

Using Local and Scientific Knowledge to Establish the Reference for Ecological Site Descriptions and State and Transition Models

Interagency Ecological Site Applications Workshop

Archbold Biological Station, Venus, Florida

15 - 17 November 2011

Jeff Herrick -- USDA-ARS Jornada Experimental Range

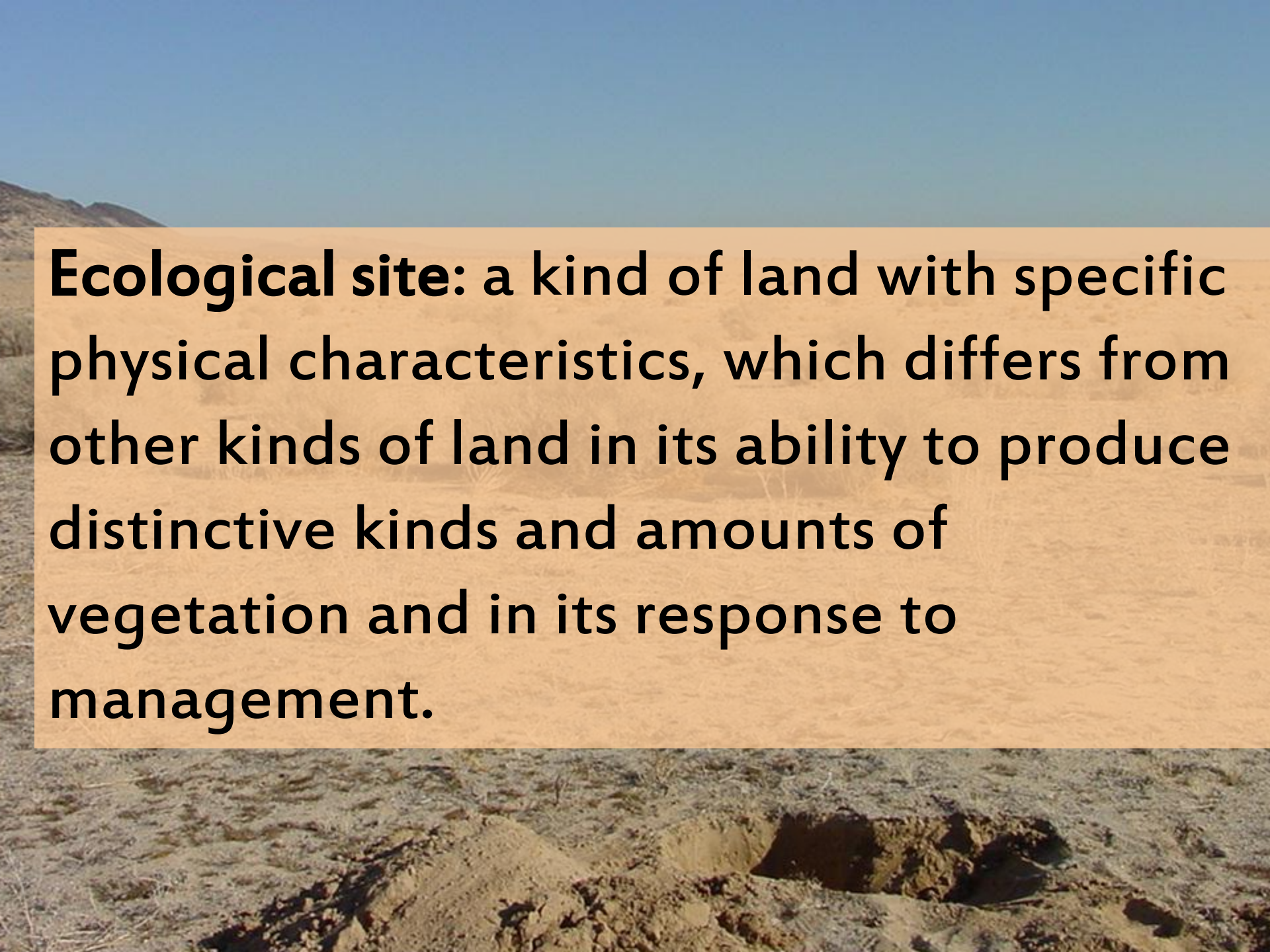




NRCS



NRCS



Ecological site: a kind of land with specific physical characteristics, which differs from other kinds of land in its ability to produce distinctive kinds and amounts of vegetation and in its response to management.





