

10800

Inter-Mountain Basins Big Sagebrush Shrubland

BpS Model/Description Version: Aug. 2020

Modelers		Reviewers	
Jan Nachlinger	jnachlinger@tnc.org	None	None
None	None	None	None
None	None	None	None

Vegetation Type

Shrubland

Map Zones

13, 14

Geographic Range

This ecological system is found in eastern California and central/southern Nevada and Utah and is distinct from sagebrush steppe (Inter-Mountain Basins Big Sagebrush Steppe) found on the Columbia Plateau and in Wyoming. This Biophysical Setting (BpS) extends into map zone (MZ) 13 but at higher elevations than in central Nevada and is not a common system.

Biophysical Site Description

This widespread system is common to the Basin and Range province but much less widespread in the Mojave Desert. In elevation, it ranges from 3,000-7,000ft (>4,000ft at lower latitudes) and occurs on well-drained soils on foothills, terraces, slopes, and plateaus. It is found on soil depths >18in and up to 60in+. Elevationally, it is found between low-elevation salt desert shrub or blackbrush and mountain big sagebrush zones where pinyon and juniper can establish. Occurs from 4-14in precipitation zones, however. Thus, other site characteristics (e.g., aspect, drainage) should be considered in identifying this ecotype. At the precipitation extremes, this system generally occurs as small patches and stringers.

Vegetation Description

Shrub canopy cover generally ranges from 5-25% but can exceed 30% at the upper elevation and precipitation zones. Basin big and/or Wyoming big sagebrush sites have fewer understory species relative to other big sagebrush types. Wyoming big sagebrush is absent from many parts of MZ13, whereas basin big sagebrush is the diagnostic shrub (USDA-NRCS 2003b). Rubber rabbitbrush is co-dominant.

Perennial forb cover is usually <10%, with perennial grass cover reaching 20-25% on the more productive sites. Sandberg bluegrass (*Poa secunda*) may be a dominant species following replacement fires and as a co-dominant after 20yrs but only in precipitation zones >10in. Bottlebrush squirreltail, Indian ricegrass, James galleta, or sandy needle-and-thread grasses are common on more xeric sites. Percent cover and species richness of understory are determined by site limitations. Pinyon (generally *Pinus monophylla*) and juniper (generally *Juniper osteosperma*) are present, occasionally reaching 50% canopy cover in areas that have escaped fire.

BpS Dominant and Indicator Species

Symbol	Scientific Name	Common Name
ARTR2	<i>Artemisia tridentata</i>	Big sagebrush
CHVI8	<i>Chrysothamnus viscidiflorus</i>	Yellow rabbitbrush
ACHY	<i>Achnatherum hymenoides</i>	Indian ricegrass
HECO26	<i>Hesperostipa comata</i>	Needle and thread
ATCO	<i>Atriplex confertifolia</i>	Shadscale saltbush
ELELE	<i>Elymus elymoides ssp. elymoides</i>	Squirreltail
POSE	<i>Poa secunda</i>	Sandberg bluegrass
PLJA	<i>Pleuraphis jamesii</i>	James' galleta

Species names are from the NRCS PLANTS database. Check species codes at <http://plants.usda.gov>.

Disturbance Description

This ecological system is characterized by replacement fires. Fires are more continuous as shrub or herb cover increases. Where pinyon or juniper has encroached after 100yrs without fire, mean fire return interval of fire replacement increases. Reduced shrub cover associated with more xeric sites pushes fire return interval to longer periods.

Weather stress: Prolonged drought on the more xeric sites will reduce woody cover.

Herbivory (non-insect): Herbivory can remove the fine fuels that support mixed-severity fires and result in woody fuel build up that leads to severe replacement fires.

Fire Frequency

Severity	Avg FI	Percent of All Fires	Min FI	Max FI
Replacement	109	100	30	200
Moderate (Mixed)				
Low (Surface)				
All Fires	109	100		

Fire interval is expressed in years for each fire severity class and for all types of fire combined (All Fires). Average FI is the central tendency modeled. Percent of all fires is the percent of all fires modeled in that severity class. Minimum and Maximum FIs show the relative range of fire intervals as estimated by model contributors, if known.

Scale Description

This BpS occupies small areas (<1,000ac). Historic disturbance (fire) likely ranged from small (<10ac) to moderate (<1,000ac) depending on conditions, time since last ignition, and fuel loading. The average fire patch size is assumed to be 100ac.

