



# 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>

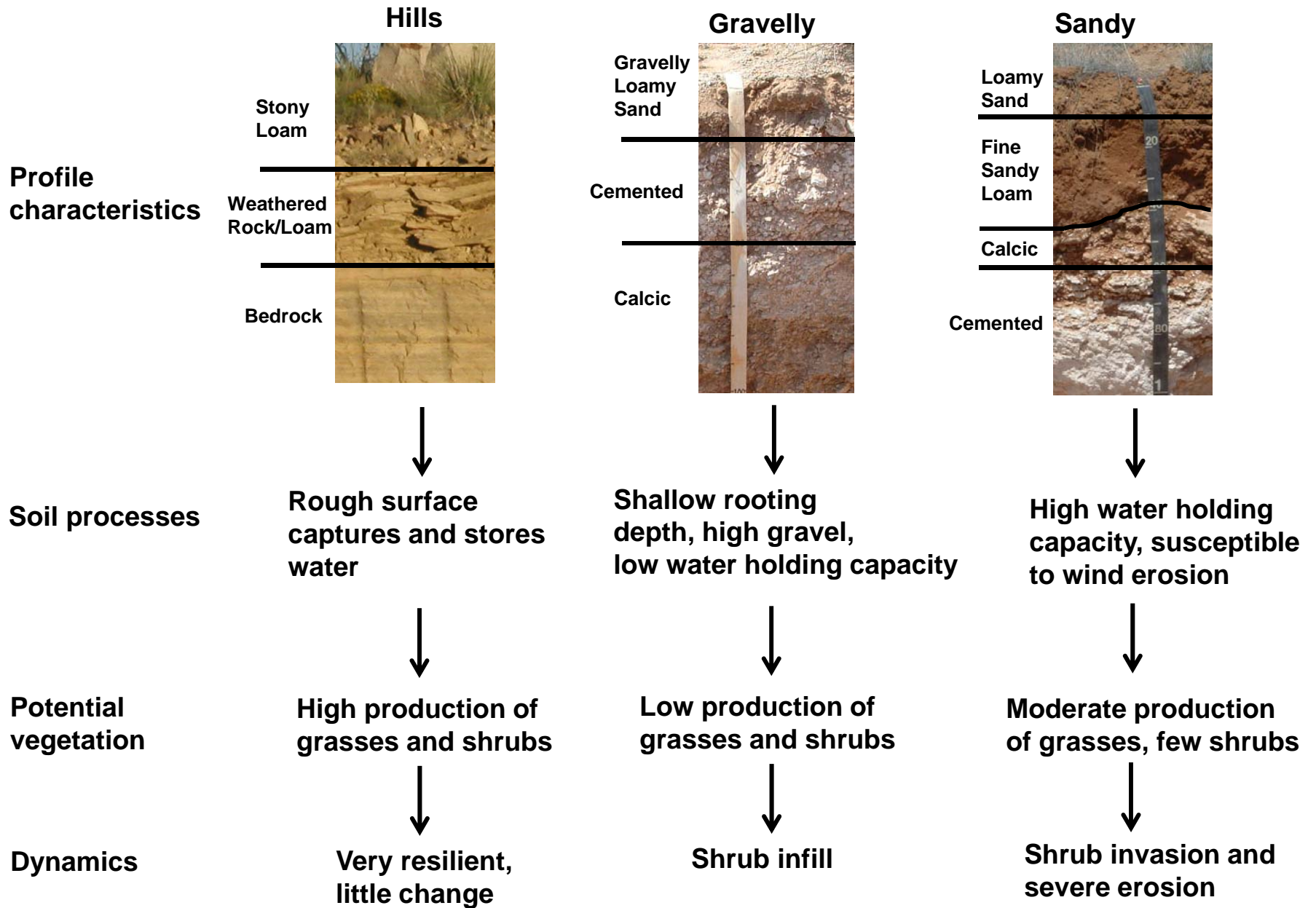
***Landscape units***-Germany, Netherlands (Bastian 2000)

# The ecological site concept

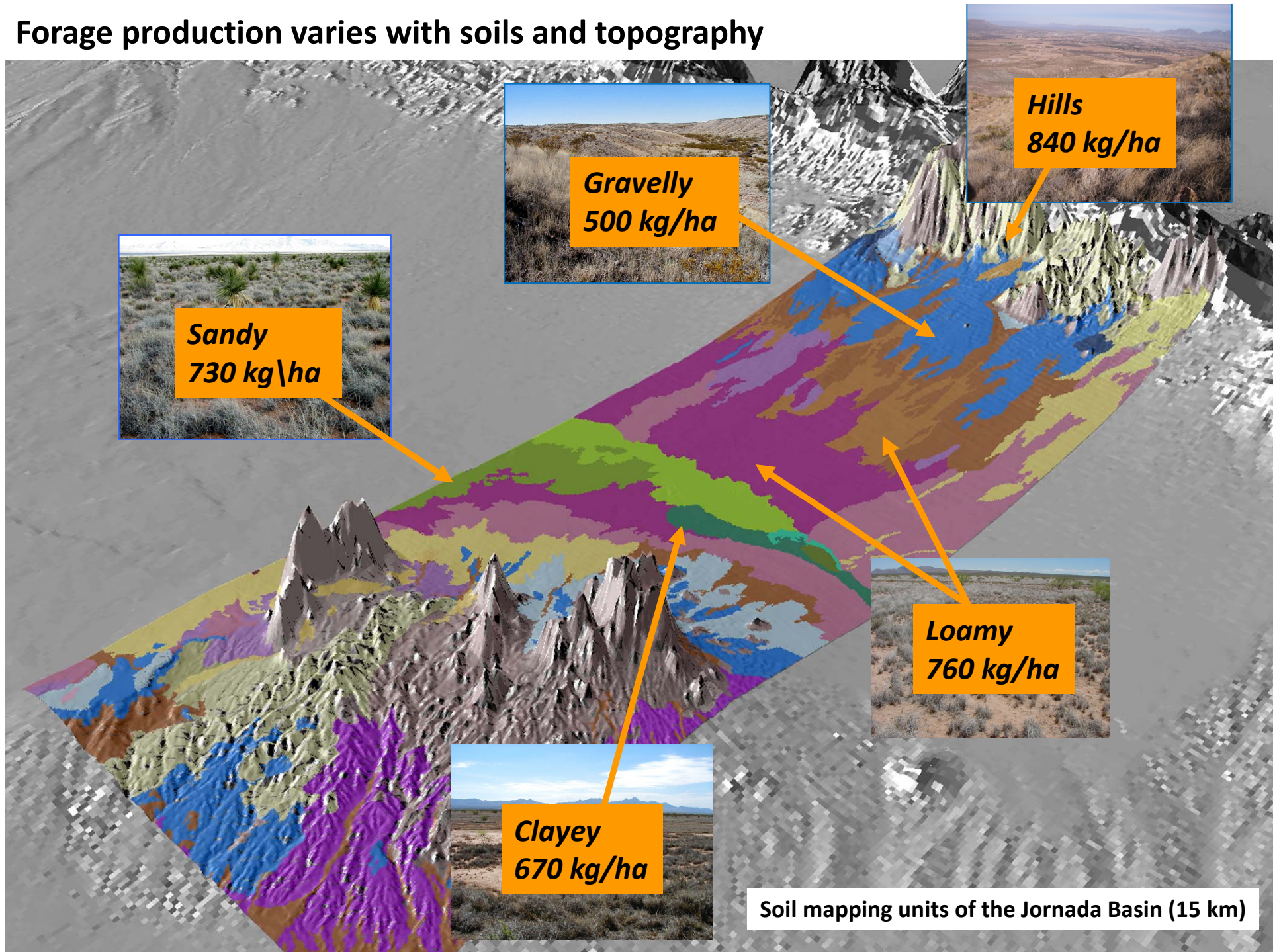
Land areas of different climate, soil, and landscape position differ in:

