# LANDFIRE Biophysical Setting Model

## *Biophysical Setting:* 1510110 Rocky Mountain Aspen Forest and Woodland

☐ *This BPS is lumped with:*
☐ *This BPS is split into multiple models:*

## *General Information*

**Contributors** (also see the Comments field) **Date** 10/18/2005


| | | | | | |
|---|---|---|---|---|---|
| **Modeler 1** | Mike Manthei | mmanthei@fs.fed.us | **Reviewer** | Rory Steinke | rsteinke@fs.fed.us |
| **Modeler 2** | Linda Wadleigh | lwadleigh@fs.fed.us | **Reviewer** | | |
| **Modeler 3** | Rory Steinke | rsteinke@fs.fed.us | **Reviewer** | | |


**Vegetation Type**

Forest and Woodland

**Map Zone**

15

**Model Zone**

☐ Alaska ☐ N-Cent.Rockies
☐ California ☐ Pacific Northwest
☐ Great Basin ☐ South Central
☐ Great Lakes ☐ Southeast
☐ Northeast ☐ S. Appalachians
☐ Northern Plains ☑ Southwest

**Dominant Species***

POTR5
SYOR2
ARUV

**General Model Sources**

☑ Literature
☑ Local Data
☑ Expert Estimate

### Geographic Range

Western CO, UT, northern NM, northern AZ, central NV.

### Biophysical Site Description

This type occurs on flat to moderately steep terrain (<50%) on all aspects. Elevation typically ranges from 2275-2700m. Annual precipitation is 56-68cm. Stable aspen typically occurs above grass, sagebrush, or PJ. Soils are generally deep, mollic, cool and moist. As a species, aspen is adapted to a much broader range of environments than most plants found associated with it.

### Vegetation Description

Aspen exists in single-storied or more commonly multi-storied stands. Conifers are not generally present in this type.

Understory consists of an abundant herbaceous component, perhaps with snowberry (Symphoricarpos spp), meadow rue (Thalictrum fendleri) and/or yarrow (Achillea millefolium) present.

Aspen suckers 5-15ft tall will be present in all classes at least 500 stems/acre. Lack of suckers is representative of an uncharacteristic class. Another uncharacteristic class is indicated if sagebrush cover is over 10% (in UT).

### Disturbance Description

Fire, insects, disease. In absence of disturbance, may stay aspen (contrary to NS description). Fire will generally come from adjacent systems. Surface fire would generally come on the margins of stands as a result of fire on adjacent vegetation types. Mixed fire may occur, but is undocumented. Native grazing on seedlings has impacts in class A.

*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100+ year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement severity.

### Adjacency or Identification Concerns

If conifers are present, please review an aspen mixed conifer BpS instead. Stable stands appear to occur more often at lower elevations compared to seral stands. Adjacent forest types such as ponderosa pine or warm/dry mixed conifer with more frequent fire may influence fire frequency in stable aspen to facilitate regeneration. Adjacent systems include sagebrush/grass (lower elevation) and mixed conifers (higher elevation).

### Native Uncharacteristic Conditions

Lack of aspen suckers is representative of an uncharacteristic class. Another uncharacteristic class is indicated if sagebrush cover is over 10% (in UT). Less than 30% cover of aspen in the mid- and late-development conditions can be considered uncharacteristic (typically due to grazing).

### Scale Description

Patch sizes range in the 10s to 100s of acres. Fires may have been as large as thousands of acres, but patches of this system would have typically been smaller than thousands of acres.

### Issues/Problems

Aspen decline does not appear to be the same across the region. Decline is thought to be critical in UT, AZ, NM, but not in CO (especially SW CO).

Aspen stands tend to remain dense through most of the lifespan, hence the open stand descriptions were not used. These are typically self-perpetuating stands, they may not need regular disturbance to regenerate. As aspen is such a wide-ranging species, there are not dominant understory species which assist in identification of this type.

### Comments

Based on the model from MZ28 for the same BpS. Modified in Flagstaff workshop with additional modelers, Jack Triepke, jtriepke@fs.fed.us; Ed Smith, esmith@tnc.org; Deb Bumpus, bdumpus@fs.fed.us. This model was based on the Rapid Assessment model R3ASPN by L. Chappell (lchappell@fs.fed.us), R. Wu (rwu@fs.fed.us), K. Ryan (kryan@fs.fed.us), and reviewed by Bill Baker (bakerwl@wyo.edu). It was further modified in a workshop in Denver 4/27/2005 with W. Baker, E. Biery, L Duran, F. Escoban, L. Kerr, D Knight, D. Toelle and B. Wilmore.

One reviewer suggests removing mixed severity fire, and set surface fire rotation at 2000yrs.

## *Vegetation Classes*

***Class A*** **5%**

Early Development 1 All Structures

**Indicator Species* and Canopy Position**

POTR5 All

**Structure Data (for upper layer lifeform)**

| | *Min* | *Max* |
|---|---|---|
| *Cover* | 0% | 100% |
| *Height* | Tree 0m | Tree 5m |
| *Tree Size Class* | Seedling <4.5ft | |

**Upper Layer Lifeform**

- ☐ Herbaceous
- ☐ Shrub
- ☑ Tree

**Fuel Model** 2

☐ Upper layer lifeform differs from dominant lifeform.

**Description**

Aspen will not necessarily be tree form; will often be <1in DBH

Aspen suckers less than six feet tall and abundant. Grass and forbs resprout vigorously with high cover. Often densely vegetated.

*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100+ year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement severity.

### *Class B* 35%

Mid Development 1 Closed

**Upper Layer Lifeform**

- ☐ Herbaceous
- ☐ Shrub
- ☑ Tree

**Fuel Model** 8

**Indicator Species* and Canopy Position**

POTR5 All

**Structure Data (for upper layer lifeform)**

| | *Min* | *Max* |
|---|---|---|
| *Cover* | 31% | 100% |
| *Height* | Tree 5.1m | Tree 10m |
| *Tree Size Class* | Pole 5-9" DBH | |

☐ Upper layer lifeform differs from dominant lifeform.

**Description**

Aspen over six feet tall dominate. Canopy cover highly variable, but usually dense. Understory also usually dense.

### *Class C* 60%

Late Development 1 Closed

**Upper Layer Lifeform**

- ☐ Herbaceous
- ☐ Shrub
- ☑ Tree

**Fuel Model** 8

**Indicator Species* and Canopy Position**

POTR5 All

**Structure Data (for upper layer lifeform)**

| | *Min* | *Max* |
|---|---|---|
| *Cover* | 31% | 100% |
| *Height* | Tree 10.1m | Tree 25m |
| *Tree Size Class* | Large 21-33"DBH | |

☐ Upper layer lifeform differs from dominant lifeform.

**Description**

Aspen trees 9in+ DBH. Canopy cover is highly variable, but usually dense. Understory dense. Lots of dead and downed material.

### *Class D* 0%

[Not Used] [Not Used]

**Upper Layer Lifeform**

- ☐ Herbaceous
- ☐ Shrub
- ☐ Tree

**Fuel Model**

**Indicator Species* and Canopy Position**

**Structure Data (for upper layer lifeform)**

| | *Min* | *Max* |
|---|---|---|
| *Cover* | % | % |
| *Height* | | |
| *Tree Size Class* | | |

☐ Upper layer lifeform differs from dominant lifeform.

**Description**

### *Class E* 0%

[Not Used] [Not Used]

**Upper Layer Lifeform**

- ☐ Herbaceous
- ☐ Shrub
- ☐ Tree

**Fuel Model**

**Indicator Species* and Canopy Position**

**Structure Data (for upper layer lifeform)**

| | *Min* | *Max* |
|---|---|---|
| *Cover* | % | % |
| *Height* | | |
| *Tree Size Class* | | |

☐ Upper layer lifeform differs from dominant lifeform.

**Description**

## *Disturbances*

*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100+ year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement severity.

**Fire Regime Group**:** IV

**Historical Fire Size (acres)**

Avg
Min
Max

**Sources of Fire Regime Data**

- [x] Literature
- [x] Local Data
- [x] Expert Estimate

| Fire Intervals | Avg FI | Min FI | Max FI | Probability | Percent of All Fires |
|---|---|---|---|---|---|
| Replacement | 150 | 50 | 300 | 0.006667 | 80 |
| Mixed | 2000 | | | 0.0005 | 6 |
| Surface | 850 | | | 0.001176 | 14 |
| All Fires | 120 | | | 0.00834 | |

***Fire Intervals (FI):***

Fire interval is expressed in years for each fire severity class and for all types of fire combined (All Fires). Average FI is central tendency modeled. Minimum and maximum show the relative range of fire intervals, if known. Probability is the inverse of fire interval in years and is used in reference condition modeling. Percent of all fires is the percent of all fires in that severity class.

**Additional Disturbances Modeled**

- [x] Insects/Disease
- [x] Wind/Weather/Stress
- [x] Native Grazing
- [ ] Competition
- [ ] Other (optional 1)
- [ ] Other (optional 2)

## References


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

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**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100+ year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement severity.

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

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**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100+ year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement severity.

# LANDFIRE Biophysical Setting Model

## *Biophysical Setting:* 1510160 Colorado Plateau Pinyon-Juniper Woodland

☐ *This BPS is lumped with:*
☐ *This BPS is split into multiple models:*

## *General Information*

**Contributors** (also see the Comments field) **Date** 10/18/2005


**Modeler 1** Mike Babler mbabler@tnc.org **Reviewer**
**Modeler 2** **Reviewer**
**Modeler 3** **Reviewer**


**Vegetation Type**
Forest and Woodland

**Map Zone**
15

**Model Zone**
☐ Alaska ☐ N-Cent.Rockies
☐ California ☐ Pacific Northwest
☐ Great Basin ☐ South Central
☐ Great Lakes ☐ Southeast
☐ Northeast ☐ S. Appalachians
☐ Northern Plains ☑ Southwest

**Dominant Species***
JUOS ARTR2
PIED JUMO
PIPO
JUSC2

**General Model Sources**
☑ Literature
☑ Local Data
☑ Expert Estimate

### Geographic Range
This BpS occurs on the Colorado Plateau from the western slope of CO to the Wasatch Range, south to the Mogollon Rim. This type is usually the lowest elevation tree-dominated type in the area, and is found on lower mountain slopes, mesas and on adjacent plains.

### Biophysical Site Description
These woodlands occur on warm dry sites on mountain slopes, mesas, plateaus and ridges. This type is found on many sites, ranging from deep, well drained soils on nearly flat slopes, to shallow, steep and rocky sites. Typically lower elevations, 1500-2400m (4950-7950ft).

### Vegetation Description
This type is dominated by JUOS and JUMO with lesser amounts of PIED and JUSC2. Understory layers are variable. The most common shrub associates are ARTR2, QUGA and CEMO2. It has a sparse to absent understory of grasses, shrubs and forbs.

### Disturbance Description
The fire regime is characterized by somewhat frequent mosaic fire with very infrequent replacement fires (Rondeau 2001).There is frequent fire importation from adjacent types. Some areas have extensive mortality since 2002 due to the drought-induced Ips beetle outbreak.

### Adjacency or Identification Concerns
At higher elevations, this type borders ponderosa pine and/or Gambel oak/Cercocarpus shrubland. At lower elevations, it abuts sagebrush and desert scrub.

### Native Uncharacteristic Conditions

*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100+ year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement severity.

## Scale Description

The most common disturbance in this type is very small scale, either single-tree or small groups. If the conditions are just right, then it will have replacement fires that burn stands up to 1000s of acres. This type may also have mixed-severity fires of 10-100s of acres.

## Issues/Problems

## Comments

This model identical to the model for the same BpS in MZ28, with a few descriptive additions. The model is based on the Rapid Assessment (RA) model R3PIJUff by E. Biery (ehbiery@fs.fed.us) and K. Paintner (kara_paintner@nps.gov) 10/28/2004. Langowski, Edwards and Biery provided informal review (July 2005) on all pinyon-juniper models. Chuck Kostecka (Colorado State Forest Service, ret.) further reviewed. Workshops in Denver, Pueblo and Ft Collins provided additional input from others for this model.

The RA model was developed based on two previous models: the original FRCC JUPI1 PNVG and a model developed by an interagency team working on a fire management plan for the Greater Sand Dunes area in southern CO (called Pjsangre).

Peer review of original RA model was mixed. One reviewer strongly recommended dropping this type entirely and using only the pinyon-juniper rare fire model (R3PIJUrf), based on studies showing no evidence of mixed severity fire in pinyon-juniper. Because of the time frame of the RA and the relative uncertainty surrounding pinyon-juniper fire history, the issue was unresolved and both models were unchanged.

One reviewer had concerns with all PJ models and wanted to be certain there was a system with a long fire return interval modeled.

## Vegetation Classes

### Class A 10%

Early Development 1 All Structures

**Indicator Species* and Canopy Position**

| | |
|---|---|
| JUOS | All |
| PIED | All |
| JUSC2 | All |

**Structure Data (for upper layer lifeform)**

| | Min | Max |
|---|---|---|
| *Cover* | 0% | 100% |
| *Height* | Shrub 0m | Shrub >3.1m |
| *Tree Size Class* | Seedling <4.5ft | |

☐ Upper layer lifeform differs from dominant lifeform.

**Upper Layer Lifeform**

- ☐ Herbaceous
- ☑ Shrub
- ☐ Tree

**Fuel Model** 2

**Description**

Grass/forb/shrub/seedling - usually post-fire.

### Class B 20%

Mid Development 1 Closed

**Indicator Species* and Canopy Position**

| | |
|---|---|
| PIED | Upper |
| JUOS | Upper |
| JUSC2 | Upper |

**Structure Data (for upper layer lifeform)**

| | Min | Max |
|---|---|---|
| *Cover* | 31% | 70% |
| *Height* | Tree 0m | Tree 5m |
| *Tree Size Class* | Pole 5-9" DBH | |

☐ Upper layer lifeform differs from dominant lifeform.

**Upper Layer Lifeform**

- ☐ Herbaceous
- ☐ Shrub
- ☑ Tree

**Fuel Model** 6

**Description**

Mid-development, dense (>40% cover) pinyon-juniper woodland; understory being lost.

*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100+ year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement severity.

### *Class C* 25%

Mid Development 1 Open

**Indicator Species* and Canopy Position**

| | |
|---|---|
| PIED | Upper |
| JUSC2 | Upper |
| JUOS | Upper |

**Structure Data (for upper layer lifeform)**

| | *Min* | *Max* |
|---|---|---|
| *Cover* | 0% | 30% |
| *Height* | Tree 0m | Tree 5m |
| *Tree Size Class* | Pole 5-9" DBH | |

☐ Upper layer lifeform differs from dominant lifeform.

**Upper Layer Lifeform**

☐ Herbaceous
☐ Shrub
☑ Tree

**Fuel Model** 6

**Description**

Mid-development, open (<40% cover) pinyon-juniper stand with mixed shrub/herbaceous community in understory.

### *Class D* 35%

Late Development 1 Open

**Indicator Species* and Canopy Position**

| | |
|---|---|
| PIED | Upper |
| JUSC2 | Upper |
| JUOS | Upper |

**Structure Data (for upper layer lifeform)**

| | *Min* | *Max* |
|---|---|---|
| *Cover* | 0% | 40% |
| *Height* | Tree 5.1m | Tree 10m |
| *Tree Size Class* | Medium 9-21"DBH | |

☐ Upper layer lifeform differs from dominant lifeform.

**Upper Layer Lifeform**

☐ Herbaceous
☐ Shrub
☑ Tree

**Fuel Model** 8

**Description**

Late-development, open juniper-pinyon stand with "savannah-like" appearance; mixed grass/shrub/herbaceous community.

### *Class E* 10%

Late Development 1 Closed

**Indicator Species* and Canopy Position**

| | |
|---|---|
| PIED | Upper |
| JUSC2 | Upper |
| JUOS | Upper |

**Structure Data (for upper layer lifeform)**

| | *Min* | *Max* |
|---|---|---|
| *Cover* | 41% | 70% |
| *Height* | Tree 5.1m | Tree 10m |
| *Tree Size Class* | Medium 9-21"DBH | |

☐ Upper layer lifeform differs from dominant lifeform.

**Upper Layer Lifeform**

☐ Herbaceous
☐ Shrub
☑ Tree

**Fuel Model** 8

**Description**

Dense, old-growth stands with multiple layers. Late-development, closed pinyon-juniper forest. May have all-aged, multi-storied structure. Moderate mortality within stand. Occasional shrubs with few grasses and forbs and often much rock.

## *Disturbances*

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**Fire Regime Group**:** III

**Historical Fire Size (acres)**

Avg
Min
Max

**Sources of Fire Regime Data**

- [x] Literature
- [x] Local Data
- [x] Expert Estimate

**Additional Disturbances Modeled**

- [x] Insects/Disease
- [x] Wind/Weather/Stress
- [ ] Native Grazing
- [x] Competition
- [ ] Other (optional 1)
- [ ] Other (optional 2)

| Fire Intervals | Avg FI | Min FI | Max FI | Probability | Percent of All Fires |
|---|---|---|---|---|---|
| Replacement | 430 | | | 0.002326 | 29 |
| Mixed | 192 | | | 0.005208 | 65 |
| Surface | 2000 | | | 0.0005 | 6 |
| All Fires | 124 | | | 0.00803 | |

***Fire Intervals (FI):***

Fire interval is expressed in years for each fire severity class and for all types of fire combined (All Fires). Average FI is central tendency modeled. Minimum and maximum show the relative range of fire intervals, if known. Probability is the inverse of fire interval in years and is used in reference condition modeling. Percent of all fires is the percent of all fires in that severity class.

## References


Despain, D.W. and J.C .Mosely. 1990. Fire history and stand structure of a pinyon-juniper woodland at Walnut Canyon National Monument, Arizona. USDI National Park Service Technical Report No. 34. Cooperative National Park Resources Studies Unit, University of Arizona. Tucson AZ. 27 pp.

Gruell, G.E., L.E. Eddleman and R. Jaindl. 1994. Fire history of the pinyon-juniper woodlands of Great Basin National Park. Technical Report NPS/PNROSU/NRTR-94/01. USDI National Park Service, Pacific Northwest Region. 27 pp.

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

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**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100+ year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement severity.

# LANDFIRE Biophysical Setting Model

## *Biophysical Setting:* 1510190 Great Basin Pinyon-Juniper Woodland

☐ *This BPS is lumped with:*
☐ *This BPS is split into multiple models:*

## *General Information*

**Contributors** (also see the Comments field) **Date** 10/18/2005


**Modeler 1** Jim Hurja jhurja@fs.fed.us **Reviewer**
**Modeler 2** **Reviewer**
**Modeler 3** **Reviewer**


**Vegetation Type**
Forest and Woodland

**Map Zone**
15

**Model Zone**
☐ Alaska ☐ N-Cent.Rockies
☐ California ☐ Pacific Northwest
☐ Great Basin ☐ South Central
☐ Great Lakes ☐ Southeast
☐ Northeast ☐ S. Appalachians
☐ Northern Plains ☑ Southwest

**Dominant Species***
PIMO ARPA
JUOS ARTR2
CELE3
PUST

**General Model Sources**
☐ Literature
☐ Local Data
☐ Expert Estimate

### Geographic Range
This ecological system occurs on dry mountain ranges of the Great Basin region and eastern foothills of the Sierra Nevada.

### Biophysical Site Description
System typically found from 5500-8000ft above the blackbrush (Coleogyne ramosissima) zone. This type generally occurred on most soil types and landforms, including fire-safe sites of steep and rocky slopes. Severe climatic events occurring during the growing season, such as frosts and drought, are thought to limit the distribution of pinyon-juniper woodlands to relatively narrow altitudinal belts on mountainsides. Soils supporting this system vary in texture ranging from stony, cobbly, gravelly sandy loams to clay loam or clay.

### Vegetation Description
Woodlands dominated by a mix of Pinus monophylla and Juniperus osteosperma, pure or nearly pure occurrences of Pinus monophylla, or woodlands dominated solely by Juniperus osteosperma comprise this system. Cercocarpus ledifolius is a common associate. Understory layers are variable. Associated species include shrubs such as Arctostaphylos patula, Arctostaphylos pungens, Artemisia nova, Artemisia tridentata, Cercocarpus ledifolius, cercocarpus intricatus, Coleogyne ramosissima, Purshia stansburiana, Ceanothuss greggii, Symphoricarpus oreophilus, Garrya falvescens, Yucca baccata and bunch grasses Pseudoroegneria spicata, Achnatherum hymenoides, Elymus elymoides and Poa fendleriana. Quercus gambelii and Quercus turbinella may be present.

Since disturbance was uncommon to rare in this ecological system and the overstory conifers may have lived for several hundred years, patches were primarily composed of later seral stages (D & E; see below) that did not occur as extensive woodlands, and that should be distinguished from shrubland ecological sites encroached by pinyon or juniper during the last 150yrs. The age structure may vary from uneven to even aged. The overstory cover is normally less that 25%, although it can sometimes be higher (up to 60%)

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where pinyon occurs.

### Disturbance Description

Uncertainty exists about the fire frequencies of this ecological system, especially since this ecological system groups different types of pinyon-juniper communities for different slopes, exposures, and elevations. Fire occurrence may be influenced by fires spreading from shrub and grassland dominated vegetation of lower and higher altitudinal zones. Replacement fires were uncommon to rare (average FRI of 100-1000yrs) and occurred primarily during extreme fire behavior conditions and during long droughts. Mixed severity fire (average FRI of 100-500yrs) was characterized as a mosaic of replacement and surface fires distributed through the patch at a fine scale (<0.1ac). There is limited evidence for surface fires (Gruell 1994; Bauer and Weisberg, unpublished data), which likely occurred only in the more productive sites during years where understory grass cover was high, providing adequate fuel. Although fire scars are only rarely found in pinyon-juniper of the Colorado Plateau and elsewhere (Baker and Shinneman 2004, Eisenhart 2004), ongoing studies in the central Great Basin are observing fire-scarred trees, suggesting that surface fires historically occurred at low frequency. Limited evidence to date suggests that while lightning ignitions in this biophysical setting may have been common, the resulting fires only rarely spread to affect more than a few trees.

Prolonged weather-related stress (mostly drought), insects, and tree pathogens are coupled disturbances that thin trees to varying degrees and kills small patches every 250-500yrs on average, with greater frequency in more closed stands. The most common disturbance in this type is very small scale--either single tree, or small groups. If the conditions are right, it will have replacement fires that burn stands up to a maximum of 1000s acres. This type may also have mixed severity fires of 10-100s of acres.

### Adjacency or Identification Concerns

This system occurs at lower elevations than Colorado Plateau Pinyon-Juniper Woodland (BpS 1016) where sympatric. In modern days, surrounding matrix shrubland vegetation (blackbrush and sagebrush) has changed somewhat to young-mid-aged woodlands. Two major modern issues, climate change and invasive plant species (especially annual grasses red brome and cheatgrass), lead to non-equilibrium vegetation dynamics for this ecological system, making it difficult to categorize and usefully apply natural disturbance regimes. Sites with an important annual grass component in the understory experience greater fire frequency, and result in more intense fire and greater spread. Moreover, fire from adjacent BpS invaded by annual grasses will spread more frequently into in BpS 1019, which is fire sensitive.

### Native Uncharacteristic Conditions

Cover greater than 60% is uncharacteristic.

### Scale Description

10000ac possible, more likely 1000ac.

### Issues/Problems

There is much uncertainty in model parameters, particularly the fire regime. Quantitative data are lacking and research is on-going. The literature for this ecological system's fire history is based on the chronologies from other pines species that are better fire recorders, growing under conditions that may not represent fire environments typical of infrequent-fire pinyon and juniper communities. For example, surface fire, which leaves scars on these other pine species (but not generally on fire-sensitive pinyon or juniper), has no effect on the dynamics of the model, although surface fire maintains the open structure of classes D and E by thinning younger trees.

Further study is needed to better elucidate the independent and interactive effects of fire, insects, pathogens,

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climate, grazing and anthropogenic impacts on historical and current vegetation dynamics in the Great Basin Pinyon-Juniper Woodland type.

### Comments

This is identical to a draft of the BpS 131019 for the Majove Desert is based on modifications of BpS 171019, developed by Peter Weisberg (pweisberg@cabnr.unr.edu) for the Great Basin and reviewed by Louis Provencher (lprovencher@tnc.org). Modifications to model 171019 for MZ13 included species composition, biophysical gradients and lumping class D and E because these were structurally hard to distinguish by satellite and their dynamics were nearly identical. The insect/disease rate was changed to 1/1000 from 2/1000 for class B because it was observed that outbreaks are rare in younger stands. BpS 171019 was based on the model from MZ16 for the same BpS. The model structure came from the Rapid Assessment model for PNVG R2PIJU. However, fire return intervals were made considerably longer to fit the Great Basin context. Elements of the model for the Colorado Plateau Pinyon-Juniper Woodland and Shrubland (BpS 1016), which was developed by Bob Unnasch (bunnasch@tnc.org) for MZ16, were also incorporated. Insects/disease are incorporated in the model in both "patch mortality" and "woodland thinning" manifestations, and are intended to also represent associated drought mortality influences.

## Vegetation Classes

### Class A 5%

Early Development 1 Open

**Upper Layer Lifeform**

- [x] Herbaceous
- [ ] Shrub
- [ ] Tree

**Fuel Model** 1

**Indicator Species* and Canopy Position**

| | |
|---|---|
| ELEL5 | Mid-Upper |
| SPHAE | Upper |
| ZIPA2 | Mid-Upper |
| POFE | Mid-Upper |

**Structure Data (for upper layer lifeform)**

| | Min | Max |
|---|---|---|
| Cover | 0% | 50% |
| Height | Herb 0m | Herb >1.1m |
| Tree Size Class | No Data | |

[ ] Upper layer lifeform differs from dominant lifeform.

**Description**

Initial post-fire community dominated by annual grasses and forbs. Later stages of this class contain greater amounts of perennial grasses and forbs. Evidence of past fires (burnt stumps and charcoal) should be observed. Duration 10yrs with succession to class B, mid-development closed. Replacement fire occurs every 300yrs on average.

---

### Class B 5%

Mid Development 1 Open

**Upper Layer Lifeform**

- [ ] Herbaceous
- [x] Shrub
- [ ] Tree

**Fuel Model** 5

**Indicator Species* and Canopy Position**

| | |
|---|---|
| ARTR2 | Upper |
| ARPU5 | Upper |
| PIMO | Mid-Upper |
| JUOS | Mid-Upper |

**Structure Data (for upper layer lifeform)**

| | Min | Max |
|---|---|---|
| Cover | 0% | 30% |
| Height | Shrub 0.6m | Shrub 3.0m |
| Tree Size Class | No data | |

[ ] Upper layer lifeform differs from dominant lifeform.

**Description**

Dominated by shrubs, perennial forbs and grasses. Tree seedlings starting to establish on favorable microsites. Total cover remains low due to shallow unproductive soil. Duration 20yrs with succession to class C unless infrequent replacement fire (FRI of 200yrs) returns the vegetation to class A. It is important to note that replacement fire at this stage does not eliminate perennial grasses. Mixed severity fire (average FRI of 200yrs) thins the woody vegetation but does not change its succession age.

---

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### *Class C* 25%

Mid Development 2 Open

**Indicator Species* and Canopy Position**

| | |
|---|---|
| PIMO | Upper |
| JUOS | Upper |
| ARTR2 | Middle |
| CELE3 | Middle |

**Structure Data (for upper layer lifeform)**

| | Min | Max |
|---|---|---|
| *Cover* | 0% | 20% |
| *Height* | Tree 0m | Tree 5m |
| *Tree Size Class* | Pole 5-9" DBH | |

☐ Upper layer lifeform differs from dominant lifeform.

**Upper Layer Lifeform**

☐ Herbaceous
☐ Shrub
☑ Tree

**Fuel Model** 5

**Description**

Shrub and tree dominated community with young juniper and pinyon seedlings becoming established. Duration 70yrs with succession to class D unless replacement fire (average FRI of 250yrs) causes a transition to class A. It is important to note that replacement fire at this stage does not eliminate perennial grasses. Mixed severity fire as in class B. Mortality from insects, pathogens, and drought occurs at a rotation of approximately 1000yrs and cause a transition to class B by killing older trees.

---

### *Class D* 65%

Late Development 1 Open

**Indicator Species* and Canopy Position**

| | |
|---|---|
| PIMO | Upper |
| JUOS | Upper |
| CELE3 | Middle |
| ARTR3 | Middle |

**Structure Data (for upper layer lifeform)**

| | Min | Max |
|---|---|---|
| *Cover* | 21% | 60% |
| *Height* | Tree 0m | Tree 25m |
| *Tree Size Class* | No data | |

☐ Upper layer lifeform differs from dominant lifeform.

**Upper Layer Lifeform**

☐ Herbaceous
☐ Shrub
☑ Tree

**Fuel Model** No d

**Description**

Community dominated by young to old juniper and pine of mixed age structure. Juniper and pinyon becoming competitive on site and beginning to affect understory composition. Duration 800 yrs unless replacement fire (average FRI of 1000yrs) causes a transition to class A. Mixed severity is less frequent than in previous states (500yrs). Surface fire (mean FRI of 500yrs) is infrequent and does not change successional dynamics. Tree pathogens and insects such as pinyon Ips become more important for woodland dynamics occurring at a rotation of 250yrs, including both patch mortality (500yr rotation) and thinning of isolated individual trees (500yr rotation).

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### *Class E* 0%

[Not Used] [Not Used]

**Indicator Species* and Canopy Position**

**Structure Data (for upper layer lifeform)**

| | Min | Max |
|---|---|---|
| *Cover* | % | % |
| *Height* | | |
| *Tree Size Class* | | |

☐ Upper layer lifeform differs from dominant lifeform.

**Upper Layer Lifeform**

☐ Herbaceous
☐ Shrub
☐ Tree

**Fuel Model**

**Description**

## *Disturbances*

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**Fire Regime Group**:** III

**Historical Fire Size (acres)**

Avg
Min
Max

**Sources of Fire Regime Data**

- [x] Literature
- [x] Local Data
- [x] Expert Estimate

| Fire Intervals | Avg FI | Min FI | Max FI | Probability | Percent of All Fires |
|---|---|---|---|---|---|
| Replacement | 476 | | | 0.002101 | 33 |
| Mixed | 333 | | | 0.003003 | 47 |
| Surface | 769 | | | 0.001300 | 20 |
| All Fires | 156 | | | 0.00640 | |

***Fire Intervals (FI):***

Fire interval is expressed in years for each fire severity class and for all types of fire combined (All Fires). Average FI is central tendency modeled. Minimum and maximum show the relative range of fire intervals, if known. Probability is the inverse of fire interval in years and is used in reference condition modeling. Percent of all fires is the percent of all fires in that severity class.

**Additional Disturbances Modeled**

- [x] Insects/Disease
- [ ] Wind/Weather/Stress
- [ ] Native Grazing
- [ ] Competition
- [ ] Other (optional 1)
- [ ] Other (optional 2)

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# LANDFIRE Biophysical Setting Model

## *Biophysical Setting:* 1510230 Madrean Encinal

☑ *This BPS is lumped with: 1510240*
☐ *This BPS is split into multiple models:*

## *General Information*

**Contributors** (also see the Comments field) **Date** 10/18/2005


| | | | | | |
|---|---|---|---|---|---|
| **Modeler 1** | Mike Babler | mbabler@tnc.org | **Reviewer** | Reese Lolley | rlolley@fs.fed.us |
| **Modeler 2** | | | **Reviewer** | Guy McPherson | grm@ag.arizona.edu |
| **Modeler 3** | | | **Reviewer** | | |


**Vegetation Type**
Forest and Woodland

**Map Zone**
15

**Model Zone**
☐ Alaska ☐ N-Cent.Rockies
☐ California ☐ Pacific Northwest
☐ Great Basin ☐ South Central
☐ Great Lakes ☐ Southeast
☐ Northeast ☐ S. Appalachians
☐ Northern Plains ☑ Southwest

**Dominant Species***
QUEM PIPO
JUDE
PIEN2
MUHLE

**General Model Sources**
☑ Literature
☐ Local Data
☑ Expert Estimate

### Geographic Range
Sierra Madre Occidentale and Sierra Madre Oriental in Mexico, Trans-Pecos TX, NM and AZ, generally south of the Mogollon Rim.

### Biophysical Site Description
The Madrean encinal of the interior North American Southwest is characterized by evergreen oaks, alligator junipers, and Mexican pines that range in height from 15-50ft (6-15m); the understory is dominated by graminoids (Brown 1994). With increasing elevation, alligator juniper and evergreen oak trees give way to a mixture of relatively mesic evergreen oak species and pines.

Kuchler (1964) includes this type within type number 31, the Oak-Juniper Woodland. Coarse-scale PNVGs included this type with type number 26, Chaparral. This PNV type is included in Bailey's (1995) and McNab and Avers (1994) Ecoregions within the Chihuahuan Semi-Desert province, Basin and range section (321A) and the Arizona-New Mexico Semi-desert Mountains province (M313) within the White Mountain-San Francisco Peaks Section (M313A) and Sacramento-Monzano Mountain Section (M313B).

### Vegetation Description
These forests and woodlands are composed of Madrean pines and evergreen oaks intermingled with patchy shrublands on most mid-elevation slopes (1500-2300m elevation). Tree species include Quercus arizonica, Q. emoryi, Q. grisea, Cupressus arizonica, Juniperus deppeana, Pinus arizonica, Pinus discolor, P. engelmannii and P. ponderosa. Subcanopy and shrub layers may include typical encinal and chaparral species such as Agave spp, Arbutus arizonica, Arctostaphylos pringlei, Arctostaphylos pungens, Garrya wrightii, Nolina spp, Quercus hypoleucoides, Q. rugosa and Q. turbinella. Some stands have moderate cover of perennial warm-season grasses such as Bouteloua curtipendula, B. gracilis, Muhlenbergia emersleyi, M. longiligula, M. virescens and Schizachyrium cirratum. Graminoids decrease in cover and biomass with increasing cover of woody plants.

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## Disturbance Description

The fire regime of this ecological system is poorly understood. Particularly at the lowest elevations, dominant trees rarely record fires, and they resprout after fire. The increasing abundance of pines with increasing elevation partially mediates this situation, and provides limited information about fire regime at these higher elevations.

It would seem that fire occurrence was determined primarily by fire occurrence in adjacent ecosystems, and was ignited by lightning during early summer. However, this information is poorly documented; based on contemporary ecological knowledge, models that assume specific fire regimes are little more than guesses. These follow, in the sincere hope they will be ignored or improved upon.

This system likely is predisposed to stand-replacement fires during any stage of stand development. Replacement fires are assumed to have occurred every century or so coincident with hot, dry, windy conditions during early summer. Surface fires and mixed severity fires likely occurred more frequently, perhaps on the magnitude of every 5-30yrs (with considerable variability around the mean frequency).

Drought likely was the most common disturbance after fire. Multi-decadal drought probably thinned stands but did not cause or contribute to stand replacement.

## Adjacency or Identification Concerns

This system generally is found at higher elevations and more mesic sites than semi-desert grassland. It may be bordered by, and confused with, pinyon-juniper woodland or interior chaparral [e.g., Great Basin pinyon-juniper woodland (Brown 1982), the juniper-pinyon or juniper steppe types of coarse-scale PNVG (Schmidt et al. 2002) and PNV (Kuchler 1964)].

Indicator species of this type include alligator juniper, evergreen oaks, Mexican pines, mountain muhly, blue grama and sideoats grama.

## Native Uncharacteristic Conditions

Tree cover >70% is uncharacteristic.

## Scale Description

This type usually was distributed across the landscape in patches of 100s to 1000s of acres. In particularly dissected topography this type may have occurred in smaller patches.

## Issues/Problems

Few components of the fire regimes are known with certainty. Fire scars are rare and most trees in this system cannot be aged accurately with conventional dendrochronological techniques. Information about fire regimes is extrapolated from adjacent systems or from the few pine trees in upper-elevation patches of this system; thus, caution is warranted when interpreting these models. Fire season can be inferred more reliably than fire frequency; most fires likely occurred during early summer as a result of lightning associated with early 'monsoonal' thunderstorms. Fire season likely is equally or more important than the fire frequency, despite the overwhelming attention to the latter instead of the former.

Madrean encinal is described as OCWI in the FRCC guidebook coarse scale description.

Lehmann lovegrass (Eragrostis lehmanniana) was purposely introduced into North America in the 1930s, and has spread to the lower and drier edge of Madrean encinal. By continuing to spread and therefore add fine fuel, it may contribute to significantly increased fire frequency in this system. Lehmann lovegrass may

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have an advantage over native grasses following fire.

### Comments

This model is identical to the model for the same BpS in MZ24. That model was based on one for MZ14 by Guy McPherson, 7/20/2005, modified by Mike Babler. Reese Lolley made suggestions for adapting model 141023 to 241023, but not a complete review. Recommended reviewers: Wendel Hann, Anthony Caprio, Geoff Babb, Drew Barton.

141023 was adapted from a model developed by Tyson Swetnam and Reese Lolley, and combined with 1024, for which no previous model was available.

The model developed by Swetnam and Lolley was modified substantially from BpS 171115. The number of classes was reduced from five to four because dominant life-forms resprout, form dense stands relatively quickly and require no nurse plants for tree establishment. Fire return intervals were altered for all fire types.

Swetnam and Lolley added a reference source and included Madrean species. FRCC OCWI was renamed R3OCWO in the Albuquerque workshop. Results of the model run are in the R3OCWO dbase. Model results and the original FRCC description did not align.

## Vegetation Classes

### Class A 20%

Early Development 1 All Structures

**Upper Layer Lifeform**

- ☐ Herbaceous
- ☐ Shrub
- ☑ Tree

**Fuel Model** 1

**Indicator Species* and Canopy Position**

| | |
|---|---|
| MUHLE | Lower |
| BOUTE | Lower |
| QUEM | Upper |
| JUDE2 | Upper |

**Structure Data (for upper layer lifeform)**

| | Min | Max |
|---|---|---|
| Cover | 0% | 70% |
| Height | Tree 0m | Tree 5m |
| Tree Size Class | Seedling <4.5ft | |

☑ Upper layer lifeform differs from dominant lifeform.

**Description**

Herbs dominant (grasses, dicots) with 10-30% cover.

Post-fire graminoids and herbaceous dicots with 10-30% cover dominated by grama and muhly grasses, asters, penstemons and mid-height shrubs such as manzanita and silktassel. Replacement fire maintains type (FRI=5-50yrs, virtually meaningless mean=30yrs). More commonly, succession lead to B, which represents the mesic soil on 3/4 of the landscape. Alternate succession is used to account for the xeric soils by dividing the proportion of this type by the duration of class A: 25%/30yrs=0.0083.

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### Class B 40%

Mid Development 1 Closed

**Upper Layer Lifeform**

- ☐ Herbaceous
- ☐ Shrub
- ☑ Tree

**Fuel Model** 9

**Indicator Species* and Canopy Position**

| | |
|---|---|
| JUDE2 | Mid-Upper |
| QUEM | Upper |
| MUHLE | Lower |
| | Upper |

**Structure Data (for upper layer lifeform)**

| | Min | Max |
|---|---|---|
| Cover | 21% | 70% |
| Height | Tree 5.1m | Tree 10m |
| Tree Size Class | Pole 5-9" DBH | |

☐ Upper layer lifeform differs from dominant lifeform.

**Description**

Woodlands in relatively productive draws and northerly aspects with 25-70% cover (average=50%). Succeeds to D within a century or so in the absence of replacement fire.

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*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100+ year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement severity.

### *Class C* 25%

Mid Development 1 Open

**Upper Layer Lifeform**

- ☐ Herbaceous
- ☐ Shrub
- ☑ Tree

**Fuel Model** 1

**Indicator Species* and Canopy Position**

| | |
|---|---|
| MUHLE | Lower |
| JUDE2 | Mid-Upper |
| QUEM | Upper |
| | Upper |

**Structure Data (for upper layer lifeform)**

| | Min | Max |
|---|---|---|
| *Cover* | 0% | 20% |
| *Height* | Tree 5.1m | Tree 10m |
| *Tree Size Class* | Medium 9-21"DBH | |

☑ Upper layer lifeform differs from dominant lifeform.

Herbs dominant (especially warm-season perennial grasses) with 25-70% cover.

**Description**

Grasslands on southerly slopes and ridges, often with relatively shallow or poorly developed soils. Herbaceous cover is 25-70% (average=50%), scattered trees and shrubs comprise 5-15% cover. Succeeds to D in the absence of replacement fire.

---

### *Class D* 15%

Late Development 1 Open

**Upper Layer Lifeform**

- ☐ Herbaceous
- ☐ Shrub
- ☑ Tree

**Fuel Model** 1

**Indicator Species* and Canopy Position**

| | |
|---|---|
| MUHLE | Lower |
| JUDE2 | Upper |
| QUEM | Upper |
| | Upper |

**Structure Data (for upper layer lifeform)**

| | Min | Max |
|---|---|---|
| *Cover* | 0% | 70% |
| *Height* | Tree 10.1m | Tree 25m |
| *Tree Size Class* | Large 21-33"DBH | |

☐ Upper layer lifeform differs from dominant lifeform.

**Description**

Open woodland derived from succession on slopes and ridgetops and from thinning on relatively productive soils. Woodland has 5-35% canopy, 25% average; alligator juniper, oaks, mountain muly, blue grama and sideoats grama.

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### *Class E* 0%

[Not Used] [Not Used]

**Upper Layer Lifeform**

- ☐ Herbaceous
- ☐ Shrub
- ☐ Tree

**Fuel Model**

**Indicator Species* and Canopy Position**

**Structure Data (for upper layer lifeform)**

| | Min | Max |
|---|---|---|
| *Cover* | % | % |
| *Height* | | |
| *Tree Size Class* | | |

☐ Upper layer lifeform differs from dominant lifeform.

**Description**

## *Disturbances*

*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100+ year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement severity.

**Fire Regime Group**:** I

**Historical Fire Size (acres)**

Avg 100
Min 1
Max 10000

**Sources of Fire Regime Data**

- [x] Literature
- [ ] Local Data
- [x] Expert Estimate

**Additional Disturbances Modeled**

- [ ] Insects/Disease
- [x] Wind/Weather/Stress
- [ ] Native Grazing
- [ ] Competition
- [ ] Other (optional 1)
- [ ] Other (optional 2)

| Fire Intervals | Avg FI | Min FI | Max FI | Probability | Percent of All Fires |
|---|---|---|---|---|---|
| Replacement | 125 | 10 | 200 | 0.008 | 18 |
| Mixed | 190 | 50 | 300 | 0.005263 | 12 |
| Surface | 33 | 15 | 100 | 0.030303 | 70 |
| All Fires | 23 | | | 0.04357 | |

***Fire Intervals (FI):***

Fire interval is expressed in years for each fire severity class and for all types of fire combined (All Fires). Average FI is central tendency modeled. Minimum and maximum show the relative range of fire intervals, if known. Probability is the inverse of fire interval in years and is used in reference condition modeling. Percent of all fires is the percent of all fires in that severity class.

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**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100+ year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement severity.

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# LANDFIRE Biophysical Setting Model

## *Biophysical Setting:* 1510240 Madrean Lower Montane Pine-Oak Forest and Woodland

☑ *This BPS is lumped with: 1510230*
☐ *This BPS is split into multiple models:*

## *General Information*

**Contributors** (also see the Comments field) **Date** 10/18/2005


| | | | | | |
|---|---|---|---|---|---|
| **Modeler 1** | Mike Babler | mbabler@tnc.org | **Reviewer** | Reese Lolley | rlolley@fs.fed.us |
| **Modeler 2** | | | **Reviewer** | Guy McPherson | grm@ag.arizona.edu |
| **Modeler 3** | | | **Reviewer** | | |


**Vegetation Type**
Forest and Woodland

**Map Zone**
15

**Model Zone**
☐ Alaska ☐ N-Cent.Rockies
☐ California ☐ Pacific Northwest
☐ Great Basin ☐ South Central
☐ Great Lakes ☐ Southeast
☐ Northeast ☐ S. Appalachians
☐ Northern Plains ☑ Southwest

**Dominant Species***
QUEM PIPO
JUDE
PIEN2
MUHLE

**General Model Sources**
☑ Literature
☐ Local Data
☑ Expert Estimate

### Geographic Range
Sierra Madre Occidentale and Sierra Madre Oriental in Mexico, Trans-Pecos TX, NM and AZ, generally south of the Mogollon Rim.

### Biophysical Site Description
The Madrean encinal of the interior North American Southwest is characterized by evergreen oaks, alligator junipers and Mexican pines that range in height from 15-50ft (6-15m); the understory is dominated by graminoids (Brown 1994). With increasing elevation, alligator juniper and evergreen oak trees give way to a mixture of relatively mesic evergreen oak species and pines.

Kuchler (1964) includes this type within type number 31, the Oak-Juniper Woodland. Coarse-scale PNVGs included this type with type number 26, Chaparral. This PNV type is included in Bailey's (1995) and McNab and Avers (1994) Ecoregions within the Chihuahuan Semi-Desert province, Basin and range section (321A), and the Arizona-New Mexico Semi-desert Mountains province (M313) within the White Mountain-San Francisco Peaks Section (M313A) and Sacramento-Monzano Mountain Section (M313B).

### Vegetation Description
These forests and woodlands are composed of Madrean pines and evergreen oaks intermingled with patchy shrublands on most mid-elevation slopes (1500-2300m elevation). Tree species include Quercus arizonica, Q. emoryi, Q. grisea, Cupressus arizonica, Juniperus deppeana, Pinus arizonica, Pinus discolor, P. engelmannii and P. ponderosa. Subcanopy and shrub layers may include typical encinal and chaparral species such as Agave spp, Arbutus arizonica, Arctostaphylos pringlei, Arctostaphylos pungens, Garrya wrightii, Nolina spp, Quercus hypoleucoides, Q. rugosa and Q. turbinella. Some stands have moderate cover of perennial warm-season grasses such as Bouteloua curtipendula, B. gracilis, Muhlenbergia emersleyi, M. longiligula, M. virescens and Schizachyrium cirratum. Graminoids decrease in cover and

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biomass with increasing cover of woody plants.

### Disturbance Description

The fire regime of this ecological system is poorly understood. Particularly at the lowest elevations, dominant trees rarely record fires, and they resprout after fire. The increasing abundance of pines with increasing elevation partially mediates this situation, and provides limited information about fire regime at these higher elevations.

It would seem that fire occurrence was determined primarily by fire occurrence in adjacent ecosystems, and was ignited by lightning during early summer. However, this information is poorly documented; based on contemporary ecological knowledge, models that assume specific fire regimes are little more than guesses. These follow, in the sincere hope they will be ignored or improved upon.

This system likely is predisposed to stand-replacement fires during any stage of stand development. Replacement fires are assumed to have occurred every century or so coincident with hot, dry, windy conditions during early summer. Surface fires and mixed severity fires likely occurred more frequently, perhaps on the magnitude of every 5-30yrs (with considerable variability around the mean frequency).

Drought likely was the most common disturbance after fire. Multi-decadal drought probably thinned stands but did not cause or contribute to stand replacement.

### Adjacency or Identification Concerns

This system generally is found at higher elevations and more mesic sites than semi-desert grassland. It may be bordered by, and confused with, pinyon-juniper woodland or interior chaparral [eg, Great Basin pinyon-juniper woodland (Brown 1982), the juniper-pinyon or juniper steppe types of coarse-scale PNVG (Schmidt et al. 2002) and PNV (Kuchler 1964)].

Indicator species of this type include alligator juniper, evergreen oaks, Mexican pines, mountain muhly, blue grama and sideoats grama.

### Native Uncharacteristic Conditions

Tree cover >70% is uncharacteristic.

### Scale Description

This type usually was distributed across the landscape in patches of 100s to 1000s of acres. In particularly dissected topography this type may have occurred in smaller patches.

### Issues/Problems

Few components of the fire regimes are known with certainty. Fire scars are rare and most trees in this system cannot be aged accurately with conventional dendrochronological techniques. Information about fire regimes is extrapolated from adjacent systems or from the few pine trees in upper-elevation patches of this system; thus, caution is warranted when interpreting these models. Fire season can be inferred more reliably than fire frequency; most fires likely occurred during early summer as a result of lightning associated with early 'monsoonal' thunderstorms. Fire season likely is equally or more important than the fire frequency, despite the overwhelming attention to the latter instead of the former.

Madrean encinal is described as OCWI in the FRCC guidebook coarse scale description.

Lehmann lovegrass (Eragrostis lehmanniana) was purposely introduced into North America in the 1930s, and has spread to the lower and drier edge of Madrean encinal. By continuing to spread and therefore add

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fine fuel, it may contribute to significantly increased fire frequency in this system. Lehmann lovegrass may have an advantage over native grasses following fire.

### Comments

This model is identical to the model for the same BpS in MZ24. That model was based on one for MZ14 by Guy McPherson, 7/20/2005, modified by Mike Babler. Reese Lolley made suggestions for adapting model 141023 to 241023, but not a complete review. Recommended reviewers: Wendell Hann, Anthony Caprio, Geoff Babb, Drew Barton.

141023 was adapted from a model developed by Tyson Swetnam and Reese Lolley, and combined with 1024, for which no previous model was available.

The model developed by Swetnam and Lolley was modified substantially from BpS 171115. The number of classes was reduced from five to four because dominant life-forms resprout, form dense stands relatively quickly and require no nurse plants for tree establishment. Fire return intervals were altered for all fire types.

Swetnam and Lolley added a reference source and included Madrean species. FRCC OCWI was renamed R3OCWO in the Albuquerque workshop. Results of the model run are in the R3OCWO dbase. Model results and the original FRCC description did not align.

## Vegetation Classes

### Class A 20%

Early Development 1 All Structures

**Upper Layer Lifeform**

- ☐ Herbaceous
- ☐ Shrub
- ☑ Tree

**Fuel Model** 1

**Indicator Species* and Canopy Position**

| | |
|---|---|
| MUHLE | Lower |
| BOUTE | Lower |
| QUEM | Upper |
| JUDE2 | Upper |

**Structure Data (for upper layer lifeform)**

| | Min | Max |
|---|---|---|
| Cover | 0% | 70% |
| Height | Tree 0m | Tree 5m |
| Tree Size Class | Seedling <4.5ft | |

☑ Upper layer lifeform differs from dominant lifeform.

**Description**

Herbs dominant (grasses, dicots) with 10-30% cover.

Post-fire graminoids and herbaceous dicots with 10-30% cover dominated by grama and muhly grasses, asters, penstemons, and mid-height shrubs such as manzanita and silktassel. Replacement fire maintains type (FRI=5-50yrs, virtually meaningless mean=30yrs). More commonly, succession lead to B, which represents the mesic soil on 3/4 of the landscape. Alternate succession is used to account for the xeric soils by dividing the proportion of this type by the duration of class A: 25%/30yrs=0.0083.

### Class B 40%

Mid Development 1 Closed

**Upper Layer Lifeform**

- ☐ Herbaceous
- ☐ Shrub
- ☑ Tree

**Fuel Model** 9

**Indicator Species* and Canopy Position**

| | |
|---|---|
| JUDE2 | Mid-Upper |
| QUEM | Upper |
| MUHLE | Lower |
| | Upper |

**Structure Data (for upper layer lifeform)**

| | Min | Max |
|---|---|---|
| Cover | 21% | 70% |
| Height | Tree 5.1m | Tree 10m |
| Tree Size Class | Pole 5-9" DBH | |

☐ Upper layer lifeform differs from dominant lifeform.

**Description**

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**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100+ year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement severity.

Woodlands in relatively productive draws and northerly aspects with 25-70% cover (average=50%). Succeeds to D within a century or so in the absence of replacement fire.

---

***Class C*** **25%**

Mid Development 1 Open

**Upper Layer Lifeform**

- ☐ Herbaceous
- ☐ Shrub
- ☑ Tree

**Fuel Model** 1

**Indicator Species* and Canopy Position**

| | |
|---|---|
| MUHLE | Lower |
| JUDE2 | Mid-Upper |
| QUEM | Upper |
| | Upper |

**Structure Data (for upper layer lifeform)**

| | *Min* | *Max* |
|---|---|---|
| *Cover* | 0% | 20% |
| *Height* | Tree 5.1m | Tree 10m |
| *Tree Size Class* | Medium 9-21"DBH | |

☑ Upper layer lifeform differs from dominant lifeform.

Herbs dominant (especially warm-season perennial grasses) with 25-70% cover.

**Description**

Grasslands on southerly slopes and ridges, often with relatively shallow or poorly developed soils. Herbaceous cover is 25-70% (average=50%), scattered trees and shrubs comprise 5-15% cover. Succeeds to D in the absence of replacement fire.

---

***Class D*** **15%**

Late Development 1 Open

**Upper Layer Lifeform**

- ☐ Herbaceous
- ☐ Shrub
- ☑ Tree

**Fuel Model** 1

**Indicator Species* and Canopy Position**

| | |
|---|---|
| MUHLE | Lower |
| JUDE2 | Upper |
| QUEM | Upper |
| | Upper |

**Structure Data (for upper layer lifeform)**

| | *Min* | *Max* |
|---|---|---|
| *Cover* | 0% | 70% |
| *Height* | Tree 10.1m | Tree 25m |
| *Tree Size Class* | Large 21-33"DBH | |

☐ Upper layer lifeform differs from dominant lifeform.

**Description**

Open woodland derived from succession on slopes and ridgetops and from thinning on relatively productive soils. Woodland has 5-35% canopy, 25% average; alligator juniper, oaks, mountain muly, blue grama and sideoats grama.

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***Class E*** **0%**

[Not Used] [Not Used]

**Upper Layer Lifeform**

- ☐ Herbaceous
- ☐ Shrub
- ☐ Tree

**Fuel Model**

**Indicator Species* and Canopy Position**

**Structure Data (for upper layer lifeform)**

| | *Min* | *Max* |
|---|---|---|
| *Cover* | % | % |
| *Height* | | |
| *Tree Size Class* | | |

☐ Upper layer lifeform differs from dominant lifeform.

**Description**

## *Disturbances*

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**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100+ year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement severity.

**Fire Regime Group**:** I

**Historical Fire Size (acres)**

Avg 100
Min 1
Max 10000

**Sources of Fire Regime Data**

- [x] Literature
- [ ] Local Data
- [x] Expert Estimate

**Additional Disturbances Modeled**

- [ ] Insects/Disease
- [x] Wind/Weather/Stress
- [ ] Native Grazing
- [ ] Competition
- [ ] Other (optional 1)
- [ ] Other (optional 2)

| Fire Intervals | Avg FI | Min FI | Max FI | Probability | Percent of All Fires |
|---|---|---|---|---|---|
| Replacement | 125 | 10 | 200 | 0.008 | 18 |
| Mixed | 190 | 50 | 300 | 0.005263 | 12 |
| Surface | 33 | 15 | 100 | 0.030303 | 70 |
| All Fires | 23 | | | 0.04357 | |

***Fire Intervals (FI):***

Fire interval is expressed in years for each fire severity class and for all types of fire combined (All Fires). Average FI is central tendency modeled. Minimum and maximum show the relative range of fire intervals, if known. Probability is the inverse of fire interval in years and is used in reference condition modeling. Percent of all fires is the percent of all fires in that severity class.

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# LANDFIRE Biophysical Setting Model

## *Biophysical Setting:* 1510250 Madrean Pinyon-Juniper Woodland

☑ *This BPS is lumped with: 1511160*
☐ *This BPS is split into multiple models:*

## *General Information*

**Contributors** (also see the Comments field) **Date** 10/18/2005


| | | | | | |
|---|---|---|---|---|---|
| **Modeler 1** | Mike Babler | mbabler@tnc.org | **Reviewer** | Keith Schulz | Keith_Schulz@natureserve.org |
| **Modeler 2** | | | **Reviewer** | Reese Lolley | rlolley@fs.fed.us |
| **Modeler 3** | | | **Reviewer** | Guy McPherson | grm@ag.arizona.edu |


**Vegetation Type**
Forest and Woodland

**Map Zone**
15

**Model Zone**
☐ Alaska ☐ N-Cent.Rockies
☐ California ☐ Pacific Northwest
☐ Great Basin ☐ South Central
☐ Great Lakes ☐ Southeast
☐ Northeast ☐ S. Appalachians
☐ Northern Plains ☑ Southwest

**Dominant Species***

| | |
|---|---|
| JUDE | QUEM |
| PIED | QUGR3 |
| PIDI3 | QUOB |
| QUAR | PILE |

**General Model Sources**
☑ Literature
☐ Local Data
☑ Expert Estimate

### Geographic Range
Sierra Madre Occidentale and Sierra Madre Oriental in Mexico, Trans-Pecos TX, southern NM, southern AZ (south of the Mogollan Rim and southwestern NM).

