Appendix 1. Descriptions of vegetation classes within biophysical settings for the Beaver Dam Wash and Red Cliffs National Conservation Areas.

Big Sagebrush Steppe - upland (BSu)

1126u

Overview: The Big Sagebrush Steppe - upland site BpS (a.k.a., mountain big sagebrush) is found above and intergrades with the mesic sites (≥10 inch Precipitation Zone) of the Blackbrush BpS in the both NCAs. Elevation is generally above 8,000 ft (2,440 m) in the Mojave Desert. In general this system shows an affinity for mild topography, fine soils, and some source of subsurface moisture. Soils generally are moderately deep to deep, well-drained, and of loam, sandy loam, clay loam, or gravelly loam textural classes; soils often have a substantial volume of coarse fragments, and are derived from a variety of parent materials. This system primarily occurs on deep soiled to stony flats, ridges, nearly flat ridge tops, and mountain slopes. Vegetation types are usually dominated by Artemisia tridentata *ssp* vaseyana*, but Mojave Desert communities have received less taxonomic description than northern mapping zones. A variety of other shrubs can be found in some occurrences, but these are seldom dominant. Abundant forbs are an indicator of good range condition. Grasses are abundant and often diverse.*

A	**Early**; 0-10% canopy of mountain sage, mountain brush; 10-80% grass/forb cover; 0-12 yrs
B	**Mid-open**; 11-30% cover of mountain sage, mountain shrub; >50% herbaceous cover; 13-38 yrs
C	**Mid-closed**; 31-50% cover of mountain sage, mountain brush, occasional blackbrush; 25-50% herbaceous cover; <10% conifer sapling cover; 38+ yrs
D	**Late-open**; 10-30% cover pinyon-juniper <3m; 25-40% cover of mountain sage, mountain brush, occasional blackbrush; <30% herbaceous cover; 80-129 yrs
E	**Late-closed**; 31-40% pinyon-juniper cover <8m; 6-20% shrub cover; <20% herbaceous cover; 130+ yrs
U-*ES*	**Early-Shrub**; 20-50% cover of cholla, snakeweed or rabbitbrush species
U-*TE*	**Tree-Encroached**; 31-40% pinyon-juniper cover 10-25m; <5% shrub cover; <5% herbaceous cover
U-*DP*	**Depleted**; 20-50% cover of mountain sage, mountain brush, occasional blackbrush; <5% herbaceous cover; <10% conifer sapling cover
U-*SEP*	**Shrub-Exotic-Species-Perennial-Grass**; 11-50% cover of mountain sage, mountain brush, occasional blackbrush; >5% cover of native grass; >5% cheatgrass cover; <10% conifer sapling cover
U-*SES*	**Shrub-Exotic-Species**; 11-50% cover of mountain sage, mountain brush, occasional blackbrush; ≥5% cheatgrass cover; ≤5% cover of native grass; <10% conifer sapling cover
U-*EX*	**Exotic-Species**; 10-30% cover of cheatgrass; snakeweed or rabbitbrush may be present
U-*TEX*	**Tree- Exotic-Species;** 31-40% pinyon-juniper cover <8m; ≥5% cover of cheatgrass; <20% shrub cover; <20% herbaceous cover
U-*SD*	**Seeded (native)**; >10% seeded native grasses, forbs, and shrubs

Blackbrush - mesic (≥10 inch precipitation zone) (BM)

1082m

Overview: The Blackbrush-mesic BpS differs between the Beaver Dam Wash and Red Cliffs NCAs: Joshua trees are present on half the area in Beaver Dam Wash NCA, but absent in the Red Cliffs NCA. The description below includes all classes with and without Joshua trees. *Within the Mojave-Colorado Plateau ecotone, blackbrush is found on dry slopes and benches above the river canyons of southern Utah and northern Arizona. It is also found midslope on mountain ranges throughout this area. Soils are mesic, predominantly shallow to a root restrictive layer, on low hills and mountains and broad alluvial fans. Precipitation ranges from 10 to 12+ inches, with most occurring from November through April. Summers are hot and dry with many days reaching above 100 degrees F. The dominant shrub 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. Codominant shrub species include* Eriogonum fasciculatum, Ephedra nevadensis, Grayia spinosa, Menodora spinescens, Opuntia acanthocarpa, Yucca brevifolia, *or* Yucca schidigera. *Utah juniper is often associated with mesic blackbrush at higher elevations.*

Appendix 1. Descriptions of vegetation classes within biophysical settings for the Beaver Dam Wash and Red Cliffs National Conservation Areas.

A	**Early**: 0-199 yrs; 0-40% cover of snakeweed, rabbbitbrush, big sagebrush, turpentine bush, yucca, and desert bitterbrush; young blackbrush may be present
B	**Mid-closed**: 200+ yrs; 10-50% cover blackbrush <1.0m; >1% cover of young Joshua trees; <10% cover of grasses (desert needlegrass, Indian ricegrass, galleta grass, fluff grass, and threeawn); other shrubs present, pinyon or juniper saplings present
C	**Mid-open**: 200+ yrs; 10-50% cover blackbrush <1.0m; Joshua trees **absent**; <10% cover of grasses (desert needlegrass, Indian ricegrass, galleta grass, fluff grass, and threeawn); other shrubs present, pinyon or juniper saplings present
D	**Late-open**: 400+ yrs; 10-40% of pinyon or juniper; 5-40% blackbrush cover; Joshua trees **absent**; <10% cover of grasses (desert needlegrass, Indian ricegrass, galleta grass, fluff grass, and threeawn); other shrubs present
E	**Late-closed**: 400+ yrs; 10-40% of pinyon or juniper; 5-40% blackbrush cover; >1% cover of Joshua trees; <10% cover of grasses (desert needlegrass, Indian ricegrass, galleta grass, fluff grass, and threeawn); other shrubs present
U-*ES*	**Early-Shrub**; 20-50% cover of cholla, snakeweed or rabbitbrush species
U-*SEPJ*	**Shrub-Exotic-Species-Perennial-Grass-Joshua-Tree**; 10-50% cover of blackbrush or other shrubs <1.0m tall; 5-20% exotic species (*Bromus rubens, Bromus tectorum*, *Erodium cicutarium*) cover; >1% cover of Joshua trees; ≥5% native grass cover
U-*SEP*	**Shrub-Exotic-Species-Perennial-Grass**; 10-50% cover of blackbrush or other shrubs <1.0m tall; Joshua trees **absent**; 5-20% exotic species (*Bromus rubens, Bromus tectorum*, *Erodium cicutarium*) cover; ≥5% native grass cover
U-*SES*	**Shrub-Exotic-Species**; 10-40% cover of blackbrush or other shrubs <1.0m tall, 5-20% exotic species (*Bromus rubens, Bromus tectorum*, *Erodium cicutarium*) cover; <5% native grass cover
U-*TEX*	**Tree- Exotic-Species**; 10-40% of pinyon or juniper; >5% exotic species (*Bromus rubens, Bromus tectorum*, *Erodium cicutarium*) cover; <20% blackbrush cover; Joshua trees may be present
U-*EX*	**Exotic-Species**; >10% exotic species (*Bromus rubens, Bromus tectorum*, *Erodium cicutarium*) cover; <10% cover of blackbrush or other shrubs; unburned and charred Joshua tree may be present
U-*EX2B*	**Exotic-Species-2nd-Burn**; identical to U-*EX*, except that it has experienced a second burn.
U-*SD*	**Seeded (native)**; >10% seeded native grasses, forbs, and shrubs
U-*SDI*	**Seeded (introduced)**; >10% seeded non-native grasses, forbs, and shrubs
U-*PL*	**Planted;** >5% planted shrubs and perennial herbaceous species; <5% non-native annual grasses and forbs
U-*BG*	**Bare ground**; mineral soil exposed by human disturbances

Blackbrush - thermic (≤10 inch precipitation zone) (BT)
1082t

Overview: The Blackbrush-thermic BpS differs between the Beaver Dam Wash and Red Cliffs NCAs: Joshua trees are present on half the area in Beaver Dam Wash NCA, but absent in the Red Cliffs NCA. The description below includes all classes with and without Joshua trees. Within the Mojave-Colorado Plateau ecotone, blackbrush is found on dry slopes and benches above the river canyons of southern Utah and northern Arizona. It is also found midslope on mountain ranges throughout this area. Soils are thermic, predominantly shallow to a root restrictive layer, on low hills and mountains and broad alluvial fans. Precipitation is <10 inches, with most occurring from November through April. Summers are hot and dry with many days reaching above 100 degrees F. The dominant shrubs are blackbrush (Coleogyne ramosissima) *and white bursage* (Ambrosia dumosa). *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. Codominant shrub species include* Eriogonum fasciculatum, Ephedra nevadensis, Grayia spinosa, Menodora spinescens, Opuntia acanthocarpa, Yucca brevifolia, *or* Yucca schidigera. *Utah juniper is never present.*

A	**Early**: 0-499 yrs; 0-50% cover of snakeweed, turpentine bush, yucca; <10% cover blackbrush

Appendix 1. Descriptions of vegetation classes within biophysical settings for the Beaver Dam Wash and Red Cliffs National Conservation Areas.

B **Late-closed**: 500+ yrs; 10-40% cover blackbrush <1.0m; creosotebush present; >1% cover of Joshua trees; 0-10% cover of grasses (desert needlegrass, Indian ricegrass, galleta grass, fluff grass, and threeawn), other shrubs present

C **Late-open**: 500+ yrs; 10-40% cover blackbrush <1.0m; creosotebush present; 0-10% cover of grasses (desert needlegrass, Indian ricegrass, galleta grass, fluff grass, and threeawn); other shrubs present

U-*ES* **Early-Shrub**; 20-50% cover of cholla, snakeweed or rabbitbrush species

U-*SEPJ* **Shrub-Exotic-Species-Perennial-Grass-Joshua-Tree**; 10-40% cover of blackbrush or other shrubs <1.0m tall, 5-20% exotic species (*Bromus rubens, Bromus tectorum*, *Erodium cicutarium*) cover; >1% cover of Joshua trees; ≥5% native grass cover

U-*SEP* **Shrub- Exotic-Species-Perennial-Grass**; 10-40% cover of blackbrush or other shrubs <1.0m tall, 5-20% exotic species (*Bromus rubens, Bromus tectorum*, *Erodium cicutarium*) cover; Joshua trees **absent**; ≥5% native grass cover

U-*SES* **Shrub-Exotic-Species**; 10-40% cover of blackbrush or other shrubs <1.0m tall, 5-20% exotic species (*Bromus rubens, Bromus tectorum*, *Erodium cicutarium*) cover; <5% native grass cover

U-EX **Exotic-Species**; >10% exotic species (*Bromus rubens, Bromus tectorum*, *Erodium cicutarium*) cover; <10% cover of blackbrush or other shrubs; unburned and charred Joshua tree may be present

U-*EX2B* **Exotic-Species-2nd-Burn**; identical to U-*EX*, except that it has experienced a second burn.

U-*PL* **Planted;** >5% planted shrubs and perennial herbaceous species; <5% non-native annual grasses and forbs

U-*BG* **Bare ground**; mineral soil exposed by human disturbances

Creosotebush-White Bursage Scrub (CB)
1087

*Overview: The Creosotebush-White Bursage BpS occupies the lowest elevations of both NCAs and is typically found below the blackbrush zone on well-drained alluvial flats. Elevations range from 5,000-6,000 ft (1,525-1,830 m) on lower mountain foot slopes. Soil types vary from shallow to very deep on erosional fan remnants, fan piedmonts, and sideslopes of hills and lower mountains. Slopes range from 2-75%, but slope of 2-15% are typical. Creosotebush (*Larrea tridentata*) and white bursage (*Ambrosia dumosa*) co-dominate, with bursage more prevalent in warmer and drier sites.*

A **Early**; 5-20% cover of creosote and white bursage builds up over time;5-20% grass cover depending on winter precipitation and season; 0-19 yrs

B **Mid-closed**; 21-40% creosote and white bursage cover; 5-20% grass and forb cover (depending on winter precipitation, soil productivity, and season); >1% cover of Joshua trees; 20+ yrs

C **Late-open**; 21-40% creosote and white bursage cover; Joshua trees **absent**; 5-20% grass and forb cover (depending on winter precipitation, soil productivity, and season); 20+ yrs

D **Late- closed;** 21-40% creosote and white bursage cover; >1% cover of Joshua trees; 5-20% grass and forb cover (depending on winter precipitation, soil productivity, and season); 400+ yrs

U-*ES* **Early-Shrub**; 20-50% cover of cholla, snakeweed or rabbitbrush species

U-*SEP* **Shrub-Exotic-Species-Perennial-Grass**; 21-40% cover of creosote and white bursage; 0-20% exotic species (*Bromus rubens, Bromus tectorum*, *Erodium cicutarium*) cover; 5-20% grass and forb cover (depending on winter precipitation, soil productivity, and season); Joshua trees **absent**

U-*SEPJ* **Shrub- Exotic-Species-Perennial-Grass-Joshua-Tree**; 21-40% cover of creosote and white bursage; 0-20% exotic species (*Bromus rubens, Bromus tectorum*, *Erodium cicutarium*) cover; 5-20% grass and forb cover (depending on winter precipitation, soil productivity, and season); >1% cover of Joshua trees

U-*SES* **Shrub-Exotic-Species**; 10-40% cover of creosotebush or other shrubs <1.0m tall; 5-20% exotic species (*Bromus rubens, Bromus tectorum*, *Erodium cicutarium*) cover; <5% cover of native grasses or forbs; Joshua tree **absent**

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U-*SESJ* **Shrub-Exotic-Species-Joshua-Tree**; 10-40% cover of creosotebush or other shrubs <1.0m tall; 5-20% exotic species (*Bromus rubens, Bromus tectorum*, *Erodium cicutarium*) cover; >1% cover of Joshua trees; <5% cover of native grasses and forbs

U-EX **Exotic-Species**; >10% exotic species (*Bromus rubens, Bromus tectorum*, *Erodium cicutarium*) cover; <10% cover of creosotebush or other shrubs; unburned and charred Joshua tree may be present

U-*EX2B* **Exotic-Species-2nd-Burn**; identical to U-*EX*, except that it has experienced a second burn.

U-*SD* **Seeded (native)**; >10% seeded native grasses, forbs, and shrubs

U-*SDI* **Seeded (introduced)**; >10% seeded non-native grasses, forbs, and shrubs

U-*PL* **Planted;** >5% planted shrubs and perennial herbaceous species; <5% non-native annual grasses and forbs

U-*BG* **Bare ground**; mineral soil exposed by human disturbances

Desert Sand Sagebrush (DSS)

1135ss

Overview: The Desert Sand Sagebrush BpS occupies deep sandy soils of the Red Cliffs NCA and Snow Canyon State Park. The dominant and diagnostic species is sand sagebrush, Artemisia filifolia*. The community is characterized by abundant sand and blowout areas. Subdominant shrubs include snakeweed and desert almond. Common grasses include big galleta, bush muhly, Indian ricegrass, and desert needlegrass*.

A **Early**; 5-19% sand sagebrush and snakeweed/rabbitbrush cover; 5-20% cover of grasses (big galleta, bush muhly, Indian ricegrass, desert needlegrass); >40% bare ground (mostly sand); 0-2 yrs after fire

B **Late-closed**; 20-40% cover of sand sagebrush, desert almond, and rabbitbrush; 5-20% grasses (big galleta, bush muhly, Indian ricegrass, desert needlegrass); scattered juniper may be present; >30% bare ground (mostly sand); 3+ yrs

U-*DP* **Depleted**; 20-40% sand sagebrush, snakeweed, and rabbitbrush cover;<5% cover of grasses; >40% bare ground cover

U-*SEP* **Shrub-Exotic-Species-Perennial-Grass**; 5-40% sand sagebrush and rabbitbrush cover; 5-10% cover of exotic species (*Bromus rubens, Bromus tectorum*, *Erodium cicutarium*); native grasses may be present to common; >30% bare ground (mostly sand)

Montane Riparian (MR)

1154

Overview: The Montane Riparian BpS is found within a broad elevation range from about 4,000 ft (1,220 m) to over 7,000 ft (2,135 m). Riparian forests and woodlands require flooding and gravel for reestablishment. The BpS is found in low- to mid-elevation canyons and draws, on floodplains, or in steep-sided canyons, or narrow V-shaped valleys with rocky substrates. Sites are subject to temporary flooding during spring runoff. Underlying gravels may keep the water table just below ground surface, and are favored substrates for cottonwood and willow. In steep-sided canyons, streams typically have perennial flow on mid to high gradients. Surface water is generally high for variable periods. Soils are typically alluvial deposits of sand, clays, silts and cobbles that are highly stratified with depth due to flood scour and deposition. Codominant and diagnostic species include willow, buffaloberry, cottonwood, velvet ash, conifers, and mesquite. Vegetation is very heterogeneous along river reaches.

A **Early**; 0-40% cover of shrub—willow dominates after fire, whereas cottonwood and willow co-dominate after flooding; grass may co-dominate; <50% cover gravel, rock, and boulders, although this may be highly variable by reach; 0-5 yrs

B **Mid-closed**; 31-100% cover of tall shrubs (willows, buffaloberry, young mesquite) and small trees (velvet ash, conifers) and small cottonwood trees; <20% gravel, rock, and boulders; 5-19yrs

C **Late-closed**; 31-100% cover of cottonwood, willow, conifers and other trees 10-24m; <20% gravel, rock, and boulders; >20 yrs

Appendix 1. Descriptions of vegetation classes within biophysical settings for the Beaver Dam Wash and Red Cliffs National Conservation Areas.

U-*SFE* **Shrub-Forb-Encroached**; 10-50% cover of Wood's rose or other unpalatable forbs and shrubs in open areas or under tree canopy

U-*EF* **Exotic-Forb**; 10-100% cover of exotic forbs (knapweed, tall whitetop, purple loosestrife), salt cedar, or Russian olive)

U- *DE* **Desertification**; Entrenched river/creek with 10-50% cover of upland shrubs (e.g., big sagebrush, snakeweed, rabbitbrush); >5% native grass cover

Mountain Mahogany (Littleleaf Mountain Mahogany) (MM)

1062

*Overview: The Mountain Mahogany BpS is only found in Beaver Dam Wash NCA in small patches on limestone bedrock, coarse rock fragments, and very shallow dry limestone soils either at the base of limestone cliffs or on ledges. The dominant and diagnostic species is little-leaf mountain mahogany (*Cercocarpus intricatus*). Other shrubs include bitterbrush (*Purshia *sp.) and snowberry (*Symphoricarpos *sp.*).

A **Early**; 10-55% cover little-leaf mountain mahogany (*Cercocarpus intricatus*) seedlings and saplings <0.5m high; mineral soil, bedrock, and rock abundant; grasses and shrubs present but not abundant; 0-9 yrs

B **Mid-open**; 10-30% cover littleleaf mountain mahogany 0.5-1m high; mineral soil abundant; 10% native perennial grasses cover; 5% cover of mountain shrubs other than mahogany; mineral soil, bedrock, and rock abundant; 10-29 yrs

C **Late-closed (formerly *E*)**; 30-45% cover of littleleaf mountain mahogany 1-2m high; 15% cover of mountain shrubs other than mahogany; 45% cover of mineral soil, bedrock, and rock; >30 yrs

U-*TEX* **Tree-Exotic-Species**; 10-55% cover of littleleaf mountain mahogany; 5-10% cheatgrass cover; 40% cover of mineral soil, bedrock, and rock

U-*EX* **Exotic-Species**; 5-20% cheatgrass cover; littleleaf mountain mahogany largely absent; 80% cover of mineral soil, bedrock, and rock

Mountain Shrub (MSh)

1126ms

*Overview: The Mountain Shrub BpS is found in primarily two compositional forms where either Stansbury cliffrose (*Purshia mexicana*) or snowberry (*Amelanchier *sp.) is the diagnostic shrub. The BpS is found in small patches on different montane landforms. The snowberry form is usually at higher elevations on moderate to steep slopes with deep mesic soils above 8,000 ft (2,440 m) elevation, sometimes with coarse fragments. Other shrubs, grasses, and forb species can be abundant. The cliffrose form is usually at lower elevations and adjacent or imbedded in the pinyon and juniper woodlands on moderate to steep slopes, and often follows linear geologic features (rock ledges).*

A **Early**; 0-10% canopy of snowberry, desert bitterbrush, or Stansbury cliffrose; 10-80% grass and forb cover; 0-12 yrs

B **Mid-open**; 11-30% cover of snowberry, desert bitterbrush, or Stansbury cliffrose; >50% herbaceous cover; 13-38 yrs

C **Mid-closed**; 31-50% cover of snowberry, desert bitterbrush, or Stansbury cliffrose; 25-50% herbaceous cover;<10% conifer sapling cover; 38+ yrs

D **Late-open**; 10-20% pinyon pine-juniper cover <5m; 25-40% cover of snowberry, desert bitterbrush, or Stansbury cliffrose; <30% herbaceous cover; 80-129 yrs

U-*ES* **Early-Shrub**; 20-50% cover rabbitbrush species

U-*DP* **Depleted**; 31-50% cover of snowberry, desert bitterbrush, Stansbury cliffrose; <5% herbaceous cover; <10% conifer sapling cover

U-*SEP* **Shrub-Exotic-Species-Perennial-Grass**; 5-40% cover of mountain shrubs; 5-20% non-native grass cover; native herbaceous cover usually present; trees may be present

U-*TE* **Tree-Encroached**; >21% pinyon pine-juniper cover 10-25m; <5% shrub cover; <5% herbaceous cover

Appendix 1. Descriptions of vegetation classes within biophysical settings for the Beaver Dam Wash and Red Cliffs National Conservation Areas.

U-*TEX* **Tree-Exotic-Species;** 10-20% pinyon pine-juniper cover <5m; ≥5% cover of non-native annual grasses and forbs; 25-40% cover of snowberry, desert bitterbrush, or Stansbury cliffrose; <30% herbaceous cover

U-*EX* **Exotic-Species;** 10-30% cover of cheatgrass; snakeweed or rabbitbrush may be present; dead standing stems of cliffrose often present

Pinyon-Juniper (PJ)

1019

*Overview: The Pinyon-Juniper Woodland BpS is typically found from 5,500-8,000 ft (1,675-2440 m) above the blackbrush (*Coleogyne ramosissima*) zone. This type generally occurs on most soils and landforms, especially fire-safe sites of steep and rocky slopes. Soils supporting this system vary in texture ranging from stony, cobbly, gravelly sandy loams to clay loam or clay. Woodlands comprising this system can be dominated by a mix of* Pinus monophylla *and* Juniperus osteosperma*, pure or nearly pure occurrences of* Pinus monophylla*, or solely by* Juniperus osteosperma*. Understory layers are variable. Grass and shrub species are often diverse and common, although not abundant.*

A **Early-open**; 5-20% herbaceous cover; 0-9 yrs

B **Mid1-open**; 11-20% cover big sage or black sage <1.0m; 10-40% herbaceous cover; 10-29 yrs

C **Mid2-open**; 11-30% cover of pinyon and/or juniper <5m; 10-40% shrub cover; <20% herbaceous cover; 30-99 yrs

D **Late-open**; 31-50% cover of pinyon and/or juniper <5m-9m; 10-40% shrub cover; <20% herbaceous cover; >99 yrs

U-*TEX* **Tree- Exotic-Species**; 31-50% cover of pinyon and/or juniper <5m-9m; 5-20% cheatgrass cover 10-40% shrub cover;

U-*EX* **Exotic-Species**; 5-30% cheatgrass cover; dead pinyon or juniper visible

Warm Desert Riparian (WDR)

1155

Overview: The Warm Desert Riparian BpS occurs primarily along perennial streams/rivers along the Colorado, Salt, Virgin, Muddy, and Mojave River corridors adjacent to low elevation shrublands. Elevation is typically below 4,000 ft (1,220 m). When mesquite bosque is the dominant type outside of perennial waterways, it is also found at elevations lower than 3,600 ft (1,100 m) along intermittent streams or in valleys bottoms along playa edges with a perched water table. The vegetation is a mix of riparian woodlands, shrublands, and grasslands. Vegetation is very patchy in rivers with active flood regimes. Dominant species are Salix gooddingii, Populus fremontii, Salix exigua, Pluchea sericea, Distichlis spicata, Sporobolis airoides, Carex *spp*., Typha *sp., and* Prosopis *sp. Halophytic shrub-dominated patches occur on drier sediment deposits or saltier surfaces. Vegetation is dependent upon periodic flooding.*

A **Early**; 10-50% cover of Gooding willow and Fremont Cottonwood seedlings and shrubs; riparian and wetland graminoids may co-dominate; 0-4 yrs post-flooding

B **Mid-closed**; 51-100% cover of willow and small trees (willow and cottonwood) <3 m; patches of graminoids and halophytic shrubs common; 5-19 yrs after flooding

C **Mid-open**; 11-50% cover of fire resprouts of mesquite and Gooding willow; patches of graminoids frequent after fire; mesquite mature to larger trees several years after fire; 1-89 yrs after fire

D **Late1-closed**; 51%-90% of mature Gooding willow and Fremont cottonwood; patches of graminoids in saturated soils and of halophytic shrubs on drier sediment deposits or more saline surfaces; 10-89 yrs

E **Late2-closed**; 51-90% mesquite cover; Gooding willow and Fremont cottonwood minor component; understory often dominated by graminoids and forbs; >90 yrs

U-*DE* **Desertified**; incised river bank caused by human disturbance; 10-90% native halophytic shrub or riparian tree cover; graminoid patches may be present

U-*DET* **Desertified-Exotic-Tree**; >5% exotic tree species (tamarisk or Russian olive) regardless of native cover; river bank incised

Appendix 1. Descriptions of vegetation classes within biophysical settings for the Beaver Dam Wash and Red Cliffs National Conservation Areas.

U-*DEF* **Desertified-Exotic-Forb**; >5% exotic forb species regardless of native cover; river bank incised

U-*DEX* **Desertified-Exotic-Species;** 5-40% exotic annual grasses and forbs; charred remnants of trees and shrubs often present; snakeweed often present to abundant; river bank incised

U-*TEX* **Tree- Exotic-Species;** 51%-90% of young or mature Gooding willow and Fremont cottonwood; >5% cover of exotic annual grass and forb species; patches of graminoids in saturated soils and of halophytic shrubs on drier sediment deposits or more saline surfaces

U-*EF* **Exotic Forb**; >5% exotic forb species regardless of native cover; river bank not incised

U-*ET* **Exotic-Tree**; >5% exotic tree species (tamarisk or Russian olive) regardless of native cover; river bank not incised

U-*EX* **Exotic-Species;** 5-40% exotic annual grasses and forbs; charred remnants of trees and shrubs often present; snakeweed often present to abundant

U-*BG* **Bare ground**; mineral soil exposed by human-caused disturbances

Warm Desert Riparian-Wash (Shallow & Deep combined) (SWA)

1155w

Overview: The Warm Desert Riparian-Wash BpS comprises intermittent to dry warm-desert drainages with mostly subsurface flow whose banks are deeply incised. The distinction between shallow and deep washes is primarily from the perspective of whether or not a desert tortoise could climb out of the wash. Flash-flooding is the major disturbance in this BpS. Gravels and desert shrub species dominate the system with shrub cover increasing with time since last flood.

