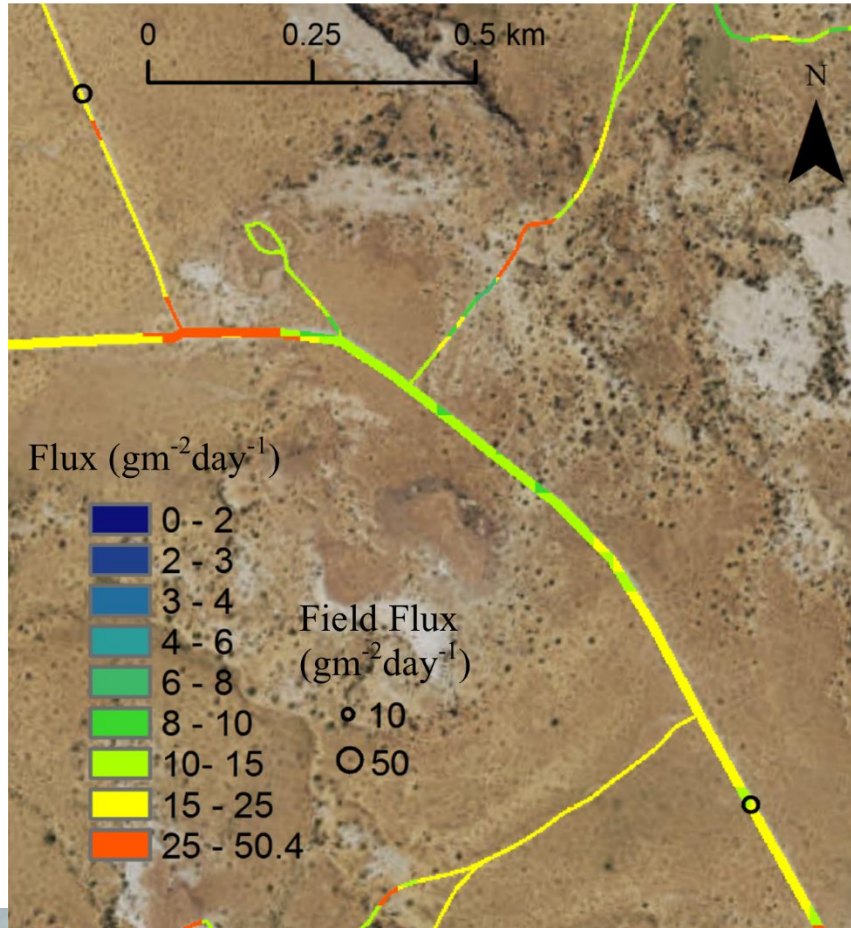


Climate vs Disturbance

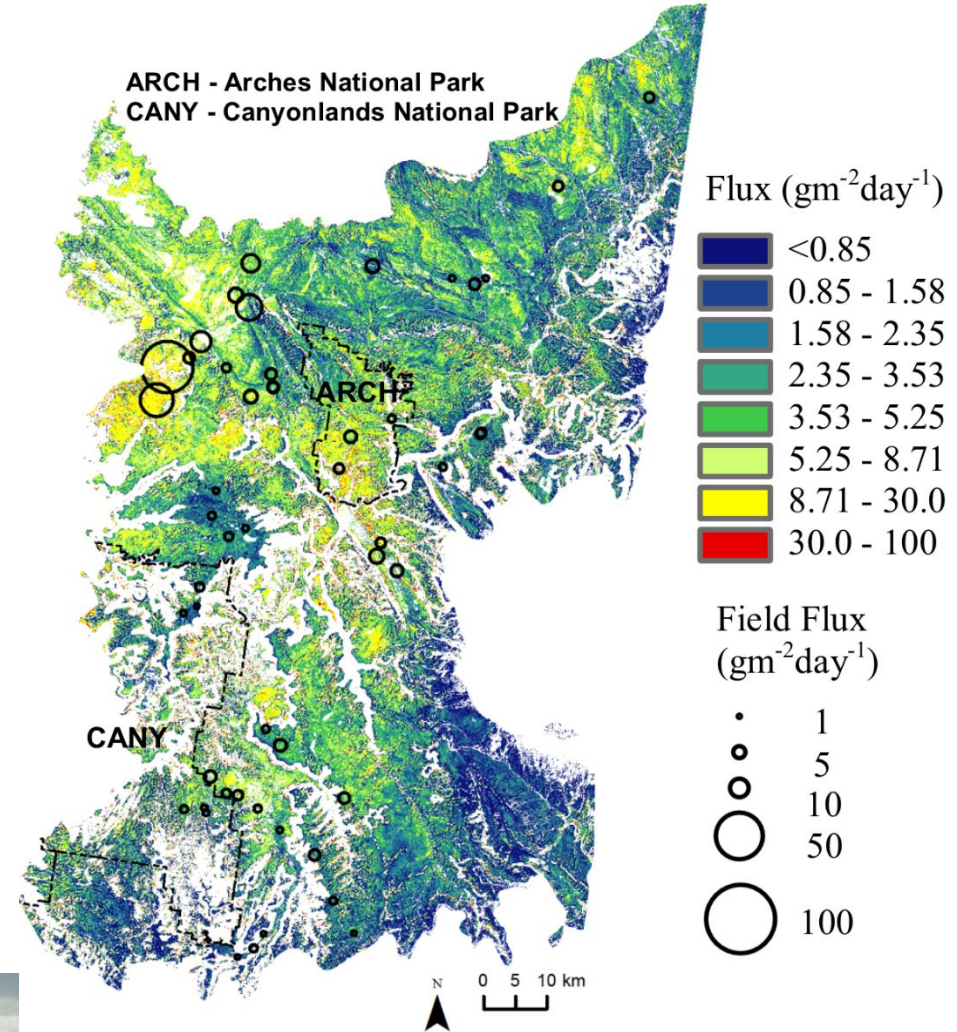
- Disturbed rangelands
 - Only had high flux on hotter, drier, windier years.
- Off road vehicle areas always had high flux, but less so on cooler, wetter, windier years
- Only unpaved roads showed no association with climate parameters



