Rapid Assessment Reference Condition Model

The Rapid Assessment is a component of the LANDFIRE project. Reference condition models for the Rapid Assessment were created through a series of expert workshops and a peer-review process in 2004 and 2005. For more information, please visit www.landfire.gov. Please direct questions to helpdesk@landfire.gov.

Potential Natural Vegetation Group (PNVG)

R2PIJU **Juniper and Pinyon Juniper Steppe Woodland**

General Information

Contributors *(additional contributors may be listed under "Model Evolution and Comments")*

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Vegetation Type

Woodland

Dominant Species*

JUOS
PIED
JUOC
PIMO

General Model Sources

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

LANDFIRE Mapping Zones

12 17
13 18
16

Rapid AssessmentModel Zones

- [ ] California
- [x] Great Basin
- [ ] Great Lakes
- [ ] Northeast
- [ ] Northern Plains
- [ ] N-Cent.Rockies
- [ ] Pacific Northwest
- [ ] South Central
- [ ] Southeast
- [ ] S. Appalachians
- [ ] Southwest

Geographic Range

This PNVG is found throughout the Great Basin zone. Juniper Steppe generally occurred at the lower elevation portions and transitions into the Pinyon-juniper woodlands at the upper end of its range. Pinyon is not found north of northwestern Nevada (Interstate 80 in Nevada is close to the northern edge of pinyon distribution) and is absent from lower elevations where juniper can tolerate drier conditions (elevation of lower limit varies greatly throughout the Great Basin). Similarly, pinyon is found in pure stands at higher elevations where juniper cannot establish. PNVG is Juniper Pinyon-Infrequent Fire type, scattered throughout the Colorado Plateau, Southern Rockies, and Southwest Desert.

Biophysical Site Description

This type generally occurred on shallow rocky soils, or rock dominated sites that are protected from frequent fire (rocky ridges, steep slopes, broken topography, mesa tops). Annual precipitation is typically greater than 12 inches, although drier sites (>5 inches) are common in Nevada. Elevation ranges from 4500-8000 feet, but varies greatly from north to south.

Vegetation Description

Since disturbance was uncommon to rare in this PNVG and the overstory conifers may live for over 1000 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 150 years. It is estimated that 400 years is required for old juniper woodland stands to develop (Romme et al. 2003). In the northwestern portions of the Great Basin zone, no co- dominant pinyon pine occurs with JUOC and here western juniper dominates throughout the entire woodland zone.

Tree overstory of mature woodlands varies across the Great Basin zone and consists of large individuals of Utah juniper (Juniperus osteosperma), western juniper (Juniper occidentalis), oneseed juniper (Juniperus

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

monosperma), pinyon pine (Pinus edulis) and/or single-leaf pinyon (Pinus monophylla). The age structure may vary from uneven to even aged. The overstory cover is normally less that 25%, although it can sometimes be higher (<40%) where pinyon occurs.

Understory shrub cover is less than 5% and composed of various sagebrush species, rabbitbrush, and/or mountain snowberry. Common herbaceous plants include (with regional variation) Idaho fescue, bottlebrush squireltail, needle-and-thread grass, onion grass, Sandberg bluegrass, arrowleaf balsamroot, tapertip hawksbeard, and wild onion. In Utah and Nevada the understory shrub cover consists of various sagebrush species. Herbaceous plants would include Sandberg bluegrass, bottlebrush squireltail, needle-and-thread grass, Idaho fescue (more north), and blue gramma.

Disturbance Description

Uncertainty exists about the fire frequencies of this PNVG, especially since this PNVG groups different types of pinyon-juniper communities for different slopes, exposures, and elevations. Fire occurrence 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 100-500 yrs) and occurred primarily during extreme fire behavior conditions. Mixed severity fire (average FRI of 100-500 yrs) was characterized as a mosaic of replacement and surface fires distributed through the patch at a fine scale (<0.1 acres). Surface fires could occur in stands where understory grass (FEID) cover is high and provides adequate fuel. Surface fires were primarily responsible for producing fire scars on juniper or pinyon trees (average FRI of 100 yrs).

Adjacency or Identification Concerns

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.

This PNVG may be similar to the PNVGs R3PIJUff and R3PIJUrf from the Southwest model zone. It may also be similar to the PNVG R0JUNIan from the Northern and Central Rockies model zone, but the Northern and Central Rockies model does not include pinyon pine.

Scale Description

Sources of Scale Data ☐ Literature ☑ Local Data ☑ Expert Estimate

Juniper/Pinyon-Juniper Steppe was usually distributed across the landscape in patches that range from 10's to 100's 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 Utah and Nevada pinyon and juniper landscape patches tended to be 10-100's of acres in size.

Issues/Problems

Experts pointed out that there is much uncertainty in model parameters, particularly the fire regime. Quantitative data is lacking and research is on-going. The literature for this PNVG'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. Different experts offered that fire was much more frequent or much less frequent than proposed here and that min and max cover values per class were lower or higher. For example, surface fire, which leaves scars on these other pine species (but not 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. However, experts argued strongly for less or more surface fire. Because the parameter values of the FRIs for surface fire, mixed severity, and replacement fire are actually comparable to those of surrounding sagebrush systems (see PNVGs for Wyoming big sagebrush, black sagebrush, and dwarf sagebrushes), the proposed FRIs were judged frequent enough and retained. The key parameter was the long FRI of replacement fire in

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classes D and E. Reducing the FRI from 1,000 yrs to 500 yrs (retained), decreased, respectively, the percent of class E from 65 to 45 but increased, respectively, the percentage of class D from 20 to 35.

