

Mitigating Dust Pollution for Climate-Resilient Development in Arid Regions



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Human Health & Safety

Asthma, Allergies, Valley Fever,
Toxic Metal Exposure, Air &
Ground Transportation

DUST IMPACTS

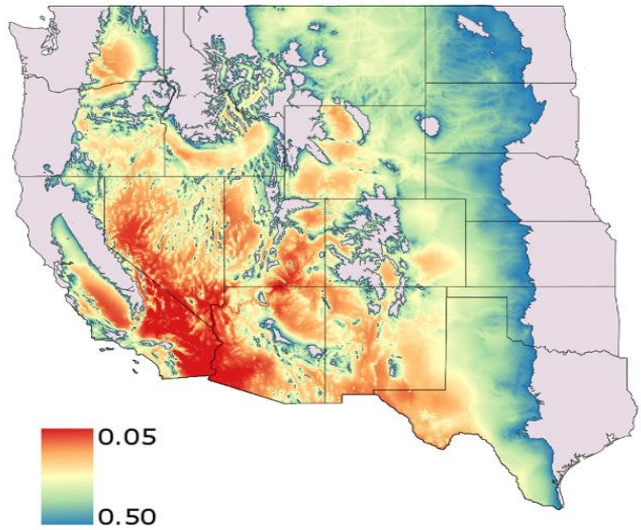
Ecosystems

Nutrient Loss/Gain,
Early-Melting Snow,
etc.

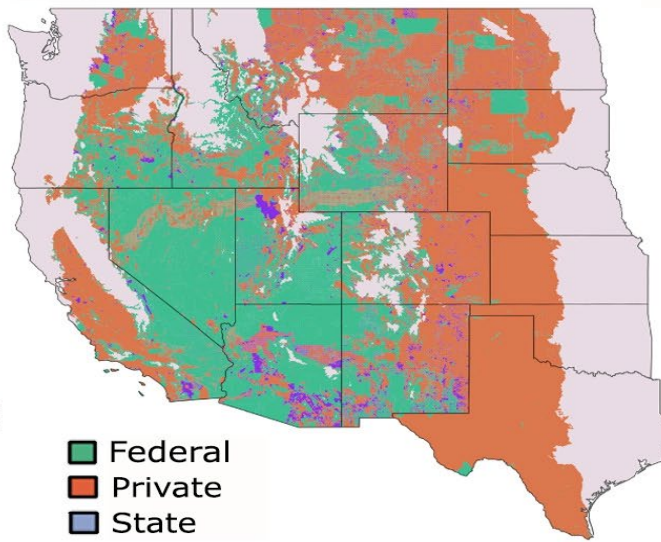
Ag Production

Loss of Topsoil,
Pathogen Spread,
etc.

