# Crust Recovery

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# Soil Stability

## Scattered Vegetation

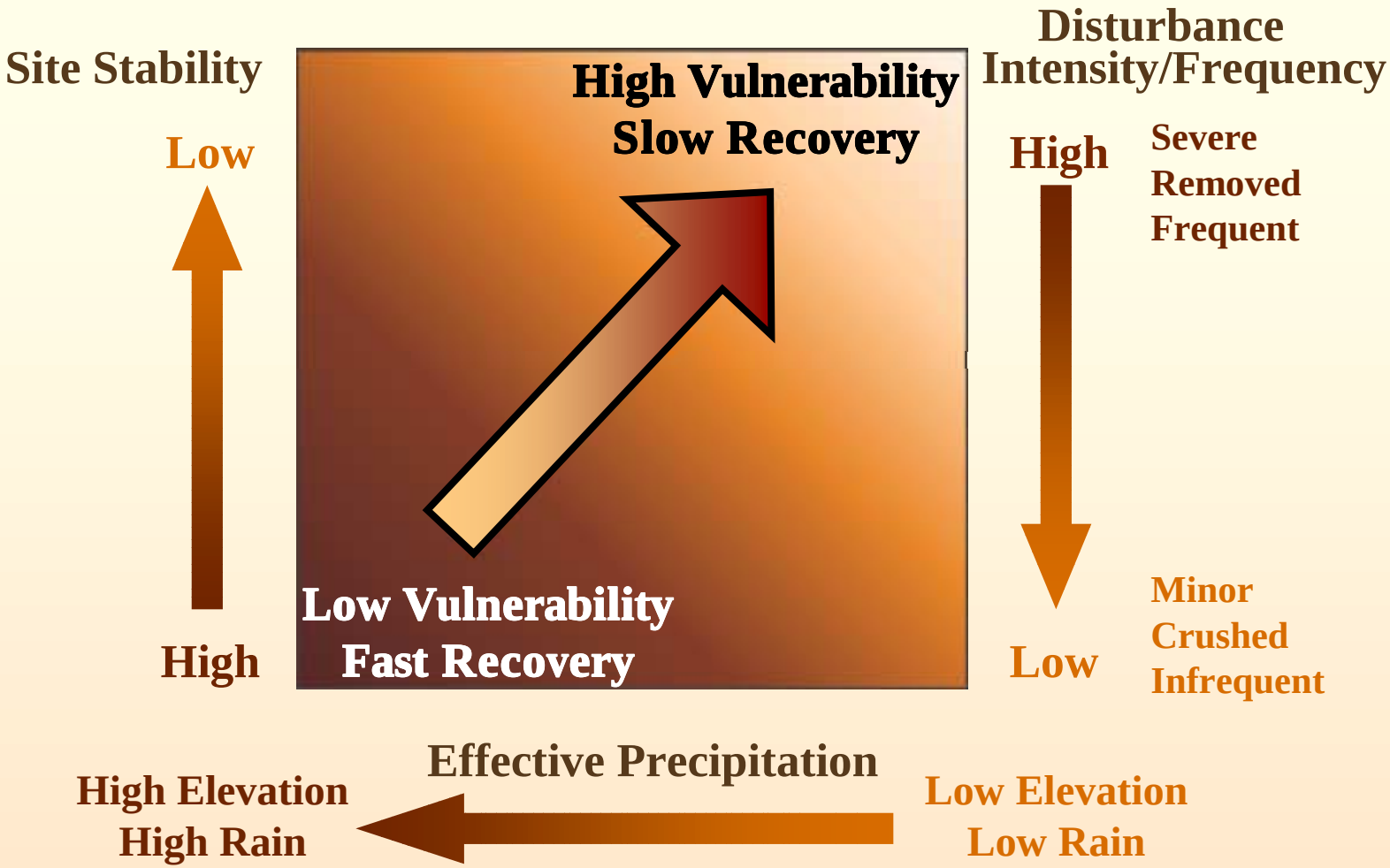
**In deserts, plants give little protection to desert soils**

## Hill slopes

**Soils held beyond angle of repose**

# Soil Fertility

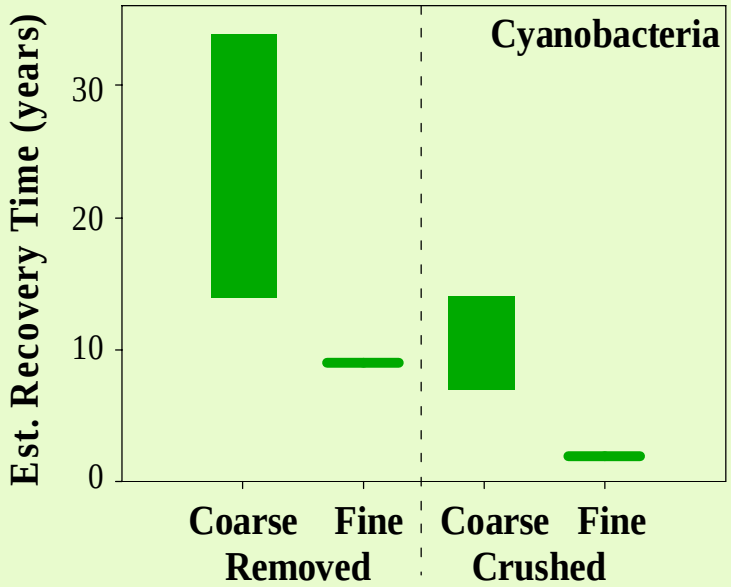
- **Crusts convert atmospheric N into bio-available forms**
- **Chelators, growth factors, sticky sheaths**
- **Plant tissue concentrations**

