

Biological Soil Crusts of the Mojave Desert

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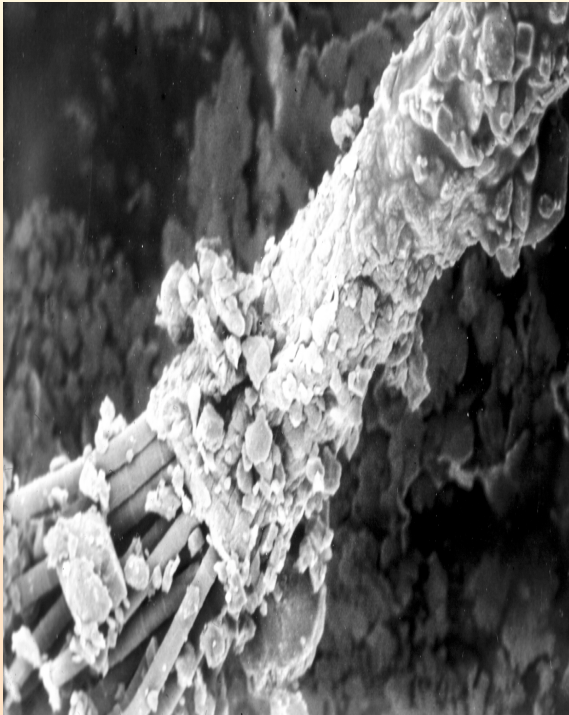


What are Biological Soil Crusts?



Biological Soil Crusts are a community of:

Cyanobacteria



Lichens



Mosses



Physical Crusts



➤ **Chemical and mechanical, not biological**

➤ **Restrict plant growth and water infiltration**

Hot Deserts

Sonoran Desert



Mojave Desert





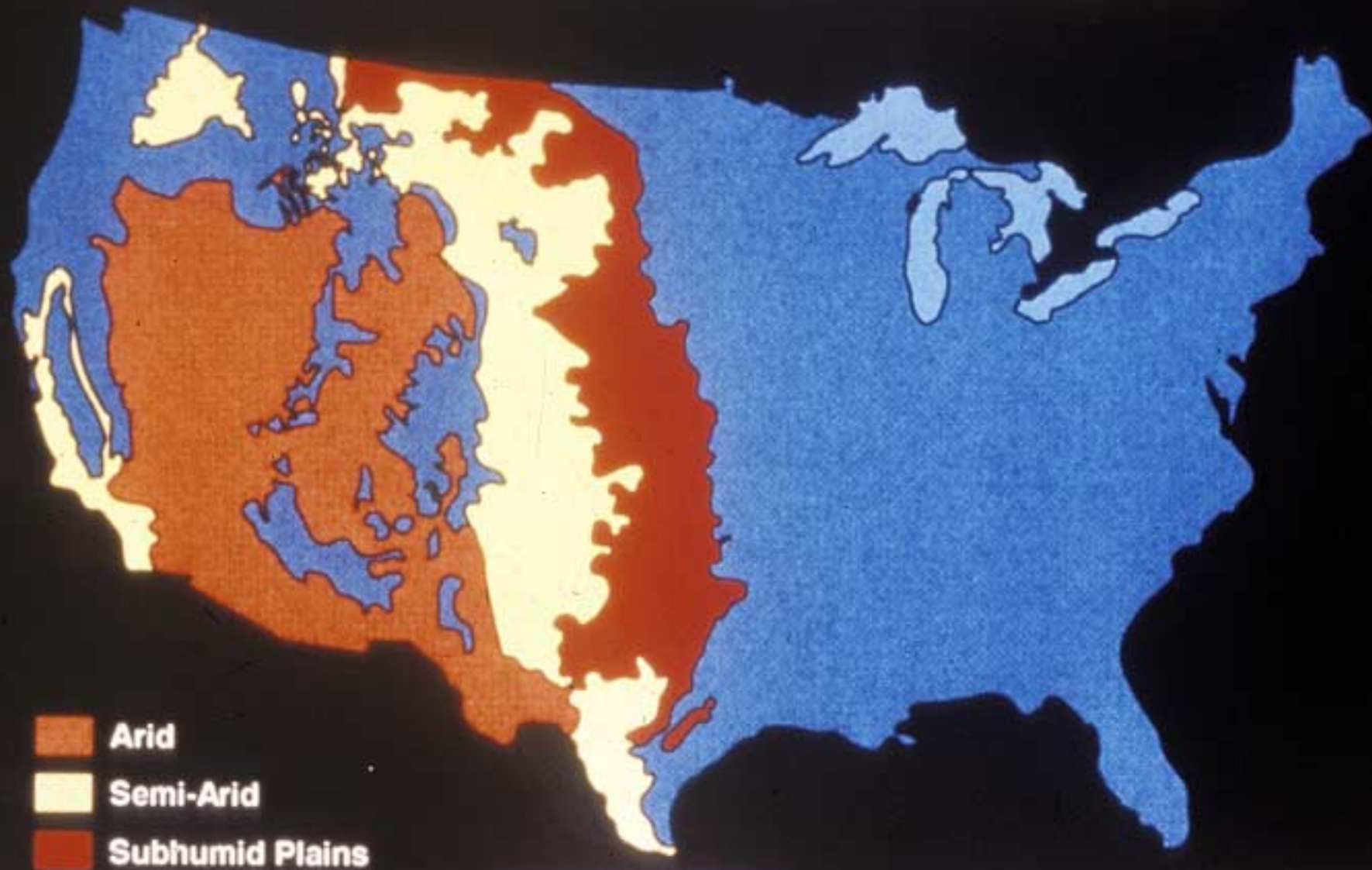
Colorado Plateau




Cool Deserts

Great Basin



Aggregated Arid Ecoregions of the U.S.



