

New Tools for Conservation:

Ecological Site Descriptions and Their Role in Conservation Planning

Creating effective conservation policies and programs requires knowledge of land resources, the ecosystem services they provide, and how landscapes change over time. The Natural Resources Conservation Service (NRCS) has developed a product called ecological site descriptions (ESDs) that can help you understand the potential and vulnerabilities of different types of land, or ecological sites.

Ecological Sites

An ecological site is a kind 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. Different ecological sites respond differently to management (see Box 1). 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). Ecological site descriptions 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. ESDs also include state and transition models (STMs), that describe in detail how vegetation responds to relatively short-term changes in weather, disturbance regime, and management.

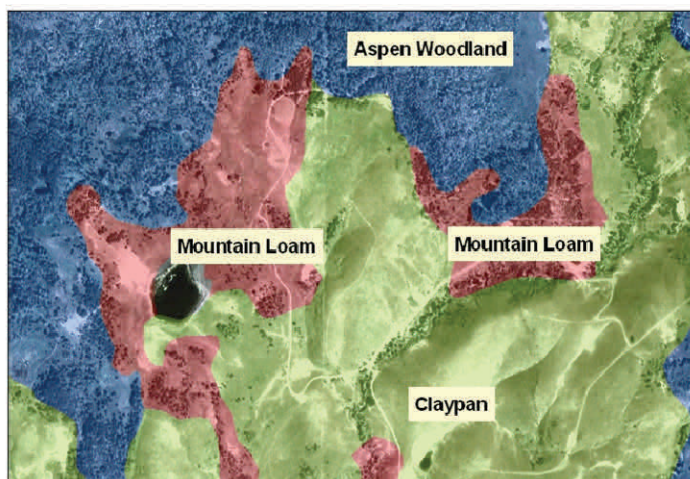


Figure 1. Aerial Photo with an Overlay Depicting Ecological Sites in a Portion of the Elkhead Watershed, Colorado

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 all of the different plant associations or “states” that may exist on a given ecological site, and explains how other site characteristics, such as hydrology and soil stability, might differ between states. 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 activities needed to restore plant communities to a desired composition. STMs help you identify where the land is currently (its present state), what potential alternative states it could inhabit, and provide ideas about how to move to a more desirable state and avoid unwanted transitions.

Box 1. Ecological Sites and Response to Management

Different ecological sites have different vegetation composition, potentials and responses to management actions. Let’s say we are interested in a property that is made up primarily 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
Type of Soil	Heavy Clay	Mix of Sand, Silt and Clay
Production	500 lbs/acre	1500 lbs/acre



Figure 2. Claypan Ecological Site



Figure 3. Mountain Loam Ecological Site

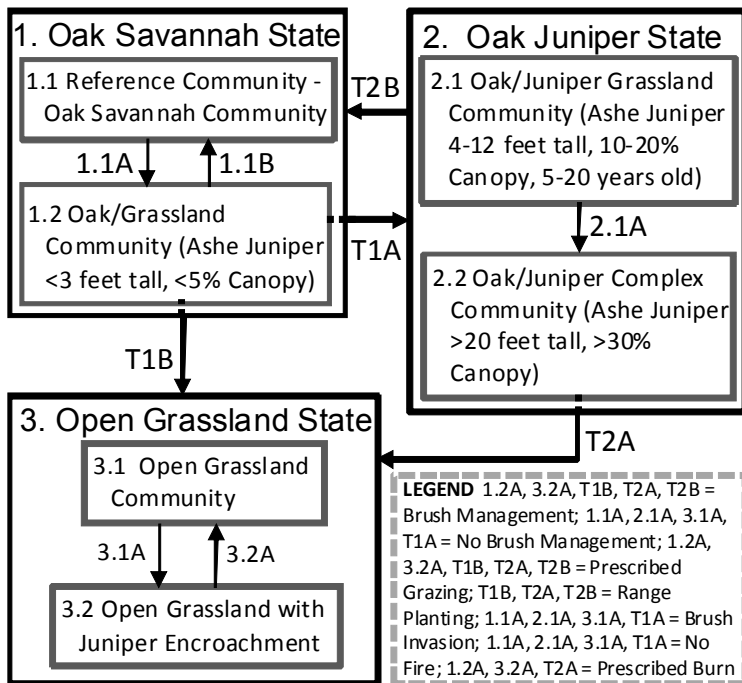


Figure 4. State-and-Transition Model (STM) for the Deep Redlands ecological site

What do they 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 can easily transition from one to another in short time frames (smaller boxes).

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 community phases 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 in order to understand what we might have to do to move from one state (box) to a more desirable state.

What can they do for you?

Habitat Conservation and Improvement. Different ecological sites and states may provide habitat for different wildlife species, or be associated with different habitat quality for a given species. Ecological site maps can help wildlife managers prioritize areas for conservation based on their ability to provide suitable habitat for target species, and STMs can be useful in planning habitat improvement projects by identifying possible states for a given site.

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.

Conservation Management. Conservation of landscapes often requires management actions to maintain desired characteristics or to minimize risks, such as wildfire. STMs describe how vegetation responds to relatively short-term changes in weather, disturbance regime and management.

Ecosystem Services. Different types of land have different soil and vegetation qualities that can influence the ecosystem services they provide. For instance, a highly eroded landscape will likely lead to lower water quality than a stable plant community. STMs help to inform what types of ecological services a given landscape can provide.

Restoration. Some states are easier to change than others. When planning for restoration it is helpful to know which 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.



Conservation Planning 101

Let's say you work for the county and you have recently acquired a ranch that you are managing. The people in your community admire it for the diverse wildlife and abundant wildflowers. This property is predominately in the Deep Redlands ecological site (Figure 4). After completing a vegetation inventory, you conclude that the property is in the Oak/Grassland community state (1.2). Looking at the Deep Redlands ecological site description, you would see that the Oak Savannah (1.1) community would provide better habitat for a more diverse group of animals. You would note that prescribed grazing and prescribed burns are necessary to maintain this state. You would also see that lack of fire, lack of brush management and brush invasion could lead to state 2, which would degrade wildlife habitat. This suggests the need for prescribed burning and brush management in order to maintain certain characteristics that the local people value. The STM provides a roadmap that helps you locate where you are, where you want to go, and how to get there.

Identifying ecological sites

In the field it is often possible to identify different types of land just by looking at variation 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 topographic and soil maps of the area of interest, along with the associated soil survey descriptions. Soil maps are available on the Web Soil Survey: 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 the area of interest from the Web: 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, state and/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.

Where to find ESDs

Ecological site descriptions are currently being developed for every ecological site in the United States. The online access system is active and available to the public. To access complete and approved ESDs for your area, visit: esis.sc.egov.usda.gov. To find maps of soils, visit Web Soil Survey at: websoilsurvey.nrcs.usda.gov. If you aren't finding what you are looking for, you may want to contact your local NRCS office directly for assistance.

This Ecological Site Description factsheet was developed by a team from Colorado State University led by Dr. Maria Fernandez-Gimenez with feedback from many others. This factsheet was written for a conservation group audience, and two similar factsheets are targeted for ranchers and federal agencies. If you are interested in obtaining copies of these factsheets to distribute in your area, please contact Dr. Fernandez-Gimenez: Maria.Fernandez-Gimenez@colostate.edu

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