

Contributions of biological soil crusts to global soil carbon stocks

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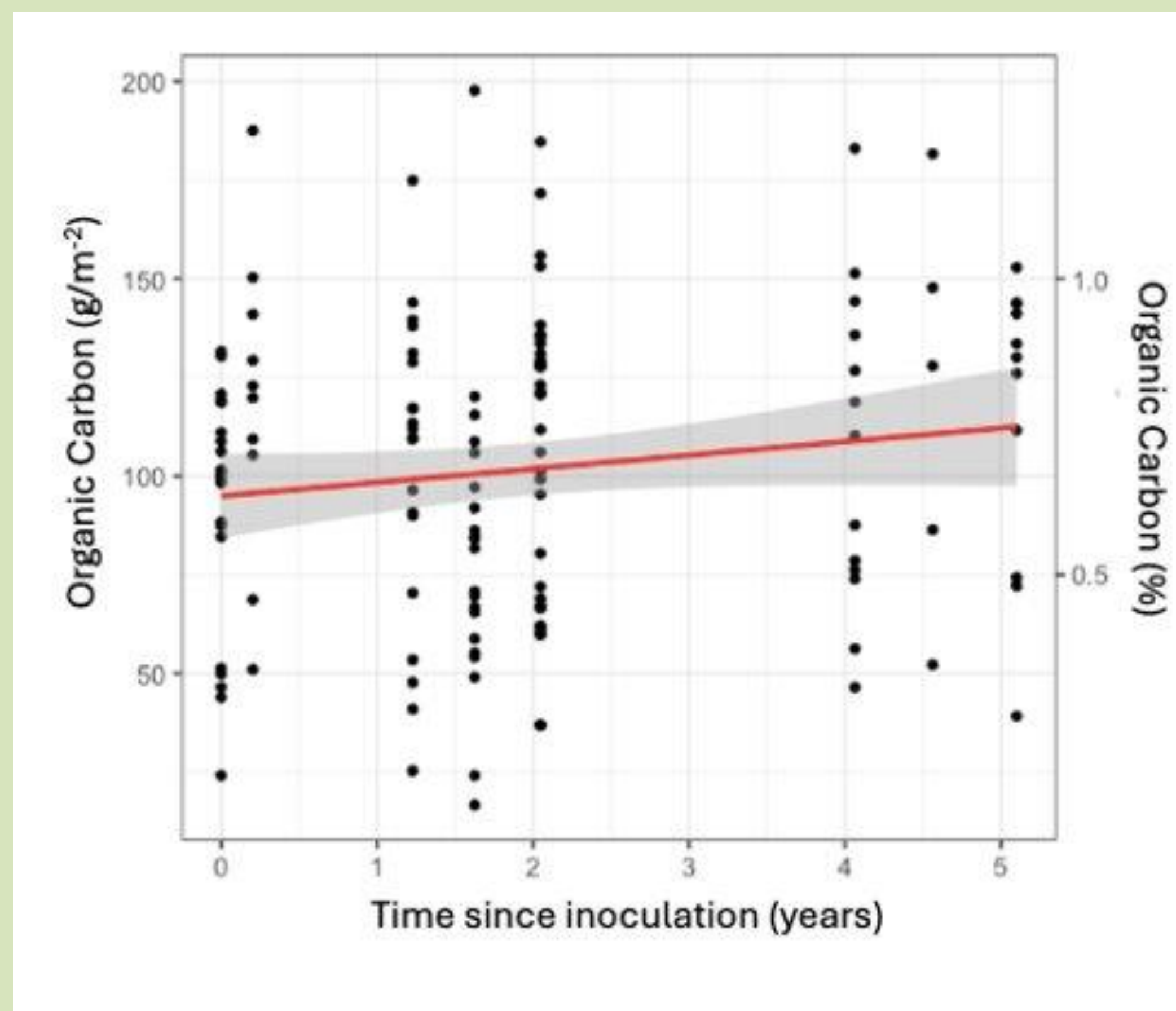


Soil organic carbon is a major global carbon sink, critical to regulating soil quality and the global carbon cycle. Contributions of drylands, particularly biocrusts as photosynthetic microbial communities, to global SOC stocks are understudied.