-  Arid
-  Semi-Arid
-  Subhumid Plains

EMAP

Kenya

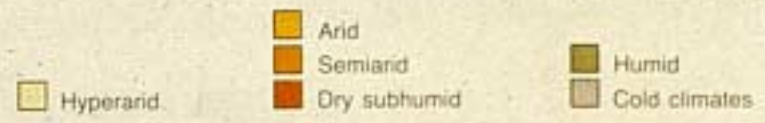
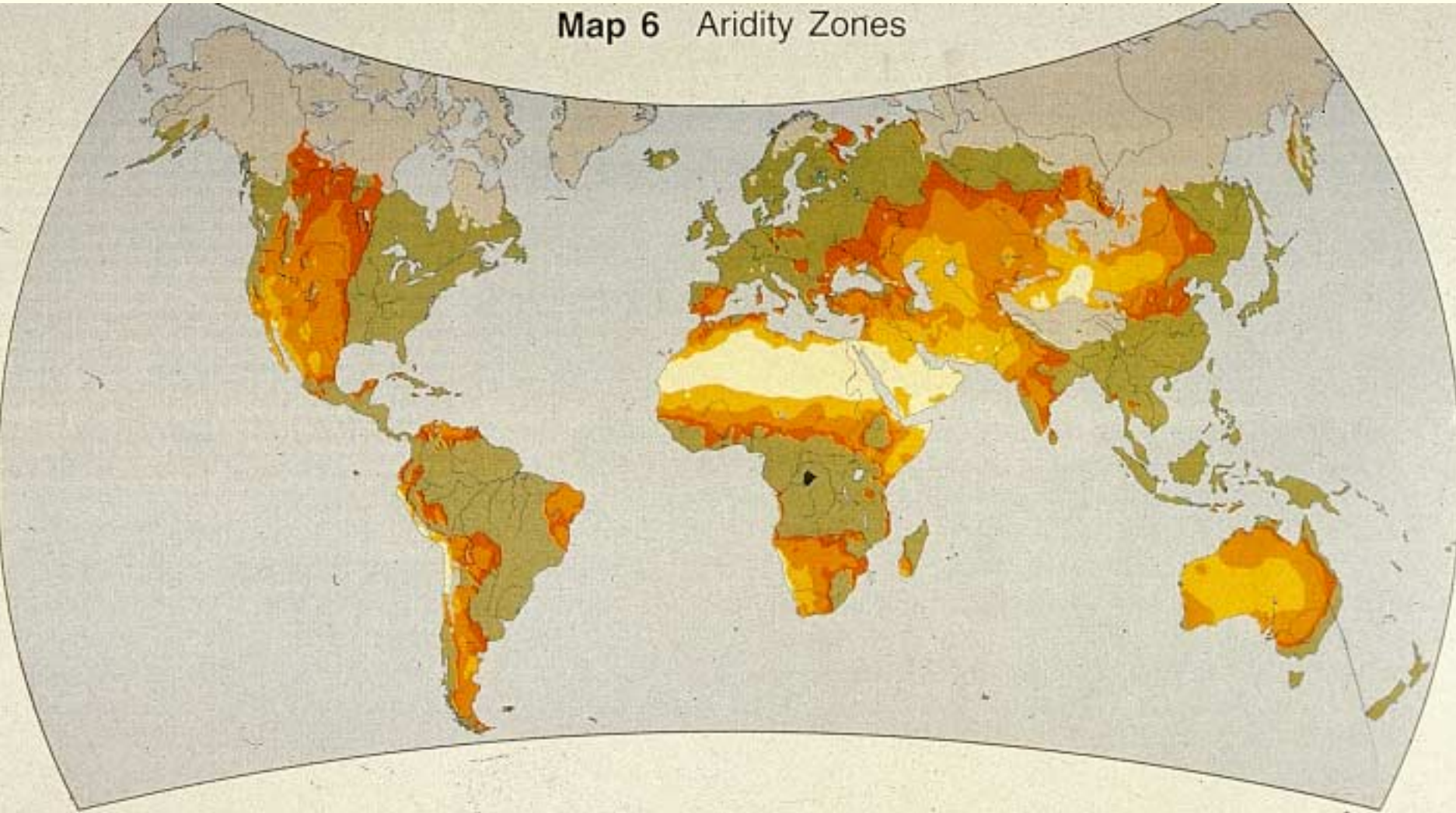