A **Early**; 20-50% cover may be gravel, sands, and/or flood debris;10-19% cover of desert almond, burrobrush, rabbitbrush, creosotebush, desert willows present; 5-15% cover of grasses (big galleta, bush muhly); forbs present to abundant; 0-5 yrs

B **Mid-closed**; 20-50% cover of desert almond, bursage, bladdersage, burrobrush, creosotebush, Anderson's wolfberry, rabbitbrush; 5-10% cover of grasses (big galleta, bush muhly); forbs present to abundant; <30% of gravel and rocks; 5-19 yrs

C **Late-closed**; 30-50% cover of bursage, burrobrush, creosotebush, desert almond, bladdersage, Anderson's wolfberry, rabbitbrush, mesquite; Joshua tree present; 5-10% cover of grasses (big galleta, bush muhly); forbs present to abundant; <10% of gravel and rocks; >20 yrs

U-*SEP* **Shrub-Exotic-Species-Perennial-Grass**; >5% exotic species (*Bromus rubens, Bromus tectorum*, *Erodium cicutarium*) cover; 0-50% small mesquite, Joshua tree, and shrubs, 5-10% cover of grasses (big galleta, bush muhly); mineral soil may be common

U-*SES* **Shrub-Exotic Species**; >5% exotic species (*Bromus rubens, Bromus tectorum*, *Erodium cicutarium*) cover; 0-50% small trees and shrubs; <5% cover of native grasses; mineral soil may be common

U-*ES* **Early-Shrub**; 20-50% cover of cholla, snakeweed or rabbitbrush species

U-*ET* **Exotic-Tree (formerly *EX*)**; >5% cover of salt cedar; 0-50% cover of bursage, burrobrush, creosotebush, Anderson's wolfberry, rabbitbrush, mesquite, Joshua tree

U-*BG* **Bare ground**; mineral soil exposed by human-caused disturbances

Warm-Season Grassland (GRL)

11212

*Overview: The Warm-Season Grassland BpS is only found in the Red Cliffs NCA and Snow Canyon State Park. Grasslands are located on fine soils, sometimes fine sandy soils, at the toe of slopes, in shallow bottoms with gentle to moderate slopes, and on gentle slopes. Galleta grass (*Hilaria *sp.) is the dominant species and usually abundant, although Indian ricegrass (*Stipa hymenoides) *may be present to abundant. With time since fire or other disturbances, woody shrub cover will increase.*

A **Early**; 20-70% cover of warm-season grasses (big galleta); forbs may be present; trace amount of resprouting shrubs may be present; woody vegetation largely absent; 30% mineral soil cover typical but ranges from 30 to 80% with time since fire; 0-19 yrs

Appendix 1. Descriptions of vegetation classes within biophysical settings for the Beaver Dam Wash and Red Cliffs National Conservation Areas.

B	**Late-open**; 5-20% cover of shrub and succulents; 50-70% cover of warm-season grasses (big galleta); forbs may be present; 30% mineral soil cover typical; >20 yrs
U-*DP*	**Depleted;** 5-20% cover of shrub and succulents; <10% cover of warm-season grasses (big galleta); forbs may be present; 30% mineral soil cover typical; >20 yrs
U-*SES*	**Shrub-Exotic-Species-Perennial-Grass**; 5-20% cover of exotic species (*Bromus rubens, Bromus tectorum*, *Erodium cicutarium*); 5-20% cover of shrub and succulents; 10-60% cover of warm-season grasses (big galleta); forbs may present
U-*EEX*	**Early-Exotic-Species**; <20% cover of warm-season grasses (big galleta); 5-30% cover of exotic species (*Bromus rubens, Bromus tectorum*, *Erodium cicutarium*); 50-70% cover of mineral soil
U-EX	**Exotic-Species**; 5-30% exotic species (*Bromus rubens, Bromus tectorum*, *Erodium cicutarium*) cover; 20-70% native grass species (big galleta); 5% cover of mineral soil

Appendix 2. Description of ecological model dynamics for the Red Cliffs and Beaver Dam Wash NCAs.

Introduction

Non-spatial state-and-transition models of ecological systems were created with the software PATH and Vegetation Dynamics Development Tool (VDDT from ESSA Technologies, Ltd.; Barrett 2001; Beukema et al. 2003). Although PATH is the general architecture of the simulation, VDDT is "called in" by PATH to perform runs. In VDDT, succession and disturbance are simulated in a semi-Markovian framework. Each vegetation state has one possible deterministic transition based on time in the state (usually succession) and several possible probabilistic transitions (natural and management). Each of these transitions has a new destination state and probability associated with it. Based on the timing of the deterministic transition and the probabilities of the stochastic transitions, at each time step a polygon may remain the same, undergo a deterministic transition based on elapsed time in the current state or undergo a probabilistic transition based on a random draw (for example, replacement fire). Model parameters (succession duration and disturbance rates) are presented in Appendix 3.

We created 11 state-and-transition models for each of the ecological systems in Table 2 (except the very small littleleaf mountain mahogany). Appendix 1 presents the different states, phases, and their abbreviations for each ecological system. Although each model represented a distinct ecological system, some models were grouped on the same VDDT project page (i.e., Uber model) to allow for seamless system conversions should models be used for climate change analysis (it was not):

- Low-to-high elevation Uber VDDT project contained 9 ecological systems: Big Sagebrush Steppe-upland, Blackbrush-mesic, Blackbrush-thermic, Creosotebush-White Bursage, Desert Washes, Montane Riparian, Pinyon-Juniper Woodland, Mountain Shrub, and Warm-Season Grassland;
- Single project: Desert sand sagebrush; and
- Single project: Warm desert riparian.

All models had at their core the LANDFIRE reference condition represented by some variation around the A-B-C-D-E classes (Table 2; Appendix 1). Essentially, this meant that models had an early development class and mid-development and/or late-development classes. Mid- and late-development classes may be expressed as open or closed canopy. Several models contained <5 boxes that did not follow the classic nomenclature. The A-E class models simply represented succession from usually herbaceous vegetation to increasing woody species dominance where the dominant woody vegetation might be shrubs or trees. For the models to also reflect the effects of management, we added uncharacteristic vegetation classes that represented different states that only exist because of direct or indirect human activity (Appendix 1).

In all models, any disturbance was quantified by a rate expressed as a probability per year. This rate is the inverse of the return interval of a disturbance or a frequency of spatial events. For example, a mean fire return interval of 100 years is equal to a rate of 0.01/year (0.01 = 1/100). The probability/year rate is used in VDDT because it has the very convenient property

of being additive, whereas return intervals are not additive. This rate was further multiplied by a proportion that partitioned the main rate in terms of success and failure outcomes, allocation of resources to realize different management objectives, or extent of application (for example, 5% of the biophysical setting was grazed at a rate of 1.0/year – livestock grazed every year [not a current practice in the Red Cliffs NCA], thus the return interval is 1 year). The rate that was ultimately used was the probability/year multiplied by proportions of allocation. Any rate, which is generally based on return intervals, is converted to a spatial draw per year as a necessary time for space substitution. Although VDDT is a non-spatial simulation software, the underlying process imitates temporal rates with virtual pixel draws. To pursue the fire return interval example, a probability/year of 0.01 means that 1 out of every 100 pixels on average receives fire within a year. Temporal multipliers described in the main text can be used to modify how many pixels are selected per year while maintaining a temporally average rate of 0.01/year (Appendix 4).

Models contained more management activities than were actually employed in final simulations to explore possibilities with workshop participants. The rate of application of each management action was set by Treatment Details in PATH or area limit function of VDDT that was reflective of management budgets and minimum treatments required to achieve objectives. Because area limits overrule rates, we generally used a default rate of 0.01 for all actions –another arbitrary rate could have been chosen; however, the proportional allocation of the area limit to different outcomes of the same management action was controlled by VDDT entries (Appendix 3). Some outcomes represented failure rates for an action, such as when a plant seeding failed and was replaced by a non-native annual species.

The format of model descriptions that follow will consist of a standard template of entries by ecological system (alphabetical order). Some entries will be repetitive among ecological systems and with Appendix 1. Each ecological system's model is intended to be self contained.

Big Sagebrush Steppe-upland (BSu) 1126u

Area of Application and Context:

- **Red Cliffs and Beaver Dam Wash National Conservation Areas of southwestern Utah**
- **Livestock grazing on Beaver Dam Wash only**
- **Full fire suppression management**
- **Date created: July 2011**

Vegetation classes:

- A-**Early**: 0-10% canopy of mountain sage, mountain brush; 10-80% grass/forb cover; 0-12 yrs
- B-**Mid-open**: 11-30% cover of mountain sage, mountain shrub; >50% herbaceous cover; 13-38 yrs
- C-**Mid-closed**: 31-50% cover of mountain sage, mountain brush, occasional blackbrush; 25-50% herbaceous cover; <10% conifer sapling cover; 38+ yrs
- D-**Late-open**: 10-30% cover pinyon-juniper <3m; 25-40% cover of mountain sage, mountain brush, occasional blackbrush; <30% herbaceous cover; 80-129 yrs
- E-**Late-closed**: 31-40% pinyon-juniper cover <8m; 6-20% shrub cover; <20% herbaceous cover; 130+ yrs
- U-*ES*: **Early-Shrub**: 20-50% cover snakeweed or rabbitbrush species
- U-*TE***: Tree-Encroached**: 31-40% pinyon-juniper cover 10-25m; <5% shrub cover; <5% herbaceous cover
- U-*DP:* **Depleted**: 20-50% cover of mountain sage, mountain brush, occasional blackbrush; <5% herbaceous cover; <10% conifer sapling cover
- U-*SEP:* **Shrub-Exotic-Species-Perennial-Grass**: 11-50% cover of mountain sage, mountain brush, occasional blackbrush; >5% cover of native grass; >5% cheatgrass cover; <10% conifer sapling cover
- U-*SES:* **Shrub-Exotic-Species**: 11-50% cover of mountain sage, mountain brush, occasional blackbrush; ≥5% cheatgrass cover; ≤5% cover of native g
  ass; <10% conifer sapling cover
- U-*EX:* **Exotic-Species**; 10-30% cover of cheatgrass; snakeweed or rabbitbrush may be present
- U-*TEX:* **Tree- Exotic-Species:** 31-40% pinyon-juniper cover <8m; ≥5% cover of cheatgrass; <20% shrub cover; <20% herbaceous cover
- U-*SD:* **Seeded (native)**: >10% seeded native grasses, forbs, and shrubs

Reference Condition:

- **Natural Range of Variability**
  - 30%: A-*Early*
  - 47%: B-*Mid-open*
  - 20%: C-*Mid--closed*
  - 1%: D-*Late-open*
  - 2%: E-*Late-closed*
  - 0%: U

Succession:

Succession follows the 5-box pathway with vegetation starting as predominantly herbaceous and ending

with pinyon and juniper dominance and a viable shrub and herbaceous understory. The succession pathway is not entirely deterministic as the *tree-invasion* probabilistic disturbance is used to cause a transition from the mid-succession closed (*BSu-C*) to the late-succession open (*BSu-D*) classes. This rate of transition is 0.01 probability/year pixels starting at age 100 in the mid-succession closed class (BSu-*C*). This rate is consistent with the transition from Phase 1 to Phase 2 by Miller and Tausch (2001): this rate approximately replicated encroachment levels proceeding in three phases of about 50 years each. Deterministic succession transitions occur at the following ages:

- Early-succession to mid-succession open: 19 years
- Mid-succession open to closed: 75 years
- Mid-succession closed to late-succession open: ≥100 years (probabilistic)
- Late-succession open to closed: 134 years

Natural Disturbances:

Replacement fire was the primary stochastic disturbance. *Replacement fire* restarts the succession clock at age zero within the reference condition, which was labeled the *early-succession* or *BSu-A* class. The mean return interval of *replacement fire* changed with vegetation classes:

- 80 years (0.0125/year) in the *early-succession* class (*BSu-A*);
- 50 years (0.02/year) in the *mid-succession classes* and *late-succession open* classes (*BSu-B*, *BSu-C* and *BSu-D*); and
- 75 years (0.013/year) in the wooded *late-succession closed* class (*BSu-E*).

Replacement fire in vegetation classes that already experienced a threshold transition also caused a threshold transition to other uncharacteristic classes:

- Fire in the *tree-encroached shrubland* (*TE*) has a mean fire return interval of 120 years (0.0085/year) and causes the following transitions:
  - 45% of times *to the exotic species* class (*EX*);
  - 45% to the *early shrub* class (*ES*); and
  - 10% to the *shrub exotic species class* (*SES*).
- Fire in the *tree-encroached shrubland with exotic annual species class* (*TEX*) has a mean fire return interval of 120 years (0.0085/year) and causes a transition to the *exotic species* class (*EX*) 45% of times.
- The *depleted shrubland* class (*DP*) burns with a 50-year return interval (0.02/year) and converts to the *early shrub* class (*ES*). Fire in this latter class (50-year fire return interval) simply promotes rabbitbrush as a self-loop for 100% of outcomes.
- A 10-year fire cycle applies to the *exotic species* class (*EX*) and behaves as a self-loop.
- Due to the presence of non-native annual species, the fire return interval is shorter (25 years or 0.04/year) in the *shrub with exotic annual species* class (*SES*) than in the *depleted shrub* class (*DP*). Fire in this class causes a conversion to the *exotic-species* class (*EX*).
- With a *replacement fire* of 25 years (0.04/year), the *shrubland with exotic annual and native perennial grasses* class (*SEP*) will become two classes:
  - *Exotic annual species* (*EX*) 90% of times; and
  - *Early-succession* class (*BSu-A*) the other 10% of occurrences.
- *Replacement fire* varied with the age of the *seeded* class (SD) and acted as a self-loop:

- 80-year fire return interval (0.0125/year) from 0 to 19 years and after age 135 years; and
- 50-year fire return interval (0.02/year) from 20 to 134 years.

Drought is found in most classes and causes stand replacing events (generally 10% of times) or stand thinning (90% of times). In most cases *drought* created tree and shrub mortality under the assumption that prolonged and decreased soil moisture weakens plants that might ultimately be killed by insects or disease. Therefore, we did not double-count mortality. A *drought* return interval rate of every 178 years (a rate of 0.0056/year) is used based on the frequency of severe drought intervals estimated by Biondi *et al*. (2007) from 2,300 years of western juniper (*Juniperus occidentalis)* tree ring data from the Walker River drainage of eastern California and western Nevada. Although we recognize that droughts may be more common than every 178 years, severe droughts, which were >7-year drought events with consecutive far-below average soil moisture (narrow tree rings), kill naturally drought resistant shrubs and trees. For vegetation classes in the reference condition, drought affects the *mid-succession closed* (*BSu-C*) to *late-succession* closed (*BSu-E*) classes (i.e., not the first two classes of succession) in different ways.

- The *mid-succession closed* class (*BSu-C*) follows the more traditional outcome of 90% thinning within the class (to its beginning) and 10% to the *early-succession* class (*BSu-A*).
- Drought partitions the *late-succession open* class (*BSu-D*) into three pathways that results from thinning young pinyon, juniper, or old shrubs:
  - 10% thinning within the class;
  - 60% thinning to the previous class (*mid-succession closed* or *BSu-C*); and
  - 30% to the *mid-succession open* class (*BSu-B*).
- The *late-succession closed* class (BSu-*E*), which is wooded, behaves differently than others to drought. Because trees have already suppressed the understory,
  - 10% of the thinning effect kills trees but releases shrubs and grass at a low cover value more typical of the *mid-succession open* class (*BSu-B*); and
  - The remaining 90% of *drought* effects accelerates woody succession by 5 years when a pixel is chosen because increased resource competition is to the detriment of shrubs and the herbaceous understory.

Drought affects four uncharacteristic classes.

- D*rought* in the *depleted* shrubland class (*DP*) causes a transition to:
  - *Early-succession shrub* (*ES*) 10% of times; and
  - Selectively thins older shrubs to age zero within the *depleted* class (*DP*) 90% of times.
- The fate of the *shrub-exotic-species* class (*SES*) is similar to the *depleted shrubland* class (*DP*) except the *exotic annual species* class *(EX*) replaces *early-succession shrubs* (*ES*).
- Drought thins the *tree-encroached shrubland with exotic annual species* (*TEX*) to two classes:
  - 10% to the *exotic annual species* class (*EX*); and
  - 90% as a self-loop to the beginning of the class.
- The *tree-encroached shrubland* class (*TE*) is thinned by drought:
  - 5% of times to the *early-shrub* class (*ES*);
  - 5% to the *exotic annual species* class (*EX*); and
  - 90% of times vegetation remained in the originating class.

- The *shrubland with mixed exotic annual species and perennial grasses* class (*SEP*) responds to drought by thinning to the following classes:
  - 1% to the *early-succession* class (*BSu-A*);
  - 9% to the *exotic species* class (*EX*); and
  - 90% as a self-loop.
- Drought also affects the *seeded* class (*SD*) by setting age back to zero.

Exotic annual species invasion (*EX-invasion*) is set at a moderate rate of 0.005/year (1 out of 200 pixels converted to a cheatgrass-invaded class per year). A base rate of 0.001/year was estimated from data of northwest Utah collected by the Utah Division of Wildlife Resources in black sagebrush semi-desert. Black sagebrush semi-desert is usually considered more resistant to cheatgrass invasion than Wyoming big sagebrush semi-desert or other big sagebrush dominated ecological systems. Because workshop participants did not have similar data, we defaulted to five times the rate estimated from the Utah data. The higher rates indicate greater susceptibility to non-native annual species because soils are more productive.

- Exotic annual species invasion (*EX-invasion*) starts in the mid-succession open class (*BSu-B*) and continues in the *late-succession open* class (*BSu-D*), causing a transition to the *shrubland with mixed exotic annual species and perennial grasses* class (*SEP*).
- *Exotic annual species invasion* is absent from the *late-succession closed* (wooded; *BSu-E*) and the *tree-encroached class* (*TE*) due to shading.
- The *depleted shrub* (*DP*) converts to the *shrub with non-native annual grass* class (*SES*) with *exotic annual species invasion* at a rate of 0.005/year.
- The rate of invasion in the *seeded* class, generally 0.005/year, was smaller from ages 20 to 134: 0.001/year because the class is more resistant to exotic annual species invasion.

Management Actions:

Modeled management activities included herbicide coupled with native plant seeding or thinning.

- Herbicide (Plateau®) application to control exotic annual grasses in exotic annual grassland and forblands (i.e., burned areas) followed by seeding native plant species. Failure rate is 20%, leading to the *exotic annual species* class (*EX*). Success causes a transition to the *seeded* class (*SD*).
- Chainsaw thinning of older trees in *tree-encroached shrublands with or without exotic annual species* (*TE and TEX*), conducting herbicide application for exotic annual species, and followed by seeding native plant species. Failure rate is 20%, causing a transition *exotic annual species* class (*EX*) if the originating class was *TEX* or a transition to the *early shrub* class (*ES*).

In theory, other management actions, such as prescribed fire, can be used. Because the big sagebrush steppe-upland ecological system is at elevations with heavy presence of exotic annual species and near housing in the Red Cliffs NCA, prescribed fire is avoided.

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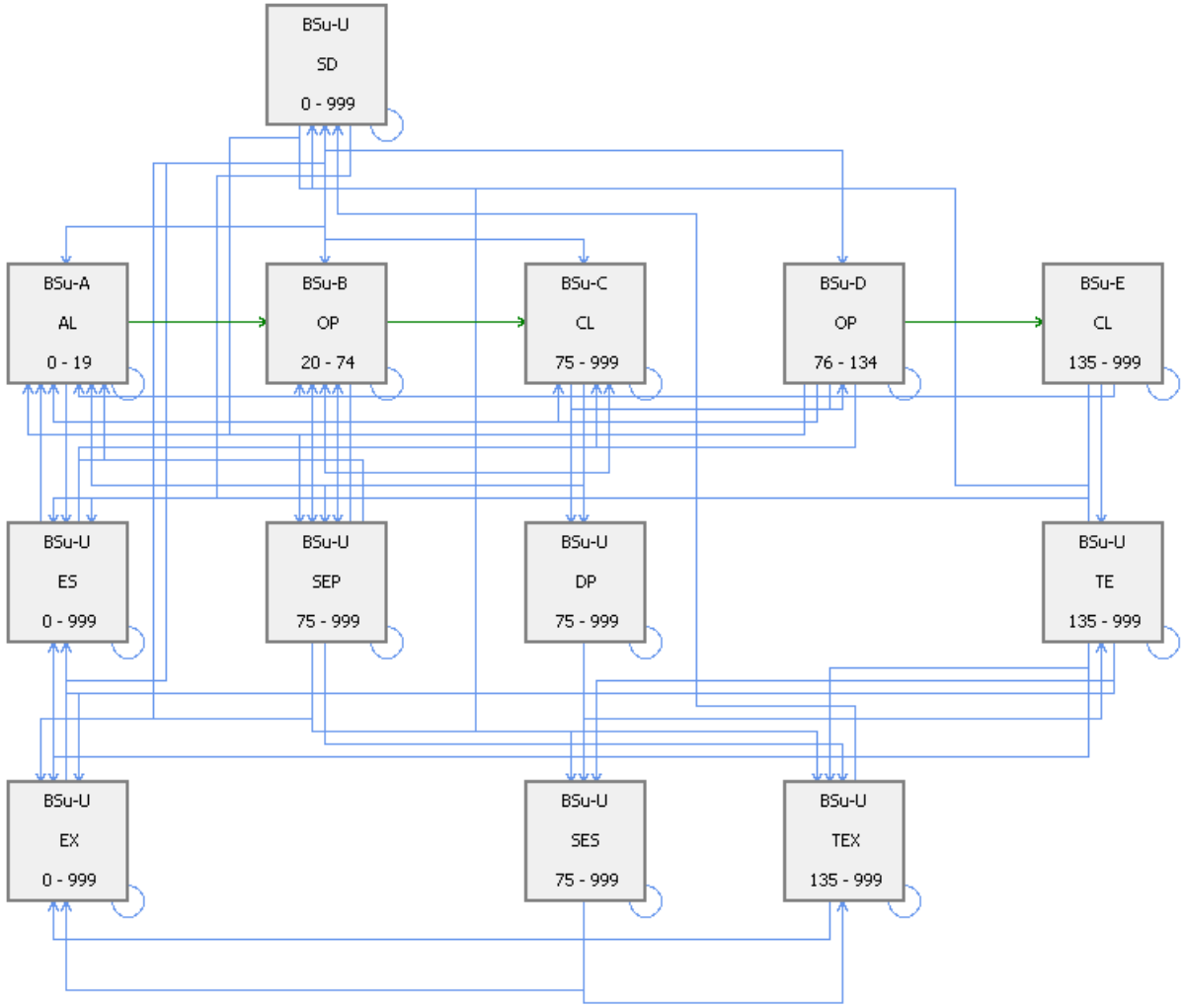
State-and-Transition Model:



Blackbrush-mesic (BM) 1082m

Area of Application and Context:

- **Red Cliffs and Beaver Dam Wash National Conservation Areas of southwestern Utah**
- **Livestock grazing on Beaver Dam Wash only**
- **Full fire suppression management**
- **Date created: July 2011**

Vegetation classes:

Two versions of mesic blackbrush were developed at the request of stakeholders: with and without Joshua Trees. USDA's Natural Resource Conservation Service (NRCS), however, does not recognize Joshua tree woodlands as a distinct ecological site because the soils on which Joshua tree grow are the same the soils as creosotebush-white bursage, thermic and mesic blackbrush, and Great Basin mixed salt desert ecological sites. Joshua tree is absent from the Red Cliffs NCA and from some areas of the Beaver Dam Wash NCA (thus boxes B, E, and U-*SEPJ* below do not exist). Joshua tree is present in a large fraction o f the Beaver Dam Wash NCA and the description below applies in its entirety:

- **A-Early**: 0-199 yrs; 0-40% cover of snakeweed, rabbbitbrush, big sagebrush, turpentine bush, yucca, and desert bitterbrush; young blackbrush may be present
- **B-Mid-closed**: 200+ yrs; 10-50% cover blackbrush <1.0m; >1% cover of young Joshua trees; <10% cover of grasses (desert needlegrass, Indian ricegrass, galleta grass, fluff grass, and threeawn); other shrubs present, pinyon or juniper saplings present
- C-**Mid-open**: 200+ yrs; 10-50% cover blackbrush <1.0m; Joshua trees **absent**; <10% cover of grasses (desert needlegrass, Indian ricegrass, galleta grass, fluff grass, and threeawn); other shrubs present, pinyon or juniper saplings present
- D-**Late-open**: 400+ yrs; 10-40% of pinyon or juniper; 5-40% blackbrush cover; Joshua trees **absent**; <10% cover of grasses (desert needlegrass, Indian ricegrass, galleta grass, fluff grass, and threeawn); other shrubs present
- E-**Late-closed**: 400+ yrs; 10-40% of pinyon or juniper; 5-40% blackbrush cover; >1% cover of Joshua trees; <10% cover of grasses (desert needlegrass, Indian ricegrass, galleta grass, fluff grass, and threeawn); other shrubs present
- U-*ES:* **Early-Shrub**; 20-50% cover of cholla, snakeweed or rabbitbrush species
- U-*SEPJ:* **Shrub-Exotic-Species-Perennial-Grass-Joshua-Tree**; 10-50% cover of blackbrush or other shrubs <1.0m tall; 5-20% exotic species (*Bromus rubens, Bromus tectorum*, *Erodium cicutarium*) cover; >1% cover of Joshua trees; ≥5% native grass cover
- U-*SEP:* **Shrub-Exotic-Species-Perennial-Grass**; 10-50% cover of blackbrush or other shrubs <1.0m tall; Joshua trees **absent**; 5-20% exotic species (*Bromus rubens, Bromus tectorum*, *Erodium cicutarium*) cover; ≥5% native grass cover
- U-*SES:* **Shrub-Exotic-Species**; 10-40% cover of blackbrush or other shrubs <1.0m tall, 5-20% exotic species (*Bromus rubens, Bromus tectorum*, *Erodium cicutarium*) cover; <5% native grass cover
- U-*TEX:* **Tree- Exotic-Species**; 10-40% of pinyon or juniper; >5% exotic species (*Bromus rubens, Bromus tectorum*, *Erodium cicutarium*) cover; <20% blackbrush cover; Joshua trees may be present
- U-*EX:* **Exotic-Species**; >10% exotic species (*Bromus rubens, Bromus tectorum*, *Erodium cicutarium*) cover;

<10% cover of blackbrush or other shrubs; unburned and charred Joshua tree may be present

- U-*EX2B:* **Exotic-Species-2nd-Burn**; identical to U-*EX*, except that it has experienced a second burn.
- U-*SD:* **Seeded (native)**; >10% seeded native grasses, forbs, and shrubs
- U-*SDI:* **Seeded (introduced)**; >10% seeded non-native grasses, forbs, and shrubs
- U-*PL:* **Planted;** >5% planted shrubs and perennial herbaceous species; <5% non-native annual grasses and forbs
- U-*BG:* **Bare ground**; mineral soil exposed by human disturbances

Reference Condition:

- **Natural Range of Variability without Joshua tree**
  - 11%: A-*Early*
  - 0%: B-*Mid-closed*
  - 73%: C-*Mid-open*
  - 16%: D-*Late-open*
  - 0%: E-*Late-closed*
  - 0%: U
- **Natural Range of Variability with Joshua tree**
  - 10%: A-*Early*
  - 39%: B-*Mid-closed*
  - 35%: C-*Mid-open*
  - 8%: D-*Late-open*
  - 8%: E-*Late-closed*
  - 0%: U

Succession:

Succession varies with the presence of Joshua trees.