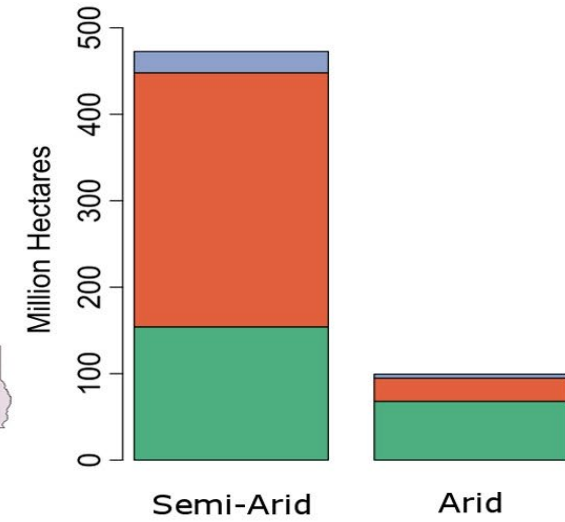
a) Aridity Index



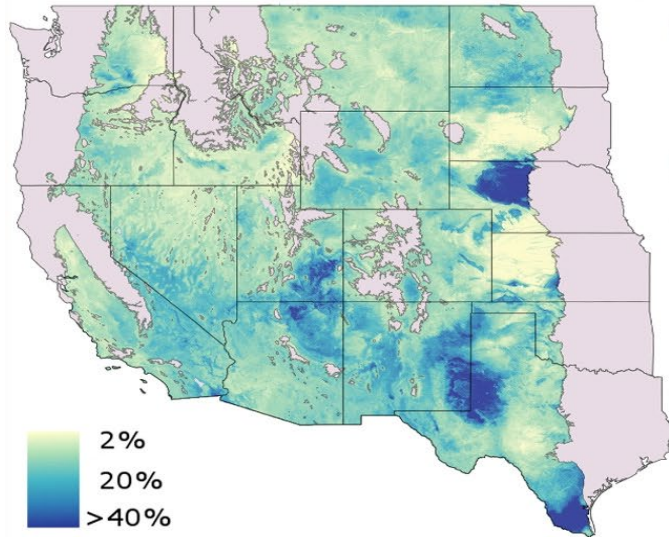
b) Ownership



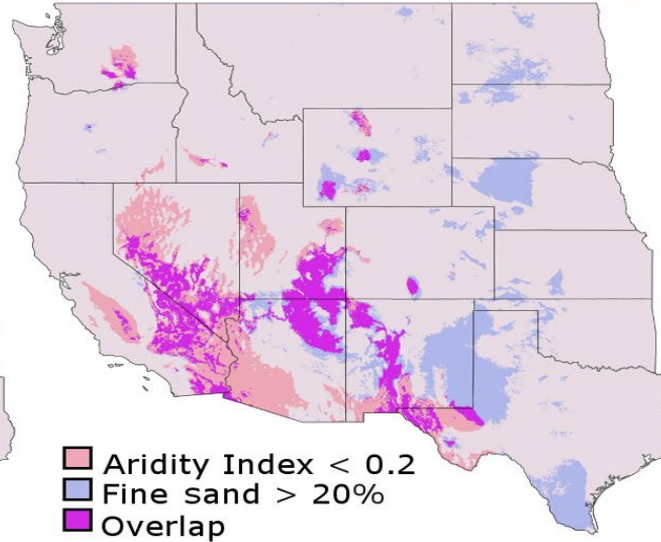
c) Dryland area by owner



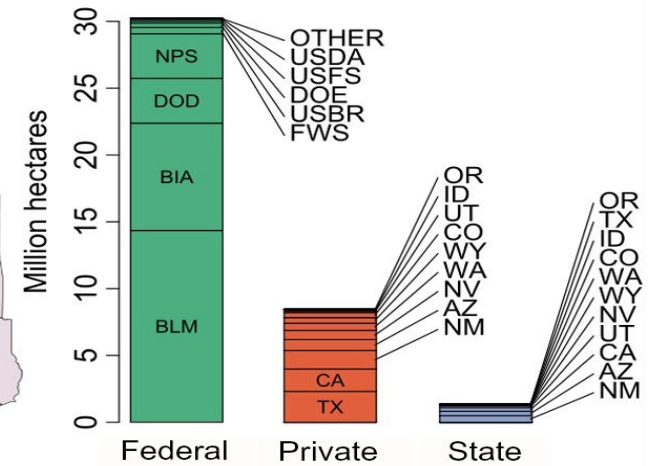
d) Fine sand



e) High-risk regions

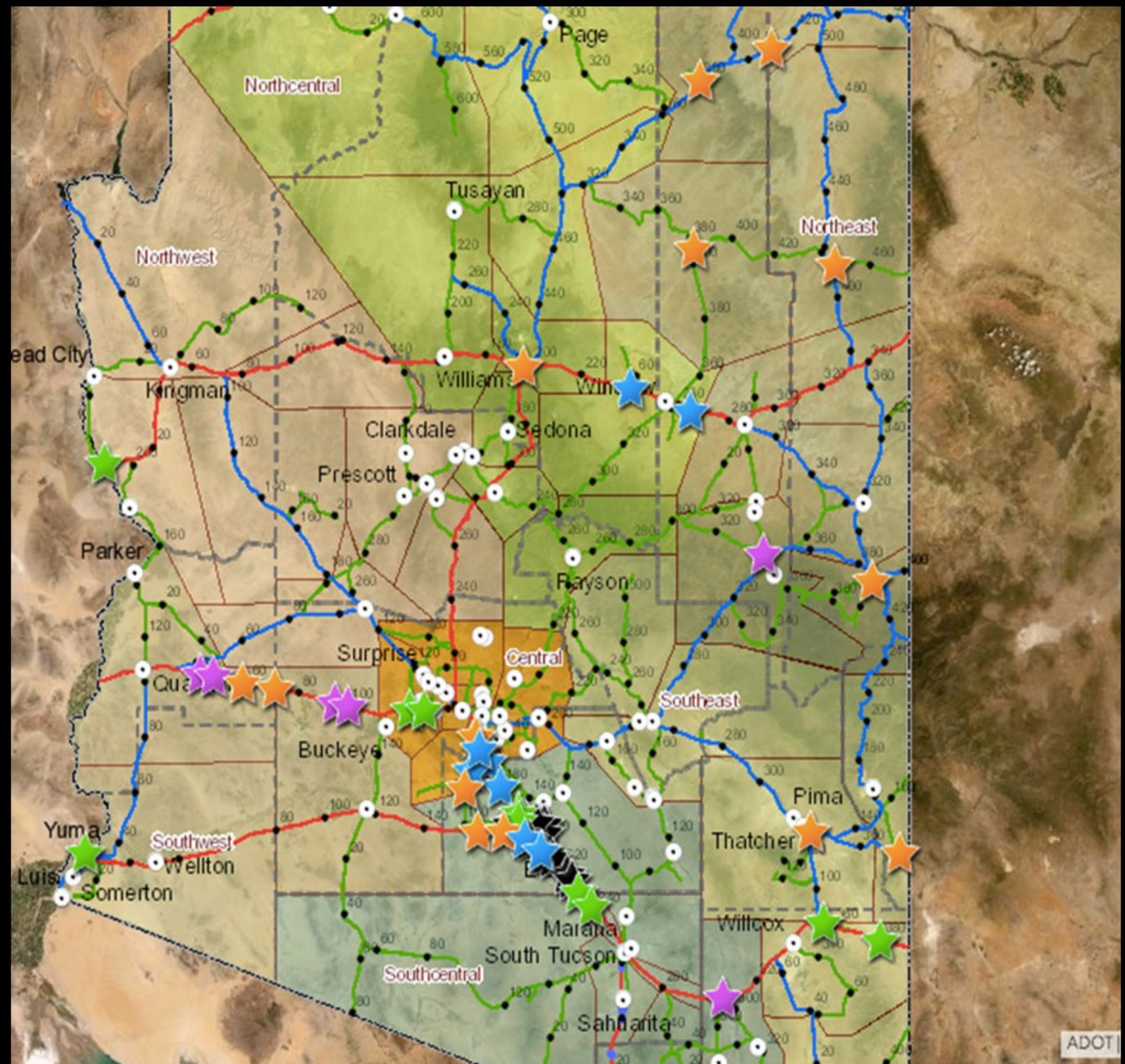


f) High-risk area by owner



Arizona Department of Transportation (ADOT) Automobile Accident Data

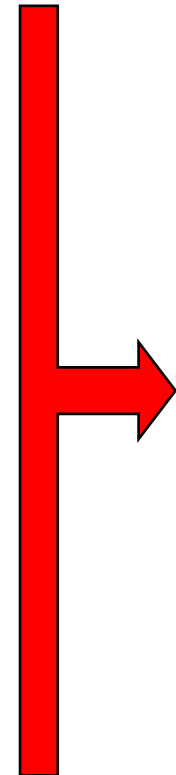
Stars show high proportion of dust-related automobile accidents. Black, green, and blue stars show most dangerous hot spots.



Dust Causes in Western U.S.

