Ecological Site Descriptions and their Applications

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Ecological Site

“a distinctive kind of land based on recurring soil, landform, geological, and climate characteristics”

Divides landscapes into units that differ in ecological potential, resilience, and management needs

Ecological Site Description

Information about characteristics of an ecological site and the interpretation of its properties related to use and management

Similar concepts used globally

***Ecological sites*-Great Britain (Ray 2001)**

***Biogeoclimatic Ecosystem Classification*-Canada (Green and Klinka 1994)**

***Land systems*-Australia (van Gool and Moore 1999)**
http://www.publish.csiro.au/nid/289/aid/16090.htm

***Landscape units*-Germany, Netherlands (Bastian 2000)**

The ecological site concept

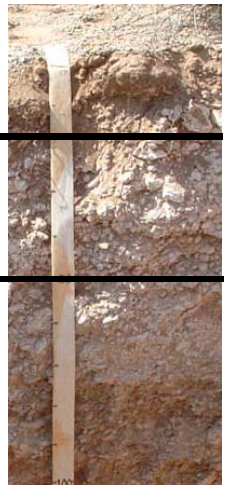
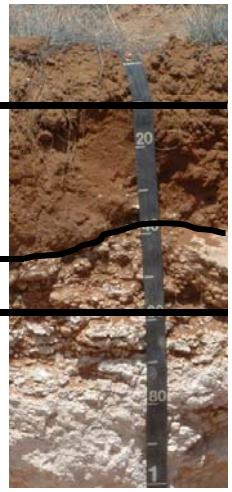
Land areas of different climate, soil, and landscape position differ in:

1) **Ecological potential**
   - **maximum possible forage production**

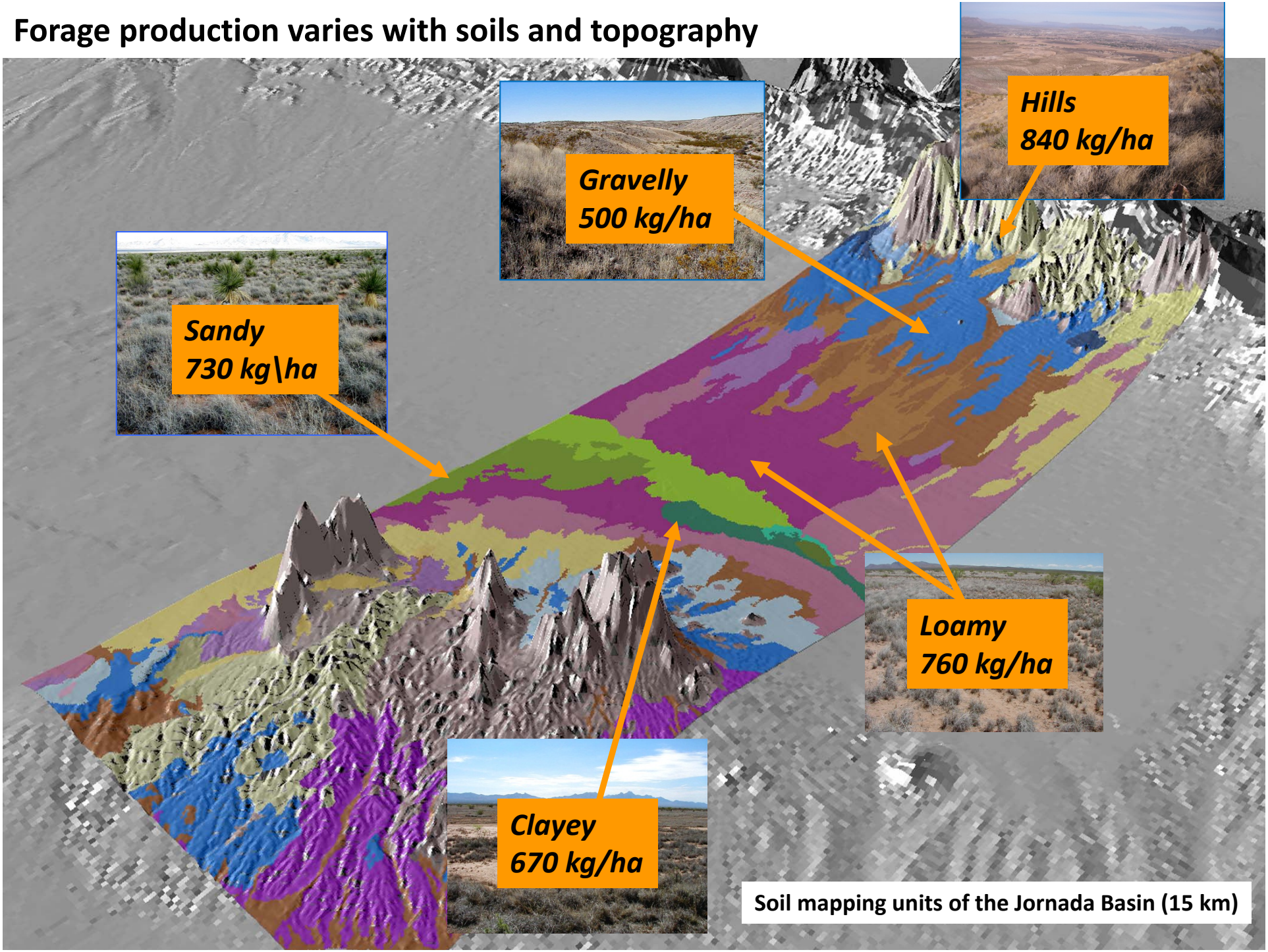
2) **Resilience and susceptibility to degradation**
   - **potential for desertification**

3) **Management needs and restoration approaches**
   - **stocking rates**
   - **season of use**
   - **species mixtures used in seeding**