### Biophysical Site Description
This BpS typically is found at elevations between 1400m and 2200m. Madrean Juniper savannas occur at the lower altitudinal limits for foothill tree species, below the pinyon-juniper woodlands but at or above semi-desert grassland where soil moisture limits cover of montane woody plants. At higher and therefore moister elevations, woodlands grade into Madrean encinal or, less frequently, montane pine-oak woodlands characterized by taller and denser vegetation than these woodlands. Savannas and woodlands are found on many and varied topographic positions, including low- to mid-elevation mountain slopes, hills, plateaus, basins and flats.

### Vegetation Description
The upper vegetation canopy is composed of open to moderately dense tree layer dominated by Pinus cembroides, Pinus discolor, Pinus edulis, Juniperus depeanna and or Juniperus monosperma. Madrean oaks such as Quercus arizonica, Q. emoryi, Q. grisia, Q. oblongifolia or Q. mohriana may be present to codominant with pinyon and or juniper trees. In SW NM Q. grisia may be dominant. Pinus engelmannii occurs infrequently, and P. ponderosa and P. arizonica are absent. Juniperus monosperma is often present to dominant on the Gila National Forest. Understory layers are variable and may be dominated by shrubs such as manzanita (Arctostaphylos pungens, A. pringlei), cliffrose (Cowania mexicana), Apache plume (Fallugia paradoxa) or barberry (Berberis spp). Graminoids may form dense (savanna) to sparse canopy. Common species include sideoats grama (Bouteloua curtipendula), cane bluestem (Bothriochloa barbinodis) and muhly grasses (Muhlenbergia emerslyei, M. torreyi, M. porteri). Graminoids decrease in cover and biomass

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with increasing cover of woody plants.

### Disturbance Description

The fire regime of this ecological system is almost completely unknown. There are essentially no data about fire frequency, fire history or fire behavior. The occasional paper that addresses fire includes considerably more speculation than data. It would seem that fire occurrence was determined primarily by fire occurrence in the surrounding matrix vegetation, and was ignited by lightning during early summer. However, even this information is speculative and undocumented; based on contemporary ecological knowledge, models that assume specific fire regimes are little more than wild guesses. Such a model follows, in the sincere hope that it will be ignored or improved upon.

This system is likely predisposed to stand-replacement fires during the earliest stage of stand development. Replacement fires are assumed to have occurred every century or so, and mixed severity fires slightly less frequently. Significant drought occurs about every 60yrs and, in combination with herbivory from invertebrates, causes disproportional mortality of large, old trees.

### Adjacency or Identification Concerns

This system generally is found at higher elevations and more mesic sites than semi-desert grassland. Typically it is bordered at higher elevations by Madrean Pine-Oak Woodlands.

Cover and density of juniper and pinyon trees at lower elevations in this type doubtless have increased as a result of fire suppression (possibly as mitigated by livestock grazing). This phenomenon is characteristic of BpS 1116 (juniper savanna), with which BpS 1025 (pinyon-juniper woodland) has been lumped for MZ15. Bordered at low elevation by Madrean Encinal and Desert Grasslands on Gila NF.

### Native Uncharacteristic Conditions

### Scale Description

Pinyon-juniper woodland usually was distributed across the landscape in patches between 100s and 1000s of acres in size. In particularly dissected topography this type may have occurred in smaller patches.

### Issues/Problems

Virtually no components of the fire regimes are known with any certainty. Fire scars are rare and trees in this system cannot be aged with conventional dendrochronological techniques. Information about fire regimes is extrapolated from adjacent systems, and extreme caution is warranted when interpreting these models. Fire season can be inferred more reliably than fire frequency; the former likely is equally or more important than the latter.

This ecological system was originally described assuming evergreen oak species are present to codominant in the understory or canopy in MZ15 (Schulz, personal communication). This system also includes Pinyon-Juniper woodlands and savannas with understories dominated by other shrubs or a grass layer and lack evergreen oaks, which may have a different fire behavior.

### Comments

This model is based on the model 141025, by Guy McPherson, with minor changes in species. Recommended reviewers: Wendell Hann, Anthony Caprio, Geoff Babb, Drew Barton.

It has been suggested that the models for MZ15 will better reflect the conditions in MZ24, but they are not developed yet. Heather Schussman also provided suggestions for Madrean models.

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As a result of final QC for LANDFIRE National by Kori Blankenship the user-defined min and max fire return intervals for surface severity fire were deleted because they were not consistent with the modeled fire return interval for this fire severity type.

## Vegetation Classes

### Class A 5%

Early Development 1 All Structures

**Upper Layer Lifeform**

- [x] Herbaceous
- [ ] Shrub
- [ ] Tree

**Fuel Model** 1

**Indicator Species* and Canopy Position**

| | |
|---|---|
| BOCU | Upper |
| BOBA3 | Upper |
| QUAR | Upper |
| QUEM | Upper |

**Structure Data (for upper layer lifeform)**

| | Min | Max |
|---|---|---|
| *Cover* | 0% | 100% |
| *Height* | Herb 0m | Herb 1.0m |
| *Tree Size Class* | No Data | |

[ ] Upper layer lifeform differs from dominant lifeform.

**Description**

Initial post-fire community dominated by perennial caespitose grasses. Evidence of past fires may be observed, including charcoal and resprouting woody plants. Duration 10yrs with succession to B, mid-development closed stand of small trees. Replacement fire occurs every century or so, based on speculation unsupported by data.

### Class B 55%

Mid Development 1 Closed

**Upper Layer Lifeform**

- [ ] Herbaceous
- [ ] Shrub
- [x] Tree

**Fuel Model** 2

**Indicator Species* and Canopy Position**

| | |
|---|---|
| JUDE | Upper |
| PIED | Upper |
| QUAR | Upper |
| QUEM | Upper |

**Structure Data (for upper layer lifeform)**

| | Min | Max |
|---|---|---|
| *Cover* | 0% | 100% |
| *Height* | Tree 0m | Tree 10m |
| *Tree Size Class* | Pole 5-9" DBH | |

[ ] Upper layer lifeform differs from dominant lifeform.

**Description**

Community dominated by young to mature alligator juniper and evergreen oak trees of various ages. This class lasts a century or so with succession to C unless replacement fire causes transition to A. Mixed severity fire every couple of centuries. Fire return intervals are based on speculation unsupported by data.

### Class C 40%

Late Development 1 Closed

**Upper Layer Lifeform**

- [ ] Herbaceous
- [ ] Shrub
- [x] Tree

**Fuel Model** 2

**Indicator Species* and Canopy Position**

| | |
|---|---|
| JUDE | Upper |
| PIED | Upper |
| QUAR | Upper |
| QUEM | Upper |

**Structure Data (for upper layer lifeform)**

| | Min | Max |
|---|---|---|
| *Cover* | 0% | 100% |
| *Height* | Tree 10.1m | Tree 25m |
| *Tree Size Class* | Medium 9-21"DBH | |

[ ] Upper layer lifeform differs from dominant lifeform.

**Description**

Site dominated by relatively dense old alligator juniper and evergreen oak trees. Duration several centuries unless replacement fire causes transition to A. Because trees have grown and aged, consequent gaps in canopy facilitate mixed severity fire every couple of centuries. Fire return intervals are based on speculation unsupported by data.

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### *Class D* 0%

[Not Used] [Not Used]

**Upper Layer Lifeform**

- ☐ Herbaceous
- ☐ Shrub
- ☐ Tree

**Fuel Model**

**Indicator Species* and Canopy Position**

**Structure Data (for upper layer lifeform)**

| | Min | Max |
|---|---|---|
| *Cover* | % | % |
| *Height* | | |
| *Tree Size Class* | | |

☐ Upper layer lifeform differs from dominant lifeform.

**Description**

### *Class E* 0%

[Not Used] [Not Used]

**Upper Layer Lifeform**

- ☐ Herbaceous
- ☐ Shrub
- ☐ Tree

**Fuel Model** No d

**Indicator Species* and Canopy Position**

**Structure Data (for upper layer lifeform)**

| | Min | Max |
|---|---|---|
| *Cover* | % | % |
| *Height* | | |
| *Tree Size Class* | | |

☐ Upper layer lifeform differs from dominant lifeform.

**Description**

## *Disturbances*

**Fire Regime Group**: III**

**Historical Fire Size (acres)**

Avg 100
Min 1
Max 100000

**Sources of Fire Regime Data**

- ☐ Literature
- ☐ Local Data
- ☑ Expert Estimate

**Fire Intervals**

| | Avg FI | Min FI | Max FI | Probability | Percent of All Fires |
|---|---|---|---|---|---|
| *Replacement* | 137 | 20 | 1000 | 0.007299 | 34 |
| *Mixed* | 213 | 20 | 1000 | 0.004695 | 22 |
| *Surface* | 104 | | | 0.009615 | 44 |
| *All Fires* | 46 | | | 0.02161 | |

***Fire Intervals (FI):***

Fire interval is expressed in years for each fire severity class and for all types of fire combined (All Fires). Average FI is central tendency modeled. Minimum and maximum show the relative range of fire intervals, if known. Probability is the inverse of fire interval in years and is used in reference condition modeling. Percent of all fires is the percent of all fires in that severity class.

**Additional Disturbances Modeled**

- ☐ Insects/Disease
- ☑ Wind/Weather/Stress
- ☐ Native Grazing
- ☐ Competition
- ☐ Other (optional 1)
- ☐ Other (optional 2)

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# LANDFIRE Biophysical Setting Model

## *Biophysical Setting:* 1510260 Madrean Upper Montane Conifer-Oak Forest and Woodland

☐ *This BPS is lumped with:*
☐ *This BPS is split into multiple models:*

## *General Information*

**Contributors** (also see the Comments field) **Date** 10/18/2005


**Modeler 1** Mike Babler mbabler@tnc.org **Reviewer** Guy McPherson grm@ag.arizona.edu
**Modeler 2** **Reviewer**
**Modeler 3** **Reviewer**


**Vegetation Type**
Forest and Woodland

**Map Zone**
15

**Model Zone**
☐ Alaska ☐ N-Cent.Rockies
☐ California ☐ Pacific Northwest
☐ Great Basin ☐ South Central
☐ Great Lakes ☐ Southeast
☐ Northeast ☐ S. Appalachians
☐ Northern Plains ☑ Southwest

**Dominant Species***
PSME
ABCO
QUHY
QURU4

**General Model Sources**
☑ Literature
☐ Local Data
☐ Expert Estimate

### Geographic Range
AZ, NM. This ecological system occurs at the upper elevations in the Sierra Madre Occidentale and Sierra Madre Orientale.

### Biophysical Site Description
Restricted to north and east aspects at high elevations (1980-2440m) in the Sky Islands (Chiricahua, Huachuca, Pinaleno, Santa Catalina and Santa Rita mountains) and along the Nantanes Rim.

### Vegetation Description
The vegetation is characterized by large and small patch forests and woodlands dominated by Pseudotsuga menziesii, Abies coahuilensis or Abies concolor and Madrean oaks such as Quercus hypoleucoides and Quercus rugosa.

### Disturbance Description
Data on fire regimes are limited. There is much uncertainty regarding fire frequency and intensity. Sudies indicate significant site to site variability. Seasonality of fire is generally accepted as May-July. The mixed conifer zones in the montane forest in the Madrean borderlands has a mixed fire regime. It is further stated that the mixed conifer forests of southern AZ and NM have an understory fire regime (FEIS). Generally higher elevation forests had longer fire intervals than lower elevation forests in this geographical area, but it appears fire interval may be significantly impacted by fire in adjacent area. Mt Graham is an example.

### Adjacency or Identification Concerns

### Native Uncharacteristic Conditions

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### Scale Description

Large patch. Patches of various sizes are common. Topography plays a significant role in patch size and distribution.

### Issues/Problems

Interactions between grass fire, forest fire and non native grazing is not well known. High elevation forest in Sierra de los Ajos is dominated by shade intolerant species as compared to Animas Mountains in southern NM (McPherson 2001).This probably is related to recurrent surface fires south of the border. Livestock grazing and consequent fire suppression in the US likely have allowed fire-intolerant, shade-tolerant species to "fill in" the understory.

### Comments

This model is identical to the model for the same BpS in MZ24, which was created by modifiying Rocky Mountain Dry-Mesic Montane Mixed Conifer Forest and Woodland, model 241051. 151026 was reviewed by Guy McPherson, Keith Schulz and Tim Christiansen. 241051 was created by Mark Loewen, mlowoen@fs.fed.us; Doug Page, doug_page@blm.gov; Linda Chappell, lchappell@fs.fed.us. This was based on the Rapid Assessment model R2PSMEdy (original modeler Lynn Bennett, lmbennett@fs.fed.us, and modified by Louis Provencher). ABCO and PIPO were added as dominant species. Hugh Safford (hughsafford@fs.fed.us) and Steve Barrett (sbarrett@mtdig.net) were reviewers of R2PSMEdy.

As a result of final QC for LANDFIRE National by Kori Blankenship the user-defined min and max fire return intervals for mixed severity fire were deleted because they were not consistent with the modeled fire return interval for this fire severity type.

## Vegetation Classes

### Class A 10%

Early Development 1 All Structures

**Upper Layer Lifeform**

- ☐ Herbaceous
- ☐ Shrub
- ☑ Tree

**Fuel Model** 1

**Indicator Species* and Canopy Position**

| | |
|---|---|
| PSME | All |
| ABCO | All |
| QUHY | All |
| QURU4 | All |

**Structure Data (for upper layer lifeform)**

| | Min | Max |
|---|---|---|
| Cover | 0% | 50% |
| Height | Tree 0m | Tree 5m |
| Tree Size Class | Pole 5-9" DBH | |

☐ Upper layer lifeform differs from dominant lifeform.

**Description**

Tree seedlings with grasses and forbs. Vegetation will succeed to the mid-development closed (class B) condition in 35yrs.

---

### Class B 10%

Mid Development 1 Closed

**Upper Layer Lifeform**

- ☐ Herbaceous
- ☐ Shrub
- ☑ Tree

**Fuel Model** 4

**Indicator Species* and Canopy Position**

| | |
|---|---|
| PSME | Upper |
| ABCO | Upper |
| QUHY | Upper |
| QURU4 | Upper |

**Structure Data (for upper layer lifeform)**

| | Min | Max |
|---|---|---|
| Cover | 31% | 100% |
| Height | Tree 5.1m | Tree 10m |
| Tree Size Class | Medium 9-21"DBH | |

☐ Upper layer lifeform differs from dominant lifeform.

**Description**

---

*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100+ year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement severity.

Forest canopy closure is >35%. Closed stand with trees, poles, saplings, grass, and scattered shrub, 75-100% Douglas-fir and/or white fir. Mixed severity fire (FRI of 35yrs) will cause a transition to an open mid-development forest (class C).

---

***Class C*** **15%**

Mid Development 1 Open

**Upper Layer Lifeform**

- ☐ Herbaceous
- ☐ Shrub
- ☑ Tree

**Fuel Model** 4

**Indicator Species* and Canopy Position**

| | |
|---|---|
| PSME | Upper |
| ABCO | Upper |
| QUHY | Upper |
| QURU4 | Upper |

**Structure Data (for upper layer lifeform)**

| | *Min* | *Max* |
|---|---|---|
| *Cover* | 0% | 30% |
| *Height* | Tree 5.1m | Tree 10m |
| *Tree Size Class* | Medium 9-21"DBH | |

☐ Upper layer lifeform differs from dominant lifeform.

**Description**

Forest canopy closure is 10-35%. Open trees, (poles, saplings) of Douglas-fir with grass. Mixed severity fire (FRI of 35yrs), primary succession is to D, the open late-development condition. Infrequent stand-replacing fire (FRI of 500yrs) A. The stand will succeed on an alternative path to a closed late-development condition after 68yrs without fire.

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***Class D*** **60%**

Late Development 1 Open

**Upper Layer Lifeform**

- ☐ Herbaceous
- ☐ Shrub
- ☑ Tree

**Fuel Model** 8

**Indicator Species* and Canopy Position**

| | |
|---|---|
| PSME | Upper |
| ABCO | Upper |

**Structure Data (for upper layer lifeform)**

| | *Min* | *Max* |
|---|---|---|
| *Cover* | 0% | 30% |
| *Height* | Tree 10.1m | Tree 25m |
| *Tree Size Class* | Large 21-33"DBH | |

☐ Upper layer lifeform differs from dominant lifeform.

**Description**

Forest canopy closure is 10-35%. Open large tree/ grass and scattered shrubs. Surface fire (FRI of 9yrs) and mixed severity fire (FRI of 35yrs) maintain the stand in the open condition. This open condition, however, will close after 70yrs without fire (alternative path to E). Replacement fire every 500yrs on average and weather-related stress (1000yrs return interval) will cause a transition to A.

---

***Class E*** **5%**

Late Development 1 Closed

**Upper Layer Lifeform**

- ☐ Herbaceous
- ☐ Shrub
- ☑ Tree

**Fuel Model** 8

**Indicator Species* and Canopy Position**

| | |
|---|---|
| PSME | Upper |
| ABCO | Upper |

**Structure Data (for upper layer lifeform)**

| | *Min* | *Max* |
|---|---|---|
| *Cover* | 31% | 100% |
| *Height* | Tree 10.1m | Tree 25m |
| *Tree Size Class* | Large 21-33"DBH | |

☐ Upper layer lifeform differs from dominant lifeform.

**Description**

Forest canopy closure is >35%. Closed large trees of Douglas-fir, white fir and scattered shrubs. Replacement fire (FRI of 500yrs). At this stage, oaks are absent from the overstory. They form scattered small trees in the mid-story. Mixed severity fire (FRI of 35yrs) opens the structure of the stand (transition to D), whereas surface fire (FRI of 50yrs) and competition, although present, do not cause transitions to other classes. Succession is from E to E in the closed condition.

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*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100+ year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement severity.

## Disturbances

**Fire Regime Group**:** I

**Historical Fire Size (acres)**

Avg
Min
Max

**Sources of Fire Regime Data**

- [x] Literature
- [ ] Local Data
- [ ] Expert Estimate

| Fire Intervals | Avg FI | Min FI | Max FI | Probability | Percent of All Fires |
|---|---|---|---|---|---|
| *Replacement* | 300 | | | 0.003333 | 3 |
| *Mixed* | 65 | | | 0.015385 | 16 |
| *Surface* | 13 | 1 | 50 | 0.076923 | 80 |
| *All Fires* | 10 | | | 0.09564 | |

***Fire Intervals (FI):***

Fire interval is expressed in years for each fire severity class and for all types of fire combined (All Fires). Average FI is central tendency modeled. Minimum and maximum show the relative range of fire intervals, if known. Probability is the inverse of fire interval in years and is used in reference condition modeling. Percent of all fires is the percent of all fires in that severity class.

**Additional Disturbances Modeled**

- [x] Insects/Disease
- [x] Wind/Weather/Stress
- [ ] Native Grazing
- [x] Competition
- [ ] Other (optional 1)
- [ ] Other (optional 2)

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*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100+ year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement severity.

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# LANDFIRE Biophysical Setting Model

## *Biophysical Setting:* 1510510 Southern Rocky Mountain Dry-Mesic Montane Mixed Conifer Forest and Woodland

☐ *This BPS is lumped with:*
☐ *This BPS is split into multiple models:*

## General Information

**Contributors** (also see the Comments field) **Date** 10/18/2005


| | | | | | |
|---|---|---|---|---|---|
| **Modeler 1** | Mark Loewen | mloewen@fs.fed.us | **Reviewer** | Tim Christiansen | tchristiansen@tnc.org |
| **Modeler 2** | Doug Page | doug_page@blm.gov | **Reviewer** | Rory Steinke | rsteinke@fs.fed.us |
| **Modeler 3** | Linda Chappell | lchappell@fs.fed.us | **Reviewer** | Linda Wadleigh | lwadleigh@fs.fed.us |


**Vegetation Type**

Forest and Woodland

**Map Zone**

15

**Model Zone**

☐ Alaska ☐ N-Cent.Rockies
☐ California ☐ Pacific Northwest
☐ Great Basin ☐ South Central
☐ Great Lakes ☐ Southeast
☐ Northeast ☐ S. Appalachians
☐ Northern Plains ☑ Southwest

**Dominant Species***

| | |
|---|---|
| PSEUD7 | CARU |
| ABCO | CAGA3 |
| PIPO | PSMEG |
| PICO | PIPOS |

**General Model Sources**

☑ Literature
☑ Local Data
☑ Expert Estimate

### Geographic Range

Occurs throughout the southern Rockies, north and west into UT, NV, western WY and ID.

### Biophysical Site Description

This type is generally located just above sagebrush ecosystems and adjacent to ponderosa pine woodlands. These are mixed-conifer forests occurring on all aspects at elevations ranging from 1200-3300 m. Rainfall averages <75cm per year (40-60cm) with summer "monsoons" during the growing season contributing substantial moisture. The composition and structure of overstory is dependent upon the temperature and moisture relationships of the site, and the successional status of the occurrence.

### Vegetation Description

Pseudotsuga menziesii and Abies concolor are most frequent, but Pinus ponderosa may be present to codominant. Pseudotsuga menziesii forests occupy drier sites, and Pinus ponderosa is a common codominant. Abies concolor dominated forests occupy cooler sites, such as upper slopes at higher elevations, canyon sideslopes, ridgetops and north- and east-facing slopes which burn somewhat infrequently. Picea pungens is most often found in cool, moist locations, often occurring as smaller patches within a matrix of other associations. As many as seven conifers can be found growing in the same occurrence, and there are a number of cold-deciduous shrub and graminoid species common, including Arctostaphylos uva-ursi, Mahonia repens, Symphoricarpos oreophilus, Jamesia americana, Quercus gambelii and Festuca arizonica.

### Disturbance Description

Disturbance regime described here is for Douglas-fir. Fire Regime Group I. Some portions of these sites are transition zones to Fire Regime Groups II and III. Frequent surface and mixed severity fires were the common fire regime characteristics. Surface fire intervals ranged from 10-50yrs, and replacement severity

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occurred at intervals of 150-400yrs+ (Crane 1986; Barrett 1988; Bradley 1992a,b; Brown 1994; Morgan et al. 1996). Mixed severity fires were assumed to have an intermediate FRI of 45-75yrs on average. Stand replacement fires were generally restricted to the closed canopy forest and the stand initiation conditions.

The Fire Regime Group I characteristics were facilitated by understory vegetation dominated by fine fuels (grasses, sedges and forbs), landscape position and adjacency to other frequent fire BpSs. Much of the forest structure was open canopy overstory that resulted in an understory dominated by healthy and vigorous plants (grasses, sedges and forbs) and generally continuous fine fuels layer. These fine fuels facilitated fire spread and thinning of the conifer or aspen seedlings (thus promoting aspen suckering).

Aspen patches occurred at smaller scales than in more mesic mixed conifer forests. These more mesic sites would have had grass understories that did not cure as early in the year as surrounding areas, especially under a closed forest canopy, and these mesic areas often experience quicker humidity recovery in the evenings. These circumstances tended to lessen the fire severity in the aspen stands which acted as fire-safe sites compared to the surrounding landscape. This was important because aspen is much less resistant to fire than Douglas-fir. Greater suckering would occur at the edges of aspen patches.

Other disturbances included insect (return interval of 100yrs), disease, drought and wind and ice damage (every 1,000yrs in closed stands; every 250yrs in open stands). Competition among trees was also a factor that increasingly slowed successional dynamics in more closed stands. Fire was by far the dominant disturbance agent.

### Adjacency or Identification Concerns

If aspen is present in large patches or if conifers are not coming in after ~30yrs, the BpS is probably misclassified and one of the pure Aspen types should be examined (Rocky Mountain Aspen Forest and Woodland or Intermountain Basins Aspen-Mixed Conifer Forest and Woodland). Pinus aristida does not occur on Coconino NF.

BpS is often transitional between non-forested areas or between Pinus ponderosa (at lower elevations) and spruce-fir at higher elevations.

### Native Uncharacteristic Conditions

### Scale Description

This BpS occurs in patches ranging from 1000s to 10000s of acres.

### Issues/Problems

Anonymous reviewer has concerns with mixed severity fire in class A. Also suggests this model may work in MZ28, warm-dry mixed conifer.

### Comments

151051 was based on the Rapid Assessment model R2PSMEdy (original modeler Lynn Bennett, lmbennett@fs.fed.us, and modified by Louis Provencher). ABCO and PIPO were added as dominant species. Hugh Safford (hughsafford@fs.fed.us) and Steve Barrett (sbarrett@mtdig.net) were reviewers of R2PSMEdy.

As a result of final QC for LANDFIRE National by Kori Blankenship the user-defined min and max fire return intervals for replacement and mixed severity fires were deleted because they were not consistent with the modeled fire return intervalsfor these fire severity types.

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## Vegetation Classes

### Class A 20%

Early Development 1 All Structures

**Upper Layer Lifeform**

- ☐ Herbaceous
- ☐ Shrub
- ☑ Tree

**Fuel Model** 5

**Indicator Species* and Canopy Position**

| | |
|---|---|
| CARU | Low-Mid |
| CAGA3 | Low-Mid |
| PSEUD7 | Upper |
| PIPO | Upper |

**Structure Data (for upper layer lifeform)**

| | Min | Max |
|---|---|---|
| Cover | 0% | 10% |
| Height | Tree 0m | Tree 5m |
| Tree Size Class | Sapling >4.5ft; <5"DBH | |

☐ Upper layer lifeform differs from dominant lifeform.

**Description**

Grass/forb/shrub/tree seedlings. Replacement fire is frequent (FRI of 25yrs). Mixed severity fires occur with an average FRI of 100yrs. Vegetation will succeed to the mid-development closed (class B) condition in 35yrs.

### Class B 5%

Mid Development 1 Closed

**Upper Layer Lifeform**

- ☐ Herbaceous
- ☐ Shrub
- ☑ Tree

**Fuel Model** 9

**Indicator Species* and Canopy Position**

| | |
|---|---|
| PSEUD7 | Upper |
| ABCO | Upper |
| PIPO | Upper |
| PICO | Upper |

**Structure Data (for upper layer lifeform)**

| | Min | Max |
|---|---|---|
| Cover | 31% | 100% |
| Height | Tree 5.1m | Tree 10m |
| Tree Size Class | Pole 5-9" DBH | |

☐ Upper layer lifeform differs from dominant lifeform.

**Description**

Closed stand with trees, poles, saplings, grass, and scattered shrub, 75-100% Douglas-fir and/or white fir.

In the absence of fire, vegetation will succeed to E (closed, late-development) after 70yrs. Replacement fire (average FRI of 150yrs) and infrequent weather-related stress (return interval of 250yrs) returns vegetation to class A. Mixed severity fire (FRI of 45yrs) and insect/diseases every 100yrs on average will cause a transition to an open mid-development forest (class C). Competition (probability/year=0.01) maintains the stand in its closed condition.

### Class C 10%

Mid Development 1 Open

**Upper Layer Lifeform**

- ☐ Herbaceous
- ☐ Shrub
- ☑ Tree

**Fuel Model** 9

**Indicator Species* and Canopy Position**

| | |
|---|---|
| PSEUD7 | Upper |
| PIPO | Upper |

**Structure Data (for upper layer lifeform)**

| | Min | Max |
|---|---|---|
| Cover | 0% | 30% |
| Height | Tree 5.1m | Tree 10m |
| Tree Size Class | Pole 5-9" DBH | |

☐ Upper layer lifeform differs from dominant lifeform.

**Description**

Open trees, (poles, saplings) of Douglas-fir and occasional ponderosa pine with grass and scattered shrubs. With surface fire (FRI of 10yrs), mixed severity fire (FRI of 75yrs), weak adult tree competition and insect/diseases (every 100yrs), primary succession is to D, the open late-development condition. Infrequent stand-replacing fire (FRI of 400yrs) and infrequent weather-related stress (return interval of 1000yrs) will cause transitions to A. The stand will succeed on an alternative path to a closed late-development condition after 68yrs without fire.

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### *Class D* 60%

Late Development 1 Open

**Upper Layer Lifeform**

- ☐ Herbaceous
- ☐ Shrub
- ☑ Tree

**Fuel Model** 9

**Indicator Species* and Canopy Position**

| | |
|---|---|
| PSEUD7 | Upper |
| PIPO | Upper |

**Structure Data (for upper layer lifeform)**

| | *Min* | *Max* |
|---|---|---|
| *Cover* | 0% | 30% |
| *Height* | Tree 10.1m | Tree 50m |
| *Tree Size Class* | Large 21-33"DBH | |

☐ Upper layer lifeform differs from dominant lifeform.

**Description**

Open large tree/grass and scattered shrubs; Douglas-fir with occasional ponderosa pine. Surface fire (FRI of 10yrs) and mixed severity fire (FRI of 75yrs) maintain the stand in the open condition (ie, succession from D to D). This open condition, however, will close after 70yrs without fire (alternative path to E). Adult tree competition (probability/year of 0.001) and insect/diseases (100yrs return interval) also disturb this class, but do not affect the successional age. Replacement fire every 500yrs on average and weather-related stress (1000yrs return interval) will cause a transition to A.

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### *Class E* 5%

Late Development 1 Closed

**Upper Layer Lifeform**

- ☐ Herbaceous
- ☐ Shrub
- ☑ Tree

**Fuel Model** 10

**Indicator Species* and Canopy Position**

| | |
|---|---|
| PSEUD7 | Upper |
| ABCO | Upper |
| PICO | Upper |
| PIPO | Middle |

**Structure Data (for upper layer lifeform)**

| | *Min* | *Max* |
|---|---|---|
| *Cover* | 31% | 100% |
| *Height* | Tree 10.1m | Tree 50m |
| *Tree Size Class* | Large 21-33"DBH | |

☐ Upper layer lifeform differs from dominant lifeform.

**Description**

Closed large trees of Douglas-fir, white fir and occasional lodgepole pine and scattered shrubs. Replacement fire (FRI of 150yrs) and infrequent weather/wind-related stress (return interval of 250yrs) cause a transition to class A. Mixed severity fire (FRI of 45yrs) open the structure of the stand (transition to D), whereas surface fire (FRI of 50yrs) and competition, although present, do not cause transitions to other classes. Insect/diseases occur every 40yrs on average, however different insects cause 50% of the time a transition to class C, whereas others cause a 50% transition to class D. Succession is from E to E in the closed condition.

## *Disturbances*

**Fire Regime Group**: I

**Historical Fire Size (acres)**

Avg 100
Min 10
Max 1000

**Sources of Fire Regime Data**

- ☑ Literature
- ☐ Local Data
- ☑ Expert Estimate

**Fire Intervals**

| | *Avg FI* | *Min FI* | *Max FI* | *Probability* | *Percent of All Fires* |
|---|---|---|---|---|---|
| *Replacement* | 90 | | | 0.011111 | 12 |
| *Mixed* | 77 | | | 0.012987 | 14 |
| *Surface* | 14 | 10 | 50 | 0.071429 | 75 |
| *All Fires* | 10 | | | 0.09553 | |

***Fire Intervals (FI):***

Fire interval is expressed in years for each fire severity class and for all types of fire combined (All Fires). Average FI is central tendency modeled. Minimum and maximum show the relative range of fire intervals, if known. Probability is the inverse of fire interval in years and is used in reference condition modeling. Percent of all fires is the percent of all fires in that severity class.

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**Additional Disturbances Modeled**

- [x] Insects/Disease
- [x] Wind/Weather/Stress
- [ ] Native Grazing
- [x] Competition
- [ ] Other (optional 1)
- [ ] Other (optional 2)

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**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100+ year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement severity.

USDA Forest Service. Pacific Northwest Research Station,. Research Paper PNW-RP-484. 27 pp.

*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100+ year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement severity.

# LANDFIRE Biophysical Setting Model

## *Biophysical Setting:* 1510520 Southern Rocky Mountain Mesic Montane Mixed Conifer Forest and Woodland

☐ *This BPS is lumped with:*
☐ *This BPS is split into multiple models:*

## General Information

**Contributors** (also see the Comments field) **Date** 10/18/2005


| | | | | | |
|---|---|---|---|---|---|
| **Modeler 1** | Mark Loewen | mloewen@fs.fed.us | **Reviewer** | Tim Christiansen | tchristiansen@tnc.org |
| **Modeler 2** | Doug Page | doug_page@blm.gov | **Reviewer** | One anonymous reviewer | |
| **Modeler 3** | Beth Corbin | ecorbin@fs.fed.us | **Reviewer** | | |


**Vegetation Type**
Forest and Woodland

**Map Zone**
15

**Model Zone**
☐ Alaska ☐ N-Cent.Rockies
☐ California ☐ Pacific Northwest
☐ Great Basin ☐ South Central
☐ Great Lakes ☐ Southeast
☐ Northeast ☐ S. Appalachians
☐ Northern Plains ☑ Southwest

**Dominant Species***
PSME
PICO

**General Model Sources**
☑ Literature
☐ Local Data
☑ Expert Estimate

### Geographic Range
Rocky Mountains west into the ranges of the Great Basin.

### Biophysical Site Description
Elevations range from 1200-3300m. Occurrences of this system are found on cooler and more mesic sites than Rocky Mountain Montane Dry-Mesic Mixed Conifer Forest and Woodland (1051). Such sites include lower and middle slopes of ravines, along stream terraces, moist, concave topographic positions and north- and east-facing slopes which burn somewhat infrequently.

### Vegetation Description
Pseudotsuga menziesii and Abies concolor are most common canopy dominants, but Picea engelmannii, Picea pungens or Pinus ponderosa may be present. This system includes mixed conifer/Populus tremuloides stands. A number of cold-deciduous shrub species can occur, including Acer glabrum, Acer grandidentatum, Alnus incana, Betula occidentalis, Cornus sericea, Jamesia americana, Physocarpus malvaceus, Robinia neomexicana, Vaccinium membranaceum and Vaccinium myrtillus. Herbaceous species include Bromus ciliatus, Carex geyeri, Carex rossii, Carex siccata, Muhlenbergia virescens, Pseudoroegneria spicata, Erigeron eximius, Fragaria virginiana, Luzula parviflora, Osmorhiza berteroi, Packera cardamine, Thalictrum occidentale and Thalictrum fendleri.

### Disturbance Description
Naturally occurring fires are of variable return intervals, and mostly light, erratic and infrequent due to the cool, moist conditions. These ecological systems are in a Fire Regime Group III. Some portions of these sites are transition zones to Fire Regime Groups I, III, and IV. This vegetation is a transition between the frequent surface and mixed severity fires and the more stand replacement regimes common in high elevation

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fir and spruce ecosystems.

Surface fire and mixed severity fire intervals were about 35-50yrs (Brown et al. 1994). Stand replacement fires occurred at intervals of 120-400yrs+ (Crane 1986; Barrett 1988; Bradley 1992a,b; Brown et al. 1994; Morgan et al. 1996). Likelihood of stand replacement fires increased with canopy closure and fuel ladders caused by white fir growth, however ground fires acted as replacement fires during early stand development (class A).

Other disturbances included insect, disease, drought, and wind and ice damage. Fire was by far the dominant disturbance agent.

### Adjacency or Identification Concerns

This ecological system is often transitional between Fire Regime Group I and Fire Regime Groups II, IV and V at higher elevations. Sites are dry/steep montane with a variety of aspects (often northerly) and soil conditions.

### Native Uncharacteristic Conditions

### Scale Description

This PNVG occurs in patches ranging from 100s to 1000s of acres.

### Issues/Problems

### Comments

This model was based on the Rapid Assessment model R2PSMEms. Additional author is Linda Chappell. Reviewers of R2PSMEms were: Hugh Safford (hughsafford@fs.fed.us), Steve Barrett (sbarrett@mtdig.net) and Clinton K Williams (cwiliam03/@fs.fed.us). Canopy closure percentages were adjusted from original model to new LF standards 9/14/05.

Anonymous reviewer has concerns with mixed severity fire in class A and would have expected higher percentages in mid and late closed classes.

As a result of final QC for LANDFIRE National by Kori Blankenship the user-defined min and max fire return intervals for mixed and surface severity fires were deleted because they were not consistent with the modeled fire return intervals for these fire severity types.

## *Vegetation Classes*

***Class A*** **10%**

Early Development 1 All Structures

**Indicator Species* and Canopy Position**

| | |
|---|---|
| PSME | Upper |
| ABCO | Upper |

**Structure Data (for upper layer lifeform)**

| | *Min* | *Max* |
|---|---|---|
| *Cover* | 0% | 100% |
| *Height* | Tree 0m | Tree 5m |
| *Tree Size Class* | Seedling <4.5ft | |

☐ Upper layer lifeform differs from dominant lifeform.

**Upper Layer Lifeform**

☐ Herbaceous
☐ Shrub
☑ Tree

**Fuel Model** 2

**Description**

Tree seedling-shrub-grass-forb. Succession to B after 30yrs unless replacement fire (average FRI of 120yrs). Mixed severity fire occurs with an average FRI of 50yrs.

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### *Class B* 30%

Mid Development 1 Closed

**Upper Layer Lifeform**

- ☐ Herbaceous
- ☐ Shrub
- ☑ Tree

**Fuel Model** 10

**Indicator Species* and Canopy Position**

| | |
|---|---|
| PSME | Upper |
| ABCO | Upper |

**Structure Data (for upper layer lifeform)**

| | Min | Max |
|---|---|---|
| *Cover* | 31% | 100% |
| *Height* | Tree 5.1m | Tree 25m |
| *Tree Size Class* | Medium 9-21"DBH | |

☐ Upper layer lifeform differs from dominant lifeform.

**Description**

Forest canopy closure is >30%. Closed trees, sapling, large poles, grass and scattered shrub, 75-100% Douglas-fir/white fir, some Lodgepole pine, and spruces at higher elevations. Primary succession is to E, the closed late development condition after 70yrs. Mixed severity fire (FRI of 47yrs) and wind/weather/stress every 200yrs on average will open the stand, thus causing a transition to class C. Insects/disease (50yrs mean return interval) cause minor mortality to this state.

---

### *Class C* 30%

Mid Development 1 Open

**Upper Layer Lifeform**

- ☐ Herbaceous
- ☐ Shrub
- ☑ Tree

**Fuel Model** 8

**Indicator Species* and Canopy Position**

| | |
|---|---|
| PSME | Upper |
| ABCO | Upper |
| | Upper |

**Structure Data (for upper layer lifeform)**

| | Min | Max |
|---|---|---|
| *Cover* | 0% | 30% |
| *Height* | Tree 5.1m | Tree 25m |
| *Tree Size Class* | Medium 9-21"DBH | |

☐ Upper layer lifeform differs from dominant lifeform.

**Description**

Forest canopy closure is <30%. Open pole-sapling/ grass scattered shrubs, maybe 90% Douglas-fir. This state will succeed to the closed mid-development condition (B) after 35yrs in the absence of fire (FRI of 40yrs on average). With fire, insect outbreaks (every 100yrs) and weather-related stress (every 1000yrs), the vegetation will become open late-development after 70yrs. Stand replacement fire occurs on average every 400yrs.

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### *Class D* 20%

Late Development 1 Open

**Upper Layer Lifeform**

- ☐ Herbaceous
- ☐ Shrub
- ☑ Tree

**Fuel Model** 8

**Indicator Species* and Canopy Position**

| | |
|---|---|
| PSME | Upper |
| ABCO | Upper |
| ABLA | Mid-Upper |

**Structure Data (for upper layer lifeform)**

| | Min | Max |
|---|---|---|
| *Cover* | 0% | 30% |
| *Height* | Tree 25.1m | Tree 50m |
| *Tree Size Class* | Large 21-33"DBH | |

☐ Upper layer lifeform differs from dominant lifeform.

**Description**

Forest canopy closure is <30%. Open large tree/grass and scattered shrubs; potentially 90% Douglas-fir. Replacement fire occurs every 400yrs on average, whereas surface fire (FRI of 40yrs) maintains the open condition of the stand. Insects/disease every 100yrs also maintain the structure of the stand open. After 35yrs without fire, existing trees will fill out the stand and cause succession to the late closed condition (E).

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***Class E*** **10%**

Late Development 1 Closed

**Upper Layer Lifeform**

- ☐ Herbaceous
- ☐ Shrub
- ☑ Tree

**Fuel Model** 10

**Indicator Species* and Canopy Position**

| | |
|---|---|
| PSME | Upper |
| ABCO | Upper |
| ABLA | Upper |

**Structure Data (for upper layer lifeform)**

| | *Min* | *Max* |
|---|---|---|
| *Cover* | 31% | 100% |
| *Height* | Tree 25.1m | Tree 50m |
| *Tree Size Class* | Large 21-33"DBH | |

☐ Upper layer lifeform differs from dominant lifeform.

**Description**

Forest canopy closure is >30%. Closed medium to large trees, scattered shrubs, 60 to 100% Douglas-fir. Replacement fire every 120yrs will remove the canopy, whereas mixed severity fire every 50yrs will return the stand to the open structure (D). Surface fire (FRI of 50yrs) will not affect the structure and age of trees. Occasional weather-related stress every 200yrs will open the structure of the stand and cause a transition to class D. Insect/diseases damage occurs every 50yrs causing 60% of times a transition to class C and 40% to class C.

## Disturbances

**Fire Regime Group**:** I

**Historical Fire Size (acres)**

Avg 100
Min 10
Max 1000

**Sources of Fire Regime Data**

- ☑ Literature
- ☐ Local Data
- ☑ Expert Estimate

**Fire Intervals**

| | *Avg FI* | *Min FI* | *Max FI* | *Probability* | *Percent of All Fires* |
|---|---|---|---|---|---|
| *Replacement* | 190 | 120 | 400 | 0.005263 | 18 |
| *Mixed* | 100 | | | 0.01 | 35 |
| *Surface* | 75 | | | 0.013333 | 47 |
| *All Fires* | 35 | | | 0.0286 | |

***Fire Intervals (FI):***
Fire interval is expressed in years for each fire severity class and for all types of fire combined (All Fires). Average FI is central tendency modeled. Minimum and maximum show the relative range of fire intervals, if known. Probability is the inverse of fire interval in years and is used in reference condition modeling. Percent of all fires is the percent of all fires in that severity class.

**Additional Disturbances Modeled**

- ☑ Insects/Disease
- ☑ Wind/Weather/Stress
- ☐ Native Grazing
- ☐ Competition
- ☐ Other (optional 1)
- ☐ Other (optional 2)

## References


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*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100+ year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement severity.

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Swetnam, T.W., B.E.. Wickman, H.G. Paul and C.H. Baisan. 1995. Historical patterns of western spruce budworm and Douglas-fir tussock moth outbreaks in the northern Blue Mountains, Oregon, since A.D. 1700. USDA Forest Service. Pacific Northwest Research Station,. Research Paper PNW-RP-484. 27 pp.

*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100+ year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement severity.

# LANDFIRE Biophysical Setting Model

## *Biophysical Setting:* 1510540 Southern Rocky Mountain Ponderosa Pine Woodland

☐ *This BPS is lumped with:*
☐ *This BPS is split into multiple models:*

## *General Information*

**Contributors** (also see the Comments field) **Date** 10/18/2005


| | | | | | |
|---|---|---|---|---|---|
| **Modeler 1** | Mike Manthei | mmanthei@fs.fed.us | **Reviewer** | Rory Steinke | rsteinke@fs.fed.us |
| **Modeler 2** | Linda Wadeligh | lwadleigh@fs.fed.us | **Reviewer** | | |
| **Modeler 3** | Jack Triepke | jtriepkl@fs.fed.us | **Reviewer** | | |


**Vegetation Type**

Forest and Woodland

**Map Zone**

15

**Model Zone**

☐ Alaska ☐ N-Cent.Rockies
☐ California ☐ Pacific Northwest
☐ Great Basin ☐ South Central
☐ Great Lakes ☐ Southeast
☐ Northeast ☐ S. Appalachians
☐ Northern Plains ☑ Southwest

**Dominant Species***

PIPOS FEAR2
QUGA
MUMO
BOGR

**General Model Sources**

☑ Literature
☑ Local Data
☑ Expert Estimate

### Geographic Range

AZ, CO, NM, Great Basin

### Biophysical Site Description

These woodlands occur at the lower treeline between grassland or shrubland and more mesic coniferous forests. Elevations range to 2800m in the NM mountains. Occurrences are found on all slopes and aspects. This ecological system generally occurs on igneous, metamorphic and sedimentary material derived soils, with characteristic features of good aeration and drainage, medium to fine texture, neutral to slightly acid pH, an abundance of mineral material, rockiness and periods of drought during the growing season. This model represent BpSs above the Mogollon Rim.

### Vegetation Description

Pinus ponderosa is the dominant conifer while Pseudotsuga menziesii, Pinus edulis, Quercus gambelii and Juniperus spp may be present in the tree canopy. The understory is usually grassy, with Purshia stansburiana, Robinia neomexicana. Festuca, Muhlenbergia and Bouteloua as some of the common grasses.

### Disturbance Description

These sites are in a Fire Regime Group I or III. Some portions of these sites are transition zones to Fire Regime Groups II and III. Frequent surface fires were the common fire regime characteristics. Surface fire intervals ranged from 2-10yrs, and replacement severity occurred at intervals of 150-400yrs+ (Brown, 2000; Crane, 1986; Bradley, 1992a; Bradley, 1992b; Barrett, 1988; Morgan et al, 1996; Brown, 1994). Stand replacement fires were generally restricted to the closed canopy forest. Topography (aspect, substrate depth, slope, position, etc.) exerted strong control over fire behavior producing spatially and temporally mixed severity regimes (personal communication, Stanley Kitchen, USFS).

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Bark beetle outbreaks are highly related to drought and stand density. Denser stands in relation to site capacity will favor outbreaks, which will decrease as trees are thinned. Non-native herbaceous species may move in following severe intensity fire.

### Adjacency or Identification Concerns

This system intergrades with pinyon-juniper at lower elevation and mixed conifer at upper elevation.

### Native Uncharacteristic Conditions

Tree cover >60% can be considered uncharacteristic in this woodland type.

### Scale Description

BpS is very large, largest contiguous areas of ponderosa pine found in US occur throughout the mapzone.

### Issues/Problems

Ponderosa pine woodlands and savannas should be better researched. Many scattered PIPO patches in the map zone were logged during the mining era of 1850-1900 (eg, several 100ac in the Clover Mountains on the Great Basin-Mojave Desert boundary in eastern NV) and during the railroad construction era throughout the western USA. It is also thought that the dominance of shrubs in understories is greater today than during pre-settlement because livestock grazing greatly reduced grasses in the southern portion of the Great Basin. Therefore, shrubby woodlands today may have been grassy savannas in the past.

Under dry site conditions, oak and chaparral vegetation will prevent stand closure from class C to B or from D to E. Possible future work to investigate separate Pine/Oak System.

This ecological system belongs to both FRG I and III (predominantly mixed severity, but with the frequency range of FRG I).

### Comments

This model is based on a model for the same BpS in MZ28 by Mark Loewen, mloewen@fs.fed.us; Doug Page, doug_page@blm.gov; Linda Chappell, lchappell@fs.fed.us; 3/2/2005. Structure data modified to meet new LF standards 9/14/05. Original model was the Rapid Assessment model R2PPDFcp by Lynn Bennett (lmbennett@fs.fed.us) modified for BpS 1054. Beth Corbin (ecorbin@fs.fed.us) participated in modeling of BpS 1054. R2PPDFcp was reviewed by Stanley G. Kitchen (skitchen@fs.fed.us) and Clinton K. Williams (cwilliams03/@fs.fed.us).

One reviewer suggests that "Woodland " be dropped from title. This ecological system includes much of the dry Douglas-fir/white fir and ponderosa pine ecosystems.

Anonymous reviewer states this ponderosa pine seems like it operates like ponderosa pine in SW CO but with longer fire return intervals.

## *Vegetation Classes*

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### *Class A* 10%

Early Development 1 All Structures

**Upper Layer Lifeform**

- ☐ Herbaceous
- ☑ Shrub
- ☐ Tree

**Fuel Model** 2

**Indicator Species* and Canopy Position**

| | |
|---|---|
| PIPOS | Upper |
| QUGA | Upper |
| MUMO | Upper |
| FEAR2 | Upper |

**Structure Data (for upper layer lifeform)**

| | *Min* | *Max* |
|---|---|---|
| *Cover* | 0% | 60% |
| *Height* | Shrub 0m | Shrub 3.0m |
| *Tree Size Class* | No Data | |

☐ Upper layer lifeform differs from dominant lifeform.

**Description**

Openings with grass, shrub, and forbs created after replacement fire. Post replacement vegetation is patchy and episodic. Ponderosa pine seedlings can be very limited and variable. Gambel oak and Ceanothus fendleri are vigorous rapid resprouters. Succession to class C after 50yrs.

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### *Class B* 2%

Mid Development 1 Closed

**Upper Layer Lifeform**

- ☐ Herbaceous
- ☐ Shrub
- ☑ Tree

**Fuel Model** 5

**Indicator Species* and Canopy Position**

| | |
|---|---|
| PIPOS | Upper |
| QUGA | Mid-Upper |
| FEAR2 | Mid-Upper |
| MUHLE | Mid-Upper |

**Structure Data (for upper layer lifeform)**

| | *Min* | *Max* |
|---|---|---|
| *Cover* | 31% | 60% |
| *Height* | Tree 0m | Tree 10m |
| *Tree Size Class* | Medium 9-21"DBH | |

☐ Upper layer lifeform differs from dominant lifeform.

**Description**

Forest canopy closure is 30% or greater. Closed pole-sapling/grass and shrubs. Replacement fire occurs every 80yrs on average. Mixed severity fire (FRI of 25yrs) will open stand structure, thus causing a transition to class C. Surface fire is considered unlikely in dense stands. Without fire, the stand will grow into a late successional closed state (class E) after 70yrs.

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### *Class C* 10%

Mid Development 1 Open

**Upper Layer Lifeform**

- ☐ Herbaceous
- ☐ Shrub
- ☑ Tree

**Fuel Model** 9

**Indicator Species* and Canopy Position**

| | |
|---|---|
| PIPOS | Upper |
| QUGA | Mid-Upper |
| FEAR2 | Low-Mid |
| MUHLE | Low-Mid |

**Structure Data (for upper layer lifeform)**

| | *Min* | *Max* |
|---|---|---|
| *Cover* | 0% | 30% |
| *Height* | Tree 0m | Tree 10m |
| *Tree Size Class* | Medium 9-21"DBH | |

☐ Upper layer lifeform differs from dominant lifeform.

**Description**

Forest canopy closure is <30%. Open pole-sapling/grass and shrubs. Replacement fire every 300yrs causes a transition back to class A, whereas surface fire and mixed severity fire maintain the open structure of the class. Without fire, the stand will transition to the open condition (class D) after 25yrs. With fire, the stand grows into class D after 60yrs.

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### *Class D* 75%

Late Development 1 Open

**Upper Layer Lifeform**

- ☐ Herbaceous
- ☐ Shrub
- ☑ Tree

**Fuel Model** 9

**Indicator Species* and Canopy Position**

| | |
|---|---|
| PIPOS | Upper |
| QUGA | Upper |
| FEAR2 | Low-Mid |
| MUHLE | Low-Mid |

**Structure Data (for upper layer lifeform)**

| | *Min* | *Max* |
|---|---|---|
| *Cover* | 0% | 30% |
| *Height* | Tree 10.1m | Tree 25m |
| *Tree Size Class* | Medium 9-21"DBH | |

☐ Upper layer lifeform differs from dominant lifeform.

**Description**

Forest canopy closure is <30%. Open large trees/grass and shrubs. Rare transition to class A is caused by replacement fire every 400yrs. Surface fire (FRI of 10yrs) and mixed severity fire (FRI of 100yrs) maintain vegetation in class D indefinitely. Without fire vegetation will close and transition to class E.

### *Class E* 3%

Late Development 1 Closed

**Upper Layer Lifeform**

- ☐ Herbaceous
- ☐ Shrub
- ☑ Tree

**Fuel Model** 10

**Indicator Species* and Canopy Position**

| | |
|---|---|
| PIPOS | Upper |
| QUGA | Upper |
| FEAR2 | Upper |
| MUHLE | |

**Structure Data (for upper layer lifeform)**

| | *Min* | *Max* |
|---|---|---|
| *Cover* | 31% | 60% |
| *Height* | Tree 10.1m | Tree 25m |
| *Tree Size Class* | Large 21-33"DBH | |

☐ Upper layer lifeform differs from dominant lifeform.

**Description**

Forest canopy closure is 30% or greater. Closed large, trees, poles, saplings and shrubs. Replacement and surface fires occur every 250yrs on average. Mixed severity fire (FRI of 125yrs) and mountain pine beetle outbreaks (every 50yrs on average) will return vegetation to class D.

## Disturbances

**Fire Regime Group**: I**

**Historical Fire Size (acres)**

Avg 100
Min 1
Max 200

**Sources of Fire Regime Data**

- ☑ Literature
- ☐ Local Data
- ☑ Expert Estimate

**Fire Intervals**

| | *Avg FI* | *Min FI* | *Max FI* | *Probability* | *Percent of All Fires* |
|---|---|---|---|---|---|
| *Replacement* | 400 | 150 | 500 | 0.0025 | 2 |
| *Mixed* | 100 | 10 | 150 | 0.01 | 9 |
| *Surface* | 10 | 5 | 50 | 0.1 | 89 |
| *All Fires* | 9 | | | 0.1125 | |

***Fire Intervals (FI):***

Fire interval is expressed in years for each fire severity class and for all types of fire combined (All Fires). Average FI is central tendency modeled. Minimum and maximum show the relative range of fire intervals, if known. Probability is the inverse of fire interval in years and is used in reference condition modeling. Percent of all fires is the percent of all fires in that severity class.

**Additional Disturbances Modeled**

- ☑ Insects/Disease
- ☐ Wind/Weather/Stress
- ☐ Native Grazing
- ☐ Competition
- ☐ Other (optional 1)
- ☐ Other (optional 2)

## References

Barrett, S.W. 1994. Fire Regimes on the Caribou National Forest, Southern Idaho. Final Report – Contract No. 53-02S2-3-05071. September 1994.

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*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100+ year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement severity.

# LANDFIRE Biophysical Setting Model

***Biophysical Setting:*** **1510550** **Rocky Mountain Subalpine Dry-Mesic Spruce-Fir Forest and Woodland**

☐ *This BPS is lumped with:*
☐ *This BPS is split into multiple models:*

## *General Information*

**Contributors** (also see the Comments field) **Date** 10/18/2005


| | | | |
|---|---|---|---|
| **Modeler 1** | Dick Edwards | rsedwards@fs.fed.us | **Reviewer** |
| **Modeler 2** | Paul Langowski | plangowski@fs.fed.us | **Reviewer** |
| **Modeler 3** | Mike Babler | mbabler@tnc.org | **Reviewer** |


**Vegetation Type**

Forest and Woodland

**Map Zone**

15

**Model Zone**

☐ Alaska ☐ N-Cent.Rockies
☐ California ☐ Pacific Northwest
☐ Great Basin ☐ South Central
☐ Great Lakes ☐ Southeast
☐ Northeast ☐ S. Appalachians
☐ Northern Plains ☑ Southwest

**Dominant Species***

PIEN
ABLA
PICO
POTR5

**General Model Sources**

☑ Literature
☐ Local Data
☑ Expert Estimate

### Geographic Range

CO, northern NM and parts of AZ and UT. Engelmann spruce and subalpine fir forests comprise a substantial part of the subalpine forests of the Cascades and Rocky Mountains from southern British Columbia east into Alberta, south into NM and the Intermountain region. They are the matrix forests of the subalpine zone, with elevations ranging from 1275m in its northern distribution to 3355m in the south (4100-11000ft). They often represent the highest elevation forests in an area. Despite their wide distribution, the tree canopy characteristics are remarkably similar, with Picea engelmannii and Abies lasiocarpa dominating either mixed or alone. In some areas, such as WY, Picea engelmannii-dominated forests are on limestone or dolomite, while nearby codominated spruce-fir forests are on granitic or volcanic rocks. Xeric species may include Juniperus communis, Linnaea borealis, Mahonia repens or Vaccinium scoparium.