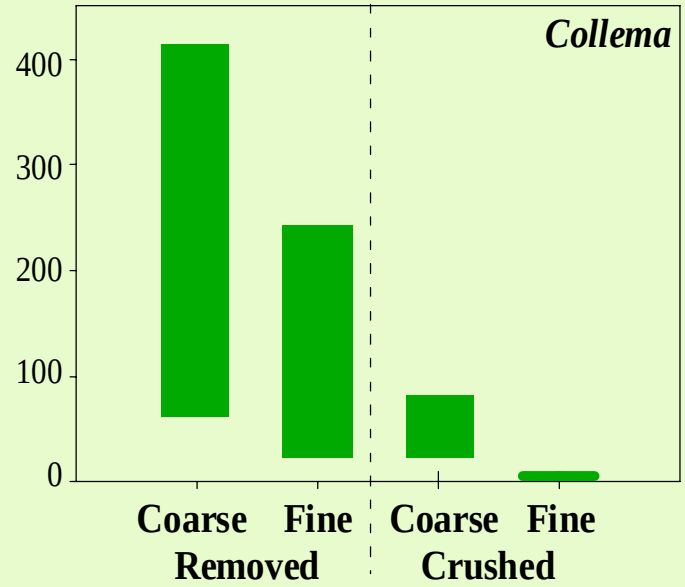


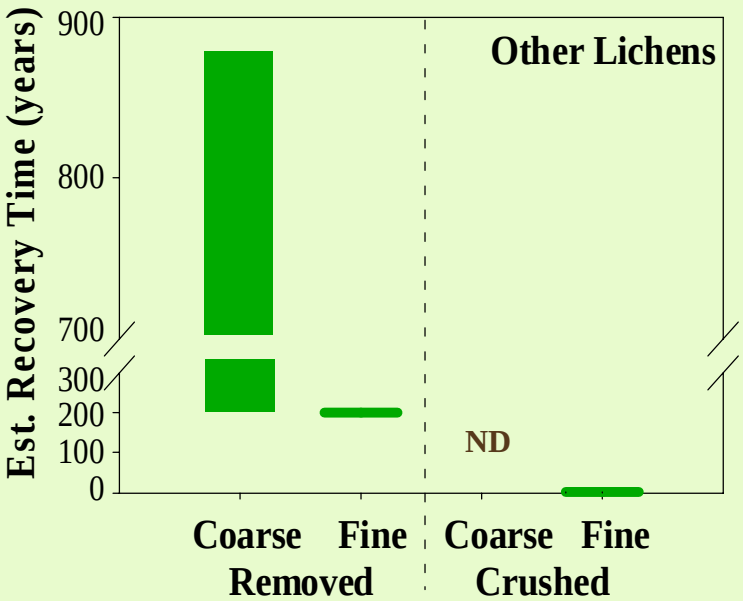

**Factors Determining Site Stability**

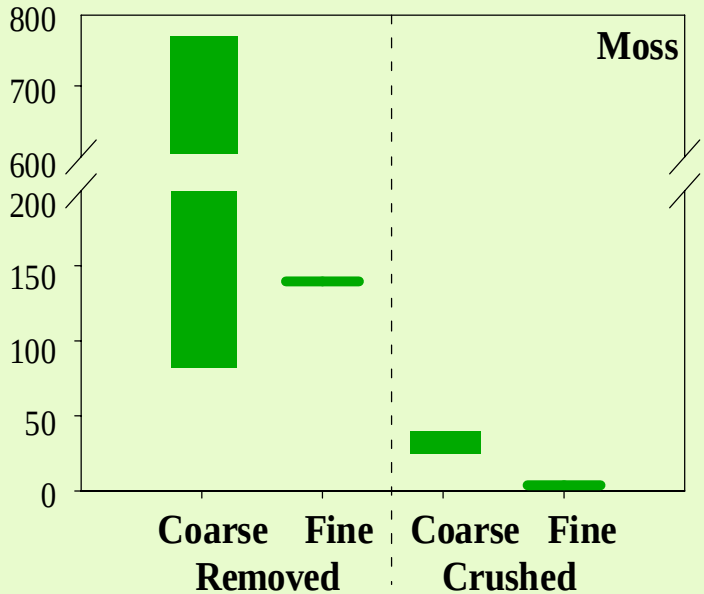
- Soil Texture/Age
- Rock/Gravel Cover
- Soil Depth
- Plant Spacing