In the absence of Joshua trees, succession follows the 3-box pathway with vegetation starting as predominantly dominated by snakeweed and herbaceous species and ending with pinyon or juniper dominance and a viable shrub understory. Deterministic succession transitions occur in the first two boxes, whereas the last step of succession is probabilistic:

- Early-succession to mid-succession open: 200 years
- Mid-succession open to late-succession open: ≥400 years (probabilistic)

With Joshua trees, succession is a 5-box model with parallel open and closed branches originating from the *early-succession* class (*BM-A*). Deterministic transitions govern succession between the *early-succession* (BM-A) and both *mid-succession* classes (*BM-B* and *BM-C*). The deterministic transition is not a true succession and reflects a partitonning of acres proportional to the current area without and with Joshua tree. *Tree-invasion* acts as a probabilistic succession disturbance between the mid-succession and late-succession classes.

- Early-succession to mid-succession open and closed: 200 years

- Mid-succession open or closed, respectively, to late-succession open or closed: ≥400 years (probabilistic)

Natural Disturbances:

Very few natural disturbances affect blackbrush: replacement fire, drought, and tree invasion. Blackbrush is an ancient vegetation type whose individual plants resisted disturbances for hundreds of years (Pendleton et al. 1986). Moreover, blackbrush is not fire adapted and has not evolved with fire (Callison et al. 1985).

Replacement fire is present at very low rates in most classes. The fire return interval of *replacement fire* changes with vegetation classes:

- From 10,000 years (0.0001/year) in the *early-succession* class (*BM*-A);
- 2,000 years (0.0005/year) in both *mid-succession with or without Joshua tree* classes (*BM-B and BM-C*); and
- 1,000 years (0.001/year) in both wooded *late-succession with or without Joshua tree* classes (*BM-D and BM-E*).

Replacement fire in vegetation classes that already experienced a threshold transition also causes a threshold transition to other uncharacteristic classes.

- Fire experienced every 400 years (0.0025/year) on average in the *tree encroached shrubland with exotic annual species* class (*TEX*) causes a transition to the *exotic annual species* class (*EX*).
- The *shrubland with mixed exotic annual and native perrennial species* class (*SEP*) burns every 200 years (0.005/year) on average, causing a transition to the *once-burned exotic annual species* class (*EX*) or twice-*burned exotic annual species* class (*EX2B*), respectively, for shrubland with previously unburned and burned (i.e., absent) blackbrush.
- The *twiced-burned exotic annual species* class (*EX2B*) and *once-burned exotic annual species* class (*EX*) *classes* burn every 10 years (0.1/year) on average from ages 0 to 20 years classes (self loop), whereas the *EX* class older than 20 years burns every 20 years on average. When the *once-burned exotic annual species* class (*EX*) class burns, it becomes the twice-*burned exotic annual species* class (*EX2B*) from which shrub natural recovery is nearly impossible without dedicated management.
- *Planted* (*PL*) and *seeded* (*SD*) classes, whose exotic annual fine fuel component is temporally suppressed, burn every 1,000 years (0.001/year). These classes transition to age zero in the same class (this possibility is very remote because residence time in these classes is short due to exotic annual seedbank emergence).

Blackbrush is assumed drought adapted. Older reference classes with juniper and pinyon and some uncharacteristic classes are affected. *Drought* causes stand replacing events (generally 1% to 10% of events) and stand thinning (99% to 90%, respectively, of events) in classes with trees. A *drought* return interval rate of every 178 years (a rate of 0.0056/year) is used based on the frequency of severe drought intervals estimated by Biondi *et al*. (2007) from 2,300 years of western juniper (*Juniperus occidentalis)* tree ring data from the Walker River drainage of eastern California and western Nevada.

Although we recognize that droughts may be more common than every 178 years, severe droughts, which are >7-year drought events with consecutive far-below average soil moisture (narrow tree rings), kill naturally drought resistant shrubs and trees.

- For the *late-succession closed with Joshua tree* class (*BM-E*), drought-induced mortality either:
  - Causes a transition to the previous succession class (*BM-B*) 99% of times by thinning juniper and pinyon; or
  - Kills shrubs and trees as a rare stand replacing event (1% of events), causing a transition to the *early succession* class (*BM-A*).
- For the *late-succession open without Joshua tree* class (*BM-D*), drought-induced mortality either:
  - Causes a transition to the previous succession class (*BM-C*) 99% of times by thinning juniper and pinyon; or
  - Kills shrubs and trees as a rare stand replacing event (1% of events) causing a transition to the *early succession* class (*BM-A*).
- The *tree-encroached shrubland with exotic annual species* class (*TEX*) experiences drought with:
  - Thinning back to age 400 years within the class for about 90% of times. We chose 90% thinning, as opposed to 99%, because trees are at the elevational lower limit of their tolerance to warmer climate and competition for soil mositure is assumed more intense among denser tree stands.
  - The remaining 10% of drought mortality is partitonned as 1% going to the *once-burned exotic annual species* class (*EX*) and 9% to the *mid-succession* classes (reflecting their landscape proportions of 5.7% and 3.3%, respectively, for *shrubs with exotic annual species with and without Joshua trees* [*SEPJ* and *SEP*]).
- The *shrubs with exotic annual species with and without Joshua trees* classes (respectively, *SEPJ* and *SEP*) each experience drought following:
  - The self-thinning proportion of 99% (and woody succession reversal to the beginning ages of the class); and
  - Transition to the *once-burned exotic annual grassland and forbland* class (*EX*) for the remaining 1% of events.
- The *seeded* (*SD*), but not the *planted* (*PL*) class:
  - Is thinned by drought within the class causing a reversal of woody succession 90% of times; whereas
  - The remaining 10% of times the transition is to the *once-burned exotic annual grassland and forbland* class (*EX*). We use a 10% stand-replacing event proportion to reflect that plantings are more fragile than natural shrublands.

Tree (pinyon and juniper) invasion is responsible for the last succession step between both *mid-succession* classes (*BM-B* and *BM-C*) and their respective *late-succession* classes (*BM-E* and *BM-D, respectively*). This disturbance also determines succession between both *shrubland with mixed exotic annual and native perrennial species* classes (*SEP* and *SEPJ*) and the *tree-encroached shrubland with exotic annual species* class (*TEX*). Pinyon and juniper invade shrublands at a rate 0.0025/year after 400 years of age.

A few anthropogenic disturbances cause accelerated woody succession in reference classes and

transitions to uncharacteristic classes of vegetation.

Present only in Beaver Dam Wash NCA, *managed herbivory* and *excessive herbivory* have return intervals of one year (livestock is present every year) but different impact areas based on the distance livestock is willing to travel away from water. The impact of grazing is modeled with fixed rates of implementation (around an average) because grazing permits have fixed stocking rates, season of use, distribution. It is assumed that *managed herbivory* utilizes 5% of all grazable areas in the Beaver Dam Wash NCA (not just blackbrush); therefore, only 5% of the area is selected for *managed herbivory* and vegetation classes in blackbrush "compete" for selection. This method of modeling livestock grazing can only be implemented with the PATH software; VDDT cannot achieve landscape-level disturbances. Similarly, *excessive herbivory* affects 0.1% of the Beaver Dam Wash NCA causing a transition to the *early shrub* class (ES); however, *excessive herbivory* is caused by the movement of livestock through the same areas near or on the way to water sources. Therefore, once areas dominated by early shrubs are created, they become permanent and no new areas are created unless watering sources are moved or created. As a consequence, 0.1% of the Beaver Dam Wash is chosen among candidate vegetation classes to become the *early shrub* class (*ES*) in the first years of simulations, and then the process is stopped.

Managed herbivory causes the following:

- Accelerates woody succession by
  - One year in the *early-succession* class (*BM-A*) and *once-burned exotic annual grassland and forbland* class (*EX*); and
  - Three years in other classes through consumption of palatable herbaceous species.
- The *tree-encroached shrubland with exotic annual species* class (*TEX*) is not grazed.
- *Managed-herbivory* in the *planted* (*PL*) or *seeded* (*SD*) classes causes a transition to the *once-burned exotic annual grassland and forbland* class (*EX*).

Excessive herbivory is present in the *early-succession (BM-A), mid-succession closed* (*BM-B*), *midsuccession-open* (*BM-C*), *shrubland with mixed exotic annual species and perennial grasses* (*BM-SEP* and *BM-SEPJ*), *once-burned exotic annual grassland and forbland* class (*EX*), *planted* (*PL*), and *seeded* (*SD*) classes. The disturbance only causes a transition to the *early shrub* class (*ES*) during the first five years of simulation.

Exotic invasion affects the reference (*BM-A*, *BM-B*, *BM-C, BM-D,* and *BM-E*), *early-shrub* (*ES*), *planted* (*PL*) and, *seeded* classes at a rate of 0.005/year. We chose an invasion rate equal to that of the big sagebrush steppe-upland ecological system because of the mesic condition of the blackbrush ecological system.

- Before age 5, e*xotic invasion* of the *early-succession* class (*BM-A*) causes a transition to the *exotic annual species* class (*EX*); whereas
- After age 5, the transition will be to both *shrubland with mixed exotic annual species and perennial grasses* classes (*BM-SEP* and *BM-SEPJ*) (if Joshua tree is present, the transiton is partitonned according to the proportion of Joshua tree *versus* no Joshua tree in the ecological system).
- The *planted* class (*PL*) transitions to both *shrubland with mixed exotic annual species and perennial grasses* classes (*BM-SEP* and *BM-SEPJ*) as above.
- The *seeded* class (*SD*) converts to the *once-burned exotic annual grassland and forbland* class

(*EX*).

Seedbank-emergence is a disturbance specific to the *planted* (*PL*) and *seeded* (*SD*) classes. These classes are created with an application of herbicide or biocide that inhibits germination, thus controlling exotic annuals. In the Mojave Desert, the duration of the herbicide or biocide's residual effect is 2-3 years. Therefore, the seedbank emerges at a high rate of 0.2/year (it takes about 5+ years for full conversion) after this period:

- The planting reverts to either *shrubland with mixed exotic annual species and perennial grasses* classes (*BM-SEP* and *BM-SEPJ*) classes; and
- The seeding transforms to the o*nce-burned exotic annual forbland and forbland* class (*EX*).

Natural-recovery is also a disturbance specific to the *planted* (*PL*) and *seeded* (*SD*) classes. After 20 years in these classes without 10 years of consecutive grazing from age 10 to 20, the class will transition to the *early-succession* class (*BM-A*).

The *Utilities* disturbance is predominantly the establishment of right-of-ways (pipelines and powerlines) made of excavated or cleared areas that become the *once-burned exotic annual forbland and forbland* (*EX*) class. The rate is low (0.0001/year) and present in all classes.

The *OHV* disturbance creates the *bare ground* class (*BG*) from illegal recreational use of off-highway vehicles. All classes are source classes. The rate is 10% of 0.0001/year to reflect that users predominantly reuse existing disturbed areas and only incrementally add new areas of illegal driving.

Management Actions:

Modeled management activities included fuel breaks, livestock closure (localized), law-enforcement, cessation of livestock grazing, and herbicide or fingers-of-death used alone and coupled with native plant seeding and planting:

- Fuel breaks are 250 feet wide strips of vegetation aerially sprayed with herbicide (Plateau®) to remove the continuous fine fuel beds created by exotic annual species. Strips are placed throughout the landscape and benefit all ecological systems by slowing or stopping wildfires. Spraying is only conducted during years of higher precipitation (perhaps following a 7-year El Nino cycle) or during of years of seedbank emergence not associated with high precipitation.
- Livestock-closure is a landscape-level treatment of the Beaver Dam Wash NCA that is applied to seedings and plantings. Closure results in the protection of seedings and plantings from livestock grazing for 10 consecutive years to the extent that enough resources (funding) allow it. Funding is shared with other ecological systems.
- Law enforcement only affects the creation of one vegetation class from OHV activity in several ecological systems of the Beaver Dam Wash NCA: *bare groud* (*BG*). Increased law-enforcement reduces the OHV disturbance by 50% (to 5% from 10%) using a static transition multiplier in PATH.
- Complete cessation of livestock grazing of the Beaver Dam Wash NCA was achieved by setting the static transition multiplier (in PATH) for livestock grazing to zero.
- Herbicide (Plateau®) application to control exotic annual grasses in the *once-burned and twice-burned exotic annual grassland and forblands* classes (*EX* and *EX2B*) followed by seeding native plant species with the current mix of seed sources. Failure rate is 99%, leading to the *exotic annual*

grassland and forblands class (*EX*). Success causes a transition to the *seeded* class (*SD*).

- Herbicide (Plateau®) application to control exotic annual grasses in *once-burned and twice-burned exotic annual grassland and forblands* classes (*EX* and *EX2B*) followed by seeding native plant species with new high-performance cultivars whose commercial release is scheduled to be 20 years in the future. Failure rate is 95%, leading to the *exotic annual grassland and forblands* class (*EX*). Success causes a transition to the *seeded* class (*SD*).
- Herbicide (Plateau®) application to control exotic annual grasses in *once-burned and twice-burned exotic annual grassland and forblands* classes (*EX* and *EX2B*) followed by planting of containerized native shrubs and forbs. Failure rate is 25%, leading to the *exotic annual grassland and forblands* class (*EX*). Success causes a transition to the *planted* class (*SD*).
- Fingers-of-death fungi application to control exotic annual species in the *shrubland with mixed exotic annual and perennial grass species (SEP*) and *shrubland with mixed exotic annual, and perennial grass and Joshua tree (SEPJ*) classes. Failure rate is 25% to 75% (no change of class), whereas success causes a transition to the *mid-succession (BM-B* and *BM-C)* and *late-succession* classes (*BM-D* and *BM-E*) depending on the age of originating vegetation and the presence of Joshua tree in the originating class.
- Fingers-of-death fungi application to control exotic annual grasses in *once-burned and twice-burned exotic annual grassland and forblands* classes (*EX* and *EX2B*) followed by seeding native plant species with new high-performance cultivars whose commercial release is scheduled to be 20 years in the future. Failure rate is 95%, leading to the *exotic annual grassland and forblands* class (*EX*), because seedling establishment and survival remains the limiting factor even with the fingers-of-death fungi. Success causes a transition to the *seeded* class (*SD*).
- Fingers-of-death fungi application to control exotic annual grasses in *once-burned and twice-burned exotic annual grassland and forblands* classes (*EX* and *EX2B*) followed by planting of containerized native shrubs and forbs. Two levels of failure rates apply to the treatment. Failure rate of planting is 25% (no change in vegetation class), leading to the *exotic annual grassland and forblands* class (*EX*). Success causes a transition to the *planted* class (*PL*). After shrubs and forbs are planted, the fungi-of-death fungi failure rate was tested at three different levels: 25%, 50%, and 75%. If the fingers-of-death fungi fails to control the seedbank of exotic annual species, the *planted* class (*PL*) transitions to the *shrubland with mixed exotic annual and perennial grass species (SEP*) and *shrubland with mixed exotic annual and perennial grass, and Joshua tree (SEPJ*) classes. The amount of either class created depends on the proportion of area with and without Joshua tree in the ecological system. Success keeps vegetation in the *planted* class (*PL*) until either future invasion by exotic species or natural recovery to *early-succession* class (*BM-A*).

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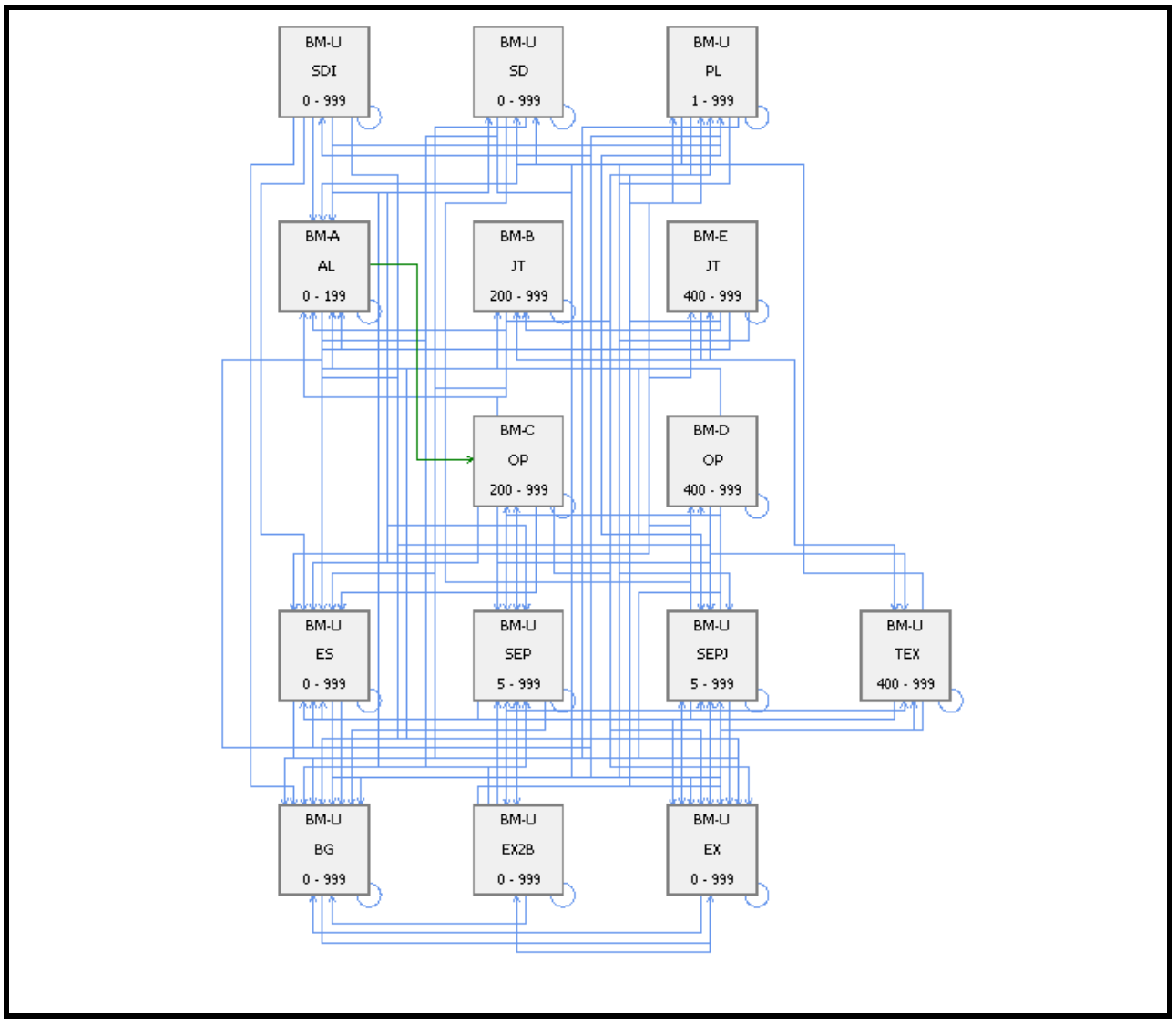
State-and-Transition Model:


BM-U
SDI
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BM-U
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BM-U
SEP
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Blackbrush - thermic (BT) 1082t

Area of Application and Context:

- **Red Cliffs and Beaver Dam Wash National Conservation Areas of southwestern Utah**
- **Livestock grazing on Beaver Dam Wash only**
- **Full fire suppression management**
- **Date created: July 2011**

Vegetation classes:

Two versions of thermic blackbrush were developed at the request of stakeholders: with and without Joshua Trees. USDA's Natural Resource Conservation Service (NRCS), however, does not recognize Joshua tree woodlands as a distinct ecological site because the soils on which it grows are the same the soils as creosotebush-white bursage, thermic and mesic blackbrush, and Great Basin mixed salt desert ecological sites. Joshua tree is absent from the Red Cliffs NCA and from some areas of the Beaver Dam Wash NCA (thus boxes B and U-*SEPJ* below do not exist). Joshua tree is present in a large fraction o f the Beaver Dam Wash NCA and the description below apply in its entirety:

- *BM-A:* **Early**; 0-50% cover of snakeweed, turpentine bush, yucca; <10% cover blackbrush; 0-499 yrs
- *BM-B:* **Late-closed**; 10-40% cover blackbrush <1.0m; creosotebush present; >1% cover of Joshua trees; 0-10% cover of grasses (desert needlegrass, Indian ricegrass, galleta grass, fluff grass, and threeawn), other shrubs present; 500+ yrs
- *BM-C*: **Late-open**; 10-40% cover blackbrush <1.0m; creosotebush present; 0-10% cover of grasses (desert needlegrass, Indian ricegrass, galleta grass, fluff grass, and threeawn); other shrubs present; 500+ yrs
- *U-ES:* **Early-Shrub**; 20-50% cover of cholla, snakeweed or rabbitbrush species
- *U-SEPJ:* **Shrub-Exotic-Species-Perennial-Grass-Joshua-Tree**; 10-40% cover of blackbrush or other shrubs <1.0m tall, 5-20% exotic species (*Bromus rubens, Bromus tectorum*, *Erodium cicutarium*) cover; >1% cover of Joshua trees; ≥5% native grass cover
- *U-SEP:* **Shrub- Exotic-Species-Perennial-Grass**; 10-40% cover of blackbrush or other shrubs <1.0m tall, 5-20% exotic species (*Bromus rubens, Bromus tectorum*, *Erodium cicutarium*) cover; Joshua trees **absent**; ≥5% native grass cover
- *U-SES:* **Shrub-Exotic-Species**; 10-40% cover of blackbrush or other shrubs <1.0m tall, 5-20% exotic species (*Bromus rubens, Bromus tectorum*, *Erodium cicutarium*) cover; <5% native grass cover
- *U-EX:* **Exotic-Species**; >10% exotic species (*Bromus rubens, Bromus tectorum*, *Erodium cicutarium*) cover; <10% cover of blackbrush or other shrubs; unburned and charred Joshua tree may be present
- *U-EX2B:* **Exotic-Species-2nd-Burn**; identical to U-*EX*, except that it has experienced a second burn.
- *U-PL:* **Planted;** >5% planted shrubs and perennial herbaceous species; <5% non-native annual grasses and forbs
- *U-BG:* **Bare ground**; mineral soil exposed by human disturbances

Reference Condition:

- **Natural Range of Variability without Joshua tree**

- 5%: A-*Early*
- 0%: B-*Mid-closed*
- 95%: C-*Mid-open*
- 0%: U

- **Natural Range of Variability with Joshua tree**
  - 5%: A-*Early*
  - 48%: B-*Mid-closed*
  - 47%: C-*Mid-open*
  - 0%: U

Succession:

Succession varies with the presence of Joshua trees.

In the absence of Joshua trees, succession follows the 2-box pathway with vegetation starting as predominantly dominated by snakeweed and herbaceous species and ending with a shrublands with a significant cover of blackbrush. Deterministic succession transitions occur between the first two boxes:

- Early-succession to mid-succession open: 500 years

With Joshua trees, succession is a 3-box model with parallel open and closed branches originating from the *early-succession* class (*BT-A*). Deterministic transitions govern succession between the *early succession* (*BM-A*) and both *mid-succession* classes (*BM-B* and *BM-C*). The deterministic transition is not a true succession and reflects a partitonning of acres proportional to the current area without and with Joshua tree.

- Early-succession to mid-succession open and closed: 500 years

Natural Disturbances:

Very few natural disturbances affect thermic blackbrush: replacement fire and drought. Blackbrush is an ancient vegetation type whose individual plants resisted disturbances for hundreds of years (Pendleton et al. 1986). Moreover, blackbrush is not fire adapted and has not evolved with fire (Callison et al. 1985).

Replacement fire was present at very low rates in most classes. The fire return interval of *replacement fire* was 10,000 years (0.0001/year) in all reference classes. *Replacement fire* in vegetation classes that already experienced a threshold transition also cause a threshold transition to other uncharacteristic classes:

- The *shrubland with mixed exotic annual and native perrennial species* classes (*SEP and SEPJ*) burn every 200 years (0.005/year) on average, causing a transition to the *once-burned exotic annual species* class (*EX*) or twice-*burned exotic annua species* class (*EX2B*), respectively, for shrubland with previously unburned and burned (i.e., absent) blackbrush (the arbitrary difference is an age of 500 years).
  - From ages 0 to 20 years, the *EX2B* and *EX* classes burn every 10 years (0.1/year) on

average (self loop);

- For vegetation older than 20 years, the *once-burned exotic annual species* class (*EX*) class burns every 20 years on average. When the EX class burns, it becomes the twice-*burned exotic annual species* class (*EX2B*) from which shrub natural recovery is nearly impossible without dedicated management.

- *Planted* (*PL*) and *seeded* (*SD*) classes, whose exotic annual fine fuel component is temporally suppressed, burn every 1,000 years (0.001/year) on average. Burned vegetation transitions to age zero in the same class (this possibility is very remote because residence in these classes is short due to exotic annual seedbank emergence).
- The *early-shrub* (*ES*) class also burns every 1,000 years (0.001/year) on average; resulting vegetation stays in the class and returns to age zero.