### Biophysical Site Description

BpS occurs in the subalpine zone on gentle to moderately steep terrain (eg, 10-60% slope). Sites within this system are cold year-round, and precipitation is predominantly in the form of snow, which may persist until late summer. Snowpacks are deep and late-lying, and summers are cool. Frost is possible almost all summer and may be common in restricted topographic basins and benches. Elevations typically range from 2875-3355m.(9500-11000ft).

### Vegetation Description

The overstory is typically dominated by Engelmann spruce and/or subalpine fir. Other tree species may include lodgepole pine, aspen, limber pine, bristlecone pine, and Douglas-fir. Cork bark fir occurs in the southern part of the zone. Pinus contorta may be common in some areas. Populous tremuloides may also occur.

*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100+ year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement severity.

### Disturbance Description

Disturbance includes occasional blow-down, insect outbreaks and stand-replacing fire. Fire Regime Groups V and IV: Primarily long-interval (eg, 150-300yr) stand replacement fires, with minor amount of terrain influenced by moderately long-interval (eg, 50-100yr) mixed severity fires. Disturbances also include insect/disease and windthrow events.

### Adjacency or Identification Concerns

Most similar to 1056, Rocky Mountain Subalpine Mesic Spruce-Fir Forest and Woodland.

### Native Uncharacteristic Conditions

### Scale Description

Patch sizes vary but are mostly in the hundreds of acres, with occasional very large patches (disturbances) in the thousands of acres. There may be frequent small disturbances in the 10s of acres or less.

### Issues/Problems

### Comments

Based on the model for the same BpS in MZ28. 1055 is based on original Rapid Assessment model R3SPFI, Jim Griffin (jgriffin01@fs.fed.us).

As a result of final QC for LANDFIRE National by Kori Blankenship the user-defined min and max fire return intervals for mixed severity fire were deleted because they were not consistent with the modeled fire return interval for this fire severity type.

## Vegetation Classes

### Class A 15%

Early Development 1 All Structures

**Indicator Species* and Canopy Position**

| | |
|---|---|
| PIEN | All |
| ABLA | All |

**Structure Data (for upper layer lifeform)**

| | Min | Max |
|---|---|---|
| Cover | 0% | 100% |
| Height | Tree 0m | Tree 5m |
| Tree Size Class | Pole 5-9" DBH | |

☐ Upper layer lifeform differs from dominant lifeform.

**Upper Layer Lifeform**

- ☐ Herbaceous
- ☐ Shrub
- ☑ Tree

**Fuel Model** 1

**Description**

Early succession after moderately-long to long interval replacement fires.

### Class B 20%

Mid Development 1 Closed

**Indicator Species* and Canopy Position**

| | |
|---|---|
| PIEN | Upper |
| ABLA | Upper |

**Structure Data (for upper layer lifeform)**

| | Min | Max |
|---|---|---|
| Cover | 51% | 100% |
| Height | Tree 5.1m | Tree 10m |
| Tree Size Class | Medium 9-21"DBH | |

☐ Upper layer lifeform differs from dominant lifeform.

**Upper Layer Lifeform**

- ☐ Herbaceous
- ☐ Shrub
- ☑ Tree

**Fuel Model** 8

**Description**

Shade tolerant and mixed conifer saplings to poles (>60% canopy cover).

*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100+ year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement severity.

### *Class C* 15%

Mid Development 1 Open

**Indicator Species* and Canopy Position**

| | |
|---|---|
| PIEN | Upper |
| ABLA | Upper |

**Structure Data (for upper layer lifeform)**

| | *Min* | *Max* |
|---|---|---|
| *Cover* | 0% | 50% |
| *Height* | Tree 0m | Tree 10m |
| *Tree Size Class* | Medium 9-21"DBH | |

☐ Upper layer lifeform differs from dominant lifeform.

**Upper Layer Lifeform**

☐ Herbaceous
☐ Shrub
☑ Tree

**Fuel Model** 8

**Description**

Primarily moderately tolerant saplings to poles (1-6.9in dbh) and <50% canopy cover.

---

### *Class D* 20%

Late Development 1 Open

**Indicator Species* and Canopy Position**

| | |
|---|---|
| PIEN | Upper |
| ABLA | Upper |

**Structure Data (for upper layer lifeform)**

| | *Min* | *Max* |
|---|---|---|
| *Cover* | 0% | 50% |
| *Height* | Tree 10.1m | Tree 50m |
| *Tree Size Class* | Large 21-33"DBH | |

☐ Upper layer lifeform differs from dominant lifeform.

**Upper Layer Lifeform**

☐ Herbaceous
☐ Shrub
☑ Tree

**Fuel Model** 8

**Description**

Poles (5in+ dbh) and larger diameter moderately shade tolerant conifer species (<50% canopy cover) in small to moderate size patches, generally on south aspects.

---

### *Class E* 30%

Late Development 1 Closed

**Indicator Species* and Canopy Position**

| | |
|---|---|
| PIEN | Upper |
| ABLA | Upper |

**Structure Data (for upper layer lifeform)**

| | *Min* | *Max* |
|---|---|---|
| *Cover* | 51% | 100% |
| *Height* | Tree 10.1m | Tree 50m |
| *Tree Size Class* | Large 21-33"DBH | |

☐ Upper layer lifeform differs from dominant lifeform.

**Upper Layer Lifeform**

☐ Herbaceous
☐ Shrub
☑ Tree

**Fuel Model** 10

**Description**

Pole and larger diameter moderately to shade tolerant conifer species (>50% canopy cover), in moderate to large size patches, all aspects.

## *Disturbances*

*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100+ year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement severity.

**Fire Regime Group**:** IV

**Historical Fire Size (acres)**

Avg
Min
Max

**Sources of Fire Regime Data**

- [ ] Literature
- [ ] Local Data
- [x] Expert Estimate

| Fire Intervals | Avg FI | Min FI | Max FI | Probability | Percent of All Fires |
|---|---|---|---|---|---|
| Replacement | 205 | 150 | 300 | 0.004878 | 68 |
| Mixed | 435 | | | 0.002299 | 32 |
| Surface | | | | | |
| All Fires | 139 | | | 0.00719 | |

***Fire Intervals (FI):***

Fire interval is expressed in years for each fire severity class and for all types of fire combined (All Fires). Average FI is central tendency modeled. Minimum and maximum show the relative range of fire intervals, if known. Probability is the inverse of fire interval in years and is used in reference condition modeling. Percent of all fires is the percent of all fires in that severity class.

**Additional Disturbances Modeled**

- [x] Insects/Disease
- [x] Wind/Weather/Stress
- [ ] Native Grazing
- [x] Competition
- [ ] Other (optional 1)
- [ ] Other (optional 2)

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*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100+ year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement severity.

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*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100+ year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement severity.

# LANDFIRE Biophysical Setting Model

***Biophysical Setting:*** **1510560** **Rocky Mountain Subalpine Mesic-Wet Spruce-Fir Forest and Woodland**

☐ *This BPS is lumped with:*
☐ *This BPS is split into multiple models:*

## *General Information*

**Contributors** (also see the Comments field) **Date** 10/18/2005


| | | | |
|---|---|---|---|
| **Modeler 1** | Paul Langowksi | plangowski@fs.fed.us | **Reviewer** |
| **Modeler 2** | Dick Edwards | rsedwards@fs.fed.us | **Reviewer** |
| **Modeler 3** | Mike Babler | mbabler@tnc.org | **Reviewer** |


**Vegetation Type**

Forest and Woodland

**Map Zone**

15

**Model Zone**

☐ Alaska ☐ N-Cent.Rockies
☐ California ☐ Pacific Northwest
☐ Great Basin ☐ South Central
☐ Great Lakes ☐ Southeast
☐ Northeast ☐ S. Appalachians
☐ Northern Plains ☑ Southwest

**Dominant Species***

PIEN
ABLA

**General Model Sources**

☑ Literature
☐ Local Data
☑ Expert Estimate

### Geographic Range

CO, northern NM and parts of AZ and UT. Elevations typically range from 9500-11000ft.

### Biophysical Site Description

BpS occurs in the subalpine zone on gentle to moderately steep terrain (eg, 10-60% slope). Sites within this system are cold year-round, and precipitation is predominantly in the form of snow, which may persist until late summer. Snowpacks are deep and late-lying, and summers are cool. Frost is possible almost all summer and may be common in restricted topographic basins and benches.

### Vegetation Description

The overstory is typically dominated by Engelmann spruce and/or subalpine fir. Pinus contorta and Populous tremuloides do not occur.

### Disturbance Description

Fire Regimes V and IV: Primarily long-interval (eg, 150-300yr) stand replacement fires, with minor amount of terrain influenced by moderately long-interval (eg, 50-100yr) mixed severity fires. Disturbances also include insect/disease and windthrow events.

### Adjacency or Identification Concerns

Identical to 1055 but no POTR or PICO in this BpS.

### Native Uncharacteristic Conditions

### Scale Description

Patch sizes vary but are mostly in the hundreds of acres, with occasional very large patches (disturbances) in the thousands of acres. There may be frequent small disturbances in the 10s of acres or less.

*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100+ year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement severity.

### Issues/Problems

### Comments

This model is identical to the model for the same BpS in MZ28. The model was originally based on the Rapid Assessment model R3SPFI by J Griffin (jgriffin01@fs.fed.us). Fire regimes were changed from original model. Mike Babler made minor adjustments to class distributions to reflect VDDT output, class B: 15% to 20%, class D: 20% to 15%.

## Vegetation Classes

### Class A 10%

Early Development 1 All Structures

**Indicator Species* and Canopy Position**

| | |
|---|---|
| PIEN | All |
| ABLA | All |

**Structure Data (for upper layer lifeform)**

| | Min | Max |
|---|---|---|
| Cover | 0% | 100% |
| Height | Tree 0m | Tree 5m |
| Tree Size Class | Pole 5-9" DBH | |

☐ Upper layer lifeform differs from dominant lifeform.

**Upper Layer Lifeform**

- ☐ Herbaceous
- ☐ Shrub
- ☑ Tree

**Fuel Model** 1

**Description**

Early succession after moderately-long to long interval replacement fires.

### Class B 20%

Mid Development 1 Closed

**Indicator Species* and Canopy Position**

| | |
|---|---|
| PIEN | Upper |
| ABLA | Upper |

**Structure Data (for upper layer lifeform)**

| | Min | Max |
|---|---|---|
| Cover | 51% | 100% |
| Height | Tree 5.1m | Tree 10m |
| Tree Size Class | Medium 9-21"DBH | |

☐ Upper layer lifeform differs from dominant lifeform.

**Upper Layer Lifeform**

- ☐ Herbaceous
- ☐ Shrub
- ☑ Tree

**Fuel Model** 8

**Description**

Shade tolerant and mixed conifer saplings to poles (>50% canopy cover).

### Class C 20%

Mid Development 1 Open

**Indicator Species* and Canopy Position**

| | |
|---|---|
| PIEN | Upper |
| ABLA | Upper |

**Structure Data (for upper layer lifeform)**

| | Min | Max |
|---|---|---|
| Cover | 0% | 50% |
| Height | Tree 5.1m | Tree 10m |
| Tree Size Class | Medium 9-21"DBH | |

☐ Upper layer lifeform differs from dominant lifeform.

**Upper Layer Lifeform**

- ☐ Herbaceous
- ☐ Shrub
- ☑ Tree

**Fuel Model** 8

**Description**

Primarily moderately tolerant saplings to poles (1in-6.9in dbh) and <50% canopy cover.

*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100+ year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement severity.

### *Class D* 15%

Late Development 1 Open

**Upper Layer Lifeform**

- ☐ Herbaceous
- ☐ Shrub
- ☑ Tree

**Fuel Model** 8

**Indicator Species* and Canopy Position**

| | |
|---|---|
| PIEN | Upper |
| ABLA | Upper |

**Structure Data (for upper layer lifeform)**

| | *Min* | *Max* |
|---|---|---|
| *Cover* | 0% | 50% |
| *Height* | Tree 10.1m | Tree 50m |
| *Tree Size Class* | Large 21-33"DBH | |

☐ Upper layer lifeform differs from dominant lifeform.

**Description**

Poles (5in+ dbh) and larger diameter moderately shade tolerant conifer species (<50% canopy cover) in small to moderate size patches, generally on south aspects.

### *Class E* 35%

Late Development 1 Closed

**Upper Layer Lifeform**

- ☐ Herbaceous
- ☐ Shrub
- ☑ Tree

**Fuel Model** 10

**Indicator Species* and Canopy Position**

| | |
|---|---|
| PIEN | Upper |
| ABLA | Upper |

**Structure Data (for upper layer lifeform)**

| | *Min* | *Max* |
|---|---|---|
| *Cover* | 51% | 100% |
| *Height* | Tree 10.1m | Tree 50m |
| *Tree Size Class* | Large 21-33"DBH | |

☐ Upper layer lifeform differs from dominant lifeform.

**Description**

Pole and larger diameter moderately to shade tolerant conifer species (>50% canopy cover), in moderate to large size patches, all aspects.

## *Disturbances*

**Fire Regime Group**: IV**

**Historical Fire Size (acres)**

Avg
Min
Max

**Sources of Fire Regime Data**

- ☐ Literature
- ☐ Local Data
- ☑ Expert Estimate

**Fire Intervals**

| | *Avg FI* | *Min FI* | *Max FI* | *Probability* | *Percent of All Fires* |
|---|---|---|---|---|---|
| *Replacement* | 200 | | | 0.005 | 68 |
| *Mixed* | 435 | | | 0.002299 | 31 |
| *Surface* | | | | | |
| *All Fires* | 137 | | | 0.00731 | |

***Fire Intervals (FI):***

Fire interval is expressed in years for each fire severity class and for all types of fire combined (All Fires). Average FI is central tendency modeled. Minimum and maximum show the relative range of fire intervals, if known. Probability is the inverse of fire interval in years and is used in reference condition modeling. Percent of all fires is the percent of all fires in that severity class.

**Additional Disturbances Modeled**

- ☑ Insects/Disease
- ☑ Wind/Weather/Stress
- ☐ Native Grazing
- ☑ Competition
- ☐ Other (optional 1)
- ☐ Other (optional 2)

## *References*


DeVelice, R.L., et al. 1986. A Classification of Forest Habitat Types of Northern New Mexico and Southern Colorado. USDA Forest Service. Rocky Mountain Forest and Range Experiment Station. GTR RM-131.

Komarkova, V., et al. 1988. Forest Vegetation of the Gunnison and Parts of the Uncompahgre National


*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100+ year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement severity.

Forests: A Preliminary Habitat Type Classification. USDA Forest Service, Rocky Mountain Forest and Range Experiment Station. GTR RM-163.

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

*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100+ year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement severity.

# LANDFIRE Biophysical Setting Model

***Biophysical Setting:*** **1510570** **Rocky Mountain Subalpine-Montane Limber-Bristlecone Pine Woodland**

☐ *This BPS is lumped with:*
☐ *This BPS is split into multiple models:*

## *General Information*

**Contributors** (also see the Comments field) **Date** 10/18/2005

| | | | |
|---|---|---|---|
| **Modeler 1** | Bruce Short | bshort@fs.fed.us | **Reviewer** |
| **Modeler 2** | Stan Kitchen | skitchen@fs.fed.us | **Reviewer** |
| **Modeler 3** | Linda Chappell | lchappell@fs.fed.us | **Reviewer** |

**Vegetation Type**

Forest and Woodland

**Map Zone**

15

**Model Zone**

☐ Alaska ☐ N-Cent.Rockies
☐ California ☐ Pacific Northwest
☐ Great Basin ☐ South Central
☐ Great Lakes ☐ Southeast
☐ Northeast ☐ S. Appalachians
☐ Northern Plains ☑ Southwest

**Dominant Species***

PIAR
PIFL2
FEAR
FETH

**General Model Sources**

☑ Literature
☐ Local Data
☑ Expert Estimate

### Geographic Range

Occurs throughout the Rocky Mountains. This is a high elevation system, ranging from 2485-3485m, mid to upper slopes. The areas are typically in rain shadows, and are the dry, cold extent of tree cover. Stands occur on thin, stony soils on high windswept ridges and open slopes with minimal ground cover.

### Biophysical Site Description

Elevation ranges from 2485-3485m, mid to upper slopes. The areas are typically in rain shadows, and are the dry, cold extent of tree cover. Stands occur on thin, stony soils on high windswept ridges and open slopes with minimal ground cover.

### Vegetation Description

Pinus flexilis dominates, with Pinus aristata in southern CO, into NM. There can be Picea engelmannii and limited Pseudotsuga menziesii in the stands. Sparse understories of forbs, grass and short shrubs form an understory. Seed dispersal of limber and bristlecone pines highly dependent on seed-caching birds.

### Disturbance Description

This group contains some of the oldest trees in the area, with Pinus longaeva 1000yrs old or more and Pinus flexilis ages of 500yrs+. Understories are often sparse, with little to carry fires across the surface. Fire occurrence is typically low frequency and surface fires (mean FRI of 200yrs). In the absence of wind, fires are likely limited in extent (2ac or less). Stand replacement fires (mean FRI of 500yrs) are usually wind-driven, especially in classes C and D. Susceptible to bark beetles (especially Pinus flexilis), but generally drought-tolerant.

### Adjacency or Identification Concerns

*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100+ year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement severity.

### Native Uncharacteristic Conditions

Tree cover >60% can be considered uncharacteristic for this woodland type.

### Scale Description

Stands vary from tens to thousands of acres in size. Stand replacement fires of 1/10th acres to 100s of acres have been experienced.

### Issues/Problems

Similar to Great Basin model. A new uncharacteristic disturbance is the potential for the introduction of white pine blister rust in both of these species. Blister rust is not occurring yet in the Utah High Plateau or western Great Basin.

### Comments

This model is based on the Rapid Assessment model R3BCLP (by Bruce Short), and the LANDFIRE (LF) model 1020 for MZ16, MZ23 and MZ24. Refined geographic range and vegetation description to fit MZ15. Also changed % in classes to represent model output: B 30 to 35%, C 55 to 50%. Structure data modified to meet new LF standards.

## Vegetation Classes

### *Class A* 15%

Early Development 1 Open

**Upper Layer Lifeform**

- ☐ Herbaceous
- ☐ Shrub
- ☑ Tree

**Fuel Model** 6

**Indicator Species* and Canopy Position**

| | |
|---|---|
| PIFL2 | All |
| PILO | All |

**Structure Data (for upper layer lifeform)**

| | *Min* | *Max* |
|---|---|---|
| *Cover* | 0% | 60% |
| *Height* | Tree 0m | Tree 5m |
| *Tree Size Class* | Seedling <4.5ft | |

☐ Upper layer lifeform differs from dominant lifeform.

**Description**

Bare ground and talus with sparse ground cover of forbs, grasses and low shrubs. Occasional old survivors may be present. Infrequent stand replacement fires (mean FRI of 500yrs) may occur. Surface fire (mean FRI of 200yrs) and weather-related stress affect this class. Succession to class B after 100yrs.

---

### *Class B* 35%

Mid Development 1 Open

**Upper Layer Lifeform**

- ☐ Herbaceous
- ☐ Shrub
- ☑ Tree

**Fuel Model** 6

**Indicator Species* and Canopy Position**

| | |
|---|---|
| PIFL2 | Upper |
| PILO | Upper |

**Structure Data (for upper layer lifeform)**

| | *Min* | *Max* |
|---|---|---|
| *Cover* | 0% | 60% |
| *Height* | Tree 5.1m | Tree 10m |
| *Tree Size Class* | Pole 5-9" DBH | |

☐ Upper layer lifeform differs from dominant lifeform.

**Description**

Open woodland with typically <40% crown closure of seedlings, saplings, and survivors. The only disturbances are surface and replacement fires with the same FRIs as in class A. Succession to class C after 150yrs.

---

*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
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### *Class C* 50%

Late Development 1 Open

**Indicator Species* and Canopy Position**

PIFL2 Upper
PILO Upper

**Structure Data (for upper layer lifeform)**

| | Min | Max |
|---|---|---|
| *Cover* | 0% | 60% |
| *Height* | Tree 10.1m | Tree 25m |
| *Tree Size Class* | Medium 9-21"DBH | |

☐ Upper layer lifeform differs from dominant lifeform.

**Upper Layer Lifeform**

☐ Herbaceous
☐ Shrub
☑ Tree

**Fuel Model** 6

**Description**

Open woodland with typically <40% crown cover of mixed diameters - 40in dbh to seedling. Sparse ground cover of grasses and low shrubs. Very old trees can develop in this class. Fire as in previous classes.

### *Class D* 0%

[Not Used] [Not Used]

**Indicator Species* and Canopy Position**

**Structure Data (for upper layer lifeform)**

| | Min | Max |
|---|---|---|
| *Cover* | % | % |
| *Height* | | |
| *Tree Size Class* | | |

☐ Upper layer lifeform differs from dominant lifeform.

**Upper Layer Lifeform**

☐ Herbaceous
☐ Shrub
☐ Tree

**Fuel Model**

**Description**

### *Class E* 0%

[Not Used] [Not Used]

**Indicator Species* and Canopy Position**

**Structure Data (for upper layer lifeform)**

| | Min | Max |
|---|---|---|
| *Cover* | % | % |
| *Height* | | |
| *Tree Size Class* | | |

☐ Upper layer lifeform differs from dominant lifeform.

**Upper Layer Lifeform**

☐ Herbaceous
☐ Shrub
☐ Tree

**Fuel Model**

**Description**

## *Disturbances*

**Fire Regime Group**:** III

**Historical Fire Size (acres)**

Avg 5
Min 1
Max 1000

**Sources of Fire Regime Data**

☑ Literature
☑ Local Data
☑ Expert Estimate

**Fire Intervals**

| | *Avg FI* | *Min FI* | *Max FI* | *Probability* | *Percent of All Fires* |
|---|---|---|---|---|---|
| *Replacement* | 500 | | | 0.002 | 29 |
| *Mixed* | | | | | |
| *Surface* | 200 | | | 0.005 | 71 |
| *All Fires* | 143 | | | 0.00701 | |

***Fire Intervals (FI):***

Fire interval is expressed in years for each fire severity class and for all types of fire combined (All Fires). Average FI is central tendency modeled. Minimum and maximum show the relative range of fire intervals, if known. Probability is the inverse of fire interval in years and is used in reference condition modeling. Percent of all fires is the percent of all fires in that severity class.

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**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100+ year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement severity.

**Additional Disturbances Modeled**

- ☐ Insects/Disease
- ☑ Wind/Weather/Stress
- ☐ Native Grazing
- ☐ Competition
- ☐ Other (optional 1)
- ☐ Other (optional 2)

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**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100+ year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement severity.

# LANDFIRE Biophysical Setting Model

## *Biophysical Setting:* 1510610 Inter-Mountain Basins Aspen-Mixed Conifer Forest and Woodland

☐ *This BPS is lumped with:*
☐ *This BPS is split into multiple models:*

## *General Information*

**Contributors** (also see the Comments field) **Date** 10/18/2005


| | | | |
|---|---|---|---|
| **Modeler 1** | Mike Manthei | mmanthei@fs.fed.us | **Reviewer** |
| **Modeler 2** | Rory Steinke | rsteinke@fs.fed.us | **Reviewer** |
| **Modeler 3** | JackTriepke | jtriepke@fs.fed.us | **Reviewer** |


**Vegetation Type**

Forest and Woodland

**Map Zone**

15

**Model Zone**

☐ Alaska ☐ N-Cent.Rockies
☐ California ☐ Pacific Northwest
☐ Great Basin ☐ South Central
☐ Great Lakes ☐ Southeast
☐ Northeast ☐ S. Appalachians
☐ Northern Plains ☑ Southwest

**Dominant Species***

POTR
PIPO
PICO
PSME

**General Model Sources**

☑ Literature
☑ Local Data
☑ Expert Estimate

### Geographic Range

This is typically found in NV, UT, CA, AZ, NM, CO, ID, WY, MT and eastern OR.

### Biophysical Site Description

This type typically occurs on flat to steep terrain (<80%) on all aspects. Elevation generally ranges from 2000-2400m. Soils are highly variable, but generally cool. This type occurs above the pinyon-juniper and/or sagebrush, but below the spruce-fir zone.

### Vegetation Description

As a species, 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 and Pinus ponderosa. Conifers are usually <25% relative tree cover. Where it is adjacent to conifer, an occasional conifer seedling may occur, but do not drive the fire regime. Conifers may include Abies concolor, Abies lasiocarpa, Pinus ponderosa, Pinus strobiformis and Pseudotsuga menziesii.

Common shrubs may include: Amelanchier alnifolia, Juniperus communis, Mahonia repens, Sheppherdia ccanadensis, Symphoricarpos oreophilus, Symphoricarpos orbiculatus and Vaccinium spp. The herbaceous layers may be lush and diverse. Graminoids may include Bromus carinatur, Calamagrostis rubensens, Carex geyeri, Carex rossii, Elymus glaucus and Elymus trachycaulus. Forbs may include Achillea millefilium, Eucephalus engelmannii, Delphimium spp, Geranium viscosissimum, Lupinus argenteus and many others. The herbaceous layers may be lush and diverse.

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## Disturbance Description

This is a strongly fire adapted forest type with mean fire intervals vary from 10-30yrs based on biophysical variation. According to Baker (1925), who most closely studied the historic condition, the FRI for replacement fire was 20-40yrs (min-max). Baker's mean FRI for mixed severity fire was 10-20yrs (min-max). A mean FRI of 13yrs was used in all development classes. 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.

## Adjacency or Identification Concerns

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

This BpS is characterized by a shorter FRI 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 w/mixed conifers for high elevation model (1055) should be considered.

## 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.

## Scale Description

This type occurs in a landscape mosaic from moderate to large sized patches.

## Issues/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 & 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, Wyoming 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 FRIs longer than those noted by Baker (1925), who actually studied the historic condition. The FRIs used here were a compromise: 1) the longer FRIs were

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used for the oldest development states and 2) the maximum FRI of Baker (1925) was used for stands <80yrs that were being encroached by lower elevation conifers.

### Comments

This model was developed at a workshop in Flagstaff, 7/13/2005. Additional modelers included Linda Wadleigh, lwadleigh@fs.fed.us; George Robertson,grobertson@fs.fed.us; Deb Bumpus, dbumpus@fs.fed.us; Ed Smith, esmith@tnc.org. It was based on a model by Linda Chappell, lchappel@fs.fed.us, Stan Kitchen, skitchen@fs.fed.us, Charles Hay, ckay@hass.usu.edu, Beth Corbin (ecorbin@fs.fed.us) and Bob Campbell (rbcampbell@fs.fed.us). This BpS is closely based on the Rapid Assessment model R2ASMClw (Aspen w/mixed conifer Low to Mid Elev) developed by Linda Chappell (lchappell@fs.fed.us), Bob Campbell (rbcampbell@fs.fed.us), and Cheri Howell (chowell02@fs.fed.us). Reviewers of R2ASMClw were Krista Gollnick-Wade & Sarah Heidi (Krista_Waid@blm.gov), Charles Kay (ckay@hass.usu.edu), and Wayne Shepperd (wshepperd@fs.fed.us). Minor changes were made to the Geographic Ranges, Vegetation Description, and Biophysical Site descriptions.

Final quality control for MZ15 resulted in elimination of a VDDT rule (use of min/max age) with no change to model results.

As a result of final QC for LANDFIRE National by Kori Blankenship the user-defined min and max fire return intervals for mixed severity fire were deleted because they were not consistent with the modeled fire return interval for this fire severity type.

## Vegetation Classes

### Class A 60%

Early Development 1 All Structures

**Indicator Species* and Canopy Position**

POTR5 Upper

**Structure Data (for upper layer lifeform)**

| | Min | Max |
|---|---|---|
| Cover | 0% | 100% |
| Height | Tree 0m | Tree 5m |
| Tree Size Class | Sapling >4.5ft; <5"DBH | |

☐ Upper layer lifeform differs from dominant lifeform.

**Upper Layer Lifeform**

- ☐ Herbaceous
- ☐ Shrub
- ☑ Tree

**Fuel Model** 4

**Description**

Grass/forb and aspen suckers and saplings. Generally, this is expected to occur 1-40yrs post-disturbance. The mean FRI for replacement fire is 40yrs. Mixed severity fire occurs with a MFRI of 13yrs. Succession to class B after 40yrs.

### Class B 25%

Mid Development 1 Closed

**Indicator Species* and Canopy Position**

POTR5 Upper

**Structure Data (for upper layer lifeform)**

| | Min | Max |
|---|---|---|
| Cover | 21% | 100% |
| Height | Tree 5.1m | Tree 10m |
| Tree Size Class | Pole 5-9" DBH | |

☐ Upper layer lifeform differs from dominant lifeform.

**Upper Layer Lifeform**

- ☐ Herbaceous
- ☐ Shrub
- ☑ Tree

**Fuel Model** 6

**Description**

Canopy cover is highly variable. Conifers can invade. The stand is composed of 80% aspen, up to 10 % conifers. The FRI of 40yrs was used for replacement fire. Mixed severity fire (mean FRI of 13yrs) maintains vegetation in class B. Succession to class D after 40yrs. An alternate successional path causes a transition to

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class C.

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### *Class C* 4%

Mid Development 2 Closed

**Indicator Species* and Canopy Position**

| | |
|---|---|
| POTR5 | Upper |

**Structure Data (for upper layer lifeform)**

| | *Min* | *Max* |
|---|---|---|
| *Cover* | 21% | 100% |
| *Height* | Tree 10.1m | Tree 25m |
| *Tree Size Class* | Medium 9-21"DBH | |

☐ Upper layer lifeform differs from dominant lifeform.

**Upper Layer Lifeform**

- ☐ Herbaceous
- ☐ Shrub
- ☑ Tree

**Fuel Model** 8

**Description**

Aspen 5-16in. This is a pure aspen stage. Mixed aspen overstory dominance. Replacement fire has a mean FRI of 60yrs. Mixed severity fire (mean FRI of 13yrs) maintains aspen structure. An insect/disease disturbance about every 200yrs will set it back to class B by killing the larger stems. Succession keeps vegetation in class C.

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### *Class D* 10%

Late Development 1 All Structures

**Indicator Species* and Canopy Position**

| | |
|---|---|
| POTR5 | Upper |
| PIPO | Mid-Upper |
| PSEUD7 | Mid-Upper |

**Structure Data (for upper layer lifeform)**

| | *Min* | *Max* |
|---|---|---|
| *Cover* | 0% | 40% |
| *Height* | Tree 5.1m | Tree 25m |
| *Tree Size Class* | Medium 9-21"DBH | |

☐ Upper layer lifeform differs from dominant lifeform.

**Upper Layer Lifeform**

- ☐ Herbaceous
- ☐ Shrub
- ☑ Tree

**Fuel Model** 10

**Description**

Aspen 5-16in dominate with conifer understory up to co-dominance: 80% aspen overstory. Conifers (eg, ponderosa pine) are assumed more resistant to fire than aspen and will likely cause the progressive suppression of aspen. Mix severity fire keeps this stand open, kills young conifers and maintains aspen: every 13yrs. Replacement fire is every 60yrs. Succession to class E after 70yrs.

---

### *Class E* 1%

Late Development 1 Closed

**Indicator Species* and Canopy Position**

| | |
|---|---|
| PIPO | Upper |
| PICO | Upper |
| PSME | Upper |
| POTR5 | Mid-Upper |

**Structure Data (for upper layer lifeform)**

| | *Min* | *Max* |
|---|---|---|
| *Cover* | 41% | 80% |
| *Height* | Tree 5.1m | Tree 25m |
| *Tree Size Class* | Large 21-33"DBH | |

☐ Upper layer lifeform differs from dominant lifeform.

**Upper Layer Lifeform**

- ☐ Herbaceous
- ☐ Shrub
- ☑ Tree

**Fuel Model** 10

**Description**

Conifers dominate at 150yrs+. Aspen over 16in, mixed conifer mixed sizes and main overstory is conifers. Greater than 50% conifer in the overstory. Mean FRI for replacement fire is every 60yrs. Both mixed severity fire (mean FRI of 13yrs) and insects/diseases every 300yrs on average cause a transition to class D. Succession maintains conifer dominance in class E.

## *Disturbances*

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**Fire Regime Group**:** I

**Historical Fire Size (acres)**

Avg 10
Min 1
Max 100

**Sources of Fire Regime Data**

- [x] Literature
- [x] Local Data
- [x] Expert Estimate

**Additional Disturbances Modeled**

- [x] Insects/Disease
- [ ] Wind/Weather/Stress
- [ ] Native Grazing
- [ ] Competition
- [ ] Other (optional 1)
- [ ] Other (optional 2)

| Fire Intervals | Avg FI | Min FI | Max FI | Probability | Percent of All Fires |
|---|---|---|---|---|---|
| Replacement | 43 | 25 | 50 | 0.023256 | 23 |
| Mixed | 13 | | | 0.076923 | 77 |
| Surface | | | | | |
| All Fires | 10 | | | 0.10019 | |

***Fire Intervals (FI):***

Fire interval is expressed in years for each fire severity class and for all types of fire combined (All Fires). Average FI is central tendency modeled. Minimum and maximum show the relative range of fire intervals, if known. Probability is the inverse of fire interval in years and is used in reference condition modeling. Percent of all fires is the percent of all fires in that severity class.

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# LANDFIRE Biophysical Setting Model

## *Biophysical Setting:* 1510640 Colorado Plateau Mixed Low Sagebrush Shrubland

☐ *This BPS is lumped with:*
☐ *This BPS is split into multiple models:*

## *General Information*

**Contributors** (also see the Comments field) **Date** 10/18/2005


**Modeler 1** Louis Provencher lprovencher@tnc.org **Reviewer** Tim Christiansen tchristiansen@tnc.org
**Modeler 2** **Reviewer**
**Modeler 3** **Reviewer**


**Vegetation Type**
Upland Shrubland

**Map Zone**
15

**Model Zone**
☐ Alaska ☐ N-Cent.Rockies
☐ California ☐ Pacific Northwest
☐ Great Basin ☐ South Central
☐ Great Lakes ☐ Southeast
☐ Northeast ☐ S. Appalachians
☐ Northern Plains ☑ Southwest

**Dominant Species***

| | |
|---|---|
| ARNO4 | BOGR2 |
| ARBI3 | HECO26 |
| ACHY | PLJA |
| ARPU9 | ERIOG |

**General Model Sources**
☑ Literature
☐ Local Data
☑ Expert Estimate

### Geographic Range
BpS occurs in the Colorado Plateau, Tavaputs Plateau and Uinta Basin. Also extends across northern NM into the southern Great Plains.

### Biophysical Site Description
Occurs in canyons, gravelly draws, hilltops and dry flats at elevations below 1800m. Soils are often rocky, shallow and alkaline. Found on limestone ridges in northern New Mexico and southern Great Plains. Black sagebrush (Artemisia nova) tends to grow where either a calcareous or volcanic cement layer exists in the soil profile.

### Vegetation Description
Open shrublands dominated by Artemisia nova or Artemesia bigelovii sometimes with Artemesia tridentata ssp. wyomingensis co-dominant. Generally have relatively low fuel loads with low growing and cushion forbs and scattered semi-arid grasses such as Achnatherum hymenoides, Aristida purpurea, Boutela gracilis, Hesperostipa comata, Pleuraphis jamesii or Poa fendleriana. Graminoid layer will often have over 25% cover. Forbs often include buckwheats (Eriogonum spp), fleabanes (Erigeron spp), phloxs (Phlox spp), paintbrushes (Castilleja spp), globemallows (Sphaeralcea spp) and lupines (Lupinus spp).

### Disturbance Description
Black sagebrush generally supports more fire than other dwarf sagebrushes. This type generally burns with mixed severity (average FRI of 100-140yrs) due to relatively low fuel loads and herbaceous cover. Bare ground acts as a micro-barrier to fire between low stature shrubs. Oils and resins present in the foliage and stems of sagebrush allow fire to spread. Stand-replacing fires (average FRI of 200-240yrs) can occur in this type when successive years of above average precipitation are followed by an average or dry year. Stand replacement fires dominate in the late succession class where the herbaceous component has diminished.

*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100+ year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement severity.

Fires may or may not be wind driven and only cover small areas. This type fits into Fire Regime Groups IV and III.

Grazing by wild ungulates occurs in this type due to the high palatability of A. nova compared to other browse. Native browsing tends to open up the canopy cover of shrubs but does not often change the succession stage.

Prolonged drought may reduce the foliar and basal covers of graminoids but not that of shrubs. Reduced foliar cover of graminoids will affect fire behavior. This effect is assumed minor and not included in the model.

### Adjacency or Identification Concerns

The dwarf sagebrush type tends to occur adjacent to Wyoming big sagebrush. The dwarf sagebrush types create a mosaic within the Wyoming big sagebrush, acting as a fire break that burns only under severe conditions.

### Native Uncharacteristic Conditions

### Scale Description

Disturbance patch size for this type is not well known but is estimated to be 10s to 100s of acres due to the relatively small proportion of the sagebrush matrix it occupies and the limited potential for fire spread.

### Issues/Problems

### Comments

This model is identical to the model for the same BpS in MZ16, MZ23 and MZ24. The model for this BpS and description were largely based on the Rapid Assessment PNVG R2SBDW developed by Sarah Heide (Sarah_Heide@blm.gov) and Gary Medlyn (gmedlyn@nv.blm.gov) for dwarf sagebrushes. Reviewers of R2SDDW were Michael Zielinski (mike_zielinski@nv.blm.gov), Gary Back (gback@srk.com) and Paul Tueller (ptt@intercomm.com).

## *Vegetation Classes*

***Class A*** **10%**

Early Development 1 All Structures

**Upper Layer Lifeform**

- ☑ Herbaceous
- ☐ Shrub
- ☐ Tree

**Fuel Model** 1

**Indicator Species* and Canopy Position**

| | |
|---|---|
| ACHY | Lower |
| BOGR2 | Lower |
| ARNO4 | Upper |
| ARBI3 | Upper |

**Structure Data (for upper layer lifeform)**

| | *Min* | *Max* |
|---|---|---|
| *Cover* | 0% | 50% |
| *Height* | Herb 0m | Herb >1.1m |
| *Tree Size Class* | No Data | |

☑ Upper layer lifeform differs from dominant lifeform.

Scattered sagebrush recovering. Dominant vegetation is bunch grasses.

**Description**

Early seral community dominated by herbaceous vegetation; less than six percent sagebrush canopy cover; up to 24yrs post-disturbance. Replacement fire occurs every 250yrs on average. Succession to B after 24yrs.

*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100+ year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement severity.

### *Class B* 70%

Late Development 1 Open

**Upper Layer Lifeform**

- ☐ Herbaceous
- ☑ Shrub
- ☐ Tree

**Fuel Model** 2

**Indicator Species* and Canopy Position**

| | |
|---|---|
| ARNO4 | Upper |
| ARBI3 | Upper |
| ACHY | Lower |
| BOGR2 | Lower |

**Structure Data (for upper layer lifeform)**

| | *Min* | *Max* |
|---|---|---|
| *Cover* | 0% | 10% |
| *Height* | Shrub 0m | Shrub 0.5m |
| *Tree Size Class* | No data | |

☐ Upper layer lifeform differs from dominant lifeform.

**Description**

Mid-seral community with a mixture of herbaceous and shrub vegetation; 6-10% sagebrush canopy cover present; between 20-59 years post-disturbance. Replacement fire (FRI of 240yrs) causes a transition to A, whereas mixed severity fire (FRI of 100yrs) maintains the site in its present condition. In the absence of fire for 120yrs, the site will follow an alternative succession path to class C. Otherwise, succession and mixed severity fire keeps site in class B.

---

### *Class C* 20%

Late Development 1 Closed

**Upper Layer Lifeform**

- ☐ Herbaceous
- ☑ Shrub
- ☐ Tree

**Fuel Model** 2

**Indicator Species* and Canopy Position**

| | |
|---|---|
| ARNO4 | Upper |
| ARBI3 | Upper |
| ACHY | Lower |
| BOGR2 | Lower |

**Structure Data (for upper layer lifeform)**

| | *Min* | *Max* |
|---|---|---|
| *Cover* | 11% | 30% |
| *Height* | Shrub 0m | Shrub 0.5m |
| *Tree Size Class* | No data | |

☐ Upper layer lifeform differs from dominant lifeform.

**Description**

Late seral community with a mixture of herbaceous and shrub vegetation; >10% sagebrush canopy cover present; 75yrs+ post-disturbance. Replacement fire is every 200yrs on average (transition to A), whereas mixed severity fire happens on average every 140yrs due to a diminished herbaceous component compared to class B. Mixed severity fire causes a transition to B. Succession will keep the site in class C without fire.

---

### *Class D* 0%

[Not Used] [Not Used]

**Upper Layer Lifeform**

- ☐ Herbaceous
- ☐ Shrub
- ☐ Tree

**Fuel Model**

**Indicator Species* and Canopy Position**

**Structure Data (for upper layer lifeform)**

| | *Min* | *Max* |
|---|---|---|
| *Cover* | % | % |
| *Height* | | |
| *Tree Size Class* | | |

☐ Upper layer lifeform differs from dominant lifeform.

**Description**

---

### *Class E* 0%

[Not Used] [Not Used]

**Upper Layer Lifeform**

- ☐ Herbaceous
- ☐ Shrub
- ☐ Tree

**Fuel Model**

**Indicator Species* and Canopy Position**

**Structure Data (for upper layer lifeform)**

| | *Min* | *Max* |
|---|---|---|
| *Cover* | % | % |
| *Height* | | |
| *Tree Size Class* | | |

☐ Upper layer lifeform differs from dominant lifeform.

---

*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100+ year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement severity.

**Description**

## Disturbances

**Fire Regime Group**:** III

**Historical Fire Size (acres)**

Avg 50
Min 10
Max 100

**Sources of Fire Regime Data**

- [x] Literature
- [ ] Local Data
- [x] Expert Estimate

| Fire Intervals | Avg FI | Min FI | Max FI | Probability | Percent of All Fires |
|---|---|---|---|---|---|
| Replacement | 238 | 100 | 240 | 0.004202 | 33 |
| Mixed | 119 | 75 | 140 | 0.008403 | 67 |
| Surface | | | | | |
| All Fires | 79 | | | 0.01262 | |

***Fire Intervals (FI):***
Fire interval is expressed in years for each fire severity class and for all types of fire combined (All Fires). Average FI is central tendency modeled. Minimum and maximum show the relative range of fire intervals, if known. Probability is the inverse of fire interval in years and is used in reference condition modeling. Percent of all fires is the percent of all fires in that severity class.

**Additional Disturbances Modeled**

- [ ] Insects/Disease
- [ ] Wind/Weather/Stress
- [ ] Native Grazing
- [ ] Competition
- [ ] Other (optional 1)
- [ ] Other (optional 2)

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*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100+ year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement severity.

# LANDFIRE Biophysical Setting Model

## *Biophysical Setting:* 1510750 Chihuahuan Mixed Salt Desert Scrub

☐ *This BPS is lumped with:*
☐ *This BPS is split into multiple models:*

## *General Information*

**Contributors** (also see the Comments field) **Date** 10/18/2005


| | | | | | |
|---|---|---|---|---|---|
| **Modeler 1** | Mike Babler | mbabler@tnc.org | **Reviewer** | Keith Schulz | Keith_Schulz@nature serve.org |
| **Modeler 2** | | | **Reviewer** | | |
| **Modeler 3** | | | **Reviewer** | | |


**Vegetation Type**

Upland Savannah/Shrub Steppe

**Map Zone**

15

**Model Zone**

☐ Alaska ☐ N-Cent.Rockies
☐ California ☐ Pacific Northwest
☐ Great Basin ☐ South Central
☐ Great Lakes ☐ Southeast
☐ Northeast ☐ S. Appalachians
☐ Northern Plains ☑ Southwest

**Dominant Species***

| | |
|---|---|
| ATCA2 | FLCE |
| ATOB | ALLEN |
| ATPO | SALIC |
| LATR2 | SUAED |

**General Model Sources**

☑ Literature
☐ Local Data
☐ Expert Estimate

### Geographic Range

Shrublands of typically saline basins in the Chihuahuan Desert.

### Biophysical Site Description

Saline basins in the Chihuahuan Desert. Stands often occur on alluvial flats and around playas. Substrates are generally fine-textured, saline soils.

### Vegetation Description

Vegetation is typically composed of one or more Atriplex species such as Atriplex canescens, Atriplex obovata or Atriplex polycarpa, along with species of Allenrolfea, Flourensia, Salicornia, Suaeda or other halophytic plants. Larrrea tridentata may be present but does not codominate. Graminoid species may include Sporobolus airoides, Pleuraphis mutica or Distichlis spicata at varying densities.

### Disturbance Description

Fourwing saltbush probably establishes primarily from seed after fire, with some populations also regenerating vegetatively. Live shrubs do not easily ignite. With a high ash content and a moderate to high salt content, fourwing saltbush resists burning. Historic fire regimes in desert shrublands are equally difficult to quantify, but on sparsely vegetated salt-desert types, fires were historically rare except under unusual circumstances.

### Adjacency or Identification Concerns

Fine fuels from alien annual grasses currently represent the most important fuelbed component in creosotebush scrub. Alien annual grasses can comprise 66-97% of the total annual biomass in this system.

Livestock grazing has contributed to the deterioration of this system.

*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100+ year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement severity.

### Native Uncharacteristic Conditions

Shrub cover >20% is uncharacteristic.

### Scale Description

### Issues/Problems

Fire ecology studies at the population level are badly needed for fourwing saltbush. Historic fire regimes in desert shrublands are difficult to quantify.

### Comments

Model is based on the Rapid Assessment model R2CRBU by Sandy Gregory, s50grego@nv.blm.gov.

## Vegetation Classes

### Class A 15%

Early Development 1 Open

**Upper Layer Lifeform**

- ☐ Herbaceous
- ☑ Shrub
- ☐ Tree

**Fuel Model** No D

**Indicator Species* and Canopy Position**

| | |
|---|---|
| ATCA2 | Upper |
| ATOB | |
| ATPO | Upper |
| | Upper |

**Structure Data (for upper layer lifeform)**

| | Min | Max |
|---|---|---|
| *Cover* | 0% | 20% |
| *Height* | Shrub 0m | Shrub 0.5m |
| *Tree Size Class* | No Data | |

☑ Upper layer lifeform differs from dominant lifeform.

Herbaceous species dominate with up to 40% cover.

**Description**

Characterized by low shrub cover. Little disturbance was considered in Class A, except for replacement fire every 300yrs on average. Under historic conditions, where invasive annual grasses are absent, the fire return interval is virtually non-existent except for areas near the base of mountains experiencing locally higher rainfall and fine fuel buildup from native annual. After 100yrs, class A transitions to B.

---

### Class B 85%

Late Development 1 Closed

**Upper Layer Lifeform**

- ☐ Herbaceous
- ☑ Shrub
- ☐ Tree

**Fuel Model** 1

**Indicator Species* and Canopy Position**

| | |
|---|---|
| ATCA2 | Upper |
| LATR2 | Upper |
| ATOB | Upper |
| ATPO | Upper |

**Structure Data (for upper layer lifeform)**

| | Min | Max |
|---|---|---|
| *Cover* | 0% | 20% |
| *Height* | Shrub 0.6m | Shrub 3.0m |
| *Tree Size Class* | No data | |

☑ Upper layer lifeform differs from dominant lifeform.

Herbaceous species dominate with up to 40% cover.

**Description**

Greater than 10% shrub cover and 20-40% grass and forb cover; associated with more productive soils. Less fine fuels are associated with this community, therefore the FRIs for replacement fire and mixed severity fire is 650yrs (min-max: 300-1000yrs). Wind/weather stress also affected this community on average every 80yrs, but did not cause a transition to class A.

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*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100+ year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement severity.

### *Class C* 0%

[Not Used] [Not Used]

**Upper Layer Lifeform**

- ☐ Herbaceous
- ☐ Shrub
- ☐ Tree

**Fuel Model**

**Description**

**Indicator Species* and Canopy Position**

**Structure Data (for upper layer lifeform)**

| | Min | Max |
|---|---|---|
| *Cover* | % | % |
| *Height* | | |
| *Tree Size Class* | | |

☐ Upper layer lifeform differs from dominant lifeform.

---

### *Class D* 0%

[Not Used] [Not Used]

**Upper Layer Lifeform**

- ☐ Herbaceous
- ☐ Shrub
- ☐ Tree

**Fuel Model**

**Description**

**Indicator Species* and Canopy Position**

**Structure Data (for upper layer lifeform)**

| | Min | Max |
|---|---|---|
| *Cover* | % | % |
| *Height* | | |
| *Tree Size Class* | | |

☐ Upper layer lifeform differs from dominant lifeform.

---

### *Class E* 0%

[Not Used] [Not Used]

**Upper Layer Lifeform**

- ☐ Herbaceous
- ☐ Shrub
- ☐ Tree

**Fuel Model**

**Description**

**Indicator Species* and Canopy Position**

**Structure Data (for upper layer lifeform)**

| | Min | Max |
|---|---|---|
| *Cover* | % | % |
| *Height* | | |
| *Tree Size Class* | | |

☐ Upper layer lifeform differs from dominant lifeform.

## *Disturbances*

**Fire Regime Group**: V**

**Historical Fire Size (acres)**

Avg
Min
Max

**Sources of Fire Regime Data**

- ☐ Literature
- ☐ Local Data
- ☐ Expert Estimate

**Fire Intervals**

| | Avg FI | Min FI | Max FI | Probability | Percent of All Fires |
|---|---|---|---|---|---|
| *Replacement* | 575 | | | 0.001739 | 55 |
| *Mixed* | 700 | | | 0.001429 | 45 |
| *Surface* | | | | | |
| *All Fires* | 316 | | | 0.00318 | |

***Fire Intervals (FI):***

Fire interval is expressed in years for each fire severity class and for all types of fire combined (All Fires). Average FI is central tendency modeled. Minimum and maximum show the relative range of fire intervals, if known. Probability is the inverse of fire interval in years and is used in reference condition modeling. Percent of all fires is the percent of all fires in that severity class.

**Additional Disturbances Modeled**

- ☐ Insects/Disease
- ☑ Wind/Weather/Stress
- ☐ Native Grazing
- ☐ Competition
- ☐ Other (optional 1)
- ☐ Other (optional 2)

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*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100+ year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement severity.

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*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100+ year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement severity.

# LANDFIRE Biophysical Setting Model

## *Biophysical Setting:* 1510770 Chihuahuan Succulent Desert Scrub

☐ *This BPS is lumped with:*
☐ *This BPS is split into multiple models:*

## *General Information*

**Contributors** (also see the Comments field) **Date** 10/18/2005


| | | | |
|---|---|---|---|
| **Modeler 1** | Mike Babler | mbabler@tnc.org | **Reviewer** |
| **Modeler 2** | Keith Schulz | Keith_Schulz@natureserve.org | **Reviewer** |
| **Modeler 3** | | | **Reviewer** |


**Vegetation Type**
Upland Shrubland

**Map Zone**
15

**Model Zone**
☐ Alaska ☐ N-Cent.Rockies
☐ California ☐ Pacific Northwest
☐ Great Basin ☐ South Central
☐ Great Lakes ☐ Southeast
☐ Northeast ☐ S. Appalachians
☐ Northern Plains ☑ Southwest

**Dominant Species***
AGLE OPSP2
FOSP2 DASYL
OPIM ECHIN3
OPEN3

**General Model Sources**
☑ Literature
☐ Local Data
☑ Expert Estimate

### Geographic Range
This ecological system is found in the Chihuahuan Desert.

### Biophysical Site Description
This system occurs on sparse rocky sites and on bare ground on colluvial slopes, upper bajadas, sideslopes, ridges, canyons, hills and mesas. Sites are hot and dry. Gravel and rock are often abundant on the ground surface

### Vegetation Description
Vegetation is characterized by the relatively high cover of succulent species such as Agave lechuguilla, Euphorbia antisyphilitica, Fouquieria splendens, Ferocactus spp, Opuntia engelmannii, Opuntia imbricata, Opuntia spinosior, Yucca baccata and many others. Perennial grass cover is generally low. The abundance of succulents is diagnostic of this desert scrub system, but scattered desert shrubs are usually present. This system does not include desert grasslands or shrub-steppe with a strong cacti component.

### Disturbance Description
Fire is extremely rare. Extended drought could set back to class A. Fire following several wet seasons may occur. Adjacent grassland or desert scrub may carry fire into this BpS. Fires in general are not prevalent over much of the range of ocotillo. Although desert vegetation rarely burns completely due to a lack of continuous fuels, unusually heavy winter rains may produce a cover of annual species dense enough to carry a fire when cured. Fires resulting from this situation tend to occur at the desert shrub-desert grassland ecotone, or in tobosa (Hilaria mutica) or sacaton (Sporobolus spp) swales, which are common habitats for ocotillo. Thomas has estimated that fire frequency in the Sonoran Desert is over 250yrs, but has cited references suggesting that fire intervals in adjacent desert grasslands may be as short as 3-40yrs.

*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100+ year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement severity.

### Adjacency or Identification Concerns

If there is a high canopy cover of perennial grasses (>20%), the system may be Apacherian Chihuahuan Semi-Desert Grassland and Steppe. These two types may be very difficult to detect via remote sensing.

### Native Uncharacteristic Conditions

If there is a high canopy cover of perennial grasses (>20%), the system may be Apacherian Chihuahuan Semi-Desert Grassland and Steppe. These two types may be very difficult to detect via remote sensing.

### Scale Description

Small patches, usually < 1.0ha, could be linear along rock ridges in bands.

### Issues/Problems

### Comments

Tim Christiansen, Esteban Muldavin should review.

## *Vegetation Classes*

### *Class A* 15%

Early Development 1 Open

**Upper Layer Lifeform**

- ☐ Herbaceous
- ☑ Shrub
- ☐ Tree

**Fuel Model** No D

**Indicator Species* and Canopy Position**

| | |
|---|---|
| AGLE | Upper |
| FOSP2 | Upper |

**Structure Data (for upper layer lifeform)**

| | *Min* | *Max* |
|---|---|---|
| *Cover* | 0% | 20% |
| *Height* | Shrub 0m | Shrub 0.5m |
| *Tree Size Class* | No Data | |

☐ Upper layer lifeform differs from dominant lifeform.

**Description**

Annual herbaceous vegetation, bare ground and rock. Seedling established. Stays in this class for 20yrs. Fire does not occur in this class.

---

### *Class B* 85%

Late Development 1 Closed

**Upper Layer Lifeform**

- ☐ Herbaceous
- ☑ Shrub
- ☐ Tree

**Fuel Model** 1

**Indicator Species* and Canopy Position**

| | |
|---|---|
| AGLE | Mid-Upper |
| FOSP2 | Upper |
| OPIM | Mid-Upper |
| DASYL | Mid-Upper |

**Structure Data (for upper layer lifeform)**

| | *Min* | *Max* |
|---|---|---|
| *Cover* | 0% | 20% |
| *Height* | Shrub 0.6m | Shrub 3.0m |
| *Tree Size Class* | No data | |

☐ Upper layer lifeform differs from dominant lifeform.

**Description**

Higher density of succulents. Agave reproducing. High moisture seasons may produce annual herbaceous vegetation. Fire is very unlikely.

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*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100+ year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement severity.

### *Class C* 0%

[Not Used] [Not Used]

**Upper Layer Lifeform**

- ☐ Herbaceous
- ☐ Shrub
- ☐ Tree

**Fuel Model**

**Description**

**Indicator Species* and Canopy Position**

**Structure Data (for upper layer lifeform)**

| | Min | Max |
|---|---|---|
| *Cover* | % | % |
| *Height* | | |
| *Tree Size Class* | | |

☐ Upper layer lifeform differs from dominant lifeform.