Adjacency or Identification Concerns

This community may be adjacent to mountain big sagebrush at elevations >6,500ft or adjacent to pinyon-juniper and ponderosa pine at mid- to high elevations and salt desert shrub and blackbrush at low elevations. Low sagebrush or black sagebrush (BpS 1079) may form large islands within this community where soils are shallow or have root-restrictive layers. Black sagebrush is very common in the Desert National Wildlife Refuge and forms matrix communities.

Post-settlement conversion to red brome with cheatgrass is common and results in change in fire frequency and vegetation dynamics. Fire suppression can lead to pinyon-juniper encroachment with subsequent loss of shrub and herbaceous understory. Disturbance of this community may

result in establishment of annual grasslands (e.g., red brome) and/or noxious weeds. Lack of disturbance can result in pinyon-juniper encroachment where adjacent to pinyon-juniper woodlands.

Post-settlement issues center on the high amount of big sagebrush with minimal to no understory and whether these decadent stands are related to fire exclusion, historic livestock overgrazing, or natural physiological/ecological progression.

Issues or Problems

There is uncertainty about whether or not Wyoming big sagebrush is present at all in MZ13. NRCS considers Wyoming big sagebrush absent from the Mojave Desert, whereas a recent flora for the Desert National Wildlife Refuge describes Wyoming big sagebrush as the only big sagebrush subspecies. While recognizing the difficulty of identifying big sagebrush species, Dr. Wes Niles from University of Nevada, Las Vegas (wniles@ccmail.nevada.edu, personal communication) confirmed that all his Mojave Desert herbarium specimens, including those from the Desert National Wildlife Refuge, are basin big sagebrush. Similarly, older flora for the Spring Mountains National Recreation Area describes basin big sagebrush, not Wyoming big sagebrush. The problem with the absence of Wyoming big sagebrush is that basin big sagebrush looks like Wyoming big sagebrush and occupies what appears to be "classic" Wyoming big sagebrush sites as seen in the Great Basin.

There are no data, although abundant opinions, for the percentage of replacement and mixed-severity fires, especially during mid-development, or whether non-replacement fires occurred at all during early development under reference (pre-settlement) condition.

NOTE regarding depleted sagebrush: Late seral stage was not modeled as it was identified that sagebrush depletion rate is much slower than the rate of juniper invasion. Further, sagebrush systems are unable to exclude grass/forb so they can maintain fire, which can move the system back to earlier classes

Native Uncharacteristic Conditions

Shrub cover >50% is uncharacteristic. Tree cover >50% is uncharacteristic.

Comments

Alan Sands reviewed this BpS in 2017 and generally agreed with the model and description. One area of disagreement was that he felt that the surface and mixed-severity fire transitions should be removed from the model. Kori Blankenship reevaluated the use of non-replacement severity fire and decided to change the Early to Early surface fire and Mid Open to Mid Open mixed fire to replacement severity fires to comply with LANDFIRE fire severity definitions. LANDFIRE defines replacement severity fire as a fire that top-kills >75% of the upper-layer lifeform. Because the dominant shrub species in this BpS are generally top-killed by fire (Tirmenstein 1999a; Tirmenstein 1999b; Simonin 2001), Blankenship assumed that the modelers used surface and mixed fire in grass and shrub succession classes to represent very patchy fires. But because where fire occurred it probably top-killed most plants, it met LANDFIRE's replacement fire criteria. MZs 13 and 14 were combined during 2015 BpS Review.

During the BpS Review in 2017, this model was part of a "macro-review" where all models representing this BpS were reviewed and evaluated relative to one another. One goal of the

review was to check for logical consistency between the models. Outstanding questions from this review that should be evaluated in the future include:

- Has LANDFIRE appropriately identified and classified the big sage shrubland (BpS 10800) relative to big sage steppe (BpS 11250)? In his system-wide review of these BpSs, Alan Sands indicated that what was mapped and modeled as Big Sage Shrubland should be Big Sage Steppe in the following MZs: 10, 19, 21, 22, 31, and 33. Kori Blankenship consulted NatureServe range maps to evaluate this suggestion and found that they reported Big Sage Shrubland occurring in all these zones. Blankenship felt that more input was needed from local ecologists and NatureServe on the distribution of the types and the distinctions between them before changing the classification. This suggestion should be considered in future review.
- What is an appropriate fire frequency and severity for this BpS? Estimates for these fire regime parameters vary widely, and during LANDFIRE National, there was considerable debate about these values in some areas (see 10801-21-22-28 and 10802-21-22-28).
- Does the Wyoming big sagebrush versus basin big sagebrush split applied in the model representing MZs 21, 22, and 28 apply elsewhere, and can it be successfully mapped from 30m imagery? Descriptions for this BpS in some other zones indicated a need for distinct BpS models and mapping units for the different big sagebrush subspecies, but questions arose about the ability to map the distinctions from satellite imagery.
- Does the upland versus semi-desert split applied in the model representing MZs 06, 12, 15, 16, 17, 18, 23, 24, and 25 apply elsewhere? The split helps distinguish differences in species, fire frequency, and management options for sites on upland soils that receive enough precipitation to support trees from semi-desert sites that cannot.