How much organic carbon do soil crusts contribute to the soil profile?

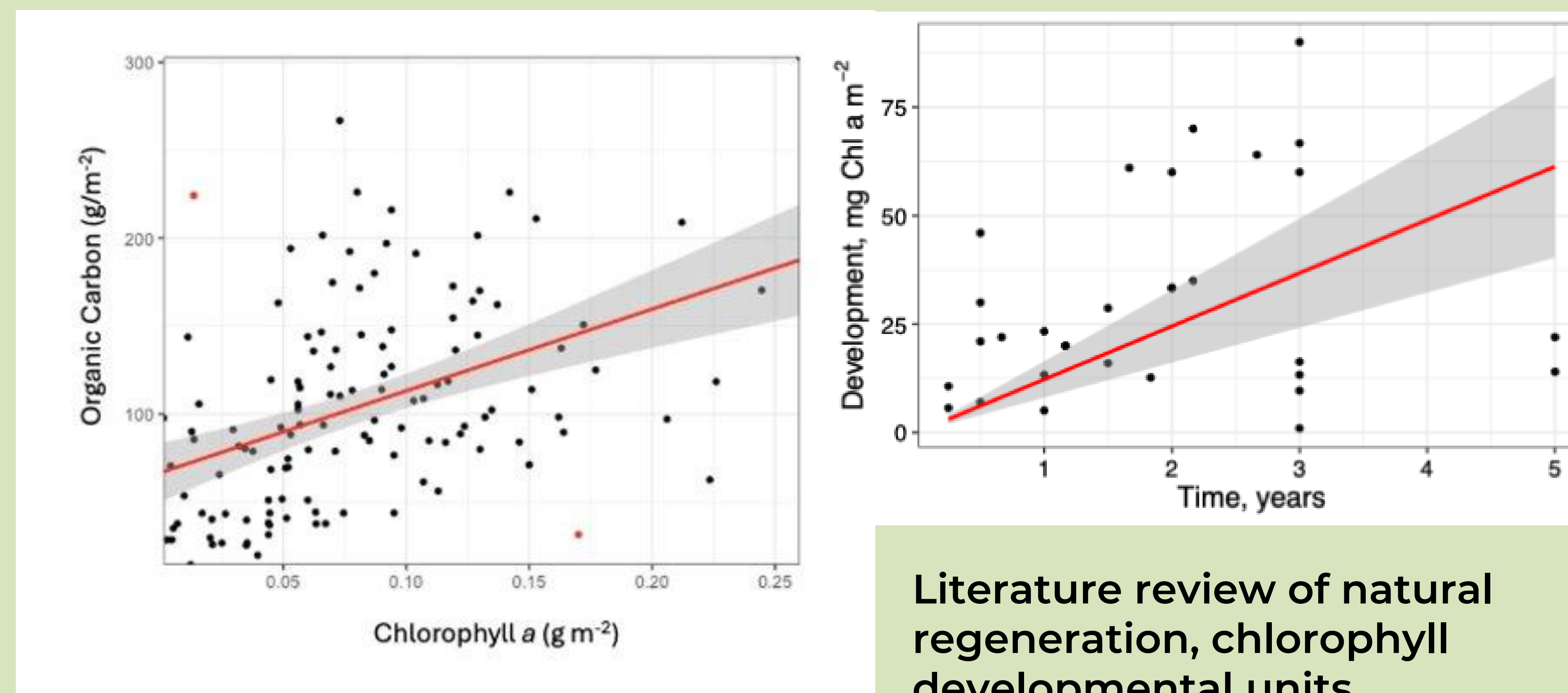
1. Determine Surface SOC accumulation rate

1.a. Time series (one site, 5 years) ★



Surface (top 1cm) soil from crustivoltaic restoration site: gradual increase of SOC
 $3.5 \pm 2.2 \text{ g C m}^{-2} \text{ y}^{-1}$