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### *Class D* 0%

[Not Used] [Not Used]

**Upper Layer Lifeform**

- ☐ Herbaceous
- ☐ Shrub
- ☐ Tree

**Fuel Model**

**Description**

**Indicator Species* and Canopy Position**

**Structure Data (for upper layer lifeform)**

| | Min | Max |
|---|---|---|
| *Cover* | % | % |
| *Height* | | |
| *Tree Size Class* | | |

☐ Upper layer lifeform differs from dominant lifeform.

---

### *Class E* 0%

[Not Used] [Not Used]

**Upper Layer Lifeform**

- ☐ Herbaceous
- ☐ Shrub
- ☐ Tree

**Fuel Model**

**Description**

**Indicator Species* and Canopy Position**

**Structure Data (for upper layer lifeform)**

| | Min | Max |
|---|---|---|
| *Cover* | % | % |
| *Height* | | |
| *Tree Size Class* | | |

☐ Upper layer lifeform differs from dominant lifeform.

## *Disturbances*

**Fire Regime Group**: V**

**Historical Fire Size (acres)**

Avg
Min
Max

**Sources of Fire Regime Data**

- ☑ Literature
- ☐ Local Data
- ☑ Expert Estimate

**Fire Intervals**

| | Avg FI | Min FI | Max FI | Probability | Percent of All Fires |
|---|---|---|---|---|---|
| *Replacement* | 350 | | | 0.002857 | 99 |
| *Mixed* | | | | | |
| *Surface* | | | | | |
| *All Fires* | 350 | | | 0.00288 | |

***Fire Intervals (FI):***
Fire interval is expressed in years for each fire severity class and for all types of fire combined (All Fires). Average FI is central tendency modeled. Minimum and maximum show the relative range of fire intervals, if known. Probability is the inverse of fire interval in years and is used in reference condition modeling. Percent of all fires is the percent of all fires in that severity class.

**Additional Disturbances Modeled**

- ☐ Insects/Disease
- ☑ Wind/Weather/Stress
- ☐ Native Grazing
- ☐ Competition
- ☐ Other (optional 1)
- ☐ Other (optional 2)

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*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100+ year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement severity.

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*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100+ year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement severity.

# LANDFIRE Biophysical Setting Model

## *Biophysical Setting:* 1510780 Colorado Plateau Blackbrush-Mormon-tea Shrubland

☐ *This BPS is lumped with:*
☐ *This BPS is split into multiple models:*

## *General Information*

**Contributors** (also see the Comments field) **Date** 10/18/2005


**Modeler 1** Matt Brooks matt_brooks@usgs.gov **Reviewer**
**Modeler 2** **Reviewer**
**Modeler 3** **Reviewer**


**Vegetation Type**
Upland Shrubland

**Map Zone**
15

**Model Zone**
☐ Alaska ☐ N-Cent.Rockies
☐ California ☐ Pacific Northwest
☐ Great Basin ☐ South Central
☐ Great Lakes ☐ Southeast
☐ Northeast ☐ S. Appalachians
☐ Northern Plains ☑ Southwest

**Dominant Species***

| | |
|---|---|
| CORA | LYAN |
| YUBR | JUOS |
| GUSA2 | ACHY |
| THMO | EPVI |

**General Model Sources**
☑ Literature
☐ Local Data
☑ Expert Estimate

### Geographic Range
Southwestern UT, western AZ and southeast NV.

### Biophysical Site Description
The blackbrush vegetation type is characterized by relatively high cover (50%) of low statured (50cm tall) evergreen woody shrubs. It occurs at the bioregional transition between the Mojave and Great Basin deserts, from CAthrough NV, AZ and UT. Blackbrush is typically found in the elevational zone from 1,220 to 1520m, above the creosotebush zone and below the interior chaparral or big sagebrush/pinyon-juniper zones.

Within the Mojave-Colorado plateau ecotone, blackbrush is found on dry slopes and benches above the river canyons of southern UT and northern AZ (Turner 1994). It is also found mid-slope on mountain ranges throughout this ecotone.

### Vegetation Description
Blackbrush is dominated by the type-species, Coloeogyne ramosissima (blackbrush), which can comprise 90-95% of the total plant cover (Shreve 1942). Cover of Coloeogyne ramosissima is highest on shallow, sandy soils with strong pretrocalcic (caliche) horizons, where it is the primary dominant plant species. Cover of Coleogyne ramosissima is lowest in deeper, silty soils or at its upper or lower ecotones, where it is co-dominant with other native species such as Larrea tridentata, Juniperus spp (juniper), Prunus fasciculata (desert almond), Lycium andersonii (Anderson wolfberry), Yucca brevifolia, Salazaria mexicana (bladder sage), Achnatherum spp and Pleuraphis spp. Dominant alien species include the annuals Bromus rubens, Bromus tectorum (cheatgrass) and Erodium cicutarium.

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**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100+ year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement severity.

## Disturbance Description

Coleogyne ramosissima is considered a poor livestock forage species. Ranchers noted that during the late 1930s and early 1940s wildfires increased production of livestock forage in blackbrush rangeland of southern Nevada and northwestern Arizona (Anonymous, 1945). In an attempt to further increase forage production, ranchers and the Bureau of Land Management (BLM) began a program of prescribed burning in the 1940s, during which time approximately 20% of the 400000ac of blackbrush were burned by prescribed fire or wildfire in southern NV (BLM, Las Vegas, Nevada, grazing district 5) (Croft 1950). Many blackbrush fires also occurred in northwestern AZ during this time (BLM, Arizona Strip, Arizona, grazing district 2). Additional blackbrush burning likely occurred at least through the 1960s, because a policy review during that time by the Range and Forestry Officer of the BLM in NV recommended that blackbrush burning be continued for purposes of increasing livestock forage (Dimrock 1960). Before 1940, fires in these regions were relatively uncommon (Croft 1950). The long-term effects of these mid-century range burns are currently being evaluated using repeat photography of historical photos originally taken 5-10yrs postfire and analyses of field reports, memos and vegetation plot data collected during the late 1940s through the early 1960s by range conservationists and foresters from the BLM and the United States Forest Service, Intermountain Forest and Range Experiment Station (M. Brooks, unpublished data).

Prior to European contact, late seral blackbrush stands were probably more extensive than they are today. The vast expanses of blackbrush rangeland that were burned to improve livestock production during the mid-1900s are still dominated by early seral species and have been re-colonized only sporadically by Coloeogyne ramosissima (M. Brooks, unpublished data). Blackbrush within the Nevada Test Site in southern Nevada that has not been managed for livestock production since 1940, and likely was not burned for rangeland improvement, does not currently contain evidence of widespread historical burning (Beatley 1976). It therefore appears that extensive burning to remove blackbrush must have created many of the vegetation stands where Coloeogyne ramosissima is either absent or a sub-dominant species today.

The historical fuel complex in late seral blackbrush stands was probably similar to that observed in relatively undisturbed sites today, except for the current prevalence of Bromus spp and Erodium cicutarium in most stands. Vegetation characteristics of these stands were characteristic of blackbrush reference conditions, described here. Shrub cover was likely comprised primarily of Coloeogyne ramosissima at 30-50% total cover, and interspaces were probably mostly bare, even during years of high rainfall, due to root competition with Coloeogyne ramosissima. Other species such as perennial grasses and early seral shrubs probably occurred sporadically, as they do today, along wash stringers and on steep hillslopes where cover of Coloeogyne ramosissima is typically low.

Low amounts of fine fuels in interspaces probably limited fire spread to only extreme fire conditions, during which high winds, low relative humidity and low fuel moisture led to high intensity stand-replacing crown fires. Historical fire return intervals appear have been on the order of centuries (Webb et al 1987), allowing late seral blackbrush stands to re-establish.

## Adjacency or Identification Concerns

Blackbrush is considered to be one of the most flammable native plant assemblages in the Mojave Desert. Many large fires have occurred in this vegetation type since the 1980s in the Spring Mountains and Mormon Mountains in NV, the Beaver Dam Mountains in UT, the Black Mountains and Virgin Mountains in AZ and at Joshua Tree National Park in CA (Brooks and Esque 2002). Although fire is generally no longer advocated as a tool for range improvement, ignitions from lightning and accidental ignitions along roads have been sufficient to burn significant acreage of blackbrush during the past few decades.

The fuel complex in blackbrush appears to be more conducive to burning now than in the past. Alien annual

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**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100+ year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement severity.

grasses currently occur in most blackbrush stands, facilitating the spread of fire after years of high rainfall. Postfire landscapes are even more dominated by these alien grasses, raising concerns that they will promote recurrent fire and prevent the re-establishment of Coloeogyne ramosissima. Interestingly, reports from the early 1950s also acknowledge the role that alien annual grasses, especially Bromus rubens, plays in facilitating the spread of fire in blackbrush (Dimrock 1960, Holmgren 1960, Jensen et al 1960), although there was disagreement as to whether the burned landscapes were more or less susceptible than unburned landscapes to reburning. Jensen et al (1960) thought the chances of reburning were low because they observed low fine fuel levels in postfire landscapes, but their observations were made during the mid-century drought when fine fuel loads were on the low end of their possible range. In contrast, Holmgren (1960), who accompanied Jensen et al on the same field visits, thought that the danger of accidental fire in blackbrush would be higher in areas that previously burned than in unburned areas, if high winter rainfall had produced more Bromus rubens biomass and other fine fuels. Prior to the invasion of Bromus rubens and Bromus tectorum during the late 1800s to early 1900s (Brooks 2000, Young 2000), fine fuel loads were likely not as great in either blackbrush stands, resulting in fewer fires, and fewer reburns

### Native Uncharacteristic Conditions

Shrub cover >50% can be considered uncharacteristic.

### Scale Description

Although the BpS can be extensive (>100000ac) in the Mojave Desert, the typical scale of common disturbance extent ranges from 100-1000ac. Exceptions do occur in excess of 1000s of acres.

### Issues/Problems

### Comments

151078 is identical to 131078. Strucural data modified from original to meet new standards 9/12/05

## Vegetation Classes

### Class A 25%

Early Development 1 Open

**Upper Layer Lifeform**

- ☐ Herbaceous
- ☑ Shrub
- ☐ Tree

**Fuel Model** 2

**Indicator Species* and Canopy Position**

| | |
|---|---|
| GUSA2 | Upper |
| MESP2 | Upper |
| EPNE | Upper |
| ACHY | Upper |

**Structure Data (for upper layer lifeform)**

| | Min | Max |
|---|---|---|
| *Cover* | 0% | 30% |
| *Height* | Shrub 0m | Shrub 0.5m |
| *Tree Size Class* | No Data | |

☐ Upper layer lifeform differs from dominant lifeform.

**Description**

Historically, fire was relatively uncommon in this vegetation. The average FRI for replacement fire was 400yrs. When burned, the fire tolerant/crown-sprouting shrubs such as spiny menodora, horsebrush and snakeweed will dominate the site. At higher elevations of mesic blackbrush, a big sagebrush-desert bitterbrush community typically replaces blackbrush for a protracted period. This class can express itself for over a hundred years with varying amounts of blackbrush gradually establishing after decades and eventually succeeding to Class B. A few examples of this that have been observed in the field are believed to be over 60yrs+. The ground cover varies by elevation and moisture regime with mesic sites being generally 10-35% with some sites only capable of 10% cover. The thermic sites are generally, 10-15% ground cover with exception going as high as 35%.

On average, transition to class B occurs after 75yrs in this region, probably longer elsewhere in the Mojave Desert (e.g. BpS 1082).

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## *Class B* 75%

Late Development 1 Closed

**Upper Layer Lifeform**

- ☐ Herbaceous
- ☑ Shrub
- ☐ Tree

**Fuel Model** 2

**Indicator Species* and Canopy Position**

| | |
|---|---|
| CORA | Upper |
| EPNE | Upper |
| YUSC2 | Upper |
| JUOS | Upper |

**Structure Data (for upper layer lifeform)**

| | *Min* | *Max* |
|---|---|---|
| *Cover* | 31 % | 50 % |
| *Height* | Shrub 0m | Shrub 3.0m |
| *Tree Size Class* | Sapling >4.5ft; <5"DBH | |

☐ Upper layer lifeform differs from dominant lifeform.

**Description**

This community class seems to be stable and occurs after a threshold is crossed. Composition is 50-70% blackbrush dominated. Other species are perennial grasses of desert needlegrass, Indian ricegrass, galleta grass, fluff grass and threeawn. Lesser shrub composition includes: Nevada ephedra, turbinella oak, desert bitterbrush, fourwing saltbush and Anderson's wolfberry in mesic sites and Nevada ephedra, creosotebush, Mojave buckwheat, snakeweed, prickly pear, white bursage and spiny menodora in thermic sites. There are other shrubs also. The FRI for replacement fire is 200yrs, which causes a rare transition to class A.

---

## *Class C* 0%

[Not Used] [Not Used]

**Upper Layer Lifeform**

- ☐ Herbaceous
- ☐ Shrub
- ☐ Tree

**Fuel Model**

**Indicator Species* and Canopy Position**

**Structure Data (for upper layer lifeform)**

| | *Min* | *Max* |
|---|---|---|
| *Cover* | % | % |
| *Height* | | |
| *Tree Size Class* | | |

☐ Upper layer lifeform differs from dominant lifeform.

**Description**

---

## *Class D* 0%

[Not Used] [Not Used]

**Upper Layer Lifeform**

- ☐ Herbaceous
- ☐ Shrub
- ☐ Tree

**Fuel Model**

**Indicator Species* and Canopy Position**

**Structure Data (for upper layer lifeform)**

| | *Min* | *Max* |
|---|---|---|
| *Cover* | % | % |
| *Height* | | |
| *Tree Size Class* | | |

☐ Upper layer lifeform differs from dominant lifeform.

**Description**

---

## *Class E* 0%

[Not Used] [Not Used]

**Upper Layer Lifeform**

- ☐ Herbaceous
- ☐ Shrub
- ☐ Tree

**Fuel Model**

**Indicator Species* and Canopy Position**

**Structure Data (for upper layer lifeform)**

| | *Min* | *Max* |
|---|---|---|
| *Cover* | % | % |
| *Height* | | |
| *Tree Size Class* | | |

☐ Upper layer lifeform differs from dominant lifeform.

**Description**

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*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100+ year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement severity.

## Disturbances

**Fire Regime Group**:** V

**Historical Fire Size (acres)**

Avg 500
Min 1
Max 1000

**Sources of Fire Regime Data**

- [x] Literature
- [ ] Local Data
- [x] Expert Estimate

| Fire Intervals | Avg FI | Min FI | Max FI | Probability | Percent of All Fires |
|---|---|---|---|---|---|
| *Replacement* | 270 | 100 | 1000 | 0.003704 | 99 |
| *Mixed* | | | | | |
| *Surface* | | | | | |
| *All Fires* | 270 | | | 0.00372 | |

***Fire Intervals (FI):***
Fire interval is expressed in years for each fire severity class and for all types of fire combined (All Fires). Average FI is central tendency modeled. Minimum and maximum show the relative range of fire intervals, if known. Probability is the inverse of fire interval in years and is used in reference condition modeling. Percent of all fires is the percent of all fires in that severity class.

**Additional Disturbances Modeled**

- [ ] Insects/Disease
- [ ] Wind/Weather/Stress
- [ ] Native Grazing
- [ ] Competition
- [ ] Other (optional 1)
- [ ] Other (optional 2)

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*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100+ year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement severity.

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*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100+ year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement severity.

# LANDFIRE Biophysical Setting Model

## *Biophysical Setting:* 1510800 Inter-Mountain Basins Big Sagebrush Shrubland

☐ *This BPS is lumped with:*
☐ *This BPS is split into multiple models:*

## General Information

**Contributors** (also see the Comments field) **Date** 10/18/2005

| | | | | | |
|---|---|---|---|---|---|
| **Modeler 1** | Mike Babler | mbabler@tnc.org | **Reviewer** | Tim Christiansen | christta@wsmr.army.mil |
| **Modeler 2** | | | **Reviewer** | anonymous | |
| **Modeler 3** | | | **Reviewer** | | |

**Vegetation Type**
Upland Shrubland

**Map Zone**
15

**Model Zone**
☐ Alaska ☐ N-Cent.Rockies
☐ California ☐ Pacific Northwest
☐ Great Basin ☐ South Central
☐ Great Lakes ☐ Southeast
☐ Northeast ☐ S. Appalachians
☐ Northern Plains ☑ Southwest

**Dominant Species***

| | |
|---|---|
| ARTR2 | ATRIP |
| JUNIP | ERNA10 |
| PURSH | CHVI8 |
| SAVE4 | SYOR2 |

**General Model Sources**
☑ Literature
☐ Local Data
☑ Expert Estimate

### Geographic Range
Mid-elevation of the central Rockies through MT, mountainous areas of UT and northwest NM/northeast AZ.

### Biophysical Site Description
This vegetation type is found on all aspects. Pure stands are found in areas with deeper soils and less topographic relief, but it is also common on slopes with a gradual shift to a mixed mountain shrub community on steeper slopes and in drainages. Elevation ranges from 1500-2300m (5000-7600ft), and precipitation from 11-20in. Soils are deep, well drained with a pH +- 7.0. Soil moistures are udic (not dry for as long as 90 cumulative days) and soil temperatures cryic (very cold soils of the Rocky Mountain Region).

### Vegetation Description
Dominant shrubs include Artemisia tridentata ssp. vaseyana, Purshia tridentata and Symphoricarpos oreophilus. Other common shrubs include Amelanchier alnifolia, Chrysothamnus viscidiflorus, Cercocarpus montanus, Tetradymia canescens and Artemisia novae. Other shrubs may be locally common. Herbaceous cover is moderate to abundant ranging from 40-85%. Common grasses include: Festuca idahoensis, Elymus elymoides, Pascopyrum smithii, Elymus trachycaulus, Hesperostipa comata, Nassella viridula, Poa fenderiana and Poa juncifolia var. ampla. Indicative forbs include Eriogonum umbellatum, Antennaria rosae, Balsomorhiza sagittata, Lupinus argenteus, Delphinium nuttallianum, Phlox multiflora and Viola nuttallii.

### Disturbance Description
Mountain sagebrush steppe dominated by mountain sage, western snowberry and bitterbrush with a grass

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and forb understory is believed to be the major pre-settlement vegetation type for the area, although the exact composition of the community before settlement is unknown. Fire is a major disturbance factor for mountain sage (Blaisdell et al 1984, Johnson 2000). Mountain big sagebrush has the fastest recovery rate of the three subspecies and may be as short as 15yrs (Johnson 2000, local data from various monitoring groups - NPS, BLM, TNC, etc). Fire size for this type is larger than other big sagebrush species because of greater fine fuel load but some unburned pockets remain. The fire return intervals reported in the literature for this sage type is 50yrs or more (Welch and Criddle 2003). Assuming that recovery rates are correlated with composite fire return intervals, one could posit with some certainty that the fire return interval lies somewhere between 40-75yrs. Ranges lie between 30yrs near Ponderosa pine communities and other productive sites (maintaining more early seral types) up to 100yrs on north aspects and on rocky slopes (maintaining more late seral types).

### Adjacency or Identification Concerns

Differentiation of Mountain Big Sagebrush Steppe from Wyoming Big Sagebrush may be difficult at the ecotone due to physical similarities and hybridization zones (ie, species concepts become blurred).

### Native Uncharacteristic Conditions

### Scale Description

Size of disturbance extent will be limited by the variation of topographical features, age classes of the sage over the landscape and vegetation types, all typical of mountain terrain. Average patch size 100-500ac with larger sizes during drought.

### Issues/Problems

Reviewer questions existence of mixed severity component in this model.

### Comments

This model was based on the Rapid Assessment model R3MASB, by Joe Viniyard (joe_vinyard@co.blm.gov), Ken Holsinger (ken_holsinger@co.blm.gov), Bill Baker bakerwl@wyo.edu) and reviewed by Bll Baker (bakerwl@wyo.edu), Tim Christiansen (christta@wsmr.army.mil). Mike Babler (mbabler@tnc.org) made species and other edits for MZ15. These edit should receive further review. R3MASB was adapted from R0SBMT, reflects drier climate and longer fire return intervals observed in Southwest Region.

In the final quality control process, modifications were made to eliminate two VDDT rule violations, and resulted in slight changes to the model results (class C changed from 20 to 25%; class D changed from 35 to 30%).

## Vegetation Classes

**Class A** **15%**

Early Development 1 All Structures

**Upper Layer Lifeform**

- ☐ Herbaceous
- ☑ Shrub
- ☐ Tree

**Fuel Model** 2

**Indicator Species* and Canopy Position**

| | |
|---|---|
| ARTR2 | Upper |
| PURSH | Upper |
| ERNA10 | Upper |
| CHVI8 | Upper |

**Structure Data (for upper layer lifeform)**

| | Min | Max |
|---|---|---|
| *Cover* | 0% | 60% |
| *Height* | Shrub 0m | Shrub 0.5m |
| *Tree Size Class* | No Data | |

☐ Upper layer lifeform differs from dominant lifeform.

**Description**

*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100+ year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement severity.

Sagebrush cover ranges from 0-60% with typically shorter shrubs. Herbaceous cover is variable, but is typically at least 30%.

---

***Class B*** **30%**

Late Development 1 Closed

**Upper Layer Lifeform**

- ☐ Herbaceous
- ☑ Shrub
- ☐ Tree

**Fuel Model** 6

**Indicator Species* and Canopy Position**

| | |
|---|---|
| ARTR2 | Upper |
| PURSH | Upper |
| ERNA10 | Upper |
| CHVI8 | Upper |

**Structure Data (for upper layer lifeform)**

| | *Min* | *Max* |
|---|---|---|
| *Cover* | 31% | 60% |
| *Height* | Shrub 0.6m | Shrub 3.0m |
| *Tree Size Class* | No data | |

☐ Upper layer lifeform differs from dominant lifeform.

**Description**

Sagebrush cover is greater than 30%. Predominant grass/forb species will vary across geographic area.

---

***Class C*** **25%**

Mid Development 1 Open

**Upper Layer Lifeform**

- ☐ Herbaceous
- ☑ Shrub
- ☐ Tree

**Fuel Model** 6

**Indicator Species* and Canopy Position**

| | |
|---|---|
| ARTR2 | Upper |
| PURSH | Upper |
| ERNA12 | Upper |
| CHVI8 | Upper |

**Structure Data (for upper layer lifeform)**

| | *Min* | *Max* |
|---|---|---|
| *Cover* | 0% | 20% |
| *Height* | Shrub 0.6m | Shrub 3.0m |
| *Tree Size Class* | No data | |

☐ Upper layer lifeform differs from dominant lifeform.

**Description**

Sagebrush cover is generally 5-15%. Predominant grass/forb species will vary across geographic area.

---

***Class D*** **30%**

Late Development 1 Open

**Upper Layer Lifeform**

- ☐ Herbaceous
- ☑ Shrub
- ☐ Tree

**Fuel Model** 6

**Indicator Species* and Canopy Position**

| | |
|---|---|
| ARTR2 | Upper |
| PURSH | Upper |
| ERNA12 | Upper |
| CHVI8 | Upper |

**Structure Data (for upper layer lifeform)**

| | *Min* | *Max* |
|---|---|---|
| *Cover* | 21% | 30% |
| *Height* | Shrub 0.6m | Shrub 3.0m |
| *Tree Size Class* | No data | |

☐ Upper layer lifeform differs from dominant lifeform.

**Description**

Sagebrush cover is 20-30%. Predominant grass/forb species will vary across geographic area.

---

***Class E*** **0%**

[Not Used] [Not Used]

**Upper Layer Lifeform**

- ☐ Herbaceous
- ☐ Shrub
- ☐ Tree

**Fuel Model**

**Indicator Species* and Canopy Position**

**Structure Data (for upper layer lifeform)**

| | *Min* | *Max* |
|---|---|---|
| *Cover* | % | % |
| *Height* | | |
| *Tree Size Class* | | |

☐ Upper layer lifeform differs from dominant lifeform.

**Description**

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*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100+ year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement severity.

## Disturbances

**Fire Regime Group**:** III

**Historical Fire Size (acres)**

Avg
Min
Max

**Sources of Fire Regime Data**

- [ ] Literature
- [ ] Local Data
- [x] Expert Estimate

| Fire Intervals | Avg FI | Min FI | Max FI | Probability | Percent of All Fires |
|---|---|---|---|---|---|
| *Replacement* | 95 | | | 0.010526 | 76 |
| *Mixed* | 300 | | | 0.003333 | 24 |
| *Surface* | | | | | |
| *All Fires* | 72 | | | 0.01387 | |

***Fire Intervals (FI):***

Fire interval is expressed in years for each fire severity class and for all types of fire combined (All Fires). Average FI is central tendency modeled. Minimum and maximum show the relative range of fire intervals, if known. Probability is the inverse of fire interval in years and is used in reference condition modeling. Percent of all fires is the percent of all fires in that severity class.

**Additional Disturbances Modeled**

- [x] Insects/Disease
- [x] Wind/Weather/Stress
- [x] Native Grazing
- [ ] Competition
- [ ] Other (optional 1)
- [ ] Other (optional 2)

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*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100+ year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement severity.

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*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100+ year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement severity.

# LANDFIRE Biophysical Setting Model

## *Biophysical Setting:* 1510810 Inter-Mountain Basins Mixed Salt Desert Scrub

☐ *This BPS is lumped with:*
☐ *This BPS is split into multiple models:*

## *General Information*

**Contributors** (also see the Comments field) **Date** 10/18/2005


| | | | |
|---|---|---|---|
| **Modeler 1** | Annie Brown | annie_brown@blm.gov | **Reviewer** |
| **Modeler 2** | Jolie Pollet | jpollet@blm.gov | **Reviewer** |
| **Modeler 3** | Stan Kitchen | skitchen@fs.fed.us | **Reviewer** |


**Vegetation Type**

Upland Shrubland

**Map Zone**

15

**Model Zone**

☐ Alaska ☐ N-Cent.Rockies
☐ California ☐ Pacific Northwest
☐ Great Basin ☐ South Central
☐ Great Lakes ☐ Southeast
☐ Northeast ☐ S. Appalachians
☐ Northern Plains ☑ Southwest

**Dominant Species***

| | |
|---|---|
| ATCO | TETRA3 |
| ARSP5 | CHVI8 |
| KRLA2 | GUSA2 |
| ATCA2 | GRSP |

**General Model Sources**

☐ Literature
☐ Local Data
☑ Expert Estimate

### Geographic Range

Throughout the Great Basin, including OR, ID, UT, NV, CA, and the Colorado Plateau. This BpS occupies sites west of the Wasatch Mountains, east of the Sierras, south of the Idaho batholith and north of the Mojave Desert.

### Biophysical Site Description

This type occurs from lower slopes to valley bottoms ranging in elevation from 4300-6500ft. Soils are often alkaline or calcareous. Soil permeability ranges from high to low, with more impermeable soils occurring in valley bottoms. Water ponds on alkaline bottoms. Texture is variable becoming finer toward valley bottoms. Many soils are derived from alluvium. Average annual precipitation ranges from 5-10in. Summers are hot and dry with many days reaching 100F. Spring is the only dependable growing season with moisture both from winter and spring precipitation. Cool springs can delay the onset of plant growth and drought can curtail the length of active spring growth. Freezing temperatures are common Nov-April.

This group generally lies above playas and lakes. It tends to be the lowest vegetation group in elevation. Both to the north and upslope it is bordered by low elevation big sagebrush groups, commonly ARTRWY, ARAR and ARNO communities, and sometimes by juniper and pinyon steppe. To the south this group is bordered by Mojave Desert transition communities.

### Vegetation Description

This ecological system includes low (<3 ft) and medium-sized shrubs found widely scattered (often 20-30ft apart), to high density (3-4 plants/sq m) shrubs interspersed with low to mid-height bunch grasses. Common shrubs are shadscale, winterfat, budsage, fourwing saltbush, Nevada ephedra, horsebrush, low rabbitbrush, broom snakeweed and spiny hopsage. Some of these will dominate more than others depending on the site.

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Common bunch grass species are Indian ricegrass, needle-and-thread, purple three-awn and bottlebrush squirreltail, whereas common rhizomatous/sod forming grasses are galleta grass, sand dropseed and blue grama. Globe mallows are the most common and widespread forbs. The understory grasses and forbs are salt-tolerant, not particularly drought tolerant and are variably abundant. The relative abundance of species may vary in a patchwork pattern across the landscape in relation to subtle differences in soils and reflect variation in disturbance history.

Total cover rarely exceeds 25% and annual precipitation is closely linked to prior 12 months' precipitation. Stand replacing disturbances (insects, extended wet periods and drought) shift dominance between shrub and grass species. Following drought, the system will tend more toward Class C (more shrub prevalence). Following fire and extended wet periods, the system will tend more toward Class A (greater grass prevalence).

### Disturbance Description

Under reference conditions disturbances were unpredictable, but flooding, drought, insects and fire may all occur in these systems. Extended wet periods were modeled as occurring every 35 years, and drought periods every 35yrs. Extended wet periods tended to favor perennial grass development, while extended drought tended to favor shrub development.

Documented Mormon cricket/grasshopper outbreaks since settlement were associated with drought; outbreaks cause shifts in composition amongst dominant species, but do not typically cause shifts to different seral stages. Therefore insect disturbance was not modeled. During outbreaks Mormon crickets prefer open, low plant communities. Herbaceous communities and the herbaceous component of mixed communities were more susceptible to cricket grazing.

Fire was rare and limited to more mesic sites (and moist periods) with high grass productivity. Mixed severity fire was modeled as occurring with a mean FRI of 500-1000yrs.

Native American manipulation of salt desert shrub plant communities was minimal. Grass seed may have been one of the more important salt desert shrub crops. It is unlikely that native Americans manipulated the vegetation to encourage grass seed.

### Adjacency or Identification Concerns

This PNVG contains the typical Great Basin salt desert shrub communities. Salt desert shrub is also common in the Wyoming big sagebrush community and there is some species overlap with other BpS, including Inter-Mountain Basins Semi-Desert Shrub Steppe (1127). A wide range of salt desert shrubs can occur in this group.

Upland salt desert shrub communities are easily invaded and, in the short term at least, replaced by cheatgrass. Other nonnative problematic annuals include halogeton, Russian thistle and several mustards. Through central UT and east central NV this group is susceptible to invasion by squarrose knapweed. More mesic areas can be invaded by tall whitetop and hoary cress. All three are noxious weeds in Great Basin states.

### Native Uncharacteristic Conditions

### Scale Description

Disturbance scale was variable during pre-settlement. Droughts and extended wet periods could be region wide or more local. A series of high water years or drought could affect whole basins.
Mormon cricket disturbances could affect hundreds to perhaps thousands of acres for years to 1-2 decades.

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**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100+ year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement severity.

Most fires were rare and <1ac, but may exceed 100s of acres with a good grass crop.

### Issues/Problems

Lack of references limited model development. Reviewers indicated that there is no evidence for fire in salt desert shrub during pre-settlement. Research from the USFS Desert Experimental Range supports this and indicates that the reference condition would have been shifting mosaics of communities based of drought, flooding and insect outbreaks. There was little to no information about the early succession species and their relationships in this system prior to the advent of aggressive and noxious non-natives. Because of the pervasive replacement of native early succession species by non-natives, an adequate description of the forb and grass early seral communities may be difficult to complete.

Since disturbance is rare and unpredictable, the disturbance and succession pathways were difficult to model.

### Comments

This model is identical to the model for the same BpS in MZ16, MZ23 and MZ24. The model was based on the Rapid Assessment PNVG R2SDSH by Bill Dragt. Jolie Pollet, Annie Brown and Stanley Kitchen simplified the model and eliminated a class dominated by Greasewood. Reviewers of R2SDSH were Stanley Kitchen (skitchen@fs.fed.us), Mike Zielinski (mike_zielinski@nv.blm.gov) and Jolie Pollet (jpollet@blm.gov).

Quality control process by Pohl on 4/6/05 resulted in slightly adjusted percentages in each class to more closely match VDDT results (A changed from 20 to 25%; B changed from 50 to 45%).

This model was subject to a bug in version 5.0.53 of VDDT and was corrected in version 5.0.55 on 4/6/2005 by Pohl.

## *Vegetation Classes*

***Class A*** **25%**

Early Development 1 All Structures

**Indicator Species* and Canopy Position**

ATCO Upper

**Structure Data (for upper layer lifeform)**

| | *Min* | *Max* |
|---|---|---|
| *Cover* | 0% | 10% |
| *Height* | Shrub 0m | Shrub 0.5m |
| *Tree Size Class* | No Data | |

☐ Upper layer lifeform differs from dominant lifeform.

**Upper Layer Lifeform**

☐ Herbaceous
☑ Shrub
☐ Tree

**Fuel Model** 2

**Description**

Dominated by continuous grass with widely scattered shrubs and relatively younger shrubs than in Classes B and C. Over 10yrs, vegetation moves to Class B as the primary succession pathway. Replacement fire occurs every 300yrs on average. Extended wet periods (every 35yrs) will also have a stand replacing effect. During a drought (mean return interval of 35yrs), vegetation will follow an alternative succession pathway to class C.

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**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100+ year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement severity.

***Class B*** **45%**

Mid Development 1 Open

**Upper Layer Lifeform**

- ☐ Herbaceous
- ☑ Shrub
- ☐ Tree

**Fuel Model** 2

**Indicator Species* and Canopy Position**

ATCO Upper

**Structure Data (for upper layer lifeform)**

| | *Min* | *Max* |
|---|---|---|
| *Cover* | 0% | 20% |
| *Height* | Shrub 0.6m | Shrub 1.0m |
| *Tree Size Class* | No data | |

☐ Upper layer lifeform differs from dominant lifeform.

**Description**

Discontinuous grass patches and higher shrub canopy cover than in Class A. Extended wet periods (every 35yrs on average) will cause a stand replacing transition to Class A. During extended drought periods (every 35yrs), vegetation will shift to Class C. Replacement fire is rare (mean FRI of 500yrs). Class B will be maintained in the absence of disturbance.

---

***Class C*** **30%**

Mid Development 2 Open

**Upper Layer Lifeform**

- ☐ Herbaceous
- ☑ Shrub
- ☐ Tree

**Fuel Model** 4

**Indicator Species* and Canopy Position**

ATCO All

**Structure Data (for upper layer lifeform)**

| | *Min* | *Max* |
|---|---|---|
| *Cover* | 21% | 30% |
| *Height* | Shrub 0.6m | Shrub 1.0m |
| *Tree Size Class* | No data | |

☐ Upper layer lifeform differs from dominant lifeform.

**Description**

Grass is lacking and shrub canopy cover is even higher than Class B. During extended wet periods (35yrs), vegetation will transition to Class A. After 20yrs, vegetation moves back to Class B through succession. Drought (mean return interval of 35yrs) will maintain vegetation in Class C. Fire would not carry in this Class and is not modeled.

---

***Class D*** **0%**

[Not Used] [Not Used]

**Upper Layer Lifeform**

- ☐ Herbaceous
- ☐ Shrub
- ☐ Tree

**Fuel Model**

**Indicator Species* and Canopy Position**

**Structure Data (for upper layer lifeform)**

| | *Min* | *Max* |
|---|---|---|
| *Cover* | % | % |
| *Height* | | |
| *Tree Size Class* | | |

☐ Upper layer lifeform differs from dominant lifeform.

**Description**

---

***Class E*** **0%**

[Not Used] [Not Used]

**Upper Layer Lifeform**

- ☐ Herbaceous
- ☐ Shrub
- ☐ Tree

**Fuel Model**

**Indicator Species* and Canopy Position**

**Structure Data (for upper layer lifeform)**

| | *Min* | *Max* |
|---|---|---|
| *Cover* | % | % |
| *Height* | | |
| *Tree Size Class* | | |

☐ Upper layer lifeform differs from dominant lifeform.

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*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100+ year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement severity.

**Description**

## Disturbances

**Fire Regime Group**:** V

**Historical Fire Size (acres)**

Avg 10
Min 1
Max 1000

**Sources of Fire Regime Data**

- ☐ Literature
- ☐ Local Data
- ☐ Expert Estimate

| Fire Intervals | Avg FI | Min FI | Max FI | Probability | Percent of All Fires |
|---|---|---|---|---|---|
| *Replacement* | 625 | | | 0.0016 | 99 |
| *Mixed* | | | | | |
| *Surface* | | | | | |
| *All Fires* | 624 | | | 0.00162 | |

***Fire Intervals (FI):***

Fire interval is expressed in years for each fire severity class and for all types of fire combined (All Fires). Average FI is central tendency modeled. Minimum and maximum show the relative range of fire intervals, if known. Probability is the inverse of fire interval in years and is used in reference condition modeling. Percent of all fires is the percent of all fires in that severity class.

**Additional Disturbances Modeled**

- ☐ Insects/Disease
- ☑ Wind/Weather/Stress
- ☐ Native Grazing
- ☐ Competition
- ☐ Other (optional 1)
- ☐ Other (optional 2)

## References


Blaisdell, J.P. and R.C. Holmgren. 1984. Managing intermountain rangelands-salt-desert shrub ranges. General Technical Report INT-163. USDA Forest Service, Intermountain Forest and Range Experiment Station, Ogden, UT. 52 pp.

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*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100+ year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement severity.

# LANDFIRE Biophysical Setting Model

## *Biophysical Setting:* 1510820 Mojave Mid-Elevation Mixed Desert Scrub

☐ *This BPS is lumped with:*
☐ *This BPS is split into multiple models:*

## *General Information*

**Contributors** (also see the Comments field) **Date** 10/18/2005


**Modeler 1** Louis Provencher lprovencher@tnc.org **Reviewer** Tim Christiansen tchristiansen@tnc.org
**Modeler 2** **Reviewer**
**Modeler 3** **Reviewer**


**Vegetation Type**
Upland Shrubland

**Map Zone**
15

**Model Zone**
☐ Alaska ☐ N-Cent.Rockies
☐ California ☐ Pacific Northwest
☐ Great Basin ☐ South Central
☐ Great Lakes ☐ Southeast
☐ Northeast ☐ S. Appalachians
☐ Northern Plains ☑ Southwest

**Dominant Species***
CORA
ACSP12
BOER4
AMDU2

**General Model Sources**
☑ Literature
☐ Local Data
☐ Expert Estimate

### Geographic Range

Mojave Mid-Elevation Desert Scrub (where blackbrush is dominant) occurs in the southern Great Basin region and in the Mojave desert from CA through NV to UT and AZ. Within the Mojave-Colorado Plateau ecotone, blackbrush is found on dry slopes and benches above the river canyons of southern UT and northern AZ. It is also found midslope on mountain ranges throughout this area.

### Biophysical Site Description

Blackbrush occurs at the bioregional transition between the Mojave Desert and Great Basin deserts in the Mojave desert and the Colorado Plateau of southeastern UT. It occurs on mesic and thermic soils that are shallow to a root restrictive layer, on low hills and mountains and broad alluvial fans. Elevation ranges from 2200-4500ft. The main difference between Mojave Desert and Colorado Plateau blackbrush communities (eg, Colorado Plateau Blackbrush-Mormon tea Shrubland, BpS 1078) is the higher proportion of sandy soils on the Colorado Plateau.

### Vegetation Description

The dominant shrub of the Mojave Mid-Elevation Desert Scrub is blackbrush (Coleogyne ramosissima). Blackbrush is considered to be one of the most flammable native plant assemblages in the Mojave Desert, although this desert does not have a history of fire. The USDA NRCS (2002) publishes many ecological site descriptions for the Mojave Desert and the bioregional transition between the Mojave Desert and Great Basin or Colorado Plateau that describe the various sites by vegetation composition and soils. In general, blackbrush dominates the site with 80-90% of total cover. Co-dominant species may include Eriogonum fasciculatum, Ephedra nevadensis, Grayia spinosa, Menodora spinescens, Nolina spp, Opuntia acanthocarpa, Salazaria mexicana, Viguirea parishii, Yucca brevifolia or Yucca schidigera. Although 185 species of vascular plants have been found growing within blackbrush, they are never abundant in the Mojave Desert except at upper- and lower-elevational ecotones. These species, however, are somewhat more abundant on the Colorado Plateau on sandier soils. For instance, desert needlegrass (Achnatherum

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speciosum) and Indian ricegrass (Oryzopsis hymenoides) are important grass species. Beatley (1976) stated that "so nearly complete is the dominance of this shrub species that in areas that are not ecotonal there are only a few associated shrubs species, and these occur usually as scattered plants in an otherwise pure stands of Coleogyne."

Understory and associated species vary with soil type. Sandy sites in southeastern Utah have a greater perennial grass component (mainly indian ricegrass and dropseeds) than the shallow calcareous soils in the Mojave Desert. On the isolated mesas in the Grand Canyon there is an interesting relationship between soil depth, site location on the landscape and associated species. Grazing has not confounded these relationships because the only ungulate grazing has been by desert bighorns. Shallow soils over a petrocalcic horizon has very little perennial grass. The deep soils on " run in " sites have much greater perennial grass and associated shrub (eg, fourwing saltbush) cover. According to Ledyard Stebbins blackbrush has been around for a long time; experts refer to it as a paleoendemic.

### Disturbance Description

Low amounts of fine fuels in interspaces probably limited fire spread to only extreme fire conditions, during which high winds, low relative humidity, and low fuel moisture led to high intensity stand-replacing crown fires. Historical fire return intervals appear to have been on the order of centuries allowing late seral blackbrush stands to re-establish.

### Adjacency or Identification Concerns

At upper elevations, adjacent systems include black sagebrush and Wyoming Big sagebrush communities and at lower elevations creosotebush and bursage communities in the Mojave Desert.

Within the upper and lower extents there are areas degraded from overgrazing and prescribed burning in the mid-1900s, characterized by burned patches with early seral characteristics. In these sites there is increased cover of early seral shrubs such as Chrysothamnus spp, Gutierrezia spp and Eriogonum fasciculatum, early seral herbaceous perennials such as Sphaeralcea ambigua and Astragalus spp, and alien annual plants such as Bromus rubens, Bromus tedtorum and Erodium cictarum. Burned stands can also have a large perennial grass component. Other areas are annual grasslands dominated by Bromus rubens and Bromus tectorum from repeated burning.

### Native Uncharacteristic Conditions

### Scale Description

The typical scale of common disturbance extent ranges from 100-1000ac. Exceptions do occur in excess of 1000s of acres.

### Issues/Problems

We don't have much data on this community.

### Comments

This model is identical to the model for the same BpS in MZ16, MZ23 and MZ24. This model and description was developed by Gary Medlyn (gmedlyn@nv.blm.gov) from the blackbrush PNVG R2BLBR for the Great Basin Rapid Assessment. The main body of literature on blackbrush is from the eastern Mojave Desert. Therefore, R2BLBR was initially based on Mojave Desert dynamics. This model (161082) was tailored more to UT's Colorado Plateau for MZ16. Reviewers of R2BLBR were Patti Novak-Echenique (patti.novak@nv.usda.gov), Jolie Pollet (jpollet@blm.gov) and James Bowns (Bowns_JE@suu.edu).

## *Vegetation Classes*

*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100+ year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement severity.

## Class A 10%

Early Development 1 All Structures

**Upper Layer Lifeform**

- ☐ Herbaceous
- ☑ Shrub
- ☐ Tree

**Fuel Model** 2

**Indicator Species* and Canopy Position**

| | |
|---|---|
| GUSA2 | Upper |
| MESP2 | Upper |
| EPNE | Upper |
| TETRA3 | Upper |

**Structure Data (for upper layer lifeform)**

| | Min | Max |
|---|---|---|
| Cover | 0% | 40% |
| Height | Shrub 0m | Shrub 0.5m |
| Tree Size Class | No Data | |

☐ Upper layer lifeform differs from dominant lifeform.

**Description**

Historically, fire was relatively uncommon in this vegetation. The average FRI for replacement fire was 333yrs. When burned, the fire tolerant/crown-sprouting shrubs such as spiny menodora, horsebrush and snakeweed will dominate the site. At higher elevations of mesic blackbrush, a big sagebrush-desert bitterbrush community typically replaces blackbrush for a protracted period.

This class can express itself for over 100yrs with varying amounts of blackbrush gradually establishing after decades and eventually succeeding to Class B. A few examples of this class have been observed in the field are believed to be over 60yrs old. The ground cover varies by elevation and moisture regime with mesic sites being generally 0-35% cover with some sites only capable of 10% cover. The thermic sites are generally 10-15% ground cover, though some sites may go as high as 35% cover.

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## Class B 90%

Late Development 1 Closed

**Upper Layer Lifeform**

- ☐ Herbaceous
- ☑ Shrub
- ☐ Tree

**Fuel Model** 2

**Indicator Species* and Canopy Position**

| | |
|---|---|
| CORA | Upper |
| EPNE | Upper |
| YUSC2 | Upper |
| LATR2 | Upper |

**Structure Data (for upper layer lifeform)**

| | Min | Max |
|---|---|---|
| Cover | 0% | 40% |
| Height | Shrub 0.6m | Shrub 3.0m |
| Tree Size Class | No data | |

☐ Upper layer lifeform differs from dominant lifeform.

**Description**

This class seems to be stable and occurs after a threshold is crossed. Composition is 70-80% blackbrush dominated. Other species are perennial grasses of desert needlegrass, Indian ricegrass, galleta grass, fluff grass and threeawn. Lesser shrub composition includes: Nevada ephedra, turbineila oak, desert bitterbrush, fourwing saltbush and Anderson's wolfberry in mesic sites and Nevada ephedra, creosotebush, Mojave buckwheat, snakeweed, prickly pear, white bursage and spiny menodora in thermic sites. The FRI for replacement fire is 1000yrs, which causes a rare transition to class A.

---

## Class C 0%

[Not Used] [Not Used]

**Upper Layer Lifeform**

- ☐ Herbaceous
- ☐ Shrub
- ☐ Tree

**Fuel Model**

**Indicator Species* and Canopy Position**

**Structure Data (for upper layer lifeform)**

| | Min | Max |
|---|---|---|
| Cover | % | % |
| Height | | |
| Tree Size Class | | |

☐ Upper layer lifeform differs from dominant lifeform.

**Description**

---

*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100+ year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement severity.

***Class D*** **0%**

[Not Used] [Not Used]

**Upper Layer Lifeform**

☐ Herbaceous
☐ Shrub
☐ Tree

**Fuel Model**

**Indicator Species* and Canopy Position**

**Structure Data (for upper layer lifeform)**

| | Min | Max |
|---|---|---|
| *Cover* | % | % |
| *Height* | | |
| *Tree Size Class* | | |

☐ Upper layer lifeform differs from dominant lifeform.

**Description**

***Class E*** **0%**

[Not Used] [Not Used]

**Upper Layer Lifeform**

☐ Herbaceous
☐ Shrub
☐ Tree

**Fuel Model**

**Indicator Species* and Canopy Position**

**Structure Data (for upper layer lifeform)**

| | Min | Max |
|---|---|---|
| *Cover* | % | % |
| *Height* | | |
| *Tree Size Class* | | |

☐ Upper layer lifeform differs from dominant lifeform.

**Description**

## Disturbances

**Fire Regime Group**:** V

**Historical Fire Size (acres)**

Avg 10
Min 1
Max 100

**Sources of Fire Regime Data**

☑ Literature
☐ Local Data
☑ Expert Estimate

**Fire Intervals**

| | Avg FI | Min FI | Max FI | Probability | Percent of All Fires |
|---|---|---|---|---|---|
| *Replacement* | 833 | 100 | 1700 | 0.001200 | 98 |
| *Mixed* | | | | | |
| *Surface* | | | | | |
| *All Fires* | 832 | | | 0.00122 | |

***Fire Intervals (FI):***

Fire interval is expressed in years for each fire severity class and for all types of fire combined (All Fires). Average FI is central tendency modeled. Minimum and maximum show the relative range of fire intervals, if known. Probability is the inverse of fire interval in years and is used in reference condition modeling. Percent of all fires is the percent of all fires in that severity class.

**Additional Disturbances Modeled**

☐ Insects/Disease
☐ Wind/Weather/Stress
☐ Native Grazing
☐ Competition
☐ Other (optional 1)
☐ Other (optional 2)

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*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100+ year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement severity.

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*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100+ year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement severity.

# LANDFIRE Biophysical Setting Model

## *Biophysical Setting:* 1510860 Rocky Mountain Lower Montane-Foothill Shrubland

☐ *This BPS is lumped with:*
☐ *This BPS is split into multiple models:*

## *General Information*

**Contributors** (also see the Comments field) **Date** 10/18/2005


| | | | | | |
|---|---|---|---|---|---|
| **Modeler 1** | Dean Erhard | derhard@fs.fed.us | **Reviewer** | Vic Ecklund | vecklund@csu.org |
| **Modeler 2** | | | **Reviewer** | Chuck Kostecka | kostecka@webaccess.net |
| **Modeler 3** | | | **Reviewer** | anonymous | |


**Vegetation Type**
Upland Shrubland

**Map Zone**
15

**Model Zone**
☐ Alaska ☐ N-Cent.Rockies
☐ California ☐ Pacific Northwest
☐ Great Basin ☐ South Central
☐ Great Lakes ☐ Southeast
☐ Northeast ☐ S. Appalachians
☐ Northern Plains ☑ Southwest

**Dominant Species***
CEMO2
CHRYS9
SYMPH
PRVI

**General Model Sources**
☑ Literature
☐ Local Data
☑ Expert Estimate

### Geographic Range

Foothills, canyon slopes and lower mountains of the Rocky Mountains. The general information provided in this form is based on personal experience in the upper Rio Grande drainage (specifically the Rio Grande NF, Erhard). The description here focuses more on true mountain-mahogany. Information in the FEIS online database indicates that the central distribution of true mountain-mahogany is located on the west side of the Rocky Mountains in the foothills and mountains of UT, CO and WY. The range of true mountain-mahogany also extends north into MT, east into SD and NB, south from OK to Mexico and west into AZ and NV. True mountain-mahogany occasionally occurs in ID and southwestern OR.

### Biophysical Site Description

This BpS occurs in the transition zone between the foothill and montane life zones. It ranges from roughly 1500-2900m (4950-9570ft). This BpS occurs on relatively xeric sites with thinly to moderately well developed soils on moderately steep to steep southerly aspects. This BpS is not intended to cover ocean-spray (HODU) dominated communities on extremely rocky sites (where vegetation is clearly subordinate to rock).

### Vegetation Description

Species dominance varies depending on site conditions and by geographic location. Shrubs include Amelanchier utahensis, Cercocarpus montanus, Purshia tridentata, Rhus trilobata, Ribes cereum, Symphoricarpus oreophilus and Yucca glauca. Grasses may include species of Bouteloua, Muhlenbergia, Hesperostipa and Pseudoroegneria spicata. Species dominant in the upper Rio Grande drainage are true mountain mahogany, several species of rabbitbrush, snowberry and chokecherry. Gambel oak is not included here.

*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100+ year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement severity.

### Disturbance Description

Historically, this type may have been in a Fire Regime IV or II -- primarily moderate-interval (eg, 20-50yr) stand replacement fires in the shrub-dominated layer. Nearly all the dominant species in this BpS have the capability to resprout after disturbance.

### Adjacency or Identification Concerns

Shrub species vary by geographic location in this region. Shrub species dominance is tied to a variety of environmental conditions including geology, soils, topographic position, etc. making a description of this generalized type problematic.

### Native Uncharacteristic Conditions

### Scale Description

Erhard's observations suggest that the scale of the most common disturbance extent is relatively small. The disturbance regime is expected to be relatively frequent under historic conditions. Scale estimate is in the hundreds of acres realm -- not thousands of acres.

### Issues/Problems

### Comments

This is identical to the model for the same BpS in MZ28. This model is based on the Rapid Assessment model R3MSHB. Mike Babler made edits 6/16/2005. R3MSHB reviewers were Barry Johnston, bcjohnston@fs.fed.us; Brenda Wilmore, bwhilmore@fs.fed.us;Tim Christiansen, christta@wsmr.army.mil; Bill Baker, bakerwl@wyo.edu.

## *Vegetation Classes*

### *Class A* 15%

Early Development 1 All Structures

**Indicator Species* and Canopy Position**

| | |
|---|---|
| BOGR2 | Upper |
| MUMO | Upper |

**Structure Data (for upper layer lifeform)**

| | *Min* | *Max* |
|---|---|---|
| *Cover* | 0% | 10% |
| *Height* | Herb 0m | Herb 1.0m |
| *Tree Size Class* | No Data | |

☐ Upper layer lifeform differs from dominant lifeform.

**Upper Layer Lifeform**

- ☑ Herbaceous
- ☐ Shrub
- ☐ Tree

**Fuel Model** 1

**Description**

Early succession, usually after moderately frequent stand replacement fires; grasses and forbs dominant.

---

### *Class B* 15%

Mid Development 1 Closed

**Indicator Species* and Canopy Position**

| | |
|---|---|
| CEMO2 | Upper |
| CHRYS9 | Upper |
| BOGR2 | Lower |
| MUMO | Lower |

**Structure Data (for upper layer lifeform)**

| | *Min* | *Max* |
|---|---|---|
| *Cover* | 11% | 80% |
| *Height* | Shrub 0m | Shrub 1.0m |
| *Tree Size Class* | No data | |

☑ Upper layer lifeform differs from dominant lifeform.

**Upper Layer Lifeform**

- ☐ Herbaceous
- ☑ Shrub
- ☐ Tree

**Fuel Model** 5

**Description**

Herbaceous cover may dominate: BOGR2 up to 0.09m in height, canopy cover 0-20%.

---

*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100+ year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement severity.

>10% shrub cover (ie, line intercept method) by weakly sprouting and seed producing shrubs; grasses/forbs dominant in scattered openings.

---

***Class C*** **10 %**

Mid Development 1 Open

**Upper Layer Lifeform**

- ☐ Herbaceous
- ☑ Shrub
- ☐ Tree

**Fuel Model** 6

**Indicator Species* and Canopy Position**

| | |
|---|---|
| BOGR2 | Lower |
| MUMO | Lower |
| CEMO | Upper |
| CHRYS9 | Upper |

**Structure Data (for upper layer lifeform)**

| | *Min* | *Max* |
|---|---|---|
| *Cover* | 0 % | 10 % |
| *Height* | Shrub 0m | Shrub 1.0m |
| *Tree Size Class* | No data | |

☑ Upper layer lifeform differs from dominant lifeform.

Herbaceous cover may dominate: BOGR2 up to 0.09m in height, canopy cover 20-60%

**Description**

<10% shrub cover, with grasses/forbs dominant in extensive openings.

---

***Class D*** **10 %**

Late Development 1 Open

**Upper Layer Lifeform**

- ☐ Herbaceous
- ☑ Shrub
- ☐ Tree

**Fuel Model** 6

**Indicator Species* and Canopy Position**

| | |
|---|---|
| BOGR2 | Lower |
| CEMO | Upper |
| MUMO | Lower |
| CHRYS9 | Upper |

**Structure Data (for upper layer lifeform)**

| | *Min* | *Max* |
|---|---|---|
| *Cover* | 0 % | 10 % |
| *Height* | Shrub 1.1m | Shrub 3.0m |
| *Tree Size Class* | No data | |

☐ Upper layer lifeform differs from dominant lifeform.

**Description**

<10% shrub cover, with overmature shrubs as patchy dominant overstory (eg, in rock outcrops); grasses/forbs dominant in extensive openings.

---

***Class E*** **50 %**

Late Development 1 Closed

**Upper Layer Lifeform**

- ☐ Herbaceous
- ☑ Shrub
- ☐ Tree

**Fuel Model** 7

**Indicator Species* and Canopy Position**

| | |
|---|---|
| CEMO2 | Upper |
| CHRYS9 | Upper |
| SYMPH | Mid-Upper |
| BOGR2 | Lower |

**Structure Data (for upper layer lifeform)**

| | *Min* | *Max* |
|---|---|---|
| *Cover* | 11 % | 80 % |
| *Height* | Shrub 1.1m | Shrub 3.0m |
| *Tree Size Class* | No data | |

☐ Upper layer lifeform differs from dominant lifeform.