“Concepts” for three ecological sites

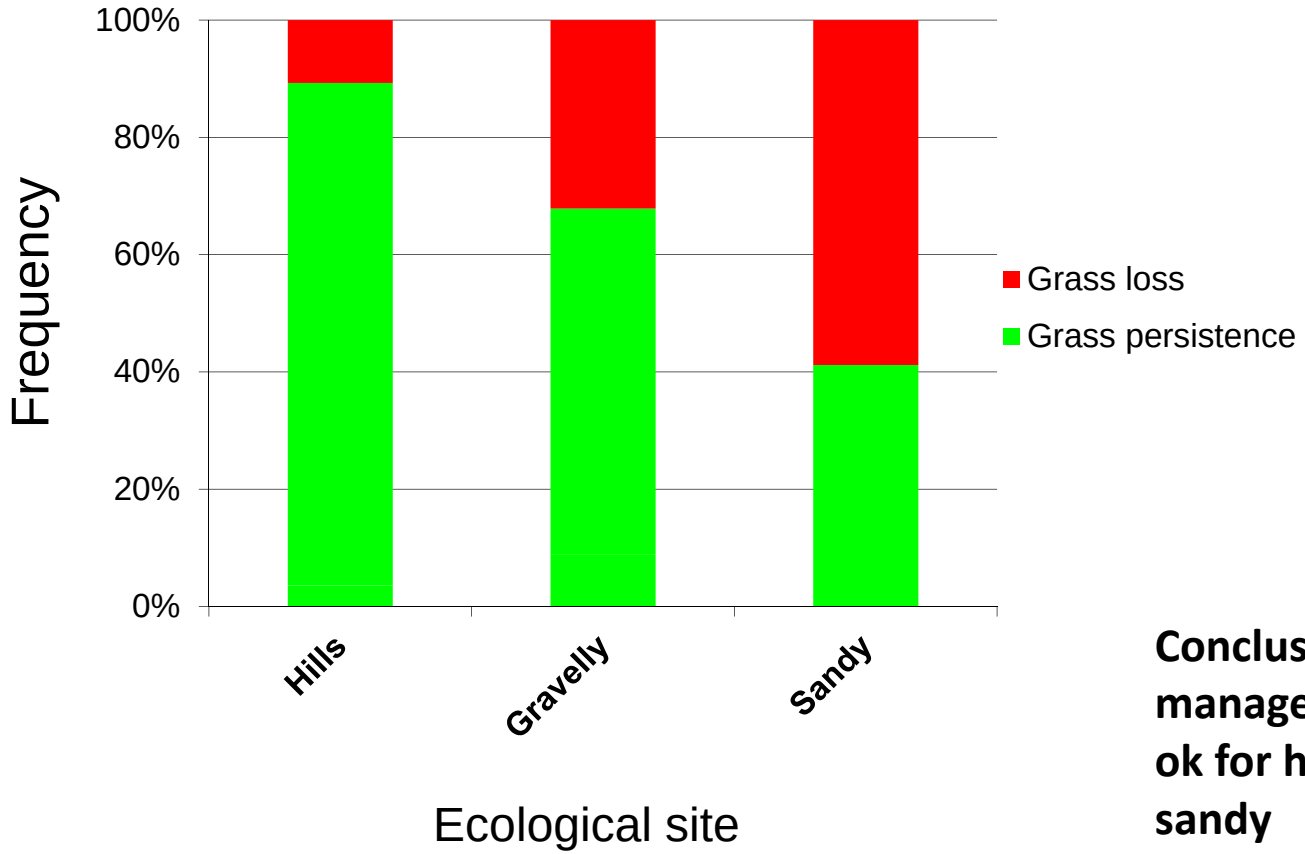
	Hills	Gravelly	Sandy
Profile characteristics			
Soil processes	Rough surface captures and stores water	Shallow rooting depth, high gravel, low water holding capacity	High water holding capacity, susceptible to wind erosion
Potential vegetation	High production of grasses and shrubs	Low production of grasses and shrubs	Moderate production of grasses, few shrubs
Dynamics	Very resilient, little change	Shrub infill	Shrub invasion and severe erosion

Forage production varies with soils and topography



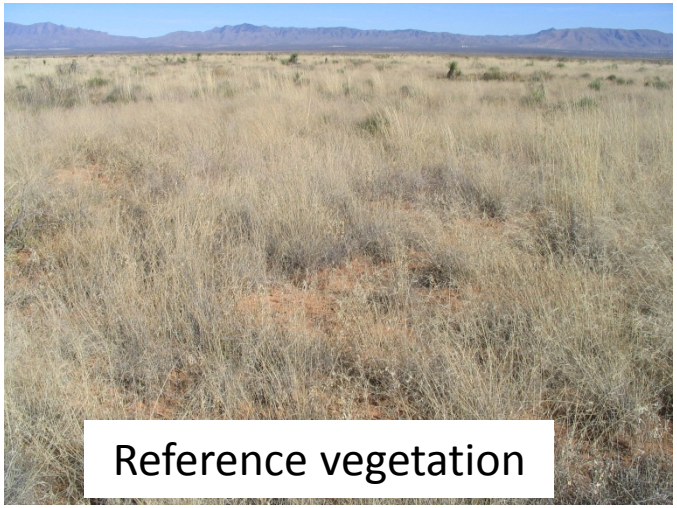
Grassland resilience and degradation also varies with soils and topography

