Data support for a state-and-transition model: what have we learned?

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Introduction

State-and-transition models (STMs) are used to describe the possible vegetation dynamics for an ecological site. Vegetation dynamics include succession and disturbance-caused shifts among plant communities as well as state changes that are unlikely to be reversed within several decades, if reversal is possible at all. STMs integrate several information sources into a STM diagram and narratives, which are housed within an Ecological Site Description (ESD) document by the USDA Natural Resources Conservation Service (http://esd.sc.egov.usda.gov). Information sources can include local and expert knowledge, historical reconstructions, plant-soil inventory data, and short- and long-term experiments. Because new information can be discovered, and existing information can yield novel interpretations, STMs are viewed as dynamic and subject to change. To provide an example of how novel data and interpretations can change the structure of a STM, we compare a STM developed in 2001 with a version revised ten years later.

Background on the state-and-transition model

The STM pertains to the Sandy ecological site of Major Land Resource Area (MLRA) 42.2 (Southern Desert Basins, Plains, and Mountains, 8°-10° precipitation zone) of the northern Chihuahuan Desert in New Mexico and Texas. USA. MLRA 42.2 currently includes thermic and hyperthermic soils across its extent. These different soil temperature regimes appear to support different potential vegetation. Consequently, the STM applies to only a portion of MLRA 42.2 and most information derives from New Mexico and extreme west Texas.

The soil components correlated to the Sandy ecological site are generally fine- to coarse-loamy Argids and Calcids, typically including a non-gravely loamy fine sand to medium sandy loam surface horizon overlying horizons of finer texture, typically sandy loam to sandy clay loam, and a calcic horizon whitened by calcium carbonate. A petrocalcic horizon (caliche) is often present at depths greater than 50 cm (20’). Similar ecological sites include Shallow Sandy (petrocalcic horizon is < 50 cm). Loamy (surface textures fine sandy loam to clay loam), and Deep Sand (no clear pedogenic horizons below A).

The characteristic reference plant community of the Sandy site features a high dominance of black grama (Bouteloua eriopoda; BOER) with bunchgrasses as subordinates, including dropseed (Bouteloua gracilis; BGOG) and threeawns (Aristida spp.; together referred to as “other PG”). Alternative states feature a loss of black grama and increasing dominance of honey mesquite (Prosopis glandulosa, PRGR) and snakeweed (Gutierrezia sarothrae).

Although not formally designated as such, the Sandy ecological site can be regarded as a benchmark ecological site for MLRA 42.2 due to the large amount of research pertaining to this site. The Sandy site is the second most extensive ecological site in MLRA 42.2 in New Mexico.