Alaska



Map 6 Aridity Zones



Crusts are in a variety of habitats



Crust Types

Low Elevation

% Cover

MORE

Effective Rainfall

Elevation

LESS

Idaho

Oregon

Southern

Utah

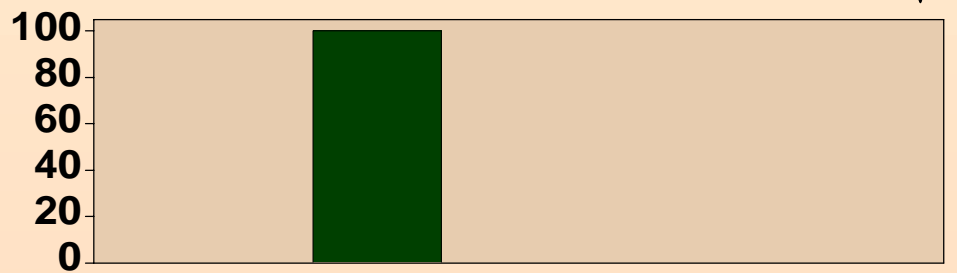
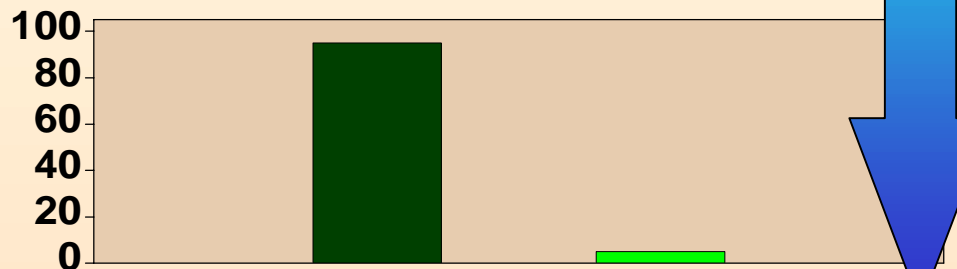
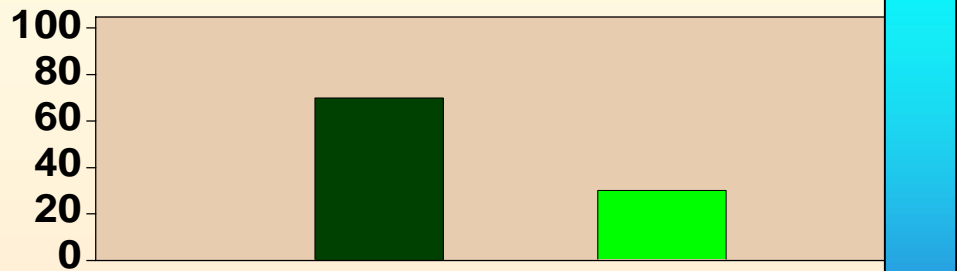
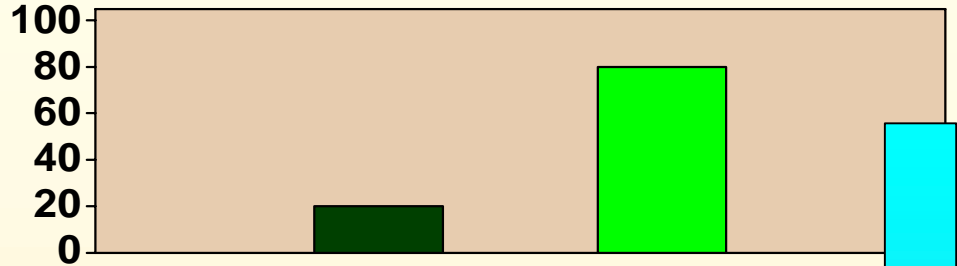
So. Arizona