- 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

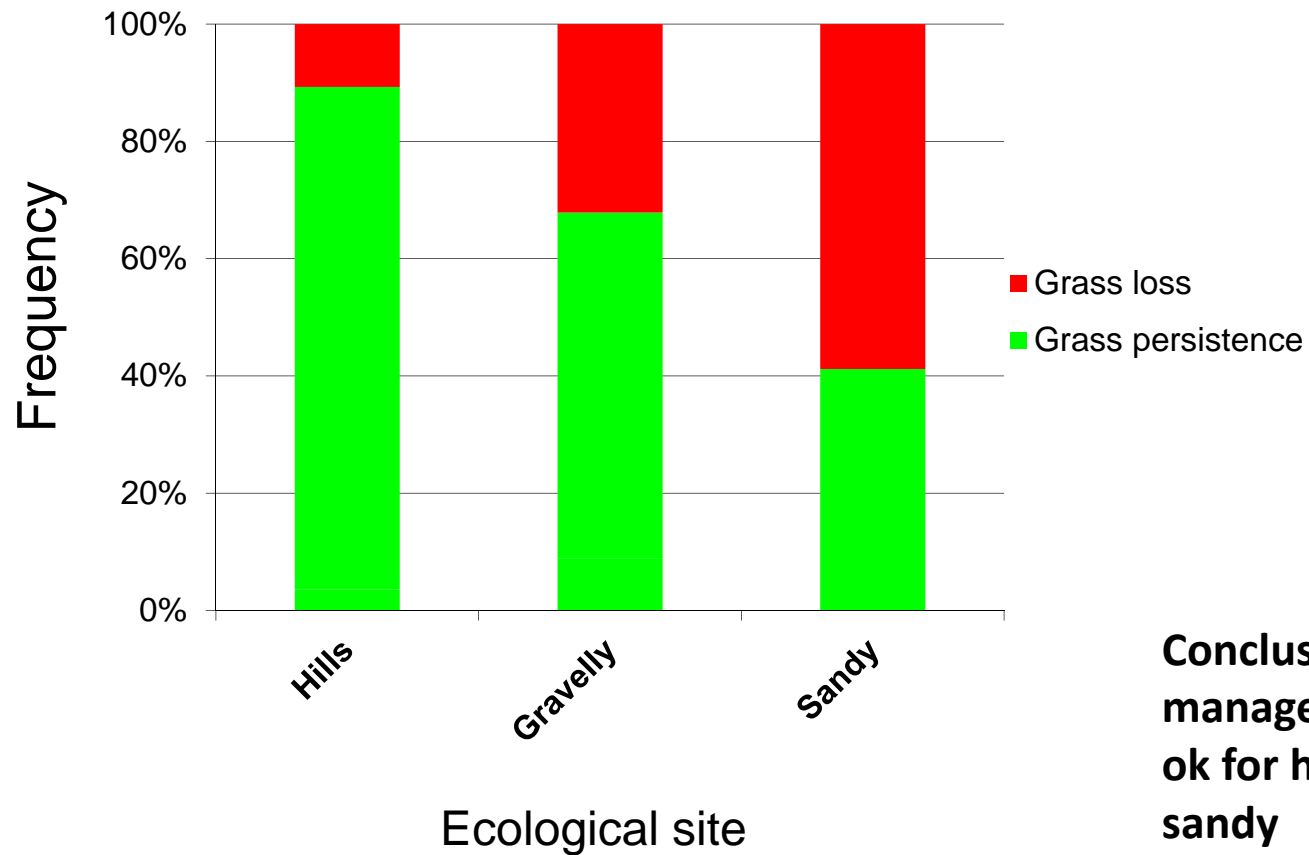


# Forage production varies with soils and topography

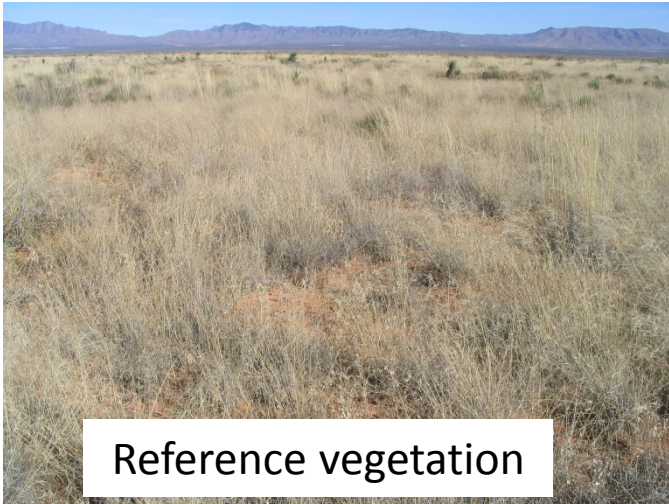


# Grassland resilience and degradation also varies with soils and topography

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



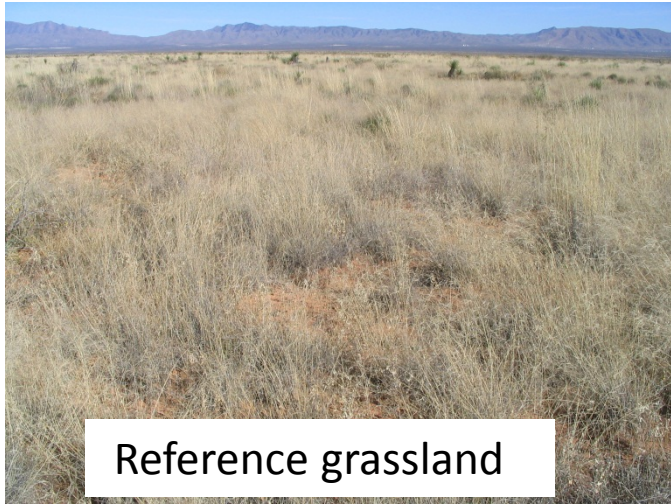
## Plant communities and alternative states