# Soil Texture

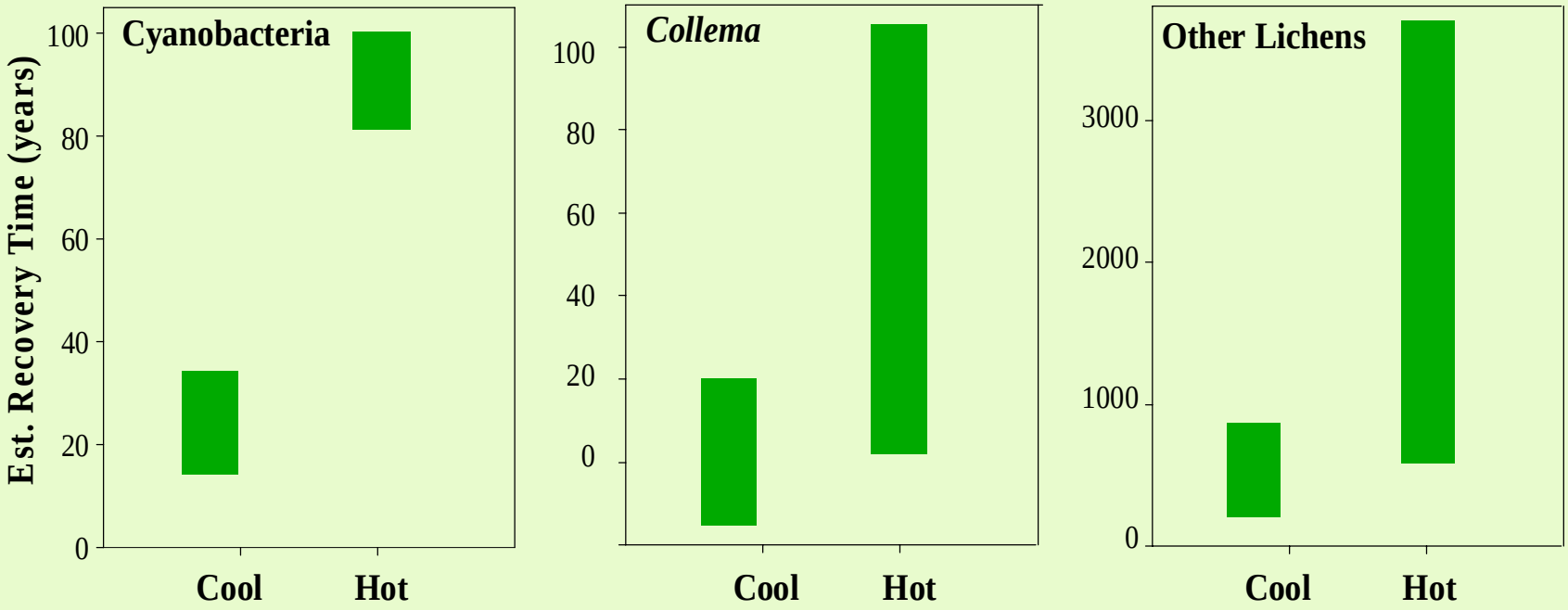


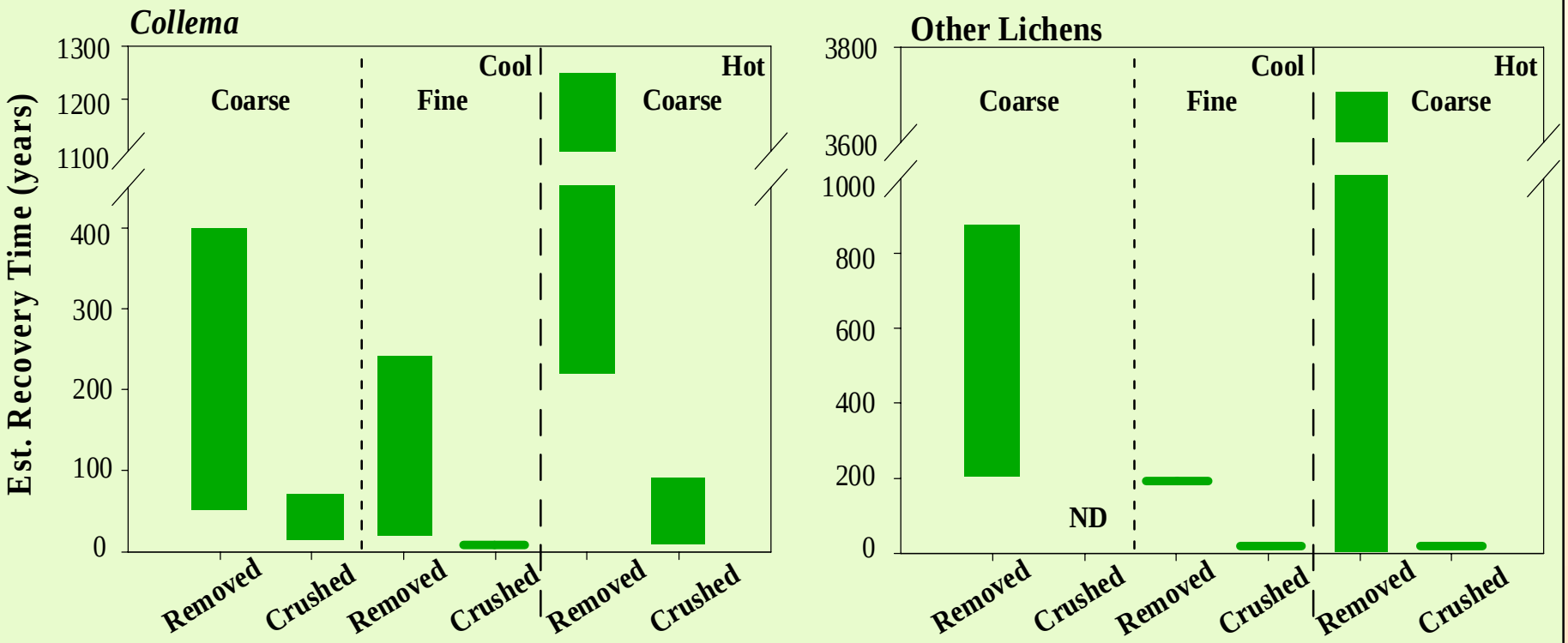