**Description**

>10% shrub cover; all age classes present but dominated by overmature shrubs (eg, in rocky draws).

## *Disturbances*

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*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100+ year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement severity.

**Fire Regime Group**:** III

**Historical Fire Size (acres)**

Avg
Min
Max

**Sources of Fire Regime Data**

- [ ] Literature
- [ ] Local Data
- [x] Expert Estimate

| Fire Intervals | Avg FI | Min FI | Max FI | Probability | Percent of All Fires |
|---|---|---|---|---|---|
| Replacement | 75 | | | 0.013333 | 73 |
| Mixed | 200 | | | 0.005 | 27 |
| Surface | | | | | |
| All Fires | 55 | | | 0.01834 | |

***Fire Intervals (FI):***

Fire interval is expressed in years for each fire severity class and for all types of fire combined (All Fires). Average FI is central tendency modeled. Minimum and maximum show the relative range of fire intervals, if known. Probability is the inverse of fire interval in years and is used in reference condition modeling. Percent of all fires is the percent of all fires in that severity class.

**Additional Disturbances Modeled**

- [ ] Insects/Disease
- [x] Wind/Weather/Stress
- [ ] Native Grazing
- [x] Competition
- [ ] Other (optional 1)
- [ ] Other (optional 2)

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*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100+ year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement severity.

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*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100+ year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement severity.

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*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100+ year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement severity.

# LANDFIRE Biophysical Setting Model

## *Biophysical Setting:* 1510870 Sonora-Mojave Creosotebush-White Bursage Desert Scrub

☐ *This BPS is lumped with:*
☐ *This BPS is split into multiple models:*

## *General Information*

**Contributors** (also see the Comments field) **Date** 10/18/2005

| | | | | | |
|---|---|---|---|---|---|
| **Modeler 1** | Patti Novak-Echenique | patti.novak@nv.usda.gov | **Reviewer** | Patti Novak-Echenique | patti.novak@nv.usda.gov |
| **Modeler 2** | | | **Reviewer** | | |
| **Modeler 3** | | | **Reviewer** | | |

**Vegetation Type**
Upland Shrubland

**Map Zone**
15

**Model Zone**
☐ Alaska ☐ N-Cent.Rockies
☐ California ☐ Pacific Northwest
☐ Great Basin ☐ South Central
☐ Great Lakes ☐ Southeast
☐ Northeast ☐ S. Appalachians
☐ Northern Plains ☑ Southwest

**Dominant Species***
AMDU2 LYCIU
LATR2
EPNE
ATRIP

**General Model Sources**
☑ Literature
☐ Local Data
☑ Expert Estimate

### Geographic Range
This system occurs in the Sonoran and Mojave Deserts.

### Biophysical Site Description
Creosotebush scrub is the most common community type in the Mojave Desert. Creosotebush scrub is typically found below the blackbrush zone on well-drained alluvial flats and slopes and above the saltbush zone. Elevations range from 500-6000ft on lower mountain footslopes. Most of the valleys and basins in this area range between 2000-4000ft. Creosotebush scrub occurs on several soil types from shallow to very deep. The site occurs on erosional fan remnants, fan piedmonts and sideslopes of hills and lower mountains. Slopes range from 2-75%, but slope gradients of 2-15% are typical. Soils are predominantly well drained, available water capacity is very low to low and runoff is moderate to rapid. Average annual precipitation ranges from 3-7in. Precipitation occurs primarily during the winter and early spring. In the eastern portion of MZ13 and western portion of MZ15, high intensity convection summer storms (July and August) occur frequently enough to influence the production and species composition of most native plant communities. The relative humidity is low, evaporation is high, solar radiation is high, and the daily and seasonal range in temperature is wide. Average annual temperature ranges from 65-75 degrees F. Average frost-free period is generally 240 days.

### Vegetation Description
Creosotebush (Larrea tridentata) dominates this scrub community. Plant community associates change from east to west Mojave Desert. Creosotebush codominants include saltbush (Atriplex spp), white bursage (Ambrosia dumosa), ephedra (Ephedra spp) and wolfberry (Lycium spp). Joshua trees (Yucca brevifolia) can be part of this community type and can form woodlands. Perennial grass species include galleta grass (Pleuraphis rigida), bush muhly (Muhlenbergia porteri), desert needlegrass (Achnatherum speciosum),

*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100+ year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement severity.

Indian ricegrass (Achnatherum hymenoides) and threeawn (Aristida spp).

Creosotebush scrub is characterized by low cover (5-30%) of woody shrubs of various heights. With the exception of Joshua tree, creosotebush has the highest cover and is the most wide-ranging plant species in the Mojave Desert.

### Disturbance Description

Cresosotebush scrub is not fire tolerant because of its drought-tolerant features such as thin bark, slow growth, shallow root system and small leaves. Although some associated species resprout after fire depending on fire severity, the creosotebush scrub community is slow to recover or re-establish after fire.

We do not know the presettlement fire conditions in warm desert plant communities. However, it is thought that fires in creosotebush scrub were absent to rare events in presettlement desert habitats because fine fuels from winter annual plants were probably sparse, only occurring in large amounts during the spring following exceptionally wet winters.

### Adjacency or Identification Concerns

The issue is not as much of a concern as in other systems because creosote communities dominate the Mojave landscape.

Fine fuels adjacency from alien annual grasses such as red brome or cheatgrass, currently represent the most important fuelbed component in creosotebush scrub. In years of good moisture, alien annual grasses can comprise 66-97% of the total annual biomass in this system.

Historic year round livestock grazing has contributed to the deterioration of this system.

### Native Uncharacteristic Conditions

### Scale Description

Patch sizes, which can be very large (>100000ac), vary according to landform, aspect and precipitation. Fire are small (<100ac) and rare.

### Issues/Problems

Little information is available regarding fire frequency and fire severity in presettlement fire conditions in warm desert plant communities. It is thought that fire was rare to absent.

### Comments

This model is identical to a draft of 131087, with minor adjustments to range and species. Original modeller reviewed and feels model is appropriate for MZ15. BpS 131087 is based on BpS 171087. Many modification were made to the geographic range, biophysical site description, and species composition. Patch size was increased to reflect the extent of this type in the Mojave Desert compared to the Great Basin. Model structure was kept.

BpS 171087 is based on the Rapid Assessment model R2CRBU developed by Sandy Gregory (s50grego@nv.blm.gov). R2CRBU was reviewed by Patti Novak-Echenique (patti.novak@nv.usda.gov), Tim Duck (tim_duck@blm.gov) and Stanley D. Smith (ssmith@ccmail.nevada.edu). Suggested reviewers for BpS 1087: Doug Merkler, doug.merkler@usda.gov; Patti Novak-Echenique (patti.novak@nv.usda.gov).

## *Vegetation Classes*

*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100+ year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement severity.

### *Class A* 15%

Early Development 1 Open

**Upper Layer Lifeform**

- ☐ Herbaceous
- ☑ Shrub
- ☐ Tree

**Fuel Model** 1

**Indicator Species* and Canopy Position**

| | |
|---|---|
| PPGG | Lower |
| AMDU2 | Low-Mid |
| LATR2 | Upper |
| HYSA | Low-Mid |

**Structure Data (for upper layer lifeform)**

| | *Min* | *Max* |
|---|---|---|
| *Cover* | 0% | 10% |
| *Height* | Shrub 0m | Shrub 3.0m |
| *Tree Size Class* | No Data | |

☑ Upper layer lifeform differs from dominant lifeform.

Dominant cover is herbaceous, 5-10% canopy cover.

**Description**

Creosotebush scrub is characterized by low cover (<10%). Little disturbance was considered in Class A, except for replacement fire every 300yrs on average. In the historic condition where invasive annual grasses are absent, the fire return interval is virtually non-existent except for areas near the base of mountains experiencing locally higher rainfall and fine fuel buildup from native annual. After 100yrs, class A transitions to B.

---

### *Class B* 85%

Late Development 1 Closed

**Upper Layer Lifeform**

- ☐ Herbaceous
- ☑ Shrub
- ☐ Tree

**Fuel Model** 1

**Indicator Species* and Canopy Position**

| | |
|---|---|
| LATR2 | Upper |
| AMDU2 | Low-Mid |
| EPHED | Low-Mid |
| LYCIU | Low-Mid |

**Structure Data (for upper layer lifeform)**

| | *Min* | *Max* |
|---|---|---|
| *Cover* | 11% | 30% |
| *Height* | Shrub 0m | Shrub 3.0m |
| *Tree Size Class* | No data | |

☑ Upper layer lifeform differs from dominant lifeform.

Dominant cover may be herbaceous with 20-40% cover.

**Description**

Greater than 10% shrub cover and 20-40% grass and forb cover; associated with more productive soils. Less fine fuels are associated with this community, therefore the FRIs for replacement fire and mixed severity fire is 650yrs (min-max: 300-1000yrs). Wind/weather stress also affected this community on average every 80yrs, but did not cause a transition to class A.

---

### *Class C* 0%

[Not Used] [Not Used]

**Upper Layer Lifeform**

- ☐ Herbaceous
- ☐ Shrub
- ☐ Tree

**Fuel Model**

**Indicator Species* and Canopy Position**

**Structure Data (for upper layer lifeform)**

| | *Min* | *Max* |
|---|---|---|
| *Cover* | % | % |
| *Height* | | |
| *Tree Size Class* | | |

☐ Upper layer lifeform differs from dominant lifeform.

**Description**

---

*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100+ year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement severity.

### *Class D* 0%

[Not Used] [Not Used]

**Upper Layer Lifeform**

- ☐ Herbaceous
- ☐ Shrub
- ☐ Tree

**Fuel Model**

**Indicator Species* and Canopy Position**

**Structure Data (for upper layer lifeform)**

| | Min | Max |
|---|---|---|
| *Cover* | % | % |
| *Height* | | |
| *Tree Size Class* | | |

☐ Upper layer lifeform differs from dominant lifeform.

**Description**

### *Class E* 0%

[Not Used] [Not Used]

**Upper Layer Lifeform**

- ☐ Herbaceous
- ☐ Shrub
- ☐ Tree

**Fuel Model**

**Indicator Species* and Canopy Position**

**Structure Data (for upper layer lifeform)**

| | Min | Max |
|---|---|---|
| *Cover* | % | % |
| *Height* | | |
| *Tree Size Class* | | |

☐ Upper layer lifeform differs from dominant lifeform.

**Description**

## *Disturbances*

**Fire Regime Group**: V**

**Historical Fire Size (acres)**

Avg 10
Min 1
Max 100

**Sources of Fire Regime Data**

- ☐ Literature
- ☐ Local Data
- ☑ Expert Estimate

**Fire Intervals**

| | Avg FI | Min FI | Max FI | Probability | Percent of All Fires |
|---|---|---|---|---|---|
| *Replacement* | 588 | 300 | 1000 | 0.001701 | 56 |
| *Mixed* | 769 | 300 | 1000 | 0.001300 | 43 |
| *Surface* | | | | | |
| *All Fires* | 333 | | | 0.00301 | |

***Fire Intervals (FI):***

Fire interval is expressed in years for each fire severity class and for all types of fire combined (All Fires). Average FI is central tendency modeled. Minimum and maximum show the relative range of fire intervals, if known. Probability is the inverse of fire interval in years and is used in reference condition modeling. Percent of all fires is the percent of all fires in that severity class.

**Additional Disturbances Modeled**

- ☐ Insects/Disease
- ☑ Wind/Weather/Stress
- ☐ Native Grazing
- ☐ Competition
- ☐ Other (optional 1)
- ☐ Other (optional 2)

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*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100+ year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement severity.

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*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100+ year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement severity.

# LANDFIRE Biophysical Setting Model

## *Biophysical Setting:* 1510910 Sonoran Mid-Elevation Desert Scrub

☐ *This BPS is lumped with:*
☐ *This BPS is split into multiple models:*

## General Information

**Contributors** (also see the Comments field) **Date** 10/18/2005

| | | | |
|---|---|---|---|
| **Modeler 1** | Mike Babler | mbabler@tnc.org | **Reviewer** |
| **Modeler 2** | Keith Schulz | keith_schulz@natureserve.org | **Reviewer** |
| **Modeler 3** | | | **Reviewer** |

**Vegetation Type**
Upland Shrubland

**Map Zone**
15

**Model Zone**
☐ Alaska ☐ N-Cent.Rockies
☐ California ☐ Pacific Northwest
☐ Great Basin ☐ South Central
☐ Great Lakes ☐ Southeast
☐ Northeast ☐ S. Appalachians
☐ Northern Plains ☑ Southwest

**Dominant Species***
EFRA2 GUTIE
ERLI6 SICH
ISTE2 LATR2
CAHO3

**General Model Sources**
☑ Literature
☐ Local Data
☑ Expert Estimate

### Geographic Range
The northern edge of the Sonoran Desert in an elevational band along the lower slopes of the Mogollon Rim/Central Highlands region. Also in the Bradshaw, Hualapai and Superstition mountains.

### Biophysical Site Description
Between 750-1300m. Sites range from a narrow strip on steep slopes to very broad areas such as the Verde Valley. Climate is too dry for chaparral species to be abundant, and freezing temperatures during winter are too frequent and prolonged for many of the frost-sensitive species that are characteristic of Sonoran Paloverde-Mixed Cacti Desert Scrub. Substrates are generally rocky soils derived from parent materials such as limestone, granitic rocks or rhyolite.

### Vegetation Description
The vegetation is typically composed of an open shrub layer of Larrea tridentata, Ericameria linearifolia or Eriogonum fasciculatum with taller shrub such as Canotia holacantha (limestone or granite) or Simmondsia chinensis (rhyolite). The herbaceous layer is generally sparse.

### Disturbance Description
Fire is unusual in this BpS.

### Adjacency or Identification Concerns
Above Sonoran Paloverde-Mixed Cacti Desert Scrub (CES302.761) and below Mogollon Chaparral (CES302.741) in elevation.

Non-native, weedy annuals may be present to dominant in Class A.

### Native Uncharacteristic Conditions

*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100+ year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement severity.

### Scale Description

50-2000 ha

### Issues/Problems

### Comments

This model was missing height information (discovered March 15, 2007). Height information was estimated by Brendan Ward at MFSL.

## Vegetation Classes

### Class A 15%

Early Development 1 Open

**Upper Layer Lifeform**

- ☐ Herbaceous
- ☑ Shrub
- ☐ Tree

**Fuel Model** No D

**Indicator Species* and Canopy Position**

| | |
|---|---|
| ERFA2 | All |
| ERLI6 | All |
| ISTE2 | All |
| GUTIE | All |

**Structure Data (for upper layer lifeform)**

| | Min | Max |
|---|---|---|
| *Cover* | 0% | 10% |
| *Height* | Shrub 0m | Shrub 3.0m |
| *Tree Size Class* | No Data | |

☐ Upper layer lifeform differs from dominant lifeform.

**Description**

High percent bare ground, with shrub seedlings or resprouts. Patchy burn may result in scattered larger plants remaining from original community. ISTE2 and GUTIE are highest percentage. Remains in class A for 50yrs. Fire does not occur in this class.

---

### Class B 85%

Late Development 1 Closed

**Upper Layer Lifeform**

- ☐ Herbaceous
- ☑ Shrub
- ☐ Tree

**Fuel Model** 1

**Indicator Species* and Canopy Position**

| | |
|---|---|
| ERFA2 | Upper |
| CAHO3 | Upper |
| SICH | Upper |
| LATR | Upper |

**Structure Data (for upper layer lifeform)**

| | Min | Max |
|---|---|---|
| *Cover* | 11% | 30% |
| *Height* | Shrub 0m | Shrub 3.0m |
| *Tree Size Class* | No data | |

☐ Upper layer lifeform differs from dominant lifeform.

**Description**

Acacia may occur in patches. Sparse herbaceous layer, high percent of bare ground. Larrea, Eriogonium, Simmondsia, Ericameria amd Canotia species, found throughout. Fire is very rare in this system, modeled at 300yrs.

---

### Class C 0%

[Not Used] [Not Used]

**Upper Layer Lifeform**

- ☐ Herbaceous
- ☐ Shrub
- ☐ Tree

**Fuel Model**

**Indicator Species* and Canopy Position**

**Structure Data (for upper layer lifeform)**

| | Min | Max |
|---|---|---|
| *Cover* | % | % |
| *Height* | | |
| *Tree Size Class* | | |

☐ Upper layer lifeform differs from dominant lifeform.

**Description**

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*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100+ year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement severity.

**Class D** 0%

[Not Used] [Not Used]

**Upper Layer Lifeform**

- ☐ Herbaceous
- ☐ Shrub
- ☐ Tree

**Fuel Model**

**Indicator Species* and Canopy Position**

**Structure Data (for upper layer lifeform)**

| | Min | Max |
|---|---|---|
| Cover | % | % |
| Height | | |
| Tree Size Class | | |

☐ Upper layer lifeform differs from dominant lifeform.

**Description**

---

**Class E** 0%

[Not Used] [Not Used]

**Upper Layer Lifeform**

- ☐ Herbaceous
- ☐ Shrub
- ☐ Tree

**Fuel Model**

**Indicator Species* and Canopy Position**

**Structure Data (for upper layer lifeform)**

| | Min | Max |
|---|---|---|
| Cover | % | % |
| Height | | |
| Tree Size Class | | |

☐ Upper layer lifeform differs from dominant lifeform.

**Description**

## Disturbances

**Fire Regime Group**:** V

**Historical Fire Size (acres)**

Avg
Min
Max

**Sources of Fire Regime Data**

- ☐ Literature
- ☐ Local Data
- ☐ Expert Estimate

**Fire Intervals**

| | Avg FI | Min FI | Max FI | Probability | Percent of All Fires |
|---|---|---|---|---|---|
| Replacement | 350 | | | 0.002857 | 99 |
| Mixed | | | | | |
| Surface | | | | | |
| All Fires | 350 | | | 0.00288 | |

***Fire Intervals (FI):***

Fire interval is expressed in years for each fire severity class and for all types of fire combined (All Fires). Average FI is central tendency modeled. Minimum and maximum show the relative range of fire intervals, if known. Probability is the inverse of fire interval in years and is used in reference condition modeling. Percent of all fires is the percent of all fires in that severity class.

**Additional Disturbances Modeled**

- ☐ Insects/Disease
- ☑ Wind/Weather/Stress
- ☐ Native Grazing
- ☐ Competition
- ☐ Other (optional 1)
- ☐ Other (optional 2)

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*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100+ year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement severity.

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*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100+ year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement severity.

# LANDFIRE Biophysical Setting Model

## *Biophysical Setting:* 1510930 Southern Colorado Plateau Sand Shrubland

☐ *This BPS is lumped with:*
☐ *This BPS is split into multiple models:*

## *General Information*

**Contributors** (also see the Comments field) **Date** 10/18/2005


**Modeler 1** Mike Babler mbabler@tnc.org **Reviewer**
**Modeler 2** **Reviewer**
**Modeler 3** **Reviewer**


**Vegetation Type**
Upland Shrubland

**Map Zone**
15

**Model Zone**
☐ Alaska ☐ N-Cent.Rockies
☐ California ☐ Pacific Northwest
☐ Great Basin ☐ South Central
☐ Great Lakes ☐ Southeast
☐ Northeast ☐ S. Appalachians
☐ Northern Plains ☑ Southwest

**Dominant Species***

| | |
|---|---|
| EPVI | POIN3 |
| EPCU | ACHY |
| EPTO | BOGR2 |
| ARFI2 | HECO26 |

**General Model Sources**
☑ Literature
☐ Local Data
☑ Expert Estimate

### Geographic Range
This system occurs in sandy plains and mesas on the south-central Colorado Plateau in northeastern AZ extending into southern and central UT. It may also occur on portions of the Colorado Plateau in NM and CO.

### Biophysical Site Description
This BpS occurs on windswept mesas, broad basins and plains at low to moderate elevations (1300-1800 m). It occurs on stabilized sandsheet and shallow to moderately deep sandy soils. May be on small hummocks or small coppice dunes.

### Vegetation Description
A semi-arid open shrublands, dominated by short shrubs (10-30% cover). Includes a sparse graminoid layer. Ephedra viridis (Green ephedra) is often dominant and regenerates from seed and by sprouting from the roots and woody crown. Seed production is erratic under natural conditions, with an abundant seed crop occurring very infrequently. Green ephedra has also been identified as a resprouting species following disturbance. Coleogyne ramosissima (blackbrush) seldom occurs in this BpS.

### Disturbance Description
Fire Regime Group IV or III, though wind may be the dominant disturbance. Fire is likely not a major factor due to limited fuels in the BpS. Green ephedra has been found in plant communities with a wide range of fire return intervals, and has been found in ecosystems following large, stand replacing fires as well as small, patchy, erratic fires.

Fire regimes in similar plant associations include: saltbush-greasewood, Atriplex confertifolia-Sarcobatus vermiculatus with MFIs of <35yrs to <100yrs; Blackbrush, Coleogyne ramosissima with MFIs of <35yrs to <100yrs; and Creosotebush, Larrea tridentata with MFIs of <35yrs to <100yrs.

*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100+ year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement severity.

### Adjacency or Identification Concerns

Coleogyne ramoisissima (blackbrush) is not present in this BpS. If blackbrush is present, one of the following BpS would be more appropriate: 1078-Colorado Plateau Blackbrush-Mormon Tea Shrubland; or 1082-Mojave Mid-Elevation Desert Scrub.

Higher vegetation cover and less prominent geomorphic features distinguish this system from Inter-Mountain Basins Active and Stabilized Dune (CES302.775).

### Native Uncharacteristic Conditions

### Scale Description

Patches may be large.

### Issues/Problems

Information on this BpS, including fire information, is lacking. The impacts of long term domestic animal grazing in this BpS are difficult to determine. A two-box model may be appropriate.

### Comments

This model is identical to the model for the same BpS in MZ23 and MZ24.

## Vegetation Classes

### Class A 20%

Early Development 1 All Structures

**Upper Layer Lifeform**

- ☐ Herbaceous
- ☑ Shrub
- ☐ Tree

**Fuel Model** 5

**Indicator Species* and Canopy Position**

| | |
|---|---|
| EPVI | Upper |
| EPCU | |
| ARFI2 | |

**Structure Data (for upper layer lifeform)**

| | Min | Max |
|---|---|---|
| *Cover* | 0% | 20% |
| *Height* | Shrub 0m | Shrub 1.0m |
| *Tree Size Class* | No Data | |

☐ Upper layer lifeform differs from dominant lifeform.

**Description**

Blowout and disturbed sites with very low cover, primarily consisting of Ephedra viridis.

### Class B 79%

Mid Development 1 All Structures

**Upper Layer Lifeform**

- ☐ Herbaceous
- ☑ Shrub
- ☐ Tree

**Fuel Model** 5

**Indicator Species* and Canopy Position**

| | |
|---|---|
| EPVI | Upper |
| EPCU | |
| ARFI2 | |

**Structure Data (for upper layer lifeform)**

| | Min | Max |
|---|---|---|
| *Cover* | 21% | 30% |
| *Height* | Shrub 0m | Shrub 1.0m |
| *Tree Size Class* | No data | |

☐ Upper layer lifeform differs from dominant lifeform.

**Description**

Canopy cover is 10-30% and dominated by Ephedra viridis. Grass and graminoids presence is highly influenced by seasonal moisture. Ephedra viridis and E. cutleri may develop a matty growth form.

*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100+ year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement severity.

### *Class C* 1 %

Late Development 1 All Structures

**Indicator Species* and Canopy Position**

EPVI Upper
EPCU
ARFI

**Structure Data (for upper layer lifeform)**

| | Min | Max |
|---|---|---|
| *Cover* | 31 % | 50 % |
| *Height* | Shrub 0m | Shrub 1.0m |
| *Tree Size Class* | No data | |

☐ Upper layer lifeform differs from dominant lifeform.

**Upper Layer Lifeform**

☐ Herbaceous
☑ Shrub
☐ Tree

**Fuel Model** 5

**Description**

Canopy cover limits potential grasses and graminoid plant growth. Ephedra viridis and E. cutleri assume matty growth form.

---

### *Class D* 0 %

[Not Used] [Not Used]

**Indicator Species* and Canopy Position**

**Structure Data (for upper layer lifeform)**

| | Min | Max |
|---|---|---|
| *Cover* | % | % |
| *Height* | | |
| *Tree Size Class* | | |

☐ Upper layer lifeform differs from dominant lifeform.

**Upper Layer Lifeform**

☐ Herbaceous
☐ Shrub
☐ Tree

**Fuel Model**

**Description**

---

### *Class E* 0 %

[Not Used] [Not Used]

**Indicator Species* and Canopy Position**

**Structure Data (for upper layer lifeform)**

| | Min | Max |
|---|---|---|
| *Cover* | % | % |
| *Height* | | |
| *Tree Size Class* | | |

☐ Upper layer lifeform differs from dominant lifeform.

**Upper Layer Lifeform**

☐ Herbaceous
☐ Shrub
☐ Tree

**Fuel Model**

**Description**

## *Disturbances*

**Fire Regime Group**:** III

**Historical Fire Size (acres)**

Avg
Min
Max

**Sources of Fire Regime Data**

☑ Literature
☐ Local Data
☑ Expert Estimate

**Fire Intervals**

| | *Avg FI* | *Min FI* | *Max FI* | *Probability* | *Percent of All Fires* |
|---|---|---|---|---|---|
| *Replacement* | 200 | | | 0.005 | 55 |
| *Mixed* | 250 | | | 0.004 | 44 |
| *Surface* | | | | | |
| *All Fires* | 111 | | | 0.00901 | |

***Fire Intervals (FI):***

Fire interval is expressed in years for each fire severity class and for all types of fire combined (All Fires). Average FI is central tendency modeled. Minimum and maximum show the relative range of fire intervals, if known. Probability is the inverse of fire interval in years and is used in reference condition modeling. Percent of all fires is the percent of all fires in that severity class.

---

*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100+ year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement severity.

**Additional Disturbances Modeled**

- ☐ Insects/Disease
- ☑ Wind/Weather/Stress
- ☐ Native Grazing
- ☐ Competition
- ☐ Other (optional 1)
- ☐ Other (optional 2)

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


*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100+ year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement severity.

# LANDFIRE Biophysical Setting Model

## *Biophysical Setting:* 1510950 Apacherian-Chihuahuan Mesquite Upland Scrub

☐ *This BPS is lumped with:*
☐ *This BPS is split into multiple models:*

## *General Information*

**Contributors** (also see the Comments field) **Date** 10/18/2005

| | | | |
|---|---|---|---|
| **Modeler 1** Mike Babler | mbabler@tnc.org | **Reviewer** | |
| **Modeler 2** | | **Reviewer** | |
| **Modeler 3** | | **Reviewer** | |

**Vegetation Type**
Upland Shrubland

**Map Zone**
15

**Model Zone**
☐ Alaska ☐ N-Cent.Rockies
☐ California ☐ Pacific Northwest
☐ Great Basin ☐ South Central
☐ Great Lakes ☐ Southeast
☐ Northeast ☐ S. Appalachians
☐ Northern Plains ☑ Southwest

**Dominant Species***
BOUTE ISTE
PLMU2 PRJU3
ARIST ACACI
MUOP2

**General Model Sources**
☑ Literature
☐ Local Data
☐ Expert Estimate

### Geographic Range
Chihuahuan Desert extending into the Sky Island region to the west and the Edwards Plateau to the east.

### Biophysical Site Description
Substrates are typically derived from alluvium, often gravelly without a well-developed argillic or calcic soil horizon that would limit infiltration and storage of winter precipitation in deeper soil layers. Prosopis spp and other deep-rooted shrubs exploit this deep soil moisture that is unavailable to grasses and cacti.

### Vegetation Description
Vegetation is typically dominated by Prosopis glandulosa or Prosopis velutina and succulents. Other desert scrub that may codominate or dominate includes Acacia neovernicosa, Acacia constricta, Juniperus monosperma or Juniperus coahuilensis. Grass cover is typically low.

### Disturbance Description

### Adjacency or Identification Concerns
Similar to Chihuahuan Mixed Desert and Thorn Scrub (CES302.734) but is generally found at higher elevations where Larrea tridentata and other desert scrub are not codominant. It is also similar to Chihuahuan Stabilized Coppice Dune and Sand Flat Scrub (CES302.737) but does not occur on eolian-deposited substrates.

### Native Uncharacteristic Conditions

### Scale Description

*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100+ year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement severity.

### Issues/Problems

This is probably not a BpS, but may be a class within semi-desert grassland (BpS 1121). During the last century, the area occupied by this system has increased through conversion of desert grasslands as a result of drought, overgrazing by livestock and/or decreases in fire frequency. It is believed that this is a system that occurred in very minor amounts and has become widespread as a result of drought, heavy grazing and other actions. In order to meet LF standards, percent canopy cover were rounded up - note the difference in Structural Data versus the Class Description.

### Comments

This model is based on information provided by Heather Schussman, hschussman@tnc.org. The VDDT model is the same as 151121. Review suggests that this BpS occupies <5% of semi-desert grassland (BpS 1121) and is not its own BpS.

## Vegetation Classes

### Class A 20%

Early Development 1 All Structures

**Indicator Species* and Canopy Position**
PRGL2
PRVE

**Structure Data (for upper layer lifeform)**

| | Min | Max |
|---|---|---|
| *Cover* | 0% | 50% |
| *Height* | Herb 0m | Herb 1.0m |
| *Tree Size Class* | No Data | |

**Upper Layer Lifeform**

- [x] Herbaceous
- [ ] Shrub
- [ ] Tree

**Fuel Model** 1

☐ Upper layer lifeform differs from dominant lifeform.

**Description**

Grass and herbs, 0-2yrs. Early succession post fire grass and herb community. Perennial bunch grasses, annual grass and herb community. Upper layer of shrubs, canopy cover typically <5%.

---

### Class B 65%

Mid Development 1 Open

**Indicator Species* and Canopy Position**

**Structure Data (for upper layer lifeform)**

| | Min | Max |
|---|---|---|
| *Cover* | 0% | 10% |
| *Height* | Shrub 0m | Shrub 1.0m |
| *Tree Size Class* | No data | |

**Upper Layer Lifeform**

- [ ] Herbaceous
- [x] Shrub
- [ ] Tree

**Fuel Model**

☐ Upper layer lifeform differs from dominant lifeform.

**Description**

Grass with some low shrubs. 3-15 years old. Perennial bunch grasses regenerated and young shrubs begin growing. Species are perennial bunch grasses and shrubs. Canopy cover of upper layer is typically 5-10%.

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*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100+ year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement severity.

### *Class C* 10%

Mid Development 2 Open

**Indicator Species* and Canopy Position**

**Structure Data (for upper layer lifeform)**

| | Min | Max |
|---|---|---|
| *Cover* | 11% | 20% |
| *Height* | Shrub 0m | Shrub 1.0m |
| *Tree Size Class* | No data | |

☐ Upper layer lifeform differs from dominant lifeform.

**Upper Layer Lifeform**

- ☐ Herbaceous
- ☑ Shrub
- ☐ Tree

**Fuel Model**

**Description**

Shrubs continue to increase in size and/or number of individuals. Species are perennial bunch grasses and shrubs. Canopy cover of upper layer is 10-20%.

---

### *Class D* 5%

Late Development 1 Open

**Indicator Species* and Canopy Position**

**Structure Data (for upper layer lifeform)**

| | Min | Max |
|---|---|---|
| *Cover* | 21% | 40% |
| *Height* | Shrub 0m | Shrub 1.0m |
| *Tree Size Class* | No data | |

☐ Upper layer lifeform differs from dominant lifeform.

**Upper Layer Lifeform**

- ☐ Herbaceous
- ☑ Shrub
- ☐ Tree

**Fuel Model**

**Description**

Shrubs with little to no perennial grass. Shrubs cover is high enough to out compete perennial grasses resulting in low levels of fine fuels and increased erosion potential.

---

### *Class E* 0%

[Not Used] [Not Used]

**Indicator Species* and Canopy Position**

**Structure Data (for upper layer lifeform)**

| | Min | Max |
|---|---|---|
| *Cover* | % | % |
| *Height* | | |
| *Tree Size Class* | | |

☐ Upper layer lifeform differs from dominant lifeform.

**Upper Layer Lifeform**

- ☐ Herbaceous
- ☐ Shrub
- ☐ Tree

**Fuel Model**

**Description**

## *Disturbances*

**Fire Regime Group**: II**

**Historical Fire Size (acres)**

Avg

Min

Max

**Sources of Fire Regime Data**

- ☑ Literature
- ☐ Local Data
- ☑ Expert Estimate

**Fire Intervals**

| | *Avg FI* | *Min FI* | *Max FI* | *Probability* | *Percent of All Fires* |
|---|---|---|---|---|---|
| *Replacement* | 10 | | | 0.1 | 80 |
| *Mixed* | | | | | |
| *Surface* | 40 | | | 0.025 | 20 |
| *All Fires* | 8 | | | 0.12501 | |

***Fire Intervals (FI):***

Fire interval is expressed in years for each fire severity class and for all types of fire combined (All Fires). Average FI is central tendency modeled. Minimum and maximum show the relative range of fire intervals, if known. Probability is the inverse of fire interval in years and is used in reference condition modeling. Percent of all fires is the percent of all fires in that severity class.

---

*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100+ year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement severity.

**Additional Disturbances Modeled**

☐Insects/Disease ☐Native Grazing ☐Other (optional 1)
☐Wind/Weather/Stress ☐Competition ☐Other (optional 2)

## References

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

*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100+ year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement severity.

# LANDFIRE Biophysical Setting Model

## *Biophysical Setting:* 1511000 Chihuahuan Mixed Desert and Thorn Scrub

☐ *This BPS is lumped with:*
☐ *This BPS is split into multiple models:*

## General Information

**Contributors** (also see the Comments field) **Date** 10/18/2005


| | | | | | |
|---|---|---|---|---|---|
| **Modeler 1** | Mike Babler | mbabler@tnc.org | **Reviewer** | Keith Schulz | Keith_Schulz@nature serve.org |
| **Modeler 2** | | | **Reviewer** | | |
| **Modeler 3** | | | **Reviewer** | | |


**Vegetation Type**

Upland Savannah/Shrub Steppe

**Map Zone**

15

**Model Zone**

☐ Alaska ☐ N-Cent.Rockies
☐ California ☐ Pacific Northwest
☐ Great Basin ☐ South Central
☐ Great Lakes ☐ Southeast
☐ Northeast ☐ S. Appalachians
☐ Northern Plains ☑ Southwest

**Dominant Species***

| | |
|---|---|
| LATR2 | FLCE |
| ATCA | FLOUR |
| PAIN | ACNE |
| ALTR2 | ACCO |

**General Model Sources**

☑ Literature
☐ Local Data
☐ Expert Estimate

### Geographic Range

Shrublands of typically saline basins in the Chihuahuan Desert.

### Biophysical Site Description

This system occurs in basins, plains and into foothills in the Chihuahuan Desert. Substrates are generally fine-textured, saline soils. Does not do well in poorly aeriated soils. Stands of Acacia constricta, Acacia neovernicosa or Acacia greggii dominated thornscrub are included in this system and limestone substrates appear important for at least these species.

### Vegetation Description

This widespread Chihuahuan Desert land cover type is composed of two ecological systems the Chihuahuan Creosotebush Xeric Basin Desert Scrub (CES302.731) and the Chihuahuan Mixed Desert and Thorn Scrub (CES302.734 ). This cover type includes xeric creosotebush basins and plains and the mixed desert scrub in the foothill transition zone above, sometimes extending up to the lower montane woodlands. Vegetation is characterized by Larrea tridentata alone or mixed with thornscrub and other desert scrub such as Agave lechuguilla, Aloysia wrightii, Fouquieria splendens, Dasylirion leiophyllum, Flourensia cernua, Leucophyllum minus, Mimosa aculeaticarpa var. biuncifera, Mortonia scabrella (= Mortonia sempervirens ssp. scabrella), Opuntia engelmannii, Parthenium incanum, Prosopis glandulosa, and Tiquilia greggii. Stands of Acacia constricta, Acacia neovernicosa or Acacia greggii dominated thornscrub are included in this system and limestone substrates appear important for at least these species. Grasses such as Dasyochloa pulchella, Bouteloua curtipendula, Bouteloua eriopoda, Bouteloua ramosa, Muhlenbergia porteri and Pleuraphis mutica may be common, but generally have lower cover than shrubs.

### Disturbance Description

Most desert fire are infrequent and of low severity. Larrea tirdentata is poorly adapted to fire. It may sprout

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**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100+ year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement severity.

if the roots are not killed during fire. Standing biomass, deadwood and leaf litter can fuel desert fires following rainy seasons. Historic fire regimes in desert shrublands are difficult to quantify, but fires were historically rare except under unusual circumstances.

### Adjacency or Identification Concerns

### Native Uncharacteristic Conditions

### Scale Description

1000-1000000ac.

### Issues/Problems

Fire ecology studies at the population level are badly needed for fourwing saltbush. Historic fire regimes in desert shrublands are difficult to quantify.

### Comments

Model is based on the Rapid Assessment model R2CRBU by Sandy Gregory, s50grego@nv.blm.gov.

## Vegetation Classes

### Class A 15%

Early Development 1 Open

**Upper Layer Lifeform**

- ☐ Herbaceous
- ☑ Shrub
- ☐ Tree

**Fuel Model** No D

**Indicator Species* and Canopy Position**

| | |
|---|---|
| LATR2 | Upper |
| ATCA2 | Upper |

**Structure Data (for upper layer lifeform)**

| | Min | Max |
|---|---|---|
| Cover | 0% | 20% |
| Height | Shrub 0m | Shrub 0.5m |
| Tree Size Class | No Data | |

☐ Upper layer lifeform differs from dominant lifeform.

**Description**

Characterized by low shrub cover (typically 5-10%). Little disturbance was considered in Class A, except for replacement fire every 300yrs on average. In the historic condition where invasive annual grasses are absent, the fire return interval is virtually non-existent except for areas near the base of mountains experiencing locally higher rainfall and fine fuel buildup from native annual. After 100yrs, class A transitions to B.

---

### Class B 85%

Late Development 1 Closed

**Upper Layer Lifeform**

- ☐ Herbaceous
- ☑ Shrub
- ☐ Tree

**Fuel Model** 1

**Indicator Species* and Canopy Position**

| | |
|---|---|
| LATR2 | Upper |
| ATCA2 | Upper |

**Structure Data (for upper layer lifeform)**

| | Min | Max |
|---|---|---|
| Cover | 0% | 20% |
| Height | Shrub 0.6m | Shrub 3.0m |
| Tree Size Class | No data | |

☐ Upper layer lifeform differs from dominant lifeform.

**Description**

Typically >10% shrub cover and <10% grass and forb cover; associated with more productive soils. Larrea tridentata characteristically dominates shrub layer. Acacia species may dominate locally in patches. Few fine fuels are associated with this community, therefore the FRIs for replacement fire and mixed severity fire is 650yrs (min-max: 300-1000yrs). Wind/weather stress also affects this community on average every 80yrs, but does not cause a transition to class A.

---

*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100+ year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement severity.

### *Class C* 0%

[Not Used] [Not Used]

**Upper Layer Lifeform**

- ☐ Herbaceous
- ☐ Shrub
- ☐ Tree

**Fuel Model**

**Description**

**Indicator Species* and Canopy Position**

**Structure Data (for upper layer lifeform)**

| | Min | Max |
|---|---|---|
| *Cover* | % | % |
| *Height* | | |
| *Tree Size Class* | | |

☐ Upper layer lifeform differs from dominant lifeform.

---

### *Class D* 0%

[Not Used] [Not Used]

**Upper Layer Lifeform**

- ☐ Herbaceous
- ☐ Shrub
- ☐ Tree

**Fuel Model**

**Description**

**Indicator Species* and Canopy Position**

**Structure Data (for upper layer lifeform)**

| | Min | Max |
|---|---|---|
| *Cover* | % | % |
| *Height* | | |
| *Tree Size Class* | | |

☐ Upper layer lifeform differs from dominant lifeform.

---

### *Class E* 0%

[Not Used] [Not Used]

**Upper Layer Lifeform**

- ☐ Herbaceous
- ☐ Shrub
- ☐ Tree

**Fuel Model**

**Description**

**Indicator Species* and Canopy Position**

**Structure Data (for upper layer lifeform)**

| | Min | Max |
|---|---|---|
| *Cover* | % | % |
| *Height* | | |
| *Tree Size Class* | | |

☐ Upper layer lifeform differs from dominant lifeform.

## *Disturbances*

**Fire Regime Group**: V**

**Historical Fire Size (acres)**

Avg
Min
Max

**Sources of Fire Regime Data**

- ☐ Literature
- ☐ Local Data
- ☐ Expert Estimate

**Fire Intervals**

| | Avg FI | Min FI | Max FI | Probability | Percent of All Fires |
|---|---|---|---|---|---|
| *Replacement* | 575 | | | 0.001739 | 55 |
| *Mixed* | 700 | | | 0.001429 | 45 |
| *Surface* | | | | | |
| *All Fires* | 316 | | | 0.00318 | |

***Fire Intervals (FI):***

Fire interval is expressed in years for each fire severity class and for all types of fire combined (All Fires). Average FI is central tendency modeled. Minimum and maximum show the relative range of fire intervals, if known. Probability is the inverse of fire interval in years and is used in reference condition modeling. Percent of all fires is the percent of all fires in that severity class.

**Additional Disturbances Modeled**

- ☐ Insects/Disease
- ☑ Wind/Weather/Stress
- ☐ Native Grazing
- ☐ Competition
- ☐ Other (optional 1)
- ☐ Other (optional 2)

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*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100+ year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement severity.

## References


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*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100+ year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement severity.

# LANDFIRE Biophysical Setting Model

## *Biophysical Setting:* 1511020 Colorado Plateau Pinyon-Juniper Shrubland

☐ *This BPS is lumped with:*
☐ *This BPS is split into multiple models:*

## *General Information*

**Contributors** (also see the Comments field) **Date** 2/23/2005


**Modeler 1** Bob Unnasch bunnasch@tnc.org **Reviewer** Tim Christiansen tchristiansen@tnc.org
**Modeler 2** **Reviewer**
**Modeler 3** **Reviewer**


**Vegetation Type**
Upland Shrubland

**Map Zone**
15

**Model Zone**
☐ Alaska ☐ N-Cent.Rockies
☐ California ☐ Pacific Northwest
☐ Great Basin ☐ South Central
☐ Great Lakes ☐ Southeast
☐ Northeast ☐ S. Appalachians
☐ Northern Plains ☑ Southwest

**Dominant Species***
PIED
JUOS
ARTR2

**General Model Sources**
☑ Literature
☐ Local Data
☐ Expert Estimate

### Geographic Range
This ecological system is characteristic of the rocky mesa tops and slopes on the Colorado Plateau and western slope of CO.

### Biophysical Site Description
Substrates are shallow/rocky and shaley soils at lower elevations (1200-2000m). These stunted tree shrublands may extend further upslope along the low-elevation margins of taller pinyon-juniper woodlands.

### Vegetation Description
The vegetation is dominated by dwarfed (usually <3 m tall) Pinus edulis and/or Juniperus osteosperma trees forming extensive tall shrublands in the region along low-elevation margins of pinyon-juniper woodlands. Other shrubs, if present, may include Artemisia nova, Artemisia tridentata ssp. wyomingensis, Chrysothamnus viscidiflorus or Coleogyne ramosissima. Herbaceous layers are sparse to moderately dense and typically composed of xeric graminoids.

### Disturbance Description
Predominantly Fire Regime Group III, but may also be characterized as IV or V. Fire regime was primarily determined by fire occurrence in the surrounding matrix vegetation. Lightning-ignited fires were common but typically did not affect more than a few individual trees. Replacement fires were uncommon to rare (average FRI of 100-500yrs) and occurred primarily during extreme fire behavior conditions. Mixed severity fire (average FRI of 100-500yrs) was characterized as a mosaic of replacement and surface fires distributed through the patch at a fine scale (<0.1ac). Surface fires could occur in stands where understory grass cover is high and provides adequate fuel. Surface fire were primarily responsible for producing fire scars on juniper or pinyon trees (average FRI of 100yrs).

### Adjacency or Identification Concerns
Sites are drier than Colorado Plateau Pinyon-Juniper Woodland (1016).

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**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100+ year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement severity.

These stunted tree shrublands may extend further upslope along the low-elevation margins of taller pinyon-juniper woodlands.

### Native Uncharacteristic Conditions

### Scale Description

Juniper/Pinyon-Juniper shrubland was usually distributed across the landscape in patches that range from 10s to 100s of acres in size. In areas with very broken topography and/or mesa landforms this type may have occurred in patches of several hundred acres. In UT and NV pinyon and juniper landscape patches tended to be 10-100s of acres in size.

### Issues/Problems

Information was scarce on this ecological system. It appears that this model is a hybrid between the Colorado Plateau Pinyon-Juniper Woodland (1016) and Inter-Mountain Basins Juniper Savanna (1115). Due to the shallow/rocky soils of mesa tops, the Inter-Mountain Basins Juniper Savanna model for MZ16 (161115) is very similar.

### Comments

This model is identical to the model for the same BpS in MZ16 (Utah High Plateaus) with minor descriptive changes based on peer review for MZ23 and MZ24. This is essentially the same model as the Rapid Assessment PNVG R2PIJU developed by Steve Bunting (sbunting@uidaho.edu), Krista Waid-Gollnick (krista_waid@blm.gov) and Henry Bastian (henry_bastian@ios.doi.gov) for juniper and/or pinyon savanna. Reviewers of R2PIJU were George Gruell (ggruell@charter.net), Jolie Pollet (jpollet@blm.gov) and Peter Weisberg (pweisberg@cabnr.unr.edu). It is also very similar to the Inter-Mountain Basins Juniper Savanna model for MZ16 (161115).

Cover breaks changed by Pohl on 3/30/2005 to facilitate LF mapping and differentiate structural classes. D was changed from 11-30% to 21-30%; E was changed from 21-40% to 31-40%.

As a result of final QC for LANDFIRE National by Kori Blankenship the user-defined min and max fire return intervals for surface severity fire were deleted because they were not consistent with the modeled fire return interval for this fire severity type.

## Vegetation Classes

**Class A** 5%

Early Development 1 Open

**Upper Layer Lifeform**

- [x] Herbaceous
- [ ] Shrub
- [ ] Tree

**Fuel Model** 1

**Indicator Species* and Canopy Position**

| | |
|---|---|
| BOGR2 | Upper |
| Forbs | Upper |
| CRYP | Lower |

**Structure Data (for upper layer lifeform)**

| | Min | Max |
|---|---|---|
| *Cover* | 2% | 10% |
| *Height* | Herb 0m | Herb 0.5m |
| *Tree Size Class* | None | |

- [ ] Upper layer lifeform differs from dominant lifeform.

**Description**

Initial post-fire community dominated by annual forbs. Later stages of this class contain greater amounts of perennial grasses and forbs. Duration 10yrs with succession to class B, mid-development closed. Replacement fire occurs every 100yrs on average. Infrequent mixed severity fire (average FRI of 300yrs) thins vegetation.

*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100+ year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement severity.

### *Class B* 5%

Mid Development 1 Open

**Upper Layer Lifeform**

- ☐ Herbaceous
- ☑ Shrub
- ☐ Tree

**Fuel Model** 2

**Indicator Species* and Canopy Position**

| | |
|---|---|
| ARTEM | Upper |
| CHVI8 | Upper |
| BOGR2 | Middle |

**Structure Data (for upper layer lifeform)**

| | *Min* | *Max* |
|---|---|---|
| *Cover* | 5% | 10% |
| *Height* | Shrub 0m | Shrub 0.5m |
| *Tree Size Class* | None | |

☐ Upper layer lifeform differs from dominant lifeform.

**Description**

Dominated by shrubs, perennial forbs and grasses. Total cover remains low due to shallow, unproductive soil. Duration 20yrs with succession to class C unless infrequent replacement fire (FRI of 100yrs) returns the vegetation to class A. It is important to note that replacement fire at this stage does not eliminate perennial grasses, thus, in reality, succession age in class A after this type of fire would be older than zero and <10. Mixed severity fire (average FRI of 100yrs) thins the woody vegetation, but does not cause a transition to another class.

---

### *Class C* 10%

Mid Development 2 Open

**Upper Layer Lifeform**

- ☐ Herbaceous
- ☐ Shrub
- ☑ Tree

**Fuel Model** 2

**Indicator Species* and Canopy Position**

| | |
|---|---|
| ARTEM | Upper |
| CHVI8 | Upper |
| JUOS | Upper |
| PIED | Upper |

**Structure Data (for upper layer lifeform)**

| | *Min* | *Max* |
|---|---|---|
| *Cover* | 11% | 20% |
| *Height* | Tree 0m | Tree 5m |
| *Tree Size Class* | Seedling <4.5ft | |

☑ Upper layer lifeform differs from dominant lifeform.

Tree seedlings emerging from a shrub dominated vegetation.

**Description**

Shrub dominated community with young juniper and pinyon seedlings becoming established. Duration 70yrs with succession to class D unless replacement fire (average FRI of 200yrs) causes a transition to class A. It is important to note that replacement fire at this stage does not eliminate perennial grasses, thus, in reality, succession age in class A after this type of fire would be older than zero and <10. Mixed severity fire as in class B.

---

### *Class D* 35%

Late Development 1 Open

**Upper Layer Lifeform**

- ☐ Herbaceous
- ☐ Shrub
- ☑ Tree

**Fuel Model** 2

**Indicator Species* and Canopy Position**

| | |
|---|---|
| JUOS | Upper |
| PIED | Upper |
| ARTEM | Middle |
| BOGR2 | Lower |

**Structure Data (for upper layer lifeform)**

| | *Min* | *Max* |
|---|---|---|
| *Cover* | 21% | 30% |
| *Height* | Tree 0m | Tree 5m |
| *Tree Size Class* | Sapling >4.5ft; <5"DBH | |

☐ Upper layer lifeform differs from dominant lifeform.

**Description**

Community dominated by young and stunted juniper and pinyon of mixed age structure. Juniper and pinyon becoming competitive on site and beginning to affect understory composition. Duration 300yrs with succession to E unless replacement fire (average FRI of 500yrs) causes a transition to A. Mixed severity fire is less frequent than in previous states (200yrs), whereas surface fire every 100yrs on average becomes more important at this age in succession.

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*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100+ year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement severity.

***Class E*** **45%**

Late Development 2 Open

**Upper Layer Lifeform**

- ☐ Herbaceous
- ☐ Shrub
- ☑ Tree

**Fuel Model** 2

**Indicator Species* and Canopy Position**

| | |
|---|---|
| JUOC | Upper |
| JUOS | Upper |
| PIED | |
| PIMO | |

**Structure Data (for upper layer lifeform)**

| | *Min* | *Max* |
|---|---|---|
| *Cover* | 31% | 40% |
| *Height* | Tree 0m | Tree 5m |
| *Tree Size Class* | Sapling >4.5ft; <5"DBH | |

☐ Upper layer lifeform differs from dominant lifeform.

**Description**

Site dominated by widely spaced old and stunted juniper and pinyon. Understory depauperate and high amounts of bare ground and rock present. Grasses present on microsites sites with deeper soils (>20in) with restricting clay subsurface horizon. Potential maximum overstory coverage is greater in those stands with pinyon as compared to those with only juniper. Replacement fire and mixed severity fires are rare (average FRIs of 500yrs). Surface fire every 100yrs on average will scar ancient stunted trees. Duration 600yrs+.

## Disturbances

**Fire Regime Group**:** **III**

**Historical Fire Size (acres)**

Avg 10
Min 1
Max 100

**Sources of Fire Regime Data**

- ☐ Literature
- ☐ Local Data
- ☑ Expert Estimate

**Fire Intervals**

| | *Avg FI* | *Min FI* | *Max FI* | *Probability* | *Percent of All Fires* |
|---|---|---|---|---|---|
| *Replacement* | 345 | 100 | 1000 | 0.002899 | 19 |
| *Mixed* | 217 | 100 | 1000 | 0.004608 | 30 |
| *Surface* | 125 | | | 0.008 | 52 |
| *All Fires* | 64 | | | 0.01551 | |

***Fire Intervals (FI):***

Fire interval is expressed in years for each fire severity class and for all types of fire combined (All Fires). Average FI is central tendency modeled. Minimum and maximum show the relative range of fire intervals, if known. Probability is the inverse of fire interval in years and is used in reference condition modeling. Percent of all fires is the percent of all fires in that severity class.

**Additional Disturbances Modeled**

- ☐ Insects/Disease
- ☐ Wind/Weather/Stress
- ☐ Native Grazing
- ☐ Competition
- ☐ Other (optional 1)
- ☐ Other (optional 2)

## References


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*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100+ year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement severity.

# LANDFIRE Biophysical Setting Model

## *Biophysical Setting:* 1511030 Great Basin Semi-Desert Chaparral

☐ *This BPS is lumped with:*
☐ *This BPS is split into multiple models:*

## *General Information*

**Contributors** (also see the Comments field) **Date** 10/18/2005


| | | | |
|---|---|---|---|
| **Modeler 1** | Louis Provencher | lprovencher@tnc.org | **Reviewer** |
| **Modeler 2** | Bryan Bracken | Bryan_Bracken@blm.gov | **Reviewer** |
| **Modeler 3** | Jack Sheffey | Jack_Sheffey@blm.gov | **Reviewer** |


**Vegetation Type**
Upland Shrubland

**Map Zone**
15

**Model Zone**
☐ Alaska ☐ N-Cent.Rockies
☐ California ☐ Pacific Northwest
☐ Great Basin ☐ South Central
☐ Great Lakes ☐ Southeast
☐ Northeast ☐ S. Appalachians
☐ Northern Plains ☑ Southwest

**Dominant Species***

| | |
|---|---|
| ARPA6 | CEIN7 |
| ARPU5 | ERFA2 |
| CEGR | GAFL2 |
| CEMOG | QUTU2 |

**General Model Sources**
☐ Literature
☐ Local Data
☑ Expert Estimate

### Geographic Range
Western, southern and central Great Basin of eastern CA, NV and UT. There are limited occurrences extending as far west as the inner Coast Ranges in central CA.

### Biophysical Site Description
This system includes chaparral on sideslopes transitioning from low-elevation desert landscapes up into pinyon-juniper and ponderosa pine woodlands of the western and central Great Basin.

### Vegetation Description
Although these ecological systems are typically dense and impenetrable shrublands, open spaces either bare or supporting patchy grass and forbs can be observed. Characteristic species may include Arctostaphylos patula, Arctostaphylos pungens, Ceanothus greggii, Cercocarpus montanus var. glaber, Cercocarpus intricatus, Eriogonum fasciculatum, Garrya flavescens, Quercus turbinella, Purshia stansburiana and Rhus trilobata. Cercocarpus ledifolius is generally absent.

### Disturbance Description
Typical fire regime in these systems varies with the amount of organic accumulation. The only significant disturbance to the system is stand-replacing fire occurring every 50yrs on average. Shrubs resprout rapidly after fire, often making the vegetation impenetrable.

### Adjacency or Identification Concerns
At higher elevations, chaparral vegetation may blend into ponderosa pine woodlands and pinyon-juniper woodlands. Stand replacement fires will periodically remove these trees.

Compared to other Great Basin systems deserving splitting (eg, BpS 1080, 1081, 1125, and 1126), chaparral

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**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100+ year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement severity.

systems for MZ12 and MZ17 (1104 Mogollon Semi-Desert Chaparral, 1107 Rocky Mountain Gambel Oak-Mixed Montane Shrublands and 1108 Sonora-Mojave Semi-Desert Chaparral) are described too finely to be distinguished and share nearly identical fire dynamics.

### Native Uncharacteristic Conditions

### Scale Description

Vegetation found in small patches of 10ac to whole mountain slopes of 10000ac.

### Issues/Problems

If BpS 1103 is mapped in the interior or southern portions of MZ5, it should probably be changed to BpS 1104 and that vegetation model should be applied. BpS 1103 is unlikely to occur in MZ15 except at the border with Great Basin mapping zones (MZ16 and the northern part of MZ24).

### Comments

This model is identical to the model for the same BpS in MZ12 and MZ17. It is essentially the same model and description for MZ16 proposed by James Bowns and translated into VDDT by Louis Provencher on 3/2/05.