Reference vegetation



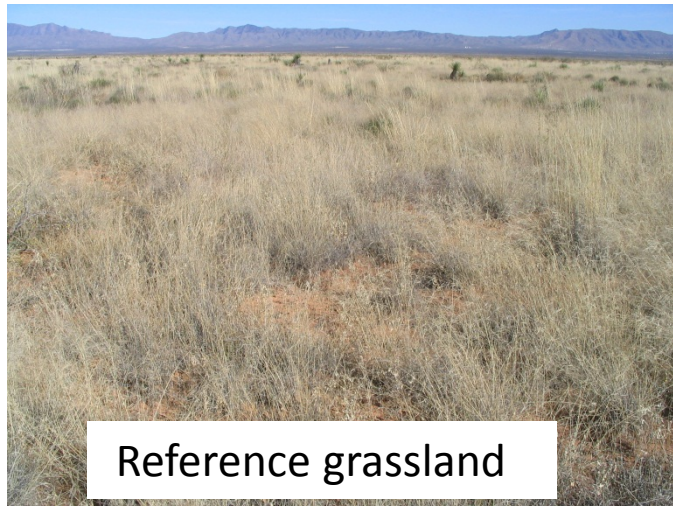
# “Degradation”



Disturbance



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



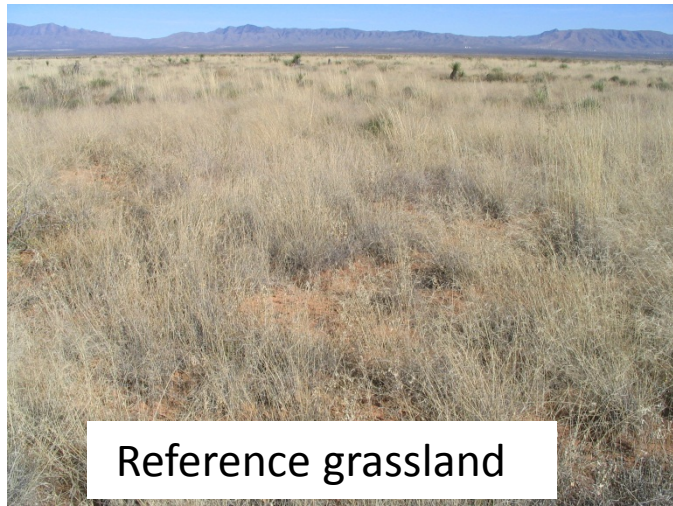
Disturbance



Succession



