Case Study

Disturbance Response Grouping of Ecological Sites Increases Utility of Ecological Sites and State-and-Transition Models for Landscape Scale Planning in the Great Basin

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On the Ground

- Ecological sites often occur at scales too small for application in planning large-scale vegetation treatments or post-fire rehabilitation.
- Disturbance Response Groups (DRGs) are used to scale up ecological sites by grouping ecological sites based on their responses to disturbances.
- A state-and-transition model (STM) is created for the DRG and refined through field investigations for each ecological site thereby creating STMs that function at both DRG and ecological site scales.
- The limited availability of ecological site descriptions hinders their use in large-scale management planning and may be a factor associated with the observed lack of application of available STMs
- Standardization of ecological site mapping tools for GIS platforms would increase the utility of DRGs, STMs, and ecological site descriptions for many land managers in the western United States.

Keywords: ecological site, state-and-transition model, disturbance response group, landscape-scale management, GIS.

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Ecological site descriptions have provided ecologically based guidance for land management decisions for more than 60 years[1]; however, the majority of utility has been realized on private lands primarily due to issues of scale. The spatial extent of individual ecological sites is determined through the correlation of sites to soil survey map units and provides a potentially valuable tool for management. Soil surveys are made by describing and classifying soils in the field and delineating their areas on maps, but different intensities of field study and degrees of detail in mapping are utilized by soil survey teams based upon the intended purposes for the soil survey. For rangeland applications, third-order soil surveys are conducted at the 1:24,000 to 1:63,360 scale and are appropriate for land uses that do not require precise knowledge of small areas or detailed soil information.[2] Therefore, it is not unusual to have multiple ecological sites correlated to one soil map unit (Fig. 1). Further complicating the issue of scale is the size of rangeland management units. For example, the average grazing allotment size in Nevada exceeds 60,000 acres[3] and rangeland wildfires vary in size often exceeding thousands of acres (i.e., wildfires in 2016 in Nevada have ranged in size from 832 to 122,292 acres).[4] Ecological sites have not been widely used by public land management agencies as a tool for management planning because they typically occur on the landscape at scales too small for landscape-scale decision-making.

However, recognizing the utility of ecological sites and the associated state-and-transition model (STM) for decision support, the Bureau of Land Management in Nevada has partnered with Nevada Natural Resources Conservation

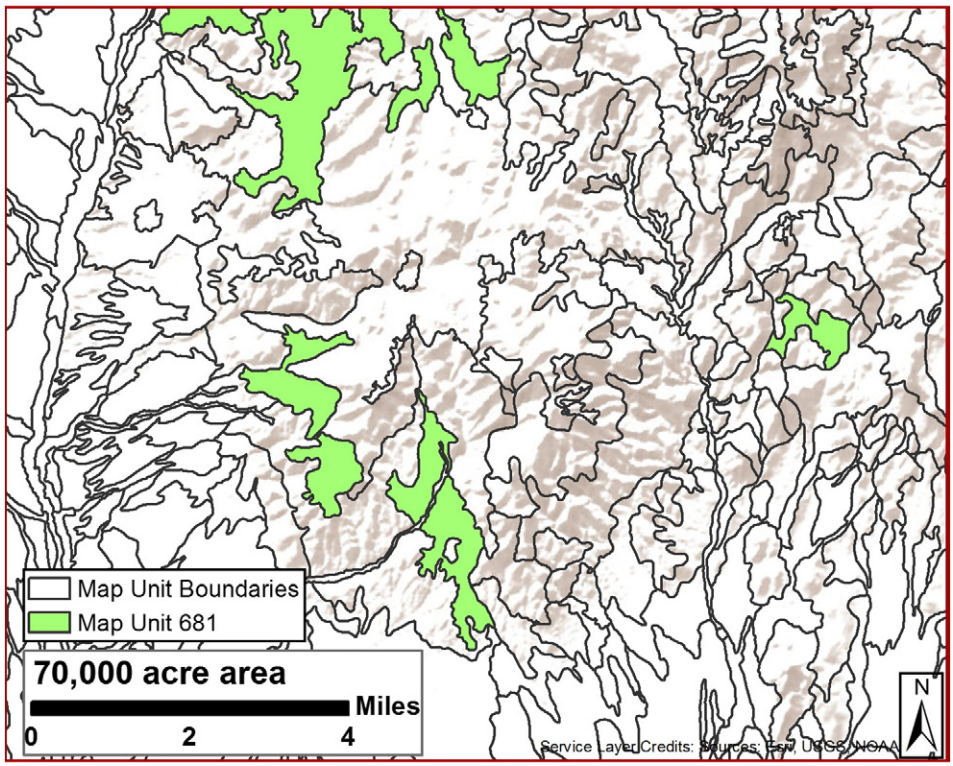

Figure 1. This illustration shows the complexity of a management unit. A total of 237 individual soil map units are shown in this 70,000-acre area. There are 9 polygons of map unit 681, totaling 4,200 acres. This map unit is highlighted to show the distribution of these polygons as they repeat across the landscape. Map unit 681 has three component soil series described: 45% Chad, 20% Cleavage, and 20% Softscrabble. Each of these are mapped to unique ecological sites, but the Chad soil at 45% is the dominant condition.

Service (NRCS) and the University of Nevada, Reno (UNR) in 2009 with the goal of formulating a team that could 1) expedite development of scientifically-sound STMs, and 2) provide a mechanism for utilizing STMs for decision support at scales larger than the individual ecological site. We present an overview of the process utilized for upscaling ecological sites and development of STMs along with a case study in which these tools were used for post-fire stabilization and rehabilitation planning.

Upscaling Ecological Sites into Disturbance Response Groups

The team of scientists, professional land managers, consultants, and interested stakeholders led by Dr Tamzen Stringham (UNR) and Patti Novak-Echenique (NV-NRCS) developed a process that examines local knowledge, soil mapping data and published literature on soils, plant ecology, plant response to various disturbances, disturbance history of the area, and any other important attributes necessary to sort pre-existing ecological sites into groups of ecological sites *based on their responses to natural or human-induced disturbances.*[5,6] These groups are referred to as Disturbance Response Groups (DRGs) and are defined as groups of ecological sites that respond similarly to disturbance, reaching the same state or endpoint although the rate of adjustment may vary by site.[7,8] This process is applied at the Major Land Resource Area (MLRA) scale with the entire MLRA being considered during the grouping effort. MLRAs are geographically associated land resource units made up of multiple ecological sites (Fig. 2). Relevant disturbances for each MLRA are identified by the team, however the primary disturbances in the Great Basin are wildland fire, insect herbivory, grazing by domestic livestock and wild horses, off-road vehicle use, and climatic events such as drought. Additionally, active vegetation management activities including tree removal methods, brush management treatments, and rangeland seeding are considered important. Environmental attributes identified as major controllers of ecological site response to disturbance include precipitation zone and soil temperature and moisture regimes.[9] Soil texture, soil depth, and depth to restrictive layers are also considered important. Extensive literature review and professional knowledge is utilized to determine vegetation dynamics in response to stressors and disturbances of the various plant communities that occur on each ecological site.[7,8] Finally, a generalized draft STM is created for the DRG and used as a template for discussion during field investigations.

Detailed field investigations are conducted for each ecological site group (DRG) within the MLRA by senior personnel including Stringham, Novak-Echenique, BLM staff, and a soil scientist in order to refine the generalized draft STMs and individual ecological site STMs into robust models appropriate for land management applications. Multiple locations for each DRG are visited and the following data is recorded: 1) soil pedon description (recorded on NRCS form