A State and Transition Model for Creosotebush and White Bursage

Todd Esque, Research Ecologist, U.S. Geological Survey - Western Ecological Research Center, Henderson, Nevada

Creosotebush (*Larrea tridentata*) and white bursage (*Ambrosia dumosa*) form the dominant vegetation type across extensive shrublands on lower slopes, outwash plains and valley bottoms across the Mojave Desert. Depending on climatic conditions large expanses of these shrublands can be lost to wildfires in some years. The patterns of vegetation and ecosystem change are known, but mechanisms of change are still being identified. Resource managers can use state and transition models are used to illustrate and identify patterns and mechanisms of change. In the models, vegetation 'states' provide a description of conditions (e.g. cover, density, condition) of vegetation and soils, while the transitions are mechanisms of change and the may include an indication of the amount of effort (money and natural resources) required to move from one state to another. Although not quantitative, these models can be used to graphically illustrate vegetation change with box and arrow diagrams to illustrate pattern and process and identify topics for further investigation. When considered uni-directionally, this model includes states that represent prehistoric conditions and proceed through a set of conditions that degrade with each pass through successive transitions. The model is closed by hypothetically forming loop with transitions and states that hypothetically improve the resource condition. Important transitions include invasion by alien annual grasses, the introduction of fire (1st time), repeated fires, further erosion and invasions, and finally reversals of those transitions and new transitions that potentially or hypothetically could move the vegetation toward the original state or some previously unknown state. Using this model for consideration of current and future vegetation and soil conditions may help managers understand the challenges they face and provide opportunities to explore the potential outcomes for a variety of management options that may or may not be currently used.

Todd C Esque is a Research Ecologist at the US Geological Survey. He received his Ph.D. in Ecology, Evolution, and Conservation Biology, at University of Nevada, Reno, Nevada - 2004. His research program uses manipulative and observational research to understand how plants, animals and ecosystems respond to disturbances.