# Or, change can become persistent



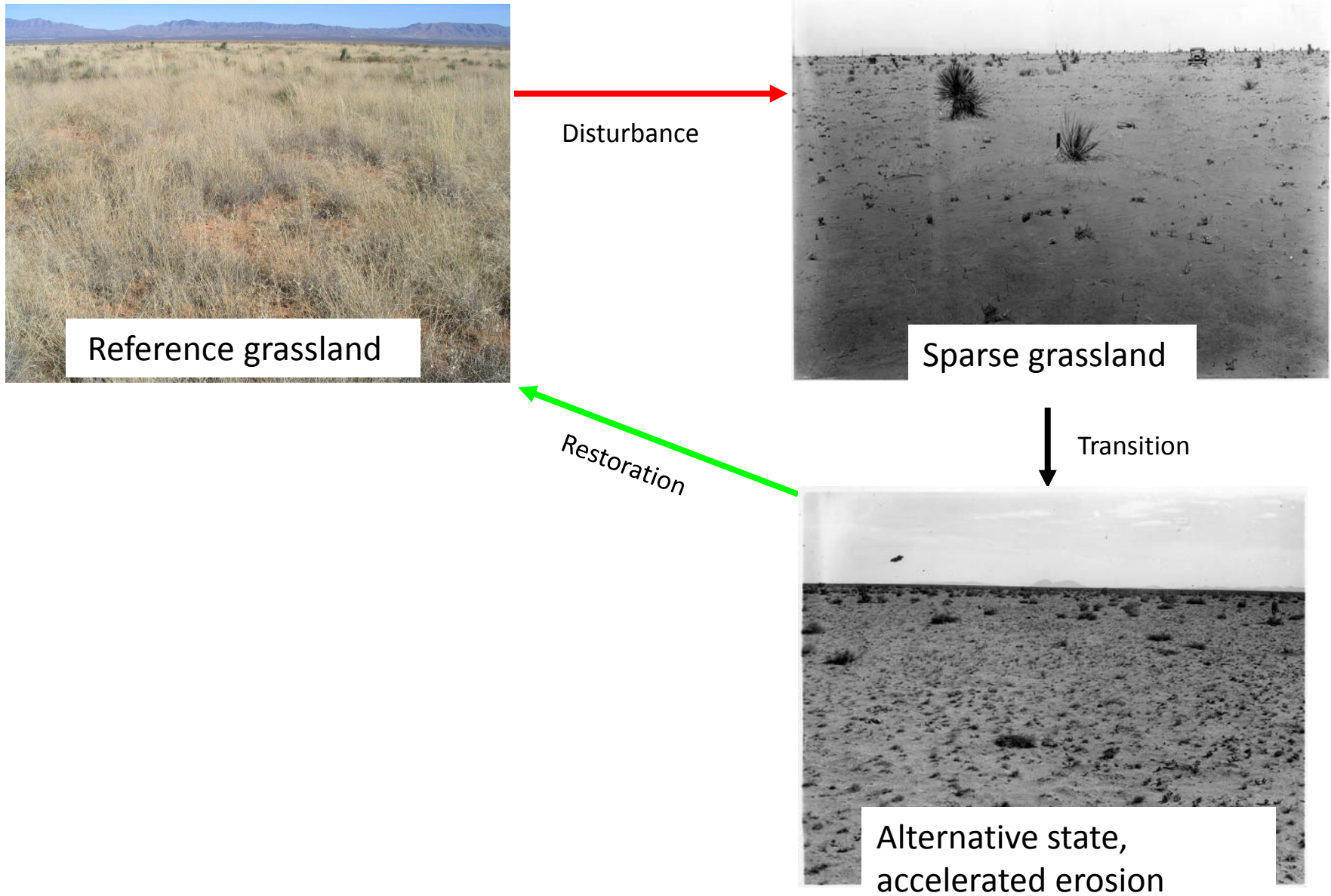
Disturbance



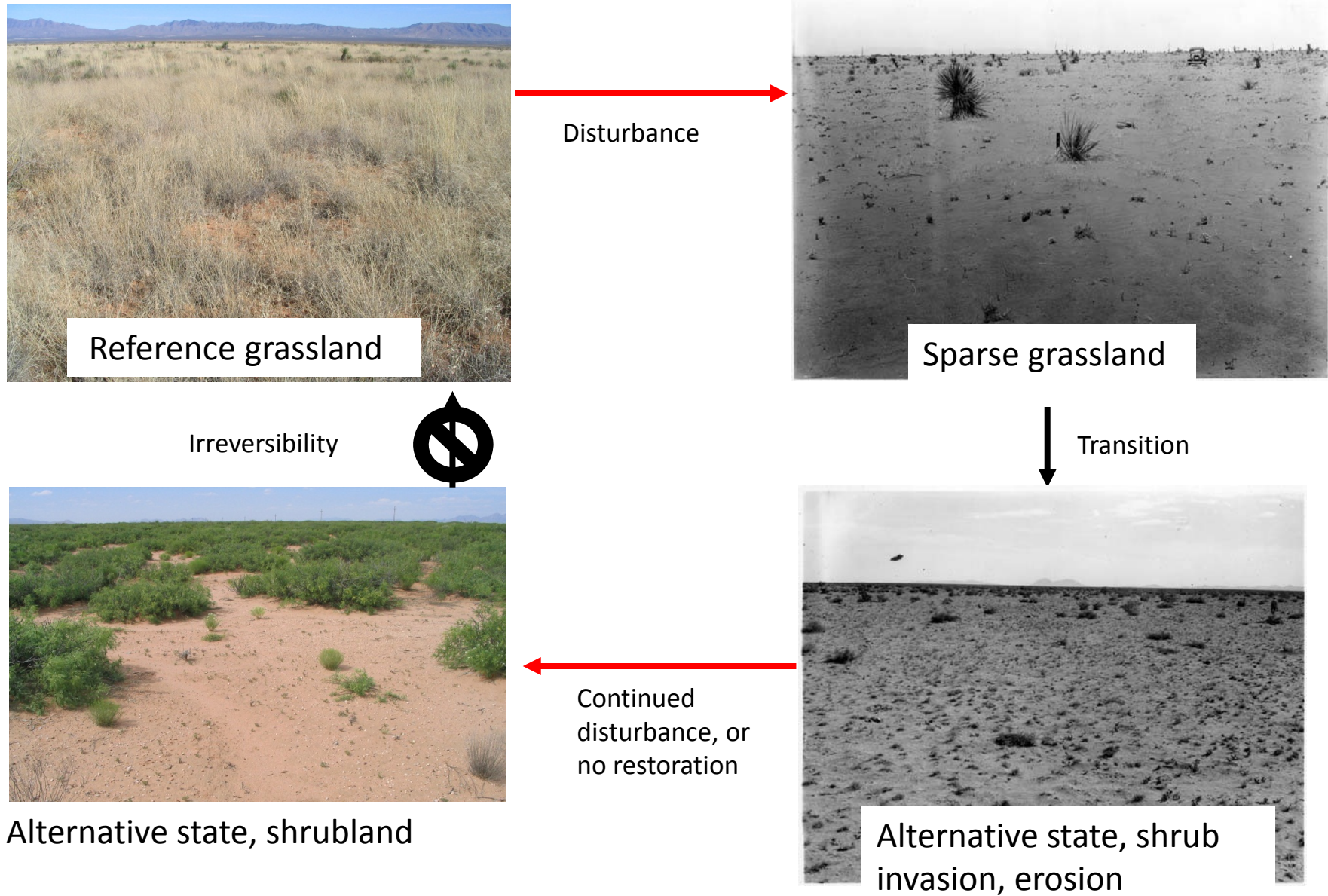
Transition



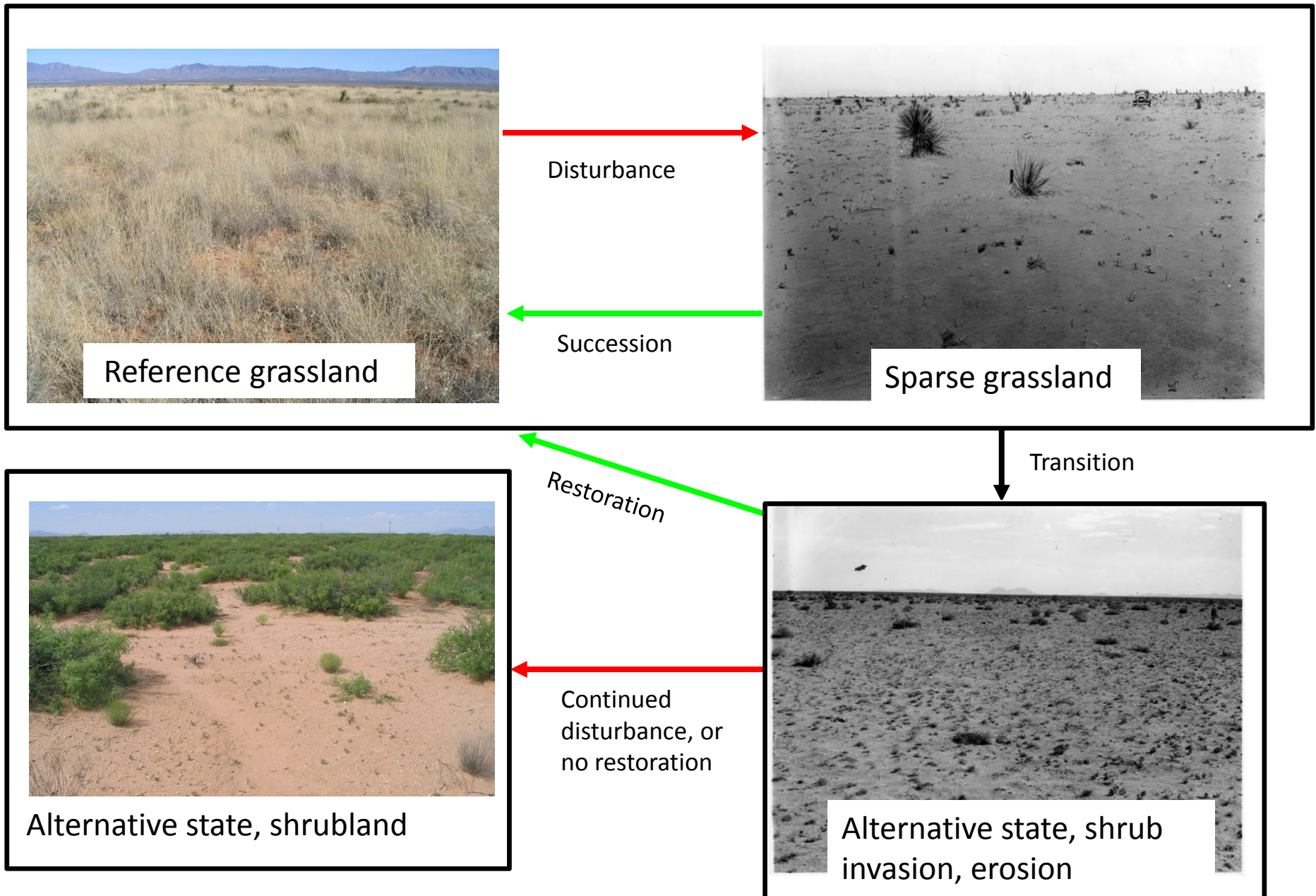
# Cannot recover on its own, but might be restored