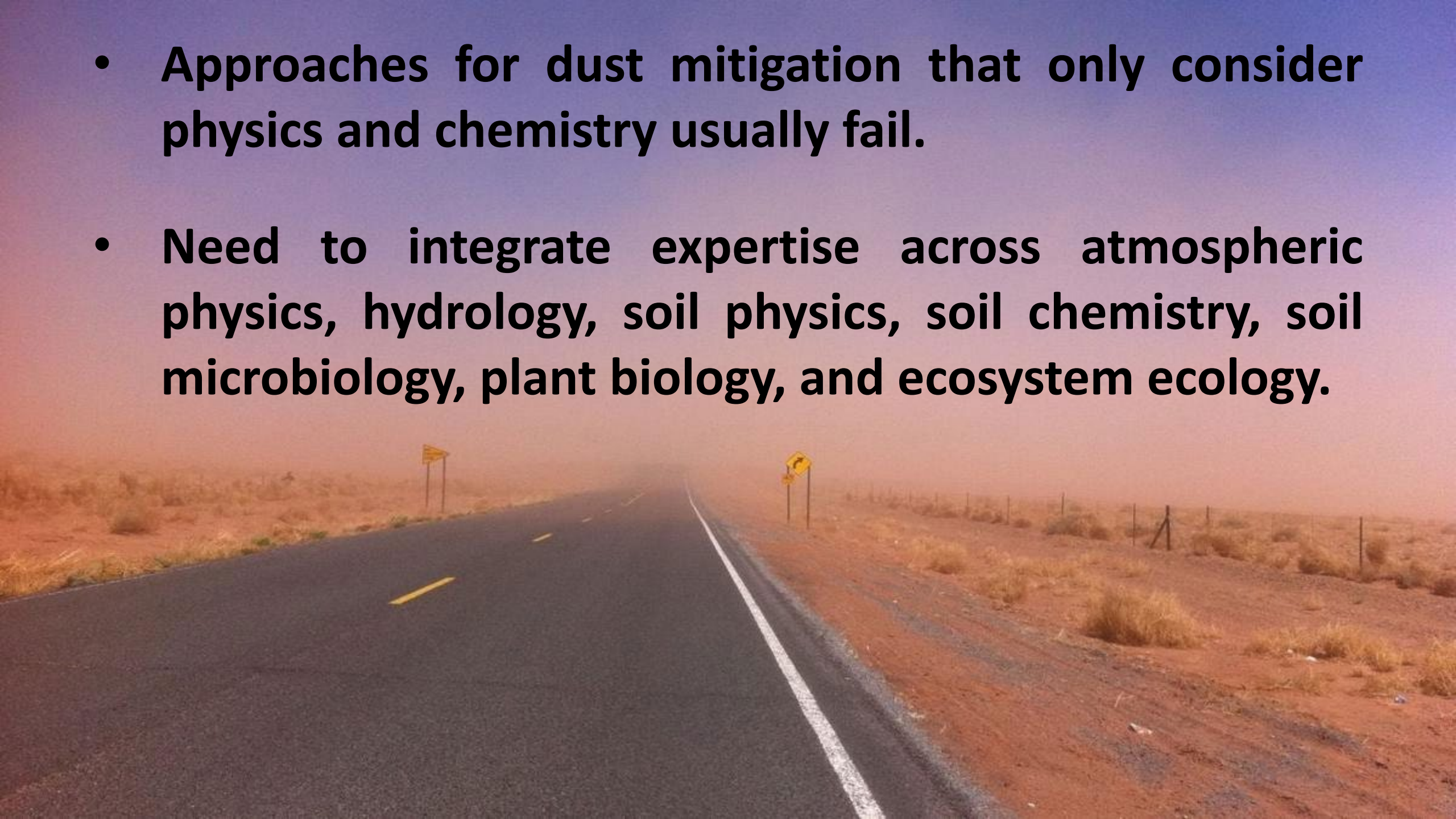
(That are only getting worse...)

- ❖ Prolonged Drought and Increasing Aridity
- ❖ Desertification (Including Overgrazing)
- ❖ Cropland Fallowing and Abandonment
- ❖ And others...



More
Barren
Land

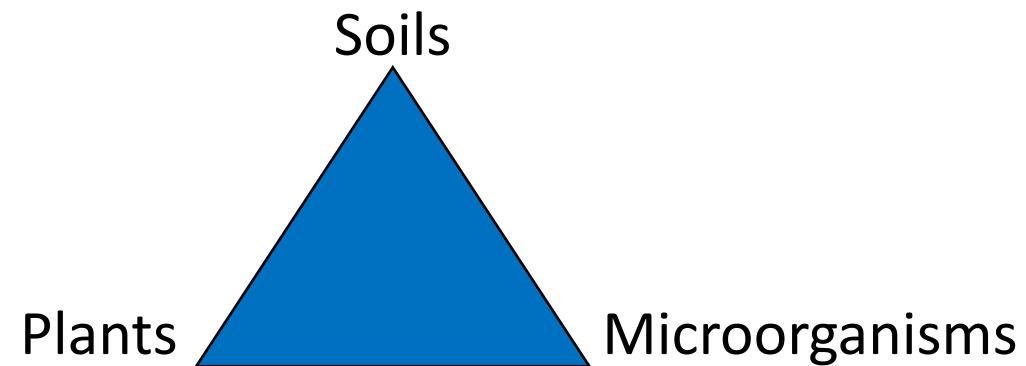
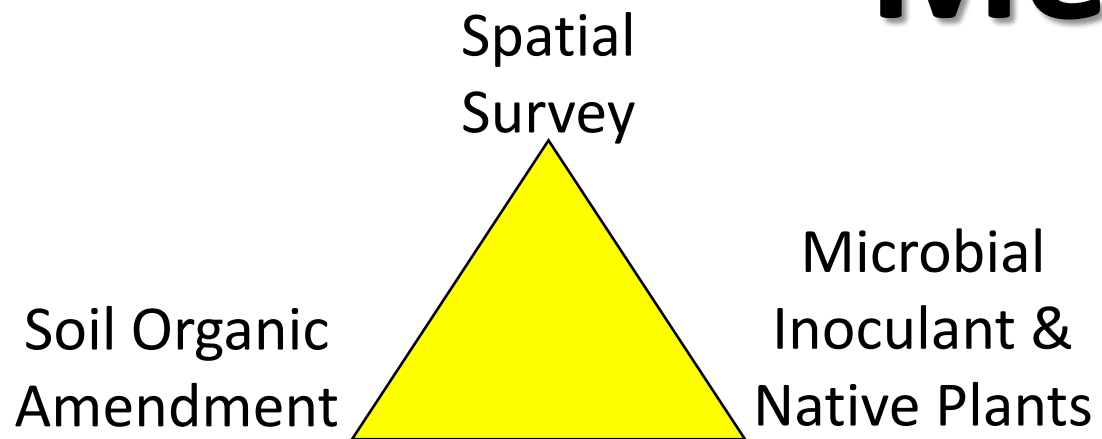
- **Approaches for dust mitigation that only consider physics and chemistry usually fail.**
- **Need to integrate expertise across atmospheric physics, hydrology, soil physics, soil chemistry, soil microbiology, plant biology, and ecosystem ecology.**