Blackbrush is drought adapted. Only uncharacteristic classes are affected. *Drought* causes stand replacing events (generally 1% to 10% of times) and stand thinning (99% to 90%, respectively, of times). A *drought* return interval rate of every 178 years (a rate of 0.0056/year) is used based on the frequency of severe drought intervals estimated by Biondi *et al*. (2007) from 2,300 years of western juniper (*Juniperus occidentalis)* tree ring data from the Walker River drainage of eastern California and western Nevada. Although we recognize that droughts may be more common than every 178 years, severe droughts, which are >7-year drought events with consecutive far-below average soil moisture (narrow tree rings), kill naturally drought resistant shrubs and trees.

- The *shrubland with mixed exotic annual and native perrennial species* classes (*SEP and SEPJ*) each experience drought with the self-thinning proportion of 99%, whereas vegetation transitons to the *once-burned exotic annual grassland and forbland* class (*EX*) for the remaining 1% of events.
- The same partitioning of drought effects applies to the *planted* (*PL*) class with 1% transitioning to the *once-burned exotic annual grassland and forbland* class (*EX*) and the remaining 99% staying in the *planted* (*PL*) class but at an age of zero.
- The *seeded* (*SD*) class is thinned by drought within the class causing a reversal of woody succession 90% of times, whereas the remaining 10% of times the transition is to the *once-burned exotic annual grassland and forbland* class (*EX*). We used a 10% stand-replacing event proportion to reflect that plantings are more fragile than natural shrublands.

A few anthropogenic disturbances cause accelerated woody succession in reference classes and some transition to uncharacteristic classes of vegetation.

Present only in Beaver Dam Wash NCA, *managed herbivory* and *excessive herbivory* have return intervals of one year (livestock is present every year) but different impact areas based on the distance livestock is willing to travel away from water. The impact of grazing is modeled with fixed rates of implementation (around an average) because grazing permits have fixed stocking rates, season of use, distribution. It is assumed that *managed herbivory* utilizes 5% of all grazable areas in the Beaver Dam Wash NCA (not just blackbrush); therefore, only 5% of the area is selected for *managed herbivory* and vegetation classes in blackbrush "compete" for selection. This method of modeling livestock grazing can only be implemented with the PATH software; VDDT cannot achieve landscape-level disturbances. Similarly, *excessive herbivory* affects 0.1% of the Beaver Dam Wash NCA causing a transition to the *early*

shrub class (ES); however, *excessive herbivory* is caused by the movement of livestock through the same areas near or on the way to water sources. Therefore, once areas dominated by early shrubs are created, they become permanent and no new areas are created unless watering sources are moved or created. As a consequence, 0.1% of the Beaver Dam Wash is chosen among candidate vegetation classes to become the *early shrub* class (*ES*) in the first years of simulations, and then the process is stopped.

Managed herbivory accelerates woody succession by:

- Two years in the *reference* classes (*BT-A, BT-B,* and *BT-C*) and both *shrubland with mixed exotic annual and native perrennial species* classes (*SEP and SEPJ*); and
- By one year in the *once-burned exotic annual grassland and forbland* class (*EX*) accelerates woody succession (succession to a shrub class too young to have blackbrush is likely), but has no effect in the *twice-burned exotic annual grassland and forbland* class (*EX2B*).

Managed-herbivory in the *planted* (*PL*) or *seeded* (*SD*) classes have different outcomes:

- A transition to the *once-burned exotic annual grassland and forbland* class (*EX*) for the highly exposed and vulnerable *planted* (*PL*) class; and
- A self loop with a one-year reversal of woody succession within the *seeded* (*SD*) class (the seeds of this class do not all emerge at once from the seedbank and become immediately vulnerable).

Excessive herbivory is present in the *early-succession (BT-A), mid-succession closed* (*BT-B*), *mid-succession-open* (*BT-C*), *shrubland with mixed exotic annual species and perennial grasses* (*BT-SEP* and *BT-SEPJ*), *once-burned exotic annual grassland and forbland* class (*EX*), *planted* (*PL*), and *seeded* (*SD*) classes. The disturbance only causes a transition to the *early shrub* class (*ES*) during the first five years of simulation.

Exotic invasion affects the reference (*BT-A*, *BT-B* [Beaver Dam Wash NCA only]), and *BT-C), bare ground* (*BG*), *early-shrub* (*ES*), *planted* (*PL*), and *seeded* (*SD*) classes at a rate of 0.005/year, the same as for mesic blackbrush.

- For the *early-succession* class (*BT-A*):
  - Before age 5, *exotic invasion* causes a transition to the *exotic annual grassland and forbland* class (*EX*); whereas
  - After age 5, the transition will be to both *shrubland with mixed exotic annual species and perennial grasses* (*BT-SEP* and *BT-SEPJ*) (if Joshua tree is present, the transiton is partitonned according to the proportion of Joshua tree *versus* no Joshua tree in the ecological system).
- The *planted* class (*PL*) converts to both *shrubland with mixed exotic annual species and perennial grasses* classes (*BT-SEP* and *BT-SEPJ*) as above,
- The *seeded* (*SD*) and *bare ground* (*BG*) classes transitions to the *once-burned exotic annual grassland and forbland* class (*EX*).

Seedbank-emergence is a disturbance specific to the *planted* (*PL*) and *seeded* (*SD*) classes. These classes are created with an application of herbicide or biocide that inhibits germination to control exotic annual species. In the Mojave Desert, the duration of the herbicide or biocide's residual effect is 2-3 years. Therefore, the seedbank emerges at a high rate of 0.2/year (it takes about 5+ years for full conversion) after this period:

- Plantings revert to both *shrubland with mixed exotic annual species and perennial grasses*

(*BT-SEP* and *BT-SEPJ*) classes; and

- Seedings transition to the *once-burned exotic annual forbland and forbland* (*EX*) class.

Natural-recovery is also a disturbance specific to the *planted* (*PL*) and *seeded* (*SD*) classes. After 20 years in these classes without 10 years of consecutive grazing from age 10 to 20, the class will transition to the *early-succession* class (*BT-A*) at a slow rate of 0.1/year (1 of 10 pixels per year).

The *Utilities* disturbance is predominantly the establishment of right-of-ways (pipelines and powerlines) made of excavated or cleared areas that become the *once-burned exotic annual forbland and forbland* (*EX*) class. The rate is low (0.0001/year) and present in all classes.

The *OHV* disturbance creates the *bare ground* (*BG*) class from illegal recreational use of off-highway vehicle, primarily in the Beaver Dam Wash NCA. All classes are source classes. The rate is 10% of 0.0001/year to reflect that users predominantly reuse existing disturbed areas and only incrementally add new areas of illegal driving.

Management Actions:

Modeled management activities included fuel breaks, livestock closure (localized), law-enforcement, cessation of livestock grazing, and herbicide or fingers-of-death used alone and coupled with native plant seeding and planting:

- Fuel breaks are 250 feet wide strips of vegetation aerially sprayed with herbicide (Plateau®) to remove the continuous fine fuel beds created by exotic annual species. Strips are placed throughout the landscape and benefit all ecological systems by slowing or stopping wildfires. Spraying is only conducted during years of higher precipitation (perhaps following a 7-year El Nino cycle) or during of years of seedbank emergence not associated with high precipitation.
- Livestock-closure is a landscape-level treatment of the Beaver Dam Wash NCA that is applied to seedings and plantings. Closure results in the protection of seedings and plantings from livestock grazing for 10 consecutive years to the extent that enough resources (funding) allow it. Funding is shared with other ecological systems.
- Law enforcement only affected the creation of one vegetation class from OHV activity in several ecological systems of the Beaver Dam Wash NCA: *bare groud* (*BG*). Increased law-enforcement reduces the OHV disturbance by 50% (to 5% from 10%) using a static transition multiplier.
- Complete cessation of livestock grazing of the Beaver Dam Wash NCA was achieved by setting the static transition multiplier for livestock grazing to zero.
- Herbicide (Plateau®) application to control exotic annual grasses in the *once-burned and twice-burned exotic annual grassland and forblands* classes (*EX* and *EX2B*) followed by seeding native plant species with the current mix of seed sources. Failure rate is 99%, leading to the *exotic annual grassland and forblands* class (*EX*). Success causes a transition to the *seeded* class (*SD*).
- Herbicide (Plateau®) application to control exotic annual grasses in the *once-burned and twice-burned exotic annual grassland and forblands* classes (*EX* and *EX2B*) followed by seeding native plant species with new high-performance cultivars whose commercial release is scheduled to be 20 years in the future. Failure rate is 95%, leading to the *exotic annual grassland and forblands* class (*EX*). Success causes a transition to the *seeded* class (*SD*).
- Herbicide (Plateau®) application to control exotic annual grasses in *once-burned and twice-burned exotic annual grassland and forblands* classes (*EX* and *EX2B*) followed by planting of containerized

native shrubs and forbs. Failure rate is 25%, leading to the *exotic annual grassland and forblands* class (*EX*). Success causes a transition to the *planted* class (*SD*).

- Fingers-of-death fungi application to control exotic annual species in the *shrubland with mixed exotic annual and perennial grass species (SEP*) and *shrubland with mixed exotic annual, and perennial grass and Joshua tree (SEPJ*) classes. Failure rate is 25% to 75% (no change of class), whereas success causes a transition to the *mid-succession (BT-B* and *BT-C)* and *late-succession* classes (*BT-D* and *BT-E*) depending on the age of originating vegetation and the presence of Joshua tree in the originating class.
- Fingers-of-death fungi application to control exotic annual grasses in *once-burned and twice-burned exotic annual grassland and forblands* classes (*EX* and *EX2B*) followed by seeding native plant species with new high-performance cultivars whose commercial release is scheduled to be 20 years in the future. Failure rate is 95%, leading to the *exotic annual grassland and forblands* class (*EX*), because seedling establishment and survival remains the limiting factor even with the fingers-of-death fungi. Success causes a transition to the *seeded* class (*SD*).
- Fingers-of-death fungi application to control exotic annual grasses in *once-burned and twice-burned exotic annual grassland and forblands* classes (*EX* and *EX2B*) followed by planting of containerized native shrubs and forbs. Two levels of failure rates apply to the treatment. Failure rate of planting is 25% (no change in vegetation class), leading to the *exotic annual grassland and forblands* class (*EX*). Success causes a transition to the *planted* class (*PL*). After shrubs and forbs are planted, the fungi-of-death fungi failure rate was tested at three different levels: 25%, 50%, and 75%. If the fingers-of-death fungi fails to control the seedbank of exotic annual species, the *planted* class (*PL*) transitions to the *shrubland with mixed exotic annual and perennial grass species (SEP*) and *shrubland with mixed exotic annual and perennial grass, and Joshua tree (SEPJ*) classes. The amount of either class created depends on the proportion of area with and without Joshua tree in the ecological system. Success keeps vegetation in the *planted* class (*PL*) until either future invasion by exotic species or natural recovery to *early-succession* class (*BM-A*).

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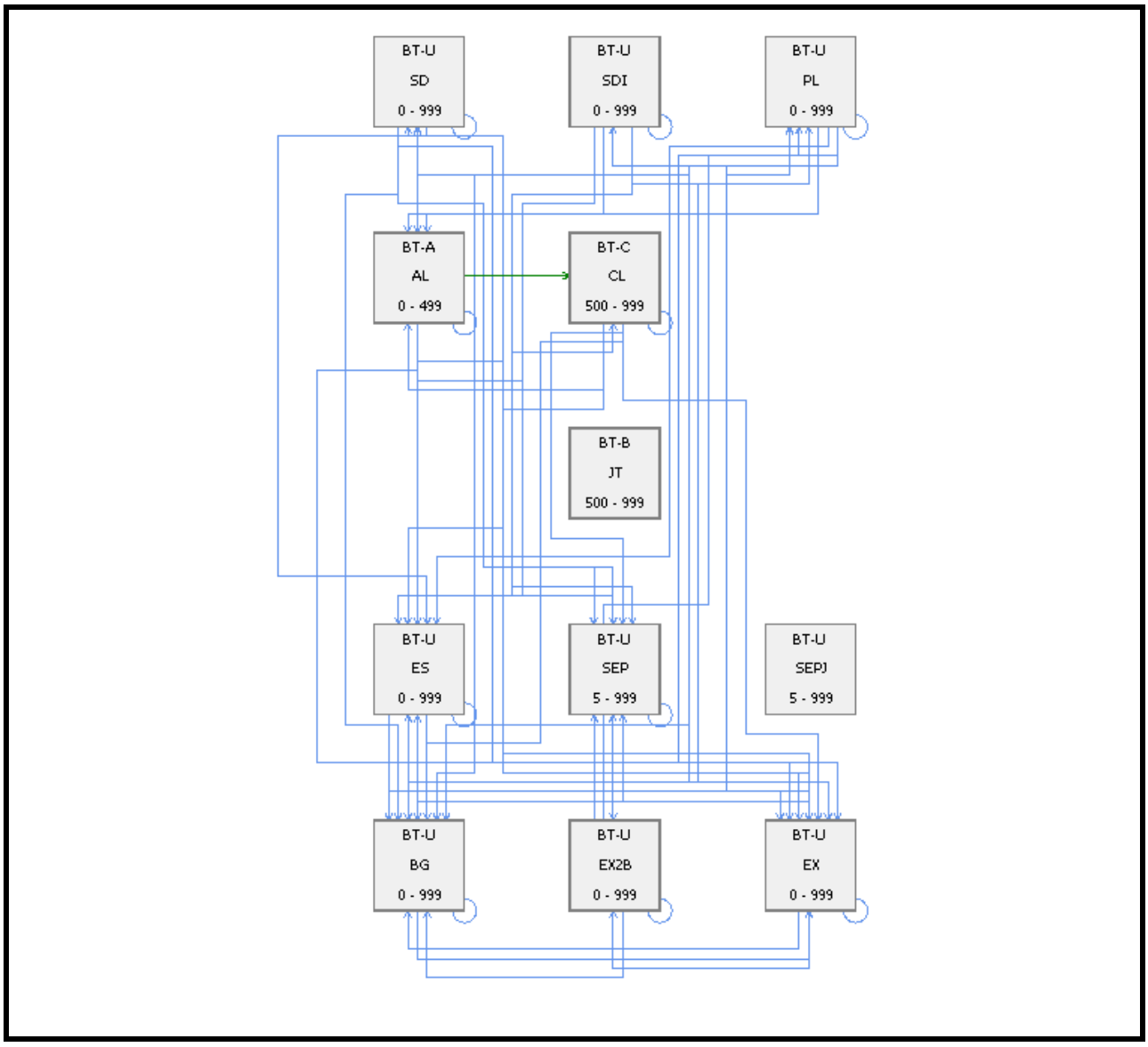
State-and-Transition Model:


BT-U
SD
0 - 999
BT-U
SDI
0 - 999
BT-U
PL
0 - 999
BT-A
AL
0 - 499
BT-C
CL
500 - 999
BT-B
JT
500 - 999
BT-U
ES
0 - 999
BT-U
SEP
5 - 999
BT-U
SEPJ
5 - 999
BT-U
BG
0 - 999
BT-U
EX2B
0 - 999
BT-U
EX
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Creosotebush-White Bursage (CB) 1087

Area of Application and Context:

- **Red Cliffs and Beaver Dam Wash National Conservation Areas of southwestern Utah**
- **Livestock grazing on Beaver Dam Wash only**
- **Full fire suppression management**
- **Date created: July 2011**

Vegetation classes:

Two versions of creosotebush-white bursage were developed at the request of stakeholders: with and without Joshua Trees. USDA's Natural Resource Conservation Service (NRCS), however, does not recognize Joshua tree woodlands as a distinct ecological site because the soils on which it grows are the same the soils as creosotebush-white bursage, thermic and mesic blackbrush, and Great Basin mixed salt desert ecological sites. Joshua tree is absent from the Red Cliffs NCA and from some areas of the Beaver Dam Wash NCA (thus boxes B, D, and U-*SEPJ* below do not exist). Joshua tree is present in a large fraction o f the Beaver Dam Wash NCA and the description below apply in its entirety:

- *CB-A:***Early**; 5-20% cover of creosote and white bursage builds up over time;5-20% grass cover depending on winter precipitation and season; 0-19 yrs
- *CB-B*: **Mid-closed**; 21-40% creosote and white bursage cover; 5-20% grass and forb cover (depending on winter precipitation, soil productivity, and season); >1% cover of Joshua trees; 20+ yrs
- *CB-C*: **Late-open**; 21-40% creosote and white bursage cover; Joshua trees **absent**; 5-20% grass and forb cover (depending on winter precipitation, soil productivity, and season); 20+ yrs
- *CB-D*: **Late- closed;** 21-40% creosote and white bursage cover; >1% cover of Joshua trees; 5-20% grass and forb cover (depending on winter precipitation, soil productivity, and season); 400+ yrs
- U-*ES:* **Early-Shrub**; 20-50% cover of cholla, snakeweed or rabbitbrush species
- U-*SEP:* **Shrub-Exotic-Species-Perennial-Grass**; 21-40% cover of creosote and white bursage; 0-20% exotic species (*Bromus rubens, Bromus tectorum*, *Erodium cicutarium*) cover; 5-20% grass and forb cover (depending on winter precipitation, soil productivity, and season); Joshua trees **absent**
- U-*SEPJ:* **Shrub- Exotic-Species-Perennial-Grass-Joshua-Tree**; 21-40% cover of creosote and white bursage; 0-20% exotic species (*Bromus rubens, Bromus tectorum*, *Erodium cicutarium*) cover; 5-20% grass and forb cover (depending on winter precipitation, soil productivity, and season); >1% cover of Joshua trees
- U-*SES:* **Shrub-Exotic-Species**; 10-40% cover of creosotebush or other shrubs <1.0m tall; 5-20% exotic species (*Bromus rubens, Bromus tectorum*, *Erodium cicutarium*) cover; <5% cover of native grasses or forbs; Joshua tree **absent**
- U-*SESJ:* **Shrub-Exotic-Species-Joshua-Tree**; 10-40% cover of creosotebush or other shrubs <1.0m tall; 5-20% exotic species (*Bromus rubens, Bromus tectorum*, *Erodium cicutarium*) cover; >1% cover of Joshua trees; <5% cover of native grasses and forbs
- *U-EX:* **Exotic-Species**; >10% exotic species (*Bromus rubens, Bromus tectorum*, *Erodium cicutarium*) cover; <10% cover of creosotebush or other shrubs; unburned and charred Joshua tree may be present
- U-*EX2B:* **Exotic-Species-2nd-Burn**; identical to U-*EX*, except that it has experienced a second burn
- U-*SD:* **Seeded (native)**; >10% seeded native grasses, forbs, and shrubs
- U-*SDI:* **Seeded (introduced)**; >10% seeded non-native grasses, forbs, and shrubs

- U-*PL:* **Planted;** >5% planted shrubs and perennial herbaceous species; <5% non-native annual grasses and forbs
- U-*BG:* **Bare ground**; mineral soil exposed by human disturbances

Reference Condition:

- **Natural Range of Variability without Joshua tree**
  - 8%: A-*Early*
  - 0%: B-*Mid-closed*
  - 92%: C-*Mid-open*
  - 0%: U
- **Natural Range of Variability with Joshua tree**
  - 9%: A-*Early*
  - 36%: B-*Mid-closed*
  - 38%: C-*Mid-open*
  - 17%: D-*Late-closed*
  - 0%: U

Succession:

Succession varies with the presence of Joshua trees.

In the absence of Joshua trees, succession follows the 2-box pathway with vegetation starting as predominantly dominated by respouting (mostly from vegetative recolonization) and herbaceous species and ending with a sometimes diverse community of creosotebush (loamier soil) and/or white bursage (harsher, warmer soils). Deterministic succession transitions occur between the first two boxes:

- Early-succession to mid-succession open: 20 years

With Joshua trees, succession is a 4-box model with parallel open (shorter) and closed (longer) branches originating from the *early-succession* class (*CB-A*). Deterministic transitions govern succession between the *early succession* (*CB-A*) and both *mid-succession* classes (*CB-B* and *CB-C*). The deterministic transition is not a true succession and reflects a partitonning of acres proportional to the current area without and with Joshua tree. A second succession step occurs at age 399 in the closed branch with Joshua trees.

- Early-succession to mid-succession open and closed: 20 years
- Mid-succession closed to late-succession closed: 399 years

Natural Disturbances:

Very few natural disturbances affect creosotebush-white bursage: drought and replacement fire. Creosotebush-white bursage is not fire adapted and has not evolved with fire.

Replacement fire is present at very low rates in most classes:

- The fire return interval is 2,000 years (0.0005/year) in all reference classes, except the late-succession closed (*CB-D*) class that contains more fuel (interval of 1,000 years or a rate of 0.001/year).
- *Replacement fire* in vegetation classes that already experienced a threshold transition also cause a threshold transition to other uncharacteristic classes.
    - The *shrubland with mixed exotic annual and native perrennial species* classes (*SEP and SEPJ*) burns every 600 years (0.0015+/year) on average, causing a transition to the *once-burned exotic annual species* class (*EX*).
    - The *twiced-burned exotic annual grassland and forbland* class (*EX2B*) burns every 10 years (0.1/year) on average (self loop); and
    - The *once-burned exotic annual grassland and forbland* class (*EX*), which contains recovering shrubs, is converted to the *twice-burned exotic annual grassland and forbland* class (*EX2B*) class by fire occurring every 20 years (0.05/year) on average.
    - *Planted* (*PL*) and *seeded* (*SD*) classes, whose exotic annual fine fuel component is temporally suppressed, burn every 600 years (0.0015+/year) on average and transitions to age zero in the same class (this possibility is very remote because residence in these classes is short due to exotic annual seedbank emergence).
    - The *early-shrub* (*ES*) class also burns every 1,000 years (0.001/year) on average and resulting vegetation stays in the class and returns to age zero.

Creosotebush is not as drought adapted as blackbrush is assumed to be. Drought is the strongest natural disturbance in this ecological system. A *drought* return interval rate of every 178 years (a rate of 0.0056/year) is used based on the frequency of severe drought intervals estimated by Biondi *et al*. (2007) from 2,300 years of western juniper (*Juniperus occidentalis)* tree ring data from the Walker River drainage of eastern California and western Nevada. Although we recognize that droughts may be more common than every 178 years, severe droughts, which were >7-year drought events with consecutive far-below average soil moisture (narrow tree rings), kill naturally drought resistant shrubs and trees:

- The *mid-succession closed* (*CB-B*) class and both *late-succession* classes (*CB-C* and *CB-D*) transition to the early-succession (*CB-A*) class;
- The *shrubland with mixed exotic annual and perennial grass species* classes (*SEPJ* and *SEP*) each transition to the *once-burned exotic annual grassland and forbland* class (*EX*); and
- The *planted* (*PL*) class experiences
    - self-thinning to age zero for 99% of drought events, and
    - a transition to the *once-burned exotic annual grassland and forbland* class (*EX*) for the other 1% of events.

A few anthropogenic disturbances cause accelerated woody succession in reference classes and transitions to uncharacteristic classes of vegetation.

Present only in Beaver Dam Wash NCA, *managed herbivory* and *excessive herbivory* have return intervals of one year (livestock is present every year) but different impact areas based on the distance livestock is willing to travel away from water. The impact of grazing is modeled with fixed rates of implementation (around an average) because grazing permits have fixed stocking rates, season of use,

distribution. It is assumed that *managed herbivory* utilizes 5% of all grazable areas in the Beaver Dam Wash NCA (not just creosotebush-white bursage); therefore, only 5% of the area is selected for *managed herbivory* and vegetation classes in creosotebush-white bursage "compete" for selection. This method of modeling livestock grazing can only be implemented with the PATH software; VDDT cannot achieve landscape-level disturbances. Similarly, *excessive herbivory* affects 0.1% of the Beaver Dam Wash NCA causing a transition to the *early shrub* class (ES); however, *excessive herbivory* is caused by the movement of livestock through the same areas near or on the way to water sources. Therefore, once areas dominated by early shrubs are created, they become permanent and no new areas are created unless watering sources are moved or created. As a consequence, 0.1% of the Beaver Dam Wash is chosen among candidate vegetation classes to become the *early shrub* class (*ES*) in the first years of simulations, and then the process is stopped.

Managed herbivory accelerates woody succession by:

- Two years in the *reference* class (*CB-A, CB-B, CB-C*, and *CB-D*) and both *shrubland with mixed exotic annual and native perrennial species* classes (*SEP and SEPJ*) when a pixel is chosen for grazing;
- One year in the *once-burned exotic annual grassland and forbland* class (*EX*) (succession to non-blackbrush shrub phase is likely); but has no effect in the *twice-burned exotic annual grassland and forbland* class (*EX*) (succession to non-blackbrush shrubs state is very unlikely).

Managed-herbivory in the *planted* (*PL*) or *seeded* (*SD*) classes have different outcomes:

- A transition to the *once-burned exotic annual grassland and forbland* class (*EX*) for the highly exposed and vulnerable *planted* (*PL*) class; and
- A self loop with a one-year reversal of woody succession within the *seeded* (*SD*) class (the seeds of this class do not all emerge at once from the seedbank and become immediately vulnerable).

Excessive herbivory is present in all classes, except the *bare ground (BG), early-shrub* (*ES;* the recipient class of this disturbance)*, and twice-burned exotic annual grassland and forbland* class (*EX2B*), during the first five years of simulation.

Exotic invasion affects the reference (*CB-A*, *CB-B* [Beaver Dam Wash NCA only]), and *CB-C), bare ground* (*BG*), *early-shrub* (*ES*), *planted* (*PL*) and *seeded* (*SD*) classes at a rate of 0.005/year.

- For the *early succession* class (*CB-A*), *exotic invasion* causes:
    - Before age 19, a transition to the *exotic annual grassland and forbland* class (*EX*); whereas
    - After age 19, the transition proceeds from classes *CB-B*, *CB-C*, *CB-D*, and *ES* to both *shrubland with mixed exotic annual species and perennial grasses* classes (*CB-SEP* and *CB-SEPJ*) (if Joshua tree is present, the transiton is partitonned according to the proportion of Joshua tree *versus* no Joshua tree in the ecological system).
- The *planted* class (*PL*) converts to both *shrubland with mixed exotic annual species and perennial grasses* classes (*BT-SEP* and *BT-SEPJ*) as above,
- The seeded (SD) and bare ground (*BG*) classes transition to the *once burned exotic annual grassland and forbland* class (*EX*).

Seedbank-emergence is a disturbance specific to the *planted* (*PL*) and *seeded* (*SD*) classes. These classes are created with an application of herbicide or biocide that inhibits germination to control exotic annual

species. In the Mojave Desert, the duration of the herbicide or biocide's residual effect is 2-3 years. Therefore, the seedbank emerges at a high rate of 0.2/year (it takes about 5+ years for full conversion) after this period:

- Plantings revert to both *shrubland with mixed exotic annual species and perennial grasses* (*CB-SEP* and *CB-SEPJ*) classes according to the proportion of creosotebush-white bursage with Joshua trees in Beaver Dam Wash NCA (no Joshua tree in Red Cliffs NCA); and
- Seedings transition to the *once-burned exotic annual forbland and forbland* (*EX*) class.