Aeolian Transport



Unpaved roads

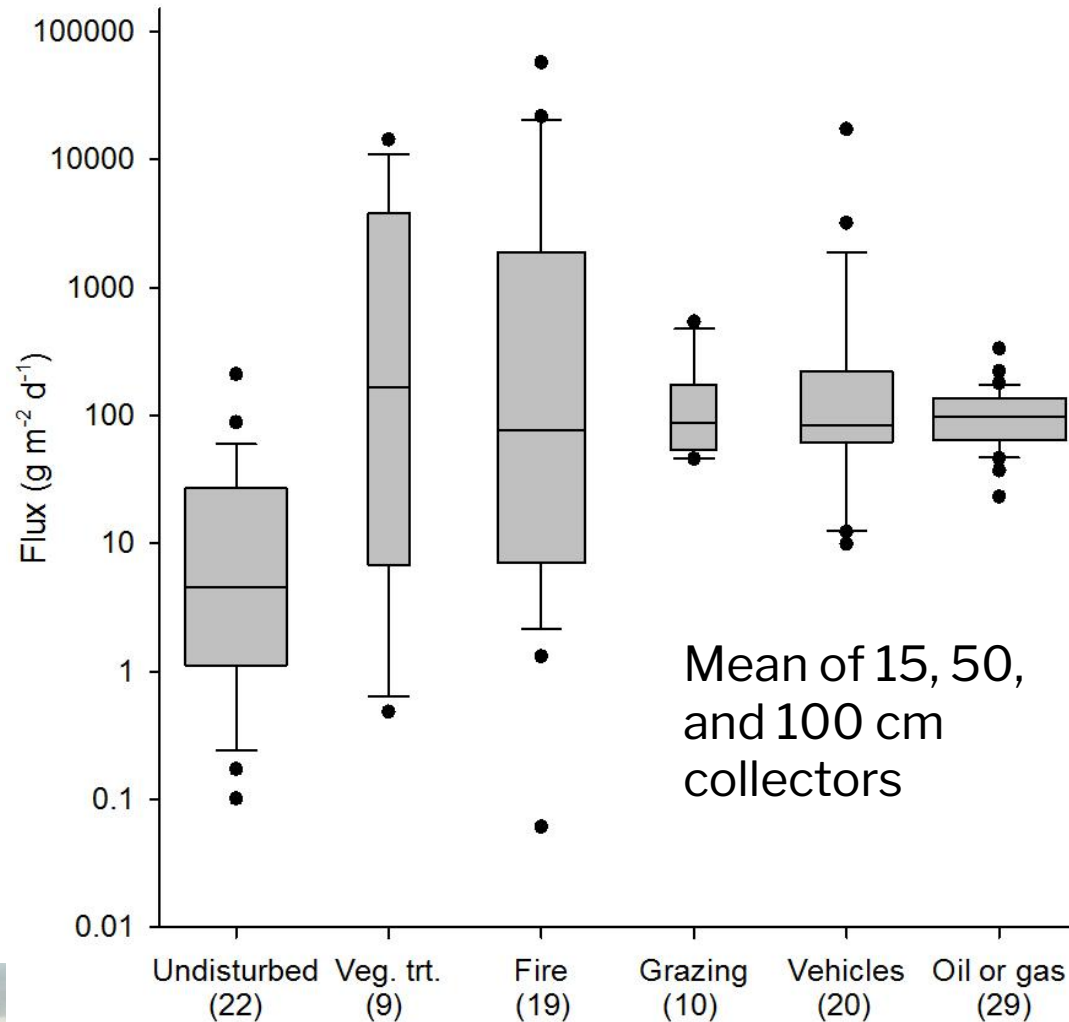


Rangelands

2018 Conclusions

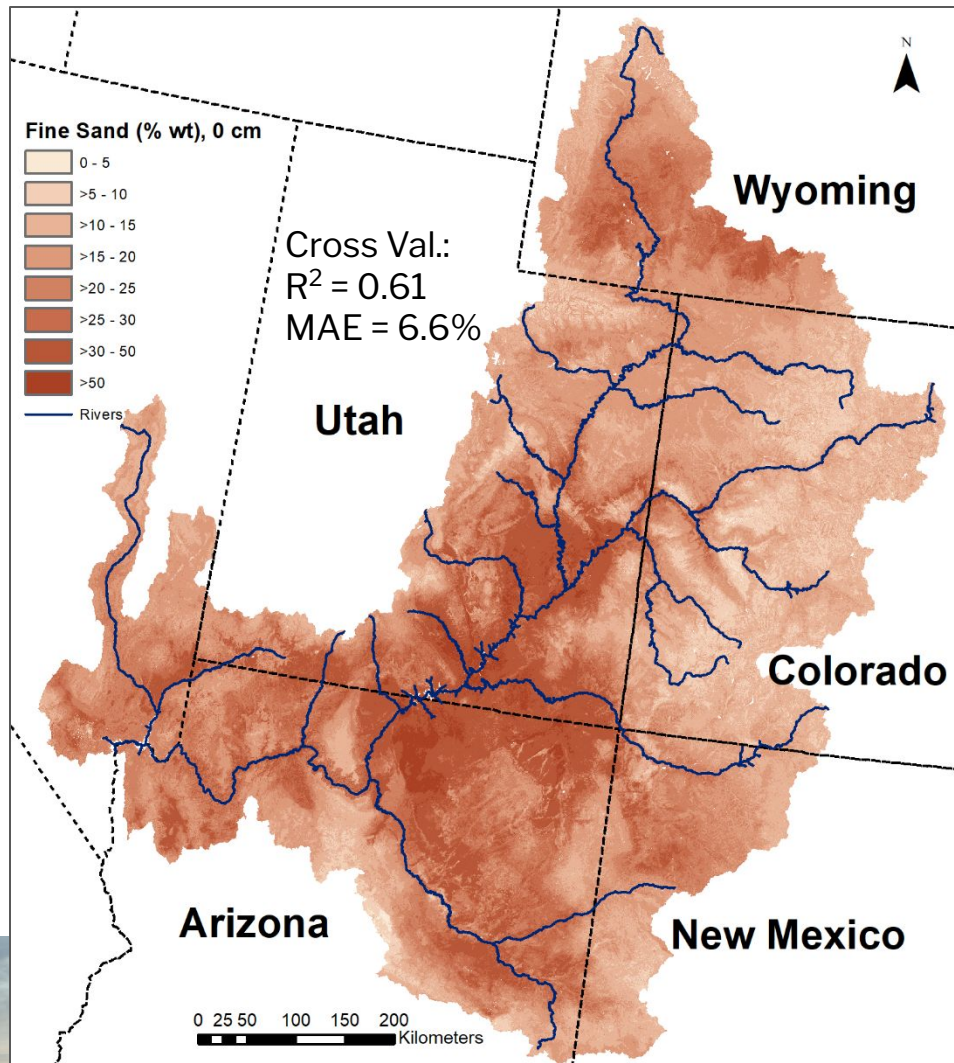
- Relative sediment transport
 - Rangelands: 93%
 - Unpaved Roads 7%
- Spatial controls: 1) soils 2) vegetation types 3) climate 4) topographic exposure
- Heavy grazing = 12x more sediment
- OHV use = 61x more sediment
- IT'S NOT CLIMATE OR DISTURBANCE ALONE, BUT THE SYNERGY OF THE TWO THAT DRIVES AEOLIAN TRANSPORT.
 - Hot/Dry/Windy + Disturbance = Sediment Mobilization

Aeolian Flux @ Disturbances



- Land disturbing practices all increase flux, but have different amounts of variability.