Great Basin chaparral experiences very few disturbances other than replacement fire.

## Vegetation Classes

### Class A 15%

Early Development 1 All Structures

**Upper Layer Lifeform**

- ☐ Herbaceous
- ☑ Shrub
- ☐ Tree

**Fuel Model** 4

**Indicator Species* and Canopy Position**

| | |
|---|---|
| ARPA6 | Upper |
| ARPU5 | Upper |
| CEGR | Upper |
| CEMOG | Upper |

**Structure Data (for upper layer lifeform)**

| | Min | Max |
|---|---|---|
| *Cover* | 0% | 100% |
| *Height* | Shrub 0m | Shrub 1.0m |
| *Tree Size Class* | No Data | |

☐ Upper layer lifeform differs from dominant lifeform.

**Description**

After fire, shrubs resprout strongly from roots or from the base of plants. Shrubs can cause stands to become impenetrable. Stand replacement fire occurs every 50yrs on average. After 10yrs, succession to class B.

### Class B 85%

Mid Development 1 Closed

**Upper Layer Lifeform**

- ☐ Herbaceous
- ☑ Shrub
- ☐ Tree

**Fuel Model** 4

**Indicator Species* and Canopy Position**

| | |
|---|---|
| ARPA6 | Upper |
| ARPU5 | Upper |
| CEGR | Upper |
| CEMOG | Upper |

**Structure Data (for upper layer lifeform)**

| | Min | Max |
|---|---|---|
| *Cover* | 0% | 100% |
| *Height* | Shrub 1.1m | Shrub >3.1m |
| *Tree Size Class* | No data | |

☐ Upper layer lifeform differs from dominant lifeform.

**Description**

Dense shrubs with grasses present in the few openings. Shrub composition same as in class A. The only disturbance is stand replacing fire every 50yrs on average. Canopy cover will generally be >50%.

*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100+ year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement severity.

### *Class C* 0%

[Not Used] [Not Used]

**Upper Layer Lifeform**

- ☐ Herbaceous
- ☐ Shrub
- ☐ Tree

**Fuel Model**

**Description**

**Indicator Species* and Canopy Position**

**Structure Data (for upper layer lifeform)**

| | Min | Max |
|---|---|---|
| *Cover* | % | % |
| *Height* | | |
| *Tree Size Class* | | |

☐ Upper layer lifeform differs from dominant lifeform.

---

### *Class D* 0%

[Not Used] [Not Used]

**Upper Layer Lifeform**

- ☐ Herbaceous
- ☐ Shrub
- ☐ Tree

**Fuel Model**

**Description**

**Indicator Species* and Canopy Position**

**Structure Data (for upper layer lifeform)**

| | Min | Max |
|---|---|---|
| *Cover* | % | % |
| *Height* | | |
| *Tree Size Class* | | |

☐ Upper layer lifeform differs from dominant lifeform.

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### *Class E* 0%

[Not Used] [Not Used]

**Upper Layer Lifeform**

- ☐ Herbaceous
- ☐ Shrub
- ☐ Tree

**Fuel Model**

**Description**

**Indicator Species* and Canopy Position**

**Structure Data (for upper layer lifeform)**

| | Min | Max |
|---|---|---|
| *Cover* | % | % |
| *Height* | | |
| *Tree Size Class* | | |

☐ Upper layer lifeform differs from dominant lifeform.

## *Disturbances*

**Fire Regime Group**: IV**

**Historical Fire Size (acres)**

Avg 500
Min 5
Max 5000

**Sources of Fire Regime Data**

- ☐ Literature
- ☐ Local Data
- ☑ Expert Estimate

**Fire Intervals**

| | Avg FI | Min FI | Max FI | Probability | Percent of All Fires |
|---|---|---|---|---|---|
| *Replacement* | 48 | 10 | 90 | 0.020833 | 100 |
| *Mixed* | | | | | |
| *Surface* | | | | | |
| *All Fires* | 48 | | | 0.02085 | |

***Fire Intervals (FI):***
Fire interval is expressed in years for each fire severity class and for all types of fire combined (All Fires). Average FI is central tendency modeled. Minimum and maximum show the relative range of fire intervals, if known. Probability is the inverse of fire interval in years and is used in reference condition modeling. Percent of all fires is the percent of all fires in that severity class.

**Additional Disturbances Modeled**

- ☐ Insects/Disease
- ☐ Wind/Weather/Stress
- ☐ Native Grazing
- ☐ Competition
- ☐ Other (optional 1)
- ☐ Other (optional 2)

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*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100+ year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement severity.

## References

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*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100+ year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement severity.

# LANDFIRE Biophysical Setting Model

## *Biophysical Setting:* 1511040 Mogollon Chaparral

☐ *This BPS is lumped with:*
☐ *This BPS is split into multiple models:*

## *General Information*

**Contributors** (also see the Comments field) **Date** 10/18/2005


**Modeler 1** Mike Babler mbabler@tnc.org **Reviewer** Linda Wadleigh lwadleigh@fs.fed.us
**Modeler 2** **Reviewer**
**Modeler 3** **Reviewer**


**Vegetation Type**
Upland Shrubland

**Map Zone**
15

**Model Zone**
☐ Alaska ☐ N-Cent.Rockies
☐ California ☐ Pacific Northwest
☐ Great Basin ☐ South Central
☐ Great Lakes ☐ Southeast
☐ Northeast ☐ S. Appalachians
☐ Northern Plains ☑ Southwest

**Dominant Species***

| | |
|---|---|
| QUTU2 | CEGR |
| QUTO2 | FOPU2 |
| CEMO2 | GAWR3 |
| CAHO3 | RHOV |

**General Model Sources**
☑ Literature
☐ Local Data
☐ Expert Estimate

### Geographic Range
This ecological system occurs across central AZ (Mogollon Rim), western NM and southern UT and NV.

### Biophysical Site Description
Dominant along the mid-elevation transition from the Mojave, Sonoran and northern Chihuahuan deserts into the mountains (1000-2200 m). It occurs on foothills, mountain slopes and canyons in drier habitats below the encinal and Pinus ponderosa woodlands. Stands are often associated with more xeric and coarse-textured substrates such as limestone, basalt or alluvium, especially in transition areas with more mesic woodlands

### Vegetation Description
Moderate to dense shrub canopy includes species such as Quercus turbinella, Quercus toumeyi, Cercocarpus montanus, Canotia holacantha, Ceanothus greggii, Forestiera pubescens (= Forestiera neomexicana), Garrya wrightii, Juniperus deppeana, Purshia stansburiana, Rhus ovata, Rhus trilobata and Arctostaphylos pungens and Arctostaphylos pringlei at higher elevations.

### Disturbance Description
Most chaparral species are fire-adapted, resprouting vigorously after burning or producing fire-resistant seeds. Stands occurring within montane woodlands are seral and a result of recent fires. Replacement fires are the dominant disturbance. Disturbance extent is dependent upon patch size, fuel continuity and weather.

### Adjacency or Identification Concerns

### Native Uncharacteristic Conditions

### Scale Description
Stand size can vary from 10s of acres to 1000s. Size of the mosaic composition is unknown.

*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100+ year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement severity.

### Issues/Problems

### Comments

This model was based on input from Dave Gori, dgori@tnc.org; and Heaher Schussman, hschussman@tnc.org. Class descriptions based in part onR3CHAP; Tyson Swetnam, tswetnam@uarizona.edu; Reese Lolley, rlolley@fs.fed.us; reviewed by Linda Wadleigh, lwadleigh@fs.fed.us.

Peer review resulted in a slightly more frequent MFI (from 120yrs to 75yrs).

## *Vegetation Classes*

### *Class A* 5%

Early Development 1 All Structures

**Indicator Species* and Canopy Position**

| | |
|---|---|
| QUTU2 | Upper |
| QUTO2 | Upper |
| CEGR | Upper |

**Structure Data (for upper layer lifeform)**

| | *Min* | *Max* |
|---|---|---|
| *Cover* | 0% | 10% |
| *Height* | Shrub 0m | Shrub 3.0m |
| *Tree Size Class* | No Data | |

☐ Upper layer lifeform differs from dominant lifeform.

**Upper Layer Lifeform**

- ☐ Herbaceous
- ☑ Shrub
- ☐ Tree

**Fuel Model** 1

**Description**

Post-fire community of grasses, forbs and sprouting shrubs. Regrowth of basal sprouters may also be present. Several species establish from soil-stored seeds after fire.

---

### *Class B* 5%

Mid Development 1 Open

**Indicator Species* and Canopy Position**

| | |
|---|---|
| QUTU2 | Upper |
| QUTO2 | Upper |
| CEGR | Upper |

**Structure Data (for upper layer lifeform)**

| | *Min* | *Max* |
|---|---|---|
| *Cover* | 11% | 30% |
| *Height* | Shrub 0m | Shrub 3.0m |
| *Tree Size Class* | No data | |

☐ Upper layer lifeform differs from dominant lifeform.

**Upper Layer Lifeform**

- ☐ Herbaceous
- ☑ Shrub
- ☐ Tree

**Fuel Model** 4

**Description**

Mid-seral, open canopy cover mixed shrub stands with depauperate understory.

---

### *Class C* 15%

Mid Development 1 Closed

**Indicator Species* and Canopy Position**

| | |
|---|---|
| QUTU2 | Upper |
| QUTO2 | Upper |
| CEGR | Upper |

**Structure Data (for upper layer lifeform)**

| | *Min* | *Max* |
|---|---|---|
| *Cover* | 31% | 80% |
| *Height* | Shrub 0m | Shrub 3.0m |
| *Tree Size Class* | No data | |

☐ Upper layer lifeform differs from dominant lifeform.

**Upper Layer Lifeform**

- ☐ Herbaceous
- ☑ Shrub
- ☐ Tree

**Fuel Model** 4

**Description**

Late-seral, mixed shrub dense canopy community with little if any herbaceous community

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*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100+ year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement severity.

### *Class D* 75%

Late Development 1 Closed

**Upper Layer Lifeform**

- ☐ Herbaceous
- ☑ Shrub
- ☐ Tree

**Fuel Model** 4

**Indicator Species* and Canopy Position**

| | |
|---|---|
| QUTU2 | Upper |
| QUTO2 | Upper |
| CEGR | Upper |

**Structure Data (for upper layer lifeform)**

| | *Min* | *Max* |
|---|---|---|
| *Cover* | 31% | 80% |
| *Height* | Shrub 3.1m | Shrub >3.1m |
| *Tree Size Class* | No data | |

☐ Upper layer lifeform differs from dominant lifeform.

**Description**

Decadent shrubs with no understory

### *Class E* 0%

[Not Used] [Not Used]

**Upper Layer Lifeform**

- ☐ Herbaceous
- ☐ Shrub
- ☐ Tree

**Fuel Model**

**Indicator Species* and Canopy Position**

**Structure Data (for upper layer lifeform)**

| | *Min* | *Max* |
|---|---|---|
| *Cover* | % | % |
| *Height* | | |
| *Tree Size Class* | | |

☐ Upper layer lifeform differs from dominant lifeform.

**Description**

## *Disturbances*

**Fire Regime Group**: IV

**Historical Fire Size (acres)**

Avg
Min
Max

**Sources of Fire Regime Data**

- ☑ Literature
- ☐ Local Data
- ☑ Expert Estimate

**Fire Intervals**

| | *Avg FI* | *Min FI* | *Max FI* | *Probability* | *Percent of All Fires* |
|---|---|---|---|---|---|
| *Replacement* | 80 | | | 0.0125 | 96 |
| *Mixed* | | | | | |
| *Surface* | 2000 | | | 0.0005 | 4 |
| *All Fires* | 77 | | | 0.01301 | |

***Fire Intervals (FI):***

Fire interval is expressed in years for each fire severity class and for all types of fire combined (All Fires). Average FI is central tendency modeled. Minimum and maximum show the relative range of fire intervals, if known. Probability is the inverse of fire interval in years and is used in reference condition modeling. Percent of all fires is the percent of all fires in that severity class.

**Additional Disturbances Modeled**

- ☐ Insects/Disease
- ☐ Wind/Weather/Stress
- ☐ Native Grazing
- ☐ Competition
- ☐ Other (optional 1)
- ☐ Other (optional 2)

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*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100+ year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement severity.

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*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100+ year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement severity.

# LANDFIRE Biophysical Setting Model

## *Biophysical Setting:* 1511070 Rocky Mountain Gambel Oak-Mixed Montane Shrubland

☐ *This BPS is lumped with:*
☐ *This BPS is split into multiple models:*

## *General Information*

**Contributors** (also see the Comments field) **Date** 10/18/2005


| | | | | | |
|---|---|---|---|---|---|
| **Modeler 1** | John Seeman | jseeman@fs.fed.us | **Reviewer** | Paul Langowski | plangowski@fs.fed.us |
| **Modeler 2** | Ken Holsinger | ken_holsinger@co.blm.gov | **Reviewer** | Vic Ecklund | vecklund@csu.org |
| **Modeler 3** | Linda Chappell | lchappell@fs.fed.us | **Reviewer** | Chuck Kostecka | |


**Vegetation Type**
Upland Shrubland

**Map Zone**
15

**Model Zone**
☐ Alaska ☐ N-Cent.Rockies
☐ California ☐ Pacific Northwest
☐ Great Basin ☐ South Central
☐ Great Lakes ☐ Southeast
☐ Northeast ☐ S. Appalachians
☐ Northern Plains ☑ Southwest

**Dominant Species***

| | |
|---|---|
| QUGA | AMAL2 |
| AMUT | PUTR2 |
| CAGE2 | RONE |
| STLE4 | PRVI |

**General Model Sources**
☑ Literature
☐ Local Data
☑ Expert Estimate

### Geographic Range
Colorado Plateau and southern Rocky Mountains. Gambel oak occurs primarily in CO, NM, UT, AZ and southeastern WY. In the southern extent of its distribution, Gambel oak occupies a minor role as an associate with ponderosa pine and mixed conifer habitats. Moving north, long-lived Gambel oak clones form dominant to mono-typic overstories. (Simonin 2000).

### Biophysical Site Description
In CO, Gambel oak occurs between 2000-2900m feet (6600-9570ft) on all aspects in this BpS. At higher elevations it is more predominant on southern exposures. Gambel oak is typically a riparian species in NM within the Black and Sacramento Mountain ranges.

### Vegetation Description
Gambel oak occurs as the dominant species ranging from dense thickets to clumps associated with serviceberry or sagebrush. Gambel oak generally has a well-developed understory comprised of snowberry, elk sedge, Letterman's needlegrass, poa ampla, yarrow, lupine and goldenrod.

### Disturbance Description
The primary disturbance mechanism is mixed-severity fire resulting in top-kill and rare mortality. Gambel oak responds to fire with vigorous sprouting from the root crown. Larger forms may survive low-intensity surface fire. Extended drought also contributes to disturbance.

### Adjacency or Identification Concerns
This BpS is characterized by >80% Gambel oak. This type merges with the mountain shrub PNVG at lower elevations and intermingles with the deciduous woodland PNVG at higher elevations and/or northern

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exposures.

### Native Uncharacteristic Conditions

### Scale Description

Scale ranges from 10 to 1000s of acres

### Issues/Problems

### Comments

This model is identical to the model for the same BpS in MZ28. It is based on the Rapid Assessment model R3QUGA, which was reviewed by Bill Baker, bakerwl@wyo.edu. This effort models Gambel oak as a climax species. Suggested reviewers; Brenda Wilmore, bwilmore@fs.fed.us; Mark Rogers, mark_rogers@co.blm.gov; Winslow Robertson, winslow_robertson@co.blm.gov.

Review suggested using a replacement fire interval of 100yrs. Based on mixed review comments, model was left as developed.

## Vegetation Classes

**Class A** 5%

Early Development 1 All Structures

**Indicator Species* and Canopy Position**

QUGA Upper

**Structure Data (for upper layer lifeform)**

| | Min | Max |
|---|---|---|
| Cover | 0% | 100% |
| Height | Shrub 0m | Shrub 0.5m |
| Tree Size Class | No Data | |

☐ Upper layer lifeform differs from dominant lifeform.

**Upper Layer Lifeform**

☐ Herbaceous
☑ Shrub
☐ Tree

**Fuel Model** 1

(This class should include shrubs of any height <20% cover.)

**Description**

Post-replacement sprouts to approximately two feet high. Dense resprouting with high number of stems/acre. Abundant grass and forb cover.

---

**Class B** 50%

Mid Development 1 Closed

**Indicator Species* and Canopy Position**

QUGA Upper

**Structure Data (for upper layer lifeform)**

| | Min | Max |
|---|---|---|
| Cover | 21% | 70% |
| Height | Shrub 0.6m | Shrub 1.0m |
| Tree Size Class | No data | |

☐ Upper layer lifeform differs from dominant lifeform.

**Upper Layer Lifeform**

☐ Herbaceous
☑ Shrub
☐ Tree

**Fuel Model** 2

**Description**

3-6ft tall to 3in dbh. Stem mortality due to competition with slight decrease in understory species due to shading. Grass and forbs declining.

---

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### *Class C* 15%

Late Development 1 Open

**Indicator Species* and Canopy Position**

QUGA Upper
ARTRV
CAGE2

**Structure Data (for upper layer lifeform)**

| | Min | Max |
|---|---|---|
| *Cover* | 21% | 70% |
| *Height* | Shrub 1.1m | Shrub >3.1m |
| *Tree Size Class* | No data | |

☐ Upper layer lifeform differs from dominant lifeform.

**Upper Layer Lifeform**

☐ Herbaceous
☑ Shrub
☐ Tree

**Fuel Model** 6

**Description**

>6ft tall and >3in dbh. Small stands <30m with open canopy and usually scattered throughout a grassland or shrub type (Brown 1958).

---

### *Class D* 30%

Late Development 1 Closed

**Indicator Species* and Canopy Position**

QUGA Upper

**Structure Data (for upper layer lifeform)**

| | Min | Max |
|---|---|---|
| *Cover* | 71% | 100% |
| *Height* | Shrub 1.1m | Shrub >3.1m |
| *Tree Size Class* | No data | |

☐ Upper layer lifeform differs from dominant lifeform.

**Upper Layer Lifeform**

☐ Herbaceous
☑ Shrub
☐ Tree

**Fuel Model** No d

**Description**

>6ft tall and 3in dbh. Nearly continuous canopy cover, two or more hectares in size with only occasional openings (Brown 1958).

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### *Class E* 0%

[Not Used] [Not Used]

**Indicator Species* and Canopy Position**

**Structure Data (for upper layer lifeform)**

| | Min | Max |
|---|---|---|
| *Cover* | % | % |
| *Height* | | |
| *Tree Size Class* | | |

☐ Upper layer lifeform differs from dominant lifeform.

**Upper Layer Lifeform**

☐ Herbaceous
☐ Shrub
☐ Tree

**Fuel Model**

**Description**

## *Disturbances*

**Fire Regime Group**: III**

**Historical Fire Size (acres)**

Avg
Min
Max

**Sources of Fire Regime Data**

☑ Literature
☑ Local Data
☑ Expert Estimate

**Fire Intervals**

| | Avg FI | Min FI | Max FI | Probability | Percent of All Fires |
|---|---|---|---|---|---|
| *Replacement* | 50 | | | 0.02 | 75 |
| *Mixed* | 150 | | | 0.006667 | 25 |
| *Surface* | | | | | |
| *All Fires* | 37 | | | 0.02668 | |

***Fire Intervals (FI):***
Fire interval is expressed in years for each fire severity class and for all types of fire combined (All Fires). Average FI is central tendency modeled. Minimum and maximum show the relative range of fire intervals, if known. Probability is the inverse of fire interval in years and is used in reference condition modeling. Percent of all fires is the percent of all fires in that severity class.

*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100+ year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement severity.

**Additional Disturbances Modeled**

☐Insects/Disease ☐Native Grazing ☐Other (optional 1)
☐Wind/Weather/Stress ☐Competition ☐Other (optional 2)

## References


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*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100+ year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement severity.

# LANDFIRE Biophysical Setting Model

## *Biophysical Setting:* 1511090 Sonoran Paloverde-Mixed Cacti Desert Scrub

☐ *This BPS is lumped with:*
☐ *This BPS is split into multiple models:*

## *General Information*

**Contributors** (also see the Comments field) **Date** 10/18/2005


| | | | |
|---|---|---|---|
| **Modeler 1** | Todd Esque | todd_esque@usgs.gov | **Reviewer** |
| **Modeler 2** | Guy McPherson | grm@ag.arizona.edu | **Reviewer** |
| **Modeler 3** | | | **Reviewer** |


**Vegetation Type**
Upland Shrubland

**Map Zone**
15

**Model Zone**
☐ Alaska ☐ N-Cent.Rockies
☐ California ☐ Pacific Northwest
☐ Great Basin ☐ South Central
☐ Great Lakes ☐ Southeast
☐ Northeast ☐ S. Appalachians
☐ Northern Plains ☑ Southwest

**Dominant Species***
PARKI2 ACGR
CAGI10 PRVE
FEROC
FOSP2

**General Model Sources**
☑ Literature
☑ Local Data
☑ Expert Estimate

### Geographic Range
West of the Colorado River, this ecological system occurs at low elevations in association with xeroriparian features and low foothills.

### Biophysical Site Description
System typically found below 1200m, with rare occurrences up to 1400m. With decreasing elevation, the system typically occurs in xeroriparian habitats and on rock outcrops. In uplands, the system is found on coarse soils that may be associated with poorly developed geomorphic surfaces; at lower elevations, it is found on very stable geomorphic surfaces.

Extended periods of drought or episodes of extreme cold limit this type. Specifically, establishment of establishment of dominant species is constrained by decadal or longer periods of below-average precipitation (Turner et al 1995). Twenty-four hours of below-freezing temperature causes nearly total mortality of the dominant plants. At the southern end of the system's range, interference from more mesic species apparently constrain distribution of this system (Turner et al 1995).

### Vegetation Description
Dominant overstory plants include giant saguaro, palo verde, barrel cactus and ocotillo. Velvet mesquite, catclaw acacia and ironwood sometimes are co-dominant species. Bursage is the dominant understory species, and it serves as a frequent nurse plant for the dominant overstory plants (McAuliffe 1988).

Cover of dominant overstory plants ranges from about 1% to about 20%. The number and variety of life-forms ranges from few to many and apparently is controlled to a great extent by soil moisture, as mediated by geomorphic conditions (Brown 1982).

Plant species composition varies significantly over at least two temporal scales. At the annual scale of

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resolution, above-average precipitation during the winter engenders development of considerable cover and biomass of annual cool-season plants (notably including Plantago spp). At decadal to century-long scales, extended periods of below-average precipitation and episodes of extremely low temperatures cause thinning and, in exceptional cases, replacement of dominant overstory species.

### Disturbance Description

This system is not thought to have supported fuel loads to sustain large fires prior to European habitation of the region. Fires would have been associated with dry lightning coincident with monsoonal storms during years when previous winter precipitation was sufficient to create a thick fine-fuel bed of annual plants. Fires probably were associated with dry lightning and very patchy due to heavier fuels in patchy microsites, or linear when high winds were associated with convection storms.

Replacement fires were very rare or absent (average FRI of 100-1000yrs, and perhaps longer). If they occurred, they did so during conditions of extreme fire behavior after consecutive years of above-average winter precipitation. These rare fires -- which may or may not have occurred -- had tremendous influence on community structure because the dominant overstory plants are extremely susceptible to fires, even those of low intensity (McLaughlin and Bowers 1982, Esque et al 2004).

Prolonged weather-related stress (drought or frost) thinned dominant overstory plants and, in rare cases, led to stand replacement. We speculate that these events occurred with similar frequency as stand-replacing fires. (In the VDDT model, drought was modeled as "wind/weather/stress" and lethal frost was modeled as "optional 1".)

Large (presumably old) saguaro plants are susceptible to windthrow, particularly after rainstorms saturate the soil.

### Adjacency or Identification Concerns

This systems is bordered at upper elevations by semi-desert grasslands or Mojave-Sonora Semi-Desert Chaparral (BpS 1108) and at lower elevations or poorly developed geomorphic surfaces by Sonora-Mojave Creosote-White Bursage Desert Scrub (BpS 1087).

This system occurs at lower elevations than Colorado Plateau Pinyon-Juniper Woodland (BpS 1016) where sympatric.

Two major modern issues, climate change and invasive nonnative plant species (especially the annual grasses red brome and Mediterranean grass and the perennial grass buffelograss), lead to non-equilibrial vegetation dynamics for this ecological system, making it difficult to categorize and usefully apply natural disturbance regimes. Sites with an important annual grass component in the understory experience increased fire frequency, and result in more intense and widespread fires. Moreover, fire from adjacent BpS invaded by annual grasses will spread more frequently into in BpS 1109, which is exceptionally fire sensitive.

### Native Uncharacteristic Conditions

In MZ13, but not MZ14, cover values greater than 30% are uncharacteristic. Above-average precipitation during the winter engenders development of considerable cover and biomass of annual cool-season plants (notably including Plantago spp). When followed by dry, windy weather and an ignition source (primarily lightning), this phenomenon may contribute to stand-replacement fires across tens of thousands of acres. However, this speculation is supported by a single anecdote from a potentially dissimilar ecosystem.

### Scale Description

This system occurs at scales of tens of thousands of acres, although the more common scale is thousands of

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acres.

Within this system, the most common disturbance is blowdown of single plants, or small groups, of saguaro.

Perhaps more important are the infrequent stand-replacing events of fire, drought and severe cold that affect very large areas.

### Issues/Problems

West of the Colorado River, fire probably was extremely rare because the vegetation is quite sparse.

There is much uncertainty in model parameters, particularly with respect to the return interval of fire, drought and lethal cold temperatures.

### Comments

This model is based on drafts of models for the same BpS in MZ13 and MZ14.

## Vegetation Classes

### Class A 5%

Early Development 1 Open

**Upper Layer Lifeform**

- [x] Herbaceous
- [ ] Shrub
- [ ] Tree

**Fuel Model** 1

**Indicator Species* and Canopy Position**

ENFA Upper

**Structure Data (for upper layer lifeform)**

| | Min | Max |
|---|---|---|
| Cover | 0% | 30% |
| Height | Herb 0m | Herb 0.5m |
| Tree Size Class | No Data | |

[ ] Upper layer lifeform differs from dominant lifeform.

**Description**

Initial post-disturbance community dominated by brittlebush. Duration 20yrs with succession to B.

### Class B 20%

Mid Development 1 Open

**Upper Layer Lifeform**

- [ ] Herbaceous
- [x] Shrub
- [ ] Tree

**Fuel Model** 5

**Indicator Species* and Canopy Position**

ENFA Upper

**Structure Data (for upper layer lifeform)**

| | Min | Max |
|---|---|---|
| Cover | 0% | 30% |
| Height | Shrub 0m | Shrub 1.0m |
| Tree Size Class | No data | |

[ ] Upper layer lifeform differs from dominant lifeform.

**Description**

Dominated by brittlebush and early-seral shrubs. Dominant succulents and woody plants have established beneath brittlebush plants. Duration 50-100yrs with succession to C unless infrequent replacement fire or climatic event (drought, frost) returns vegetation to A. Lethal freeze and drought are listed as Wind/Weather/Stress in model.

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**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100+ year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement severity.

### *Class C* 75%

Late Development 1 Closed

**Upper Layer Lifeform**

- ☐ Herbaceous
- ☐ Shrub
- ☑ Tree

**Fuel Model** 5

**Indicator Species* and Canopy Position**

| | |
|---|---|
| ENFA | Lower |
| PARKI2 | Upper |
| CAGI10 | Upper |
| FEROC | Upper |

**Structure Data (for upper layer lifeform)**

| | Min | Max |
|---|---|---|
| *Cover* | 0% | 30% |
| *Height* | Tree 0m | Tree 10m |
| *Tree Size Class* | Pole 5-9" DBH | |

☑ Upper layer lifeform differs from dominant lifeform.

Dominant lifeform is bursage with canopy cover of 5-30% and height is 0.1-0.3 m.

**Description**

Succulent and small tree-dominated community. Persists until infrequent replacement fire or climatic event (drought, frost) returns vegetation to A. Lethal freeze and drought are listed as Wind/Weather/Stress in model.

---

### *Class D* 0%

[Not Used] [Not Used]

**Upper Layer Lifeform**

- ☐ Herbaceous
- ☐ Shrub
- ☐ Tree

**Fuel Model**

**Indicator Species* and Canopy Position**

**Structure Data (for upper layer lifeform)**

| | Min | Max |
|---|---|---|
| *Cover* | % | % |
| *Height* | | |
| *Tree Size Class* | | |

☐ Upper layer lifeform differs from dominant lifeform.

**Description**

---

### *Class E* 0%

[Not Used] [Not Used]

**Upper Layer Lifeform**

- ☐ Herbaceous
- ☐ Shrub
- ☐ Tree

**Fuel Model**

**Indicator Species* and Canopy Position**

**Structure Data (for upper layer lifeform)**

| | Min | Max |
|---|---|---|
| *Cover* | % | % |
| *Height* | | |
| *Tree Size Class* | | |

☐ Upper layer lifeform differs from dominant lifeform.

**Description**

## *Disturbances*

**Fire Regime Group**:** V

**Historical Fire Size (acres)**

Avg 1
Min 1
Max 1

**Sources of Fire Regime Data**

- ☑ Literature
- ☑ Local Data
- ☑ Expert Estimate

**Fire Intervals**

| | Avg FI | Min FI | Max FI | Probability | Percent of All Fires |
|---|---|---|---|---|---|
| *Replacement* | 1000 | 50 | 10000 | 0.001 | 98 |
| *Mixed* | | | | | |
| *Surface* | | | | | |
| *All Fires* | 998 | | | 0.00102 | |

***Fire Intervals (FI):***
Fire interval is expressed in years for each fire severity class and for all types of fire combined (All Fires). Average FI is central tendency modeled. Minimum and maximum show the relative range of fire intervals, if known. Probability is the inverse of fire interval in years and is used in reference condition modeling. Percent of all fires is the percent of all fires in that severity class.

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**Additional Disturbances Modeled**

☐ Insects/Disease ☐ Native Grazing ☑ Other (optional 1) lethal frost
☑ Wind/Weather/Stress ☐ Competition ☐ Other (optional 2)

## References


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Turner, R.M., J.E. Bowers and T.L. Burgess. 1995. Sonoran Desert Plants: An Ecological Atlas. University of Arizona Press. 504 pp.

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**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100+ year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement severity.

# LANDFIRE Biophysical Setting Model

## *Biophysical Setting:* 1511150 Inter-Mountain Basins Juniper Savanna

☐ *This BPS is lumped with:*
☐ *This BPS is split into multiple models:*

## *General Information*

**Contributors** (also see the Comments field) **Date** 10/18/2005


**Modeler 1** Bob Unnasch bunnasch@tnc.org **Reviewer**
**Modeler 2** **Reviewer**
**Modeler 3** **Reviewer**


**Vegetation Type**
Upland Savannah/Shrub Steppe

**Map Zone**
15

**Model Zone**
☐ Alaska ☐ N-Cent.Rockies
☐ California ☐ Pacific Northwest
☐ Great Basin ☐ South Central
☐ Great Lakes ☐ Southeast
☐ Northeast ☐ S. Appalachians
☐ Northern Plains ☑ Southwest

**Dominant Species***
JUOS
JUOC
BOGR2

**General Model Sources**
☑ Literature
☐ Local Data
☐ Expert Estimate

### Geographic Range
This widespread ecological system occupies dry foothills and sandsheets of western CO, northwestern NM, northern AZ, UT, west into the Great Basin of NV and southern ID.

### Biophysical Site Description
This ecological system is typically found at lower elevations, ranging from 1500-2300m. Occurrences are found on lower mountain slopes, hills, plateaus, basins and flats often where juniper is expanding into semi-desert grasslands and steppe.

### Vegetation Description
The vegetation is typically open savanna, although there may be inclusions of more dense juniper woodlands. This savanna is typically dominated by Juniperus osteosperma trees with high cover of perennial bunch grasses and forbs, with Bouteloua gracilis, Hesperostipa comata and Pleuraphis jamesii being most common. In the southern Colorado Plateau, Juniperus monosperma or juniper hybrids may dominate the tree layer. Pinyon trees are typically not present because sites are outside the ecological or geographic range of Pinus edulis and Pinus monophylla.

### Disturbance Description
Uncertainty exists about the fire frequencies of this ecological system, though it is predominantly Fire Regime Group III. Fire regime was primarily determined by fire occurrence in the surrounding matrix vegetation. Lightning-ignited fires were common but typically did not affect more than a few individual trees. Replacement fires were uncommon to rare (average FRI of 100-500yrs) and occurred primarily during extreme fire behavior conditions. Mixed severity fire (average FRI of 100-500yrs) was characterized as a mosaic of replacement and surface fires distributed through the patch at a fine scale (<0.1ac). Surface fires could occur in stands where understory grass (FEID) cover is high and provides adequate fuel. Surface fire were primarily responsible for producing fire scars on juniper or pinyon trees (average FRI of 100yrs).

*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100+ year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement severity.

### Adjacency or Identification Concerns

This system is generally found at lower elevations and more xeric sites than Great Basin Pinyon-Juniper Woodland (1019) or Colorado Plateau Pinyon-Juniper Woodland (1016). It is also ecologically similar to (and the model is similar to) Colorado Plateau Pinyon-Juniper Shrubland (1102).

Fire regime primarily determined by adjacent vegetation and spread from the adjacent types into this community.

In modern days, surrounding matrix vegetation has changed to young mid-aged woodlands that burn more intensely than the former sagebrush matrix. Many lay-people confuse these younger pinyon and juniper woodlands with true woodlands dependent on naturally fire-protected features.

### Native Uncharacteristic Conditions

### Scale Description

Juniper steppe was usually distributed across the landscape in patches that range from 10s to 100s of acres in size. In areas with very broken topography and/or mesa landforms this type may have occurred in patches of several hundred acres. In UT and NV pinyon and juniper landscape patches tended to be 10-100s of acres in size.

### Issues/Problems

### Comments

This model is identical to the model for the same BpS in MZ16, MZ23 and MZ24. This is essentially the same model as the Rapid Assessment PNVG R2PIJU developed by Steve Bunting (sbunting@uidaho.edu), Krista Waid-Gollnick (krista_waid@blm.gov) and Henry Bastian (henry_bastian@ios.doi.gov) for juniper and/or pinyon savanna. Reviewers of R2PIJU were George Gruell (ggruell@charter.net), Jolie Pollet (jpollet@blm.gov) and Peter Weisberg (pweisberg@cabnr.unr.edu). It is almost identical to the model for Colorado Plateau Pinyon-Juniper Shrubland for MZ16 (161102).

Cover breaks changed by Pohl on 3/30/2005 to facilitate LF mapping and differentiate structural classes. D was changed from 11-30% to 21-30%; E was changed from 21-40% to 31-40%.

As a result of final QC for LANDFIRE National by Kori Blankenship the user-defined min and max fire return intervals for surface severity fire were deleted because they were not consistent with the modeled fire return interval for this fire severity type.

## *Vegetation Classes*

***Class A*** **5%**

Early Development 1 Open

**Upper Layer Lifeform**

- [x] Herbaceous
- [ ] Shrub
- [ ] Tree

**Fuel Model** 1

**Description**

**Indicator Species* and Canopy Position**

| | |
|---|---|
| BOGR2 | Upper |
| HECO26 | Upper |
| CRYP | Lower |
| PLEUR12 | Upper |

**Structure Data (for upper layer lifeform)**

| | *Min* | *Max* |
|---|---|---|
| *Cover* | 0% | 10% |
| *Height* | Herb 0m | Herb 0.5m |
| *Tree Size Class* | No Data | |

[ ] Upper layer lifeform differs from dominant lifeform.

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**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100+ year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement severity.

Initial post-fire community dominated by annual forbs. Later stages of this class contain greater amounts of perennial grasses and forbs. Duration 10yrs with succession to B, mid-development closed. Replacement fire occurs every 100yrs on average. Infrequent mixed severity fire (average FRI of 300yrs) thins vegetation.

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***Class B*** **5%**

Mid Development 1 Open

**Upper Layer Lifeform**

- [x] Herbaceous
- [ ] Shrub
- [ ] Tree

**Fuel Model** 1

**Indicator Species* and Canopy Position**

| | |
|---|---|
| BOGR2 | Upper |
| HECO26 | Upper |
| ARTRV | Upper |

**Structure Data (for upper layer lifeform)**

| | Min | Max |
|---|---|---|
| *Cover* | 10% | 20% |
| *Height* | Herb 0.6m | Herb 1.0m |
| *Tree Size Class* | No data | |

- [ ] Upper layer lifeform differs from dominant lifeform.

**Description**

Dominated by perennial forbs and grasses. Total cover remains low due to shallow, unproductive soil. Duration 20yrs with succession to C unless infrequent replacement fire (FRI of 100yrs) returns the vegetation to A. It is important to note that replacement fire at this stage does not eliminate perennial grasses, thus, in reality, succession age in A after this type of fire would be older than zero and <10. Mixed severity fire (average FRI of 100yrs) thins the woody vegetation.

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***Class C*** **15%**

Mid Development 2 Open

**Upper Layer Lifeform**

- [ ] Herbaceous
- [ ] Shrub
- [x] Tree

**Fuel Model** 2

**Indicator Species* and Canopy Position**

| | |
|---|---|
| ARTRV | Upper |
| BOGR2 | Middle |
| JUOC | Mid-Upper |
| JUOS | Mid-Upper |

**Structure Data (for upper layer lifeform)**

| | Min | Max |
|---|---|---|
| *Cover* | 0% | 20% |
| *Height* | Tree 0m | Tree 5m |
| *Tree Size Class* | Seedling <4.5ft | |

- [x] Upper layer lifeform differs from dominant lifeform.

Juniper seedlings emerging from vegetation; this class may be dominated by shrubs.

**Description**

Shrub dominated community with young juniper seedlings becoming established. Duration 70yrs with succession to D unless replacement fire (average FRI of 200yrs) causes a transition to A. It is important to note that replacement fire at this stage does not eliminate perennial grasses, thus, in reality, succession age in A after this type of fire would be older than zero and <10. Mixed severity fire as in B.

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***Class D*** **35%**

Late Development 1 Open

**Upper Layer Lifeform**

- [ ] Herbaceous
- [ ] Shrub
- [x] Tree

**Fuel Model** 2

**Indicator Species* and Canopy Position**

| | |
|---|---|
| JUOC | Upper |
| BOGR2 | Lower |
| ARTRV | Middle |
| JUOS | Upper |

**Structure Data (for upper layer lifeform)**

| | Min | Max |
|---|---|---|
| *Cover* | 21% | 30% |
| *Height* | Tree 0m | Tree 5m |
| *Tree Size Class* | Pole 5-9" DBH | |

- [ ] Upper layer lifeform differs from dominant lifeform.

**Description**

Community dominated by young juniper and pine of mixed age structure. Juniper and pinyon becoming competitive on site and beginning to affect understory composition. Duration 300yrs with succession to E unless replacement fire (average FRI of 500yrs) causes a transition to A. Mixed severity fire is less frequent than in

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previous states (200yrs), whereas surface fire every 100yrs on average becomes more important at this age in succession.

***Class E*** **40 %**

Late Development 2 Open

**Upper Layer Lifeform**

- ☐ Herbaceous
- ☐ Shrub
- ☑ Tree

**Fuel Model** 1

**Indicator Species* and Canopy Position**

| | |
|---|---|
| JUOC | Upper |
| BOGR2 | Lower |
| JUOS | Upper |

**Structure Data (for upper layer lifeform)**

| | *Min* | *Max* |
|---|---|---|
| *Cover* | 31 % | 40 % |
| *Height* | Tree 0m | Tree 10m |
| *Tree Size Class* | Medium 9-21"DBH | |

☐ Upper layer lifeform differs from dominant lifeform.

Any trees >5m should be included in this class, up to 40% canopy cover.

**Description**

Site dominated by widely spaced old juniper. Grasses (eg, Bouteloua gracilis, Hesperostipa comata) present on microsites sites with deeper soils (>20 in) with restricting clay subsurface horizon. Potential maximum overstory coverage is greater in those stands with pinyon as compared to those with only juniper. Replacement fire and mixed severity fires are rare (average FRIs of 500yrs). Surface fire every 100yrs on average will scar ancient trees. Duration 600yrs+.

## Disturbances

**Fire Regime Group**:** **III**

**Historical Fire Size (acres)**

Avg 10
Min 1
Max 100

**Sources of Fire Regime Data**

- ☐ Literature
- ☐ Local Data
- ☑ Expert Estimate

**Fire Intervals**

| | *Avg FI* | *Min FI* | *Max FI* | *Probability* | *Percent of All Fires* |
|---|---|---|---|---|---|
| *Replacement* | 345 | 100 | 1000 | 0.002899 | 19 |
| *Mixed* | 217 | 100 | 1000 | 0.004608 | 30 |
| *Surface* | 125 | | | 0.008 | 52 |
| *All Fires* | 64 | | | 0.01551 | |

***Fire Intervals (FI):***

Fire interval is expressed in years for each fire severity class and for all types of fire combined (All Fires). Average FI is central tendency modeled. Minimum and maximum show the relative range of fire intervals, if known. Probability is the inverse of fire interval in years and is used in reference condition modeling. Percent of all fires is the percent of all fires in that severity class.

**Additional Disturbances Modeled**

- ☐ Insects/Disease
- ☐ Wind/Weather/Stress
- ☐ Native Grazing
- ☐ Competition
- ☐ Other (optional 1)
- ☐ Other (optional 2)

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# LANDFIRE Biophysical Setting Model

## *Biophysical Setting:* 1511160 Madrean Juniper Savanna

☑ *This BPS is lumped with: 1510250*
☐ *This BPS is split into multiple models:*

## *General Information*

**Contributors** (also see the Comments field) **Date** 10/18/2005


| | | | | | |
|---|---|---|---|---|---|
| **Modeler 1** | Mike Babler | mbabler@tnc.org | **Reviewer** | Keith Schulz | Keith_Schulz@natureserve.org |
| **Modeler 2** | | | **Reviewer** | Reese Lolley | rlolley@fs.fed.us |
| **Modeler 3** | | | **Reviewer** | Guy McPherson | grm@ag.arizona.edu |


**Vegetation Type**
Forest and Woodland

**Map Zone**
15

**Model Zone**
☐ Alaska ☐ N-Cent.Rockies
☐ California ☐ Pacific Northwest
☐ Great Basin ☐ South Central
☐ Great Lakes ☐ Southeast
☐ Northeast ☐ S. Appalachians
☐ Northern Plains ☑ Southwest

**Dominant Species***

| | |
|---|---|
| JUDE | QUEM |
| PIED | QUGR3 |
| PIDI3 | QUOB |
| QUAR | PILE |

**General Model Sources**
☑ Literature
☐ Local Data
☑ Expert Estimate

### Geographic Range
Sierra Madre Occidentale and Sierra Madre Oriental in Mexico, Trans-Pecos TX, southern NM, southern AZ (south of the Mogollan Rim) and southwestern NM.

### Biophysical Site Description
This biophysical system typically is found at elevations between 1400m and 2200m. Madrean Juniper savannas occur at the lower altitudinal limits for foothill tree species, below the pinyon-juniper woodlands but at or above semi-desert grassland where soil moisture limits cover of montane woody plants. At higher and therefore moister elevations, woodlands grade into Madrean encinal or, less frequently, montane pine-oak woodlands characterized by taller and denser vegetation than these woodlands. Savannas and woodlands are found on many and varied topographic positions, including low- to mid-elevation mountain slopes, hills, plateaus, basins and flats.

### Vegetation Description
The upper vegetation canopy is composed of open to moderately dense tree layer dominated by Pinus cembroides, Pinus discolor, Pinus edulis, Juniperus depeanna and or Juniperus monosperma. Madrean oaks such as Quercus arizonica, Q. emoryi, Q. grisia, Q. oblongifolia or Q. mohriana may be present to codominant with pinyon and or juniper trees. In SW NM, Q. grisia may be dominant. Pinus engelmannii occurs infrequently and P. ponderosa and P. arizonica are absent. Juniperus monosperma is often present to dominant on the Gila National Forest. Understory layers are variable and may be dominated by shrubs such as manzanita (Arctostaphylos pungens, A. pringlei), cliffrose (Cowania mexicana), Apache plume (Fallugia paradoxa) or barberry (Berberis spp). Graminoids may form dense (savanna) to sparse canopy. Common species include sideoats grama (Bouteloua curtipendula), cane bluestem (Bothriochloa barbinodis), muhly grasses (Muhlenbergia emerslyei, M. torreyi, M. porteri). Graminoids decrease in cover and biomass with

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increasing cover of woody plants.

### Disturbance Description

The fire regime of this ecological system is almost completely unknown. There are essentially no data about fire frequency, fire history or fire behavior. The occasional paper that addresses fire includes considerably more speculation than data. It would seem that fire occurrence was determined primarily by fire occurrence in the surrounding matrix vegetation, and was ignited by lightning during early summer. However, even this information is speculative and undocumented; based on contemporary ecological knowledge, models that assume specific fire regimes are little more than wild guesses. Such a model follows, in the sincere hope that it will be ignored or improved upon.

This system is likely predisposed to stand-replacement fires during the earliest stage of stand development. Replacement fires are assumed to have occurred every century or so, and mixed severity fires slightly less frequently. Significant drought occurs about every 60yrs and, in combination with herbivory from invertebrates, causes disproportional mortality of large, old trees.

### Adjacency or Identification Concerns

This system generally is found at higher elevations and more mesic sites than semi-desert grassland. Typically it is bordered at higher elevations by Madrean Pine-Oak Woodlands.

Cover and density of juniper and pinyon trees at lower elevations in this type doubtless have increased as a result of fire suppression (possibly as mitigated by livestock grazing). This phenomenon is characteristic of BpS 1116 (juniper savanna), with which BpS 1025 (pinyon-juniper woodland) has been lumped for MZ15. Bordered at low elevation by Madrean Encinal and Desert Grasslands on Gila NF.

### Native Uncharacteristic Conditions

### Scale Description

Pinyon-juniper woodland usually was distributed across the landscape in patches between 100s and 1000s of acres in size. In particularly dissected topography this type may have occurred in smaller patches.

### Issues/Problems

Virtually no components of the fire regimes are known with any certainty. Fire scars are rare and trees in this system cannot be aged with conventional dendrochronological techniques. Information about fire regimes is extrapolated from adjacent systems, and extreme caution is warranted when interpreting these models. Fire season can be inferred more reliably than fire frequency; the former likely is equally or more important than the latter.

This ecological system was originally described assuming evergreen oak species are present to codominant in the understory or canopy inMZ15 (Schulz, personal communication). This system also includes pinyon-juniper woodlands and savannas with understories dominated by other shrubs or a grass layer and lack evergreen oaks, which may have a different fire behavior.

### Comments

This model is based on the model 141025, by Guy McPherson, with minor changes in species. Recommended reviewers: Wendell Hann, Anthony Caprio, Geoff Babb, Drew Barton.

It has been suggested that the models for MZ15 will better reflect the conditions in MZ24, but they are not developed yet. Heather Schussman also provided suggestions for Madrean models.

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As a result of final QC for LANDFIRE National by Kori Blankenship the user-defined min and max fire return intervals for surface severity fire were deleted because they were not consistent with the modeled fire return interval for this fire severity type.

## Vegetation Classes

### Class A 5%

Early Development 1 All Structures

**Upper Layer Lifeform**

- [x] Herbaceous
- [ ] Shrub
- [ ] Tree

**Fuel Model** 1

**Indicator Species* and Canopy Position**

| | |
|---|---|
| BOCU | Upper |
| BOBA3 | Upper |
| QUAR | Upper |
| QUEM | Upper |

**Structure Data (for upper layer lifeform)**

| | Min | Max |
|---|---|---|
| *Cover* | 0% | 100% |
| *Height* | Herb 0m | Herb 1.0m |
| *Tree Size Class* | No Data | |

[ ] Upper layer lifeform differs from dominant lifeform.

**Description**

Initial post-fire community dominated by perennial caespitose grasses. Evidence of past fires may be observed, including charcoal and resprouting woody plants. Duration 10yrs with succession to B, mid-development closed stand of small trees. Replacement fire occurs every century or so, based on speculation unsupported by data.

### Class B 55%

Mid Development 1 Closed

**Upper Layer Lifeform**

- [ ] Herbaceous
- [ ] Shrub
- [x] Tree

**Fuel Model** 2

**Indicator Species* and Canopy Position**

| | |
|---|---|
| JUDE | Upper |
| PIED | Upper |
| QUAR | Upper |
| QUEM | Upper |

**Structure Data (for upper layer lifeform)**

| | Min | Max |
|---|---|---|
| *Cover* | 0% | 100% |
| *Height* | Tree 0m | Tree 10m |
| *Tree Size Class* | Pole 5-9" DBH | |

[ ] Upper layer lifeform differs from dominant lifeform.

**Description**

Community dominated by young to mature alligator juniper and evergreen oak trees of various ages. This class lasts a century or so with succession to C unless replacement fire causes transition to A. Mixed severity fire every couple of centuries. Fire return intervals are based on speculation unsupported by data.

### Class C 40%

Late Development 1 Closed

**Upper Layer Lifeform**

- [ ] Herbaceous
- [ ] Shrub
- [x] Tree

**Fuel Model** 2

**Indicator Species* and Canopy Position**

| | |
|---|---|
| JUDE | Upper |
| PIED | Upper |
| QUAR | Upper |
| QUEM | Upper |

**Structure Data (for upper layer lifeform)**

| | Min | Max |
|---|---|---|
| *Cover* | 0% | 100% |
| *Height* | Tree 10.1m | Tree 25m |
| *Tree Size Class* | Medium 9-21"DBH | |

[ ] Upper layer lifeform differs from dominant lifeform.

**Description**

Site dominated by relatively dense old alligator juniper and evergreen oak trees. Duration several centuries unless replacement fire causes transition to A. Because trees have grown and aged, consequent gaps in canopy facilitate mixed severity fire every couple of centuries. Fire return intervals are based on speculation unsupported by data.

*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100+ year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement severity.

**Class D** 0%

[Not Used] [Not Used]

**Upper Layer Lifeform**

- ☐ Herbaceous
- ☐ Shrub
- ☐ Tree

**Fuel Model**

**Indicator Species* and Canopy Position**

**Structure Data (for upper layer lifeform)**

| | Min | Max |
|---|---|---|
| Cover | % | % |
| Height | | |
| Tree Size Class | | |

☐ Upper layer lifeform differs from dominant lifeform.

**Description**

---

**Class E** 0%

[Not Used] [Not Used]

**Upper Layer Lifeform**

- ☐ Herbaceous
- ☐ Shrub
- ☐ Tree

**Fuel Model**

**Indicator Species* and Canopy Position**

**Structure Data (for upper layer lifeform)**

| | Min | Max |
|---|---|---|
| Cover | % | % |
| Height | | |
| Tree Size Class | | |

☐ Upper layer lifeform differs from dominant lifeform.

**Description**

## Disturbances

**Fire Regime Group**: III**

**Historical Fire Size (acres)**

Avg 100
Min 1
Max 100000

**Sources of Fire Regime Data**

- ☐ Literature
- ☐ Local Data
- ☑ Expert Estimate

**Fire Intervals**

| | Avg FI | Min FI | Max FI | Probability | Percent of All Fires |
|---|---|---|---|---|---|
| Replacement | 137 | 20 | 1000 | 0.007299 | 34 |
| Mixed | 213 | 20 | 1000 | 0.004695 | 22 |
| Surface | 104 | | | 0.009615 | 44 |
| All Fires | 46 | | | 0.02161 | |

***Fire Intervals (FI):***

Fire interval is expressed in years for each fire severity class and for all types of fire combined (All Fires). Average FI is central tendency modeled. Minimum and maximum show the relative range of fire intervals, if known. Probability is the inverse of fire interval in years and is used in reference condition modeling. Percent of all fires is the percent of all fires in that severity class.

**Additional Disturbances Modeled**

- ☐ Insects/Disease
- ☑ Wind/Weather/Stress
- ☐ Native Grazing
- ☐ Competition
- ☐ Other (optional 1)
- ☐ Other (optional 2)

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*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100+ year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement severity.

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*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100+ year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement severity.

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*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100+ year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement severity.

# LANDFIRE Biophysical Setting Model

## *Biophysical Setting:* 1511170 Southern Rocky Mountain Ponderosa Pine Savanna

☐ *This BPS is lumped with:*
☐ *This BPS is split into multiple models:*

## *General Information*

**Contributors** (also see the Comments field) **Date** 10/18/2005


| | | | | | |
|---|---|---|---|---|---|
| **Modeler 1** | Jeff Redders | jredders@fs.fed.us | **Reviewer** | Brenda Wilmore | bwilmore@fs.fed.us |
| **Modeler 2** | Patrick Medina | pmedina@fs.fed.us | **Reviewer** | Laurie Huckaby | lhuckaby@fs.fed.us |
| **Modeler 3** | anonymous | | **Reviewer** | anonymous | |


**Vegetation Type**

Forest and Woodland

**Map Zone**

15

**Model Zone**

☐ Alaska ☐ N-Cent.Rockies
☐ California ☐ Pacific Northwest
☐ Great Basin ☐ South Central
☐ Great Lakes ☐ Southeast
☐ Northeast ☐ S. Appalachians
☐ Northern Plains ☑ Southwest

**Dominant Species***

PIPO
FEAR2
MUMO

**General Model Sources**

☑ Literature
☐ Local Data
☐ Expert Estimate

### Geographic Range

Central and northern NM and AZ, southern CO, possibly southern UT

### Biophysical Site Description

1970-2575 m in elevation on a variety of topographic features, including mountains, mesas and canyons. Mean annual precipitation ranges from about 16-25in. BpS is best described as a savanna that has widely spaced (>150yrs old) Pinus ponderosa.

### Vegetation Description

Overstory canopy of ponderosa pine with a grassy understory, predominantly the bunchgrasses Arizona fescue and mountain muhly. May include sites with minor cover of Gambel oak (<15% cover).

### Disturbance Description

Mean composite surface fire intervals have been found to be 5-15yrs (Swetnam and Baisan 1996). Infrequent stand-replacement fire on the order of a few hundred years possible (300-500yrs?). Drought and other weather events (eg, blowdown), parasites and disease may play a minor role, and have very long rotations. Insects may be a significant, but infrequent occurrence.

### Adjacency or Identification Concerns

### Native Uncharacteristic Conditions

### Scale Description

Landscape scale (thousands to tens of thousands of acres)--Swetnam and Baisan 1996.

*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100+ year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement severity.

### Issues/Problems

Replacement fire rotation uncertain, and this affects the amount of forest in each class.

### Comments

This model is identical to the model for the same BpS in MZ28. It is based on the Rapid Assessment model R3PPGRsw by J Redders (jredders@fs.fed.us), W. Baker, (bakerwl@wyo.gov) and P. Medina (pmedina@fs.fed.us). Original model reviewed by Brenda Wilmore, bwilmore@fs.fed.us.

Additional reviewers of this BpS include Paul Langowski, plangowski@fs.fed.us; Dick Edwards, rledwards@fs.fed.us; Vic Ecklund, vecklund,vecklund@csu.org; Chuck Kostecka. Based on the reviews, there was disagreement on surface fire interval. Majority of reviews supported models mixed fire interval. One reviewer thought the surface fire interval should be 20yrs.

## Vegetation Classes

### Class A 10%

Early Development 1 All Structures

**Upper Layer Lifeform**

- ☐ Herbaceous
- ☐ Shrub
- ☑ Tree

**Fuel Model** 1

**Indicator Species* and Canopy Position**

| | |
|---|---|
| FEAR2 | Lower |
| MUMO | Lower |
| PIPO | All |

**Structure Data (for upper layer lifeform)**

| | Min | Max |
|---|---|---|
| *Cover* | 0 % | 100 % |
| *Height* | Tree 0m | Tree 5m |
| *Tree Size Class* | Seedling <4.5ft | |

☑ Upper layer lifeform differs from dominant lifeform.