Changes in perennial grass cover from 1970-2003, New Mexico, USA

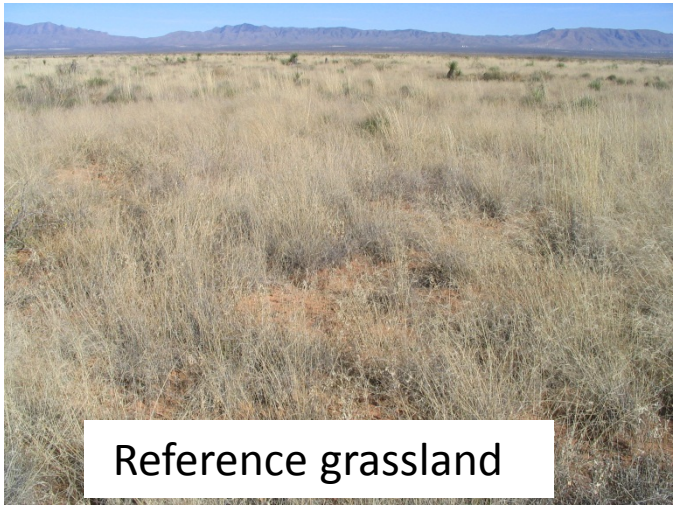


Conclusion: grazing management system ok for hills, not for sandy

Plant communities and alternative states

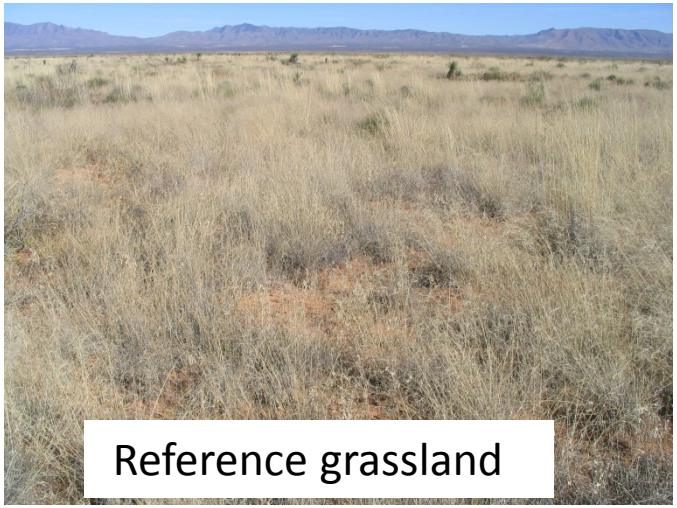


“Degradation”



Disturbance

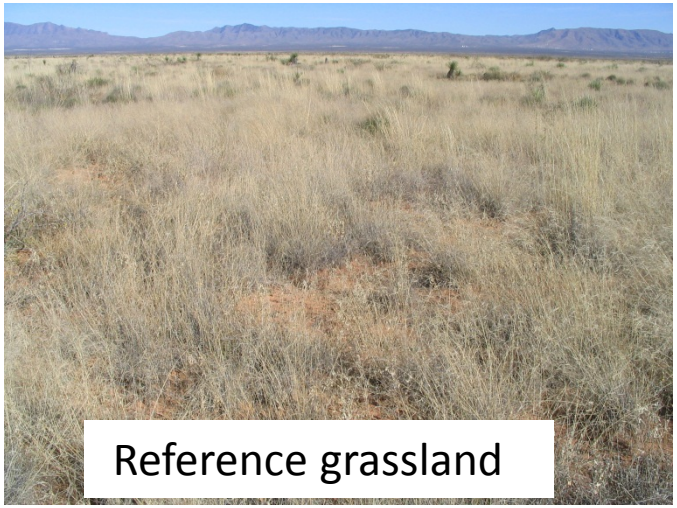
But there is recovery with changed grazing management and good rain, the site is resilient



Disturbance

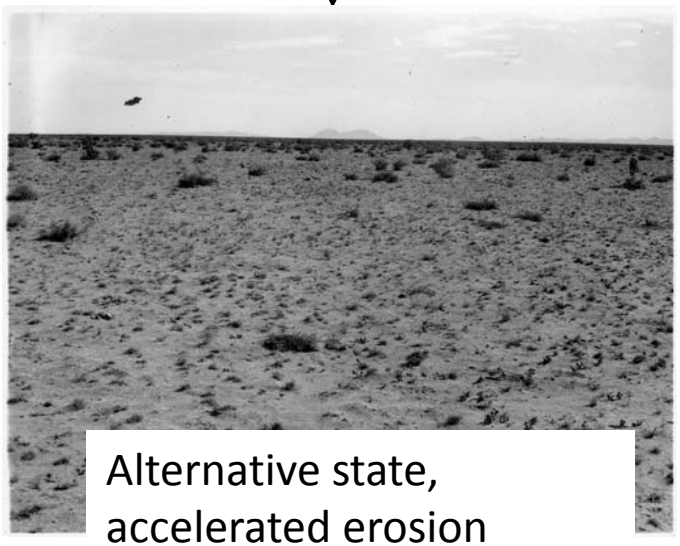
Succession

Or, change can become persistent

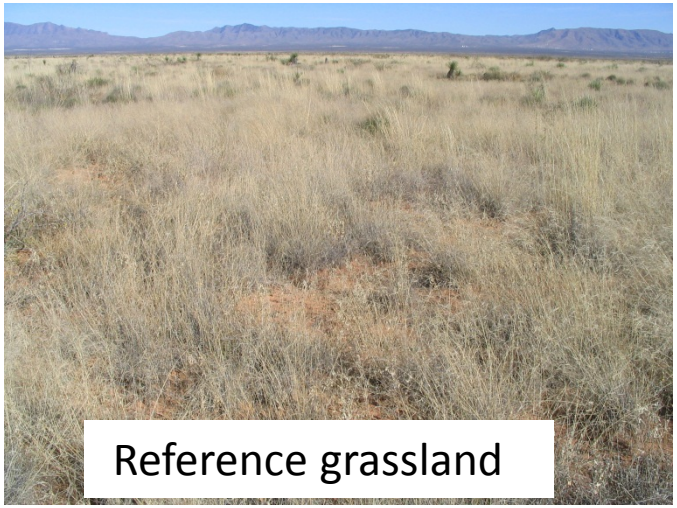


Disturbance

Transition



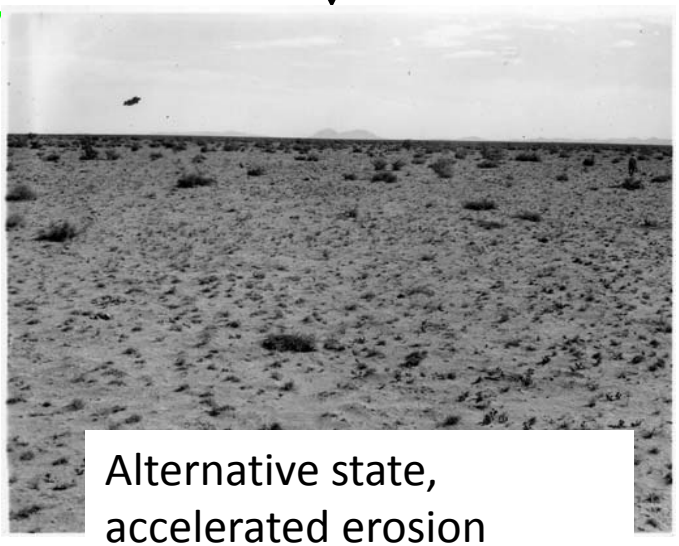
Cannot recover on its own, but might be restored