1.b. Continental Survey (one time, many sites)

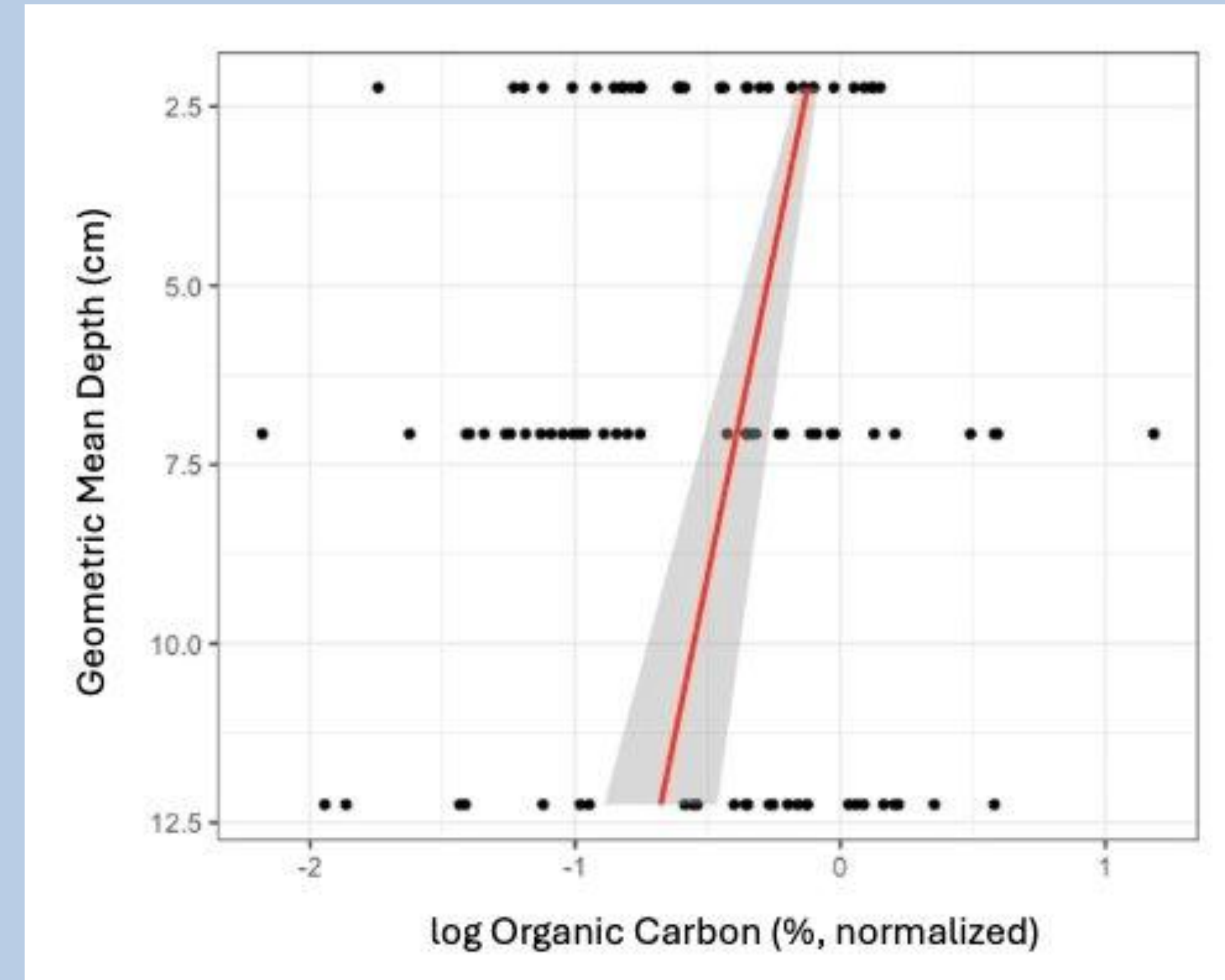


143 samples of cyanobacteria crusts from deserts across Southwest: chlorophyll correlated with SOC