Natural-recovery is also a disturbance specific to the *planted* (*PL*) and *seeded* (*SD*) classes. After 20 years in these classes without 10 years of consecutive grazing from age 10 to 20, the class will transition to the *early-succession* class (*CB-A*) at a slow rate of 0.1/year (1 of 10 pixels per year).

The *Utilities* disturbance is predominantly the establishment of right-of-ways (pipelines and powerlines) with excavated or cleared areas that become the *once-burned exotic annual forbland and forbland* (*EX*) class. The rate is low (0.0001/year) and present in all classes.

The *OHV* disturbance creates the *bare ground* (*BG*) class from illegal recreational use of off-highway vehicles, primarily in the Beaver Dam Wash NCA. All classes are source classes. The rate is 10% of 0.0001/year to reflect that users predominantly reuse existing disturbed areas and only incrementally add new areas of illegal driving.

Management Actions:

Modeled management activities included fuel breaks, livestock closure (localized), law-enforcement, cessation of livestock grazing, and herbicide or fingers-of-death used alone and coupled with native plant seeding and planting:

- Fuel breaks are 250 feet wide strips of vegetation aerially sprayed with herbicide (Plateau®) to remove the continuous fine fuel beds created by exotic annual species. Strips are placed throughout the landscape and benefit all ecological systems by slowing or stopping wildfires. Spraying is only conducted during years of higher precipitation (perhaps following a 7-year El Nino cycle) or during of years of seedbank emergence not associated with high precipitation.
- Livestock-closure is a landscape-level treatment of the Beaver Dam Wash NCA that is applied to seedings and plantings. Closure results in the protection of seedings and plantings from livestock grazing for 10 consecutive years to the extent that enough resources (funding) allow it. Funding is shared with other ecological systems.
- Law enforcement only affects the creation of one vegetation class from OHV activity in several ecological systems of the Beaver Dam Wash NCA: *bare groud* (*BG*). Increased law-enforcement reduces the OHV disturbance by 50% (to 5%) using a static transition multiplier.
- Complete cessation of livestock grazing of the Beaver Dam Wash NCA is achieved by setting the static transition multiplier for livestock grazing to zero.
- Herbicide (Plateau®) application to control exotic annual grasses in *once-burned and twice-burned exotic annual grassland and forblands* classes (*EX* and *EX2B*) followed by seeding native plant species with the current mix of seed sources. Failure rate is 99%, leading to the *exotic annual grassland and forblands* class (*EX*). Success causes a transition to the *seeded* class (*SD*).
- Herbicide (Plateau®) application to control exotic annual grasses in *once-burned and twice-burned exotic annual grassland and forblands* classes (*EX* and *EX2B*) followed by seeding native plant

species with new high-performance cultivars whose commercial release is scheduled to be 20 years in the future. Failure rate is 95%, leading to the *exotic annual grassland and forblands* class (*EX*). Success causes a transition to the *seeded* class (*SD*).

- Herbicide (Plateau®) application to control exotic annual grasses in *once-burned and twice-burned exotic annual grassland and forblands* classes (*EX* and *EX2B*) followed by planting of containerized native shrubs and forbs. Failure rate is 25%, leading to the *exotic annual grassland and forblands* class (*EX*). Success causes a transition to the *planted* class (*SD*).
- Fingers-of-death fungi application to control exotic annual species in the *shrubland with mixed exotic annual and perennial grass species (SEP*) and *shrubland with mixed exotic annual, and perennial grass and Joshua tree (SEPJ*) classes. Failure rate is 25% to 75% (no change of class), whereas success causes a transition to the *mid-succession (CB-B* and *CB-C)* and *late-succession* classes (*CB-D* and *CB-E*) depending on the age of originating vegetation and the presence of Joshua tree in the originating class.
- Fingers-of-death fungi application to control exotic annual grasses in *once-burned and twice-burned exotic annual grassland and forblands* classes (*EX* and *EX2B*) followed by seeding native plant species with new high-performance cultivars whose commercial release is scheduled to be 20 years in the future. Failure rate is 95%, leading to the *exotic annual grassland and forblands* class (*EX*), because seedling establishment and survival remains the limiting factor even with the fingers-of-death fungi. Success causes a transition to the *seeded* class (*SD*).
- Fingers-of-death fungi application to control exotic annual grasses in *once-burned and twice-burned exotic annual grassland and forblands* classes (*EX* and *EX2B*) followed by planting of containerized native shrubs and forbs. Two levels of failure rates apply to the treatment. Failure rate of planting is 25% (no change in vegetation class), leading to the *exotic annual grassland and forblands* class (*EX*). Success causes a transition to the *planted* class (*PL*). After shrubs and forbs are planted, the fungi-of-death fungi failure rate was tested at three different levels: 25%, 50%, and 75%. If the fingers-of-death fungi fails to control the seedbank of exotic annual species, the *planted* class (*PL*) transitions to the *shrubland with mixed exotic annual and perennial grass species (SEP*) and *shrubland with mixed exotic annual and perennial grass, and Joshua tree (SEPJ*) classes. The amount of either class created depends on the proportion of area with and without Joshua tree in the ecological system. Success keeps vegetation in the *planted* class (*PL*) until either future invasion by exotic species or natural recovery to *early-succession* class (*CB-A*).

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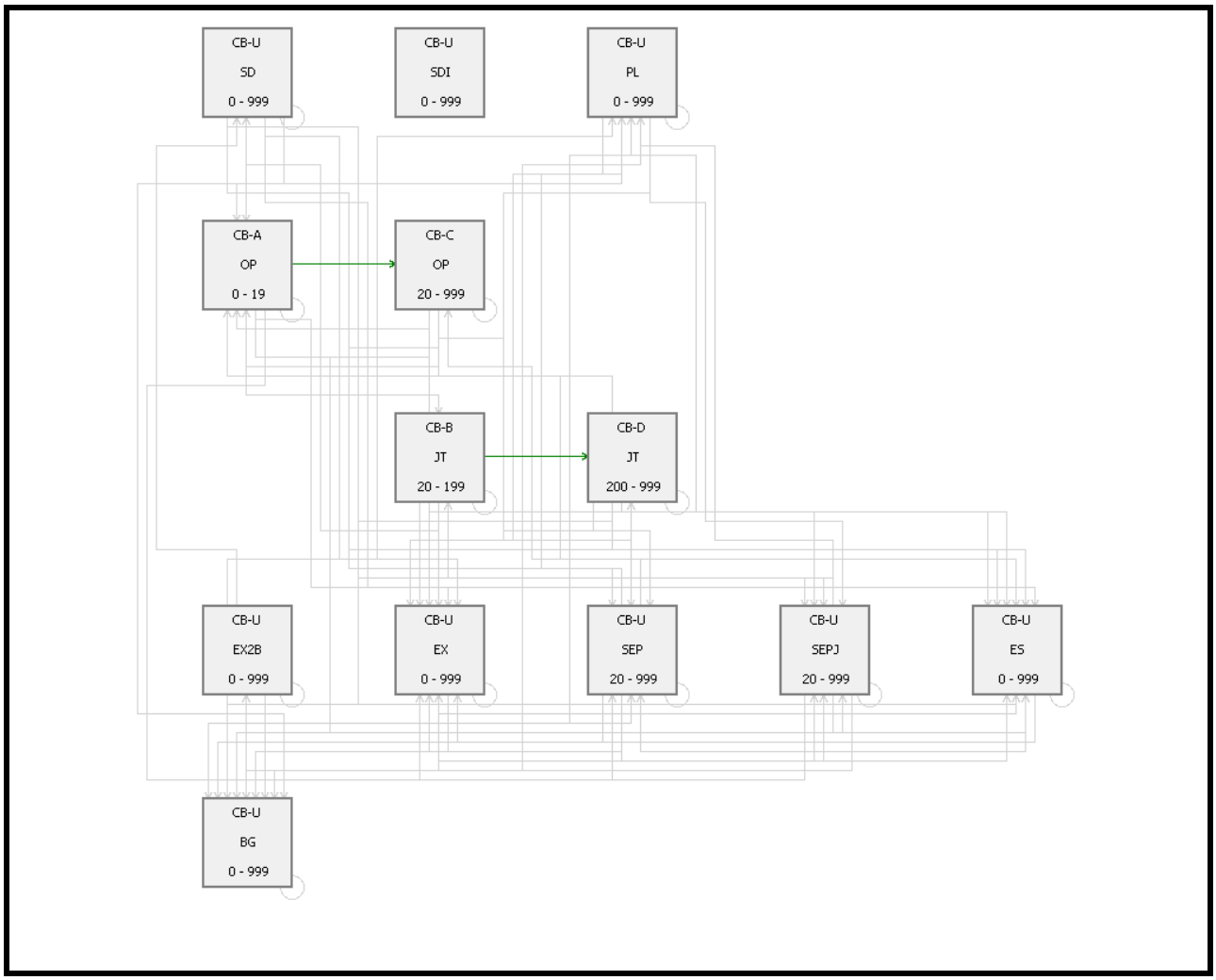
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CB-U
SDI
0 - 999
CB-U
PL
0 - 999
CB-A
OP
0 - 19
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OP
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CB-B
JT
20 - 199
CB-D
JT
200 - 999
CB-U
EX2B
0 - 999
CB-U
EX
0 - 999
CB-U
SEP
20 - 999
CB-U
SEPJ
20 - 999
CB-U
ES
0 - 999
CB-U
BG
0 - 999

Desert Sand Sagebrush (DSS) 1135ss

Area of Application and Context:

- **Red Cliffs National Conservation Areas of southwestern Utah**
- **No livestock grazing**
- **Very limited off-highway travel east of Interstate-15**
- **Full fire suppression management**
- **Date created: July 2011**

Vegetation classes:

- DSS-A: **Early**; 5-19% sand sagebrush and snakeweed/rabbitbrush cover; 5-20% cover of grasses (big galleta, bush muhly, Indian ricegrass, desert needlegrass); >40% bare ground (mostly sand); 0-2 yrs after fire
- DSS-B: **Late-closed**; 20-40% cover of sand sagebrush, desert almond, and rabbitbrush; 5-20% grasses (big galleta, bush muhly, Indian ricegrass, desert needlegrass); scattered juniper may be present; >30% bare ground (mostly sand); 3+ yrs
- U-*DP:* **Depleted**; 20-40% sand sagebrush, snakeweed, and rabbitbrush cover;<5% cover of grasses; >40% bare ground cover
- U-*SEP:* **Shrub-Exotic-Species-Perennial-Grass**; 5-40% sand sagebrush and rabbitbrush cover; 5-10% cover of exotic species (*Bromus rubens, Bromus tectorum*, *Erodium cicutarium*); native grasses may be present to common; >30% bare ground (mostly sand)

Reference Condition:

- **Natural Range of Variability**
  - 2%: A-*Early*
  - 98%: B-*Late-closed*
  - 0%: U

Succession:

Succession follows the 2-box pathway with vegetation starting as resprouting desert sand sagebrush and ending as denser desert sand sagebrush with 20-40% of shrubs. Sand sagebrush dominates all phases of succession. The succession pathway is entirely deterministic with transitions occurring at the following ages:

- Early-succession to late-succession closed: 2 years

Natural Disturbances:

Replacement fire and variation in precipitation, therefore the frequency of *drought*, are the primary natural stochastic disturbances in desert sand sagebrush. Native herbivory by small mammals is a marginal disturbance that only applies to the *early-succession* class while grass is present.

Sand sagebrush resprouts after fire and has been observed to return to pre-fire structural levels within 3

years. We assume that the likelihood on ignition increases with fuel buildup. *Replacement fire* is present in all classes at a mean fire return interval of:

- 120 years (rate of 0.0083/year) in the *early-succession* class (*DSS-A*);
- 95 years (0.0106/year) in the *late-succession closed* class (*DSS-B*); and
- 120 years in the *depleted* class (*DP*) because of the absence of fine fuel despite mature shrub structure.

The fire return interval varies in the *shrubland* with *exotic annual and native grass species* class (*SEP*):

- 20 years (0.05/year) during the first 2 years of succession essentially dominated by non-native annual grasses; and
- 95 years as woody structure builds up while non-native annual grasses persist.

Drought causes shrub thinning in the older vegetation class under the assumption that prolonged and decreased soil moisture weakened plants that might ultimately be killed by insects or disease. Therefore, we do not double-count mortality. A *drought* return interval rate of every 178 years (a rate of 0.0056/year) is used based on the frequency of severe drought intervals estimated by Biondi *et al*. (2007) from 2,300 years of western juniper (*Juniperus occidentalis)* tree ring data from the Walker River drainage of eastern California and western Nevada. Although we recognize that droughts may be more common than every 178 years, severe droughts, which were >7-year drought events with consecutive far-below average soil moisture (narrow tree rings), kill naturally drought resistant shrubs.

- Drought kills some, but not all shrubs in the *late-succession closed* class (*DSS-B*); therefore drought thins this class under the assumption that older shrubs succumb first and the class is reset at 3 years.
- In the two uncharacteristic classes, *drought* is only a thinning agent resetting to zero the age of the following classes:
  - *Depleted* desert sand sagebrush (*DP); and*
  - *Shrubland with exotic annual and perennial grass species* class (*SEP*).

Lagomorphs and small mammals accelerate woody succession by the consumption of grasses and forbs during the early outburst of herbaceous vegetation (for example, Indian ricegrass and galleta grass) after a stand replacing event. We assume a small rate (5 out of 1,000 pixels per year) that advances succession by one extra year when chosen for *native herbivory*.

Exotic annual species invasion (*EX-invasion*) only affects uninvaded classes (*DSS-A*, *DSS-B*, and *DP*). The rate of is tied to a base rate of 0.001/year estimated from data of northwest Utah collected by the Utah Division of Wildlife Resources in black sagebrush semi-desert, which is usually considered more resistant to cheatgrass invasion than big sagebrush dominated biophysical settings. Sandy soils also appear resistant to non-native annual species. *EX-invasion* transforms the *early-succession* (*DSS-A*), *late-succession* (*DSS-B*), and depleted (*DP*) classes into the *exotic annual and native grass species* class (*SEP*) with the age of pixels maintained.

Management Actions:

Modeled management activities include herbicide or fingers-of-death coupled with native plant seeding:

- Application of Plateau® to control non-native annuals followed by seeding of native grass species in *shrub with mixed annual and perennial grass species class* (*DSS-SEP*). The combined success rates of herbicide application and seeding is 50% leading to the *late-closed succession* classs (*DSS-B*). Failure results in vegetation staying in the originating class (*DSS-SEP*).
- Application of the finger-of-death fungi followed by seeding of native grass species in *shrubland invaded by non-native annuals* (*SEP*). Failure rate of the finger-of-death fungi iss varied from 25% to 75%%, leading to the shrubs with mixed *exotic annual and perennial grass species* class (*SEP*). The combined success rates of herbicide application and seeding varies from 18% to 56% leading to the *late-closed succession* classs (*DSS-B*). Failure results in vegetation staying in the originating class (*SEP*).

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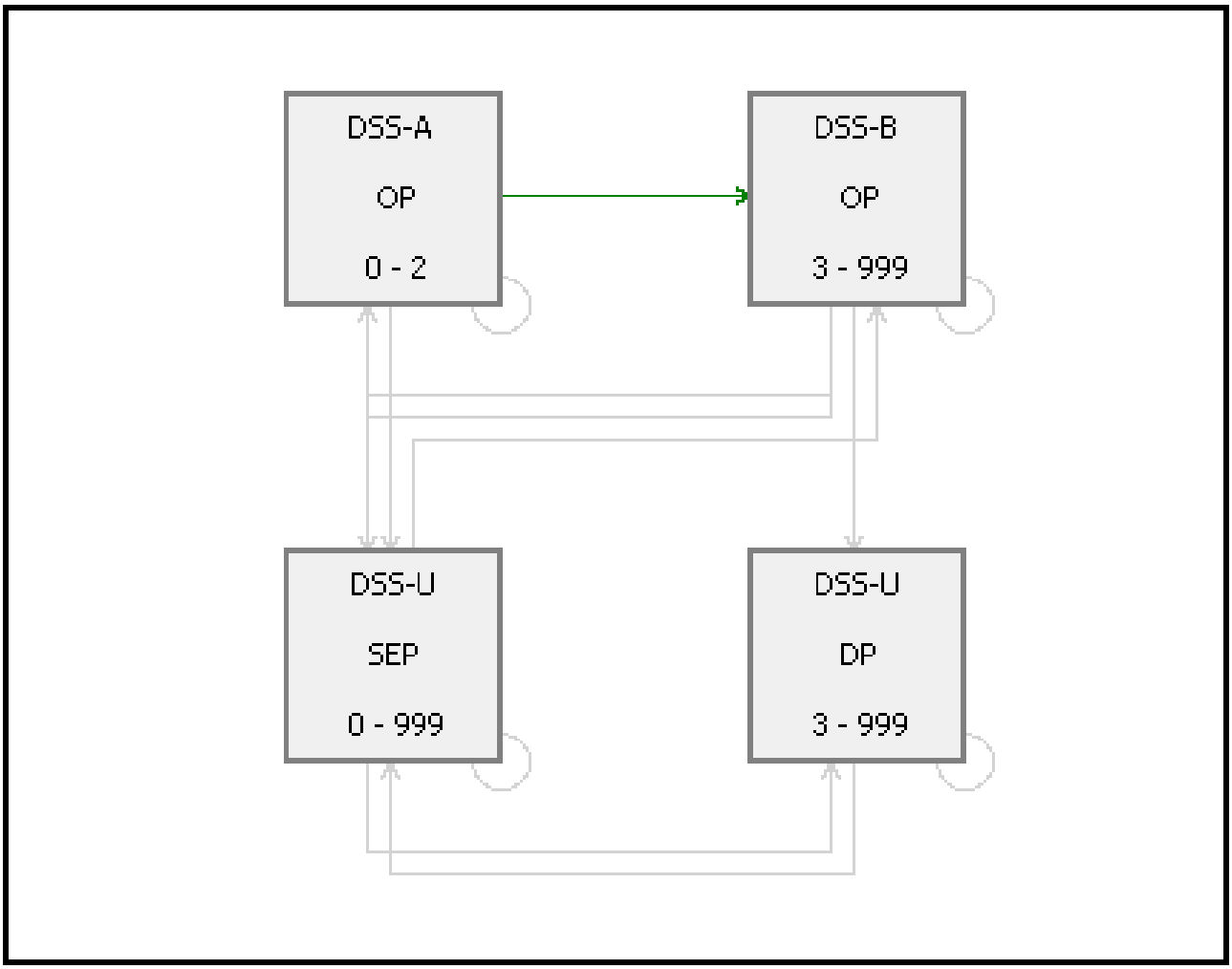
State-and-Transition Model (cropped):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OP
0 - 2
DSS-B
OP
3 - 999
DSS-U
SEP
0 - 999
DSS-U
DP
3 - 999

Desert Washes (SWA) 1155w

Area of Application and Context:

- **Red Cliffs and Beaver Dam Wash National Conservation Areas of southwestern Utah**
- **Livestock grazing on Beaver Dam Wash only**
- **Full fire suppression management**
- **Date created: July 2011**

Vegetation:

- *SWA-A*: **Early**; 20-50% cover may be gravel, sands, and/or flood debris;10-19% cover of desert almond, burrobrush, rabbitbrush, creosotebush, desert willows present; 5-15% cover of grasses (big galleta, bush muhly); forbs present to abundant; 0-5 yrs
- *SWA-B*: **Mid-closed**; 20-50% cover of desert almond, bursage, bladdersage, burrobrush, creosotebush, Anderson's wolfberry, rabbitbrush; 5-10% cover of grasses (big galleta, bush muhly); forbs present to abundant; <30% of gravel and rocks; 5-19 yrs
- SWA-C: **Late-closed**; 30-50% cover of bursage, burrobrush, creosotebush, desert almond, bladdersage, Anderson's wolfberry, rabbitbrush, mesquite; Joshua tree present; 5-10% cover of grasses (big galleta, bush muhly); forbs present to abundant; <10% of gravel and rocks; >20 yrs
- U-*SEP:* **Shrub-Exotic-Species-Perennial-Grass**; >5% exotic species (*Bromus rubens, Bromus tectorum*, *Erodium cicutarium*) cover; 0-50% small mesquite, Joshua tree, and shrubs, 5-10% cover of grasses (big galleta, bush muhly); mineral soil may be common
- U-*SES:* **Shrub-Exotic Species**; >5% exotic species (*Bromus rubens, Bromus tectorum*, *Erodium cicutarium*) cover; 0-50% small trees and shrubs; <5% cover of native grasses; mineral soil may be common
- U-*ES* **Early-Shrub**; 20-50% cover of cholla, snakeweed or rabbitbrush species
- U-*ET:* **Exotic-Tree (formerly *EX*)**; >5% cover of saltcedar; 0-50% cover of bursage, burrobrush, creosotebush, Anderson's wolfberry, rabbitbrush, mesquite, Joshua tree
- U-*BG:* **Bare ground**; mineral soil exposed by human-caused disturbances

Reference Condition:

- **Natural Range of Variability**
  - 10%: A-*Early*
  - 18%: B-*Mid-closed*
  - 72%: C-*Late-closed*
  - 0%: U

Succession:

Succession follows the 3-box pathway with heterogeneous vegetation starting with abundant flood material (gravel, sand, and cobble) mixed with snakeweed and herbaceous species ending with a denser cover of shrubs and small trees. The succession pathway is entirely deterministic with transitions occurring at the following ages:

- Early-succession to mid-succession closed: 4 years
- Mid-succession closed to late-succession closed: 19 years

Natural Disturbances:

Flash flooding dominates the dynamics of desert washes, which do not have perennial water. Three levels of *flooding* were:

- 7-year events (0.14/year) that kills or removes only herbaceous vegetation in the *early-succession* class (*SWA-A*);
- 20-year events (0.05/year) that kills or removes shrubs and young trees in the *mid-succession closed* class (*SWA-B*); and
- 100-year events (0.01/year) that top-kills larger trees and everything else in the *late-succession closed* class (*SWA-C*).

One hundred-year *flash floods* affect three uncharacteristic classes: *exotic tree* (*ET*), *shrubs with non-native annual and perennial grass species* (*SEP*), and *shrubs with non-native annual species* (*SES*). Outcomes are similar for these three classes:

- 1% of each class is converted to to the early succession class as flood debris (sand, gravel, rock, and wood); and
- The remaining 99% of vegetation stays within the original classes while experiencing a return to age zero.

Replacement fire generally originates from the surrounding landscape and restarts the succession clock to age zero after sweeping through the riparian corridor. Fire is possible in all classes. Fuel breaks will prevent fire activity for three consecutive years after their implementation. Fire is rare because the surrounding blackbrush and creosotebush-white bursage ecological systems do not carry fire, unless they are invaded by non-native annual grasses. The mean fire return interval is set at:

- 1,000 years (rate of 0.001/year) for the *mid-succession closed* (*SWA-B*) and *late-succession closed* (*SWA-C*) classes; and
- 10,000 years (0.0001/year) for the *early-succession* class (*SWA-A*), which is dominated by sand and gravel.

Fire return intervals are shorter in uncharacteristic classes:

- The *early shrub* (*ES*) class burns every 650 years (0.0015/year) on average and burned vegetation resets to age zero within the class.
- The *exotic tree* (*ET*) and *shrubs with non-native annual and perennial grass species* (*SEP*) class both have a 50-year return intervals (0.02/year) because the added fine fuels from non-native annual grass or saltcedar increase ignition probabilities. Vegetation in these classes remains in them, although at a younger age.
- The shortest fire return interval (50 years or 0.02/year) was in the *shrubs with non-native annual species* (*SES*) class because of the importance of non-native annual grass species. Again, fire is a self-loop.

Present only in Beaver Dam Wash NCA, *managed herbivory* and *excessive herbivory* have return

intervals of one year (livestock is present every year) but different impact areas based on the distance livestock is willing to travel away from water. The impact of grazing is modeled with fixed rates of implementation (around an average) because grazing permits have fixed stocking rates, season of use, distribution. It is assumed that *managed herbivory* utilizes 5% of all grazable areas in the Beaver Dam Wash NCA (not just desert washes); therefore, only 5% of the area is selected for *managed herbivory* and vegetation classes in desert washes "compete" for selection. This method of modeling livestock grazing can only be implemented with the PATH software; VDDT cannot achieve landscape-level disturbances. Similarly, *excessive herbivory* affects 0.1% of the Beaver Dam Wash NCA causing a transition to the *early shrub* class (ES); however, *excessive herbivory* is caused by the movement of livestock through the same areas near or on the way to water sources. Therefore, once areas dominated by early shrubs are created, they become permanent and no new areas are created unless watering sources are moved or created. As a consequence, 0.1% of the Beaver Dam Wash is chosen among candidate vegetation classes to become the *early shrub* class (*ES*) in the first years of simulations, and then the process is stopped.

Managed herbivory accelerates woody succession by one year for selected pixels in all grazable classes (SWA-A, SWA-B, SWA-C, *SEP, and SES*). *Excessive herbivory* is present in all classes except the *bare ground (BG) and early-shrub* (*ES)* class. It causes a transition to the *early-shrub* (*ES)* class.

An important disturbance is the invasion by exotic trees (*exotic-tree-invasion*) represented by saltcedar. *Exotic-tree-invasion* causes a transition to the *exotic tree* class (*ET*). Saltcedar's tiny seeds are wind dispersed. Workshop participants agreed to a low rate (0.0001/year) for most classes because washes lack perennial water, but a rate five times higher for the *bare ground* (*BG*) and *early shrub* (*ES*) classes that have more disturbed soils and vegetation. It is assumed that invasion will happen at specified rates if a weed detection effort and follow-up treatment has not occurred for five consecutive years. *Exotic tree invasion* occurs in seven classes: *early-succession closed* (*SWA-A*), *mid-succession closed* (*SWA-B*), *late-succession closed* (*SWA-C*), *bare ground* (*BG*), *early shrub* (*ES*), *shrubs with non-native annual and perennial grass species* (*SEP*), and *shrubs with non-native annual species* (*SES*).

An important source of saltcedar mortality is the introduced biocontrol beetle (*beetle-mortality*), which is present to abundant in the Virgin River drainage. Workshop participants decided that beetles kill saltcedars after 4 consecutive years of defoliation; therefore, the return interval for beetle induced mortality was 4 years (rate of 0.25/year). Beetle induced mortality cause age-dependent transitions from the *exotic-tree* class (*ET*) to the early-succession (*SWA-A*), *mid-succession* (*SWA-B*), and *late-succession* (*SWA-C*) classes.