Soil Property Maps, 30 meter grids

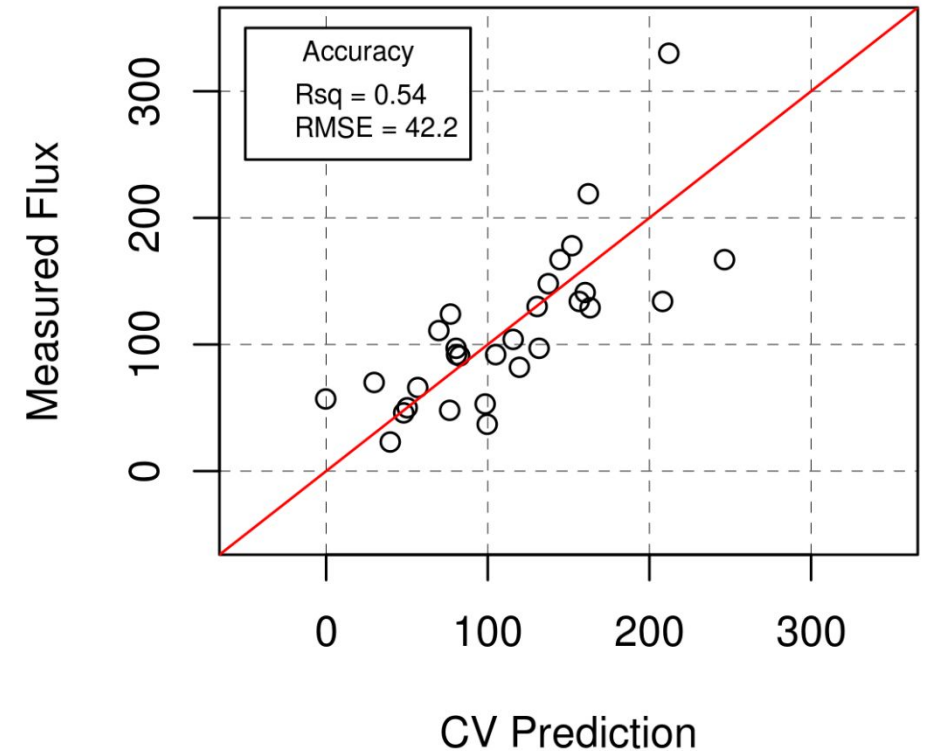


- Texture (sand, silt, clay, fine sand, very fine sand, rock)
- Surface rock
- Organic matter
- pH
- Erodibility
- Bulk density
- Available water capacity
- Salinity (ec, sar)
- Gypsum
- Carbonates
- Depth to restriction
- 108 Maps and associated uncertainty!

