10610
Inter-Mountain Basins Aspen-Mixed Conifer Forest and Woodland

BpS Model/Description Version: Aug. 2020

Modelers		Reviewers	
Mike Manthei	mmanthei@fs.fed.us	Rory Steinke	rsteinke@fs.fed.us
Rory Steinke	rsteinke@fs.fed.us	Tim Christiansen	tchristiansen@tnc.org
JackTriepke	jtriepke@fs.fed.us	Keith Schulz	Keith_Schulz@natureserve.org

Reviewer: Casey Teske

Vegetation Type
Forest and Woodland

Map Zones
15, 25

Geographic Range
This is typically found in Nevada, Utah, California, Arizona, New Mexico, Colorado, Idaho, Wyoming, Montana, and eastern Oregon. It may occur in map zone (MZ) 25, but it is a very minor component.

Biophysical Site Description
This type typically occurs on flat to steep terrain (<80%) on all aspects. Elevation generally ranges from 2,000-2,400m. Soils are variable and are derived from colluvium and have frigid (cool) temperature and udic (moist) moisture regimes, with fairly thick organic surface horizons. This type occurs above the pinyon-juniper and/or sagebrush but below the spruce-fir zone.

Vegetation Description
As a species, *Populus tremuloides* (aspen) is adapted to a much broader range of environments than most plants found associated with it. Stands are usually closed. This highly variable ecological system is comprised of pure aspen or primarily aspen with few to several conifer species at lower montane elevations. These conifers include: *Pseudotsuga menziesii*, *Abies concolor*, *Abies lasiocarpa*, *Pinus strobiformis*, *P. contorta*, and *P. ponderosa*. Conifers are usually <25% relative tree cover. Where it is adjacent to conifer, an occasional conifer seedling may occur, but these do not drive the fire regime.

The species listed between MZs 15 and 25 differed in several cases. If a species was only included in one of the zones, a parenthetical note with the zone number will follow the species. Common shrubs may include: *Amelanchier alnifolia* (MZ15), *Amelanchier utahensis* (MZ25), *Juniperus communis*, *Mahonia repens*, *Sheppherdia ccanadensis* (MZ15), *Symphoricarpos oreophilus*, *Symphoricarpos orbiculatus* (MZ15), and *Vaccinium* spp. The herbaceous layers may be lush and diverse. Graminoids may include *Bromus carinatur* (MZ15), *Bromus marginatus* (MZ25), *Calamagrostis rubensens*, *Carex geyeri* (MZ15), *Carex rossii* (MZ15), *Elymus glaucus*, and *Elymus trachycaulus*. Forbs may include *Achillea millefilium*, *Eucephalus engelmannii* (MZ15), *Delphimium* spp., *Geranium viscosissimum*, *Lupinus argenteus*, and many others. The herbaceous layers may be lush and diverse.

BpS Dominant and Indicator Species

Symbol	Scientific Name	Common Name
POTR5	*Populus tremuloides*	Quaking aspen
PIPO	*Pinus ponderosa*	Ponderosa pine
PICO	*Pinus contorta*	Lodgepole pine
PSME	*Pseudotsuga menziesii*	Douglas-fir

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

Disturbance Description

This is a strongly fire-adapted forest type with mean fire intervals varying from 10-30yrs based on biophysical variation. According to Baker (1925), who most closely studied the historic condition, the mean fire return interval (MFRI) for replacement fire was 20-40yrs (min-max). Baker's MFRI for mixed-severity fire was 10-20yrs (min-max). Studies by Bartos and Campbell (1998) support these findings. Native American burning was the primary source of fire, especially mixed-severity fire. It is important to understand that aspen is considered a fire-proof vegetation type that does not burn during the normal lightning season, yet evidence of frequent fire scars and historical studies show that native burning was the only source of fire that occurred mostly during the spring and fall.

Secondary disturbances may include: snowslides, mudslides, and rotational slumping. Flooding may also operate in these systems. Without regular fire and with high levels of herbivory, conifers may replace the aspen community wherever aspen is present. The presence of even a single aspen tree in a stand provides strong evidence that the area historically supported aspen clones. The predominance of elk herbivory has drastically reduced aspen regeneration in northern Arizona in most places.

Fire Frequency

Severity	Avg FI	Percent of All Fires	Min FI	Max FI
Replacement	43	28	25	50
Moderate (Mixed)	20	61		
Low (Surface)	111	11		
All Fires	12	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 type occurs in a landscape mosaic from moderate- to large-sized patches.

