## Big Sagebrush (SAGE)

### General Information

### Cover Type Overview

* 4,003 acres / 1620 hectares
* 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

### Vegetation Description

SAGE stands are typically 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 cnaopies touching but can be greater at higher elevations and in areas receiving more precipitation (LandFire 2007, Neal 1988). In addition to a deep root system, *A. tridentata* has a well-developed system of lateral roots near the soil surface. Consequently, the plants almost completely use the edaphic potential of a site, excluding most other plants in an area up to three times their crown area. This produces stands of shrubs of very uniform size and spacing. *A. tridentata* is often mixed with other species of shrubs of similar form and growth habit. In better sites, the understory is composed of perennial grasses and forbs (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 2150 m (3000-7000 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 trees, and may kill many of the shrubs and herbs as well, although below-ground organs of at least some individual shrubs and herbs survive and re-sprout.

SAGE is characterized by replacement fires 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). Big sagebrush 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 change in fire frequency and vegetation dynamics. Fire suppression 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) and Van de Water and Safford (2011).

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| --- | --- | --- | --- | --- | --- | --- |
| **Variant** | **Modifier** | **Fire Mortality** | **Mean** | **Min** | **Max** | **% of Fires** |
| SAGE | None | High | 124 | – | – | 89 |
| Low | 1000 | – | – | 11 |
| All Fires | 110 | 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. The condition classes described below are based on the classes described in the pertinent LandFire Biophysical Setting model descriptions, which in turn were based on a “5-box” state and transition models describing major successional stages related to fire regime condition classification. According to the Fire Regime Condition Class guidebook, up to five successional classes may be utilized to describe age, size, canopy cover, and vegetation composition, ranging from early seral (post-disturbance) to late seral (such as old growth) (Barrett et al. 2010). The SAGE variant is assigned to the following condition classes: Early Development (ED), Mid Development – Open (MDO), Mid Development – Closed (MDC), Late Development – Open (LDO), and Late Development – Closed (LDC).

### Early Development (ED)

**Description** Big sagebrush 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 rabbitbrush, horsebrush, 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, this class will transition to MDO after 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** Sagebrush usually reaches a fairly stable dominance in 10 to 20 years after disturbance, with or without an understory of perennial bunchgrass. Sagebrush 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** After 40 years without disturbance, this class 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** After 40 years without disturbance, this class 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** After 50 years without disturbance, this class 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, this class 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 will be assigned to Late condition, which is actually not an *Artemisia*-dominated condition. Polygons will be 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.

|  |  |  |  |
| --- | --- | --- | --- |
| Successional stage | Early and mid seral communities | Percent | 14.6 |

Ecosystem Structure. Trees are generally found in close proximity to and mixed with sagebrush shrublands, including pinyon pine, Utah juniper, Jeffrey pine, limber pine, lodegepole pine, and others. This is reflected in the relatively high proportion of trees to shrubs in this assessment type at the landscape scale (0.1:1; Table 7), and in the low percentages of sagebrush mapped as series (7%); 11% of sagebrush is mapped with patches less than 5 acres in size that consist of different vegetation series, and 75% is mapped with patches greater than 5 acres in size. Early and mid seral ecosystems comprise 15% of this assessment type, which mainly include burned areas currently dominated by herbaceous vegetation or by shrub species that increase rapidly following fire, such as rabbitbrush (*Chrysothmanus* spp.). Stand level physiognomy indicates that low numbers of trees are often found in sagebrush shrublands (0.1:1 ratio for tree:shrub). The shrub:herb ratio has a mean of 17:1, although the cover of perennial grass is highly variable (ranges from 0 - 75%; Table 7).

**Figure 1a.** Area and proportion of assessment types influenced by disturbance.

A separate analysis that used different methods to determine the proportion of disturbance by assessment type was available from the Inyo NF Potential Natural Vegetation (PNV) dataset (Figure 1b). In this dataset, areas of the forest were visually inspected using aerial photography to estimate the extent of communities in early to mid seral condition, due to timber harvest, fire, flooding, and avalanche. Findings for the proportion of early to mid seral assessment types matches findings using the disturbance dataset (Fig. 1a) for sagebrush (ca. 15% in early to mid seral stages), xeric shrublands and blackbrush (ca. 8%), alpine (0%), special types (5%), mountain mahogany (6-10%), pinyon-juniper (7-12%), and subalpine forest (1-5%). Similarities between these different methods indicate relatively high confidence in estimating the extent of disturbance-impacted areas in these types. However, neither method is able to account for disturbance caused by grazing, because no information was available at a Forest-wide scale for the extent and intensity of grazing and its influence on community seral status.

**Draft Model**

(See PDF) Disturbance-Succession model for SAGE.

**References**

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