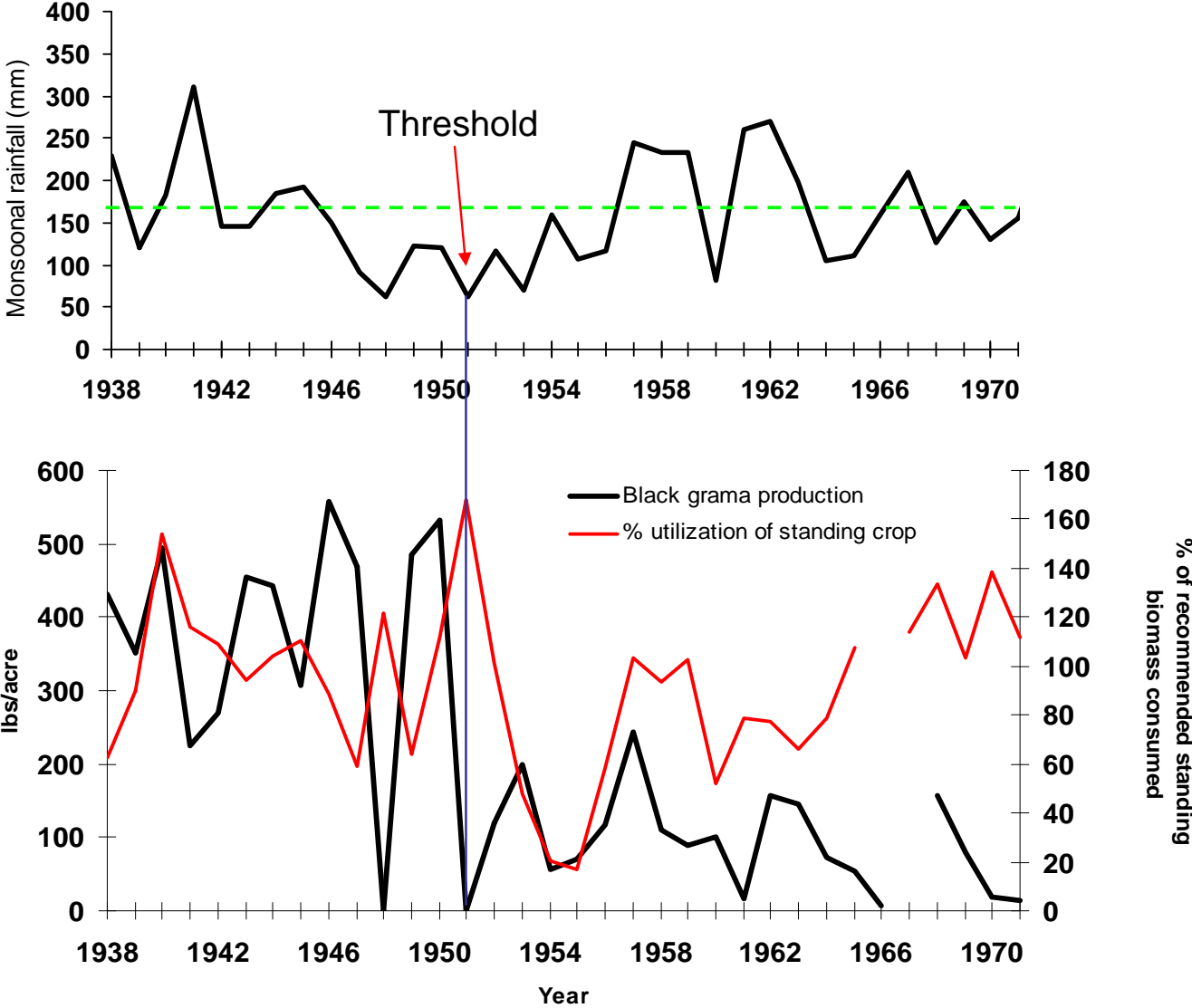
# Without restoration or changed management, change can become irreversible



# Three distinct states for the same ecological site



# 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?



Soil degradation

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



Persistent changes in plant dominance

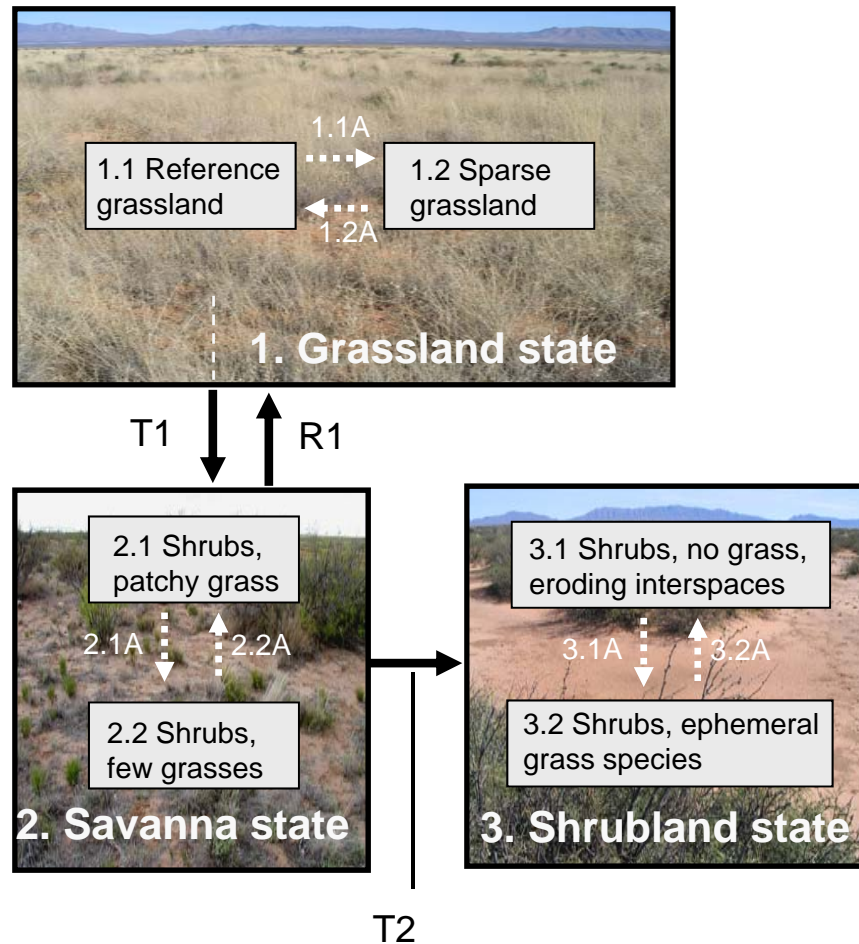
Land degradation involves different processes in different ecological sites