E. Mojave

Death Valley

Disturbed

Areas



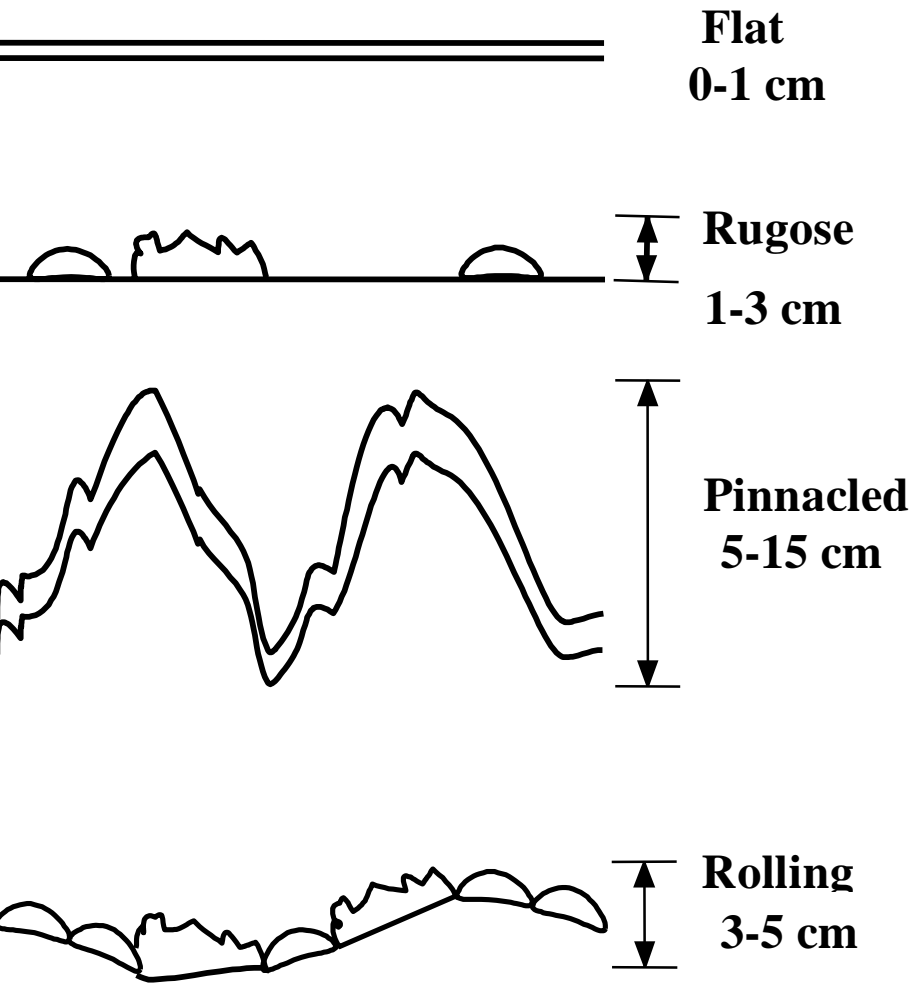
Cyanobacteria

Lichens/Mosses

Summer Rainfall

Soil Surface Roughness

Four Types:



Less

Effective Rainfall

More



**Hyper-arid,
Disturbed**



**Mojave
Sonoran**



**Co.
Plateau**



**Great
Basin**

Flat (0 cm)



Rugose (2.5 cm)



Pinnacled (15 cm)



Rolling (7.5 cm)



Why are soil crusts important?

Because they influence soils.



- Soil stability
- Soil fertility
- Soil moisture
- Soil surface roughness
- Soil temperature

Soil Stability Then and Now

Thin Soils

Easily lost

Expands habitat



Soil Stability



Scattered Vegetation

In deserts, plants give little protection to desert soils



Hill slopes

Soils held beyond angle of repose



90 X



Soil Fertility



- **Crusts convert atmospheric N into bio-available forms**
- **Chelators, growth factors, sticky sheaths**
- **Plant tissue concentrations**



Dust Capture

- **Dust contains high levels of nutrients**
- **Rough surface, sticky organisms retain dust**
- **Small particles hold more moisture**

