## Big Sagebrush (SAGE)

### General Information

### Cover Type Overview

* Crosswalks
  + EVeg: Regional Dominance Type 1
    - Bitterbrush
    - Basin Sagebrush
    - Great Basin Mixed Scrub
    - Bitterbrush – Sagebrush
  + LandFire BpS Model: 0610800 Inter-Mountain Basins Big Sagebrush Shrubland
  + Presettlement Fire Regime Type: Big Sagebrush

Reviewed by:

* Michele Slaton, GIS Specialist, Inyo National Forest, USDA Forest Service

### Vegetation Description

The Big Sagebrush landcover type is typified by large, open, discontinuous stands of *Artemisia tridentata* of fairly uniform height. *A. tridentata* tends to have a single short, thick, stem that branches into a nearly globular crown (Neal 1988). *Ericameria nauseosa* is a frequent associate or co-dominant (LandFire 2007).

Shrub canopy cover generally ranges from very open, widely spaced, small plants to large, closely spaced plants with canopies touching. Cover may be greater at higher elevations and in areas receiving more precipitation. In addition to a deep root system, *A. tridentata* has a well-developed system of lateral roots near the soil surface (LandFire 2007, Neal 1988). Consequently, well-established sagebrush plants exclude most other shrubs in an area up to three times their crown area. Forbs and graminoids are often more abundant beneath these crowns (Slaton pers. comm. 2013). This produces stands of shrubs of very uniform size and spacing (Neal 1988).

Often the habitat is composed of pure stands of *A. tridentata*, but many stands include other species of *Artemisia, Ericameria, Tetradymia, Ribes, Prunus, Cercocarpus,* and *Purshia.* In communities not fully occupied by *Artemisia*, various amounts of herbaceous understory are found. Perennial forb cover is usually less than 10% with perennial grass cover reaching 20-25% on the more productive sites. *Pseudoroegneria spicata* may be a dominant species following replacement fires and a co-dominant after 20 years. *Elymus elymoides* and *Oryzopsis hymenoides* are common on more xeric sites. *Festuca, Stipa, Poa,* and Leymus are among the more common grasses. Percent cover and species richness of understory are determined by site limitations. *Pinus monophylla* and *Juniperus osteosperma* may be present, especially in areas protected from fire (Neal 1988, LandFire 2007).

### Distribution

This widespread system is common to the Basin and Range province. It ranges in elevation from 900 m to 2450+ m (3000-8000+ ft) and occurs on well-drained soils on foothills, terraces, slopes, and plateaus. It is found on deeper soils (LandFire 2007).

**Disturbances**

### Wildfire

Wildfires tend to be high mortality, stand-replacing fires that initiate a process of post-fire forest succession. High mortality fires kill large as well as small shrubs, and may kill many of the forbs and grasses as well, although below-ground organs of at least some individual shrubs and herbs survive and re-sprout.

Replacement fires generally occur where shrub canopy exceeds 25% cover, or where grass cover is greater than 15% and shrub cover is greater than 20%. Surface fires occur in areas dominated by grasses but are otherwise uncommon (LandFire 2007). *A tridentata* does not sprout after burning but most of the other shrubs common to the type do (Neal 1988). For the last several decades, post-settlement converstion to *Bromus tectorum* has become common and results in changes to fire frequency and vegetation dynamics. Extended periods of fire suppression or absence can lead to *P. monophylla-J. osteosperma* encroachment and subsequent decline of other shrubs and herbaceous plants (LandFire 2007).

Data on fire return intervals (FRIs) are available from a few review papers. Van de Water and Safford’s 2011 review paper aggregates hundreds of articles, conference proceedings, and LandFire data on fire return intervals, with an emphasis on Californian sources. They report a mean FRI of 35 years, median of 41 years, mean min of 15 years and mean max of 95 years. The LandFire model for this type (2007) predicted a mean replacement FRI of 137 years with a range of 30-200 years, a mean mixed severity FRI of 1000 years, a mean surface FRI of 2500 years, and an overall mean FRI of 115 years. We recalculated these numbers using condition-specific information and using only high and low mortality fire categories, which resulted in an interval of 124 years for high mortality fire, 1000 years for low mortality fire, and 110 years for any fire.

Table 1. Fire return intervals (years) and percentage of high versus low mortality fires. Values were derived from BpS model 0610800 (LandFire 2007), Van de Water and Safford (2011), and Safford (pers. comm. 2013).

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Variant** | **Modifier** | **Fire Mortality** | **Mean** | **Min** | **Max** | **% of Fires** |
| SAGE | None | High | 124 | – | – | 89 |
| Low | 1000 | – | – | 11 |
| All Fires | 42 | 15 | 95 | 100 |

### Other Disturbance

Other disturbances are not currently modeled, but may, depending on the condition affected and mortality levels, reset patches to early development, maintain existing condition classes, or shift/accelerate succession to a more open condition.