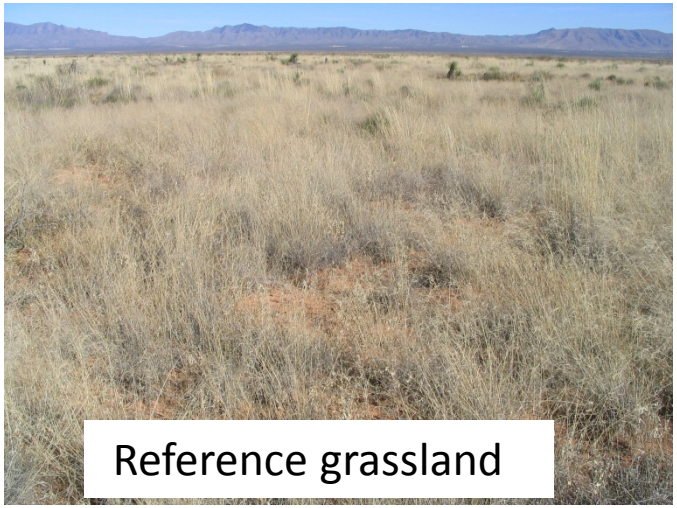
Disturbance

Transition

Restoration



Without restoration or changed management, change can become irreversible



Reference grassland

Disturbance

Sparse grassland

Transition

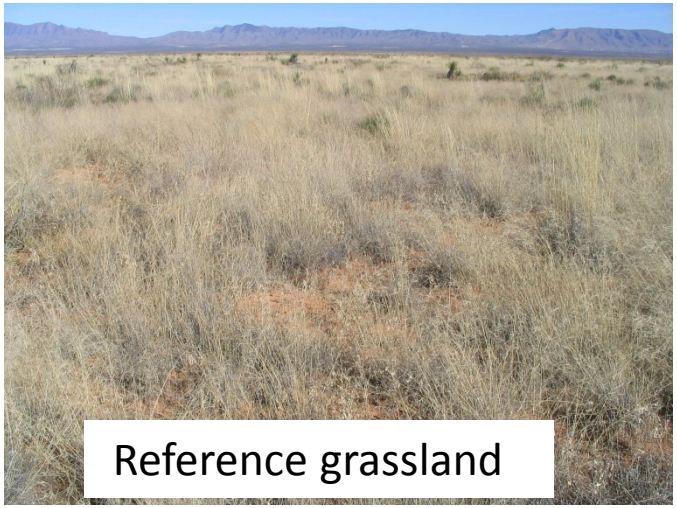
Alternative state, shrub invasion, erosion

Continued disturbance, or no restoration

Alternative state, shrubland

Irreversibility

Three distinct states for the same ecological site



Reference grassland

Disturbance

Succession

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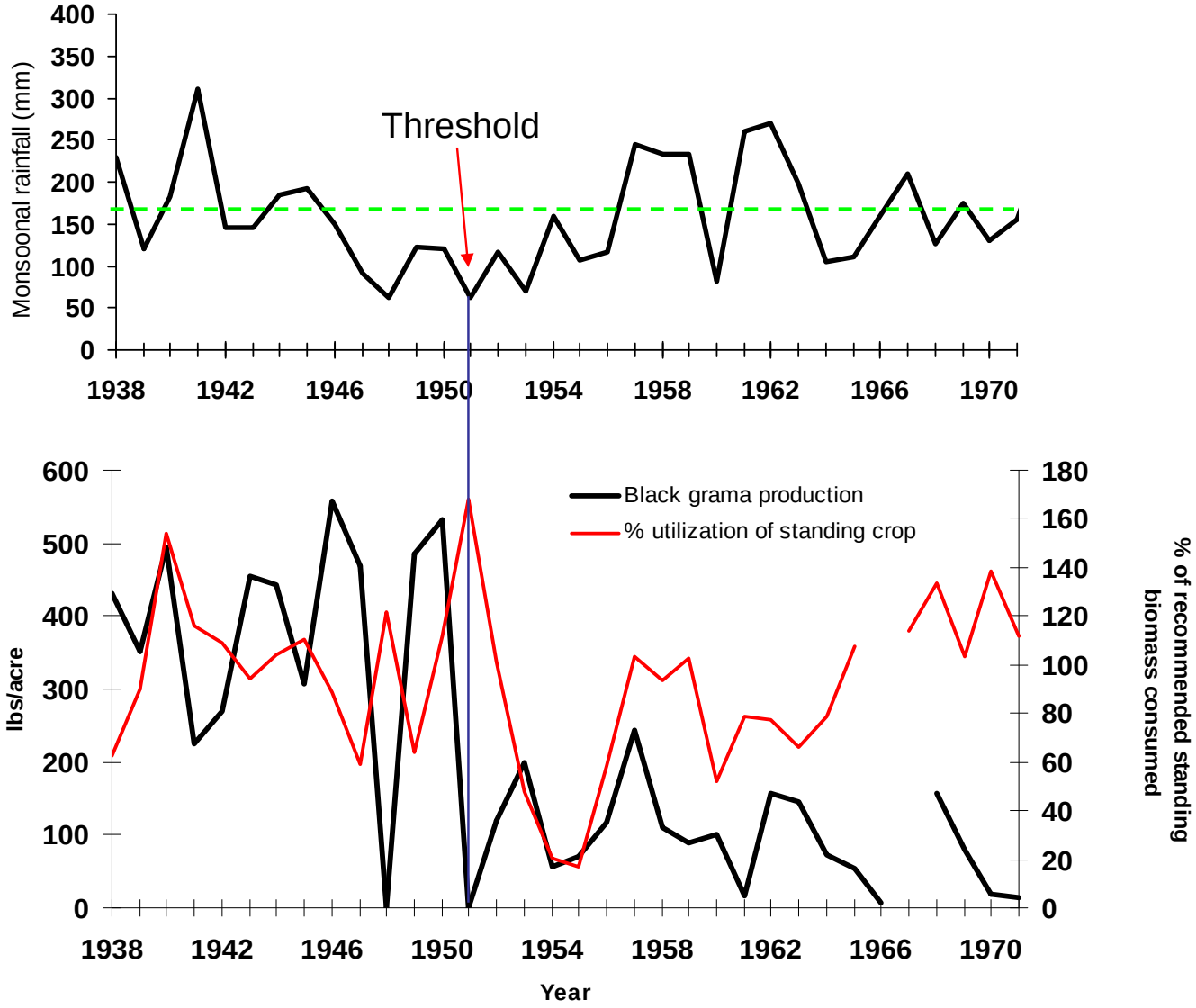
Restoration