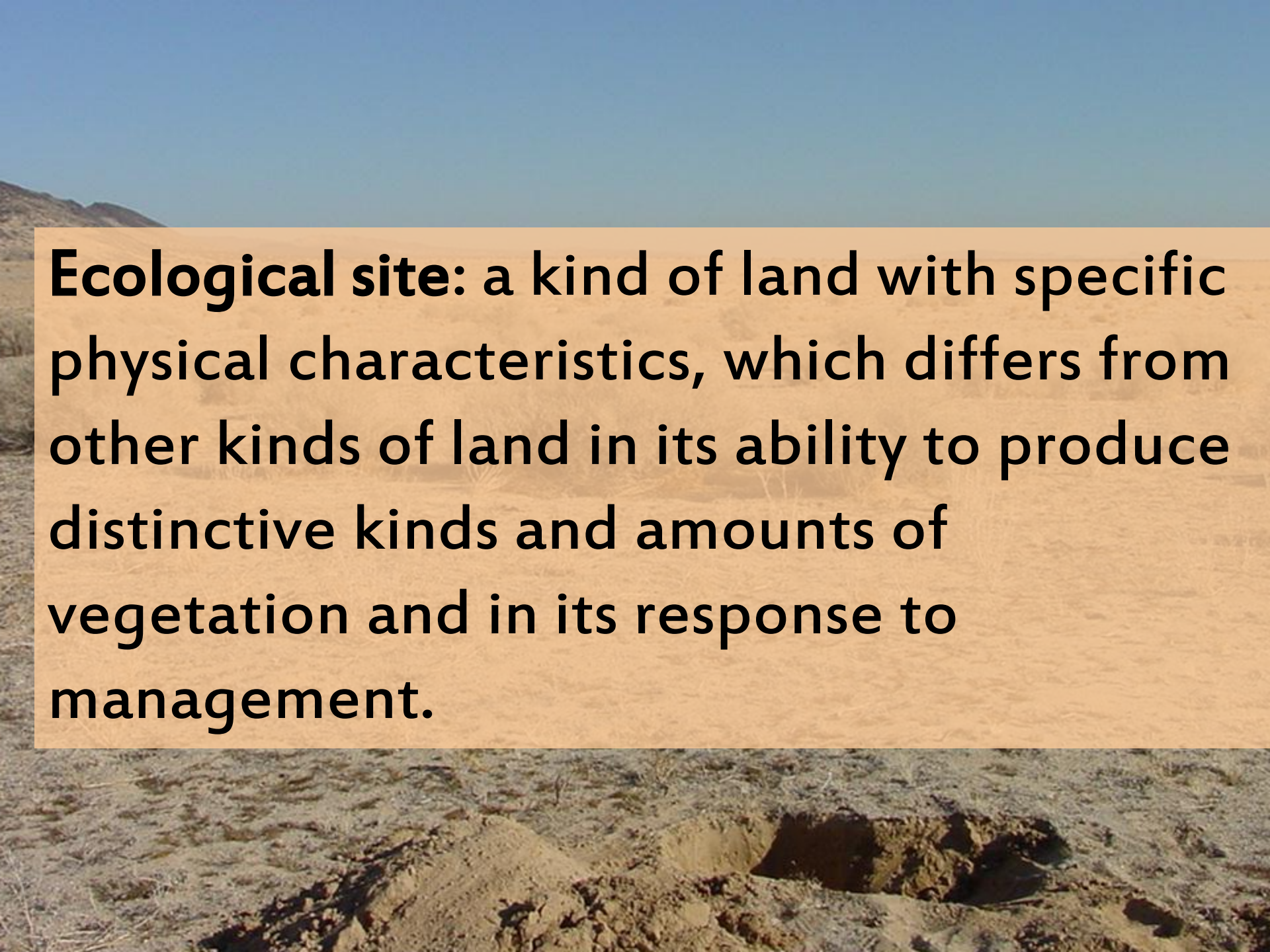
Clay-rich
(probably
saline) layer



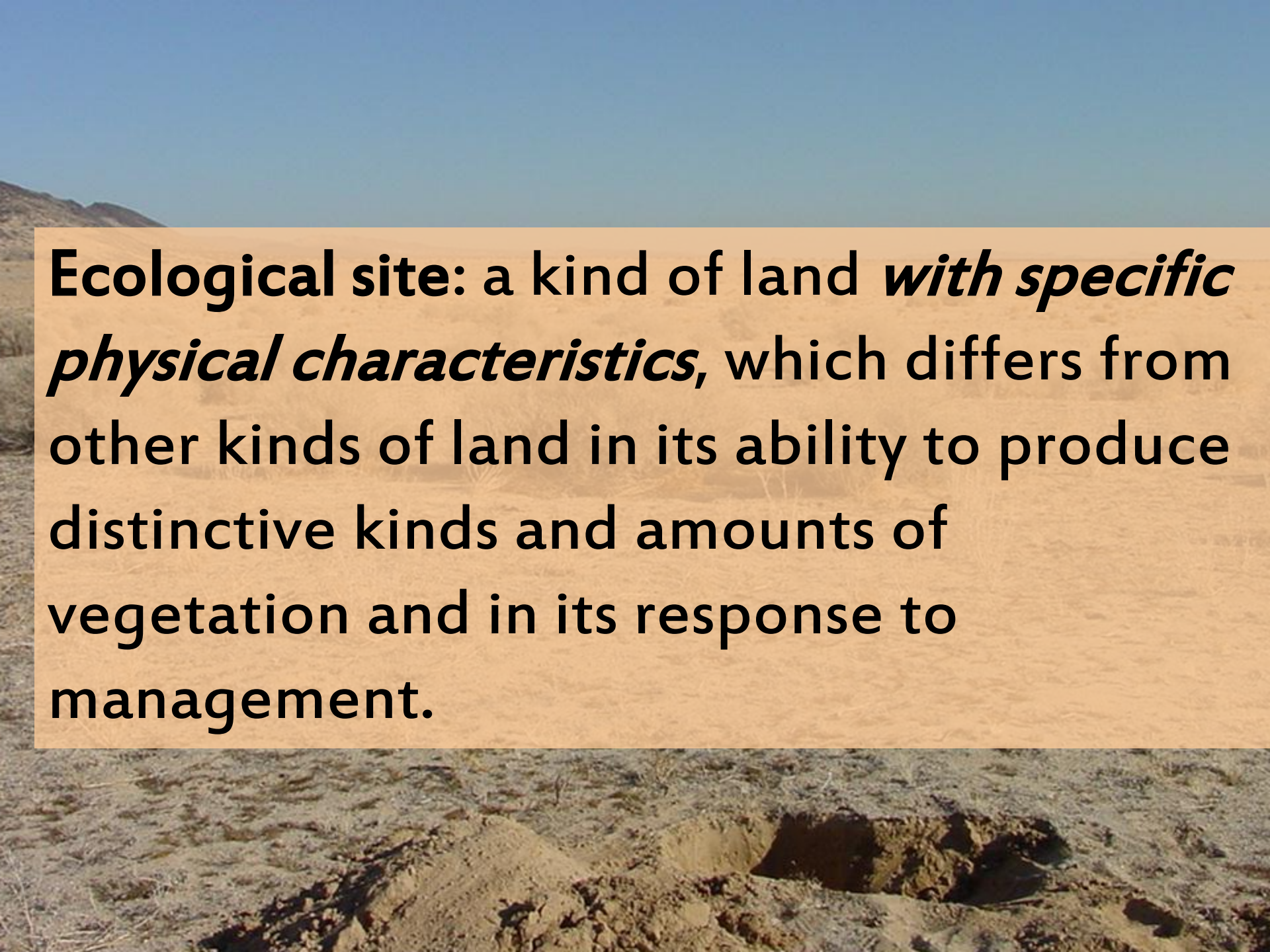