## Effective Precipitation



# Severity of Disturbance



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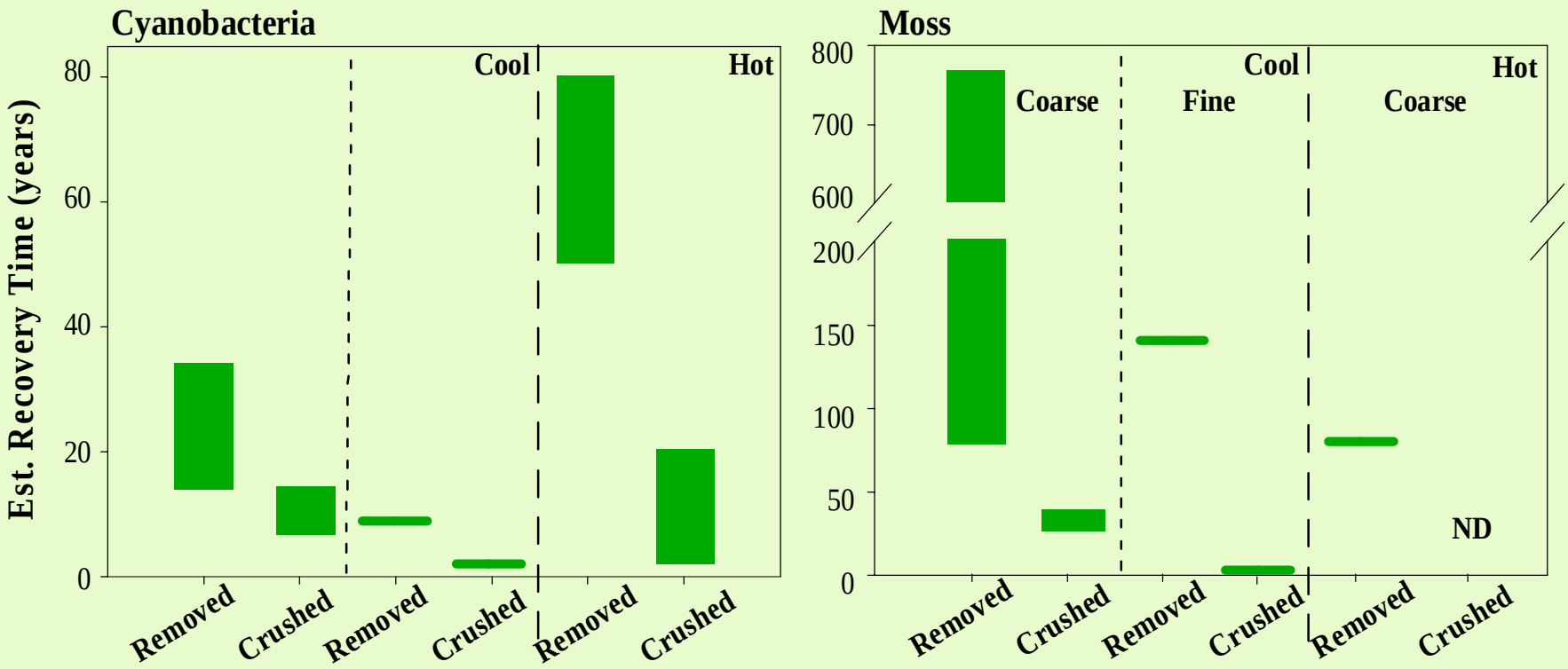
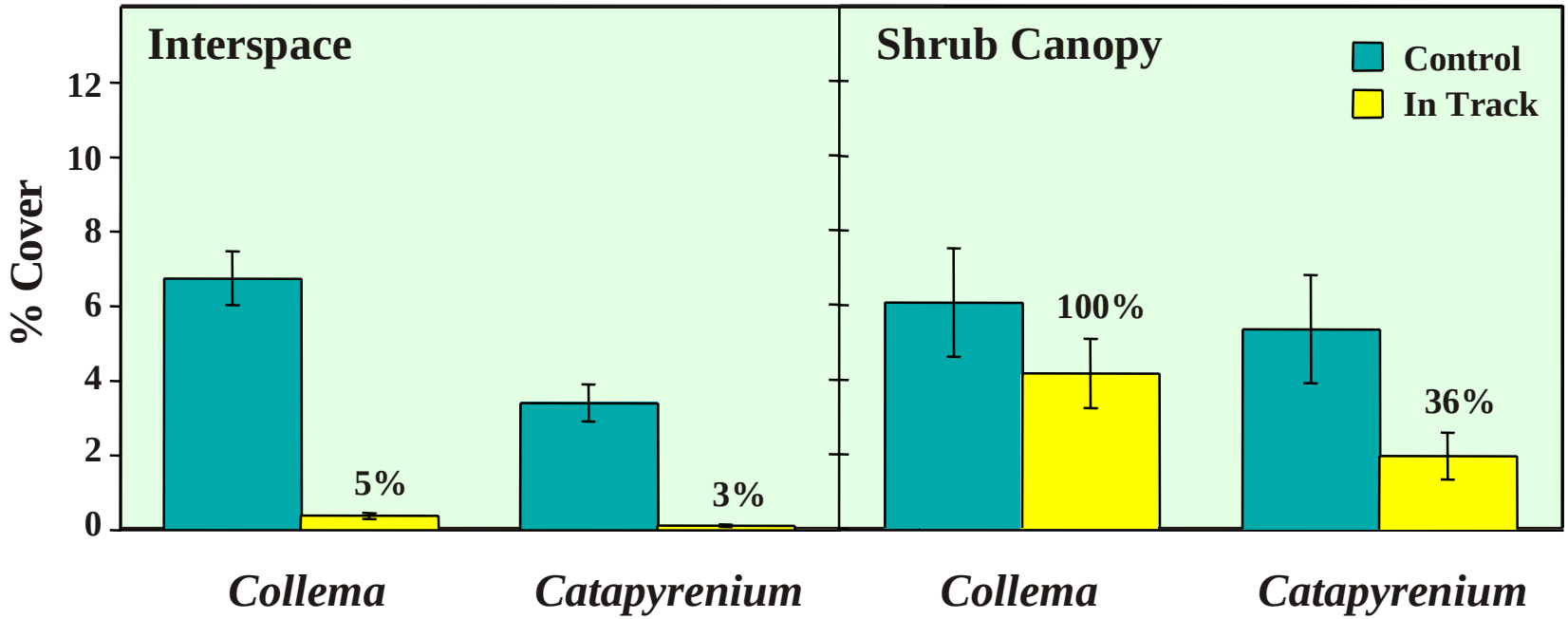