Another invasion is by non-native annual species (*EX-invasion*) occurring at a rate of 0.005/year (5 of 1,000 pixels per year) in all uninvaded classes: *early-succession closed* (*SWA-A*), *mid-succession closed* (*SWA-B*), *late-succession closed* (*SWA-C*), *bare ground* (*BG*), and *early shrub* (*ES*). A base rate of 0.001/year was estimated for cheatgrass from data of northwest Utah collected by the Utah Division of Wildlife Resources in black sagebrush semi-desert. We defaulted to five times the rate estimated from the Utah data because desert washes are more productive systems. Invasion of:

- Reference classes causes an age-dependent transition to the *shrubs with non-native annual and perennial grass species* (*SEP*); and
- The *early shrub* (*ES*) and *bare ground* (*BG*) classes causes a transition to *shrubs with non-native annual species* (*SES*).

The *Utilities* disturbance is predominantly the establishment of right-of-ways (pipelines and powerlines).

Excavated or cleared areas become:

- *Early-succession* (*SWA-A*) class no different than the wash channel for 30% of the cleared area; and
- The remaining 70% of the area becomes the *shrub with non-native annual* class (*SES*) for vegetation originating from the reference (*SWA-A*, *SWA-B*, and *SWA-C*), *bare ground* (*BG*), *early-shrub* (*ES*), and *shrubs with non-native annual and perennial grass species* (*SEP*) classes. For the *exotic tree* (*ET*) class, the remaining 70% of the cleared area stays in the *exotic tree* class.

The *OHV* disturbance creates the *bare ground* (*BG*) class from illegal recreational use of off-highway vehicle in the Beaver Dam Wash NCA only. All classes are source classes. The rate is 10% of 0.0001/year to reflect that users predominantly reuse existing disturbed areas and only incrementally add new areas of illegal driving.

Management Actions:

Several actions (six in Beaver Dam Wash and five in Red Cliffs NCAs, respectively) are used in this ecological system:

- Inventory of weeds and saltcedar on a rotation (i.e., revisit the same reach every *X* years) for identification of occurrences for immediate or future treatment (w*eed-inventory-WAS).*
- Control of saltcedar and exotic forbs: *exotic-control-MR*. Action consists of cutting saltcedar and immediately painting the stumps with the herbicide Garlon IV®. If exotic forbs are found, they are sprayed with a different herbicide. Failure rate is 10% (no change of class), whereas success causes a transition to the *early-succession* (*SWA-A*), *mid-succession (SWA-B),* and *late-succession* classes (*SWA-C*) depending on the age of originating vegetation class.
- In the Beaver Dam Wash NCA, reduction of livestock stocking rates (*livestock-closure*) in desert washes whose effect last for 10 consecutive years.
- Fuel breaks are 250 feet wide strips of vegetation aerially sprayed with herbicide (Plateau®) to remove the continuous fine fuel beds created by exotic annual species. Strips are placed throughout the landscape and benefit all ecological systems by slowing or stopping wildfires. Spraying is only conducted during years of higher precipitation (perhaps following a 7-year El Nino cycle) or during of years of seedbank emergence not associated with high precipitation. The effect of fuel breaks persists for 3 years.
- Herbicide Plateau® application to control exotic annual species in the *shrubland with mixed exotic annual and perennial grass species (SEP*) class. Failure rate is 50% (no change of class), whereas success causes a transition to the *early-succession* (*SWA-A*), *mid-succession (SWA-B)* and *late-succession* classes (*SWA-C*) depending on the age of originating vegetation class.
- Fingers-of-death fungi application to control exotic annual species in the *shrubland with mixed exotic annual and perennial grass species (SEP*) and *shrubland with mixed exotic annual and perennial grass (SES*) classes. Failure rate is 25% to 75% (no change of class), whereas success causes a transition to the *early-succession* (*SWA-A*), *mid-succession (SWA-B),* and *late-succession* classes (*SWA-C*) depending on the age of originating vegetation class.

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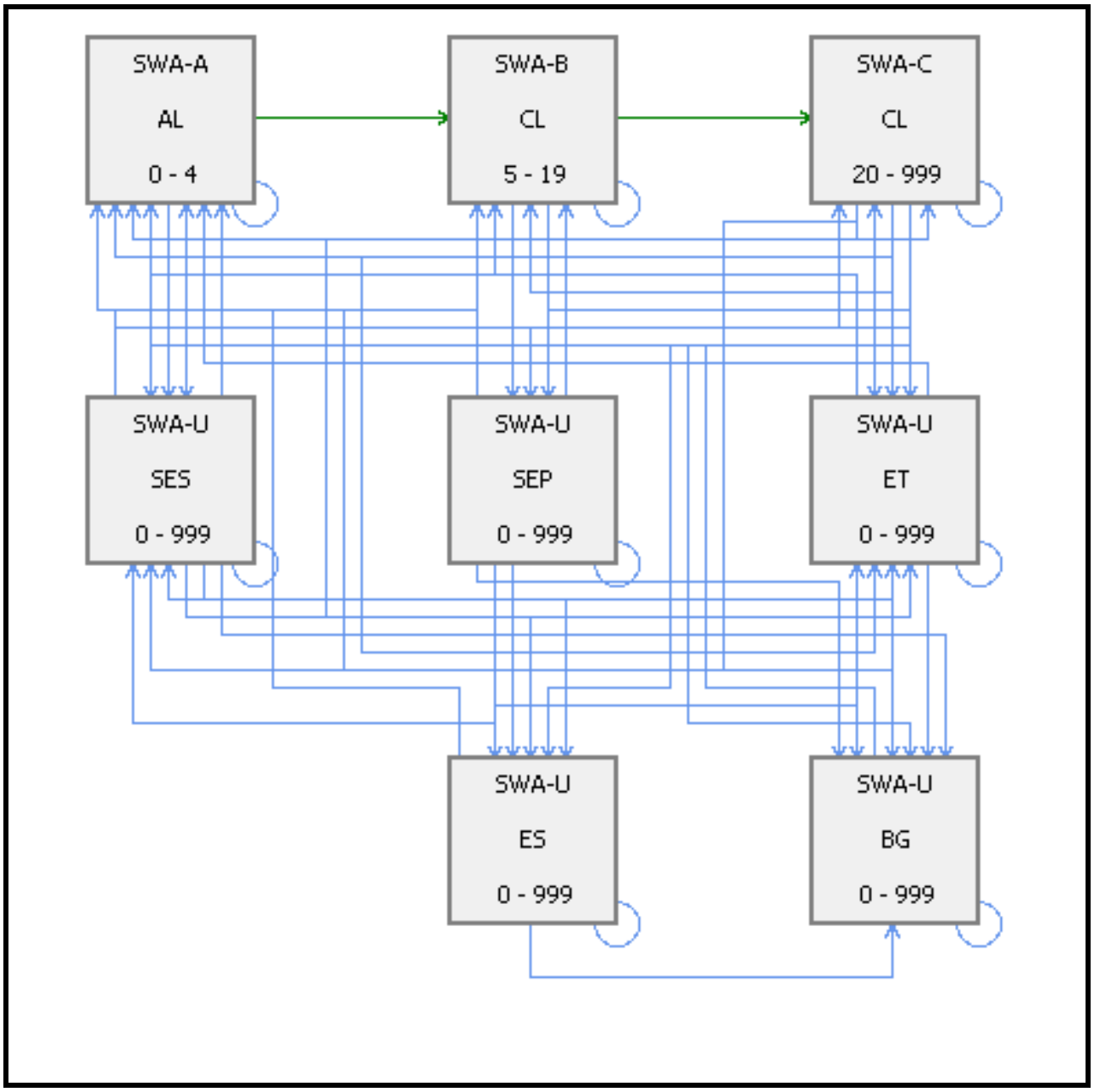
State-and-Transition Model (cropped):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Montane Riparian (MR) 1154

Area of Application and Context:

- **Red Cliffs and Beaver Dam Wash National Conservation Areas of southwestern Utah**
- **Livestock grazing on Beaver Dam Wash only**
- **Full fire suppression management**
- **Date created: July 2011**

Vegetation:

- A-**Early**: 0-40% cover of shrub—willow dominates after fire, whereas cottonwood and willow co-dominate after flooding; grass may co-dominate; <50% cover gravel, rock, and boulders, although this may be highly variable by reach; 0-5 yrs
- B-**Mid-closed**: 31-100% cover of tall shrubs (willows, buffaloberry, young mesquite) and small trees (velvet ash, conifers) and small cottonwood trees; <20% gravel, rock, and boulders; 5-19yrs
- C-**Late-closed**: 31-100% cover of cottonwood, willow, conifers and other trees 10-24m; <20% gravel, rock, and boulders; >20 yrs
- U-*SFE:* **Shrub-Forb-Encroached**; 10-50% cover of Wood's rose or other unpalatable forbs and shrubs in open areas or under tree canopy
- U-*EF*-**Exotic-Forb**: 10-100% cover of exotic forbs (knapweed, tall whitetop, purple loosestrife), salt cedar, or Russian olive)
- U- *DE*-**Desertification**: Entrenched river/creek with 10-50% cover of upland shrubs (e.g., big sagebrush, snakeweed, rabbitbrush); >5% native grass cover

Reference Condition:

- **Natural Range of Variability**
  - 10%: A-*Early*
  - 19%: B-*Mid-closed*
  - 71%: C-*Late-closed*
  - 0%: U

Succession:

Succession follows the 3-box pathway with heterogeneous vegetation starting with willow and Fremont cottonwood, and wet meadows and ending with a forested mix of willow, cottonwood, pinyon, juniper, alder, and wet meadows. The succession pathway is entirely deterministic with transitions occurring at the following ages:

- Early-succession to mid-succession closed: 4 years
- Mid-succession closed to late-succession closed: 19 years

Natural Disturbances:

Flooding dominates the dynamics of the montane riparian system. Three levels of *flooding* are:

- 7-yr events (0.14/year) that killed or removed only herbaceous vegetation in the *early-succession* class (*MR-A*);
- 20-year events (0.05/year) that killed or removed shrubs and young trees in the *mid-succession closed* class (*MR-B*); and
- 100-year events (0.01/year) that top-killed larger trees and everything else in the *late-succession closed* class (*MR-C*).

Replacement fire originates from the surrounding landscape and restarts the succession clock to age zero after sweeping through the riparian corridor. Fire is possible in all classes. However, fire is rare because the surrounding blackbrush, creosotebush-white bursage, and sand sagebrush ecological systems only rarely burn. The mean fire return interval is set at 1,000 years (rate of 0.001/year). Fire in reference classes causes a stand replacing event and recruitment into the *early-succession* class (*MR-A*), whereas fire in uncharacteristic classes acts as a self-loop and resets all vegetation to age zero.

An important disturbance was the invasion by exotic trees and forbs (*exotic-riparian-invasion*) represented mainly by saltcedar, tall whitetop, knapweeds, and thistles. *Exotic-riparian-invasion* causes a transition to the *exotic forb* class (*EF;* old terminology that actually contains exotic riparian trees). Workshop participants agreed to a moderately high rate (0.01/year) to plan for a worst case scenario. Roadways, off-highway vehicles, and animals are usually the greatest vectors of exotic forbs. Saltcedar is wind dispersed. *Exotic invasion* occurs in four classes: *early-succession closed* (*MR-A*), *mid-succession closed* (*MR-B*), *late-succession closed* (*MR-C*), and *shrub and forb encroached* (*SFE*).

An important source of saltcedar mortality is the introduced biocontrol beetle (*beetle-mortality*), which is present to abundant in the Virgin River drainage. Workshop participants decided that beetles kill saltcedars after 4 consecutive years of defoliation; therefore, the return interval for beetle induced mortality was 4 years (rate of 0.25/year). Beetle induced mortality causes age-dependent transitions from the *exotic-tree* class (*ET*) to the early-succession (*SWA-A*), *mid-succession* (*SWA-B*), and *late-succession* (*SWA-C*) classes.

A class reflecting historic grazing is the dominance of riparian corridors by native forbs and shrub species unpalatable to domestic sheep and cattle (*shrub and forb encroached* or *SFE*). Wood's rose (*Rosa woodsii*) and shinkbush (*Rhus trilobata*) are classic examples. The dynamics crating this class are retained in the model but the class was not detected by remote sensing and livestock no longer graze in the Red Cliffs NCA. Due to the proximity of creeks, *100-year flooding* events have the power to:

- Substantially rework sediments over 1% of the area of the class and cause a transition to the *early-succession* class (*MR-A*);whereas
- 99% of the remaining area is returned to age zero of the *shrub and forb encroached* class (*SFE*).

Desertification (or incision) of riparian vegetation, largely from past management, opens up dynamics more typical of upland communities. Incision causes a drop of water table and dries out riparian vegetation in favor of upland species. Due to the proximity of creeks, *100-year flooding* events have the power to

- Substantially rework sediments over 1% of the area of the class and cause a transition to the *early-succession* class (*MR-A*); whereas

- 99% of the remaining area is returned to age zero of the *desertified* class (*DE*).

One other natural disturbance can "restore" desertified riparian vegetation: flows will naturally rework banks and promote riparian vegetation at a low rate of 0.001/year (*floodplain recovery* disturbance) if and only if livestock grazing is absent for 10 consecutive years, which should happen in the Red Cliffs NCA.

Management Actions:

The only action retained for this small ecological system is control of saltcedar and exotic forbs: e*xotic-control-MR*. Small saltcedar saplings and trees are peppered throughout the montane riparian and relatively easy to locate. Action consists of cutting saltcedar and immediately painting the stumps with the herbicide Garlon IV®. If exotic forbs are found, they are sprayed with a different herbicide.

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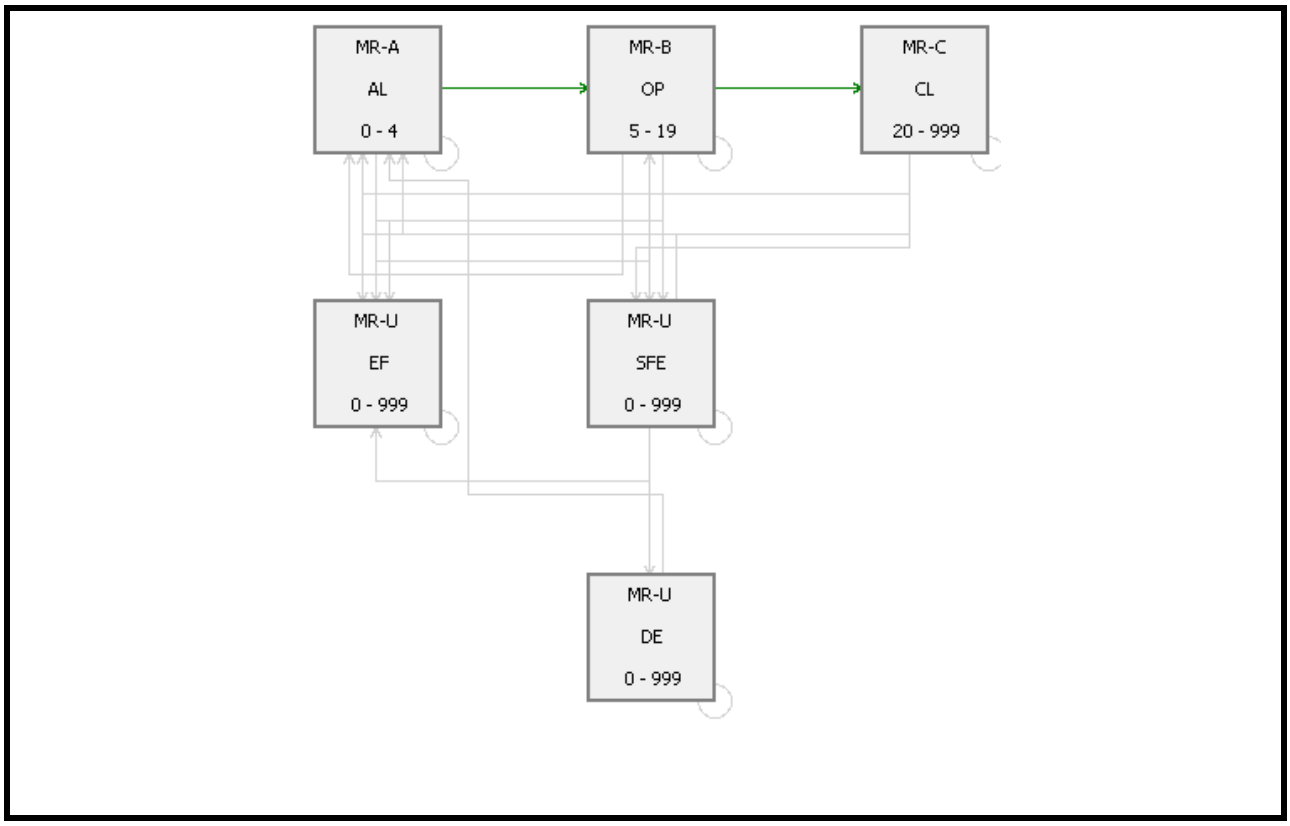
State-and-Transition Model (cropped):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Mountain Shrub (MSb) 1126ms

Area of Application and Context:

- **Red Cliffs and Beaver Dam Wash National Conservation Areas of southwestern Utah**
- **Livestock grazing on Beaver Dam Wash only**
- **Full fire suppression management**
- **Date created: July 2011**

Vegetation classes:

- A-**Early**: 0-10% canopy of snowberry, desert bitterbrush, or Stansbury cliffrose; 10-80% grass and forb cover; 0-12 yrs
- B-**Mid-open**: 11-30% cover of snowberry, desert bitterbrush, or Stansbury cliffrose; >50% herbaceous cover; 13-38 yrs
- C-**Mid-closed**: 31-50% cover of snowberry, desert bitterbrush, or Stansbury cliffrose; 25-50% herbaceous cover;<10% conifer sapling cover; 38+ yrs
- D-**Late-open**: 10-20% pinyon pine-juniper cover <5m; 25-40% cover of snowberry, desert bitterbrush, or Stansbury cliffrose; <30% herbaceous cover; 80-129 yrs
- U-*ES:* **Early-Shrub**; 20-50% cover rabbitbrush species
- U-*DP:* **Depleted**; 31-50% cover of snowberry, desert bitterbrush, Stansbury cliffrose; <5% herbaceous cover; <10% conifer sapling cover
- U-*SEP:* **Shrub-Exotic-Species-Perennial-Grass**; 5-40% cover of mountain shrubs; 5-20% non-native grass cover; native herbaceous cover usually present; trees may be present
- U-*TE:* **Tree-Encroached**; >21% pinyon pine-juniper cover 10-25m; <5% shrub cover; <5% herbaceous cover
- U-*TEX:* **Tree-Exotic-Species;** 10-20% pinyon pine-juniper cover <5m; ≥5% cover of non-native annual grasses and forbs; 25-40% cover of snowberry, desert bitterbrush, or Stansbury cliffrose; <30% herbaceous cover
- U-*EX:* **Exotic-Species;** 10-30% cover of cheatgrass; snakeweed or rabbitbrush may be present; dead standing stems of cliffrose often present

Reference Condition:

- **Natural Range of Variability**
  - 7%: A-*Early*
  - 15%: B-*Mid-open*
  - 63%: C-*Mid-closed*
  - 14%: D-*Late-open*
  - 0%: U

Succession:

Succession follows the 4-box pathway with vegetation starting as predominantly herbaceous and ending with pinyon or juniper, dominance and a viable shrub and herbaceous understory. Deterministic succession transitions occur in the first three boxes, whereas the last step of succession is probabilistic:

- Early-succession to mid-succession open: 4 years

- Mid-succession open to mid-succession closed: 19 years
- Mid-succession closed to late-succession open: ≥50 years (probabilistic)

Natural Disturbances:

Replacement fire is the primary stochastic disturbance. We chose a fire return interval slightly longer than that of the big sagebrush steppe-upland ecological system because mountain shrub dominated by cliffrose or desert bitterbrush is located on harsher, thinner soils. The mean return interval of *replacement fire* changes with vegetation classes:

- 70 years (0.014/year) in the *mid-succession* class (*MSb-B*) and in the *late-succession* class; to
- 150 years (0.0067/year) in the more wooded *late-succession open* class (*MSb-D*).

Replacement fire in vegetation classes that already experienced a threshold transition also causes a threshold transition to other uncharacteristic classes:

- For a 150-year fire return interval;
  - The *tree encroached shrubland* class (*TE*) converts to the *early shrub* class (*ES*), and
  - The *tree encroached shrubland with exotic annual species* class (*TEX*) transitions to the *exotic annual species* class (*EX*);
- With a 70-year (0.014/year) fire return interval, the *early shrub* class (*ES*) simply promotes rabbitbrush as a self-loop; and
- The *shrubland with mixed exotic annual and native perrennial species* class (*SEP*) burns every 40 years (0.025/year) on average, causing a transition to the *exotic annual species* class (*EX*).

Cliffrose is drought adapted. Seedling germination and survival is higher during dry years because drought reduces competition from grasses (Price and Botherson 1987). *Drought* causes stand replacing events (generally 10% of times) and stand thinning (90% of times) in classes with trees. A *drought* return interval rate of every 178 years (a rate of 0.0056/year) is used based on the frequency of severe drought intervals estimated by Biondi *et al*. (2007) from 2,300 years of western juniper (*Juniperus occidentalis)* tree ring data from the Walker River drainage of eastern California and western Nevada. Although we recognize that droughts may be more common than every 178 years, severe droughts, which were >7-year drought events with consecutive far-below average soil moisture (narrow tree rings), kill naturally drought resistant shrubs and trees.

- In the *late-succession closed* class (*MSh-D*):
  - For 10% of events, drought-induced mortality converts vegetation to the previous succession class (*MSh-C*); and
  - For the remaining 90% of events, *drought* reverses woody succession within the same vegetation class the originating class (*MSh-D*).
- In the *tree-encroached shrubland* class and *tree-encroached shrubland with exotic annual species* class, respectively, *drought* causes a transition to *early-shrub* (*ES*) and *exotic annual species* class (*ES*) 10% of times (otherwise, self thinning within each originating class).

Because cliffrose is drought adapted, the *wet-year* disturbance reverses succession by one year in the *early-succession* class (*MSh-A*); therefore making this a weak disturbance. The *wet-year* disturbance is caused by the 7-year El Nino cycle (rate of 0.14/year).

Tree (pinyon and juniper) invasion is responsible for the last succession step between the *mid-succession closed* (*MSh-C*) and *late-succession closed* (*MSh-D*) classes. This disturbance also causes succession from the *shrubland with mixed exotic annual and native perrennial species* class (*SEP*) to the *tree-encroached shrubland with exotic annual species* class (*TEX*). Pinyon and juniper invade shrublands at two different rates:

- 0.001/year from ages 50 to 99 years; and
- 0.005/year from ages after 100 years.

Pinyon and juniper require mature shrubs (usually sagebrush and bitterbrush) as nurse plants for seed germination and seedling establishment; therefore, the rate of tree invasion accelerates with time since succession.

A few anthropogenic disturbances cause accelerated woody succession in reference classes and transitions to uncharacteristic classes of vegetation.

Present only in Beaver Dam Wash NCA, *managed herbivory* and *excessive herbivory* have return intervals of one year (livestock is present every year) but different impact areas based on the distance livestock is willing to travel away from water. The impact of grazing is modeled with fixed rates of implementation (around an average) because grazing permits have fixed stocking rates, season of use, distribution. It is assumed that *managed herbivory* utilizes 5% of all grazable areas in the Beaver Dam Wash NCA (not just mountain shrub); therefore, only 5% of the area is selected for *managed herbivory* and vegetation classes in mountain shrub "compete" for selection. This method of modeling livestock grazing can only be implemented with the PATH software; VDDT cannot achieve landscape-level disturbances. Similarly, *excessive herbivory* affects 0.1% of the Beaver Dam Wash NCA causing a transition to the *early shrub* class (*ES*); however, *excessive herbivory* is caused by the movement of livestock through the same areas near or on the way to water sources. Therefore, once areas dominated by early shrubs are created, they become permanent and no new areas are created unless watering sources are moved or created. As a consequence, 0.1% of the Beaver Dam Wash is chosen among candidate vegetation classes to become the *early shrub* class (*ES*) in the first years of simulations, and then the process is stopped.

Managed herbivory reverses woody succession to age zero (i.e., stand replacing event) in the *early succession* class (*MSh-A*) through consumption of palatable cliffrose seedlings and grasses.

- After cliffrose establishes, managed herbivory accelerates woody succession by one year for every year selected for grazing by removal of grasses in the *mid-succession open* (*MSh-B*), *mid-succession-closed* (*MSh-C*), and *shrubland with mixed exotic annual species and perennial grasses* (*MSh-SEP*) classes.
- The wooded *late-succession closed* class (*MSh-D*) is not grazed.
- *Managed herbivory* is present but does not have any successional effect in the *early shrub* (*ES*) and the *exotic annual species* (*EX*) classes.

Excessive herbivory is present in the *mid-succession open* (*MSh-B*), *mid-succession-closed* (*MSh-C*), and *shrubland with mixed exotic annual species and perennial grasses* (*MSh-SEP*) classes and only causes a transition to the *early shrub* class (*ES*) during the first five years of simulation.

Exotic invasion affects the reference (*MSH-A*, *MSh-B*, *MSh-C,* and *MSh-D*) and *tree-encroached* (*TE*)

classes at a rate of 0.0025/year. We chose an invasion rate half that of the big sagebrush steppe-upland ecological system because cliffrose grows on harsher, thinner soils. *Exotic invasion* of:

- The *early succession* class (*MSH-A*) causes a transition to the *exotic annual species* class (*EX*);
- The *mid-succession* (*MSh-B* and *MSh-C*) and *late-succession* (*MSh-D*) classes convert to the *shrubland with mixed exotic annual species and perennial grasses* class (*MSh-SEP*); and
- The *tree-encroached shrublands* (*TE*) converts to the *tree-encroached shrubland with exotic annual species* class (*TEX*).

Management Actions:

Two restoration actions are proposed:

- Spraying the herbicide Plateau® to control exotic annual species followed by seeding cliffrose in the *exotic annual grassland and forbland* class (*EX*).
- Spraying the herbicide Plateau® to control exotic annual species followed by seeding perennial native grasses in the *shrubland* with *exotic annual species* class (*SES*).