Dominant lifeform will be herbaceous, with <90% canopy cover and any height.

**Description**

Bunchgrass dominated (0-49yrs). Some ponderosa pine individuals also becoming established.

---

### Class B 5%

Mid Development 1 Closed

**Upper Layer Lifeform**

- ☐ Herbaceous
- ☐ Shrub
- ☑ Tree

**Fuel Model** 8

**Indicator Species* and Canopy Position**

| | |
|---|---|
| PIPO | Lower |
| FEAR2 | Lower |
| MUMO | Lower |

**Structure Data (for upper layer lifeform)**

| | Min | Max |
|---|---|---|
| *Cover* | 51 % | 100 % |
| *Height* | Tree 5.1m | Tree 10m |
| *Tree Size Class* | Pole 5-9" DBH | |

☐ Upper layer lifeform differs from dominant lifeform.

**Description**

Small and medium sized ponderosa pine (50-149yrs), still with high bunchgrass cover. Closed canopy defined as greater than 50%.

---

*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100+ year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement severity.

### *Class C* 20%

Mid Development 1 Open

**Indicator Species* and Canopy Position**

| | |
|---|---|
| PIPO | Upper |
| FEAR2 | Lower |
| MUMO | Lower |

**Structure Data (for upper layer lifeform)**

| | *Min* | *Max* |
|---|---|---|
| *Cover* | 0% | 50% |
| *Height* | Tree 5.1m | Tree 10m |
| *Tree Size Class* | Pole 5-9" DBH | |

☐ Upper layer lifeform differs from dominant lifeform.

**Upper Layer Lifeform**

☐ Herbaceous
☐ Shrub
☑ Tree

**Fuel Model** 1

**Description**

Small and medium sized ponderosa pine (50-149yrs), with moderate bunchgrass cover. Open canopy defined as 10-49%.

---

### *Class D* 60%

Late Development 1 Open

**Indicator Species* and Canopy Position**

| | |
|---|---|
| PIPO | Upper |
| FEAR2 | Lower |
| MUMO | Lower |

**Structure Data (for upper layer lifeform)**

| | *Min* | *Max* |
|---|---|---|
| *Cover* | 0% | 50% |
| *Height* | Tree 10.1m | Tree 50m |
| *Tree Size Class* | Large 21-33"DBH | |

☐ Upper layer lifeform differs from dominant lifeform.

**Upper Layer Lifeform**

☐ Herbaceous
☐ Shrub
☑ Tree

**Fuel Model** 8

**Description**

Large and very large old growth ponderosa pine, with medium to high cover of bunchgrasses. Old growth attributes prominent, including down wood, snags and diseased trees.

---

### *Class E* 5%

Late Development 1 Closed

**Indicator Species* and Canopy Position**

| | |
|---|---|
| PIPO | Upper |
| FEAR2 | Lower |
| MUMO | Lower |

**Structure Data (for upper layer lifeform)**

| | *Min* | *Max* |
|---|---|---|
| *Cover* | 51% | 100% |
| *Height* | Tree 10.1m | Tree 50m |
| *Tree Size Class* | Large 21-33"DBH | |

☐ Upper layer lifeform differs from dominant lifeform.

**Upper Layer Lifeform**

☐ Herbaceous
☐ Shrub
☑ Tree

**Fuel Model** 10

**Description**

Large and very large old growth ponderosa pine, with medium cover of bunchgrasses. Old growth attributes prominent, including down wood, snags and diseased trees.

## *Disturbances*

*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100+ year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement severity.

**Fire Regime Group**:** I

**Historical Fire Size (acres)**

Avg
Min
Max

**Sources of Fire Regime Data**

- [x] Literature
- [ ] Local Data
- [ ] Expert Estimate

| Fire Intervals | Avg FI | Min FI | Max FI | Probability | Percent of All Fires |
|---|---|---|---|---|---|
| Replacement | 300 | | | 0.003333 | 4 |
| Mixed | | | | | |
| Surface | 12 | | | 0.083333 | 96 |
| All Fires | 12 | | | 0.08668 | |

***Fire Intervals (FI):***

Fire interval is expressed in years for each fire severity class and for all types of fire combined (All Fires). Average FI is central tendency modeled. Minimum and maximum show the relative range of fire intervals, if known. Probability is the inverse of fire interval in years and is used in reference condition modeling. Percent of all fires is the percent of all fires in that severity class.

**Additional Disturbances Modeled**

- [ ] Insects/Disease
- [ ] Wind/Weather/Stress
- [ ] Native Grazing
- [ ] Competition
- [ ] Other (optional 1)
- [ ] Other (optional 2)

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*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100+ year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement severity.

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*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100+ year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement severity.

# LANDFIRE Biophysical Setting Model

***Biophysical Setting:*** **1511210** **Apacherian-Chihuahuan Semi-Desert Grassland and Steppe**

☐ *This BPS is lumped with:*
☐ *This BPS is split into multiple models:*

## *General Information*

**Contributors** (also see the Comments field) **Date** 10/18/2005


| | | | |
|---|---|---|---|
| **Modeler 1** | Mike Babler | mbabler@tnc.org | **Reviewer** |
| **Modeler 2** | Heather Schussman | hschussman@tnc.org | **Reviewer** |
| **Modeler 3** | Dave Gori | dgori@tnc.org | **Reviewer** |


**Vegetation Type**

Upland Shrubland

**Map Zone**

15

**Model Zone**

☐ Alaska ☐ N-Cent.Rockies
☐ California ☐ Pacific Northwest
☐ Great Basin ☐ South Central
☐ Great Lakes ☐ Southeast
☐ Northeast ☐ S. Appalachians
☐ Northern Plains ☑ Southwest

**Dominant Species***

BOUTE ARIST
LATR2 ISTE2
MUPO2 ACACI
PLMU3 OPUNT

**General Model Sources**

☑ Literature
☐ Local Data
☑ Expert Estimate

### Geographic Range

Borderland of AZ, NM, TX, northern Mexico. Extends from Sonoran Desert, to the Mogollon Rim and much of the Chihuahuan Desert.

### Biophysical Site Description

Gently sloping, on mesa's, foothill slopes, piedmonts, 1100-1800m elevations.

### Vegetation Description

Annual and perennial grasses, herbs with shrubs as the upper life form. In class D shrubs are eliminating grasses.

### Disturbance Description

Fire has a major impact in desert grasslands. Fire controls the abundance of woody plants and maintains desert grasslands. In the absence of fire, woody plants may dominate. Dry lightning accompanies the monsoons in late June-July. Pre 1882 fires were extensive, up to 100s of square miles.

### Adjacency or Identification Concerns

NRCS Ecological Site Descriptions are Gravelly and Gravelly loam.

### Native Uncharacteristic Conditions

### Scale Description

1000 to 100000 of hectares.

### Issues/Problems

Moisture following fire has significant impact on plant response/recovery.

*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100+ year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement severity.

### Comments

Original model reviewed and modified in Las Cruces, 6/29/05 to reflect conditions in MZ15. Adapted from FRCC Model DGRA3, Hann, 9/25/03. This model is based on grass shrub community and does not address large tree savanna community.

## Vegetation Classes

### Class A 20%

Early Development 1 All Structures

**Upper Layer Lifeform**

- [x] Herbaceous
- [ ] Shrub
- [ ] Tree

**Fuel Model** 1

**Indicator Species* and Canopy Position**

| | |
|---|---|
| BOUTE | Upper |
| PLMU3 | Upper |
| ARIST | Upper |

**Structure Data (for upper layer lifeform)**

| | Min | Max |
|---|---|---|
| Cover | 0% | 20% |
| Height | Herb 0m | Herb 0.5m |
| Tree Size Class | No Data | |

- [ ] Upper layer lifeform differs from dominant lifeform.

**Description**

Grass and herbs, 0-2 years. Early succession post fire grass and herb community. Perennial bunch grasses, annual grass and herb community. Upper layer of shrubs, canopy cover <5%.

---

### Class B 65%

Mid Development 1 All Structures

**Upper Layer Lifeform**

- [ ] Herbaceous
- [x] Shrub
- [ ] Tree

**Fuel Model** 1

**Indicator Species* and Canopy Position**

| | |
|---|---|
| BOUTE | Low-Mid |
| PLMU3 | Low-Mid |
| ARIST | Low-Mid |
| LATR2 | Upper |

**Structure Data (for upper layer lifeform)**

| | Min | Max |
|---|---|---|
| Cover | 0% | 10% |
| Height | Shrub 0m | Shrub 1.0m |
| Tree Size Class | No data | |

- [x] Upper layer lifeform differs from dominant lifeform.

Herbaceous species (BOUTE) may dominate with 35-50% canopy cover; <0.5m height.

**Description**

Grass with some low shrubs. 3-15 years old. Perennial bunch grasses regenerated and young shrubs begin growing. Species are perennial bunch grasses and shrubs. Canopy cover of shrubs is 5-10%

---

### Class C 10%

Mid Development 2 All Structures

**Upper Layer Lifeform**

- [ ] Herbaceous
- [x] Shrub
- [ ] Tree

**Fuel Model** 1

**Indicator Species* and Canopy Position**

| | |
|---|---|
| BOUTE | Low-Mid |
| PLMU3 | Low-Mid |
| ARIST | Low-Mid |
| LATR2 | Upper |

**Structure Data (for upper layer lifeform)**

| | Min | Max |
|---|---|---|
| Cover | 11% | 20% |
| Height | Shrub 0m | Shrub 1.0m |
| Tree Size Class | No data | |

- [ ] Upper layer lifeform differs from dominant lifeform.

Herbaceous species (BOUTE) may dominate with 10-35% canopy cover; <0.5m height.

**Description**

Shrubs continue to increase in size and/or number of individuals. Species are perennial bunch grasses and shrubs. Canopy cover of shrubs is 10-20%. (Shrub cover will be similar to species composition found in the Ecological System, Apacherian-Chihuahuan Mesquite Upland Scrub.)

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*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100+ year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement severity.

### *Class D* 5%

Late Development 1 Closed

**Upper Layer Lifeform**

- ☐ Herbaceous
- ☑ Shrub
- ☐ Tree

**Fuel Model** 4

**Indicator Species* and Canopy Position**

| | |
|---|---|
| PRGL2 | Upper |
| PLMU3 | Lower |
| ARIST | Lower |
| LATR2 | Upper |

**Structure Data (for upper layer lifeform)**

| | *Min* | *Max* |
|---|---|---|
| *Cover* | 21% | 40% |
| *Height* | Shrub 0m | Shrub 1.0m |
| *Tree Size Class* | No data | |

☐ Upper layer lifeform differs from dominant lifeform.

**Description**

Shrubs with little to no perennial grass. Shrubs cover is high enough to out-compete perennial grasses resulting in low levels of fine fuels and increased erosion potential. Fires that do occur return the system to class C. (Shrub cover will be similar to species composition found in the Ecological System, Apacherian-Chihuahuan Mesquite Upland Scrub.)

### *Class E* 0%

[Not Used] [Not Used]

**Upper Layer Lifeform**

- ☐ Herbaceous
- ☐ Shrub
- ☐ Tree

**Fuel Model**

**Indicator Species* and Canopy Position**

**Structure Data (for upper layer lifeform)**

| | *Min* | *Max* |
|---|---|---|
| *Cover* | % | % |
| *Height* | | |
| *Tree Size Class* | | |

☐ Upper layer lifeform differs from dominant lifeform.

**Description**

## *Disturbances*

**Fire Regime Group**: II**

**Historical Fire Size (acres)**

Avg 100
Min 1
Max 10000

**Sources of Fire Regime Data**

- ☑ Literature
- ☐ Local Data
- ☑ Expert Estimate

**Fire Intervals**

| | *Avg FI* | *Min FI* | *Max FI* | *Probability* | *Percent of All Fires* |
|---|---|---|---|---|---|
| *Replacement* | 9.5 | | | 0.105263 | 83 |
| *Mixed* | | | | | |
| *Surface* | 45 | | | 0.022222 | 17 |
| *All Fires* | 8 | | | 0.1275 | |

***Fire Intervals (FI):***

Fire interval is expressed in years for each fire severity class and for all types of fire combined (All Fires). Average FI is central tendency modeled. Minimum and maximum show the relative range of fire intervals, if known. Probability is the inverse of fire interval in years and is used in reference condition modeling. Percent of all fires is the percent of all fires in that severity class.

**Additional Disturbances Modeled**

- ☐ Insects/Disease
- ☐ Wind/Weather/Stress
- ☐ Native Grazing
- ☐ Competition
- ☐ Other (optional 1)
- ☐ Other (optional 2)

## *References*


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*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100+ year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement severity.

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**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100+ year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement severity.

# LANDFIRE Biophysical Setting Model

## *Biophysical Setting:* 1511250 Inter-Mountain Basins Big Sagebrush Steppe

☐ *This BPS is lumped with:*
☐ *This BPS is split into multiple models:*

## *General Information*

**Contributors** (also see the Comments field) **Date** 2/23/2005


**Modeler 1** Don Major dmajor@tnc.org **Reviewer** Tim Christiansen tchristiansen@tnc.org
**Modeler 2** **Reviewer**
**Modeler 3** **Reviewer**


**Vegetation Type**
Upland Savannah/Shrub Steppe

**Map Zone**
15

**Model Zone**
☐ Alaska ☐ N-Cent.Rockies
☐ California ☐ Pacific Northwest
☐ Great Basin ☐ South Central
☐ Great Lakes ☐ Southeast
☐ Northeast ☐ S. Appalachians
☐ Northern Plains ☑ Southwest

**Dominant Species***
ARTRW
PSSP6
STTH2
POSA12

**General Model Sources**
☑ Literature
☑ Local Data
☑ Expert Estimate

### Geographic Range
This widespread matrix-forming ecological system occurs throughout much of the Columbia Plateau, northern Great Basin and WY. It is found at slightly higher elevations farther south.

### Biophysical Site Description
Sagebrush steppe is found in continental, semi-arid climate where annual precipitation generally ranges from 7-12in (~180-300mm) (McArthur 2000), but occasionally ranging into the 14in precipitation zone. This system is common on foothills, undulating terraces, slopes and plateaus, but also in basins and valley bottoms. Soil depths range from shallow to moderately deep, well-drained with an effective rooting depth of less than 40in (~ 1m). NRCS Range Site is (Droughty) Loamy 8-10in precipitation zone.

### Vegetation Description
This shrub-steppe is dominated by perennial grasses and forbs (>25% cover) with Artemisia tridentata ssp. tridentata, Artemisia tridentata ssp. xericensis, Artemisia tridentata ssp. wyomingensis, Artemisia tripartita ssp. tripartita and/or Purshia tridentata dominating or codominating the open to moderately dense (10-40% cover) shrub layer. In southern ID and northern UT, Artemisia tridentata ssp. wyomingensis dominates large landscape. Atriplex confertifolia, Chrysothamnus viscidiflorus, Ericameria nauseosa, Tetradymia spp or Artemisia frigida may be common, especially in disturbed stands. Associated graminoids include Achnatherum hymenoides, Calamagrostis montanensis, Elymus lanceolatus ssp. lanceolatus, Festuca idahoensis, Festuca campestris, Koeleria macrantha, Poa secunda and Pseudoroegneria spicata. Common forbs are Phlox hoodii, Arenaria spp and Astragalus spp. Areas with deeper soils more commonly support Artemisia tridentata ssp. tridentata but have largely been converted for other land uses.

The sagebrush steppe landscape is a mosaic of shrub-dominated and herbaceous-dominated phases (West 2000). Forbs have low diversity but are important for wildlife, including the greater sage grouse. Species diversity is lower in Wyoming big sagebrush communities than in other big sagebrush types (Howard

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1999). Wyoming big sagebrush communities are critical habitat for greater sage grouse and other sagebrush obligate species.

### Disturbance Description

Historically, fire was the principal disturbance within this vegetation type. Intervals between natural wildfires varied between 25yrs (eg, northern Yellowstone National Park, West 2000 ) and 100yrs+ (West 2000). West (1983) and Miller and Eddelman (2000) cite mean FRIs of <100yrs for replacement fire. Howard (1999) cites mean FRIs of 10 to 70yrs with a mean of 40yrs for Wyoming sagebrush steppe. Studies cited in Howard (1999) may underestimate FRIs or not hold up to scrutiny (Welch and Criddle 2003). This BpS was modeled with a MFI of 75yrs for the system as a whole. Eighty percent of fires modeled were replacement severity. Re-establishment following fire is from seed germination and establishment. Establishment is dependent upon soil seedbank and/or proximity of seed sources, fire size and continuity, and climatic conditions.

Other disturbances included insects (eg, moths and grasshoppers that eat leaves, moth larval grubs that eat roots) with an average return interval of 75yrs. Periods of drought, wet cycles and shifts in climate would have also affected this system with an average return interval of 100yrs.

### Adjacency or Identification Concerns

The NatureServe description of Inter-Mountain Basin Big Sagebrush Steppe (1125) includes different species of sagebrush and steppe ecosystems that are structurally and ecologically different such as Artemisia tridentata ssp. tridentata, Artemisia tridentata ssp. wyomingensis and Artemisia tripartita ssp. tripartita. We highly recommend that, at least, Artemisia tridentata ssp. tridentata, which is a taller shrub found in drainages and deeper soils, be separated from the other shrubs. Ultimately, all three sagebrush species should be modeled separately.

Wyoming big sagebrush is known to hybridize with other subspecies of the big sagebrush complex; ie, basin big sagebrush A. tridentata ssp. tridentata and mountain big sagebrush A. tridentata ssp. vaseyana (Freeman et al 1991, McArthur et al 1998). Across ecotones, populations of Wyoming big sagebrush probably intergrade with basin big sagebrush and mountain big sagebrush. Soils and elevation may help determine which species is present.

Invasion of cheatgrass has transformed this ecological system into large areas of uncharacteristic annual grasslands and shrublands with understories where annual grasses replaced perennial grasses.

### Native Uncharacteristic Conditions

### Scale Description

Sagebrush steppe covers vast landscapes >10000ac with inclusions of low sagebrush and basin big sagebrush. Historic disturbance (fire) likely ranged from small (<10ac) to large (>10000ac) depending on conditions, time since last ignition and fuel loading. The average patch size was assumed to be approximately 250ac.

### Issues/Problems

West (2000) cites wide range in FRI (25-100yrs+). West (1983) and Miller and Eddelman (2000) recommend a FRI of <100yrs for replacement fire. Howard (1999) gives 10-70yr range (40yr average) (but see Welch and Criddle 2003). Current scientific opinion (Mike Pellant, BLM Range Ecologist on the Great Basin Restoration Initiative, Stephen Bunting, and David Pyke, personal communication) puts the natural fire return interval at about 100yrs. Given uncertainties and opinions of reviewers, a MFI of 75yrs was modeled. Without this shorter MFI and differences in fire behavior, there would be no difference between

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Wyoming sagebrush steppe from the Snake River plains and Wyoming big sagebrush semi-desert from central NV, UT, and eastern CA. Because replacement fire is by far dominant over mixed severity fire, a FRG IV was selected by recommendation of reviewers.

### Comments

This model is identical to the model for the same BpS in MZ16 (Utah High Plateaus) with minor descriptive changes based on peer review for MZ23 and MZ24. BpS 1125 is completely based on the Rapid Assessment PNVG R2SBWYse developed by Eric Limbach (eric_limbach@blm.gov) for Wyoming big sagebrush steppe and reviewed by Krista Waid-Gollnick, Sarah Heidi (krista_waid@blm.gov), Stanley Kitchen (skitchen@fs.fed.edu), Michael Zielinski (mike_zielinski@nv.blm.gov), Jolie Pollet (jpollet@blm.gov) and Gary Back (gback@srk.com).

As a result of final QC for LANDFIRE National by Kori Blankenship the user-defined min and max fire return intervals for mixed severity fire were deleted because they were not consistent with the modeled fire return interval for this fire severity type.

## Vegetation Classes

### Class A 20%

Early Development 1 Open

**Upper Layer Lifeform**

- ☐ Herbaceous
- ☑ Shrub
- ☐ Tree

**Fuel Model** 1

**Indicator Species* and Canopy Position**

| | |
|---|---|
| PSSP6 | Upper |
| STTH2 | Upper |
| POSA12 | Upper |
| ARTRW8 | Upper |

**Structure Data (for upper layer lifeform)**

| | Min | Max |
|---|---|---|
| *Cover* | 0% | 4% |
| *Height* | Shrub 0m | Shrub 1.0m |
| *Tree Size Class* | None | |

☑ Upper layer lifeform differs from dominant lifeform.

Vegetation is primarily herbaceous with a few scattered shrubs.

**Description**

Perennial grasses and forbs dominate where woody shrub canopy has been top killed / removed by wildfire. Shrub cover less than five percent. Replacement fire every 120yrs on average resets succession back to zero. Succession to class B after 20yrs.

---

### Class B 50%

Mid Development 1 Open

**Upper Layer Lifeform**

- ☐ Herbaceous
- ☑ Shrub
- ☐ Tree

**Fuel Model** 1

**Indicator Species* and Canopy Position**

| | |
|---|---|
| PSSP6 | Lower |
| STTH2 | Lower |
| ARTRW8 | Upper |
| POSA12 | Lower |

**Structure Data (for upper layer lifeform)**

| | Min | Max |
|---|---|---|
| *Cover* | 5% | 25% |
| *Height* | Shrub 0m | Shrub 3.0m |
| *Tree Size Class* | None | |

☐ Upper layer lifeform differs from dominant lifeform.

**Description**

Shrubs dominate (5-25% cover) with diverse perennial grass and forb understory. MFI is 75yrs with 80% replacement fire (mean FRI of 94yrs) and 20% mixed severity fire (mean FRI of 375yrs). Mixed severity fire, insect/disease (return interval of 75yrs) and weather related stress (return interval of 100yrs) maintains vegetation in class B. Succession to class C after 40yrs.

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### *Class C* 30%

Late Development 1 Closed

**Indicator Species* and Canopy Position**

ARTRW8 Upper
PSSP6 Lower
STTH2 Lower
POSA12 Lower

**Structure Data (for upper layer lifeform)**

| | Min | Max |
|---|---|---|
| *Cover* | 26% | 35% |
| *Height* | Shrub 0m | Shrub 3.0m |
| *Tree Size Class* | None | |

☐ Upper layer lifeform differs from dominant lifeform.

**Upper Layer Lifeform**

☐ Herbaceous
☑ Shrub
☐ Tree

**Fuel Model** 2

**Description**

Mature shrub canopy >25% cover with proportional reduction in understory productivity as canopy cover increases. The mean FRI for replacement fire is 75yrs. Insect/diseases (return interval of 75yrs) and weather related stress (return interval of 100yrs) thin the shrub canopy, causing a transition to class B. Otherwise, this class persists indefinitely.

---

### *Class D* 0%

[Not Used] [Not Used]

**Indicator Species* and Canopy Position**

**Structure Data (for upper layer lifeform)**

| | Min | Max |
|---|---|---|
| *Cover* | % | % |
| *Height* | | |
| *Tree Size Class* | | |

☐ Upper layer lifeform differs from dominant lifeform.

**Upper Layer Lifeform**

☐ Herbaceous
☐ Shrub
☐ Tree

**Fuel Model**

**Description**

---

### *Class E* 0%

[Not Used] [Not Used]

**Indicator Species* and Canopy Position**

**Structure Data (for upper layer lifeform)**

| | Min | Max |
|---|---|---|
| *Cover* | % | % |
| *Height* | | |
| *Tree Size Class* | | |

☐ Upper layer lifeform differs from dominant lifeform.

**Upper Layer Lifeform**

☐ Herbaceous
☐ Shrub
☐ Tree

**Fuel Model**

**Description**

## *Disturbances*

**Fire Regime Group**: IV**

**Historical Fire Size (acres)**

Avg 250
Min 10
Max 10000

**Sources of Fire Regime Data**

☑ Literature
☑ Local Data
☑ Expert Estimate

**Fire Intervals**

| | Avg FI | Min FI | Max FI | Probability | Percent of All Fires |
|---|---|---|---|---|---|
| *Replacement* | 92 | 30 | 120 | 0.01087 | 89 |
| *Mixed* | 714 | | | 0.001401 | 11 |
| *Surface* | | | | | |
| *All Fires* | 81 | | | 0.01228 | |

***Fire Intervals (FI):***

Fire interval is expressed in years for each fire severity class and for all types of fire combined (All Fires). Average FI is central tendency modeled. Minimum and maximum show the relative range of fire intervals, if known. Probability is the inverse of fire interval in years and is used in reference condition modeling. Percent of all fires is the percent of all fires in that severity class.

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**Additional Disturbances Modeled**

- [x] Insects/Disease
- [x] Wind/Weather/Stress
- [ ] Native Grazing
- [ ] Competition
- [ ] Other (optional 1)
- [ ] Other (optional 2)

## References


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*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100+ year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement severity.

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**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100+ year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement severity.

# LANDFIRE Biophysical Setting Model

## *Biophysical Setting:* 1511270 Inter-Mountain Basins Semi-Desert Shrub-Steppe

☐ *This BPS is lumped with:*
☐ *This BPS is split into multiple models:*

## *General Information*

**Contributors** (also see the Comments field) **Date** 10/18/2005


| | | | | | |
|---|---|---|---|---|---|
| **Modeler 1** | Mike Babler | mbabler@tnc.org | **Reviewer** | Vic Ecklund | vecklund@csu.org |
| **Modeler 2** | | | **Reviewer** | Chuck Kostecka | kostecka@webaccess.net |
| **Modeler 3** | | | **Reviewer** | | |


**Vegetation Type**
Upland Shrubland

**Map Zone**
15

**Model Zone**
☐ Alaska ☐ N-Cent.Rockies
☐ California ☐ Pacific Northwest
☐ Great Basin ☐ South Central
☐ Great Lakes ☐ Southeast
☐ Northeast ☐ S. Appalachians
☐ Northern Plains ☑ Southwest

**Dominant Species***
ARTRT PSSP6
ARTRW
ATCA2
ACHY

**General Model Sources**
☑ Literature
☐ Local Data
☑ Expert Estimate

### Geographic Range
This ecological system occurs throughout the Intermountain West from the western Great Basin to the northern Rocky Mountains and Colorado Plateau.

### Biophysical Site Description
Found at elevations ranging from 300m up to 2500m (1000-8250 ft). The climate where this system occurs is generally hot in summers and cold in winters with low annual precipitation, ranging from 18-40cm and high inter-annual variation. This system primarily occurs on deep-soiled to stony flats, ridges, nearly flat ridgetops and mountain slopes. In general this system shows an affinity for mild topography, fine soils and some source of subsurface moisture. Much of the precipitation falls as snow, and growing-season drought is characteristic. Temperatures are continental with large annual and diurnal variation. Sites are generally alluvial fans and flats with moderate to deep soils. Some sites can be flat, poorly drained and intermittently flooded with a shallow or perched water table often within 1m depth (West 1983).

### Vegetation Description
This semi-arid shrub-steppe is typically dominated by grasses at more than 25% cover. The general aspect of occurrences may be either open shrubland with patchy grasses or patchy open herbaceous layer. Disturbance may be important in maintaining the woody component. Microphytic crust is very important in some stands. The plant associations in this system are characterized by a somewhat sparse to moderately dense (10-70% cover) shrub layer of Ephedra spp, Ericameria nauseosa, Chrysothamnus viscidiflorus, Gutierrezia sarothrae or Atriplex canescens. Artemisia tridentata may be present but does not dominate. The herbaceous layer is dominated by bunch grasses which occupy patches in the shrub matrix. Species may include Sporobolus airoides, Bouteloua gracilis, Distichlis spicata, Hesperostipa comata and Poa secunda. Forbs are generally of low importance and are highly variable across the range, but may be diverse in some

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occurrences.

### Disturbance Description

Replacement fire is rare, modeled as occurring at 250yr return in mid-seral stage and 200yr return interval in early and late seral. Mixed fire modeled in the mid-seral stage at 100yr return, which does not change its seral stage. Drought occurs frequently (10yr return for all seral stages), but does not change seral stage. The Aroga moth can affect sagebrush (100yr return in mid-seral, 50yr return in late seral), but does not change seral stage. A wood borer may affect Atriplex, without changing seral stage.

### Adjacency or Identification Concerns

Separates from greasewood and saltbrush types because they will be on saline soils. This type is somewhat lower elevation and drier than the sagebrush montane steppe. Differs from Intermountain Basins Big sagebrush Steppe in 1127 being somewhat farther south and drier.

### Native Uncharacteristic Conditions

### Scale Description

The BpS can occupy fairly large areas (1000s-10000s ac). Disturbance patch size within the type are generally 100s of acres.

### Issues/Problems

### Comments

This is identical to the model for the same BpS in MZ16, MZ23, MZ24 and MZ28. That model was developed by Jim Bowns, bowns_je@suu.edu; Don Major, dmajor2tnc.org; Beth Corbin, ecorbin@fs.fed.us; 3/2/2005. Edits were made by Mike Babler, mbabler@tnc.org, in species composition and changes in model fire frequencies to better match written values.

This model was based on R2SBDW (dwarf sagebrush) developed by Sarah Heidi (Sarah_Heide@blm.gov) and Gary Medlyn (gmedlyn@nv.blm.gov). R2SBDW was reviewed by Michael Zielinski (mike_zielinski@nv.blm.gov), Gary Back (gback@srk.com) and Paul Tueller (ptt@intercomm.com).

## Vegetation Classes

***Class A*** **10%**

Early Development 1 All Structures

**Upper Layer Lifeform**

- ☐ Herbaceous
- ☑ Shrub
- ☐ Tree

**Fuel Model** 2

**Indicator Species* and Canopy Position**

| | |
|---|---|
| STCO4 | Lower |
| PSSP6 | Lower |
| ACHY | Lower |
| ATTR | Mid-Upper |

**Structure Data (for upper layer lifeform)**

| | *Min* | *Max* |
|---|---|---|
| *Cover* | 0% | 10% |
| *Height* | Shrub 0m | Shrub 0.5m |
| *Tree Size Class* | No Data | |

☑ Upper layer lifeform differs from dominant lifeform.

Grasses are dominant lifeform, with 20-50% cover, height 0-1m.

**Description**

Primarily grass, with shrubs just beginning. Stand age up to 24yrs. Replacement fire (mean FRI of 200yrs) and drought (mean return interval 10yrs) would keep it in class A.

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***Class B*** **50%**

Mid Development 1 Open

**Upper Layer Lifeform**

- ☐ Herbaceous
- ☑ Shrub
- ☐ Tree

**Fuel Model** 5

**Indicator Species* and Canopy Position**

| | |
|---|---|
| ARTRT | Upper |
| ARTRW8 | Upper |
| ATCA2 | Upper |
| PSSP6 | Lower |

**Structure Data (for upper layer lifeform)**

| | *Min* | *Max* |
|---|---|---|
| *Cover* | 11 % | 20 % |
| *Height* | Shrub 0m | Shrub 1.0m |
| *Tree Size Class* | No data | |

☐ Upper layer lifeform differs from dominant lifeform.

**Description**

Mid-seral, open, still primarily grasses, but also includes mature shrubs. Age 25-145yrs (succeeding to late seral after 120yrs without disturbance). Replacement fire modeled at 250yr return sets back to early seral. Mixed fire (100yr return) maintains within mid-seral. Drought (10yr return) will not change it from mid-seral. Insects (100yr return) will affect sagebrush and Atriplex, but not change the seral stage.

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***Class C*** **40%**

Late Development 1 Open

**Upper Layer Lifeform**

- ☐ Herbaceous
- ☑ Shrub
- ☐ Tree

**Fuel Model** 5

**Indicator Species* and Canopy Position**

| | |
|---|---|
| ARTRT | Upper |
| ARTRW8 | Upper |
| ATCA2 | Upper |
| PSSP6 | Lower |

**Structure Data (for upper layer lifeform)**

| | *Min* | *Max* |
|---|---|---|
| *Cover* | 21 % | 30 % |
| *Height* | Shrub 0m | Shrub 3.0m |
| *Tree Size Class* | No data | |

☐ Upper layer lifeform differs from dominant lifeform.

**Description**

Late seral shrubs over grasses. Shrubs are dominated by Atriplex species and sagebrush, and grass cover will be lower than the mid-seral stage. Disturbance is replacement fire at 200yr return, which produces early seral, and frequent drought (10yrs) and infrequent insects (50yrs) which do not change the seral stage.

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***Class D*** **0%**

[Not Used] [Not Used]

**Upper Layer Lifeform**

- ☐ Herbaceous
- ☐ Shrub
- ☐ Tree

**Fuel Model**

**Indicator Species* and Canopy Position**

**Structure Data (for upper layer lifeform)**

| | *Min* | *Max* |
|---|---|---|
| *Cover* | % | % |
| *Height* | | |
| *Tree Size Class* | | |

☐ Upper layer lifeform differs from dominant lifeform.

**Description**

---

***Class E*** **0%**

[Not Used] [Not Used]

**Upper Layer Lifeform**

- ☐ Herbaceous
- ☐ Shrub
- ☐ Tree

**Fuel Model**

**Indicator Species* and Canopy Position**

**Structure Data (for upper layer lifeform)**

| | *Min* | *Max* |
|---|---|---|
| *Cover* | % | % |
| *Height* | | |
| *Tree Size Class* | | |

☐ Upper layer lifeform differs from dominant lifeform.

**Description**

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*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100+ year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement severity.

## Disturbances

**Fire Regime Group**:** III

**Historical Fire Size (acres)**

Avg 100
Min 10
Max 1500

**Sources of Fire Regime Data**

- [x] Literature
- [ ] Local Data
- [x] Expert Estimate

| Fire Intervals | Avg FI | Min FI | Max FI | Probability | Percent of All Fires |
|---|---|---|---|---|---|
| Replacement | 285 | | | 0.003509 | 41 |
| Mixed | 200 | | | 0.005 | 59 |
| Surface | | | | | |
| All Fires | 118 | | | 0.00852 | |

***Fire Intervals (FI):***

Fire interval is expressed in years for each fire severity class and for all types of fire combined (All Fires). Average FI is central tendency modeled. Minimum and maximum show the relative range of fire intervals, if known. Probability is the inverse of fire interval in years and is used in reference condition modeling. Percent of all fires is the percent of all fires in that severity class.

**Additional Disturbances Modeled**

- [x] Insects/Disease
- [x] Wind/Weather/Stress
- [ ] Native Grazing
- [ ] Competition
- [ ] Other (optional 1)
- [ ] Other (optional 2)

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*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100+ year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement severity.

# LANDFIRE Biophysical Setting Model

## *Biophysical Setting:* 1511350 Inter-Mountain Basins Semi-Desert Grassland

☐ *This BPS is lumped with:*
☐ *This BPS is split into multiple models:*

## General Information

**Contributors** (also see the Comments field) **Date** 10/18/2005


| | | | | | |
|---|---|---|---|---|---|
| **Modeler 1** | Bob Unnasch | bunnasch@tnc.org | **Reviewer** | Chuck Kostecka | kostecka@webaccess.net |
| **Modeler 2** | | | **Reviewer** | Vic Ecklund | vecklund@csu.org |
| **Modeler 3** | | | **Reviewer** | anonymous | |


**Vegetation Type**
Upland Grassland

**Map Zone**
15

**Model Zone**
☐ Alaska ☐ N-Cent.Rockies
☐ California ☐ Pacific Northwest
☐ Great Basin ☐ South Central
☐ Great Lakes ☐ Southeast
☐ Northeast ☐ S. Appalachians
☐ Northern Plains ☑ Southwest

**Dominant Species***
BOGR2 ARIST
ACHY MUHLE
HECO26
PLEUR1

**General Model Sources**
☑ Literature
☐ Local Data
☐ Expert Estimate

### Geographic Range
Occurs throughout the Intermountain western US on dry plains and mesas.

### Biophysical Site Description
Ecological systems found at approximately 1450-2320m (4750-7610ft) elevation. These grasslands occur in lowland and upland areas and may occupy swales, playas, mesa tops, plateau parks, alluvial flats and plains, but sites are typically xeric. Substrates are often well-drained sandy or loamy-textured soils derived from sedimentary parent materials but are quite variable and may include fine-textured soils derived from igneous and metamorphic rocks. These grasslands typically occur on xeric sites. When they occur near foothill grasslands they will be at lower elevations. These grasslands occur on a variety of aspects and slopes. Sites may range from flat to moderately steep. Annual precipitation is usually from 20-40cm (7.9-15.7in).

### Vegetation Description
Grasslands within this system are typically characterized by a sparse to moderately dense herbaceous layer dominated by medium-tall and short bunch grasses, often in a sod-forming growth. The dominant perennial bunch grasses and shrubs within this system are all very drought-resistant plants. These grasslands are typically dominated or codominated by Achnatherum hymenoides, Aristida spp, Bouteloua gracilis, Hesperostipa comata, Muhlenbergia spp or Pleuraphis jamesii and may include scattered shrubs and dwarf-shrubs of species of Artemisia, Atriplex, Coleogyne, Ephedra, Gutierrezia or Krascheninnikovia lanata. Muhlenbergia-dominated grasslands which flood temporarily, combined with high evaporation rates in this dry system, can have accumulations of soluble salts in the soil. Soil salinity depends on the amount and timing of precipitation and flooding.

*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100+ year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement severity.

## Disturbance Description

This system is maintained by frequent fires and sometimes associated with specific soils, often well-drained clay soils. Fire most often occurred in these sites when adjacent shrublands burned. Fires were typically mixed (average FRI of 37yrs) and stand replacement (average FRI of 75yrs). Most species respond favorably to fire. Rabbitbrush tends to increase with spring and summer fires.

These sites were prone to flooding during high precipitation, resulting in erosion of topsoil and some short term loss of vegetative cover. In cases of 500yr+ flooding event, the site could downcut, thus lowering the water table, and favored woody species in an altered state.

Infrequent native grazing has occurred, which may have resulted in heavy defoliation, but was confined to small acreage and generally temporary in nature.

Drought cycles likely resulted in a reduction in vegetative cover, production and acreage of these sites. Drought negatively affected woody species (mean return interval of 100yrs).

Native American's likely used these sites for camping and some vegetation collection, while hunting and gathering in adjacent wetlands. Human's likely caused heavy impacts to soils and vegetation in small campsites, but overall impact was light and transitory in nature.

## Adjacency or Identification Concerns

Found adjacent to wet meadows, wetlands, sagebrush uplands and salt desert shrublands. Sites adjacent to sagebrush uplands tended to burn more frequently than sites adjacent to wet or salt desert shrub.

Many of these sites were impacted by introduced grazing animals post-European settlement and have been converted to shrub dominated systems with soil compaction problems that tend toward an increase in tap-rooted forb species. Class D is found more frequently now, due to altered disturbance regimes with livestock grazing, changes in fire frequency, altered water flow and climate change.

## Native Uncharacteristic Conditions

## Scale Description

These sites are generally small and often moist. Fire in these systems is usually introduced from adjacent shrublands or native burning to improve herbaceous understory.

## Issues/Problems

The scale of historic fire is unknown and numbers provided are a guess.

## Comments

This is nearly identical to the model for the same BpS in MZ16, MZ23, MZ24 and MZ28. Minor species edits were made (Mike Babler, mbabler@tnc.org, 5/5/2005). Minor modifications to structural data was made for MZ15. Additional reviewers for MZ28 were Mike Frary (mike_frary@blm.gov), Linkda Kerr (linda_kerr@nps.gov) and Paul Langowski (plangowski@fs.fed.us). One reviewer sugggests deleting mixed severity fire. Other reviewers stated that mixed fire should remain. Because of the disagreement, mixed fire was left.

This system is similar to the Great Basin Grassland (R2MGWAws) developed by Cheri Howell (chowell@fs.fed.us) and edited by Louis Provencher (lprovencher@tnc.org).

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*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100+ year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement severity.

## Vegetation Classes

### Class A 5%

Early Development 1 Open

**Upper Layer Lifeform**

- [x] Herbaceous
- [ ] Shrub
- [ ] Tree

**Fuel Model** 1

**Indicator Species* and Canopy Position**

| | |
|---|---|
| BOGR2 | Upper |
| ACHY | Upper |
| HECO26 | Upper |
| PLEUR12 | Upper |

**Structure Data (for upper layer lifeform)**

| | Min | Max |
|---|---|---|
| *Cover* | 0% | 20% |
| *Height* | Herb 0m | Herb 1.0m |
| *Tree Size Class* | No Data | |

- [ ] Upper layer lifeform differs from dominant lifeform.

**Description**

Post fire, flood or drought early seral community. Bare ground is 10-30%.Total vegetative canopy cover is 0-25%. Relative forb cover is 10-40%. Relative graminoid cover is 60-90%. Shrub cover is minimal or non-existent. Replacement fire (FRI of 75yrs) maintains the vegetation in A, whereas mixed severity fire (FRI of 37yrs), while occurring, does not change the successional age. Rare flood events (mean return interval of 500yrs) moves the vegetation to a more shrubby condition, class D, after downcutting. Succession is from class A to B.

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### Class B 70%

Mid Development 1 Open

**Upper Layer Lifeform**

- [x] Herbaceous
- [ ] Shrub
- [ ] Tree

**Fuel Model** 1

**Indicator Species* and Canopy Position**

| | |
|---|---|
| BOGR2 | Upper |
| ACHY | Upper |
| HECO26 | Upper |
| PLEUR12 | Upper |

**Structure Data (for upper layer lifeform)**

| | Min | Max |
|---|---|---|
| *Cover* | 21% | 80% |
| *Height* | Herb 0m | Herb 1.0m |
| *Tree Size Class* | No data | |

- [ ] Upper layer lifeform differs from dominant lifeform.

**Description**

Mostly stable and resilient system. Bare ground is less than 10%. Total canopy cover is 25-80%. Relative cover of grasses is >85%. Relative cover of forbs is 0-5%. Relative cover of shrubs is 0-10%. Replacement fire (mean FRI 75yrs) causes a transition to class A, whereas mixed severity (FRI of 37yrs), while active, does not affect the successional age of class B. Weather and flooding affects this system in three different ways: 1) Recurring drought with a 100yr return interval will thin vegetation and keep it open; 2) The site will be scoured, but not downcut, by 100yr flood events causing a transition to class A; and 3) Rare 1000yr flooding event will cause a downcut and alteration of the site towards a more permanent woody condition (class D). Succession is from class B to C.

---

### Class C 20%

Late Development 1 Open

**Upper Layer Lifeform**

- [ ] Herbaceous
- [x] Shrub
- [ ] Tree

**Fuel Model** 1

**Indicator Species* and Canopy Position**

| | |
|---|---|
| BOGR2 | Lower |
| ACHY | Lower |
| HECO26 | Upper |
| PLEUR1 | Upper |

**Structure Data (for upper layer lifeform)**

| | Min | Max |
|---|---|---|
| *Cover* | 11% | 80% |
| *Height* | Shrub 0m | Shrub 3.0m |
| *Tree Size Class* | No data | |

- [ ] Upper layer lifeform differs from dominant lifeform.

**Description**

This system differs from mid-open by an increase in the shrub cover component. Bare ground is <10%. Total canopy cover is 50-80%. Relative cover of grasses is 25-50%. Relative cover of forbs is 0-5%. Relative cover

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**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100+ year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement severity.

of shrubs (most frequently rubber rabbitbrush and Basin big sagebrush) is 10-75%. The dynamics of class C are similar to those of class B, except that drought causes a transition to class B (not class A) through the thinning of shrubs. Class C, unlike class B, experiences infrequent native grazing (browsing, 1/1000 probability/yr) that will reduce woody vegetation and cause a transition to class B. Succession remains in class C.

***Class D*** **5%**

Mid Development 1 Closed

**Upper Layer Lifeform**

- ☐ Herbaceous
- ☑ Shrub
- ☐ Tree

**Fuel Model** 2

**Indicator Species* and Canopy Position**

| | |
|---|---|
| BOGR2 | Lower |
| ACHY | Lower |
| HECO26 | Upper |
| PLEUR12 | Upper |

**Structure Data (for upper layer lifeform)**

| | *Min* | *Max* |
|---|---|---|
| *Cover* | 81 % | 100 % |
| *Height* | Shrub 0m | Shrub 3.0m |
| *Tree Size Class* | No data | |

☐ Upper layer lifeform differs from dominant lifeform.

**Description**

This system differs from mid-open by a significant increase in the shrub cover component. Bare ground is <20%. Total canopy cover can exceed 100% due to shrub dominance. Relative cover of grasses is <25%. Relative cover of forbs is 0-5%. Relative cover of shrubs (most frequently rubber rabbitbrush and Basin big sagebrush) is >75%. Replacement fire (FRI of 75yrs) and 100yr flood event are the only disturbances causing a transition to class A. Mixed severity fire (average FRI of 37yrs) opens the stand, but maintain in a woody state (transition to class C). Class D is likely less than 5%.

***Class E*** **0%**

[Not Used] [Not Used]

**Upper Layer Lifeform**

- ☐ Herbaceous
- ☐ Shrub
- ☐ Tree

**Fuel Model**

**Indicator Species* and Canopy Position**

**Structure Data (for upper layer lifeform)**

| | *Min* | *Max* |
|---|---|---|
| *Cover* | % | % |
| *Height* | | |
| *Tree Size Class* | | |

☐ Upper layer lifeform differs from dominant lifeform.

**Description**

## *Disturbances*

**Fire Regime Group**: I**

**Historical Fire Size (acres)**

Avg 100
Min 1
Max 500

**Sources of Fire Regime Data**

- ☑ Literature
- ☑ Local Data
- ☑ Expert Estimate

**Fire Intervals**

| | *Avg FI* | *Min FI* | *Max FI* | *Probability* | *Percent of All Fires* |
|---|---|---|---|---|---|
| *Replacement* | 75 | 40 | 110 | 0.013333 | 33 |
| *Mixed* | 37 | 20 | 54 | 0.027027 | 67 |
| *Surface* | | | | | |
| *All Fires* | 25 | | | 0.04037 | |

***Fire Intervals (FI):***
Fire interval is expressed in years for each fire severity class and for all types of fire combined (All Fires). Average FI is central tendency modeled. Minimum and maximum show the relative range of fire intervals, if known. Probability is the inverse of fire interval in years and is used in reference condition modeling. Percent of all fires is the percent of all fires in that severity class.

**Additional Disturbances Modeled**

- ☐ Insects/Disease
- ☑ Wind/Weather/Stress
- ☑ Native Grazing
- ☐ Competition
- ☐ Other (optional 1)
- ☐ Other (optional 2)

*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100+ year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement severity.

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*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100+ year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement severity.

# LANDFIRE Biophysical Setting Model

## *Biophysical Setting:* 1511450 Rocky Mountain Subalpine-Montane Mesic Meadow

☐ *This BPS is lumped with:*
☐ *This BPS is split into multiple models:*

## *General Information*

**Contributors** (also see the Comments field) **Date** 10/18/2005

| | | | |
|---|---|---|---|
| **Modeler 1** | Cheri Howe | chowell02@fs.fed.us | **Reviewer** |
| **Modeler 2** | Julia Richardson | jhrichardson@fs.fed.ud | **Reviewer** |
| **Modeler 3** | | | **Reviewer** |

**Vegetation Type**

Upland Grassland

**Map Zone**

15

**Model Zone**

☐ Alaska ☐ N-Cent.Rockies
☐ California ☐ Pacific Northwest
☐ Great Basin ☐ South Central
☐ Great Lakes ☐ Southeast
☐ Northeast ☐ S. Appalachians
☐ Northern Plains ☑ Southwest

**Dominant Species***

ERIGE2 LUPIN
MERTE SOLID
PENST DECA18
CAMPA KOELE

**General Model Sources**

☑ Literature
☐ Local Data
☑ Expert Estimate

### Geographic Range

Found in the Rocky Mountains, restricted to the subalpine zone typically above 3000m in the southern part, 1500m in the north.

### Biophysical Site Description

Finely textured soils. Snow deposition, wind swept dry conditions limit tree establishment. On gentle to moderate gradient slopes. Soils seasonally moist in spring, drying out later in the growing season.

### Vegetation Description

Vegetation is typically forb-rich, with forbs contributing more to overall herbaceous cover than graminoids. Important taxa include Agastache urticifolia, Chamerion angustifolium, Erigeron spp, Senecio spp, Helianthella spp, Mertensia spp, Penstemon spp, Campanula spp, Hackelia spp, Lupinus spp, Solidago spp, Ligusticum spp, Osmorhiza spp, Thalictrum spp, Valeriana spp, Balsamorhiza sagitatta and Wyethia spp. Burrowing mammals can increase for density.

### Disturbance Description

Fires are primarily replacement and occur about every 40yrs. Mixed severity fire (mean FRI of 75yrs) occurs in late development meadows and removes shrubs. The ignition source is generally not in this type and probably associated with native burning in the fall and spring, but spreads from an adjacent shrub or tree dominated sites, such as mountain big sagebrush, ponderosa pine and aspen.

### Adjacency or Identification Concerns

This BpS could be confused with low forb/alpine shrub communities. Often adjacent to aspen/tall forb communities and mountain or big sagebrush/tall forb communities. In degraded sites this community may convert to silver sagebrush/tall forb.

*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100+ year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement severity.

### Native Uncharacteristic Conditions

### Scale Description

Range in size from less than ten acres to 300ac.

### Issues/Problems

With heavy grazing these sites can convert to undesirable forbs and grasses such as Circium spp (thistle, any species), Galium spp (bedstraw), Rudbeckia occidentalis (coneflower), Helenium hoopesii (Orange sneezeweed), Polygonum spp. (knotweed), Rumex spp (sorrel or dock), Taraxacom officinale (dandelion), Veratrum californicum (false hellebore), Wyethia amplexicaulis (mulesears), Potentilla gracilis (cinquefoil), Geum marcophyllum (avens), Arnica chamissonis (arnica), Collomia linearis (tiny trumpet), Madia glomerata (mountain tarweed), Descurainia spp (tansymustard), Nemophila brevifolia (basin blue eyes), Poa pratensis (Kentucky bluegrass), Agrostis exarata (bentgrass), Dactylis glomerata (orchardgrass), Bromus inermis (smooth brome), Bromus tectorum (cheatgrass), Poa bulbosa (bulbous bluegrass) and Vulpia octoflora (six-week fescue). Roads and trails can impact these sites.

There is not much information about this type. We estimated the fire frequency of 40yrs based on adjacent aspen, herbaceous and sagebrush communities. Also, because fire was assumed to occur in the fall and spring when the summer's green and wet biomass would be dead and cured, replacement fire has little effect on annual tall forbs themselves. Fires would affect encroaching shrubs.

### Comments

This is nearly identical to the model for the same BpS in MZ16, MZ23, MZ24 and MZ28. Minor edits were made to the description for MZ28 (Mike Babler, mbabler@tnc.org, 5/6/2005).

## *Vegetation Classes*

***Class A*** **5%**

Early Development 1 Open

**Upper Layer Lifeform**

- ☑ Herbaceous
- ☐ Shrub
- ☐ Tree

**Fuel Model** 1

**Indicator Species* and Canopy Position**

| | |
|---|---|
| ERIGE2 | Upper |
| LUPIN | Upper |
| DECA18 | Upper |

**Structure Data (for upper layer lifeform)**

| | *Min* | *Max* |
|---|---|---|
| *Cover* | 0% | 100% |
| *Height* | Herb 0m | Herb 0.5m |
| *Tree Size Class* | No Data | |

☐ Upper layer lifeform differs from dominant lifeform.

**Description**

Vegetation is typically forb-rich, with forbs contributing more to overall herbaceous cover than graminoids. Succession to class B after three years. Replacement fire (mean FRI of 40yrs) presumably occurred during the fall and spring, therefore removing completely dead biomass, but in these early development meadows, fire would not cause an ecological setback (ie, relative age=0) because fire would simply remove dead annual forbs.

*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100+ year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement severity.

***Class B*** **45%**

Mid Development 1 Open

**Upper Layer Lifeform**

- [x] Herbaceous
- [ ] Shrub
- [ ] Tree

**Fuel Model** 1

**Indicator Species* and Canopy Position**

| | |
|---|---|
| ERIGE2 | Upper |
| LUPIN | Upper |
| DECA | Upper |

**Structure Data (for upper layer lifeform)**

| | Min | Max |
|---|---|---|
| *Cover* | 51% | 100% |
| *Height* | Herb 0.6m | Herb 1.0m |
| *Tree Size Class* | No data | |

[x] Upper layer lifeform differs from dominant lifeform.

Shrubs may be present, but will be less than five percent cover.

**Description**

Vegetation is typically forb-rich, with forbs contributing more to overall herbaceous cover than graminoids. Some increase in shrub component, shrubs young and less than five percent cover. Succession to C after 20yrs. Replacement fire removes shrubs (mean FRI of 40yrs).

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***Class C*** **50%**

Late Development 1 Open

**Upper Layer Lifeform**

- [ ] Herbaceous
- [x] Shrub
- [ ] Tree

**Fuel Model** 1

**Indicator Species* and Canopy Position**

| | |
|---|---|
| ASTER | Middle |
| LUPIN | Middle |
| ROWO | Middle |
| RIBES | Middle |

**Structure Data (for upper layer lifeform)**

| | Min | Max |
|---|---|---|
| *Cover* | 0% | 10% |
| *Height* | Shrub 0m | Shrub >3.1m |
| *Tree Size Class* | Seedling <4.5ft | |

[x] Upper layer lifeform differs from dominant lifeform.

Forbs dominate. Trees (Populus tremuloides) or shrubs (Artemisia cana, Artemisia tridentata, Rosa
woodsii, Ribes spp and Amelanchier spp.) may be the upper layer lifeform, with low canopy cover (<10%).

**Description**

Vegetation is typically forb-rich, with forbs contributing more to overall herbaceous cover than graminoids. Five to 10% of cover in late seral may be woody species from adjacent plant communities such as Populus tremuloides, Artemisia cana, Artemisia tridentata, Rosa
woodsii, Ribes spp and Amelanchier spp. Mixed severity fire (mean FRI of 75yrs) removes shrubs from overstory. Replacement fire (mean FRI of 40yrs) sets site back to class A.

---

***Class D*** **0%**

[Not Used] [Not Used]

**Upper Layer Lifeform**

- [ ] Herbaceous
- [ ] Shrub
- [ ] Tree

**Fuel Model**

**Indicator Species* and Canopy Position**

**Structure Data (for upper layer lifeform)**

| | Min | Max |
|---|---|---|
| *Cover* | % | % |
| *Height* | | |
| *Tree Size Class* | | |

[ ] Upper layer lifeform differs from dominant lifeform.

**Description**

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*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100+ year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement severity.

***Class E*** **0%**

[Not Used] [Not Used]

**Upper Layer Lifeform**

- ☐ Herbaceous
- ☐ Shrub
- ☐ Tree

**Fuel Model**

**Description**

**Indicator Species* and Canopy Position**

**Structure Data (for upper layer lifeform)**

| | *Min* | *Max* |
|---|---|---|
| *Cover* | % | % |
| *Height* | | |
| *Tree Size Class* | | |

☐ Upper layer lifeform differs from dominant lifeform.

## *Disturbances*

**Fire Regime Group**: II**

**Historical Fire Size (acres)**

Avg 50
Min 1
Max 250

**Sources of Fire Regime Data**

- ☑ Literature
- ☑ Local Data
- ☑ Expert Estimate

**Fire Intervals**

| | *Avg FI* | *Min FI* | *Max FI* | *Probability* | *Percent of All Fires* |
|---|---|---|---|---|---|
| *Replacement* | 40 | | | 0.025 | 80 |
| *Mixed* | 161 | | | 0.006211 | 20 |
| *Surface* | | | | | |
| *All Fires* | 32 | | | 0.03122 | |

***Fire Intervals (FI):***

Fire interval is expressed in years for each fire severity class and for all types of fire combined (All Fires). Average FI is central tendency modeled. Minimum and maximum show the relative range of fire intervals, if known. Probability is the inverse of fire interval in years and is used in reference condition modeling. Percent of all fires is the percent of all fires in that severity class.

**Additional Disturbances Modeled**

- ☐ Insects/Disease
- ☐ Wind/Weather/Stress
- ☐ Native Grazing
- ☐ Competition
- ☐ Other (optional 1)
- ☐ Other (optional 2)

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*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100+ year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement severity.