# Placement Matters

## General Patton's Tank Tracks, after 55 years



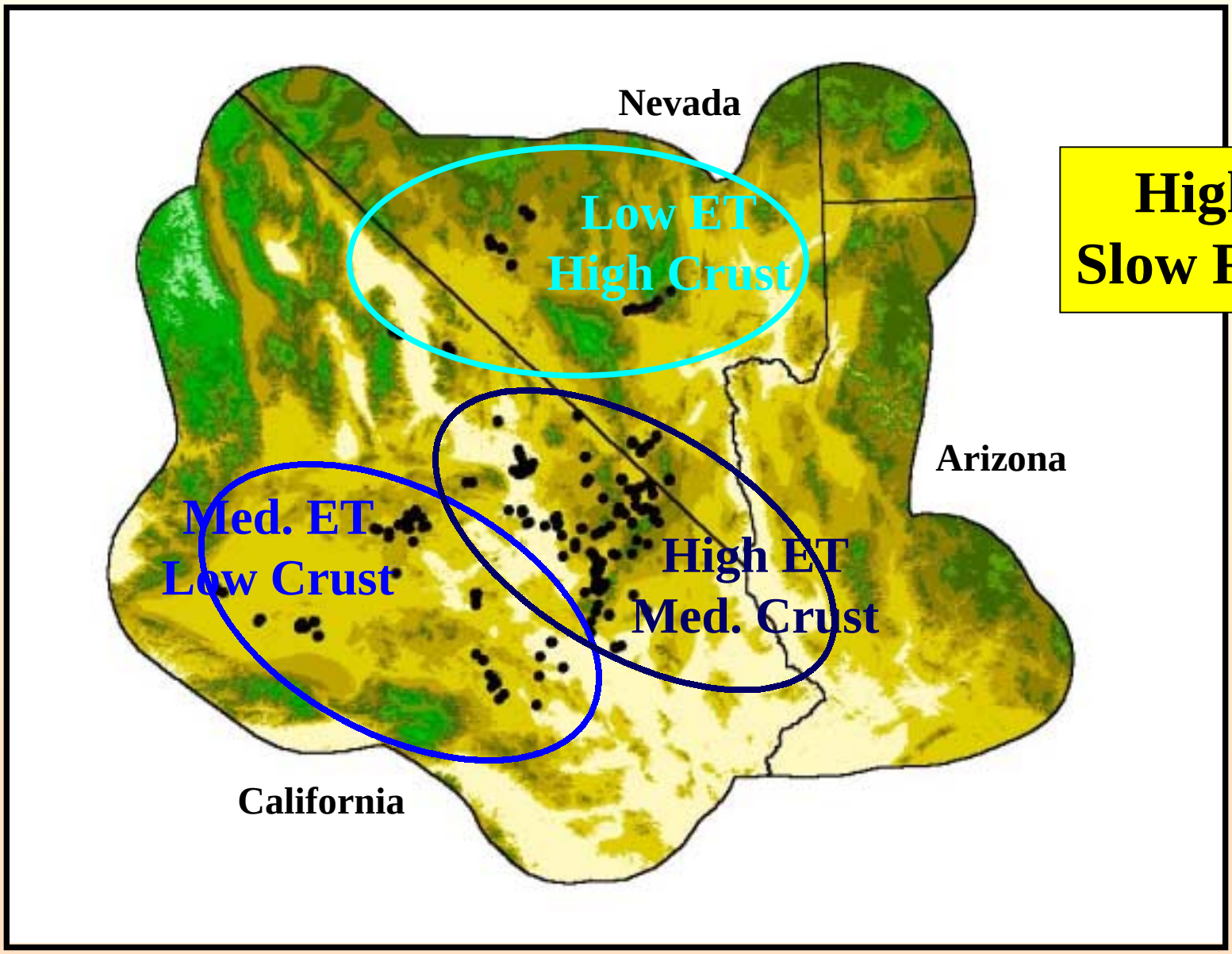

## Estimated Time to Full Recovery

| Interspaces | | Under Shrub Canopy |
|---|---|---|
| Cyanobacteria | 85-120 years | NA |
| *Collema* | ~900 years | ~85 years |
| *Catapyrenium*: | ~1900 years | ~150 years |