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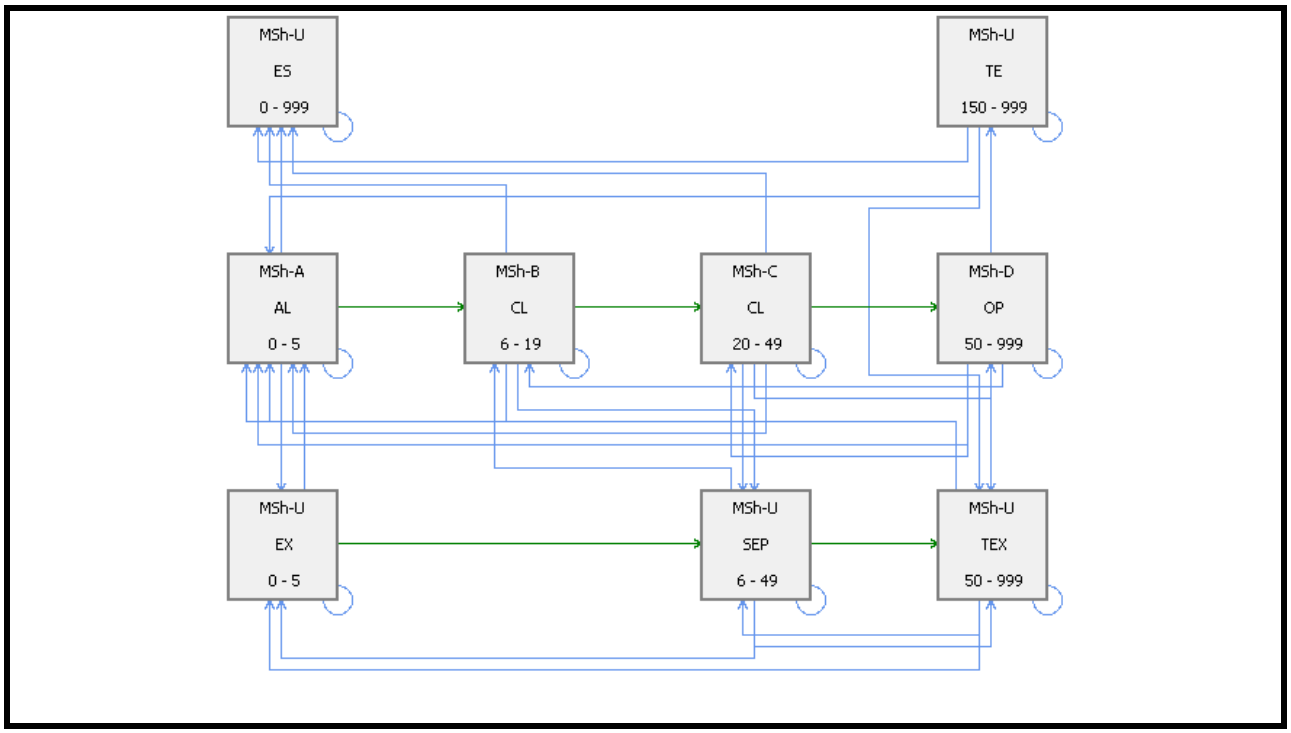
State-and-Transition Model: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Pinyon-Juniper Woodland (PJ) 1019

Area of Application and Context:

- **Red Cliffs and Beaver Dam Wash National Conservation Areas of southwestern Utah**
- **Livestock grazing on Beaver Dam Wash only**
- **Full fire suppression management**
- **Date created: July 2011**

Vegetation classes:

- A-**Early-open**: 5-20% herbaceous cover; 0-9 yrs
- B-**Mid1-open**: 11-20% cover big sage or black sage <1.0m; 10-40% herbaceous cover; 10-29 yrs
- C-**Mid2-open**: 11-30% cover of pinyon and/or juniper <5m; 10-40% shrub cover; <20% herbaceous cover; 30-99 yrs
- D-**Late-open**: 31-50% cover of pinyon and/or juniper <5m-9m; 10-40% shrub cover; <20% herbaceous cover; >99 yrs
- U-TEX: **Tree- Exotic-Species**; 31-50% cover of pinyon and/or juniper <5m-9m; 5-20% cheatgrass cover 10-40% shrub cover
- U-*EX:* **Exotic-Species**; 5-30% cheatgrass cover; dead pinyon or juniper visible

Reference Condition:

- **Natural Range of Variability**
  - 2%: A-*Early*
  - 3%: B-*Mid1-open*
  - 13%: C-*Mid2--open*
  - 82%: D-*Late-open*
  - 0%: U

Succession:

Succession follows the 4-box pathway with vegetation starting as predominantly native annual and perennial herbaceous species and ending with old (>300 years) pinyon and juniper and generally with a viable shrub and herbaceous understory. The succession pathway is entirely deterministic. Deterministic succession transitions occur at the following ages:

- Early-succession to mid-succession open: 9 years
- Mid1-succession open to mid2-succession open: 29 years
- Mid2-succession open to late-succession open: 99 years

Natural Disturbances:

Replacement fire restarts the succession clock to age zero within the reference condition, which is the *early-succession* or *PJ-A* class. The mean return interval of *replacement fire* is:

- 300 years (0.003/year) in the *early-succession* class (*PJ-A*);
- 200 years (0.005/year) in *mid1-succession open,* and *mid2-succession open* classes*; and*
- 1,000 years (0.001/year) in the *late-succession open* classes (*PJ-D*).

Replacement fire in vegetation classes that already experienced a threshold transition also causes a threshold transition to other uncharacteristic classes. The fire return interval is;

- 200 years in the *tree with exotic annual species* class (*TEX*). Fire causes a conversion to the *exotic annual grassland and forbland* class (*EX*); and
- 10 years in the *exotic annual grassland and forbland* class (*EX*), where vegetation remains in the class (self-loop).

Drought operates in the *mid2-succession open* (*PJ-C*), *late-succession open* (*PJ-D*) and *tree with exotic annual species* (*TEX*) class. *Drought* causes thinning to the previous succession class (generally 10% of times) and thinning within a class (90% of times). In most cases *drought* created tree and shrub mortality under the assumption that prolonged and decreased soil moisture weakened plants that might ultimately be killed by insects or disease. Therefore, we do not double-count mortality. A *drought* return interval rate of every 178 years (a rate of 0.0056/year) is used based on the frequency of severe drought intervals estimated by Biondi *et al*. (2007) from 2,300 years of western juniper (*Juniperus occidentalis)* tree ring data from the Walker River drainage of eastern California and western Nevada. Although we recognize that droughts may be more common than every 178 years, severe droughts, which were >7-year drought events with consecutive far-below average soil moisture (narrow tree rings), kill naturally drought resistant shrubs and trees.

- The *mid2-succession closed* class (*PJ-C*) is thinned by *drought*:
  - Within the class (to its beginning) for 90% of events; and
  - To the previous succession class, *mid1-succession open* class (*PJ-B*), for the other 10% of events, which assumes older trees are more affected.
- The *late-succession open* class (*PJ-D*) responds differently to *drought* because older trees become more vulnerable to the baseline 178-year return interval of severe *droughts* and additional insect attacks (both sources are assumed in the total 0.0168/year rate [60 years] for *drought* in the model):
  - 90% of mortality is expressed as thinning to age 100 year within the class;
  - 7% of thinning is to the previous succession class (*mid2-succession open* or *PJ-C*); and
  - 3% of thinning results in the *mid1-succession open* class (*PJ-B*).
- The only uncharacteristic class affected is *trees with exotic annual species* (*TEX*) class:
  - 90% of the class is thinned from within; and
  - 10% of the class converts to the *exotic annual grassland and forbland* class (*EX*).

Exotic annual species invasion (*EX-invasion*) is set at a slow rate of 0.001/year (1 out of 1,000 pixels converted to a cheatgrass-invaded class per year). A base rate of 0.001/year is estimated from data of northwest Utah collected by the Utah Division of Wildlife Resources in black sagebrush semi-desert. Black sagebrush semi-desert is usually considered more resistant to cheatgrass invasion than Wyoming big sagebrush semi-desert or other big sagebrush dominated biophysical settings. We default to five times the rate estimated from the Utah data. The soils of pinyon-juniper woodlands are either harsher or similar to those of black sagebrush. Exotic annual species invasion (*EX-invasion*) starts in the *mid2-succession open* class (*PJ-C*) and continues in the *late-succession open* class (*PJ-D*), causing a transition to

the *tree with annual grass* class (*TA*).

Management Actions:

Two management actions were retained for pinyon and juniper woodlands invaded by exotic annual species:

- In mostly wilderness areas, hand spraying of herbicide (Plateau®) to control exotic annual species followed by aerial seeding of native species in *exotic annual grasslands and forblands* (*EX*). Success rate is 60% and restores the *early-succession* class (*PJ-A*). Failure simply keeps vegetation in the originating class.
- In mostly wilderness areas, hand spraying of herbicide (Plateau®) under the canopy of trees to control exotic annual species in the *tree with exotic annual species* class (*TEX*). Herbicide succeeds 60% of times causing recruitment to the *mid2-succession closed* class (*PJ-C*) for vegetation from 60-99 years and to the *late-succession closed* class (*PJ-D*) for vegetation older than 99 years.

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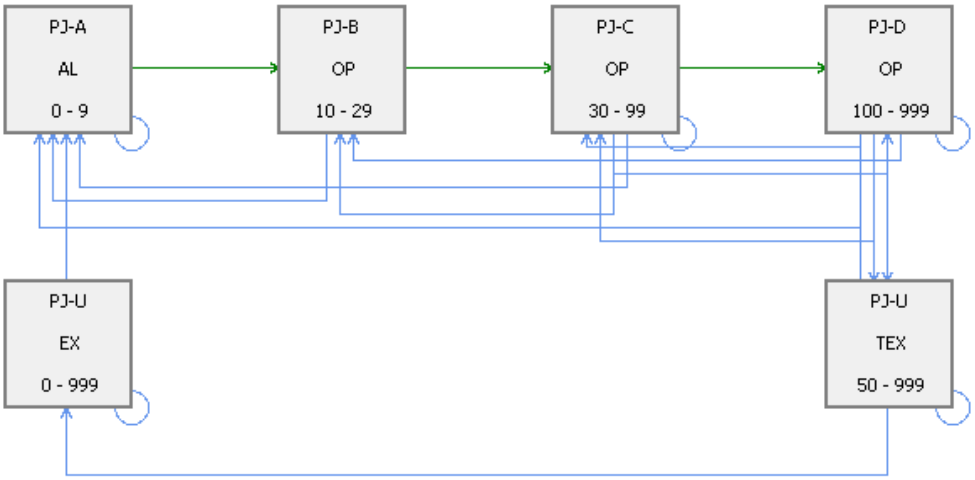
State-and-Transition Model:



Warm Desert Riparian (WDR) 1155

Area of Application and Context:

- **Red Cliffs and Beaver Dam Wash National Conservation Areas of southwestern Utah**
- **Livestock grazing on Beaver Dam Wash only**
- **Full fire suppression management**
- **Date created: July 2011**

Vegetation:

- *WDR-A*: **Early**; 10-50% cover of Gooding willow and Fremont Cottonwood seedlings and shrubs; riparian and wetland graminoids may co-dominate; 0-4 yrs post-flooding
- *WDR-B*: **Mid-closed**; 51-100% cover of willow and small trees (willow and cottonwood) <3 m; patches of graminoids and halophytic shrubs common; 5-19 yrs after flooding
- *WDR-C*: **Mid-open**; 11-50% cover of fire resprouts of mesquite and Gooding willow; patches of graminoids frequent after fire; mesquite mature to larger trees several years after fire; 1-89 yrs after fire
- *WDR-D*: **Late1-closed**; 51%-90% of mature Gooding willow and Fremont cottonwood; patches of graminoids in saturated soils and of halophytic shrubs on drier sediment deposits or more saline surfaces; 10-89 yrs
- *WDR-E*: **Late2-closed**; 51-90% mesquite cover; Gooding willow and Fremont cottonwood minor component; understory often dominated by graminoids and forbs; >90 yrs
- *U-DE:* **Desertified**; incised river bank caused by human disturbance; 10-90% native halophytic shrub or riparian tree cover; graminoid patches may be present
- *U-DET:* **Desertified-Exotic-Tree**; >5% exotic tree species (tamarisk or Russian olive) regardless of native cover; river bank incised
- *U-DEF:* **Desertified-Exotic-Forb**; >5% exotic forb species regardless of native cover; river bank incised
- *U-DEX:* **Desertified-Exotic-Species;** 5-40% exotic annual grasses and forbs; charred remnants of trees and shrubs often present; snakeweed often present to abundant; river bank incised
- *U-TEX:* **Tree- Exotic-Species;** 51%-90% of young or mature Gooding willow and Fremont cottonwood; >5% cover of exotic annual grass and forb species; patches of graminoids in saturated soils and of halophytic shrubs on drier sediment deposits or more saline surfaces
- *U-EF:* **Exotic Forb**; >5% exotic forb species regardless of native cover; river bank not incised
- *U-ET:* **Exotic-Tree**; >5% exotic tree species (tamarisk or Russian olive) regardless of native cover; river bank not incised
- *U-EX:* **Exotic-Species;** 5-40% exotic annual grasses and forbs; charred remnants of trees and shrubs often present; snakeweed often present to abundant
- *U-BG:* **Bare ground**; mineral soil exposed by human-caused disturbances

Reference Condition:

- **Natural Range of Variability**
  - 10%: A-*Early*
  - 19%: B-*Mid-closed*
  - 8%: C-*Mid-open*
  - 40*%:* D-*Late1-closed*

- 23%: E-*Late2-closed*
- 0%: U

Succession:

Succession follows the 4-box pathway with one lateral pathway. The succession pathway is determined most by flooding has heterogeneous vegetation starting with young Goodding's willow and Fremont cottonwood, and graminoids (*WDR-A*) and finishing with mature mesquite, Goodding's willow, and Fremont cottonwood (*WDR-E*). When any of the late-closed classes (*WDR-D* and *WDR-E*) burn, they transition to the *mid-succession open* (*WDR-C*) class dominated by resprouting mesquite, which succeeds to the *late2-succession closed* (*WDR-E*) class. Therefore, fire has a key role in this succession pathway. Succession is entirely deterministic with transitions occurring at the following ages:

- Early-succession to mid-succession closed: 4 years
- Mid-succession closed to late1-succession closed: 19 years
- Late1-succession closed to late2-succession closed: 89 years
- Mid-succession open to late2-succession closed: 89 years

Natural Disturbances:

Flooding dominates the dynamics of the warm desert riparian system. Three levels of *flooding* are:

- 7-yr events (0.14/year) that kills or removes only herbaceous vegetation in the *early-succession* class (*WDR-A*);
- 20-year events (0.05/year) that kills or removs shrubs and young trees in the *mid-succession classes* (*WDR-B* and *WDR-C*); and
- 100-year events (0.01/year) that top-kills larger trees and everything else in the *late-succession closed* classes (*WDR-D* and *WDR-E*).

One-hundreth-year flooding events also transformed uncharacteristic classes:

- In all classes except *exotic forbs* (*EF*), 100-year flooding acted as a self-loop (class stays the same) in 99% of cases with the age of the class being reset to the age at the beginning of the class;
- Variation exists for the remaining 1% of events:
  - Most classes transition to the *early-succession* class (*WDR-A*) due to pure scouring; but
  - The *trees with exotic annual species* class (*TEX*) will become the *exotic-annual-species* class (*EX*) because trees are toppled; and
  - The *desertified exotic tree* (*DET*) and *desertified exotif forb* (*DEF*) classes, respectively, transition to the *exotic tree* (*ET*) and *exotic forbs* (*EF*) classes as the energy of the flow reworks the sediments of the perched river bank (i.e., eliminates it) but does not entirely remove roots of exotic species that could then resprout.
- The *exotic-forb* class (*EF*) remains the same in 100% of cases due to a resprouting and extensive root system.

Replacement fire originates from the surrounding landscape and restarts the succession clock to age

zero after sweeping through the riparian corridor. Fire is possible in both *late-succession closed* classes (*WDR-D* and *WDR-E*), because greater woody debris and drier vegetation classes are more prone to lightning strikes in addition to fire importation. Fire in reference classes causes a stand replacing event and recruitment into the *mid-succession* open class (*WDR-C*). However, fire is rare because the surrounding blackbrush and creosotebush-white bursage ecological systems do not carry fire, unless invaded by non-native annual grasses. The mean fire return interval is set at:

- About 750 years (rate of 0.0013/year) in the *late1-succession closed* (*WDR-D*) class; and
- 250 years (rate of 0.004/year) *late2-succession closed* (*WDR-E*) class.

Fire in most uncharacteristic classes often acts as a self-loop, returning all vegetation to age zero.

- These classes are *desertified-exotic-tree* (*DET*), *exotic-tree* (*ET*), *desertified-exotic-annual-species* (*DEX*), and *exotic-annual-species* (*EX*) and they all have a 20-year fire return interval (rate of 0.05/year). In other words, saltcedar, red brome, and *Erodium* spp. either strongly resprout after or strive with fire.
- The *tree with exotic annual species* class (*TEX*) converts to the *exotic-annual-species* (*EX*) class after fire experienced, on average, about every 650 years (rate of 0.0015/year).

An important disturbance is the invasion by exotic trees (*exotic-tree-invasion*) represented mainly by saltcedar. This invasion is triggered if weed inventory and follow-up control has not happened in a pixel for five consecutive years. *Exotic-tree-invasion* causes a transition to the *exotic-tree* class (*ET*) on un-incised river banks and to the *desertified-exotic-tree* (*DET*) class. Workshop participants agreed to moderate rates of invasion varying from 0.005/year to 0.01/year to plan for a worst case scenario. Saltcedar is wind dispersed. *Exotic-tree-invasion* occurs in several classes: *early-succession closed* (*WDR-A*), *mid-succession closed* and *open* classes (*WDR-B and WDR-C, respectively*), *late1-succession closed* (*WDR-D*), *late2-succession closed* class (*WDR-E*), *desertified* (*DE*), *desertified-exotic-annual-species* (*DEX*), *exotic-annual-species* (*EX*), and *tree with exotic annual species* class (*TEX*). Invasion rates vary:

- The highest rate of invasion of 0.01/year is found in classes with exposed mineral soil or substrate: *early-succession* (*WDR-A*) and the first four years of *mid-succession open* class (*WDR-C*);
- As vegetation builds up, the invasion rate decreases to 0.0075/year in the following classes: *mid-succession closed* (*WDR-B*), from year 5 to 89 of the *mid-succession open* (*WDR-C*), *exotic-annual-species* (*EX*), *desertified* (*DE*), and *tree with exotic annual species* (*TEX*); and
- The lowest rate of invasion of 0.005/year is observed in either the most mature reference classes or desertified (drier) classes: *late1-succession closed* (*WDR-D*), *late2-succession closed* (*WDR-E*), and *desertified-exotic-annual-species* (*DEX*).

An important source of saltcedar mortality is the introduced biocontrol beetle (*beetle-mortality*), which is present to abundant in the Virgin River drainage. Workshop participants decided that beetles kill saltcedars after 4 consecutive years of defoliation; therefore, the return interval for beetle induced mortality is 4 years (rate of 0.25/year). *Beetle-mortality* has a failure rate of 75% (vegetation remains in the same class), whereas success (25%) is a transition. Beetle induced mortality causes age-dependent transitions from:

- The *exotic-tree* class (*ET*) to the early-succession (*DWR-A*), *mid-succession* closed (*DWR -B*), *mid-succession* open (*DWR-C*), *late1-succession closed* (*DWR -D*), and *late2-succession closed* (*DWR -E*) classes; and

- The *desertified-exotic-tree* class (*DET*) to the *desertified* class (*DE*).

In the warm desert riparian system, *exotic-forb-invasion* is decoupled from *exotic-tree-invasion* (it is not in other riparian ecological systems). Exotic forbs are represented mainly by knapweed species and tall whitetop. *Exotic-forb-invasion* causes a transition to the *exotic-forb* class (*EF*) on un-incised river banks and to the *desertified-exotic-tree* (*DEF*) class. Classes affected and rates of invasion of the *exotic-forb* class (*EF*) are identical to those of the *exotic-tree* (*ET*) class. There is not, however, a biocontrol beetle for exotic forb control.

A third form of invasion is by non-native annual species (*EX-invasion*) occurring at a rate of 0.005/year (5 of 1,000 pixels per year) in all uninvaded classes: *early-succession closed* (*DWR-A*), *mid-succession closed* (*DWR-B*), *mid-succession open* (*DW-C*), *late1-succession closed* (*DWR-D*), and *late2-succession closed* (*DWR-E*). Exotic annual species invasion (*EX-invasion*) is set at a moderate rate of 0.005/year (1 out of 200 pixels converted to a cheatgrass-invaded class per year. A base rate of 0.001/year was estimated for cheatgrass from data of northwest Utah collected by the Utah Division of Wildlife Resources in black sagebrush semi-desert. We default to five times the rate estimated from the Utah data because desert riparian systems are more productive systems. Invasion of reference classes causes an age-dependent transition to the *trees with non-native annual species* (*TEX*).

Present in Beaver Dam Wash only, *managed herbivory* and *excessive herbivory* have return intervals of one year (livestock is present every year) but different impact areas based on the distance livestock is willing to travel away from water. In theory, water is in this ecological system. The impact of grazing was modeled with area limits, because grazing permits have fixed stocking rates, season of use, and distribution. It was assumed that *managed herbivory* utilizes 5% of all grazable areas in the Beaver Dam Wash NCA (not just desert riparian); therefore, only 5% of the area is selected for *managed herbivory* and vegetation classes in desert riparian "compete" for selection. This method of modeling livestock grazing can only be implemented with the PATH software; VDDT cannot achieve landscape-level disturbances. Similarly, *excessive herbivory* affects 0.1% of the Beaver Dam Wash NCA causing a transition to the *desertified* class (*DE*); however, *excessive herbivory* is caused by the movement of livestock through the same areas near or on the way to water sources. Therefore, once areas dominated by incised river banks are created, they become permanent and no new areas are created. As a consequence, 0.1% of the Beaver Dam Wash is chosen among candidate vegetation classes to become the *desertified* class (*DE*) in the first years of simulations, and then the process is stopped.

Managed herbivory has different effects on woody succession depending on the age of the grazable vegetation classes:

- The *early-succession* class (*WDR-A*) is very vulnerable to grazing; therefore, new vegetation is largely eliminated and the age of grazed vegetation is reset at zero years;
- A similar effect is found in the *exotic-annual-species* class (*EX*) because livestock is concentrated in riparian areas and livestock will focus on non-native annual species because, during winter grazing (the permit is primarily for winter grazing), these species are often the only green forage available;
- In both *mid-succession* classes (*WDR-B* and *WDR-C*), grazing of more established vegetation has a small negative effect that consist of a one year reversal of woody vegetation after vegetation is grazed. This effect reverses woody succession through the reduction of preferentially herbaceous and nutrient-rich soft woody vegetation;
- Preference for these food types in more developed woody vegetation of the *late1-succession*

closed (*WDR-D*), *desertified with exotic annual species* (*DEX*), and *tree with exotic species* (*TEX*) classes causes a small acceleration of woody succession by favoring unpalatable or hardened woody species; and

- Grazing has no effect on the succession age of the *late2-succession closed* class (*WDR-E*).

Excessive herbivory is present in all classes except the *desertified (DE), exotic-tree* (*ET), exotic forb* (*EF*), *desertified exotic tree* (*DET*), and *desertified exotic forb* (*DEF*) classes. *Excessive herbivory* primarily causes a transition to the *desertified* (DE*)* class, however the *desertified with exotic annual species* (*DEX*) is one exception. This class cannot be further incised but the shade from trees and presence of green winter forage creates a strong grazing pressure that accelaerates woody succession by three years for every pixel chosen.

Management Actions:

Several actions (six in Beaver Dam Wash and five in Red Cliffs NCAs, respectively) are used in this ecological system:

- Inventory of weeds and saltcedar on a rotation (i.e., revisit the same reach every *X* years) for identification of occurrences for future treatment (*weed-inventory).*
- Control of saltcedar: *exotic-tree-control*. Action consists of cutting saltcedar and immediately painting the stumps with the herbicide Garlon IV® in the *exotic-tree* (*ET*) and *desertified-exotic-tree* (*DET*) classes. Two types of failures occur: 10% of times there is no change of class because saltcedar resprout immediately and vigorously and 10% of times exotic forb species (knapweeds and tall whitetop) emerge (therefore, the *exotic-forb* [*EF*] or *desertified-exotic-forb* [*DEF*] classes). Success rate, therefore, is 80% and results in a transition to the *early-succession* (*WDR-A*) class for the non-desertified river reaches or the *desertified* (*DE*) class for saltcedar originally growing on incised river banks.
- Control of exotic forbs: *exotic-forb-control*. Action consists of spraying exotic forbs in the *exotic-forb* (*EF*) and *desertified-exotic-forb* (*DEF*) classes. On incised river banks, failure rate is 40% (no change of class), whereas "success" occurs 60% of time leaving a desertified and seeded (native species) river bank. On un-incised river banks, the treatment fails 40% of times with no change of class, whereas the treatment succeeds 60% of times resulting in a transition to the *early-succession* (*WDR-A*) class.
- In the Beaver Dam Wash NCA, cessation of livestock grazing by having a third party purchase all AUMs and retire grazing permits (i.e., by turning off grazing with one transition multiplier).
- Hand spraying of the herbicide Plateau® to control exotic annual species in the *tree with exotic species* (*TEX*) class. Failure rate is 50% (no change of class), whereas success causes a transition to the *early-succession* (*WDR-A*), *mid-succession closed (WDR-B), late1-succession closed* (*WDR-D*), and *late2-succession closed* (*WDR-D*) classes that depends on the age of originating vegetation class.
- Law enforcement only affected the creation of one vegetation class from OHV activity in several ecological systems of the Beaver Dam Wash NCA: *bare groud* (*BG*). Increased law-enforcement reduces the OHV disturbance by 50% (to 5% absolute rate) using a static transition multiplier in PATH.

Appendix 3. Probabilistic transitions for biophysical settings of the Red Cliffs and Beaver Dam Wash NCAs. Output obtained from PATH database. Legend: BSu = Big Sagebrush Steppe-upland, BM = Blackbrush-mesic, BT= Blackbrush-thermic, CB = Creosotebush-White Bursage, DSS = Desert Sand Sagebrush, GRL = Warm Season Grassland, MR = Montane Riparian, MSh = Mountain Shrub, PJ = Pinyon-Juniper Woodland, WAS = Desert Washes, WDR = Warm-Desert Riparian.