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*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100+ year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement severity.

# LANDFIRE Biophysical Setting Model

## *Biophysical Setting:* 1511460 Southern Rocky Mountain Montane-Subalpine Grassland

☐ *This BPS is lumped with:*
☐ *This BPS is split into multiple models:*

## *General Information*

**Contributors** (also see the Comments field) **Date** 10/18/2005


**Modeler 1** Wayne Robbie wrobbie@fs.fed.us **Reviewer**
**Modeler 2** **Reviewer**
**Modeler 3** **Reviewer**


**Vegetation Type**
Upland Grassland

**Map Zone**
15

**Model Zone**
☐ Alaska ☐ N-Cent.Rockies
☐ California ☐ Pacific Northwest
☐ Great Basin ☐ South Central
☐ Great Lakes ☐ Southeast
☐ Northeast ☐ S. Appalachians
☐ Northern Plains ☑ Southwest

**Dominant Species***
FETH DAIN
FEAR2 FEID
MUMO MUFI
DAIN PSSP6

**General Model Sources**
☑ Literature
☑ Local Data
☑ Expert Estimate

### Geographic Range
Northern AZ, southern and northern NM, southern CO.

### Biophysical Site Description
Elevated plains, valleys, hills and mountain sideslopes ranging from nearly level to very steep topography. Aspect varies, however the larger patches are on southern exposures and on summit plains. Elevation ranges from 2200 to 3000 m. Moderately deep to deep Typic to Pachic Cryoborolls (FETH) and Argiborolls/Haploborolls (FEAR2).

### Vegetation Description
Thurber fescue (FETH), Arizona fescue (FEAR2), sheep fescue (FEOV), mountain muhly (MUMO), timber/Parry's oatgrass (DAIN/DAPA, kentucky bluegrass (POPR), nodding brome (BRAN); tufted hairgrass (DECE) and various sedges (CAREX spp.) in moist (concave) sites. See TES map units 560, 561, 563, 566, 198, 131, 132, 133 of the Carson NF; map units 640, 595, 594 of the Coconino NF; and 513 and 518 of the Kaibab NF and map units 3164, 3174, and 3094 of the Smokey Bear TES report.

### Disturbance Description
Predicted historic stand replacement fire regime of approximately 30-60 yr based upon historic photographic analysis, personal communication (Barry Johnston-R2) and inference from mean/max and min fire regimes of adjacent forest types (PIPO 3-12yr, ABCO/PSMEG 14-46yr, PIEN/ABLAA 60-180+yr) . Anthropogenic (pre-European cf., Spanish colonial?) fire use ignitions 5-15yr, current regime greater than 60yr in montane and 100yr in subalpine systems.

### Adjacency or Identification Concerns

### Native Uncharacteristic Conditions

*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100+ year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement severity.

### Scale Description

### Issues/Problems

### Comments

This model is identical to a model for the same BpS in mapping zone 15. It is based on the Rapid Assessment model R3MGRA by W Robbie (wrobbie@fs.fed.us) and reviewed by Bill Baker, bakerwl@wyo.edu.

## Vegetation Classes

### Class A 20%

Early Development 1 All Structures

**Upper Layer Lifeform**

- [x] Herbaceous
- [ ] Shrub
- [ ] Tree

**Fuel Model** 1

**Indicator Species* and Canopy Position**

| | |
|---|---|
| FETH | Upper |
| FEAR2 | Upper |
| ANPA | Upper |
| ERFO | Upper |

**Structure Data (for upper layer lifeform)**

| | Min | Max |
|---|---|---|
| Cover | 0% | 30% |
| Height | Herb 0m | Herb 1.0m |
| Tree Size Class | No Data | |

- [ ] Upper layer lifeform differs from dominant lifeform.

**Description**

Low cover and frequency of Thurber fescue (FETH), Arizona fescue (FEAR2), sheep fescue (FEOV), mountain muhly (MUMO), timber/Parry's oatgrass (DAIN/DAPA, kentucky bluegrass (POPR), nodding brome (BRAN); tufted hairgrass (DECE) and various sedges (CAREX spp.) in moist (concave) sites. BLTR is common.

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### Class B 30%

Mid Development 1 Closed

**Upper Layer Lifeform**

- [x] Herbaceous
- [ ] Shrub
- [ ] Tree

**Fuel Model** 1

**Indicator Species* and Canopy Position**

| | |
|---|---|
| FETH | Upper |
| DAIN | Upper |
| MUMO | Upper |
| FEAR2 | Upper |

**Structure Data (for upper layer lifeform)**

| | Min | Max |
|---|---|---|
| Cover | 31% | 70% |
| Height | Herb 0m | Herb 1.0m |
| Tree Size Class | No data | |

- [ ] Upper layer lifeform differs from dominant lifeform.

**Description**

Thurber fescue (FETH), Arizona fescue (FEAR2), sheep fescue (FEOV), mountain muhly (MUMO), timber/Parry's oatgrass (DAIN/DAPA, kentucky bluegrass (POPR), nodding brome (BRAN); tufted hairgrass (DECE) and various sedges (CAREX spp.) in moist (concave) sites.

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### Class C 50%

Late Development 1 Closed

**Upper Layer Lifeform**

- [x] Herbaceous
- [ ] Shrub
- [ ] Tree

**Fuel Model** 1

**Indicator Species* and Canopy Position**

| | |
|---|---|
| FETH | Upper |
| FEAR2 | Upper |
| DAIN | Upper |
| MUMO | Upper |

**Structure Data (for upper layer lifeform)**

| | Min | Max |
|---|---|---|
| Cover | 71% | 100% |
| Height | Herb 0m | Herb 1.0m |
| Tree Size Class | No data | |

- [ ] Upper layer lifeform differs from dominant lifeform.

**Description**

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*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100+ year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement severity.

Thurber fescue (FETH), Arizona fescue (FEAR2), sheep fescue (FEOV), mountain muhly (MUMO), timber/Parry's oatgrass (DAIN/DAPA, kentucky bluegrass (POPR), nodding brome (BRAN); tufted hairgrass (DECE) and various sedges (CAREX spp.) in moist (concave) sites.

***Class D*** **0%**

[Not Used] [Not Used]

**Upper Layer Lifeform**

- ☐ Herbaceous
- ☐ Shrub
- ☐ Tree

**Fuel Model**

**Description**

**Indicator Species* and Canopy Position**

**Structure Data (for upper layer lifeform)**

| | Min | Max |
|---|---|---|
| *Cover* | % | % |
| *Height* | | |
| *Tree Size Class* | | |

☐ Upper layer lifeform differs from dominant lifeform.

***Class E*** **0%**

[Not Used] [Not Used]

**Upper Layer Lifeform**

- ☐ Herbaceous
- ☐ Shrub
- ☐ Tree

**Fuel Model**

**Description**

**Indicator Species* and Canopy Position**

**Structure Data (for upper layer lifeform)**

| | Min | Max |
|---|---|---|
| *Cover* | % | % |
| *Height* | | |
| *Tree Size Class* | | |

☐ Upper layer lifeform differs from dominant lifeform.

## Disturbances

**Fire Regime Group**: I**

**Historical Fire Size (acres)**

Avg
Min
Max

**Sources of Fire Regime Data**

- ☑ Literature
- ☐ Local Data
- ☐ Expert Estimate

**Fire Intervals**

| | Avg FI | Min FI | Max FI | Probability | Percent of All Fires |
|---|---|---|---|---|---|
| *Replacement* | 18 | 10 | 100 | 0.055556 | 55 |
| *Mixed* | | | | | |
| *Surface* | 22 | | | 0.045455 | 45 |
| *All Fires* | 10 | | | 0.10102 | |

***Fire Intervals (FI):***
Fire interval is expressed in years for each fire severity class and for all types of fire combined (All Fires). Average FI is central tendency modeled. Minimum and maximum show the relative range of fire intervals, if known. Probability is the inverse of fire interval in years and is used in reference condition modeling. Percent of all fires is the percent of all fires in that severity class.

**Additional Disturbances Modeled**

- ☐ Insects/Disease
- ☐ Wind/Weather/Stress
- ☐ Native Grazing
- ☑ Competition
- ☐ Other (optional 1)
- ☐ Other (optional 2)

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*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100+ year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement severity.

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*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100+ year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement severity.

# LANDFIRE Biophysical Setting Model

## *Biophysical Setting:* 1511551 North American Warm Desert Riparian Systems

☐ *This BPS is lumped with:*

☑ *This BPS is split into multiple models:* *BpS 1511550 was split between 1511551 dominated by mid to large perrennial rivers where Native American use was possible and 1511552 that represents smaller riparian stringers with either intermittent water or subsurface groundwater flow (washes, canyon corridor, small streams) imbedded in the creosote and paloverde matrix.*

## *General Information*

**Contributors** (also see the Comments field) **Date** 10/18/2005


| | | | |
|---|---|---|---|
| **Modeler 1** | Janet Grove | jgrove@fs.fed.us | **Reviewer** |
| **Modeler 2** | Holly Richter | hrichter@fs.fed.us | **Reviewer** |
| **Modeler 3** | Jony Cockman | jcockman@blm.gov | **Reviewer** |


**Vegetation Type**

Wetlands and Riparian

**Map Zone**

15

**Model Zone**

☐ Alaska ☐ N-Cent.Rockies
☐ California ☐ Pacific Northwest
☐ Great Basin ☐ South Central
☐ Great Lakes ☐ Southeast
☐ Northeast ☐ S. Appalachians
☐ Northern Plains ☑ Southwest

**Dominant Species***

| | |
|---|---|
| POFR2 | TYAN |
| PLSE | DISTI |
| ATLEB | WAFI |
| SAEX | PROSO |

**General Model Sources**

☑ Literature
☐ Local Data
☑ Expert Estimate

### Geographic Range

Perennial and intermittant desert drainages in central and southwestern AZ.

### Biophysical Site Description

Riparian systems occur primarily along perennial streams/rivers along the Lower Colorado, Lower Salt, Lower Verde, Lower Gila, Big Sandy, Bill Williams, Santa Maria, Hassayampa and Lower Santa Cruz corridors adjacent to Sonoran Desert Scrub.

### Vegetation Description

The vegetation is a diverse mosaic of riparian forests, shrublands, streamside marshes and barren alluvial surfaces. Larger river systems were dominated by gallery forests. Dominant species are Salix gooddingii, Populus fremontii, Distichlis spicata, Scirpus spp, Typha spp, Prosopis spp, Baccharis salicifolia and Muhlenbergia rigens. Vegetation is dependent upon periodic flooding. Native Americans also had a strong influence on vegetation composition and structure by favoring edible plants (eg, mesquite), collecting fuel wood and burning to flush animals and increase accessibility to open water and agricultural fields.

### Disturbance Description

This BpS is a flood-dependent ecosystem. The entire range of flood magnitudes contribute to ecological processes such as nutrient cycling, recruitment, species composition. Two to ten-year events primarily impact herbaceous vegetation, 7-50yr events result in patchy removal of shrubs and saplings. 50yr+ events remove stands of larger trees. Cottonwood will return to pole size within 10yrs of disturbance. Cottonwood

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**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100+ year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement severity.

is considered mature around 60yrs.

New mud/silt flats created by flooding were cultivated for corn, bean and squash by Native Americans (we assumed 10% utilization of class A per year to imitate 50% utilization during the first year only). Farming would be a stand replacing events that prevented cottonwood and willow seedling establishment.

Fuel characteristics and fire behavior are extremely variable, due to the wide range of vegetation types that characterize the riparian zone and to Native American manipulations. In general fuels are typically continuous and fuel loads high, but fuel moisture content is also often high. Wildfires may not carry except under extreme fire weather conditions (average FRI for replacement fire is 500-1000yrs; assumed 750yrs). For stands not recently tended by Native Americans, higher fuels loads allow for an average FRI of 500yrs, whereas the intense collection of fuel wood (30% of area of late-development cottonwood dominated) and prescribed burning for hunting and agricultural purposes increased the mean FRI to 1000yrs. Native Americans had a profound influence on these systems with the development of irrigation ditches, crop production on silt/mud flats deposited by yearly floods, the burning of willows for basketry (only first-year willows can be used for weaving), to maintain open irrigation ditches and agricultural fields, and burning to facilitate access and flush jackrabbits, game birds and deer. A mixed severity FRI of 10-20yrs was assumed, respectively, for late-development and mid-development and was calculated by assuming that Native Americans burned every year but affected only 10-5%, respectively, of the floodplain per year (thus, probability/year of 0.1-0.05). It was also assumed that older stands received more burning than younger stands that provided less fuel wood. Fire was applied in the fall when fuels would be cured and dry. Thus, the historic fire regime is characterized by small to moderate sized, complete, high intensity passive crown fires, and small moderate intensity fires set frequently by Native Americans. FRG is difficult to identify because it is either V, I or II. In the absence of native bruning, the FRG will be V.

Willow resprouts more vigorously than cottonwood from fire. Woodland dominants such as Fremont cottonwood (Populus fremontii) honey mesquite (Prosopis glandulosa), and willows (Salix spp) typically resprout after being topkilled. However, resprouting individuals and seedlings are susceptible to mortality during recurrent fires.

### Adjacency or Identification Concerns

Exotic trees of Tamarix spp and Bromus rubrum, Bromus tectorum and Bermuda grass are common in some stands.

Water diversions and groundwater pumping have greatly modified hydrologic regimes and water levels, perhaps permanently.

Livestock grazing can be a major influence in the alteration of structure, composition and function of the community.

In riparian woodlands the invasives saltcedar Tamarix spp, Bromus rubrum, Bromus tectorum and Bermuda grass are common in some stands and create contiguous fuels that allow fire to spread. After an initial fire, these invasives may quickly recover and surpass their pre-fire dominance, promoting increasingly more frequent and intense fires, which can eventually displace native plants.

### Native Uncharacteristic Conditions

Canopy cover can reach 100%.

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*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100+ year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement severity.

### Scale Description

These systems can exist as small to large linear features in the landscape. In larger, low elevation riverine systems, this system may exist as mid-large patches.

### Issues/Problems

### Comments

This model is based on the model for the same BpS in MZ14. Modeler of 141155 also includes Brooke Gebow (bgebow@tnc.org). BpS 141155 was created by substantially revising BpS 131155a. Many changes were done. 1) Floods causing stand replacing events were more frequent (5-50yr, 50yrs+, for respectively, mid- and late-development classes); classes C and D in 131155a were merged into class C (still accounting for Native American influences); and class D is Mesquite Bosque, which is the last successional phase in the floodplain (not in the Mojave Desert), with 500yr flood replacement events and replacement fire every 250yrs on average; and, although Native American influences were maintained, the importance of mixed severity was implicitely reduced by removing time since disturbance from BpS 131155a.

For BpS 131155a, Native American burning was introduced as a very plausible disturbance, however no data or expertise were available. Consultation with ethno-biologist Kay Fowler, resulted in modifications to the original model and description. The native American influence was greater than initially thought with farming of mud flats (not in late development stands as initially modeled), irrigation, massive fuel wood collection and extensive small-scale burning for willow control, basketry, general access and hunting. Therefore, very frequent mixed severity fire was added by Louis Provencher to the mid-development closed and late-development closed stage, the time since disturbance was shorten from 50 to 15 years and farming and fuel collection were added, respectively, as model parameters in early and late-development open classes. Mixed severity fire and fuel wood collection was added to the late-development closed class to represent Native Americans utilization of neglected or virgin stands. These last parameters had a large influence on model results.

Suggested reviewers: Dave Gori (TNC AZ), Julie Stromberg, ASU, Dan Robinette (NRCS Tucson) and Richard Felger (rfleger@ag.arizona.edu).

Final quality control for MZ15 (Pohl 10/18/2005) resulted in changes to the structure data for all classes to adhere to LF standards.

As part of LF re-mapping of 8 western map zones in March 2007, this model was split as was done in MZ13 and MZ14. The original model 1511550 was retained as 1511551, as was done in MZ13 and MZ14. 1511552 was copied from MZ14.

As a result of final QC for LANDFIRE National by Kori Blankenship the user-defined min and max fire return intervals for mixed severity fire were deleted because they were not consistent with the modeled fire return interval for this fire severity type.

## *Vegetation Classes*

*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100+ year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement severity.

## *Class A* 20%

Early Development 1 All Structures

**Indicator Species* and Canopy Position**

| | |
|---|---|
| SAGO | Upper |
| POFR2 | Upper |
| BASA | Upper |

**Structure Data (for upper layer lifeform)**

| | *Min* | *Max* |
|---|---|---|
| *Cover* | 0% | 100% |
| *Height* | Shrub 0m | Shrub 3.0m |
| *Tree Size Class* | No data | |

☐ Upper layer lifeform differs from dominant lifeform.

**Upper Layer Lifeform**

- ☐ Herbaceous
- ☑ Shrub
- ☐ Tree

**Fuel Model** 8

**Description**

Immediate post-disturbance responses are dependent on pre-disturbance vegetation composition. Species composition vary with fire (Salix gooddingii favored) or flood magnitude (Salix gooddingii and Populus fremontii favored by flooding). This class is typically shrub/seedling dominated, but grasses may co-dominate. This class also exists as recently deposited mud/silt flats that may be farmed for corn, squash and beans.

Generally, this class is expected to occur 1-5yrs post-disturbance. Modeled disturbances include 1) stand-replacing flood events for herbaceous vegetation and seedlings approximately every seven years and 2) farming was applied to new mud flats and prevented germination of cottonwood and willow (10% area per year).

Transition to Class B after five years.

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## *Class B* 25%

Mid Development 1 Closed

**Indicator Species* and Canopy Position**

| | |
|---|---|
| SAGO | Upper |
| POFR2 | Upper |

**Structure Data (for upper layer lifeform)**

| | *Min* | *Max* |
|---|---|---|
| *Cover* | 0% | 100% |
| *Height* | Tree 0m | Tree 5m |
| *Tree Size Class* | Pole 5-9" DBH | |

☐ Upper layer lifeform differs from dominant lifeform.

**Upper Layer Lifeform**

- ☐ Herbaceous
- ☐ Shrub
- ☑ Tree

**Fuel Model** 8

**Description**

Highly dependent on the hydrologic regime. Vegetation composition includes tall shrubs and small trees (willows & cottonwoods). Modeled disturbances include 7-50yr flooding events (used 15yr flood events) on mid-level terraces causing stand replacement. Native mixed severity burning in the fall for basketry, clearing of irrigation ditches and hunting was conducted every year on five percent of the area. Shrubs resprouted vigorously the year following burning. Succession to class C after 15yrs.

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## *Class C* 35%

Late Development 1 Closed

**Indicator Species* and Canopy Position**

| | |
|---|---|
| POFR2 | Upper |
| SAGO | Upper |
| PROSO | Middle |

**Structure Data (for upper layer lifeform)**

| | *Min* | *Max* |
|---|---|---|
| *Cover* | 0% | 100% |
| *Height* | Tree 5.1m | Tree 25m |
| *Tree Size Class* | Large 21-33"DBH | |

☐ Upper layer lifeform differs from dominant lifeform.

**Upper Layer Lifeform**

- ☐ Herbaceous
- ☐ Shrub
- ☑ Tree

**Fuel Model** 8

**Description**

This class represents the mature, large cottonwood and willow riparian woodlands. Mesquite increases in importance in the midstory and lower canopy. When Native Americans used this class, the midstory shrub component was tended and open, but the tree canopy was generally unaffected. Native American burning was

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*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
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every year in 10% of area in small patches, most likely to flush jackrabbit and deer, and to control willow encroachment near waterways (irrigation ditches or side channels) and agricultural fields situated on nearby alluvial deposits. Fuel collection was an important activity resulting in understory thinning and fuel load reduction in 30% of the area every year. Stand replacement was caused by 50yrs+ flooding events and rare wildlire (mean FRI of 750yrs). Succession to class D after 90yrs.

### *Class D* 20%

Late Development 2 Closed

**Upper Layer Lifeform**

- ☐ Herbaceous
- ☐ Shrub
- ☑ Tree

**Fuel Model** 8

**Indicator Species* and Canopy Position**

| | |
|---|---|
| PROSO | Upper |
| CEPA8 | Middle |

**Structure Data (for upper layer lifeform)**

| | Min | Max |
|---|---|---|
| *Cover* | 0% | 100% |
| *Height* | Tree 5.1m | Tree 25m |
| *Tree Size Class* | Large 21-33"DBH | |

☐ Upper layer lifeform differs from dominant lifeform.

**Description**

Mesquite dominates the riparian floodplain. Salix goodingii and Populus fremontii are a minor component in this class. Vegetation would remain in this condition unless 500yrs+ flooding events and fire every 250yrs on average would cause stand replacing events.

### *Class E* 0%

[Not Used] [Not Used]

**Upper Layer Lifeform**

- ☐ Herbaceous
- ☐ Shrub
- ☐ Tree

**Fuel Model**

**Indicator Species* and Canopy Position**

**Structure Data (for upper layer lifeform)**

| | Min | Max |
|---|---|---|
| *Cover* | % | % |
| *Height* | | |
| *Tree Size Class* | | |

☐ Upper layer lifeform differs from dominant lifeform.

**Description**

## *Disturbances*

**Fire Regime Group**:** I

**Historical Fire Size (acres)**

Avg 50
Min 1
Max 100

**Sources of Fire Regime Data**

- ☐ Literature
- ☐ Local Data
- ☑ Expert Estimate

**Fire Intervals**

| | Avg FI | Min FI | Max FI | Probability | Percent of All Fires |
|---|---|---|---|---|---|
| *Replacement* | 769 | 500 | 1000 | 0.001300 | 3 |
| *Mixed* | 21 | | | 0.047619 | 97 |
| *Surface* | | | | | |
| *All Fires* | 20 | | | 0.04893 | |

***Fire Intervals (FI):***
Fire interval is expressed in years for each fire severity class and for all types of fire combined (All Fires). Average FI is central tendency modeled. Minimum and maximum show the relative range of fire intervals, if known. Probability is the inverse of fire interval in years and is used in reference condition modeling. Percent of all fires is the percent of all fires in that severity class.

**Additional Disturbances Modeled**

- ☐ Insects/Disease
- ☑ Wind/Weather/Stress
- ☐ Native Grazing
- ☐ Competition
- ☑ Other (optional 1) farming
- ☐ Other (optional 2)

*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100+ year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement severity.

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*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100+ year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement severity.

# LANDFIRE Biophysical Setting Model

## *Biophysical Setting:* 1511552 North American Warm Desert Riparian Systems - Stringers

☐ *This BPS is lumped with:*

☑ *This BPS is split into multiple models:* *BpS 1511550 was split between 1511551 dominated by mid to large perrennial rivers where Native American use was possible and 1511552 that represents smaller riparian stringers with either intermittent water or subsurface groundwater flow (washes, canyon corridor, small streams) imbedded in the creosote and blackbrush matrix vegetation.*

## *General Information*

**Contributors** (also see the Comments field) **Date** 5/6/2006

| | | | |
|---|---|---|---|
| **Modeler 1** | Louis Provencher | lprovencher@tnc.org | **Reviewer** |
| **Modeler 2** | | | **Reviewer** |
| **Modeler 3** | | | **Reviewer** |

**Vegetation Type**

Wetlands and Riparian

**Map Zone**

15

**Model Zone**

☐ Alaska ☐ N-Cent.Rockies
☐ California ☐ Pacific Northwest
☐ Great Basin ☐ South Central
☐ Great Lakes ☐ Southeast
☐ Northeast ☐ S. Appalachians
☐ Northern Plains ☑ Southwest

**Dominant Species***

| | |
|---|---|
| ACACI | DISP |
| SAEX | SPAI |
| PROSO | POFR2 |
| PLSE | FRVE2 |

**General Model Sources**

☑ Literature
☐ Local Data
☑ Expert Estimate

### Geographic Range

Found in the warm deserts of the southwestern US. Intermittent to dry warm desert (Mojave and Sonoran Deserts) drainages with mostly subsurface flow in southern CA, NV, AZ and southwest UT.

### Biophysical Site Description

Narrow riparian systems occur primarily along low elevation shrublands (creosote, blackbrush and paloverde matrix vegetation) and in canyons, washes or as spring brooks. Elevation is typically below 4000ft. Examples of intermittent streams can be found in the Amargosa Gorge, Whitewater River, Andreas Canyon, Paiute Creek and Palm Canyon. Oasis woodlands occur in isolated stands such as the Palm Canyon, Thousand Palms and Twentynine-palms oases.

### Vegetation Description

The vegetation is a mix of riparian shrublands dotted with tree species Salix gooddingii, Populus fremontii and Fraxinus velutina where water surfaces. Patches of grassland and forbs (Distichlis spicata, Sporobolus airoides, Carex spp and Pluchea sericea) are present but not extensive. Dominant shrubs include Acacia spp, Salix exigua, Prosopis spp and Washingtonia filifera (in oases primarily). Mesquite occurs as dispersed shrubs, not bosque. Halophytic shrub-dominated patches occur on drier sediment deposits or saltier surfaces. Vegetation is dependent upon periodic flash flooding. Native Americans had a minor effect on these riparian systems compared to larger floodplains.

### Disturbance Description

This BpS is a flash flood-dependent ecosystem. The entire range of flood magnitudes contribute to

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ecological processes such as nutrient cycling, recruitment and species composition. Two to 10yr events (7yr event used) primarily impact herbaceous vegetation, 7-50yr events (20yr events used) result in patchy removal of shrubs and saplings. 50yr+ events (50yr event used) remove stands of larger trees. Cottonwood, if present, will return to pole size within 10yrs of disturbance. Cottonwood is considered mature around 60yrs.

In general, fuels are typically continuous and fuel loads high, but fuel moisture content is also often high. Wildfires may not carry except under extreme fire weather conditions. The average FRI for replacement fire is 500-1000yrs; assumed 1000yrs ofr mid-development riparian vegetation and 500yrs for late-development vegetation. Native American burning of desert washes was assumed rare. Willow and mesquite resprout after fire.

### Adjacency or Identification Concerns

Creosote (BpS 131087) and blackbrush (BpS 131082) will be immedaitely adjacent to BpS 1311552 and the transition is sharp to riparian vegetation.

Water diversions and groundwater pumping have greatly modified hydrologic regimes and water levels, perhaps permanently.

Livestock grazing can be a major influence in the alteration of structure, composition and function of the community.

Exotic trees of Elaeagnus angustifolia and Tamarix spp are common in some stands.

In some riparian woodlands, the invasives saltcedar (Tamarix spp), and less frequently giant reed (Arundo donax), can create ladder fuel that allows fire to spread from surface fuel of willow (Salix spp), saltbush (Atriplex spp), sedge (Carex spp), reed (Juncus spp) and arrow weed (Pluchea sericea) into the crowns of overstory Fremont cottonwood trees, top-killing them. After an initial fire, these invasives quickly recover and surpass their pre-fire dominance, promoting increasingly more frequent and intense fires which, can eventually displace most native plants.

In palm oases, Washington fan palms depend on surface fire to clear understory species and facilitate recruitment. However, these sites can be pre-empted by saltcedar as it rapidly recovers after fire. The ladder fuel saltcedar creates can also carry fire into the crown of Washington fan palms, increasing the incidence of crown fires lethal to other species.

### Native Uncharacteristic Conditions

Canopy cover can reach 100% in classes B and C.

### Scale Description

These systems exist as small linear features <60m wide in the landscape. Flash flooding will disturb miles of riparian vegetation, whereas fires may burn <100ac in long linear patches.

### Issues/Problems

### Comments

BpS 1411552 was split from 1411550 by Louis Provencher (lprovencher@tnc.org) at the request of the Missoula Fire Lab. This version of the model is restricted to stringers; therefore the Native American influence on fire regimes, farming and wood collection was removed, A longer FRI of 500-1000yrs was retained. The system is nearly entirely dependent on flash flooding.

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BpS 1411550, now 1411551, was originally created by Matt Brooks (matt_brooks@usgs.gov) and Louis Provencher (lprovencher@tnc.org) and substantially revised with the input of several reviewers: Kay Fowler (csfowler@scs.unr.edu), Amadeo M. Rea (San Diego SU), Janet Grove (jgrove@fs.fed.us), Holly Richter (hrichter@tnc.org), Jony Cockman (jcockman@blm.gov), Julie Stromberg (jstrom@asu.edu) and Brooke Gebow (bgebow@tnc.org). All reviewers, except Kay Fowler, Amadeo Rea and Julie Stromberg participated in modeling at TNC's Ramsey Canyon Preserve, AZ on 9/18/05.

Following further discussions with Jeri Kruger (jkruger@fws.edu), Julie Stromberg and literature reviews, Louis Provencher (lprovencher@tnc.org) modified the model by adding a fifth class resulting from stand replacement fire that does not cause cottonwood and willow germination because this case is not associated with flooding. Many changes were done to the original model by M. Brooks. Floods causing stand replacing events were more frequent (5-50yrs, 50yrs+, for respectively, mid- and late-development classes). Classes C and D in 1411551 were merged into new class D (mature cottonwood and willow; still accounting for Native American influences). Class E was added for mesquite bosque, which is the last successional phase in the floodplain, with 500yr flood events and replacement fire every 250yrs on average; and, although Native American influences were maintained, the importance of mixed severity was implicitly reduced by removing time since disturbance from the original BpS. In the original model, and it's revision from 9/18/05, replacement fire was assumed to cause a return to class A, which is impossible. Class A is only the result of stand replacing flood events where cottonwood and willow germination is possible. Replacement fire does not change the elevation of a terrace or create a seedbed for willows and cottonwoods, but allows resprouting and seed establishment by mesquite and other shrubs (eg, Salix gooddingii). Therefore, class C is the recipient of all replacement fire and will eventually succeed to mesquite bosque unless a 50yr flood event scours the more fragile soils of class C. To accommodate the LANDFIRE (LF) limit for one early S-Class, class C starts at age one and is considered mid-development. In reality, class C behaves as an alternative early-development class.

One reviewer suggested several changes to clarify the geographic location of the BpS, its elevation and species/patch composition. The reviewer indicated that presettlement warm desert riparian systems were very patchy (Jeri Krueger from FWS NV forwarded accounts from early explorers of the Virgin River that support the patchy nature of the vegetation and importance of mesquite) and probably contained more grasslands and shrub patches that we find today, and therefore, may have supported a greater amount of fine fuels and fire. These issues were addressed, although the fire frequency was not changed as it is frequent enough in the current version. The reviewer also recommended adding references on southwestern riparian systems by Busch, Ellis and Davis, which was done.

Native American burning was introduced as a very plausible disturbance. However, no data or expertise were available at the creation of the original model. Reviews by ethnobiologists Kay Fowler and Amadeo Rea resulted in important modifications to the original model and description (Fowler 2003; Rea 1983). The Native American influence was greater than initially thought with farming of mud flats (not in late development stands as initially modeled), irrigation, massive fuel wood collection and extensive small-scale burning for willow control, basketry, general access and hunting. Therefore, very frequent mixed severity fire was added by Louis Provencher to all mid-development and late-development classes (except mesquite bosque, class E), and farming and fuel collection were added, respectively, as model parameters in early and late-development open classes. Amadeo Rea explained that warm desert rivers of MZ14 and MZ15 were more heavily farmed by the Pimans Indian than those of MZ13 (Mohave and Shoshone Indians) (also suggested by Dr. Fowler). In all cases, he agreed that Native people probably modified the vegetation structure and composition of warm desert river floodplains far more than currently understood. Dr. Rea also explained that Native burning was used to flush rodents, even more than jackrabbits, and that fire was

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avoided in mesquite bosque, in cultivated fields and near fences. Burning was especially intense in riparian grasslands dominated by Sporobolus spp, marshes and shrubby areas.

As part of LF re-mapping of 8 western MZs in March 2007, this model was split as was done in MZ13 and MZ14. The original model 1511550 was retained as 1511551, as was done in MZ13 and MZ14. 1511552 was copied from MZ14.

## Vegetation Classes

### Class A 15%

Early Development 1 All Structures

**Upper Layer Lifeform**

- ☐ Herbaceous
- ☑ Shrub
- ☐ Tree

**Fuel Model** 8

**Indicator Species* and Canopy Position**

| | |
|---|---|
| SAGO | Upper |
| PROSO | Upper |
| DISP | Lower |
| SPAI | Lower |

**Structure Data (for upper layer lifeform)**

| | Min | Max |
|---|---|---|
| *Cover* | 0% | 50% |
| *Height* | Shrub 0.6m | Shrub 1.0m |
| *Tree Size Class* | None | |

☐ Upper layer lifeform differs from dominant lifeform.

**Description**

Immediate post-disturbance responses are dependent on pre-disturbance vegetation composition. Salix gooddingii and Populus fremontii favored by flooding, whereas Salix, mesquite and graminoids are favored by fire. This class is typically shrub/seedling dominated, but graminoids may co-dominate.

Generally, this class is expected to occur 1-5yrs post-disturbance. Modeled disturbances include stand-replacing flood events for herbaceous vegetation and seedlings approximately every 7yrs and 20yr flood events that remove shrubs and small trees.

Transition to Class B after five years.

### Class B 30%

Mid Development 1 Closed

**Upper Layer Lifeform**

- ☐ Herbaceous
- ☑ Shrub
- ☐ Tree

**Fuel Model** 8

**Indicator Species* and Canopy Position**

| | |
|---|---|
| SAGO | Upper |
| POFR2 | Upper |
| PROSO | Lower |
| FRVE2 | Upper |

**Structure Data (for upper layer lifeform)**

| | Min | Max |
|---|---|---|
| *Cover* | 51% | 100% |
| *Height* | Shrub 1.1m | Shrub >3.1m |
| *Tree Size Class* | Pole 5-9" DBH | |

☐ Upper layer lifeform differs from dominant lifeform.

**Description**

Highly dependent on the hydrologic regime. Vegetation composition includes tall shrubs and small trees (willows, maybe cottonwoods if surface water is present) with patches of graminoids and halophytic shrubs. Modeled disturbances include 20yr flooding events on mid-level terraces causing stand replacement and 7yr events than maintain the stand in class B. The FRI of replacement fire is 1000yrs. This class is an ideal bed for mesquite germination and establishment. Succession to class C after 15yrs.

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### *Class C* 55%

Late Development 1 Closed

**Upper Layer Lifeform**

- ☐ Herbaceous
- ☐ Shrub
- ☑ Tree

**Fuel Model** 8

**Indicator Species* and Canopy Position**

| | |
|---|---|
| PROSO | Middle |
| SAGO | Upper |
| ACACI | Middle |
| FRVE2 | Upper |

**Structure Data (for upper layer lifeform)**

| | *Min* | *Max* |
|---|---|---|
| *Cover* | 51% | 100% |
| *Height* | Tree 5.1m | Tree 25m |
| *Tree Size Class* | Medium 9-21"DBH | |

☐ Upper layer lifeform differs from dominant lifeform.

**Description**

This class represents the mature cottonwood, if surface is present, acacia, mesquite and willow riparian woodlands with patches of graminoids in saturated soils and of halophytic shrubs on drier sediment deposits or saltier surfaces. Stand replacement is caused by 50yr flooding events and rare wildfire (mean FRI of 500yrs). 20yr flood events remove shrubs and small trees in the mid-story and understory and maintain vegetation in class C.

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### *Class D* 0%

[Not Used] [Not Used]

**Upper Layer Lifeform**

- ☐ Herbaceous
- ☐ Shrub
- ☐ Tree

**Fuel Model**

**Indicator Species* and Canopy Position**

**Structure Data (for upper layer lifeform)**

| | *Min* | *Max* |
|---|---|---|
| *Cover* | % | % |
| *Height* | | |
| *Tree Size Class* | | |

☐ Upper layer lifeform differs from dominant lifeform.

**Description**

---

### *Class E* 0%

[Not Used] [Not Used]

**Upper Layer Lifeform**

- ☐ Herbaceous
- ☐ Shrub
- ☐ Tree

**Fuel Model**

**Indicator Species* and Canopy Position**

**Structure Data (for upper layer lifeform)**

| | *Min* | *Max* |
|---|---|---|
| *Cover* | % | % |
| *Height* | | |
| *Tree Size Class* | | |

☐ Upper layer lifeform differs from dominant lifeform.

**Description**

## *Disturbances*

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**Fire Regime Group**:** V

**Historical Fire Size (acres)**

Avg 50
Min 1
Max 100

**Sources of Fire Regime Data**

- [x] Literature
- [ ] Local Data
- [x] Expert Estimate

| Fire Intervals | Avg FI | Min FI | Max FI | Probability | Percent of All Fires |
|---|---|---|---|---|---|
| Replacement | 666 | 500 | 1000 | 0.001502 | 99 |
| Mixed | | | | | |
| Surface | | | | | |
| All Fires | 665 | | | 0.00152 | |

***Fire Intervals (FI):***
Fire interval is expressed in years for each fire severity class and for all types of fire combined (All Fires). Average FI is central tendency modeled. Minimum and maximum show the relative range of fire intervals, if known. Probability is the inverse of fire interval in years and is used in reference condition modeling. Percent of all fires is the percent of all fires in that severity class.

**Additional Disturbances Modeled**

- [ ] Insects/Disease
- [x] Wind/Weather/Stress
- [ ] Native Grazing
- [ ] Competition
- [ ] Other (optional 1)
- [ ] Other (optional 2)

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*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100+ year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement severity.

Sons, Inc.

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**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100+ year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement severity.

# LANDFIRE Biophysical Setting Model

## *Biophysical Setting:* 1511590 Rocky Mountain Montane Riparian Systems

☐ *This BPS is lumped with:*
☐ *This BPS is split into multiple models:*

## *General Information*

**Contributors** (also see the Comments field) **Date** 10/18/2005


| | | | | | |
|---|---|---|---|---|---|
| **Modeler 1** | Jan Nachlinger | jnachlinger@tnc.org | **Reviewer** | Mark Kaib | mark_kaib@fws.gov |
| **Modeler 2** | Louis Provencher | lprovencher@tnc.org | **Reviewer** | | |
| **Modeler 3** | | | **Reviewer** | | |


**Vegetation Type**

Wetlands/Riparian

**Map Zone**

15

**Model Zone**

☐ Alaska ☐ N-Cent.Rockies
☐ California ☐ Pacific Northwest
☐ Great Basin ☐ South Central
☐ Great Lakes ☐ Southeast
☐ Northeast ☐ S. Appalachians
☐ Northern Plains ☑ Southwest

**Dominant Species***

| | |
|---|---|
| POPUL | ACGL |
| SALIX | BEOC |
| ROWO | COSE16 |
| CAREX | PRVI |

**General Model Sources**

☑ Literature
☐ Local Data
☑ Expert Estimate

### Geographic Range

This system is found throughout the Rocky Mountain and Colorado Plateau regions.

### Biophysical Site Description

This system occurs within a broad elevation range from approximately 900-2800m. This system is dependent on a natural hydrologic regime, especially annual to episodic flooding. Occurrences are found within the flood zone of rivers, on islands, sand or cobble bars and immediate streambanks. They can form large, wide occurrences on mid-channel islands in larger rivers or narrow bands on small, rocky canyon tributaries and well-drained benches. It is also typically found in backwater channels and other perennially wet but less scoured sites, such as floodplains swales and irrigation ditches.

### Vegetation Description

This system often occurs as a mosaic of multiple communities that are tree dominated with a diverse shrub component. Species include, Platanus wrightii, Quercus spp, Juglans major, Arbustus arizonica, Pinus engelmannii, Pinus leiophyla, Pinus arizonica, Acer negundo, Populus angustifolia, Populus balsamifera, Populus deltoides, Populus fremontii, Pseudotsuga menziesii, Picea pungens or Juniperus scopulorum. Dominant shrubs include Acer glabrum, Alnus incana, Betula occidentalis, Cornus sericea, Crataegus rivularis, Forestiera pubescens, Prunus virginiana, Rhus trilobata, Salix amygdaloides, Salix drummondiana, Salix exigua, Salix goodingii, Salix irrorata, Salix luicida, Salix monticola, Shepherdia argentea or Symphoricarpos spp.

### Disturbance Description

The role of fire in these systems has been commonly underestimated. Increased amounts of pine results in increased fire in these systems. MFRI in the western Chiricahuas ranged from 4-7yrs, where these canyon riparian systems act as corridors for fire spread from grasslands below and ponderosa pine forests above. They are relatively productive systems due to water drainage and springs/surface water. Fuel accumulates

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**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100+ year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement severity.

rapidly due to this high productivity and gravity. Fuel is continuous and abundant, can be high in moisture but dry out during the summer and can carry fire, often surface fire, from adjacent systems. Dominant scrub species, which resprout as as adaption to flooding, also resprout following fire. Apache used these areas as seasonal rancherias. Burning was used on fine scale except during wartime periods, mid 1700s and mid 1800s, when there was more widespread use by Apache, Spanish and Anglo Americans.

This system is dependent on a natural hydrologic regime, especially annual to episodic flooding. Flood events of increasing magnitude will cause maintenance to stand replacing disturbances; 7yr flood events for herbaceous and seedling cover; 20yr events for shrubs and pole size trees; and 50yr events for mature trees. Although Hall (1946) describes a spotty distribution of Beaver (Castor canadensis) in the Coloroado River system, this disturbance is not included as a significant factor.

### Adjacency or Identification Concerns

Today exotic trees of Elaeagnus angustifolia and Tamarix spp are common in some stands. Generally, the upland vegetation surrounding this riparian system is different and ranges from grasslands to forests. Fire behavior in these systems is strongly influenced by the adjacent uplands. Hydrological processes (eg, flooding) are the determining factors in these systems.

### Native Uncharacteristic Conditions

### Scale Description

These systems are small linear features in the landscape. May exist as mid-large patches in low elevation riverine systems.

### Issues/Problems

Over-grazing and irrigation use have had major impacts on some of these systems. This ecological system occurs at scales below 30m resolution of LANDFIRE.

There is a paucity of information on this system.

### Comments

This model adopted from Great Basin 131159, species and other modifications for MZ15 are based on peer review.

As a result of final QC for LANDFIRE National by Kori Blankenship the user-defined min and max fire return intervals for replacement severity fire were deleted because they were not consistent with the modeled fire return interval for this fire severity type.

## *Vegetation Classes*

***Class A*** **25%**

Early Development 1 All Structures

**Upper Layer Lifeform**

- ☐ Herbaceous
- ☑ Shrub
- ☐ Tree

**Fuel Model** 1

**Indicator Species* and Canopy Position**

| | |
|---|---|
| POPUL | Upper |
| SALIX | Upper |
| CAREX | Lower |
| | Upper |

**Structure Data (for upper layer lifeform)**

| | *Min* | *Max* |
|---|---|---|
| *Cover* | 0% | 100% |
| *Height* | Shrub 0m | Shrub 3.0m |
| *Tree Size Class* | None | |

☐ Upper layer lifeform differs from dominant lifeform.

**Description**

Grass may codominate; up to 100% canopy cover.

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Immediate post-fire responses in this ecological system are dependent on pre-burn vegetation form. Genrally this classs is expected to occur 1-5yrs post-disturbance. It is typically shrub dominated, but grass may codominate. Salix spp dominates after fire, whereas Popilus spp and Salix spp codominate after flooding. Silt, gravel, cobble and woody debris may be common. Composition is highly variable. Modeled disturbances include weather related stress which is expresssed as seven year annual flooding events. Succession to class B after five years.

---

***Class B*** **55%**

Mid Development 1 Open

**Upper Layer Lifeform**

- ☐ Herbaceous
- ☐ Shrub
- ☑ Tree

**Fuel Model** 3

**Indicator Species* and Canopy Position**

| | |
|---|---|
| POPUL | Upper |
| SALIX | Upper |
| | Upper |
| | Upper |

**Structure Data (for upper layer lifeform)**

| | Min | Max |
|---|---|---|
| *Cover* | 0% | 100% |
| *Height* | Tree 0m | Tree 10m |
| *Tree Size Class* | Pole 5-9" DBH | |

☐ Upper layer lifeform differs from dominant lifeform.

**Description**

Highly dependent on the hydrologic regime. Vegetation composition includes tall shrubs and small trees (cottonwood, aspen and conifers). Modeled disturbances include 1) weather related stress expressed as five year annual flooding events, which maintains vegetation in class B and 2) 20yr flooding events (weather related stress) causing stand replacement. Replacement fire occurs about every 50yrs on average. Successsion to class C after 15yrs.

---

***Class C*** **20%**

Late Development 1 Closed

**Upper Layer Lifeform**

- ☐ Herbaceous
- ☐ Shrub
- ☑ Tree

**Fuel Model**

**Indicator Species* and Canopy Position**

| | |
|---|---|
| POPUL | Upper |
| PINUS | Upper |
| SALIX | Mid-Upper |

**Structure Data (for upper layer lifeform)**

| | Min | Max |
|---|---|---|
| *Cover* | 0% | 100% |
| *Height* | Tree 10.1m | Tree 25m |
| *Tree Size Class* | Very Large >33"DBH | |

☐ Upper layer lifeform differs from dominant lifeform.

**Description**

This class represents the mature, large cottonwood, conifer, etc. woodlands. 50yr flooding events (weather related stress) cause a transition to class A, whereas 20yr flood events cause a transition to class B. Replacement fire occurs about every 50yrs on average.

---

***Class D*** **0%**

[Not Used] [Not Used]

**Upper Layer Lifeform**

- ☐ Herbaceous
- ☐ Shrub
- ☐ Tree

**Fuel Model**

**Indicator Species* and Canopy Position**

**Structure Data (for upper layer lifeform)**

| | Min | Max |
|---|---|---|
| *Cover* | % | % |
| *Height* | | |
| *Tree Size Class* | | |

☐ Upper layer lifeform differs from dominant lifeform.

**Description**

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***Class E*** **0%**

[Not Used] [Not Used]

**Upper Layer Lifeform**

- ☐ Herbaceous
- ☐ Shrub
- ☐ Tree

**Fuel Model**

**Description**

**Indicator Species* and Canopy Position**

**Structure Data (for upper layer lifeform)**

| | *Min* | *Max* |
|---|---|---|
| *Cover* | % | % |
| *Height* | | |
| *Tree Size Class* | | |

☐ Upper layer lifeform differs from dominant lifeform.

## Disturbances

**Fire Regime Group**: I**

**Historical Fire Size (acres)**

Avg 10
Min 1
Max 100

**Sources of Fire Regime Data**

- ☐ Literature
- ☐ Local Data
- ☑ Expert Estimate

**Fire Intervals**

| | *Avg FI* | *Min FI* | *Max FI* | *Probability* | *Percent of All Fires* |
|---|---|---|---|---|---|
| *Replacement* | 60 | | | 0.016667 | 11 |
| *Mixed* | | | | | |
| *Surface* | 7.5 | | | 0.133333 | 89 |
| *All Fires* | 7 | | | 0.15001 | |

***Fire Intervals (FI):***
Fire interval is expressed in years for each fire severity class and for all types of fire combined (All Fires). Average FI is central tendency modeled. Minimum and maximum show the relative range of fire intervals, if known. Probability is the inverse of fire interval in years and is used in reference condition modeling. Percent of all fires is the percent of all fires in that severity class.

**Additional Disturbances Modeled**

- ☐ Insects/Disease
- ☑ Wind/Weather/Stress
- ☐ Native Grazing
- ☐ Competition
- ☑ Other (optional 1) farming
- ☐ Other (optional 2)

## References


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Rassman, J.P. 1993. Prescribed fire effects in southwestern Montana, aspen dominated riparian areas. Thesis (M.S.)--Colorado State University, 154 pp.


*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100+ year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement severity.

Uchytil, R.J. 1991. Salix geyeriana. In: Fire Effects Information System, [Online]. USDA Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). Available: http://www.fs.fed.us/database/feis/ [2005, April 13].

*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
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# LANDFIRE Biophysical Setting Model

## *Biophysical Setting:* 1511600 Rocky Mountain Subalpine/Upper Montane Riparian Systems

☑ *This BPS is lumped with: 1511590*
☐ *This BPS is split into multiple models:*

## General Information

**Contributors** (also see the Comments field) **Date** 10/18/2005


| | | | |
|---|---|---|---|
| **Modeler 1** | Charles Kay | ckay@hass.usu.edu | **Reviewer** |
| **Modeler 2** | Don Major | dmajor@tnc.org | **Reviewer** |
| **Modeler 3** | | | **Reviewer** |


**Vegetation Type**
Wetlands and Riparian

**Map Zone**
15

**Model Zone**
☐ Alaska ☐ N-Cent.Rockies
☐ California ☐ Pacific Northwest
☐ Great Basin ☐ South Central
☐ Great Lakes ☐ Southeast
☐ Northeast ☐ S. Appalachians
☐ Northern Plains ☑ Southwest

**Dominant Species***
POPUL ABLA
SALIX PICEA
POTR5
CAREX

**General Model Sources**
☑ Literature
☑ Local Data
☑ Expert Estimate

### Geographic Range
Found throughout the Rocky Mountain cordillera, Great Basin, CA, northern Rockies, AK, Pacific Northwest, and north central regions.

### Biophysical Site Description
This ecological system represents the combination of numerous riparian types occurring in the upper montane/sub-alpine zones. This ecological system exists as relatively small linear stringers in the fire management landscape.

### Vegetation Description
This ecological system encompasses a broad array of riparian species. These systems are highly variable and generally consist of one or more of the following five basic vegetation forms: 1) cottonwoods, 2) willows, 3) sedges and other herbaceous vegetation, 4) aspen or 5) conifers (primarily spruce and sub-alpine fir).

### Disturbance Description
The moisture associated with riparian areas promotes lower fire frequency compared with adjacent uplands, and rapid recovery from fire events. Wet meadow types seldom burn. In riparian systems the preburn herbaceous plant community is not permanently destroyed, and rapidly recovers. Recovery is possible within a single growing season. Woody species (ie, aspen, Salix spp, and occasionally cottonwood species.) can be topkilled, but generally resprout within a short period. In systems with conifers, post-fire establishment is from seed. Hydrological events are the major disturbance agent in these systems. In addition, beaver (Castor canadensis) were historically important in many of these systems. Older vegetation experienced fire when replacement fires burned the uplands (MRI of 100yrs). Surface fire (mean FRI of 50yrs) affected the early development class through a combination of replacement fire from uplands and occasional native burning.

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### Adjacency or Identification Concerns

### Native Uncharacteristic Conditions

### Scale Description

These systems are small linear features in the landscape.

### Issues/Problems

Overgrazing and irrigation use have had major impacts on some of these systems. This ecological system occurs at scales below 30m resolution of LANDFIRE.

There is a paucity of information on this system.

### Comments

This is identical to the model for the same BpS in MZ16, MZ23, MZ24 and MZ28 with minor modifications to description.

Fire behavior in these systems is strongly influenced by the adjacent uplands. Hydrological processes (e.g., flooding) are the determining factors in these systems.

## *Vegetation Classes*

***Class A*** **65%**

Early Development 1 All Structures

**Upper Layer Lifeform**

- ☐ Herbaceous
- ☑ Shrub
- ☐ Tree

**Fuel Model** 3

**Indicator Species* and Canopy Position**

| | |
|---|---|
| POPUL | Upper |
| SALIX | Upper |
| CAREX | Upper |
| PICEA | Upper |

**Structure Data (for upper layer lifeform)**

| | *Min* | *Max* |
|---|---|---|
| *Cover* | 0% | 10% |
| *Height* | Shrub 0m | Shrub 3.0m |
| *Tree Size Class* | No Data | |

☑ Upper layer lifeform differs from dominant lifeform.

The dominant lifeform may vary between shrubs and herbaceous. The herbaceous layer may range in cover from 0-100% and in height from short (<0.5m) to tall (>1m).

**Description**

Immediate post-fire responses in this ecological system are dependent on pre-burn vegetation form. Shrub or grass dominated. Composition varies within reach. Generally, this class is expected to occur 1-3yrs post-disturbance. Re-establishment of conifers may require 50-100yrs. Modeled disturbances include surface fire, two flooding disturbances (W/W/S - 5yr common event FI=3yr; Option 2 - 100yr event FI=80yr) and beaver (Option 1) FI=2yr. Replacement fire was typically rare and not included. Surface fire was more frequent (mean 50yrs FRI) and a combination of upland-driven fire and native burning. Succession to class B after 24yrs, however this is highly variable due to high moisture levels and high species variability.

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***Class B*** **35%**

Late Development 1 All Structures

**Upper Layer Lifeform**

- ☐ Herbaceous
- ☑ Shrub
- ☐ Tree

**Fuel Model** 8

**Description**

**Indicator Species* and Canopy Position**

| | |
|---|---|
| POPUL | Upper |
| SALIX | Upper |
| CAREX | Upper |
| PICEA | Upper |

**Structure Data (for upper layer lifeform)**

| | *Min* | *Max* |
|---|---|---|
| *Cover* | 11 % | 100 % |
| *Height* | Shrub 0m | Shrub >3.1m |
| *Tree Size Class* | Pole 5-9" DBH | |

☑ Upper layer lifeform differs from dominant lifeform.

The dominant lifeform may also include trees (but will be highly variable). Canopy cover of trees may range from 0-100% and will range in height from regeneration (<5m) to tall (25-49m).

Highly dependent on the hydrologic regime. For example, could include any combination of the five vegetation forms described above. Composition of adjacent uplands is the determining factor for future fire events. Further, conifer establishment in these higher elevation areas also influences FRI (100yrs) therefore replacement fire HRV values were selected to characterize this form.

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***Class C*** **0%**

[Not Used] [Not Used]

**Upper Layer Lifeform**

- ☐ Herbaceous
- ☐ Shrub
- ☐ Tree

**Fuel Model**

**Description**

**Indicator Species* and Canopy Position**

**Structure Data (for upper layer lifeform)**

| | *Min* | *Max* |
|---|---|---|
| *Cover* | % | % |
| *Height* | | |
| *Tree Size Class* | | |

☐ Upper layer lifeform differs from dominant lifeform.

---

***Class D*** **0%**

[Not Used] [Not Used]

**Upper Layer Lifeform**

- ☐ Herbaceous
- ☐ Shrub
- ☐ Tree

**Fuel Model**

**Description**

**Indicator Species* and Canopy Position**

**Structure Data (for upper layer lifeform)**

| | *Min* | *Max* |
|---|---|---|
| *Cover* | % | % |
| *Height* | | |
| *Tree Size Class* | No dat | |

☐ Upper layer lifeform differs from dominant lifeform.

---

***Class E*** **0%**

[Not Used] [Not Used]

**Upper Layer Lifeform**

- ☐ Herbaceous
- ☐ Shrub
- ☐ Tree

**Fuel Model**

**Indicator Species* and Canopy Position**

**Structure Data (for upper layer lifeform)**

| | *Min* | *Max* |
|---|---|---|
| *Cover* | % | % |
| *Height* | | |
| *Tree Size Class* | | |

☐ Upper layer lifeform differs from dominant lifeform.

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**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100+ year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement severity.

**Description**

## Disturbances

**Fire Regime Group**:** III

**Historical Fire Size (acres)**

Avg 100
Min
Max

**Sources of Fire Regime Data**

- [ ] Literature
- [ ] Local Data
- [x] Expert Estimate

| Fire Intervals | Avg FI | Min FI | Max FI | Probability | Percent of All Fires |
|---|---|---|---|---|---|
| *Replacement* | 270 | | | 0.003704 | 23 |
| *Mixed* | | | | | |
| *Surface* | 81 | | | 0.012346 | 77 |
| *All Fires* | 62 | | | 0.01606 | |

***Fire Intervals (FI):***

Fire interval is expressed in years for each fire severity class and for all types of fire combined (All Fires). Average FI is central tendency modeled. Minimum and maximum show the relative range of fire intervals, if known. Probability is the inverse of fire interval in years and is used in reference condition modeling. Percent of all fires is the percent of all fires in that severity class.

**Additional Disturbances Modeled**

- [ ] Insects/Disease
- [x] Wind/Weather/Stress
- [ ] Native Grazing
- [ ] Competition
- [x] Other (optional 1) Beaver
- [x] Other (optional 2) 50 yr flood event

## References


Cope, A.B. 1992. Carex aquatilis. In: Fire Effects Information System, [Online]. USDA Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). Available: http://www.fs.fed.us/database/feis/ [2005, April 13].

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