Alternative state, shrubland

Continued disturbance, or no restoration

Alternative state, shrub invasion, erosion

How are thresholds crossed? Confluence of multiple factors

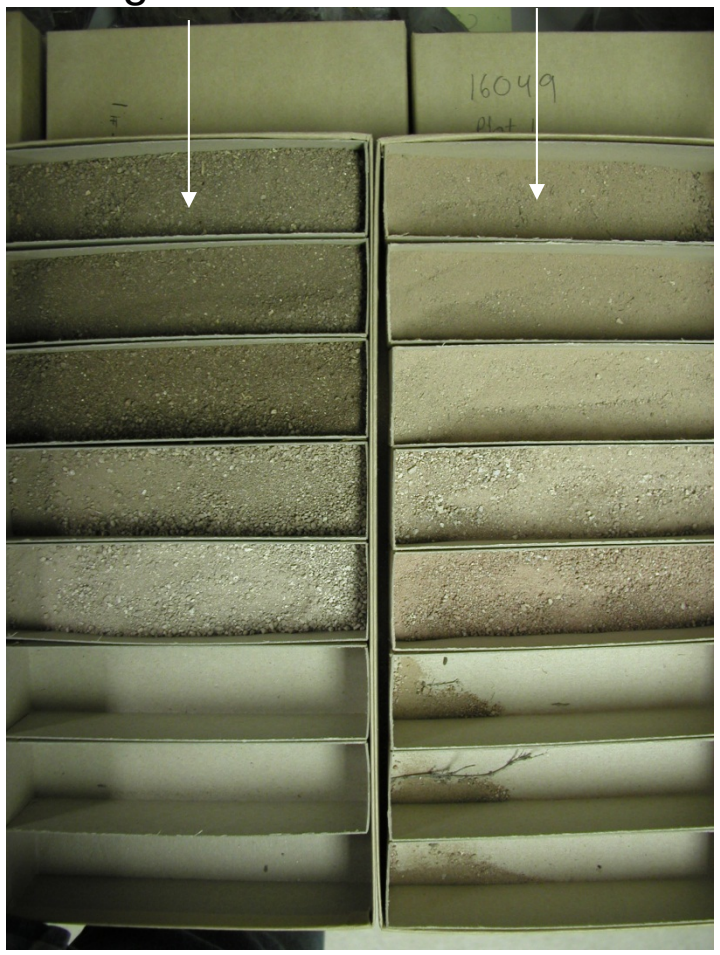


Why are changes after a transition difficult or impossible to reverse?

Soil loss

Why are changes after a transition difficult or impossible to reverse?

High humus Low humus



Soil degradation

Why are changes after a transition difficult or impossible to reverse?

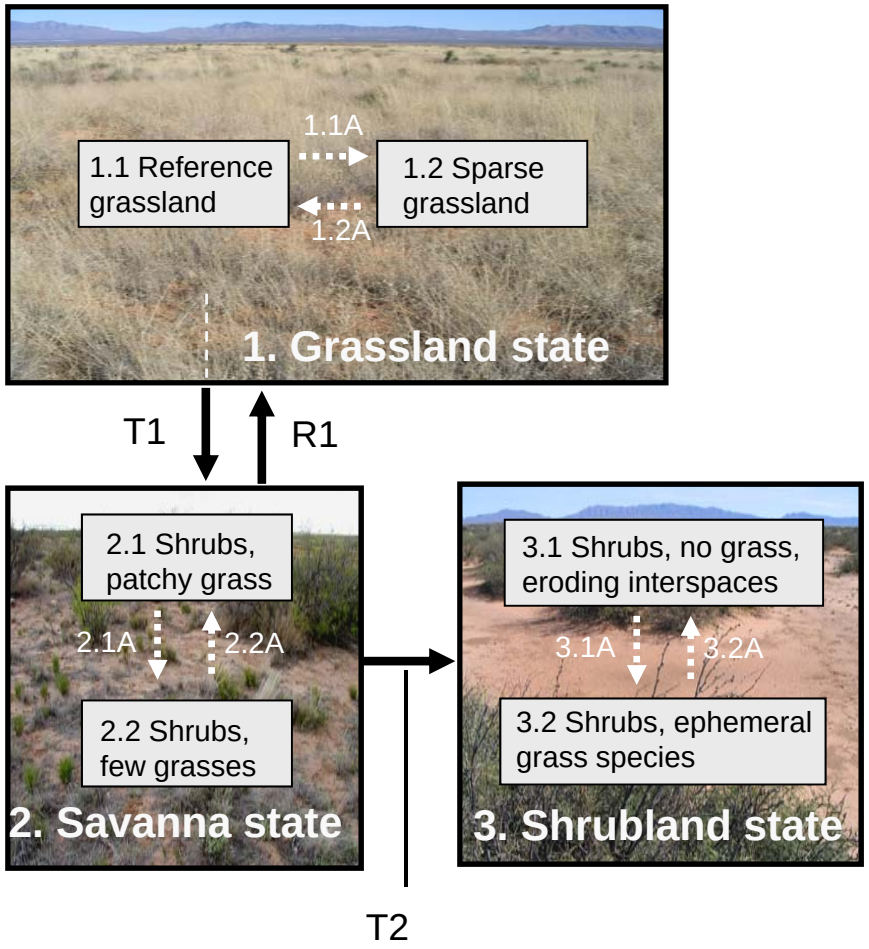
Persistent changes in plant dominance

Land degradation involves different processes in different ecological sites

In sandy loam plains of the northern Gobi,
is low cover a normal response to drought, or is this desertification?