Literature review of natural regeneration, chlorophyll developmental units translated to time:
 $6.2 \pm 2.0 \text{ g C m}^{-2} \text{ y}^{-1}$

2. Expand to entire profile

2. Depth Integration (3 sites, 15 cm deep)



15cm deep cores from crusts: exponential SOC decay with depth
 $\lambda = 0.055 \pm 0.009$
 $\text{OC}(z) = \text{surface OC} e^{-\lambda z}$



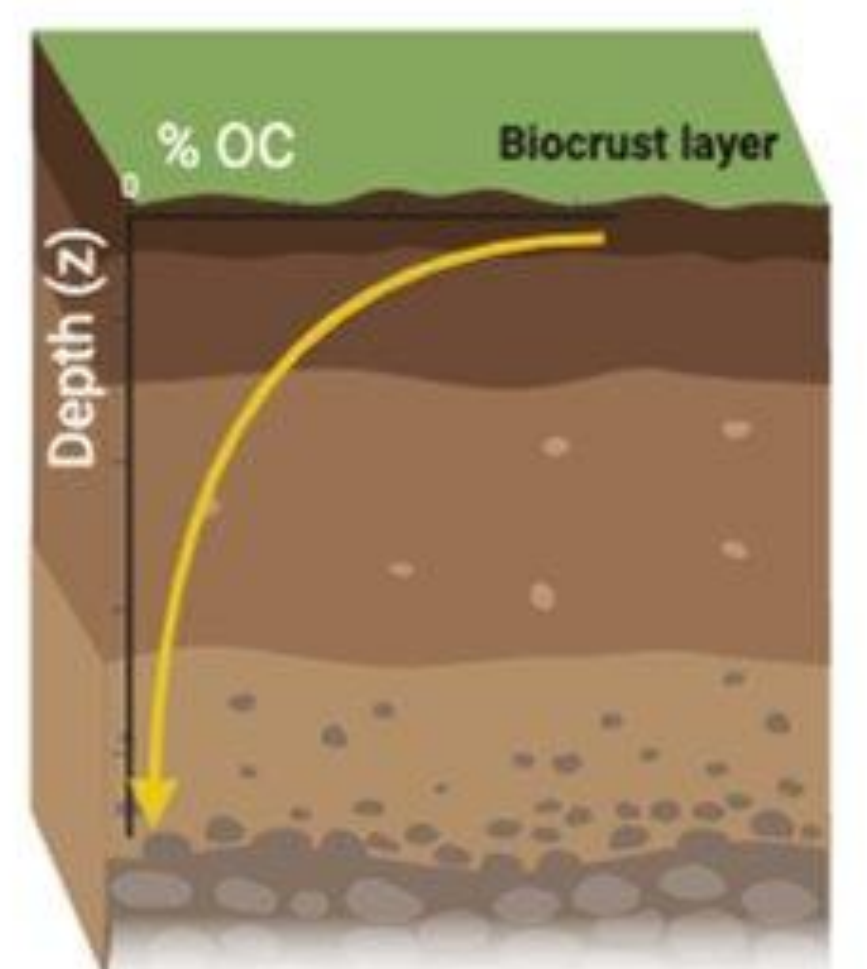
$3.5 \pm 2.2 \text{ g C m}^{-2} \text{ y}^{-1}$

$6.2 \pm 2.0 \text{ g C m}^{-2} \text{ y}^{-1}$

SOC density accumulation rate estimates

$169 \pm 0.054 \text{ g C m}^{-2} \text{ y}^{-1}$

$\text{OC}(z) = \text{surface OC} e^{-\lambda z}$



Cyanobacteria biocrusts contribute 0.17Kg of soil organic carbon per m² per year, 1.2Kg per m² in a lifetime. Globally, currently existing biocrusts have contributed 22 Pg of soil organic carbon, 5% of SOC in arid lands.