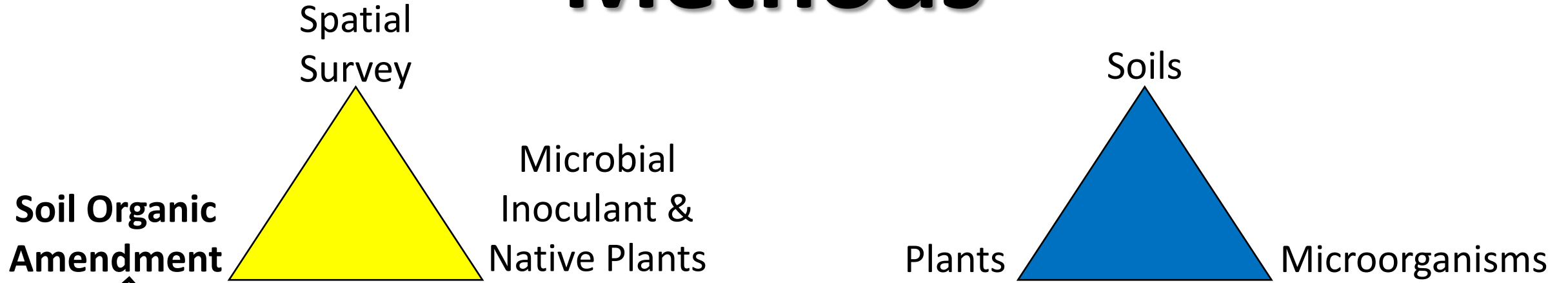
Research Questions

1. Ways of mitigating dust by linking landscaping waste from “organic-rich” cities to “organic-poor” degraded arid ecosystems?
2. Ways of “jumpstarting” biological components of the ecosystem to stabilize soil and mitigate dust?

Methods



Methods



Wood/leaf mulch applied in rows to 1-acre plots near Picacho Peak, AZ



Phase 1: Laboratory



3 Native Plant Species:

Bush muhly

Low woollygrass

Fourwing saltbush



3 Microbial Inoculants:

Cyanobacteria

Mycorrhizal fungi

EPS-producing bacteria

Phase 2: Field Plots



1x1 m plots with 5 replicates of 4 treatments:
Control, Microbial Inoculant, Plant Seeds, Combo

- Soil aggregates
- Microbial EPS “glues”
- Other organic metabolites
- Nutrients
- Metagenome
- Plant root biomass
- Dust production

Key Results So Far

- For all end goals (dust, soil stability, revegetation), organic mulch has been effective whereas synthetic chemicals have been ineffective.
- Successful use of cyanobacterial inoculant to improve soil stability and promote plant growth. Awaiting results from field trial...

SOIL HEALTH

The continued capacity of a soil to **function** as a vital, **living** ecosystem that sustains plants, animals, and humans.



Conclusions

Resilient
(Re)Development
in Arid Regions

SOIL HEALTH



- ✓ Microorganisms!
 - EPS secretors
 - Biocrusts
 - Others...
- ✓ Surface additions of organic matter!
(Not done in most yards and cities...)