

# New Tools for Land Management: Putting Ecological Site Descriptions to Use on Your Ranch

Changes in rangeland vegetation often seem unpredictable and can directly impact your economic bottom line.  
When pasture production decreases, you might rest that pasture or sell some of your cattle.  
When invasive weed populations increase, you might invest in weed management.  
What causes these changes and how can you manage the land to avoid unpleasant surprises?

## Ecological sites

An ecological site is a type of land with specific physical characteristics (climate, soil, topography) that differs from other kinds of land in its ability to produce distinctive kinds and amounts of vegetation. A landscape is made up of a patchwork of ecological sites. For instance, a single pasture may contain several different ecological sites (see Figure 1). Different ecological sites respond differently to management (Box 1). Ecological site descriptions (ESDs) tell you about the characteristics of a given site, such as its distinct topography, soil depth and texture, the plants you might find there, and the value of the site for management objectives such as livestock grazing and wildlife habitat. By providing information on the potential plant production and species composition on particular ecological sites, ESDs can help land managers set realistic objectives for the land they manage. ESDs also include a resource to understand how specific types of land may change over time and what causes the changes. This product, or roadmap, is called a state and transition model.

## What is a state and transition model?

A state and transition model (STM) is a diagram that depicts our current understanding of ecological dynamics on an ecological site. An STM identifies the different

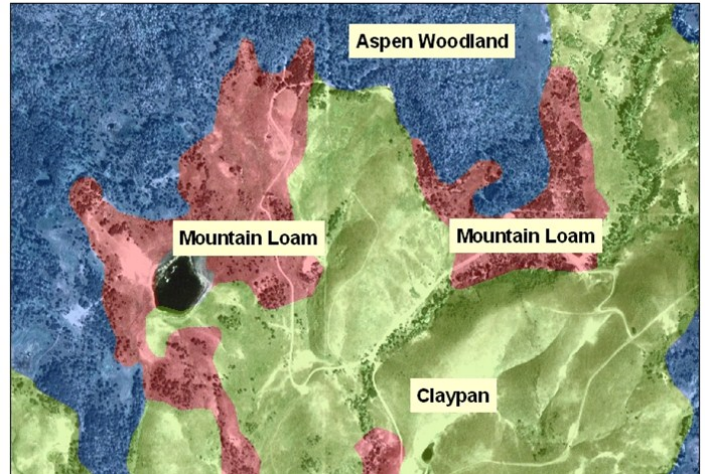


Figure 1. Aerial Photo With an Overlay Depicting Ecological Sites in a Portion of the Elkhead Watershed, Colorado

plant associations or “states” that may exist on a given ecological site and how other site characteristics, such as hydrology and soil stability, might change with them. STMs describe the environmental conditions, disturbances and management actions that cause vegetation to change from one group of plant species to a different set of species, and the management actions needed to restore plant communities to a desired composition. STMs help you identify where your land is currently (its present state), suggest potential alternative states, and provide ideas about how to move to a more desirable state and avoid unwanted transitions.



Figure 2. Claypan Ecological Site

### Box 1. Ecological Sites and Response to Management

Different ecological sites have different vegetation composition, potentials and responses to management actions. Let's say a ranch is made up of two ecological sites: Claypan and Mountain Loam. The following table compares these two ecological sites.

	Claypan	Mountain Loam
Soil Surface Color	Medium to Light	Dark
Organic Matter	Low	High
Soil Texture	Heavy Clay	Mix of Sand, Silt and Clay
Average Production	500 lbs/acre	1500 lbs/acre