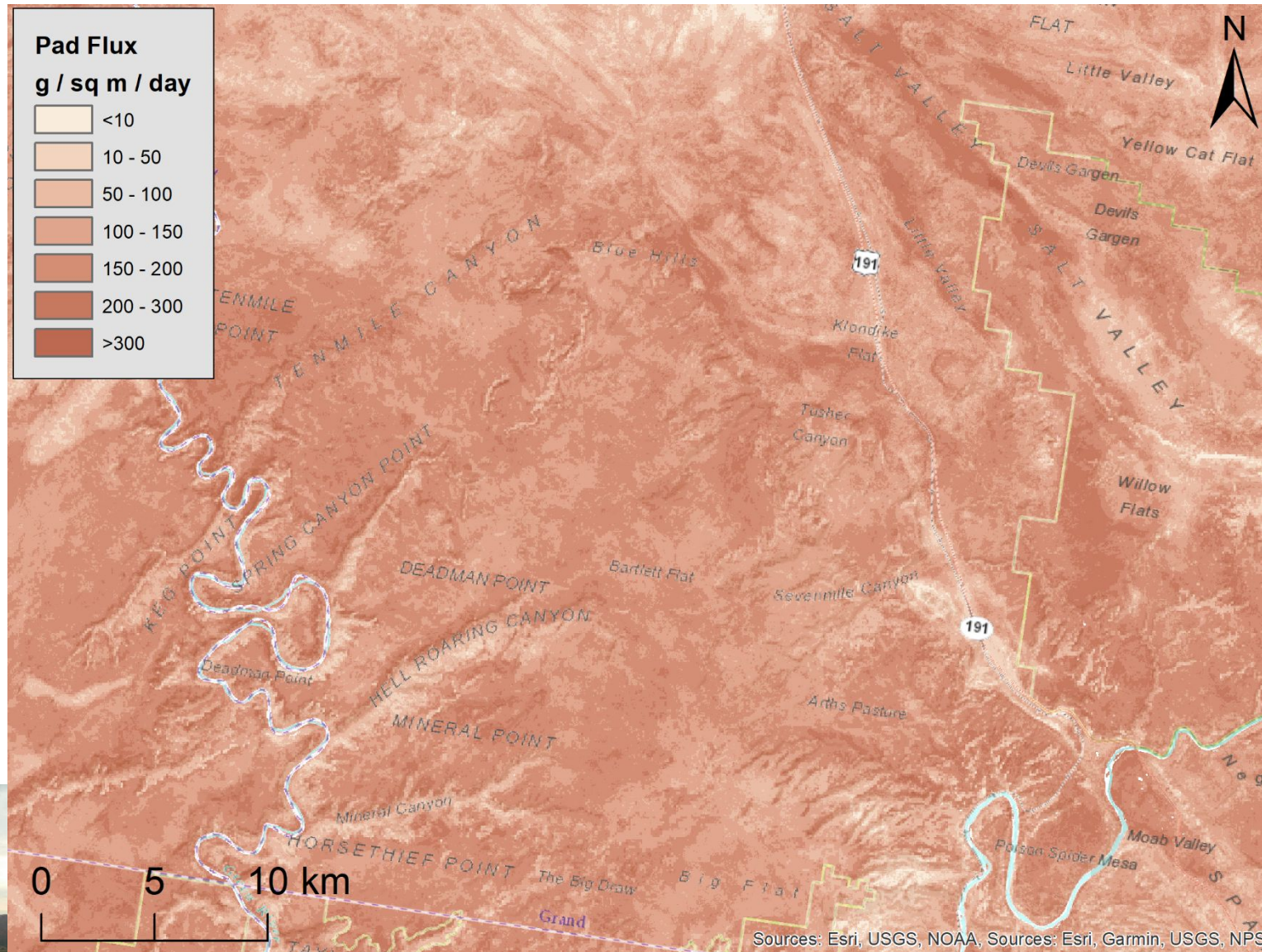
Dust from Oil and Gas Well Pads

Variables	Estimate	Std. Error	t value	Pr(> t)	
Sodium Adsorption Ratio (100 cm)	48.32	8.82	5.48	1.30E-05	***
Fine Sand Content (5 cm)	7.88	1.94	4.06	0.00045	***
Silt Content (30 cm)	11.51	3.04	3.78	0.00091	***
Total Sand Content (100 cm)	4.06	1.15	3.53	0.0017	**
Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1					
Adjusted R-squared: 0.647 F-statistic: 13.8 on 4 and 24 DF, p-value: 5.57e-06					