The first three development classes chosen for this ecological system correspond to the early, mid-, and late seral stages familiar to range ecologists. The two classes with conifer invasion (classes D and E) approximately correspond to Miller and Tausch's (2001) phases 2 and 3 of pinyon and juniper invasion into shrublands. Prolonged drought in the model was estimated at occurring 1 in 50yrs (20-30yr Pacific cycle modified by 7yr El Nino/El Nina cycle).

BpS 131080 is based on BpS 1080 from MZs 12 and 17 with modifications for species composition, smaller spatial scale, disturbances, and geographic range. Wyoming big sagebrush is uncommon to absent in many parts of the Mojave Desert mountain ranges, whereas basin big sagebrush is the dominant shrub for BpS 131080. Model was changed because defoliation by Aroga moth and prolonged flooding were removed, and the drought cycle was shortened from 100 to 50yrs to reflect the different climate cycles of the Mojave Desert compared to the Great Basin.

Succession Classes

Mapping Rules

Upper Layer Lifeform	Height (m)	Canopy Cover (%)									
		0-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	91-100
Herb	0-0.5	A	A	A	A	UN	UN	UN	UN	UN	UN
Herb	0.5-1.0	A	A	A	A	UN	UN	UN	UN	UN	UN

Herb	>1.0	A	A	A	A	UN	UN	UN	UN	UN	UN
Shrub	0-0.5	A	B	C	C	C	UN	UN	UN	UN	UN
Shrub	0.5-1.0	A	B	C	C	C	UN	UN	UN	UN	UN
Shrub	1.0-3.0	B	B	C	C	C	UN	UN	UN	UN	UN
Shrub	>3.0	B	B	C	C	C	UN	UN	UN	UN	UN
Tree	0-5	D	D	E	E	E	UN	UN	UN	UN	UN
Tree	5-10	D	D	E	E	E	UN	UN	UN	UN	UN
Tree	10-25	UN	UN	UN	UN	UN	UN	UN	UN	UN	UN
Tree	25-50	UN	UN	UN	UN	UN	UN	UN	UN	UN	UN
Tree	>50	UN	UN	UN	UN	UN	UN	UN	UN	UN	UN

Succession class letters A-E are described in the Succession Class Description section. Some classes use a leafform distinction where a qualifier is added to the class letter: Brdl (broadleaf), Con (conifer), or Mix (mixed conifer and broadleaf). UN refers to uncharacteristic native or a combination of height and cover that would not be expected under the reference condition. NP refers to not possible or a combination of height and cover which is not physiologically possible for the species in the BpS.

Description

Class A 15 Early Development 1 - All Structures

Indicator Species

Symbol	Scientific Name	Common Name	Canopy Position
ACHY	Achnatherum hymenoides	Indian ricegrass	Upper
HECOC8	Hesperostipa comata ssp. comata	Needle and thread	Upper
CHVI8	Chrysothamnus viscidiflorus	Yellow rabbitbrush	Upper
ARTR2	Artemisia tridentata	Big sagebrush	Upper

Description

Post-replacement disturbance; dominated by grasses and forbs, with scattered shrubs representing <10% upper canopy cover. Shrubs are between 0-1m. Fuel loading discontinuous.

Maximum Tree Size Class

None

Class B 46 Mid Development 1 - Open

Indicator Species

Symbol	Scientific Name	Common Name	Canopy Position
ARTR2	Artemisia tridentata	Big sagebrush	Upper
ACHY	Achnatherum hymenoides	Indian ricegrass	Lower
CHVI8	Chrysothamnus viscidiflorus	Yellow rabbitbrush	Mid-Upper
HECO26	Hesperostipa comata	Needle and thread	Lower

Description

Shrubs and herbaceous vegetation can be co-dominant; fine fuels bridge the woody fuels, but fuel discontinuities are possible.