*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

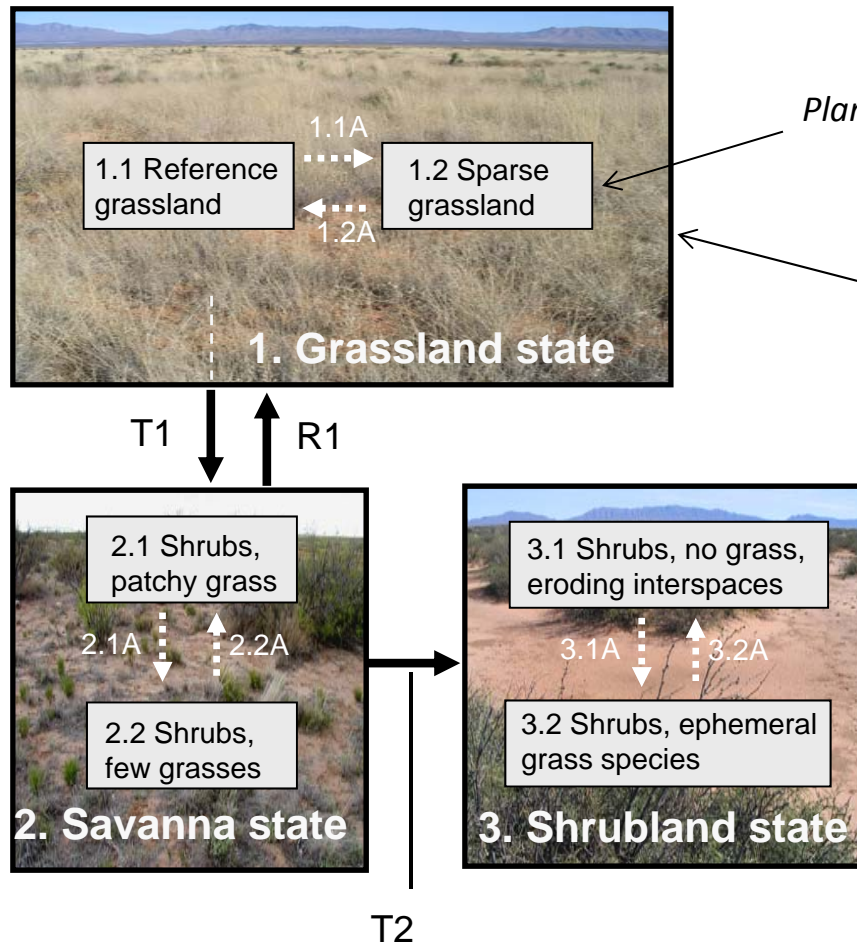


**T1.** Continuous heavy grazing, thinning and patchy loss of black grama, shrub proliferation.

**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"*

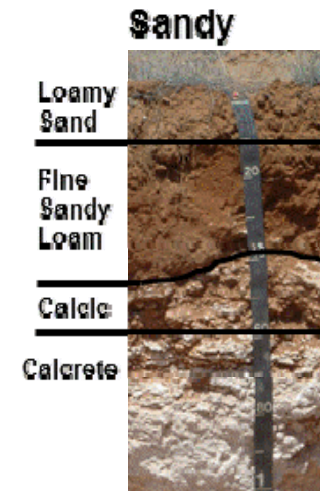
-what vegetation you have at a point in time

*Ecological state*

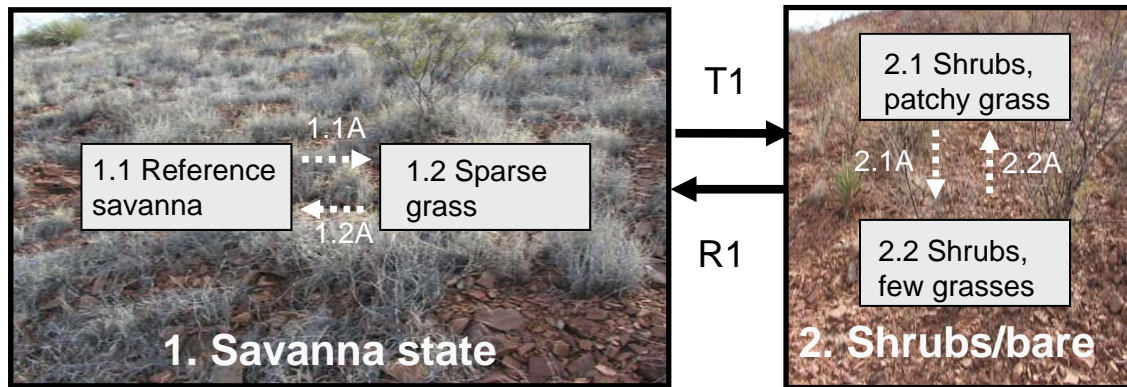
-what vegetation you can attain given novel constraints to recovery

*Ecological site*

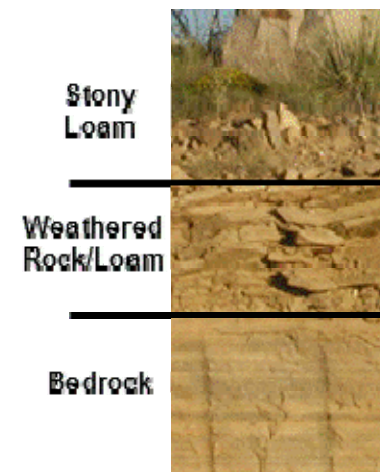
-what vegetation you can attain given climate, soils, and topography