Seed Capture

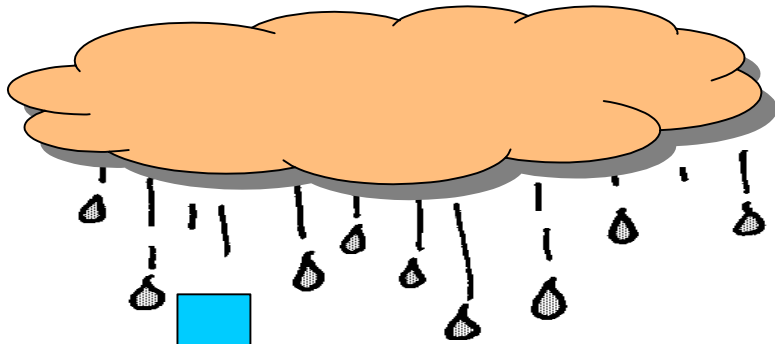
Organic Matter Capture



**Plants in crusted soils have
higher nutrient contents**



Soil Moisture

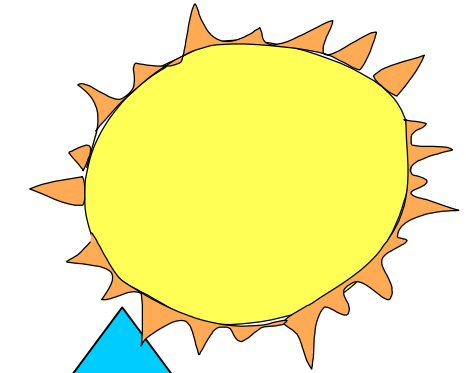


Roughness
Permeability



More roughness = More water in
Bigger pores = More water in

More organisms = Less water in

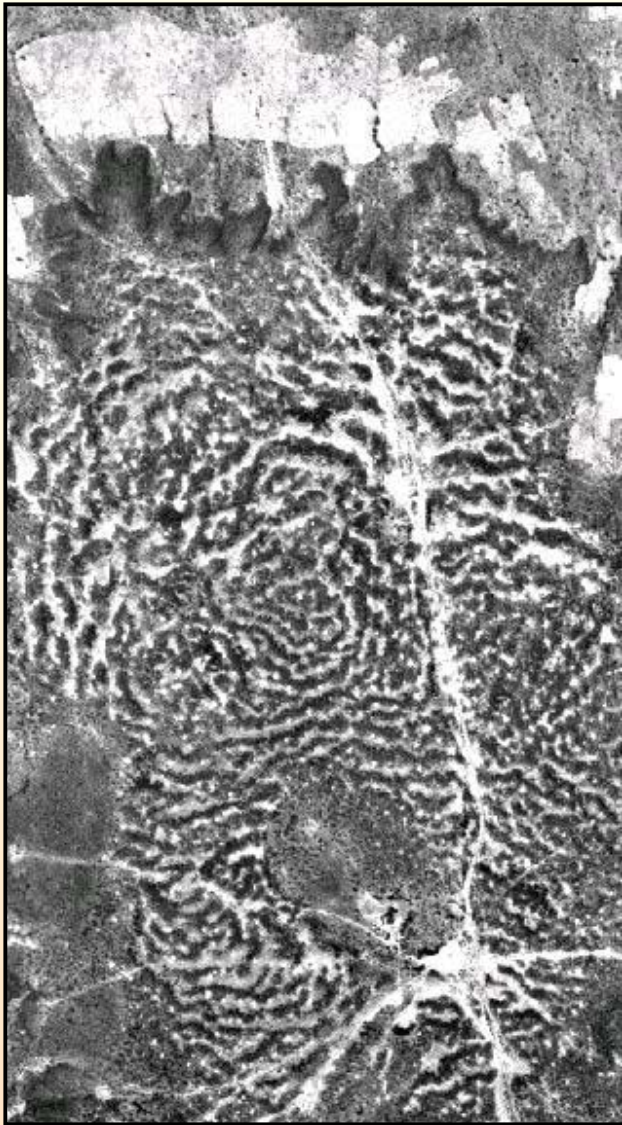


Capping
Soil Temperature



More capping = Less water out

Darker surface = More water out



Patchy		Evenly Spaced
Very Arid		Semi Arid
Flat Crust		Bumpy Crust

Albedo/Soil temperature



Potential Lichen/Moss Distribution

Location

Altitude

Slope

Aspect

Quarternary Unit

Parent Material

Chemical Weathering Rate

Pavement Formation

Aeolian Sand Inputs

Rockiness Index

Roughness

% Disturbance

Rock Cover (3 Rock Size Classes)

Litter Cover (2 Litter Classes)

Lichen & Moss Cover (by Species)

Lichen & Moss Species Richness

Cyanobacterial Cover

Cyanobacterial Biomass

Shrub Cover

Annual Grass Cover

Perennial Grass Cover

Soil Surface & Subsurface

Chemistry (P, K, Zn,

Fe, Mn, Cu, Ca, Mg,

Na, N, CaCO₃)