None

Indicator Species

Symbol	Scientific Name	Common Name	Canopy Position
ARTR2	<i>Artemisia tridentata</i>	Big sagebrush	Upper
CHVI8	<i>Chrysothamnus viscidiflorus</i>	Yellow rabbitbrush	Mid-Upper
ELEL5	<i>Elymus elymoides</i>	Squirreltail	Lower
HECO26	<i>Hesperostipa comata</i>	Needle and thread	Lower

Description

Shrubs dominate the landscape; fuel loading is primarily woody vegetation. Shrub density sufficient in old stands to carry the fire without fine fuels. Establishment of pinyon and juniper seedlings and saplings widely scattered. Prolonged drought can thin shrubs.

Maximum Tree Size Class

None

Class D	9	Late Development 1 - Open
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Indicator Species

Symbol	Scientific Name	Common Name	Canopy Position
JUNIP	Juniperus	Juniper	Upper
PIMO	Pinus monophylla	Singleleaf pinyon	Upper
ARTR2	Artemisia tridentata	Big sagebrush	Mid-Upper
HECO26	Hesperostipa comata	Needle and thread	None

Description

Pinyon-juniper encroachment where disturbance has not occurred for at least 100yrs (tree species cover <15%). Shrubs may still represent the dominant lifeform (<25% cover), with pinyon and juniper saplings common. Sagebrush cover and herbaceous cover decreasing compared to Class C. Prolonged drought thins both trees and shrubs.

Maximum Tree Size Class

Sapling >4.5ft; <5" DBH

Class E	3	Late Development 1 - Closed
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Indicator Species

Symbol	Scientific Name	Common Name	Canopy Position
JUNIP	Juniperus	Juniper	Upper
PIMO	Pinus monophylla	Singleleaf pinyon	Upper

SYOR	Symphoricarpos orbiculatus	Coralberry	Lower
HECO26	Hesperostipa comata	Needle and thread	Lower

Description

Shrubland encroached with mature pinyon and/or juniper (cover 16-90%) where disturbance does not occur for some time in Class D. Shrub cover <10% and graminoids scattered. Prolonged drought thins trees.

Maximum Tree Size Class

None

Model Parameters

Deterministic Transitions

From Class	Begins at (yr)	Succeeds to	After (years)
Early1:ALL	0	Mid1:OPN	19
Mid1:OPN	20	Mid1:CLS	59
Mid1:CLS	60	Late1:OPN	99
Late1:OPN	100	Late1:CLS	149
Late1:CLS	150	Late1:CLS	999

Probabilistic Transitions

Disturbance Type	Disturbance occurs In	Moves vegetation to	Disturbance Probability	Return Interval (yrs)	Reset Age to New Class Start Age After Disturbance?	Years Since Last Disturbance
Replacement Fire	Early1:ALL	Early1:ALL	0.005	200	Yes	0
Replacement Fire	Mid1:OPN	Mid1:OPN	0.002	500	No	0
Replacement Fire	Mid1:OPN	Early1:ALL	0.008	125	Yes	0
Insects or Disease	Mid1:CLS	Mid1:OPN	0.001	1000	Yes	0
Replacement Fire	Mid1:CLS	Early1:ALL	0.01	100	Yes	0
Wind or Weather or Stress	Mid1:CLS	Mid1:OPN	0.02	50	Yes	0
Insects or Disease	Late1:OPN	Mid1:CLS	0.001	1000	Yes	0
Replacement Fire	Late1:OPN	Early1:ALL	0.0083	120	Yes	0
Wind or Weather or Stress	Late1:OPN	Mid1:CLS	0.02	50	Yes	0
Replacement Fire	Late1:CLS	Early1:ALL	0.008	125	Yes	0
Wind or Weather or Stress	Late1:CLS	Mid1:OPN	0.02	50	Yes	0