Figure 3. Mountain Loam Ecological Site

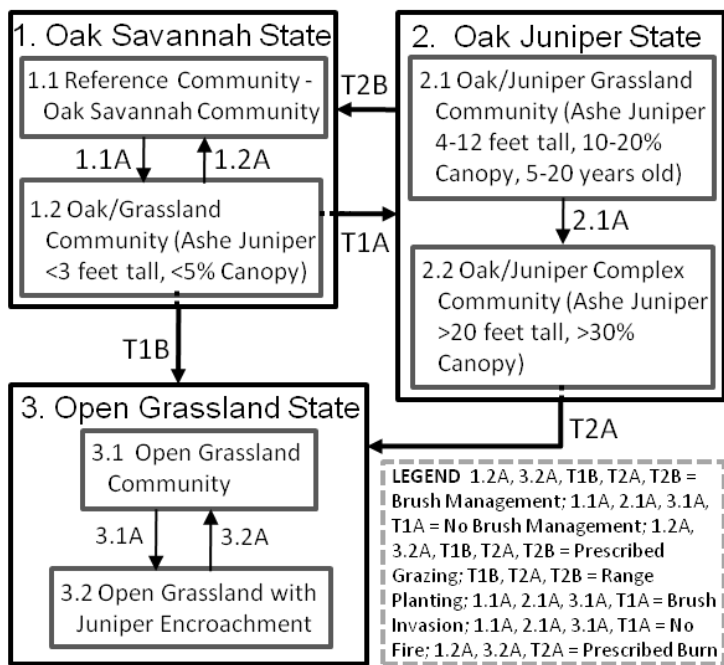


Figure 4. State-and-Transition Model (STM) for the Deep Redlands ecological site

### What do STMs look like?

STMs include recognizable and relatively stable groupings of plant species or “states” (boxes) and the pathways of change between states (arrows). A state may contain several communities which are called plant community phases (or plant associations). Plant community phases (smaller boxes) can easily transition from one to another in short time frames.

If we were interested in understanding the Deep Redlands ecological site (Figure 4), the model would show us that there are three vegetation states (boxes) that might occur on this site, and two communities in each state (smaller internal boxes). The narrative section of the STM model gives a written description of each of these states that explains what plants you would find in each state, how useful each state is for achieving specific management objectives, and other site characteristics. We would also notice that these states are connected through transitions (arrows). The arrows between the large boxes, or states, signify that a threshold has been crossed. This means that new ecological processes characterize the site, and it will take active management to shift back to the previous state. We could look at the descriptions of each transition to understand what we might have to do to move from one state (box) to another (more desirable) state.

### What can STMs do for you?

**Grazing Management.** STMs describe the potential of different types of land to support livestock grazing, and illustrate how grazing affects plant composition and ecological processes on a given ecological site. STMs can help make grazing management decisions that take advantage of opportunities and avoid negative outcomes.

**Invasive Species.** The combination of management and natural disturbances can lead to areas that are more vulnerable to the establishment and spread of invasive species. STMs highlight vulnerable ecological sites and states so that you can manage to prevent the spread of invasive species.

**Fire Management.** Different states in the same ecological site may react differently to fire. Prescribed burns may have different outcomes (e.g. in terms of erosion or plant regrowth) depending on the current state. The STM describes the role of fire in vegetation change, suggests which ecological sites and states are more vulnerable to wildfire, identifies which can be managed with prescribed fire, and provides information about how you can manage to reduce wildfire risk.

**Restoration or Improvements.** Some states are easier to change than others. When planning for restoration it is helpful to know if your actions are likely to have a positive impact. STMs help you to prioritize restoration in the areas where you are most likely to succeed. ESDs also provide information about the plant communities that a given site can support, providing useful information for selecting appropriate plant materials for revegetation.

#### Box 2. Using STMs on Your Ranch

Let’s say I have a ranch that is predominately in the Deep Redlands ecological site. From my experience I know that the dominant plant community for this ecological site on my land is the oak grassland community (1.2). Looking at the Deep Redlands STM (Figure 4), I would see that I would like to be in the reference state (1.1) and the description of the transition (1.2A) tells me that it would take prescribed grazing, prescribed burning, and brush management to get there. The STM provides a roadmap that helps you locate where you are, where you want to go, and how to get there.

**Habitat Management.** Different ecological sites and states may provide habitat for different wildlife species, or be associated with different habitat quality for a given species. If you are managing your ranch for hunting or wildlife habitat, ecological site maps can help you to prioritize areas for conservation based on their ability to provide suitable habitat for target species. STMs can be useful in planning habitat improvement projects by identifying possible states for a given site.