Replacement fire in classes B and C cause a transition to A, however, in reality, this type of fire does not topkill perennial grasses. Therefore, succession age in A after these transitions should be greater than 0 and less than 10. In future LANDFIRE modeling, one should consider creating 2 early development classes; one dominated by annual forbs (the result of replacement fire in mature woodlands) succeeding to the other early class after 10 years and the second early development class dominated by perennial grasses (the result of replacement fire in shrub-dominated classes of woodlands), then shrubs later on, succeeding to a shrub-dominated class after 30 years. Overall, results would not be too different, if at all, from current results, but be more ecologically correct.

Model Evolution and Comments

Other expert reviewers: Gary Back (gback@srk.com) and William Bryant (wbryant@fs.fed.us).

*Succession Classes***

Succession classes are the equivalent of "Vegetation Fuel Classes" as defined in the Interagency FRCC Guidebook (www.frcc.gov).

Class A 5 %

Early1 PostRep

Description

Initial post-fire community dominated by annual forbs. Later stages of this class contain greater amounts of perennial grasses and forbs. Duration 10 years with succession to B, mid-development closed. Replacement fire occurs every 100 yrs on average, thus resetting to zero the succession clock. Infrequent mixed severity fire (average FRI of 300 yrs) thins vegetation but has no effect on succession age.

Dominant Species* and Canopy Position

EPAN
CRAC
CRYP
SENEC

Upper Layer Lifeform

☐ Herbaceous
☐ Shrub
☐ Tree

Fuel Model no data

Structure Data (for upper layer lifeform)

	Min	*Max*
Cover	2 %	10 %
Height	no data	no data
Tree Size Class	no data	

☐ Upper layer lifeform differs from dominant lifeform. Height and cover of dominant lifeform are:

Class B 5 %

Mid1 Closed

Description

Dominated by shrubs, perennial forbs and grasses. Total cover remains low due to shallow unproductive soil. Duration 20 years with succession to C unless infrequent replacement fire (FRI of 100 yrs) 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

Dominant Species* and Canopy Position

ARTRV
SYOR
ACOC3
CRAC

Upper Layer Lifeform

☐ Herbaceous
☐ Shrub
☐ Tree

Fuel Model no data

Structure Data (for upper layer lifeform)

	Min	*Max*
Cover	5 %	10 %
Height	no data	no data
Tree Size Class	no data	

☐ Upper layer lifeform differs from dominant lifeform. Height and cover of dominant lifeform are:

older than 0 and less than 10. Mixed severity fire (average FRI of 100 yrs) thins the woody vegetation but does not change its succession age.

Class C **10 %**

Mid1 Open

Description

Shrub dominated community with young juniper and pinyon seedlings becoming established. Duration 70 years with succession to D unless replacement fire (average FRI of 200 yrs) 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 0 and less than 10. Mixed severity fire as in B.

Dominant Species* and Canopy Position

ARTRV
SYOR
POSE
ACOC3

Upper Layer Lifeform

- ☐ Herbaceous
- ☐ Shrub
- ☐ Tree

Fuel Model no data

Structure Data (for upper layer lifeform)

	Min	Max
Cover	11 %	20 %
Height	no data	no data
Tree Size Class	no data	

☐ Upper layer lifeform differs from dominant lifeform. Height and cover of dominant lifeform are:

Class D **35 %**

Late1 Open

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 300 years with succession to E unless replacement fire (average FRI of 500 yrs) causes a transition to A. Mixed severity fire is less frequent than in previous states (200 yrs), whereas surface fire every 100 yrs on average becomes more important at this age in succession.

Dominant Species* and Canopy Position

JUOC/J
PIED/PI
SYOR
FEID

Upper Layer Lifeform

- ☐ Herbaceous
- ☐ Shrub
- ☐ Tree

Fuel Model no data

Structure Data (for upper layer lifeform)

	Min	Max
Cover	11 %	30 %
Height	no data	no data
Tree Size Class	no data	

☐ Upper layer lifeform differs from dominant lifeform. Height and cover of dominant lifeform are:

Class E **45 %**

Late1 Open

Description

Site dominated by widely spaced old juniper and pinyon. Understory depauperate and high amounts of bare ground present. Grasses (e.g., Idaho fescue in more northern or cooler areas) present on microsites sites with deeper soils (>20 inches) 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 500 yrs). Surface fire every 100 yrs on average will scar ancient trees. Duration 600+ yrs.

Dominant Species* and Canopy Position

JUOC/J
PIED/PI
FEID
BASA

Upper Layer Lifeform

- ☐ Herbaceous
- ☐ Shrub
- ☐ Tree

Fuel Model no data

Structure Data (for upper layer lifeform)

	Min	Max
Cover	21 %	40 %
Height	no data	no data
Tree Size Class	no data	

☐ Upper layer lifeform differs from dominant lifeform. Height and cover of dominant lifeform are:

Disturbances

Disturbances Modeled

- ☑ Fire
- ☑ Insects/Disease
- ☑ Wind/Weather/Stress
- ☐ Native Grazing
- ☐ Competition
- ☐ Other:
- ☐ Other

Historical Fire Size (acres)

Avg: no data
Min: no data
Max: no data

Sources of Fire Regime Data

- ☐ Literature
- ☐ Local Data
- ☑ Expert Estimate

Fire Regime Group: 3

I: 0-35 year frequency, low and mixed severity
II: 0-35 year frequency, replacement severity
III: 35-200 year frequency, low and mixed severity
IV: 35-200 year frequency, replacement severity
V: 200+ year frequency, replacement severity

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. All values are estimates and not precise.

	Avg FI	Min FI	Max FI	Probability	Percent of All Fires
Replacement	333	100	1000	0.00300	20
Mixed	217	100	1000	0.00461	31
Surface	135	100	100	0.00741	49
All Fires	67			0.01502	

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