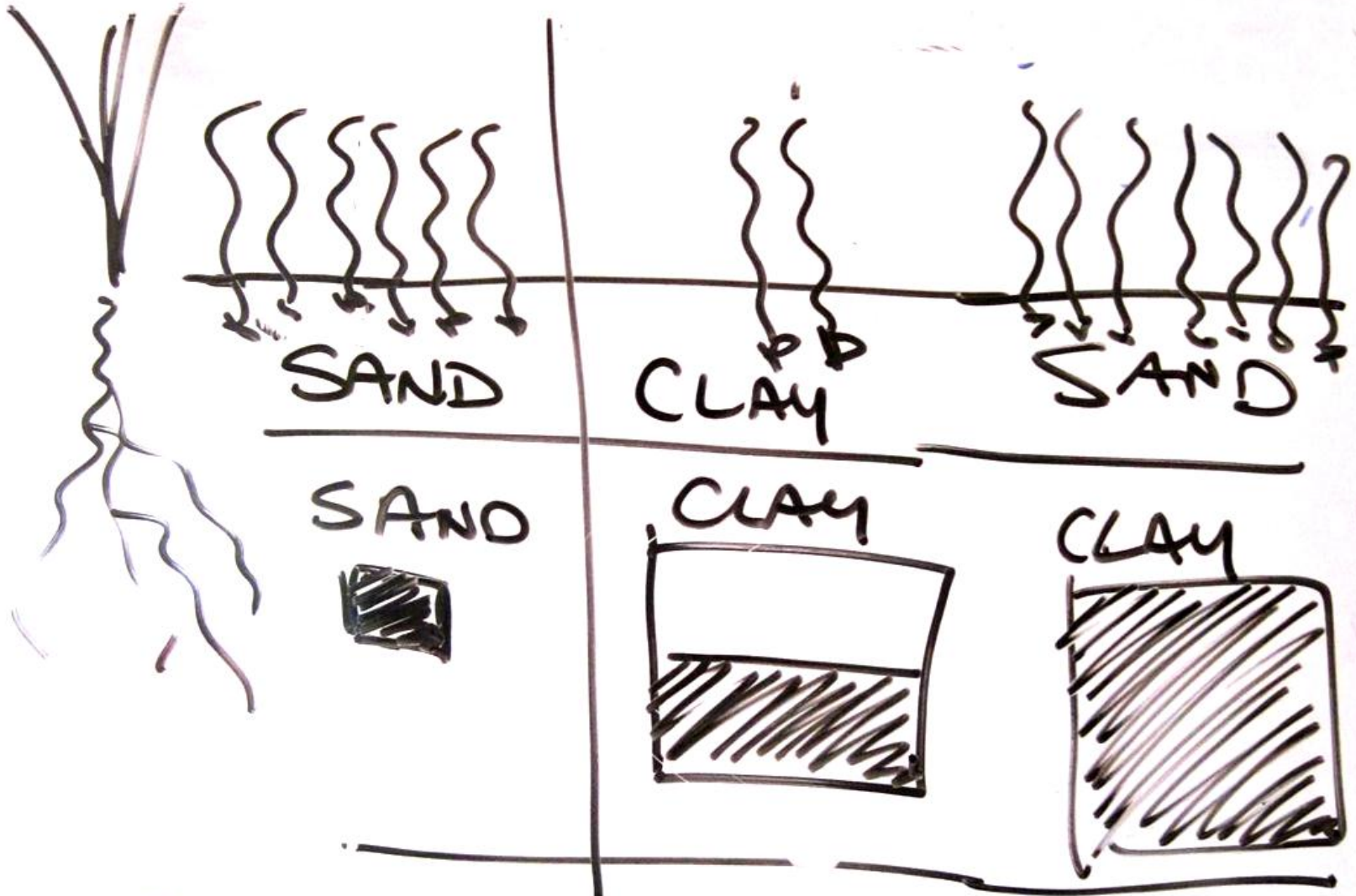
Ecological site: a kind of land with specific physical characteristics, which differs from other kinds of land in its ability to produce distinctive kinds and amounts of vegetation and in its response to management.