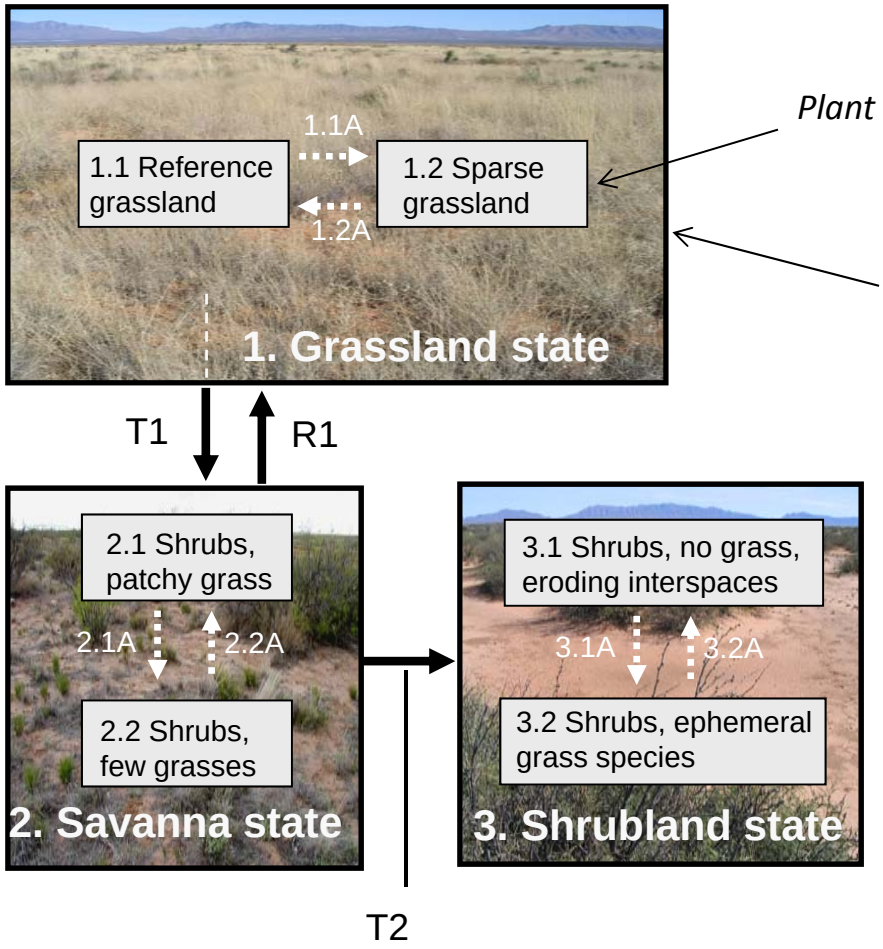
Is it a phase of the reference state,
or in a process of transition to degraded state?

State-and-transition model: multiple plant communities and states



T1. Continuous heavy grazing, thinning and patchy loss of black grama, shrub proliferation.
R1. Shrub control followed by grazing deferment and adequate rainfall for black grama recovery
T2. Loss of remaining interspace grasses, gradual loss of soil organic matter, infill of shrubs, and soil erosion

A state-and-transition model: multiple plant communities and states



Plant community or "community phase"

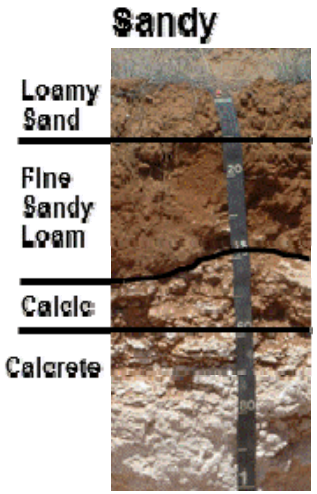
-what vegetation you have at a point in time

Ecological state

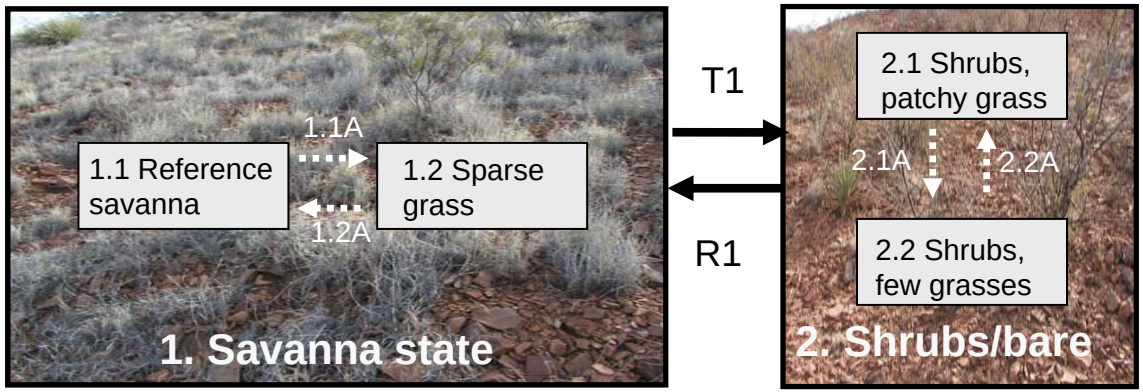
-what vegetation you can attain given novel constraints to recovery