## The difference between ecological site descriptions and range site descriptions:

Ecological site descriptions (ESDs) are replacing range site descriptions. They provide similar information about site potential and plant species you might expect in an area. The primary difference is that ESDs reflect new understandings about the way that vegetation changes over time. Instead of describing vegetation change as a gradual linear process, the STMs included in ESDs reflect the sudden and unpredictable changes that sometimes occur in rangelands. Although the Natural Resources Conservation Service (NRCS) is working to revise all range site descriptions to ecological site descriptions, there are some areas where range site descriptions are the best and only information available. In these areas, obtain the range site descriptions or speak with a local rangeland management specialist to learn when the ecological site descriptions are expected to be completed.

## Identifying ecological sites

In the field it is often possible to identify different types of land just by looking at variations in vegetation and site characteristics (Figure 5). This gives you a general sense of the types of land, but in order to identify the ecological site of interest, it is necessary to gather a few additional resources. You will need to consider the topography, soils and plants on a site (see Box 3). Since different ecological sites have different characteristics and potentials, it is important to follow these steps in order to make sure that you correctly identify the ecological site of interest.



Figure 5. Rangeland Depicting Different Types of Land Based on Visual Clues in Aspect, Topography and Vegetation.

### Box 3. Steps for Identifying Ecological Sites

Identifying ecological sites is challenging and requires knowledge of different sites within an area and their ecological functioning. It may be beneficial to go out with your local NRCS rangeland specialist the first time you attempt to identify ecological sites.

1. Obtain your state's ecological site key, if one is available.
2. Obtain topographical and soil maps of your ranch, along with the associated soil survey descriptions. Soil maps are available on the web soil survey: [websoilsurvey.nrcs.usda.gov](http://websoilsurvey.nrcs.usda.gov). Soil map units represent one or more soil types and each soil type has its own ecological site description.
3. Obtain copies of the most common ecological site descriptions for your ranch from the Web: [esis.sc.egov.usda.gov](http://esis.sc.egov.usda.gov) or your local NRCS office.
4. Take the maps with you on the land and see what soil and ecological site they predict for the spot you are standing on.
5. Look at the ESD for the predicted site and see if the physical description matches the place where you are standing. Are the elevation, slope and topography similar or the same? What about the soil texture? If not, what ecological sites do match the physical description for that spot? It is important to remember that the ESD is the central concept for the site. While it describes the majority of locations in this site, variants may occur.
6. When you find the ESD that matches the physical characteristics of your site, look at the list of plant species in the reference state and alternative vegetation states. Does one of the described states or community phases fit what you see around you? If so, you have matched your location with an ecological site and state or community phase.
7. Use the supporting narrative within the ecological site description to understand how your land came to be in its current state, whether a change in states is desirable or possible and how a transition to another state might be achieved or prevented.

Place Postage  
Here

This fact sheet was developed by researchers at Colorado State University and peer-reviewed by rangeland scientists and managers from a variety of agencies and organizations. To obtain a pdf of this or other fact sheets developed for agency or conservationist audiences please contact Dr. Maria Fernandez-Gimenez at [maria.fernandez-gimenez@colostate.edu](mailto:maria.fernandez-gimenez@colostate.edu). This outreach effort is supported by a grant from the USDA AFRI Managed Ecosystems Program (Project Number COL0-2008-00725) and the Colorado Agricultural Experiment Station (Project Number COL00698). This fact sheet may be copied or reprinted for distribution.

## New Tools for Land Management: Putting Ecological Site Descriptions to Use on Your Ranch

### Where to find ESDs

Ecological site descriptions are currently being developed for every ecological site in the United States. Central and Western states are further along, while many Midwestern and Eastern states are just beginning to classify potential ecological sites. The online access system is active and available to the public. To access draft and approved ESDs for your area, visit: [esis.sc.egov.usda.gov](http://esis.sc.egov.usda.gov).

Web Soil Survey provides access to the largest natural resource information system in the world. This site has soil maps and data for almost all of the nation's counties. This online tool helps land managers see how soils, landscape and vegetation come together. To find maps of soils, visit the Web Soil Survey at: [websoilsurvey.nrcs.usda.gov](http://websoilsurvey.nrcs.usda.gov).

If you aren't finding what you are looking for, you may contact your local NRCS office directly for assistance.



**Colorado  
State  
University**