# Elevation matters

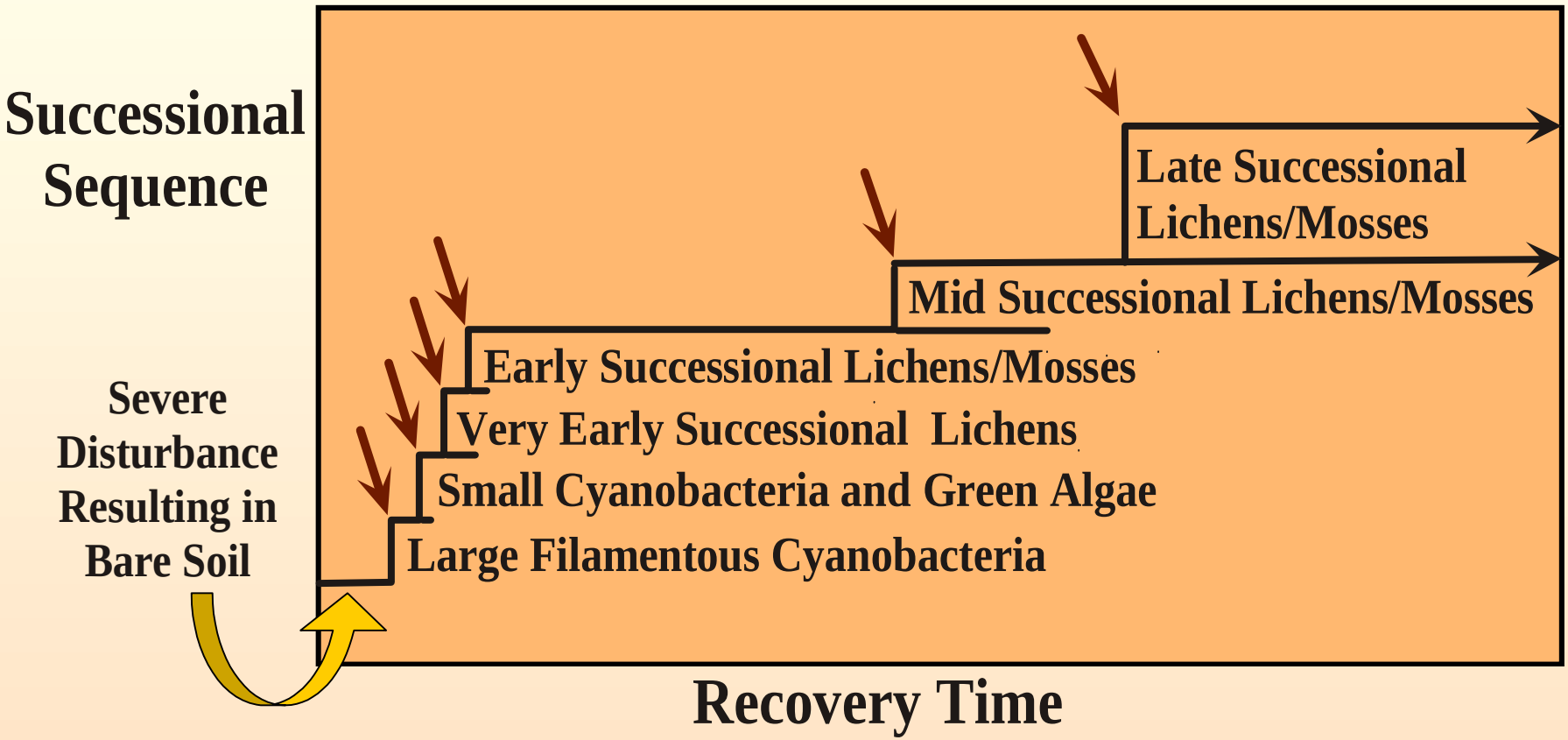
| Skidoo Townsite, April 1998 | | | | | |
|---|---|---|---|---|---|
| | Control Sites | Streets and Alleys | % Difference | *P* | Years to Recovery |
| Cyanobacteria | 12.78 | 15.22 | 19 | 0.07 | |
| *Collema* sp. | 18.19 | 6.79 | -63 | <0.0001 | 219 |
| *Fulgensia* sp. | 1.47 | 0.70 | -53 | 0.01 | 172 |
| *Psora decipiens* | 2.03 | 0.34 | -83 | <0.0001 | 490 |
| *Aspicilia reptans* | 5.03 | 2.58 | -49 | <0.0001 | 160 |
| *Toninia* sp. | 1.09 | 0 | -100 | <0.0001 | 4 |
| *Heppia* sp. | 0.31 | 0 | -100 | 0.02 | 4 |
| *Catapyrenium squamulosum* | 10.21 | 0.83 | -92 | <0.0001 | 1007 |
| Moss | 13.22 | 14.88 | 13 | 0.23 | |
| Annual Plant | 2.75 | 4.88 | 78 | 0.002 | |
| Perennial Plant | 14.25 | 15.11 | 6 | 0.80 | |
| Litter | 2.41 | 3.80 | 58 | 0.18 | |
| Rock | 16.25 | 34.87 | 115 | <0.0001 | |

# Mojave Ecosystem Potential Evapotranspiration



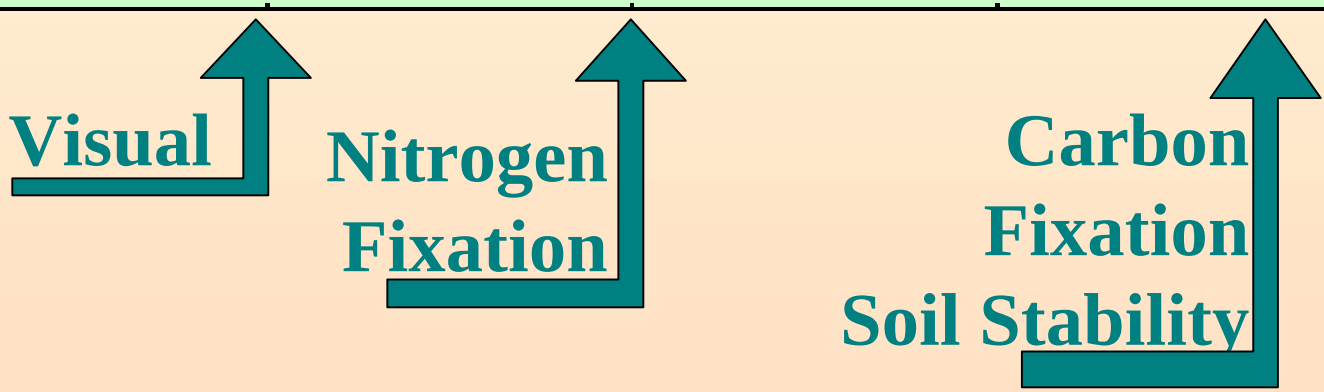

**High PET**
**Slow Recovery**

# Vulnerability and Recoverability of Species



# Recovery Time

| *Desert* | Cyanobacteria Biomass | Early Lichens | Mid-Lichens and Mosses | Late Lichens and Mosses |
|---|---|---|---|---|
| Mojave (low) | 50 - 100 | 200 - 1200 | 600 - ? | ? |
| Mojave (high)<br>Colorado Plateau | 14-34 | 50 - 400 | 200- ? | ? |
| No. Great Basin | | 20 | 60 | 125 |