Adjacency or Identification Concerns

This type is significantly altered today and is very difficult to identify because of conifer encroachment and fire suppression.

This Biophysical Setting (BpS) is characterized by a shorter MFRI and lower elevations than 1011 (Rocky Mountain Aspen Forest and Woodland). The BpS 1052 (Rocky Mountain Mesic Montane Mixed Conifer Forest and Woodland) is adjacent to this BpS along the riparian systems.

If subalpine fir or spruce are present, the aspen with mixed conifers for high-elevation model (1055) should be considered.

Issues or Problems
Mapping: if any aspen is present, this is probably the correct BpS (or 1011 at higher elevations).

As this type has a fairly short fire return interval compared to other aspen types, it should be noted that aspen can act as a tall shrub. Bradley et al. (1992) state that Loope and Gruell estimated a fire frequency of 25-100yrs for a Douglas-fir forest with seral aspen in Grand Teton National Park (p39). They later state that fire frequencies of 100-300yrs appear to be appropriate for maintaining most seral aspen stands. In the Fontenelle Creek, WY, drainage, the mean fire-free interval was estimated to be 40yrs. Fires in this area burned in a mosaic pattern of severities, from stand-replacement to low fires that scarred bur did not kill the relatively thin-barked lodgepole pine on the site (p46).

There is uncertainty about the role of mixed-severity fire. We assumed that native burning in aspen stands invaded by young conifers resulted in mixed-severity fire, whereas the same source of fire would cause low-severity fire (surface fire) in same-age stands that were more open. Experts and modelers expressed different views about the frequency of all fires, citing MFRIs longer than those noted by Baker (1925), who actually studied the historic condition. The MFRIs used here were a compromise: 1) the longer MFRIs were used for the oldest development states and 2) the maximum MFRI of Baker (1925) was used for stands <80yrs that were being encroached upon by lower-elevation conifers. Keith Schulz of NaureServe suggests this model is more reflective of Aspen Forest and Woodland and that it could be renamed Rocky Mountain Aspen Forest and Woodland.

Native Uncharacteristic Conditions
In mid- and late-development pure aspen conditions (Classes B and C), <20% cover of aspen is generally uncharacteristic, created from overgrazing or browsing.

Comments
Casey Teske reviewed this model during the 2016 BpS Review. As a result of review comments, surface fire was added to the model. MZs 15 and 25 were combined during 2015 BpS Review. The few descriptive differences between the zones (mostly species differences) are noted in the revised description.

Additional modelers for MZ15 included Linda Wadleigh, lwadleigh@fs.fed.us; George Robertson, grobertson@fs.fed.us; Deb Bumpus, dbumpus@fs.fed.us; and Ed Smith, esmith@tnc.org. Steinke was a modeler for MZ15 and did further review for MZ25. MZ25 was reviewed by T. Christansen and K. Schulz.

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

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 **58** **Early Development 1 - All Structures**

Indicator Species

Symbol	Scientific Name	Common Name	Canopy Position
POTR5	Populus tremuloides	Quaking aspen	Upper

Description

Grass/forb and aspen suckers and saplings.

Maximum Tree Size Class

Sapling >4.5ft; <5" DBH

Class B **21** **Mid Development 1 - Closed**

Indicator Species

Symbol	Scientific Name	Common Name	Canopy Position
POTR5	Populus tremuloides	Quaking aspen	Upper

Description

Canopy cover is highly variable. Conifers can invade. The stand is composed of 80% aspen, up to 10% conifers.

Maximum Tree Size Class

Pole 5-9" DBH

Class C **6** **Mid Development 2 - Closed**

Indicator Species

Symbol	Scientific Name	Common Name	Canopy Position
POTR5	Populus tremuloides	Quaking aspen	Upper

Description
Aspen 5-16in DBH. This is a pure aspen stage. Mixed aspen overstory dominance. An insect/ disease disturbance will typical kill the larger stems.

Maximum Tree Size Class
Medium 9-21" DBH

Class D 14 Late Development 1 - All Structures

Indicator Species

Symbol	Scientific Name	Common Name	Canopy Position
POTR5	Populus tremuloides	Quaking aspen	Upper
PIPO	Pinus ponderosa	Ponderosa pine	Mid-Upper
PSEUD7	Pseudotsuga	Douglas-fir	Mid-Upper

Description
Aspen 5-16in DBH dominate with conifer understory up to co-dominance: 80% aspen overstory. Conifers (e.g., ponderosa pine) are assumed more resistant to fire than aspen and will likely cause the progressive suppression of aspen.