### Vegetation Condition Classes

We recognize five separate condition classes for SAGE: Early Development (ED), Mid Development – Open (MDO), Mid Development – Closed (MDC), Late Development – Open (LDO), and Late Development – Closed (LDC). We use condition classes not in the sense of fire regime condition classes, but as an alternative to “successional” classes that imply a linear progression of states and tend not to incorporate disturbance. The condition classes identified here are derived from a combination of successional processes and anthropogenic and natural disturbance, and are intended to represent a composition and structural condition that can be arrived at from multiple other conditions described for that landcover type. Thus our condition classes incorporate age, size, canopy cover, and vegetation composition as well as relative seral stages. In general, the delineation of stages has originated from the LandFire biophysical setting model descriptive of a given landcover type; however, condition classes are not necessarily identical to the classes identified in those models.

### Early Development (ED)

**Description** *A. tridentata* does not sprout after burning but most of the other shrubs common to the type do. Consequently, for as long as 20 years after fire the vegetative community may be dominated by *Chrysothamnus*, *Tetradymia*, and grasses. A very hot fire in a degraded site may result in a seral community dominated by annual grasses and forbs. Perennial bunchgrasses frequently survive fires and become dominant (Neal 1988). Canopy cover is less than 40%, but shrub cover may be as little as 10%. Fuel loading is discontinuous (LandFire 2007).

**Succession Transition** In the absence of disturbance, patches in this condition will transition to MDO at 20 years.

**Wildfire Transition** High mortality wildfire (100% of fires in this condition) recycles the patch through the ED condition. Low mortality wildfire is not modeled for this condition class.

**Mid Development – Open (MDO)**

**Description** *A. tridentata* usually reaches fairly stable dominance 10 to 20 years after disturbance, with or without an understory of perennial bunchgrass. *A. tridentata* usually remains dominant indefinitely or until the next disturbance (Neal 1988). Shrubs and herbaceous vegetation can be codominant. Generally, shrub cover is less than 20% (LandFire 2007).

**Succession Transition** At 40 years without disturbance, patches in this condition will transition to MDC.

**Wildfire Transition** High mortality wildfire (80% of fires in this condition) recycles the patch through the ED condition. Low mortality wildfire (20%) does not effect a change in the MDO condition.

**Mid Development – Closed (MDC)**

**Description** Shrubs domiante the landscape; fuel loading is primarily woody vegetation. Shrub density is sufficient in old stands to carry the fire without fine fuels. *P. monophylla* and *J. osteosperma* seedlings and saplings widely scattered. Generally, shrub cover is greater than 20% (LandFire 2007).

**Succession Transition** At 40 years without disturbance, patches in this condition will transition to LDO.

**Wildfire Transition** High mortality wildfire (100% of fires in this condition) recycles the patch through the ED condition. Low mortality wildfire is not modeled for this condition class.

**Late Development – Open (LDO)**

**Description** *P. monophylla* and *J. osteosperma* encroachment where disturbance has not occurred for at least 80 years. Tree canopy cover less than 15%. Shrub and herbaceous plant cover declining (LandFire 2007).

**Succession Transition** At 50 years without disturbance, patches in this condition will transition to LDC.

**Wildfire Transition** High mortality wildfire (100% of fires in this condition) recycles the patch through the ED condition. Low mortality wildfire is not modeled for this condition class.

**Late Development – Closed (LDC)**

**Description** Shrubland encroached with mature *P. monophylla* and *J. osteosperma*. Wildfire has not occurred for at least 130 years. Tree species cover ranges from 15-90% and shrub cover has declined to less than 10% (LandFire 2007).

**Succession Transition** In the absence of disturbance, patches in this condition will maintain.

**Wildfire Transition** High mortality wildfire (100% of fires in this condition) recycles the patch through the ED condition. Low mortality wildfire is not modeled for this condition class.

**Condition Classification**

Because condition classification was done through orthophoto analysis, no polygons are assigned to Late condition, which is actually not an *Artemisia*-dominated condition. Polygons are assigned to MDO or MDC based on a 20% break point. Open conditions have less than 20% cover and closed conditions have greater than 20% cover. Polygons with a Null value for shrub cover are assigned to ED.

**Draft Model**

(See PDF) Disturbance-Succession model for SAGE.

**References**

LandFire. “Biophysical Setting Models.” Biophysical Setting 0610800: Inter-Mountain Basins Big Sagebrush Shrubland. 2007. LANDFIRE Project, U.S. Department of Agriculture, Forest Service; U.S. Department of the Interior. <http://www.landfire.gov/national\_veg\_models\_op2.php>. Accessed 9 November 2012.

Neal, Donald L. “Sagebrush (SGB).” *A Guide to Wildlife Habitats of California*, edited by Kenneth E. Mayer and William F. Laudenslayer. California Deparment of Fish and Game, 1988. <http://www.dfg.ca.gov/biogeodata/cwhr/pdfs/SGB.pdf>. Accessed 4 December 2012.

Safford, Hugh. Regional Ecologist, USDA Forest Service. Personal communication, 15 August 2013.

Van de Water, Kip M. and Hugh D. Safford. “A Summary of Fire Frequency Estimates for California Vegetation Before Euro-American Settlement.” *Fire Ecology* 7.3 (2011): 26-57. doi: 10.4996/fireecology.0703026.