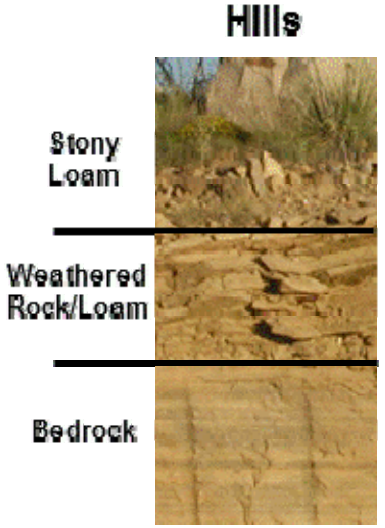
Ecological site

-what vegetation you can attain given climate, soils, and topography

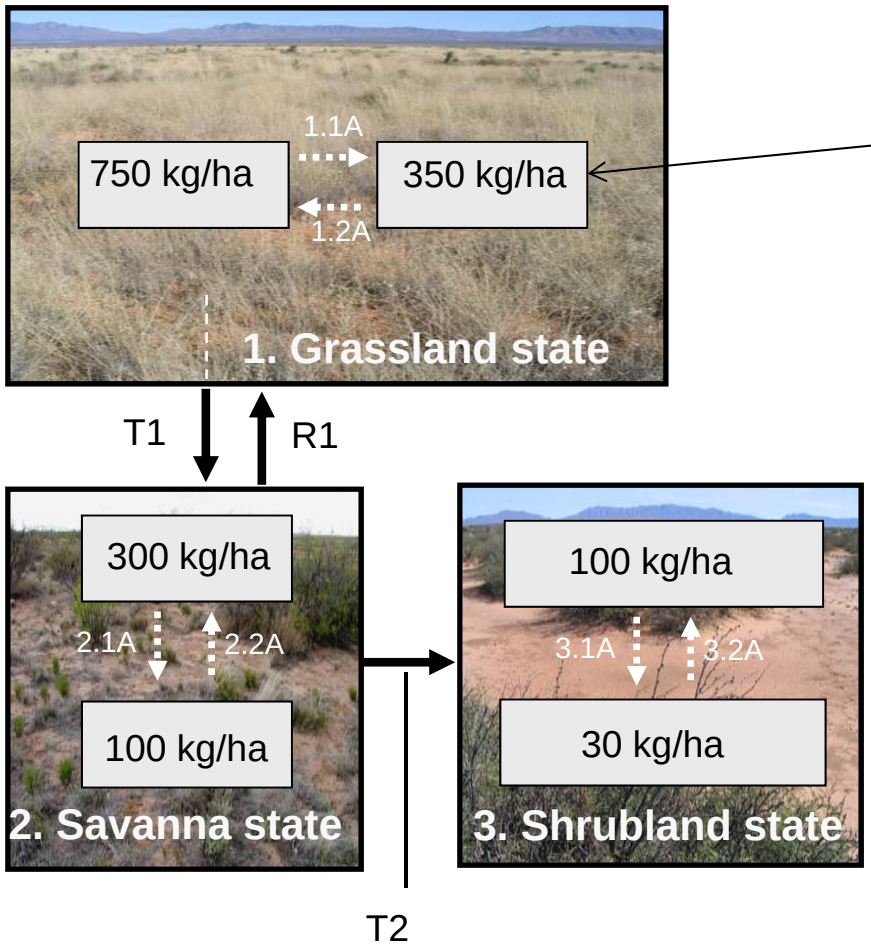


Different ecological sites have different state-and-transition models





Community phases and states in models link to management information



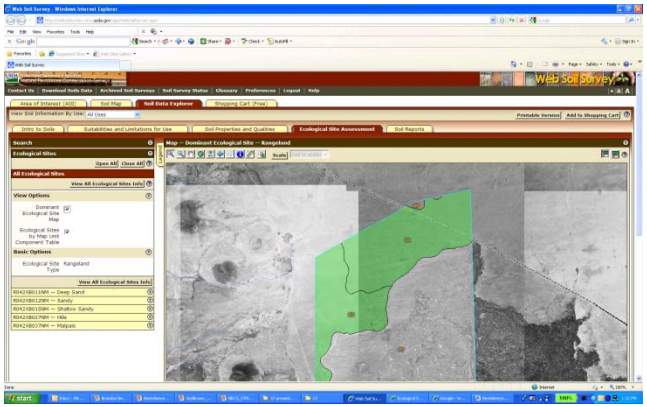
Forage availability to cattle

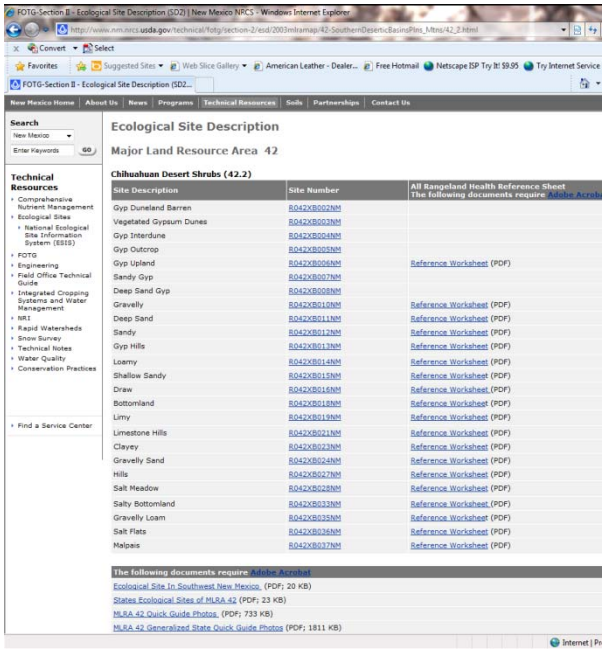
Stocking rates and season of use to maintain productivity

Benchmarks for interpretation of assessment and monitoring data

Many kinds of information can be included in an ecological site description

How are ecological site descriptions accessed in the US?





http://websoilsurvey.nrcs.usda.gov

1. Use maps or internet tools to locate a set of possible ecological sites for an area

2. Interpret field observations to match a land area(pasture) to an ecological site

3. Use state-and-transition model descriptions to identify current state and community, other possible states, and reference state.