Maximum Tree Size Class
Medium 9-21" DBH

Class E 1 Late Development 1 - Closed

Indicator Species

Symbol	Scientific Name	Common Name	Canopy Position
PIPO	Pinus ponderosa	Ponderosa pine	Upper
PICO	Pinus contorta	Lodgepole pine	Upper
PSME	Pseudotsuga menziesii	Douglas-fir	Upper
POTR5	Populus tremuloides	Quaking aspen	Mid-Upper

Description
Conifers dominate. Aspen >16in DBH, mixed conifer mixed sizes, main overstory is conifers; >50% conifer in the overstory.

Maximum Tree Size Class
Large 21-33" DBH

Model Parameters

Deterministic Transitions

From Class	Begins at (yr)	Succeeds to	After (years)
Early1:ALL	0	Mid1:CLS	39
Mid1:CLS	40	Late1:ALL	79
Mid2:CLS	80	Mid2:CLS	999
Late1:ALL	80	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
Surface Fire	Early1:ALL	Early1:ALL	0.01	100	No	0
Replacement Fire	Early1:ALL	Early1:ALL	0.025	40	Yes	0
Mixed Fire	Early1:ALL	Early1:ALL	0.05	20	No	0
Alternative Succession	Mid1:CLS	Mid2:CLS	0.0062	161	Yes	0
Surface Fire	Mid1:CLS	Mid1:CLS	0.01	100	No	0
Replacement Fire	Mid1:CLS	Early1:ALL	0.025	40	Yes	0
Mixed Fire	Mid1:CLS	Mid1:CLS	0.05	20	No	0
Insects or Disease	Mid2:CLS	Mid1:CLS	0.005	200	Yes	0
Surface Fire	Mid2:CLS	Mid2:CLS	0.01	100	No	0
Replacement Fire	Mid2:CLS	Early1:ALL	0.017	59	Yes	0
Mixed Fire	Mid2:CLS	Mid2:CLS	0.05	20	No	0
Surface Fire	Late1:ALL	Late1:ALL	0.004	250	No	0
Replacement Fire	Late1:ALL	Early1:ALL	0.017	59	Yes	0
Mixed Fire	Late1:ALL	Late1:ALL	0.05	20	No	0
Insects or Disease	Late1:CLS	Late1:ALL	0.003	333	Yes	0
Surface Fire	Late1:CLS	Late1:CLS	0.004	250	No	0
Replacement Fire	Late1:CLS	Early1:ALL	0.017	59	Yes	0
Mixed Fire	Late1:CLS	Late1:ALL	0.05	20	Yes	0

References

Baker, F.S. 1925. Aspen in the Central Rocky Mountain Region. USDA Department Bulletin 1291: 1-47.

Bartos, D.L. 2001. Landscape dynamics of aspen and conifer forests. Pages 5-14 in: W.D. Shepperd, D. Binkley, D.L. Bartos, T.J. Stohlgren and L.G. Eskew, compilers. 2001. Sustaining aspen in western landscapes: symposium proceedings; 13-15 June 2000; Grand Junction, CO.

Proceedings. RMRS-P-18. Fort Collins, CO: USDA Forest Service, Rocky Mountain Research Station. 460 pp.

Bartos, D.L. and R.B. Campbell, Jr. 1998. Decline of Quaking Aspen in the Interior West – Examples from Utah. Rangelands 20(1): 17-24.

Bradley, A.F., N.V. Noste and W.C. Fischer. 1992. Fire ecology of the forests and woodland in Utah. GTR-INT-287. Ogden, UT: Intermountain Research Station.

Bradley, A.F., W.C. Fischer and N.V. Noste. 1992. Fire ecology of the forest habitat types of eastern Idaho and western Wyoming. Gen. Tech. Rep. INT-290. Ogden, UT: USDA Forest Service, Intermountain Research Station. 92 pp.

Brown, J.K. and D.G. Simmerman. 1986. Appraisal of fuels and flammability in western aspen: a prescribed fire guide. General technical report INT-205. Ogden, UT: USDA Forest Service, Rocky Mountain Research Station.

Brown, J.K. and D.G. Simmerman. 1986. Appraisal of fuels and flammability in western aspen: a prescribed fire guide. General technical report INT-205. Ogden, UT: USDA Forest Service, Rocky Mountain Research Station.