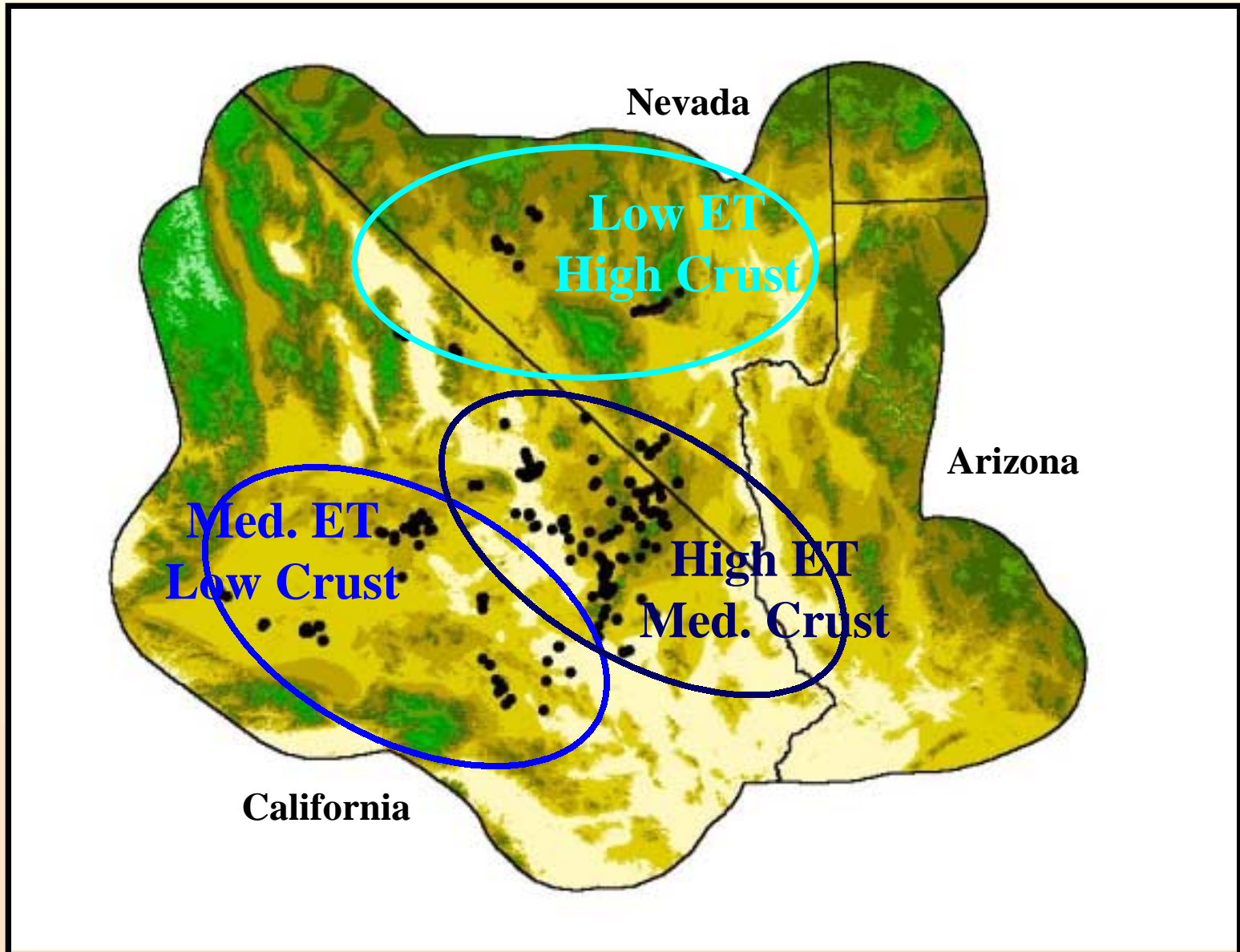
Soil Texture

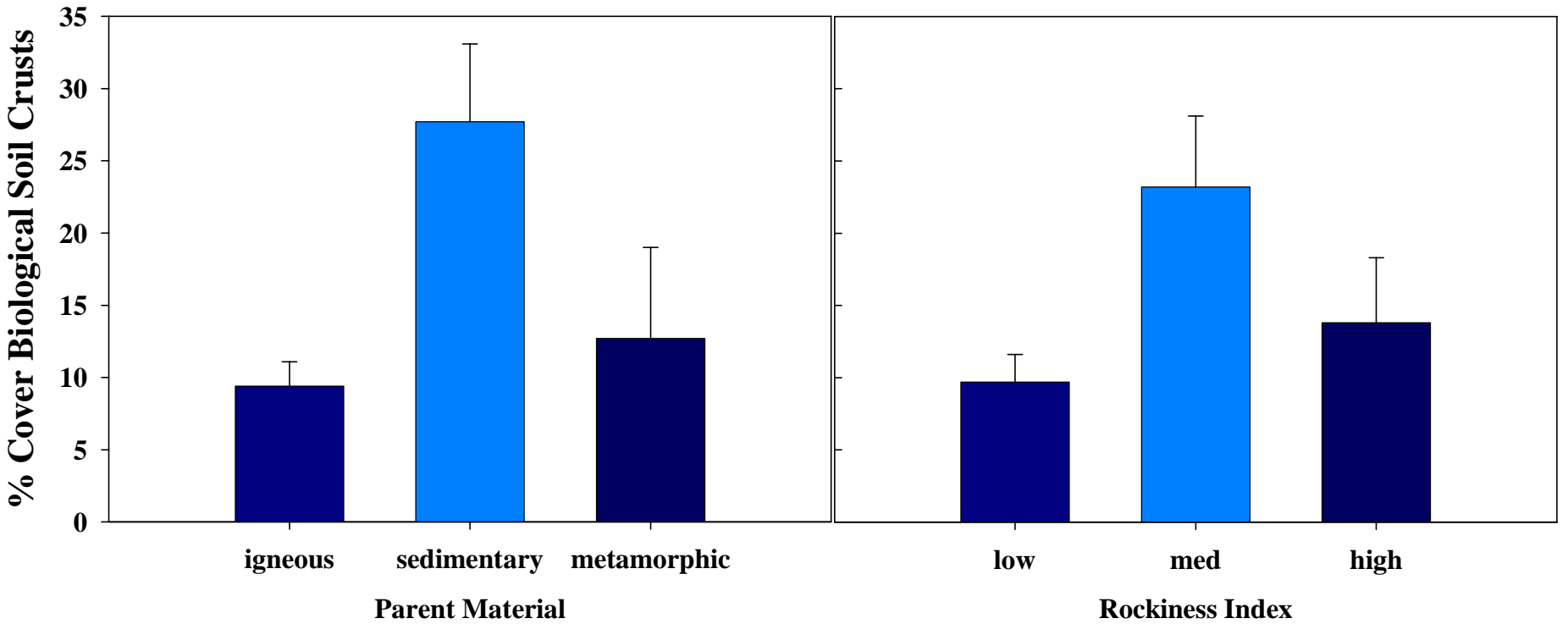
Sand Size Fractions

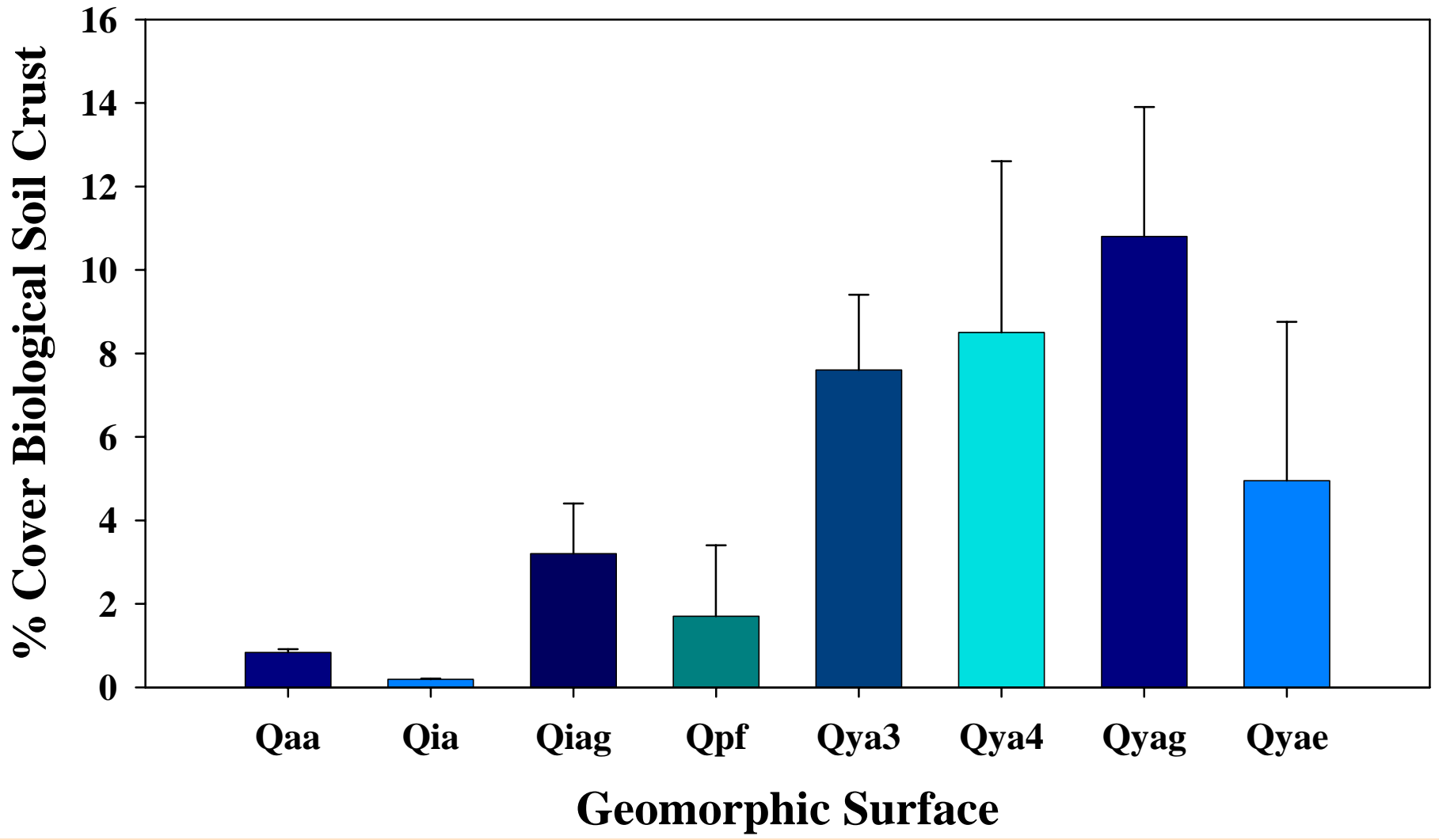