4. Develop management and monitoring plans to attain/sustain desired state.

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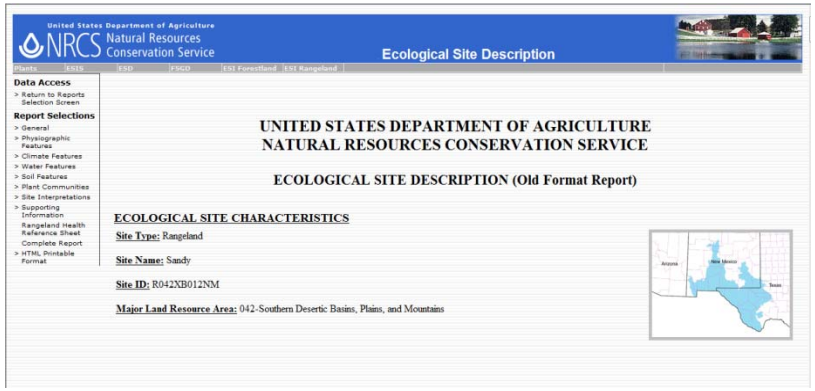
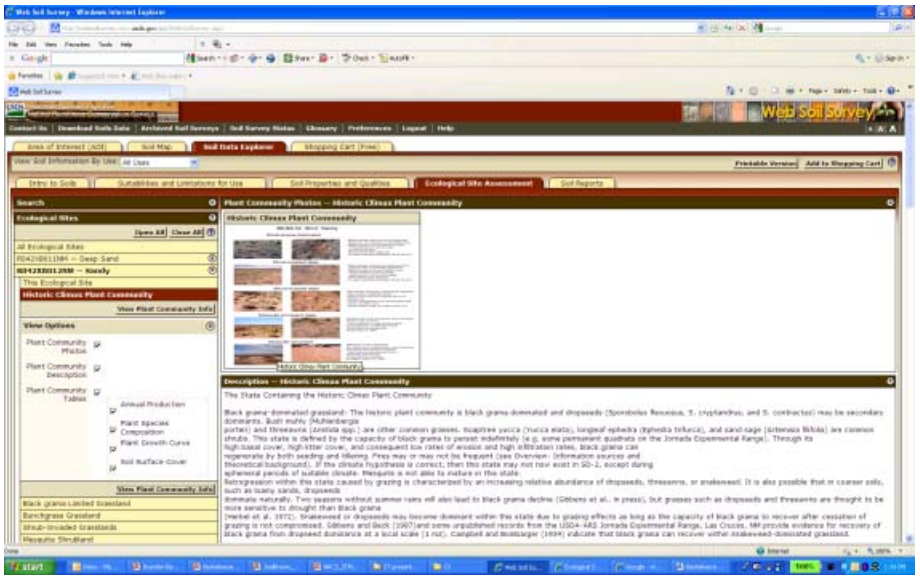
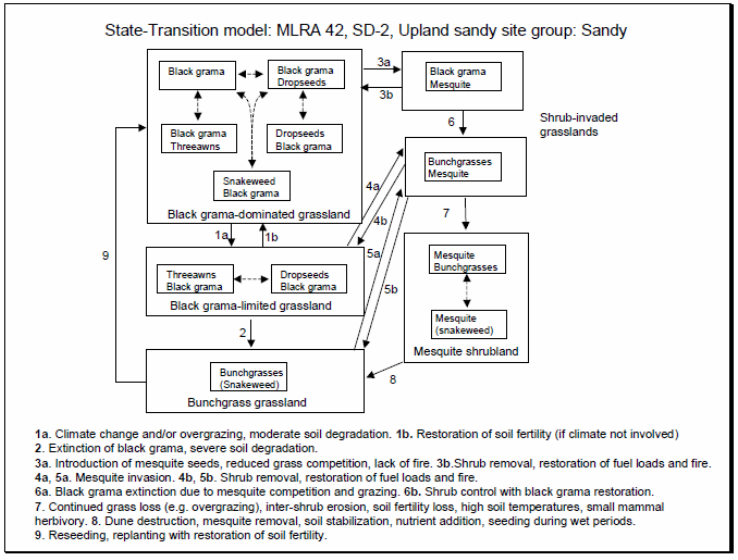
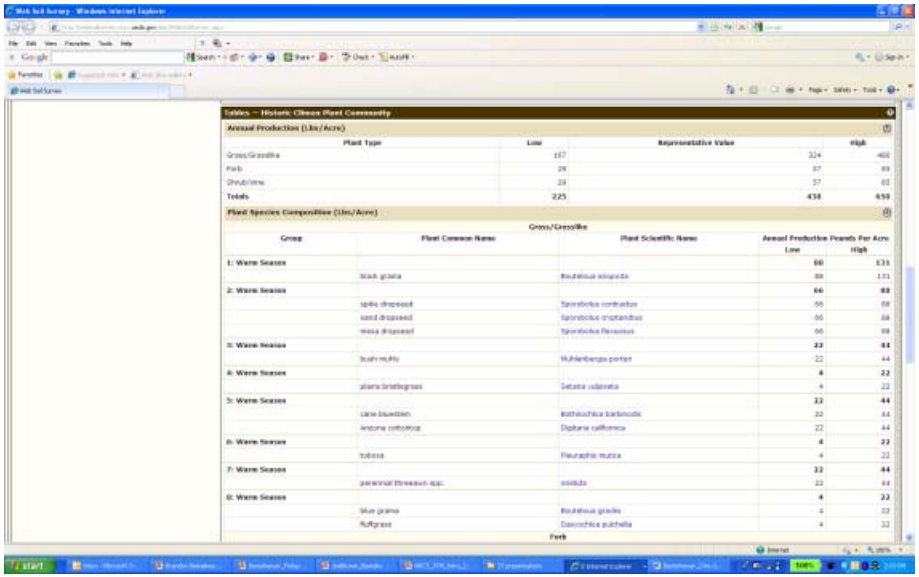




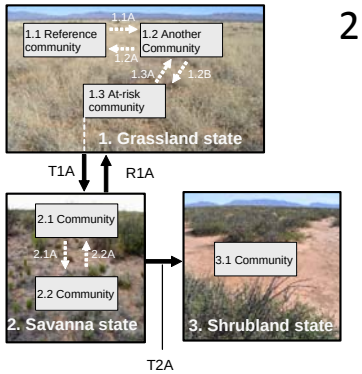




How are ecological sites are developed and used?

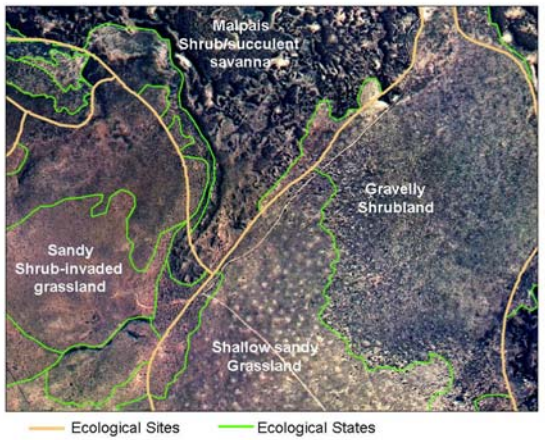
1. Collaboration

Herders, soum and national government, NGOs, university and international scientists



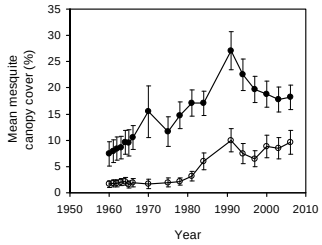
2. Ecological sites/state-and-transition models, indicators, and best practices

Adaptive Management



3. Develop maps for actions

4. Develop management plans



5. Monitoring to test assumptions database and analysis