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.

Campbell, R.B. and D.L. Bartos. 2001. Objectives for sustaining biodiversity. In: W.D. Shepperd, D. Binkley, D.L. Bartos, T.J. Stohlgren and L.G. Eskew, compilers. 2001. Sustaining aspen in western landscapes: symposium proceedings; 13-15 June 2000; Grand Junction, CO. Proceedings. RMRS-P-18. Fort Collins, CO: USDA Forest Service, Rocky Mountain Research Station. 460 pp.

Debyle, N.V., C.D. Bevins and W.C. Fisher. 1987. Wildfire occurrence in aspen in the interior western United States. Western Journal of Applied Forestry. 2: 73-76.

Kay, C.E. 1997. Is aspen doomed? Journal of Forestry 95: 4-11.

Kay, C.E. 2001. Evaluation of burned aspen communities in Jackson Hole, Wyoming. In: W.D. Shepperd, D. Binkley, D.L. Bartos, T.J. Stohlgren and L.G. Eskew, compilers. 2001. Sustaining aspen in western landscapes: symposium proceedings; 13-15 June 2000; Grand Junction, CO. Proceedings. RMRS-P-18. Fort Collins, CO: USDA Forest Service, Rocky Mountain Research Station. 460 pp.

Kay, C.E. 2001. Long-term aspen enclosures in the Yellowstone ecosystem. In: W.D. Shepperd, D. Binkley, D.L. Bartos, T.J. Stohlgren and L.G. Eskew, compilers. 2001. Sustaining aspen in western landscapes: symposium proceedings; 13-15 June 2000; Grand Junction, CO.

Proceedings. RMRS-P-18. Fort Collins, CO: USDA Forest Service, Rocky Mountain Research Station. 460 pp.

Kay, C.E. 2001. Native burning in western North America: implications for hardwood forest management. General Technical Report NE-274. USDA Forest Service, Northeast Research Station. 8 pp.

Mueggler, W.F. 1988. Aspen Community Types of the Intermountain Region. USDA Forest Service, General Technical Report INT-250. 135 pp.

Mueggler, W. \F. 1989. Age Distribution and Reproduction of Intermountain Aspen Stands. Western Journal of Applied Forestry, 4(2): 41-45.

NatureServe. 2004. International Ecological Classification Standard: Terrestrial Ecological Classifications. NatureServe Central Databases. Arlington, VA. U.S.A. Data current as of November 4, 2004.

NatureServe. 2007. International Ecological Classification Standard: Terrestrial Ecological Classifications. NatureServe Central Databases. Arlington, VA. Data current as of 10 February 2007.

Romme, W.H., L. Floyd-Hanna, D.D. Hanna and E. Bartlett. 2001. Aspen's ecological role in the west. Pages 243-259 in: W.D. Shepperd, D. Binkley, D.L. Bartos, T.J. Stohlgren and L.G. Eskew, compilers. 2001. Sustaining aspen in western landscapes: symposium proceedings; 13-15 June 2000; Grand Junction, CO. Proceedings RMRS-P-18. Fort Collins, CO: USDA Forest Service, Rocky Mountain Research Station. 460 pp.

Shepperd, W.D. and E.W. Smith. 1993. The role of near-surface lateral roots in the life cycle of aspen in the central Rocky Mountains. Forest Ecology and Management 61: 157-160.

Shepperd, W.D. 2001. Manipulations to regenerate aspen ecosystems. Pages 355-365 in: W.D. Shepperd, D. Binkley, D.L. Bartos, T.J. Stohlgren and L.G. Eskew, compilers. 2001. Sustaining aspen in western landscapes: symposium proceedings; 13-15 June 2000; Grand Junction, CO. Proceedings. RMRS-P-18. Fort Collins, CO: USDA Forest Service, Rocky Mountain Research Station. 460 pp.

Shepperd, W.D., D.L. Bartos and S.A. Mata. 2001. Above- and below-ground effects of aspen clonal regeneration and succession to conifers. Canadian Journal of Forest Resources 31: 739-745.

USDA Forest Service. 2000. Properly Functioning Condition: Rapid Assessment Process (January 7, 2000 version). Intermountain Region, Ogden, UT. Unnumbered.

Welsh, S.L., N.D. Atwood, S. Goodrich and L.C. Higgins. 2003. A Utah Flora, Third edition, revised. Provo, UT: Print Services, Brigham Young University. 912 pp.