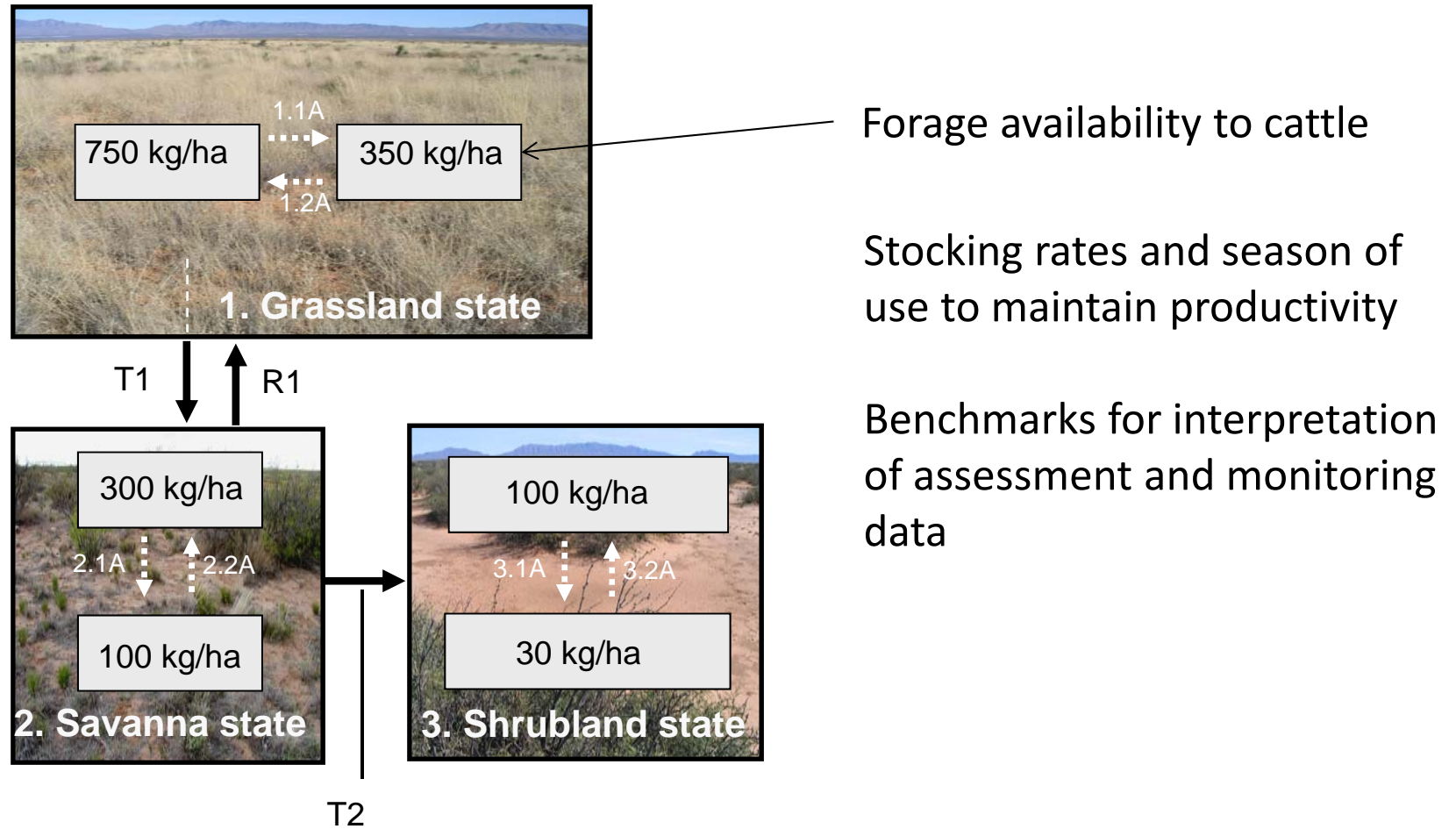
# Different ecological sites have different state-and-transition models



## Hills

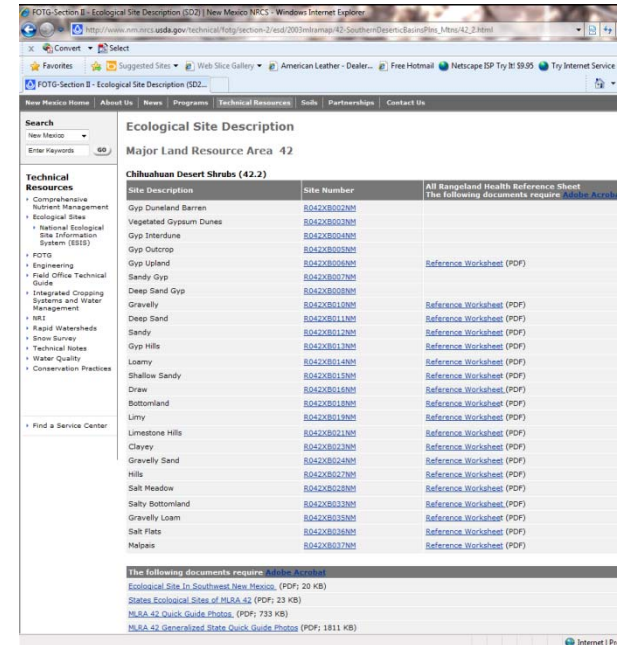
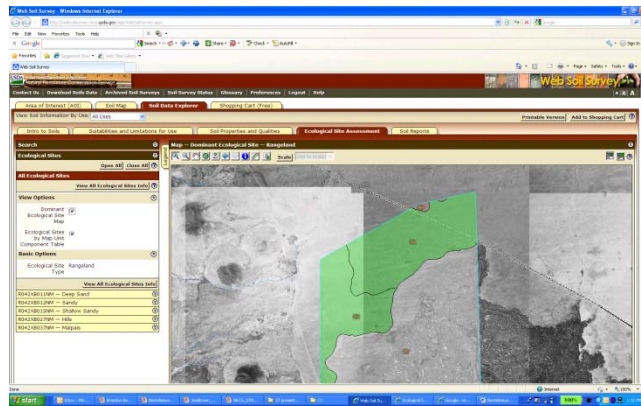


## Community phases and states in models link to management information



*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.