Cross Validation

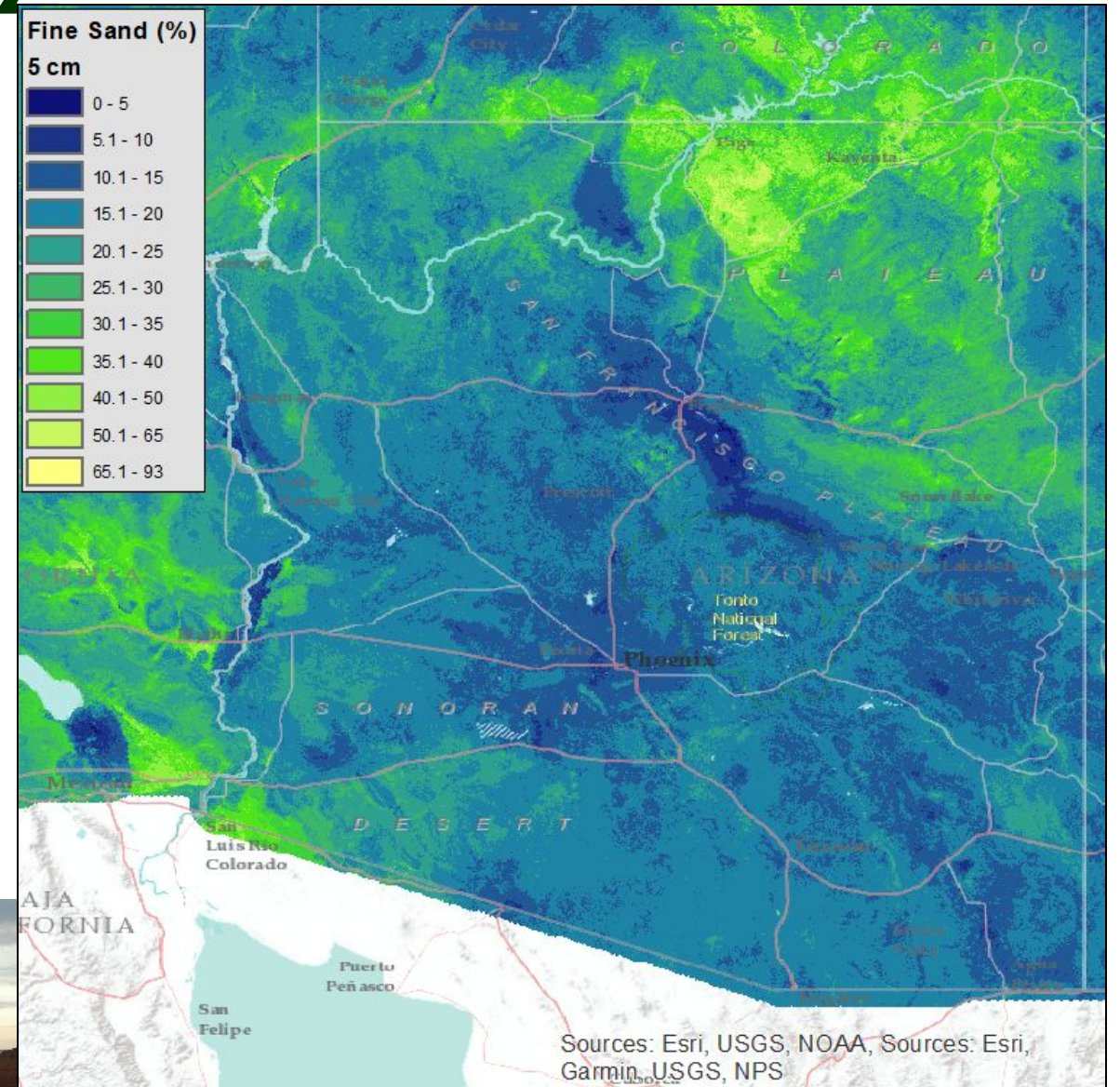