Average Annual Precipitation

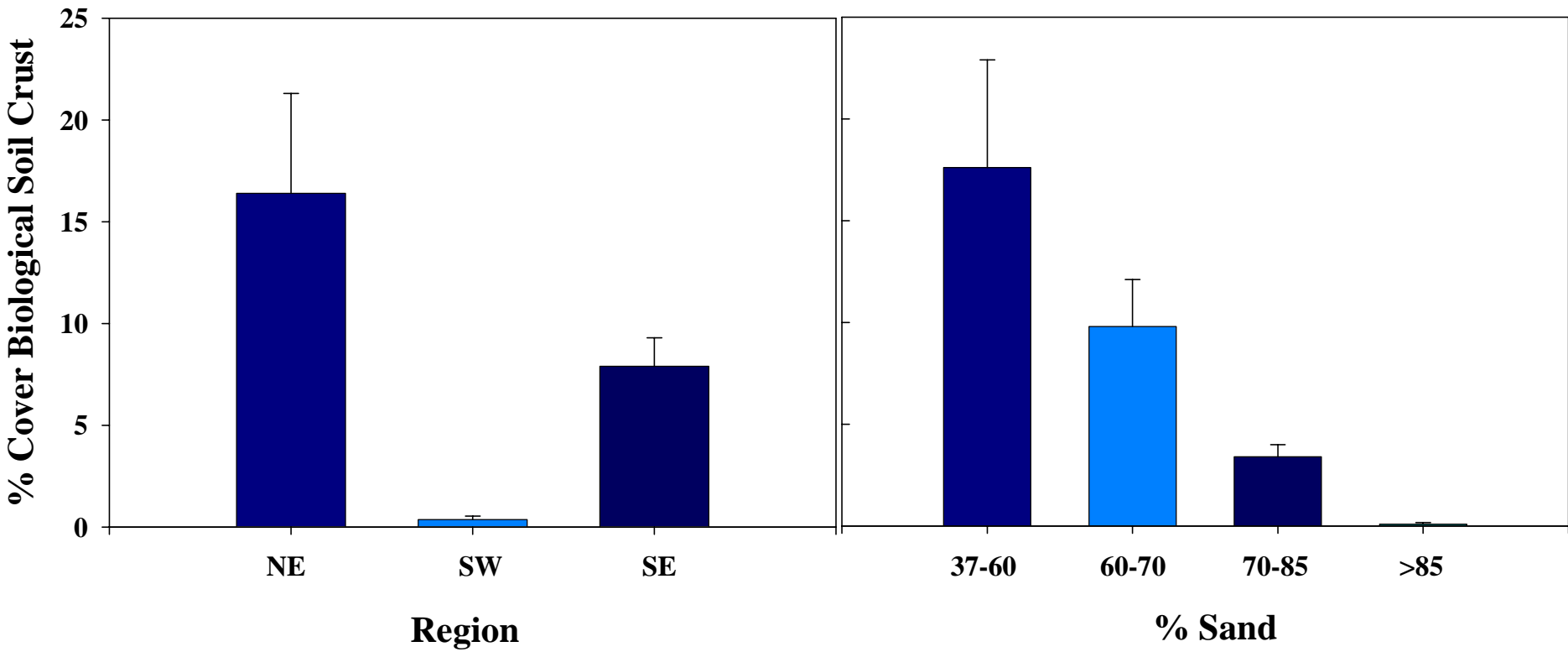
Average Annual ET

Mojave Ecosystem Potential Evapotranspiration









Parent Material

Sedimentary (limestone)