# How are ecological site descriptions accessed in the US?

United States Department of Agriculture  
Natural Resources Conservation Service

Ecological Site Description

UNITED STATES DEPARTMENT OF AGRICULTURE  
NATURAL RESOURCES CONSERVATION SERVICE

ECOLOGICAL SITE DESCRIPTION (Old Format Report)

**ECOLOGICAL SITE CHARACTERISTICS**

Site Type: Rangeland

Site Name: Sandy

Site ID: R042XB012NM

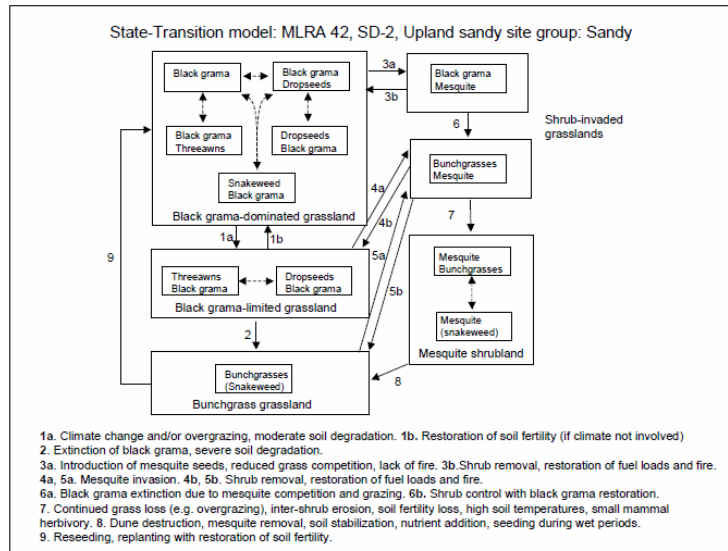
Major Land Resource Area: 042-Southern Desertic Basins, Plains, and Mountains

Web Soil Survey - Windows Internet Explorer

Ecological Site Assessment

Historic Climate Plant Community

Black grama-dominated grassland: The historic plant community is black grama-dominated and disperses (Sporobolus tenax, S. cryptanthus, and S. contractus) may be secondary dominants. Salt-tolerant subperennial grama and forbesia (Lespedeza spp.) are other common grasses. Sarcobatus yucca (Yucca elata), longleaf spurge (Ephedra trifurca), and sand sage (Sarcobatus BMD) are common shrubs. This state is defined by the capacity of black grama to persist indefinitely (e.g. some permanent pastures on the Jornada Experimental Range). Through its high soil cover, high litter cover, and consequent low rates of erosion and high infiltration rates, black grama can regenerate by both seeding and tillering. Fire may or may not be frequent (see Overview: Information sources and historical background). If the climate history is correct, then this state may not have exist in SD-2, except during ephemeral periods of suitable climate. Mesquite is not able to mature in this state. Retrogression within the state caused by grazing is characterized by an increasing relative abundance of disperses, threawns, or snakeweed. It is also possible that in certain soils, such as loamy sands, it disperses dominantly. Two seasons without summer rains will also lead to black grama decline (Dillon et al., in press), but grasses such as disperses and threawns are thought to be more sensitive to drought than black grama. (Dillon et al., 2012). Snakeweed or disperses may become dominant within this state due to grazing effects as long as the capacity of black grama to recover after cessation of grazing is not compromised. Sibson and Jack (1997) and some unpublished records from the USDA-RAS Jornada Experimental Range, Las Cruces, NM provide evidence for recovery of black grama from dispersed dominance at a local scale (1 mi). Campbell and Metzger (1991) indicate that black grama can recover with stakeweed-associated grasses.



Plant Species Compendium (Lbs/Acre)

Plant Type	Low	High	Representative Value	High
Grass/Croft	157	214	185	214
Forb	29	37	33	37
Shrub/Vine	23	37	30	37
<b>Totals</b>	<b>209</b>	<b>288</b>	<b>248</b>	<b>288</b>

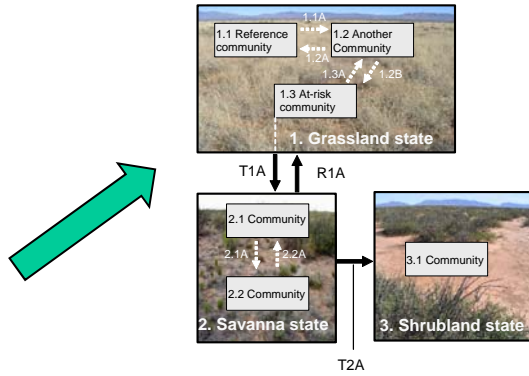
Group	Plant Common Name	Plant Scientific Name	Annual Production Pounds Per Acre	High
1. Warm Season			50	53
	black grama	Bouteloua eriopoda	88	111
	spike disperses	Sporobolus contractus	50	58
2. Warm Season	sand disperses	Sporobolus contractus	50	58
	mesquite disperses	Sporobolus tenax	50	58
3. Warm Season	sub-mulga	Muhlenbergia porteri	22	44
	stems		22	44
4. Warm Season	stems		4	22
	stems		22	44
5. Warm Season	stems		22	44
	stems		22	44
6. Warm Season	stems		4	22
	stems		4	22
7. Warm Season	stems		22	44
	stems		22	44
8. Warm Season	stems		4	22
	stems		4	22

# How are ecological sites are developed and used?



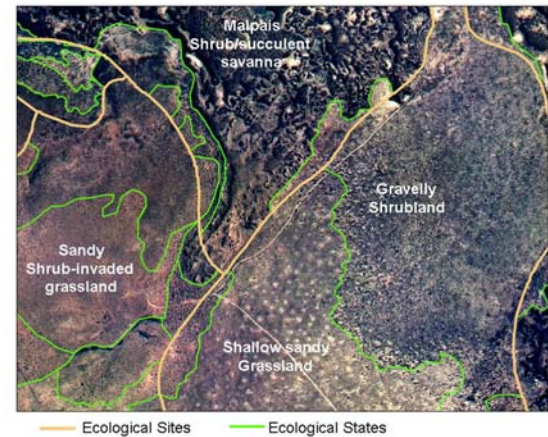
## 1. Collaboration

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

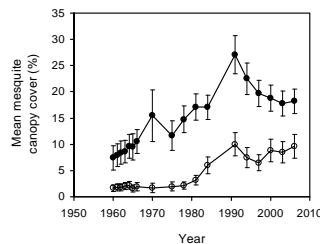
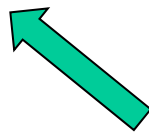


## 2. Ecological sites/state-and-transition models, indicators, and best practices

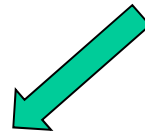
# Adaptive Management



## 3. Develop maps for actions



## 5. Monitoring to test assumptions database and analysis



## 4. Develop management plans