References

- Ackerman, T.L. 2003. A flora of the Desert National Wildlife Range, Nevada. Edited by J. Bair and A. Tiehm. *Mentzelia* 7.
- Barbour, M.G. and J. Major eds. 1977. *Terrestrial vegetation of California*. John Wiley and Sons, New York.
- Brown, J.K. and J. Kapler-Smith, eds. 2000. *Wildland fire in ecosystems: effects of fire on flora*. Gen. Tech. Rep. RMRS-GTR-42-vol. 2. Ogden, UT: USDA Forest Service, Rocky Mountain Research Station. 257 pp.
- Cook, J. G., T.J. Hershey and L.L. Irwin. 1994. Vegetative response to burning on Wyoming mountain-shrub big game ranges. *Journal of Range Management* 47: 296-302.
- Cronquist, A., A.H. Holmgren, N.H. Holmgren, J.L. Reveal and P.K. Holmgren. 1994. *Intermountain Flora: Vascular Plants of the Intermountain West, U.S.A. Asterales*. Volume 5. New York Botanical Garden, Bronx, NY.
- Gruell, G.E. 1999. Historical and modern roles of fire in pinyon-juniper. P. 24-28. In: S.B. Monsen and R. Stevens, compilers. *Proceedings: ecology and management of pinyon-juniper communities within the Interior West; 1997, Provo, UT*. Proc. RMRS-P-9. Ogden, UT. USDA Forest Service, Rocky Mountain Research Station.
- Kinney, W.C. 1996. Conditions of rangelands before 1905. Sierra Nevada ecosystem project: Final report to Congress, Vol. II. Davis: University of California, Centers for water and wildland resources. 31-45.
- Kuchler, A.W. 1985. Potential natural vegetation (map at scale of 1:7,500,000). In: U.S. Geological survey, *The National Atlas of the USA*. U.S. Govt. Print. Off. Washington, D.C.
- Miller, R.F. and J.A. Rose. 1999. Fire history and western juniper encroachment in sagebrush-steppe. *Journal of Range Management*. 550-559.
- Miller, R.F. and L.L. Eddleman. 2000. Spatial and temporal changes of sage grouse habitat in the sagebrush biome. *Oregon State Univ. Agr. Exp. Stat. Technical Bull.* 151. 35 pp.
- Miller, R.F. and R.J. Tausch. 2001. The role of fire in juniper and pinyon woodlands: a descriptive analysis. Pages 15-30 in: *Proceedings: The First National Congress on Fire, Ecology, Prevention, and Management*. San Diego, CA, Nov. 27- Dec. 1, 2000. Tall Timbers Research Station, Tallahassee, FL. Miscellaneous Publication 11.
- NatureServe. 2007. *International Ecological Classification Standard: Terrestrial Ecological Classifications*. NatureServe Central Databases. Arlington, VA. Data current as of 10 February 2007.

Simonin, Kevin A. 2001. *Atriplex confertifolia*. In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). Available: <http://www.fs.fed.us/database/feis/plants/shrub/atrcon/all.html> [2018, January 29].

Tausch, R.J. and R.S. Nowak. 1999. Fifty years of ecotone change between shrub and tree dominance in the Jack Springs Pinyon Research Natural Area. Pages 71-77 in: E.D. McArthur, W.K. Ostler and C.L. Wambolt, compilers. *Proceedings: shrubland ecotones*. 1998. Ephraim, UT. Proc. RMRS-P-11. Ogden, UT. USDA Forest Service, Rocky Mountain Research Station.

Tilsdale, E.W. 1994. Great Basin region: sagebrush types. P. 40-46. In: T.N. Shiflet (ed.) *Rangeland Cover Types*. Soc. Range Manage., Denver, CO.

Tirmenstein, D. 1999a. *Artemisia tridentata* subsp. *tridentata*. In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). Available: <https://www.fs.fed.us/database/feis/plants/shrub/arttrit/all.html> [2018, January 29].

Tirmenstein, D. 1999b. *Chrysothamnus viscidiflorus*. In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). Available: <http://www.fs.fed.us/database/feis/> [2018, January 29].

USDA-NRCS. 2003a. Major Land Resource Area 28B Central Nevada Basin and Range. Nevada Ecological Site Descriptions. Reno, NV. Available online: <http://esis.sc.egov.usda.gov/Welcome/pgESDWelcome.aspx>.

USDA-NRCS. 2003b. Major Land Resource Area 29 Southern Nevada Basin and Range. Nevada Ecological Site Descriptions. Reno, NV. Available online: <http://esis.sc.egov.usda.gov/Welcome/pgESDWelcome.aspx>.

Vale, T.R. 1973. The sagebrush landscape of the intermountain west. Dissertation. Berkeley: University of California. 508 pp.

Vale, T.R. 1975. Presettlement vegetation in the sagebrush-grass area of the intermountain west. *Journal of Range Management* 28(1): 32-36.

West, N.E. 1983. Western Intermountain sagebrush steppe. Pages 351-297 in: N.E. West, ed. *Ecosystems of the World 5: Temperate deserts and semi-deserts*. Elsevier Scientific Publishing Company, New York, NY.