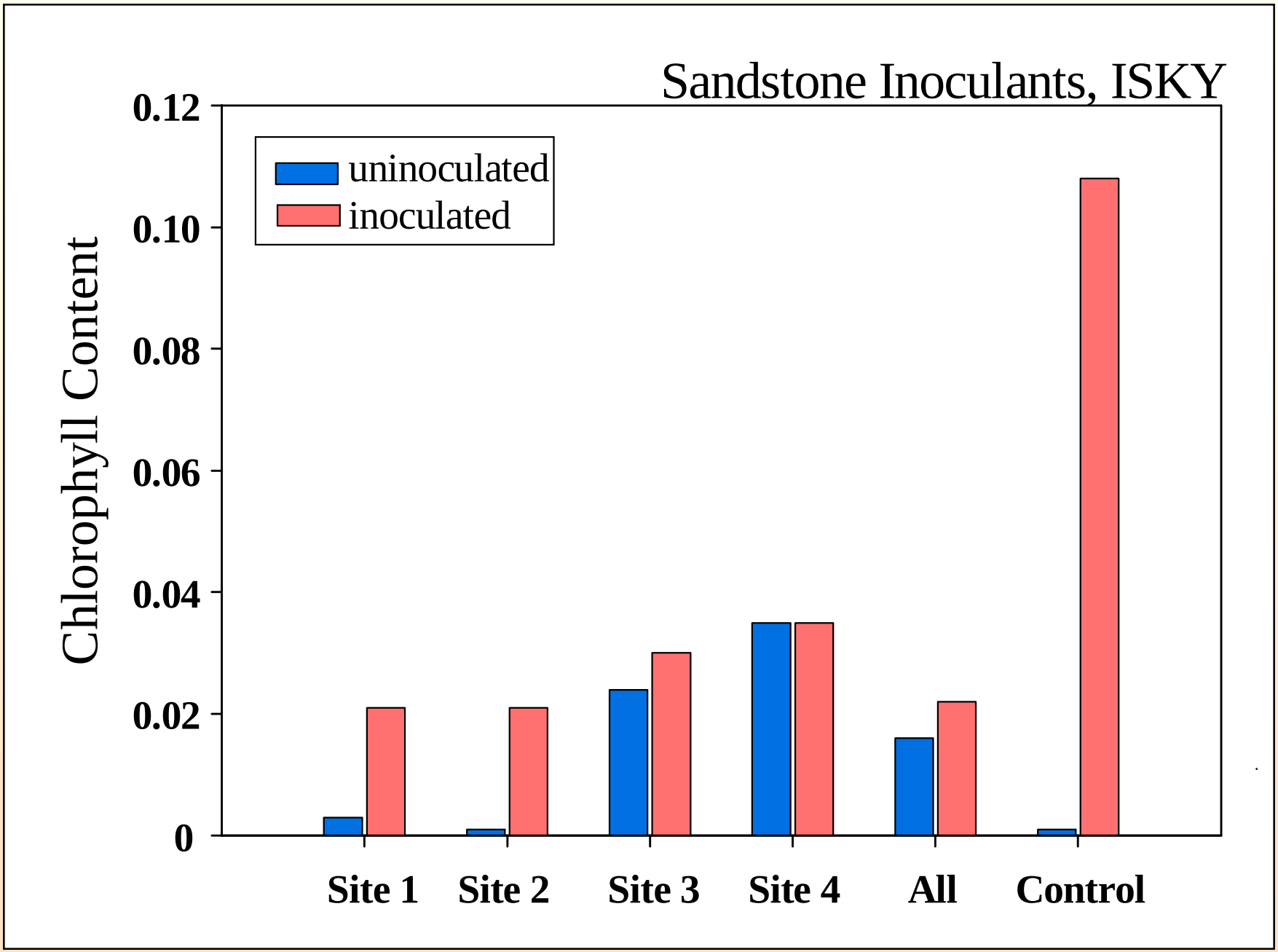
# Recovery: Is It Linear?

| | 2-5 years | 10-14 years |
|---|---|---|
| Cyanobacteria | 45-110 | 14-34 |
| Moss | 400 | 42 |
| Lichen | 85 | 50 |

# How can we enhance recovery?

**(Nutrients? Water?Need to understand processes)**

- **Reduce Disturbance**
- **Plant Cover**
- **Inoculation**
- **Fertilization?**


Sandstone Inoculants, ISKY
uninoculated
inoculated
Chlorophyll Content
0.12
0.10
0.08
0.06
0.04
0.02
0
Site 1
Site 2
Site 3
Site 4
All
Control

# How to innoculate

1. Commercial innoculant
2. Collect and spread
3. Collect as chunks (alter shape)
4. Storage
5. Fertilize?
6. Stabilize surfaces?

**Look forward to the altered world!**