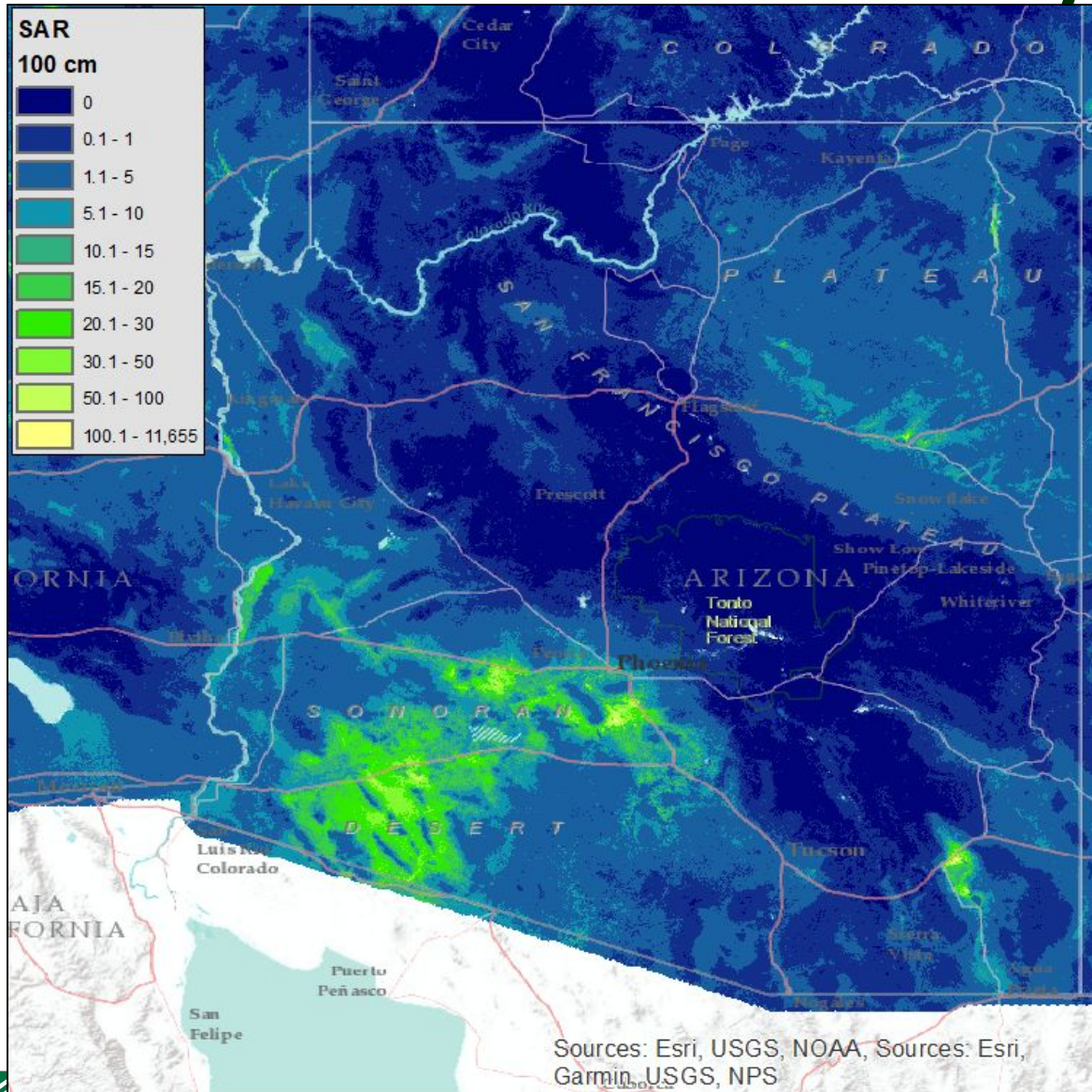