A photograph of a desert landscape with a large orange text box overlaid. The background shows a clear blue sky, a sandy dune in the distance, and a rocky, sparsely vegetated foreground. The text box contains a definition of an ecological site.

Ecological site: a kind of land *with specific physical characteristics*, which differs from other kinds of land in its ability to produce distinctive kinds and amounts of vegetation and in its response to management.

What characteristics determine productivity?

Ecological site: a kind of land with specific physical characteristics, which differs from other kinds of land *in its ability to produce distinctive kinds and amounts of vegetation* and in its response to management.



50cm CLAY W

What characteristics determine short- and long-term response to management?

Ecological site: a kind of land with specific physical characteristics, which differs from other kinds of land in its ability to produce distinctive kinds and amounts of vegetation *and in its response to management.*

(Relatively) static vs. Dynamic Soil Properties

What's the difference?

Why do we care?



(Relatively) static vs. dynamic soil properties

- (Relatively) static properties:
 - are used to define soil map unit components (and therefore ecological sites)
 - change little in response to differences in management and vegetation
- Dynamic properties:
 - are used to define the relative condition of the soil
 - change in response to differences in management
 - are related to changes in erodibility, infiltration, nutrient availability, etc...



Factors associated with (relatively) static vs. dynamic soil properties

- (Relatively) static properties associated with:
 - parent material and soil profile development (mineralogy, depth, texture)
 - landscape position (long-term source/sink for sediment, water and nutrients)
- Dynamic properties associated with:
 - vegetation
 - soil biotic activity (from bacteria to badgers)
 - above-ground disturbance and short-term erosion/deposition (surface texture, infiltration capacity, microbiotic crusts)



(Relatively) static soil properties are used to identify ecological sites

- Soil depth
- Soil texture by depth
- Stoniness
- Type of clay (cracking vs. non-cracking)















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Regular Article

NITROGEN CYCLING MEDIATED BY BIOLOGICAL SOIL CRUSTS AND ARBUSCULAR MYCORRHIZAL FUNGI

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Plants in terrestrial systems obtain nitrogen primarily by root uptake from soil, yet current models of ecosystem nitrogen cycling assume little interaction of plant roots with the soil microbial community. The objective of this study was to determine how soil microorganisms in biological soil crusts interact with herbaceous plants for nitrogen in a pyrogenic ecosystem in Florida (USA), using a combination of natural abundance and tracer isotope methods. I demonstrate that plant nitrogen is strongly affected by interactions with mycorrhizal fungi and biological soil crusts. Measurements of nitrogenase activity indicated a high capacity of crusts to fix nitrogen that dramatically decreased after disturbance. Natural abundance of $\delta^{15}\text{N}$ differed between arbuscular mycorrhizal and nonmycorrhizal herbs. When a small amount of enriched nitrogen was used as a tracer, crusts initially captured a greater amount of the ^{15}N that was added compared to plants, with some turnover of nitrogen from the crusts to plants observed after 15 days. Observations in this study indicate that crusts

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... **plant nitrogen** is strongly affected by interactions with **mycorrhizal fungi** and **biological soil crusts**. Measurements of nitrogenase activity indicated a **high capacity of crusts to fix nitrogen that dramatically decreased after disturbance**.

When a small amount of enriched nitrogen was used as a tracer, crusts initially captured a greater amount of the ^{15}N that was added compared to plants, with **some turnover of nitrogen from the crusts to plants observed after 15 days**.

Observations in this study indicate that crusts have more than one function in nitrogen dynamics: **cyanobacteria in crusts fix nitrogen, crusts retain nitrogen in the system that would otherwise be lost to leaching...**

What's possible depends on soils and climate (= ecological site)

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Questions?

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