Igneous

Metamorphic



Soil Texture

Silt + Very Fine Sand

Medium Sand

High Sand

**Where do
biological soil
crusts grow**

BEST

Region

NE Mojave

SW Mojave



Rock Cover

Moderate Rock Cover

Low Rock Cover

High Rock Cover

Parent Material

Sedimentary

Igneous

Metamorphic



Soil Texture

Low Sand

Medium Sand

High Sand

Where do
biological soil
crusts grow

WORST

Region

NE Mojave

SW Mojave



Pavement Development

Low

Moderate

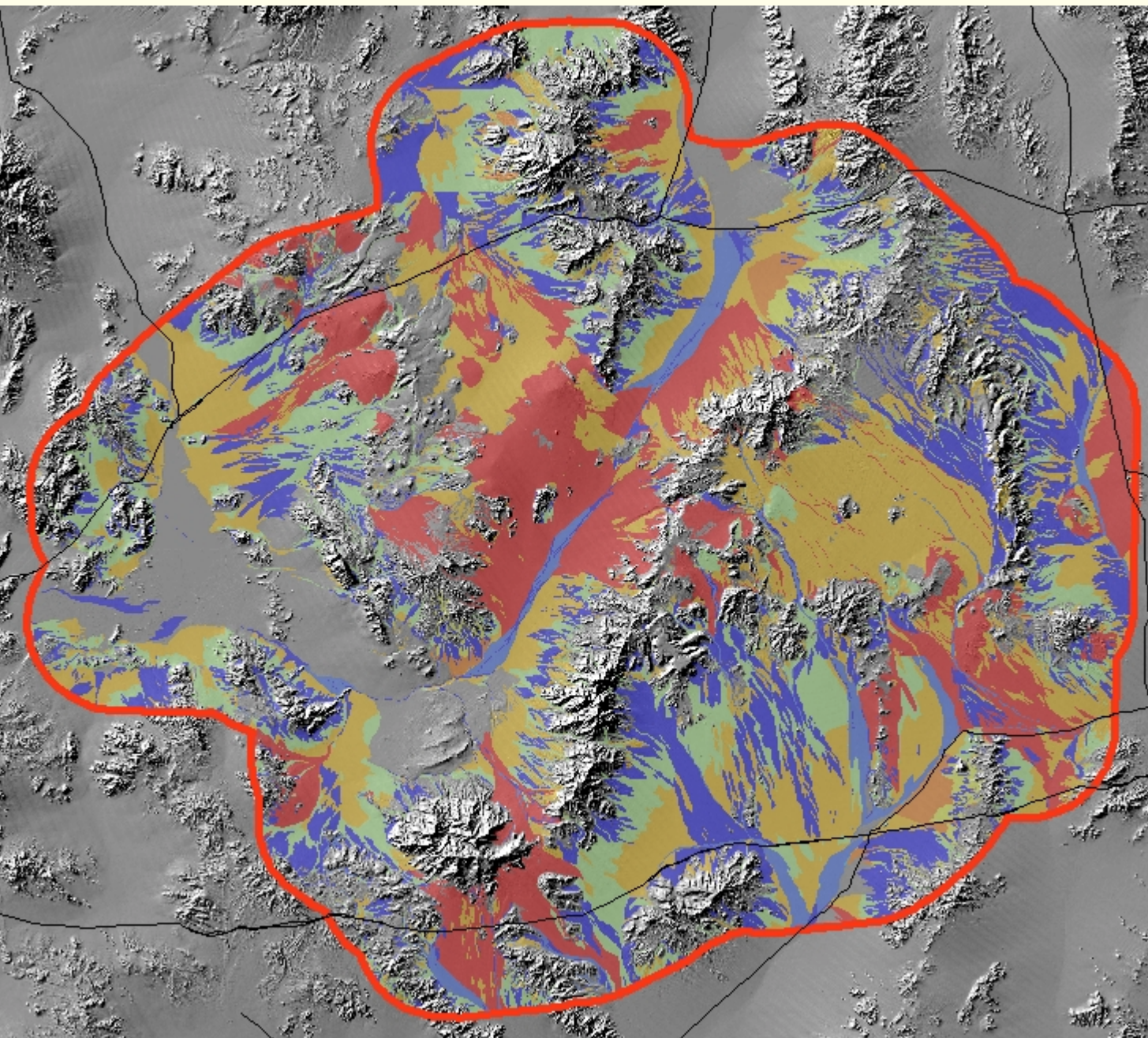
High

(well-developed)

Preliminary Biological Soil Crust Map of the

Legend

- Main Road
- MOJA border, buffer



Where from here, for Mojave Crusts?



- **Map of predicted lichen distribution**
 - **Verify in the field**
- **Enlarge database of dated disturbances to better predict recovery**