Well pad potential flux map

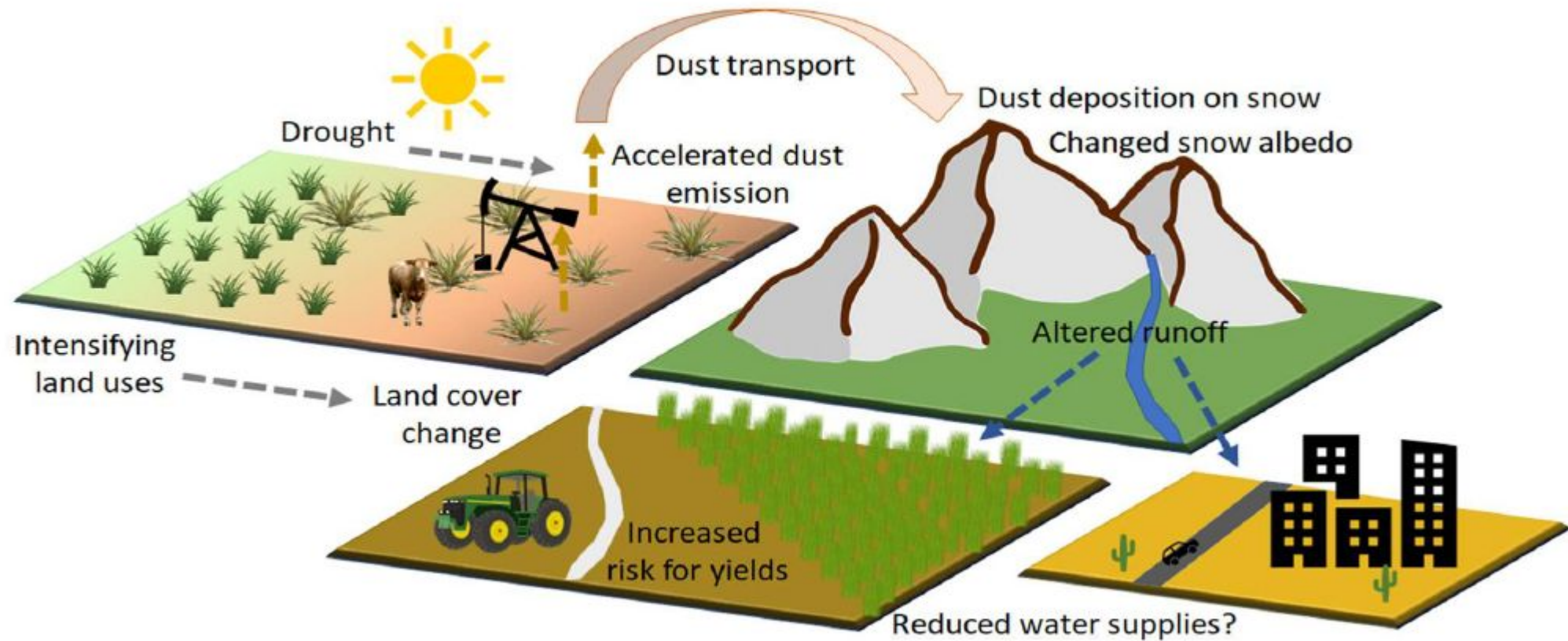


Sodium Adsorp. Ratio and Fine Sand in

AZ



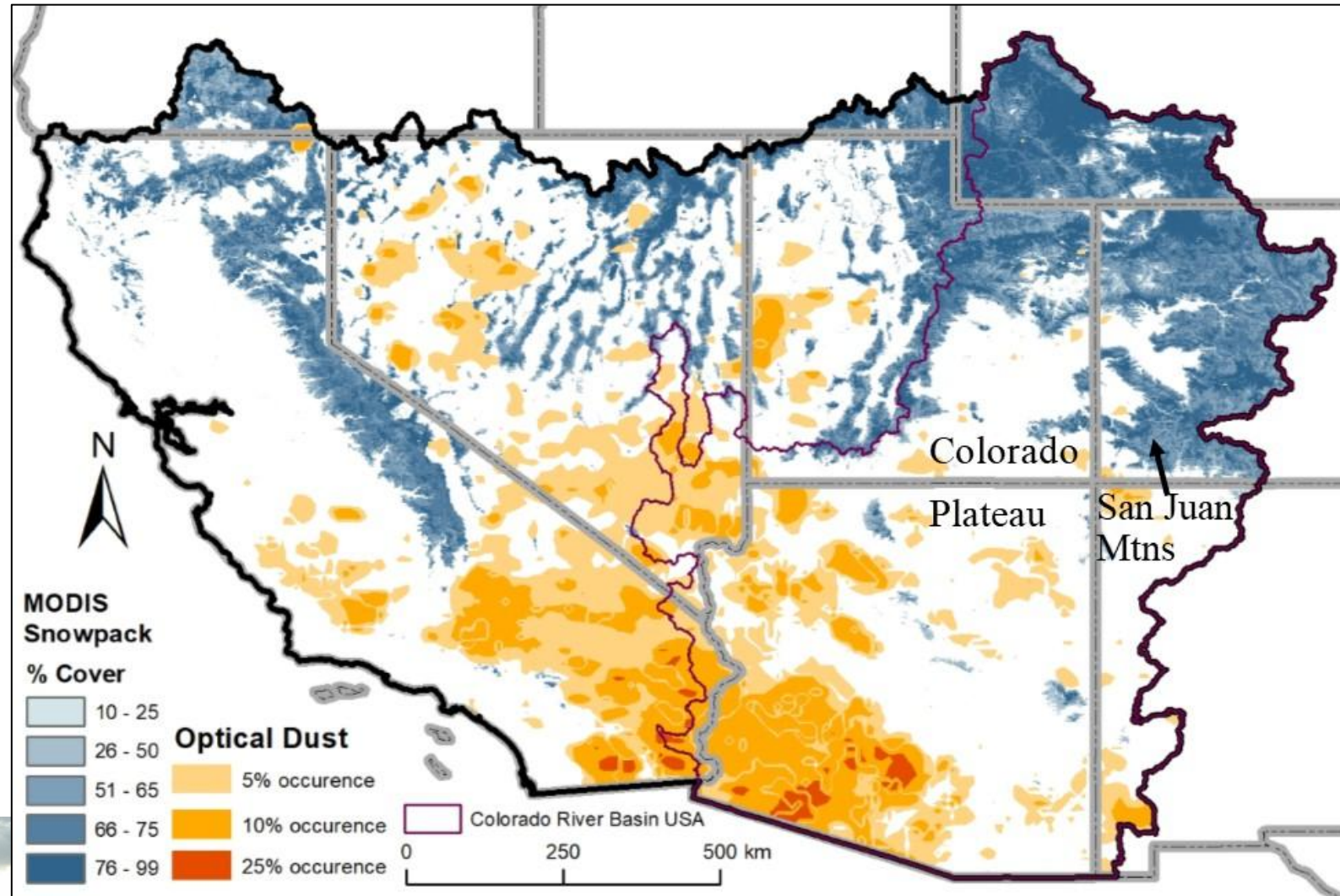
Dust, Drought, Land Use, Snow and Water



Hypothesis: interaction of surface **disturbance** and **drought** is the primary driver of dust related impacts, **as opposed to either factor alone.**

Dust, Drought, Land Use, Snow and Water

- New NASA funded project
 - USGS, NMSU, U of UT, Duke
- Improving the WRF Earth System model using updated
 - Satellite albedo inputs
 - Soil inputs
 - Dust emission scheme
 - Snowmelt response to dust
 - Basin discharge response
 - Multi-faceted validation
 - Surrogate modeling hypothesis testing



Thanks!

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