From Class	To Class	Transition Type	Prob	Propn	Start Age	End Age	Rel Age	Keep Age	Min TST	Max TST
Red Cliffs NCA										
DSS-A:OP	DSS-A:OP	NativeHerbivory	0.0050	1.0000	0	2	1	No	0	9999
DSS-A:OP	DSS-A:OP	ReplacementFire	0.0083	1.0000	0	2	-2	No	0	9999
DSS-A:OP	DSS-U:SEP	EX-Invasion	0.0010	1.0000	0	2	0	Yes	0	9999
DSS-B:OP	DSS-A:OP	ReplacementFire	0.0106	1.0000	3	999	0	No	0	9999
DSS-B:OP	DSS-B:OP	Drought	0.0056	1.0000	3	999	-999	No	0	9999
DSS-B:OP	DSS-B:OP	Managed-Herbivory	1.0000	0.0500	3	999	2	No	0	9999
DSS-B:OP	DSS-U:DP	Excessive-Herbivory	0.0010	1.0000	10	10	0	Yes	0	9999
DSS-B:OP	DSS-U:SEP	EX-Invasion	0.0010	1.0000	3	999	0	Yes	0	9999
DSS-U:DP	DSS-U:DP	Drought	0.0056	1.0000	0	999	-999	No	0	9999
DSS-U:DP	DSS-U:DP	ReplacementFire	0.0083	1.0000	0	999	-999	No	0	9999
DSS-U:DP	DSS-U:SEP	EX-Invasion	0.0010	1.0000	0	999	0	Yes	0	9999
DSS-U:SEP	DSS-B:OP	FOD+Seed-DSS	0.0100	0.6000	0	999	0	Yes	0	9999
DSS-U:SEP	DSS-B:OP	Hrbx+Seed-DSS	0.0100	0.5000	0	999	0	Yes	0	9999
DSS-U:SEP	DSS-U:DP	Excessive-Herbivory	1.0000	0.0010	10	10	0	Yes	0	9999
DSS-U:SEP	DSS-U:SEP	Drought	0.0056	1.0000	0	999	-999	No	0	9999
DSS-U:SEP	DSS-U:SEP	FOD+Seed-DSS	0.0100	0.4000	0	999	0	No	0	9999
DSS-U:SEP	DSS-U:SEP	Hrbx+Seed-DSS	0.0100	0.5000	0	999	0	No	0	9999
DSS-U:SEP	DSS-U:SEP	Managed-Herbivory	1.0000	0.0500	0	999	1	No	0	9999
DSS-U:SEP	DSS-U:SEP	ReplacementFire	0.0106	1.0000	3	999	-999	No	0	9999
DSS-U:SEP	DSS-U:SEP	ReplacementFire	0.0500	1.0000	0	2	-999	No	0	9999
BM-A:AL	BM-A:AL	FuelBreak	0.0100	1.0000	0	999	0	No	0	9999
BM-A:AL	BM-A:AL	Managed-Herbivory	1.0000	0.0500	2	199	1	No	0	9999
BM-A:AL	BM-A:AL	ReplacementFire-Mojave	0.0001	1.0000	0	199	-999	No	3	9999
BM-A:AL	BM-U:BG	OHV	1.0000	0.0001	0	199	0	No	2	9999

BM-A:AL	BM-U:ES	Excessive-Herbivory	1.0000	0.0010	10	10	0	Yes	0	9999
BM-A:AL	BM-U:EX	EX-Invasion	0.0050	1.0000	0	4	0	Yes	0	9999
BM-A:AL	BM-U:EX	Utilities	0.0001	1.0000	0	999	0	No	0	9999
BM-A:AL	BM-U:SEP	EX-Invasion	0.0050	1.0000	5	199	0	Yes	0	9999
BM-C:OP	BM-A:AL	ReplacementFire-Mojave	0.0005	1.0000	200	999	0	No	3	9999
BM-C:OP	BM-C:OP	FuelBreak	0.0100	1.0000	200	999	0	No	0	9999
BM-C:OP	BM-C:OP	Managed-Herbivory	1.0000	0.0500	200	999	3	No	0	9999
BM-C:OP	BM-D:OP	Tree-Invasion	0.0025	1.0000	400	999	0	Yes	0	9999
BM-C:OP	BM-U:BG	OHV	1.0000	0.0001	200	999	0	No	2	9999
BM-C:OP	BM-U:ES	Excessive-Herbivory	1.0000	0.0010	210	210	0	Yes	0	9999
BM-C:OP	BM-U:EX	Utilities	0.0001	1.0000	200	999	0	No	0	9999
BM-D:OP	BM-A:AL	Drought	0.0056	0.0100	400	999	0	No	0	9999
BM-D:OP	BM-A:AL	ReplacementFire-Mojave	0.0010	1.0000	400	999	0	No	3	9999
BM-D:OP	BM-C:OP	Drought	0.0056	0.9900	400	999	0	No	0	9999
BM-D:OP	BM-D:OP	FuelBreak	0.0100	1.0000	400	999	0	No	0	9999
BM-D:OP	BM-D:OP	Managed-Herbivory	1.0000	0.0500	400	999	3	No	0	9999
BM-D:OP	BM-U:BG	OHV	1.0000	0.0001	400	999	0	No	2	9999
BM-D:OP	BM-U:EX	Utilities	0.0001	1.0000	400	999	0	No	0	9999
BM-D:OP	BM-U:TEX	EX-Invasion	0.0050	1.0000	400	999	0	Yes	0	9999
BM-D:OP	BM-U:TEX	Tree-Encroachment	0.0050	1.0000	600	999	0	No	0	9999
BM-U:BG	BM-U:BG	OHV	1.0000	0.0001	0	999	-999	No	2	9999
BM-U:BG	BM-U:EX	EX-Invasion	0.0050	1.0000	0	999	0	No	0	9999
BM-U:BG	BM-U:EX	Utilities	0.0001	1.0000	0	999	0	No	0	9999
BM-U:ES	BM-U:BG	OHV	1.0000	0.0001	0	999	0	No	2	9999
BM-U:ES	BM-U:ES	FuelBreak	0.0100	1.0000	0	999	0	No	0	9999
BM-U:ES	BM-U:ES	ReplacementFire-Mojave	0.0010	1.0000	0	999	-999	No	3	9999
BM-U:ES	BM-U:EX	Utilities	0.0001	1.0000	0	999	0	No	0	9999
BM-U:ES	BM-U:SEP	EX-Invasion	0.0050	1.0000	0	999	0	No	0	9999
BM-U:EX	BM-U:BG	OHV	1.0000	0.0001	0	999	0	No	2	9999
BM-U:EX	BM-U:ES	Excessive-Herbivory	1.0000	0.0010	0	999	0	No	0	9999
BM-U:EX	BM-U:EX	FuelBreak	0.0100	1.0000	0	999	0	No	0	9999
BM-U:EX	BM-U:EX	Hrbx+Current-Native-Seed-BM	0.0100	0.9900	0	999	-999	No	0	9999

BM-U:EX	BM-U:EX	Hrbx+Introduced-Seed-BM	0.0100	0.9500	0	999	-999	No	0	9999
BM-U:EX	BM-U:EX	Hrbx+New-Seed-BM	0.0100	0.9500	0	999	0	Yes	0	9999
BM-U:EX	BM-U:EX	Managed-Herbivory	1.0000	0.0500	2	999	1	No	0	9999
BM-U:EX	BM-U:EX	Planting+FOD-BM	0.0100	0.1000	0	999	0	No	0	9999
BM-U:EX	BM-U:EX	Planting+Herbicde-BM	0.0100	0.1000	0	999	0	No	0	9999
BM-U:EX	BM-U:EX2B	ReplacementFire-Mojave	0.0500	1.0000	21	999	-999	No	3	9999
BM-U:EX	BM-U:EX2B	ReplacementFire-Mojave	0.1000	1.0000	0	20	-999	No	3	9999
BM-U:EX	BM-U:EX2B	Utilities	0.0001	1.0000	0	999	0	No	0	9999
BM-U:EX	BM-U:PL	Planting+FOD-BM	0.0100	0.6950	0	999	0	No	0	9999
BM-U:EX	BM-U:PL	Planting+Herbicde-BM	0.0100	0.4500	0	999	0	Yes	0	9999
BM-U:EX	BM-U:SD	Hrbx+Current-Native-Seed-BM	0.0100	0.0100	0	999	0	Yes	0	9999
BM-U:EX	BM-U:SD	Hrbx+New-Seed-BM	0.0100	0.0500	0	999	0	Yes	0	9999
BM-U:EX	BM-U:SDI	Hrbx+Introduced-Seed-BM	0.0100	0.0500	0	999	0	Yes	0	9999
BM-U:EX	BM-U:SEP	Non-Joshua-Succession	0.1000	1.0000	20	999	0	No	0	9999
BM-U:EX	BM-U:SEP	Planting+FOD-BM	0.0100	0.2050	0	999	0	No	0	9999
BM-U:EX	BM-U:SEP	Planting+Herbicde-BM	0.0100	0.4500	0	999	0	Yes	0	9999
BM-U:EX2B	BM-U:BG	OHV	1.0000	0.0001	0	999	0	No	2	9999
BM-U:EX2B	BM-U:EX2B	FuelBreak	0.0100	1.0000	0	999	0	No	0	9999
BM-U:EX2B	BM-U:EX2B	Hrbx+New-Seed-BM	0.0100	0.9500	0	999	0	No	0	9999
BM-U:EX2B	BM-U:EX2B	Law-Inforcement	0.0100	1.0000	0	999	0	No	0	9999
BM-U:EX2B	BM-U:EX2B	Managed-Herbivory	1.0000	0.0500	2	999	0	No	0	9999
BM-U:EX2B	BM-U:EX2B	Planting+FOD-BM	0.0100	0.1000	0	999	0	No	0	9999
BM-U:EX2B	BM-U:EX2B	Planting+Herbicde-BM	0.0100	0.1000	0	999	0	No	0	9999
BM-U:EX2B	BM-U:EX2B	ReplacementFire-Mojave	0.1000	1.0000	0	999	-999	No	3	9999
BM-U:EX2B	BM-U:PL	Planting+FOD-BM	0.0100	0.6950	0	999	0	No	0	9999
BM-U:EX2B	BM-U:PL	Planting+Herbicde-BM	0.0100	0.4500	0	999	0	No	0	9999
BM-U:EX2B	BM-U:SD	Hrbx+New-Seed-BM	0.0100	0.0500	0	999	0	No	0	9999
BM-U:EX2B	BM-U:SEP	Planting+FOD-BM	0.0100	0.2050	0	999	0	No	0	9999
BM-U:EX2B	BM-U:SEP	Planting+Herbicde-BM	0.0100	0.4500	0	999	0	No	0	9999
BM-U:PL	BM-A:AL	Natural-Recovery	0.1000	1.0000	20	999	0	No	10	9999
BM-U:PL	BM-U:BG	OHV	1.0000	0.0001	0	999	-999	No	2	9999
BM-U:PL	BM-U:ES	Excessive-Herbivory	1.0000	0.0010	10	10	0	Yes	10	9999

BM-U:PL	BM-U:EX	Drought	0.0056	0.1000	0	999	0	No	0	9999
BM-U:PL	BM-U:EX	Managed-Herbivory	1.0000	0.0500	0	999	0	No	10	9999
BM-U:PL	BM-U:EX	Utilities	0.0001	1.0000	0	999	0	No	0	9999
BM-U:PL	BM-U:PL	Drought	0.0056	0.9000	0	999	-999	No	0	9999
BM-U:PL	BM-U:PL	Livestock-Closure	0.0100	1.0000	1	2	0	No	0	9999
BM-U:PL	BM-U:SEP	Seedbank-Emergence	0.2000	1.0000	0	999	0	Yes	2	9999
BM-U:SD	BM-A:AL	Natural-Recovery	0.1000	1.0000	20	999	0	No	10	9999
BM-U:SD	BM-U:BG	OHV	1.0000	0.0001	0	999	0	No	2	9999
BM-U:SD	BM-U:ES	Excessive-Herbivory	1.0000	0.0010	10	10	0	Yes	10	9999
BM-U:SD	BM-U:EX	EX-Invasion	0.0050	1.0000	0	19	0	Yes	0	9999
BM-U:SD	BM-U:EX	Managed-Herbivory	1.0000	0.0500	2	999	0	No	10	9999
BM-U:SD	BM-U:EX	Seedbank-Emergence	0.2000	1.0000	0	999	0	Yes	2	9999
BM-U:SD	BM-U:EX	Utilities	0.0001	1.0000	0	999	0	No	0	9999
BM-U:SD	BM-U:SD	FuelBreak	0.0100	1.0000	0	999	0	No	0	9999
BM-U:SD	BM-U:SD	Livestock-Closure	0.0100	1.0000	1	2	0	No	0	9999
BM-U:SD	BM-U:SD	ReplacementFire-Mojave	0.0010	1.0000	0	999	-999	No	3	9999
BM-U:SD	BM-U:SEP	EX-Invasion	0.0050	1.0000	20	999	0	Yes	0	9999
BM-U:SDI	BM-A:AL	Natural-Recovery	0.0010	1.0000	20	199	0	Yes	10	9999
BM-U:SDI	BM-U:BG	OHV	1.0000	0.0001	0	999	0	No	2	9999
BM-U:SDI	BM-U:ES	Excessive-Herbivory	1.0000	0.0001	10	10	0	Yes	10	9999
BM-U:SDI	BM-U:EX	EX-Invasion	0.0010	1.0000	0	19	0	Yes	0	9999
BM-U:SDI	BM-U:EX	Utilities	0.0001	1.0000	0	999	0	No	0	9999
BM-U:SDI	BM-U:SDI	FuelBreak	0.0100	1.0000	0	999	0	No	0	9999
BM-U:SDI	BM-U:SDI	Livestock-Closure	0.0100	1.0000	1	2	0	No	0	9999
BM-U:SDI	BM-U:SDI	Managed-Herbivory	1.0000	0.0500	2	999	1	No	10	9999
BM-U:SDI	BM-U:SDI	ReplacementFire-Mojave	0.0001	1.0000	0	999	-999	No	3	9999
BM-U:SDI	BM-U:SEP	EX-Invasion	0.0010	1.0000	20	999	0	Yes	0	9999
BM-U:SDI	BM-U:SEP	Seedbank-Emergence	0.2000	1.0000	0	999	0	Yes	2	9999
BM-U:SEP	BM-C:OP	Fingers-of-Death-BM	0.0100	0.7500	5	399	0	Yes	0	9999
BM-U:SEP	BM-D:OP	Fingers-of-Death-BM	0.0100	0.7500	400	999	0	Yes	0	9999
BM-U:SEP	BM-U:BG	OHV	1.0000	0.0001	20	999	0	No	2	9999
BM-U:SEP	BM-U:ES	Excessive-Herbivory	1.0000	0.0010	30	30	0	Yes	0	9999

BM-U:SEP	BM-U:EX	Drought	0.0056	0.0100	20	999	0	No	0	9999
BM-U:SEP	BM-U:EX	ReplacementFire-Mojave	0.0050	1.0000	199	999	0	No	3	9999
BM-U:SEP	BM-U:EX	Utilities	0.0001	1.0000	20	999	0	No	0	9999
BM-U:SEP	BM-U:EX2B	ReplacementFire-Mojave	0.0500	1.0000	0	199	0	No	3	9999
BM-U:SEP	BM-U:EX2B	Utilities	0.0001	1.0000	0	999	0	No	0	9999
BM-U:SEP	BM-U:PL	Herbicide-BM	0.0100	0.5000	5	15	0	No	1	9999
BM-U:SEP	BM-U:SEP	Drought	0.0056	0.9900	20	999	-999	No	0	9999
BM-U:SEP	BM-U:SEP	Fingers-of-Death-BM	0.0100	0.2500	5	999	0	No	0	9999
BM-U:SEP	BM-U:SEP	FuelBreak	0.0100	1.0000	20	999	0	No	0	9999
BM-U:SEP	BM-U:SEP	Herbicide-BM	0.0100	0.5000	5	15	0	No	1	9999
BM-U:SEP	BM-U:SEP	Managed-Herbivory	1.0000	0.0500	20	999	1	No	0	9999
BM-U:SEP	BM-U:TEX	Tree-Invasion	0.0025	1.0000	400	999	0	Yes	0	9999
BM-U:TEX	BM-U:EX	Drought	0.0056	0.0100	400	999	0	No	0	9999
BM-U:TEX	BM-U:EX	ReplacementFire-Mojave	0.0025	1.0000	400	999	0	No	3	9999
BM-U:TEX	BM-U:SD	Utilities	0.0001	1.0000	0	999	0	No	0	9999
BM-U:TEX	BM-U:SEP	Chainsaw-Lopping-BM	0.0100	1.0000	0	999	0	No	0	9999
BM-U:TEX	BM-U:SEP	Drought	0.0056	0.1000	400	999	0	No	0	9999
BM-U:TEX	BM-U:TEX	Drought	0.0056	0.9000	400	999	-999	No	0	9999
BM-U:TEX	BM-U:TEX	FuelBreak	0.0100	1.0000	0	999	0	No	0	9999
BSu-A:AL	BSu-A:AL	Managed-Herbivory	1.0000	0.0500	2	19	1	No	0	9999
BSu-A:AL	BSu-A:AL	ReplacementFire	0.0125	1.0000	0	19	-999	No	0	9999
BSu-A:AL	BSu-U:ES	Excessive-Herbivory	1.0000	0.0010	10	10	0	Yes	0	9999
BSu-B:OP	BSu-A:AL	ReplacementFire	0.0200	1.0000	20	74	0	No	0	9999
BSu-B:OP	BSu-B:OP	Managed-Herbivory	1.0000	0.0500	20	74	1	No	0	9999
BSu-B:OP	BSu-U:ES	Excessive-Herbivory	1.0000	0.0010	30	30	0	Yes	0	9999
BSu-B:OP	BSu-U:SEP	EX-Invasion	0.0050	1.0000	20	74	0	Yes	0	9999
BSu-C:CL	BSu-A:AL	ReplacementFire	0.0200	1.0000	75	999	0	No	0	9999
BSu-C:CL	BSu-B:OP	Drought	0.0060	0.1000	75	999	0	No	0	9999
BSu-C:CL	BSu-C:CL	Drought	0.0056	0.9000	75	999	-999	No	0	9999
BSu-C:CL	BSu-C:CL	Managed-Herbivory	1.0000	0.0500	75	999	1	No	0	9999
BSu-C:CL	BSu-D:OP	Tree-Invasion	0.0050	1.0000	100	999	0	Yes	0	9999
BSu-C:CL	BSu-U:DP	Excessive-Herbivory	1.0000	0.0010	85	85	0	Yes	0	9999

BSu-C:CL	BSu-U:SEP	EX-Invasion	0.0050	1.0000	75	999	0	Yes	0	9999
BSu-D:OP	BSu-A:AL	ReplacementFire	0.0200	1.0000	76	134	0	No	0	9999
BSu-D:OP	BSu-B:OP	Drought	0.0056	0.3000	76	134	0	No	0	9999
BSu-D:OP	BSu-C:CL	Drought	0.0056	0.6000	76	134	0	No	0	9999
BSu-D:OP	BSu-D:OP	Chainsaw-Thinning-BSu	0.0100	1.0000	76	134	-999	No	0	9999
BSu-D:OP	BSu-D:OP	Drought	0.0056	0.1000	76	134	-999	No	0	9999
BSu-D:OP	BSu-D:OP	Excessive-Herbivory	0.0010	0.7500	86	86	3	No	0	9999
BSu-D:OP	BSu-D:OP	Managed-Herbivory	1.0000	0.0500	76	134	1	No	0	9999
BSu-D:OP	BSu-U:DP	Excessive-Herbivory	0.0010	0.2500	86	86	0	Yes	0	9999
BSu-D:OP	BSu-U:SEP	EX-Invasion	0.0050	1.0000	76	134	0	No	0	9999
BSu-E:CL	BSu-A:AL	Chainsaw-Thinning-BSu	0.0100	1.0000	135	999	0	No	0	9999
BSu-E:CL	BSu-A:AL	ReplacementFire	0.0130	1.0000	135	999	0	No	0	9999
BSu-E:CL	BSu-B:OP	Drought	0.0056	0.1000	135	999	0	No	0	9999
BSu-E:CL	BSu-E:CL	Drought	0.0056	0.9000	135	999	5	No	0	9999
BSu-E:CL	BSu-U:TE	Tree-Encroachment	0.0200	1.0000	250	999	0	Yes	0	9999
BSu-U:DP	BSu-U:DP	Chainsaw-Lopping-BSu	0.0100	1.0000	100	999	-999	No	0	9999
BSu-U:DP	BSu-U:DP	Drought	0.0056	0.9000	75	999	-999	No	0	9999
BSu-U:DP	BSu-U:ES	Drought	0.0056	0.1000	75	999	0	No	0	9999
BSu-U:DP	BSu-U:ES	ReplacementFire	0.0200	1.0000	75	999	0	No	0	9999
BSu-U:DP	BSu-U:SES	EX-Invasion	0.0050	1.0000	75	999	0	Yes	0	9999
BSu-U:DP	BSu-U:TE	Tree-Invasion	0.0050	1.0000	134	999	0	No	0	9999
BSu-U:ES	BSu-A:AL	ReplacementFire	0.0200	0.0100	0	999	0	No	0	9999
BSu-U:ES	BSu-B:OP	Natural-Recovery	0.0010	1.0000	12	49	10	Yes	0	9999
BSu-U:ES	BSu-C:CL	Natural-Recovery	0.0010	1.0000	50	999	10	Yes	0	9999
BSu-U:ES	BSu-U:ES	ReplacementFire	0.0200	0.9900	0	999	0	No	0	9999
BSu-U:EX	BSu-U:EX	Herbicide+Seed-BSu	0.0100	0.2000	0	999	0	No	0	9999
BSu-U:EX	BSu-U:EX	ReplacementFire	0.1000	0.1000	0	999	-999	No	0	9999
BSu-U:EX	BSu-U:SD	Herbicide+Seed-BSu	0.0100	0.8000	0	999	0	No	0	9999
BSu-U:SD	BSu-A:AL	Natural-Recovery	0.0010	1.0000	5	19	0	Yes	0	9999
BSu-U:SD	BSu-B:OP	Natural-Recovery	0.0100	1.0000	20	74	0	Yes	0	9999
BSu-U:SD	BSu-C:CL	Natural-Recovery	0.0500	1.0000	75	999	0	Yes	0	9999
BSu-U:SD	BSu-D:OP	Tree-Invasion	0.0050	1.0000	75	999	0	No	0	9999

BSu-U:SD	BSu-U:ES	Excessive-Herbivory	1.0000	0.0010	10	10	0	Yes	0	9999
BSu-U:SD	BSu-U:EX	EX-Invasion	0.0050	1.0000	0	19	0	Yes	0	9999
BSu-U:SD	BSu-U:SD	Drought	0.0056	1.0000	0	999	-999	No	0	9999
BSu-U:SD	BSu-U:SD	Managed-Herbivory	1.0000	0.0500	2	999	1	No	0	9999
BSu-U:SD	BSu-U:SD	ReplacementFire	0.0125	1.0000	0	19	-999	No	0	9999
BSu-U:SD	BSu-U:SD	ReplacementFire	0.0125	1.0000	135	999	-999	No	0	9999
BSu-U:SD	BSu-U:SD	ReplacementFire	0.0200	1.0000	20	134	-999	No	0	9999
BSu-U:SD	BSu-U:SEP	EX-Invasion	0.0010	1.0000	20	134	0	Yes	0	9999
BSu-U:SD	BSu-U:TEX	EX-Invasion	0.0050	1.0000	135	999	0	Yes	0	9999
BSu-U:SEP	BSu-A:AL	Drought	0.0056	0.0100	75	999	0	No	0	9999
BSu-U:SEP	BSu-A:AL	ReplacementFire	0.0400	0.1000	75	999	0	No	0	9999
BSu-U:SEP	BSu-C:CL	Herbicide+Seed-BSu	0.0100	0.9000	75	999	0	No	0	9999
BSu-U:SEP	BSu-C:CL	Natural-Recovery	0.0010	1.0000	75	999	0	Yes	10	9999
BSu-U:SEP	BSu-U:EX	Drought	0.0056	0.0900	75	999	0	No	0	9999
BSu-U:SEP	BSu-U:EX	ReplacementFire	0.0400	0.9000	75	999	0	No	0	9999
BSu-U:SEP	BSu-U:SEP	Chainsaw-Lopping-BSu	0.0100	1.0000	0	999	-999	No	0	9999
BSu-U:SEP	BSu-U:SEP	Drought	0.0056	0.9000	75	999	-999	No	0	9999
BSu-U:SEP	BSu-U:SEP	Herbicide+Seed-BSu	0.0100	0.1000	75	999	0	No	0	9999
BSu-U:SEP	BSu-U:SEP	Managed-Herbivory	1.0000	0.0500	75	99	1	No	0	9999
BSu-U:SEP	BSu-U:SES	Excessive-Herbivory	0.0010	1.0000	85	85	0	Yes	0	9999
BSu-U:SEP	BSu-U:SES	Managed-Herbivory	1.0000	0.0500	100	999	0	No	0	9999
BSu-U:SEP	BSu-U:TEX	Tree-Invasion	0.0050	1.0000	134	999	0	No	0	9999
BSu-U:SES	BSu-U:EX	Drought	0.0056	0.1000	75	999	0	No	0	9999
BSu-U:SES	BSu-U:EX	ReplacementFire	0.0400	1.0000	75	999	0	No	0	9999
BSu-U:SES	BSu-U:SES	Drought	0.0056	0.9000	75	999	-999	No	0	9999
BSu-U:SES	BSu-U:TEX	Tree-Invasion	0.0050	1.0000	134	999	0	Yes	0	9999
BSu-U:TE	BSu-U:ES	Drought	0.0056	0.0500	135	999	0	No	0	9999
BSu-U:TE	BSu-U:ES	ReplacementFire	0.0085	0.4500	135	999	0	No	0	9999
BSu-U:TE	BSu-U:EX	Drought	0.0056	0.0500	135	999	0	No	0	9999
BSu-U:TE	BSu-U:EX	ReplacementFire	0.0085	0.4500	135	999	0	No	0	9999
BSu-U:TE	BSu-U:EX	Thin+Herbicide+Seed-BSu	0.0100	0.1000	0	999	0	No	0	9999
BSu-U:TE	BSu-U:SD	Thin+Herbicide+Seed-BSu	0.0100	0.9000	0	999	0	No	0	9999

BSu-U:TE	BSu-U:SES	ReplacementFire	0.0085	0.1000	135	999	0	No	0	9999
BSu-U:TE	BSu-U:TE	Drought	0.0056	0.9000	135	999	-999	No	0	9999
BSu-U:TE	BSu-U:TEX	EX-Invasion	0.0050	1.0000	135	999	0	Yes	0	9999
BSu-U:TEX	BSu-U:EX	Drought	0.0056	0.1000	135	999	0	No	0	9999
BSu-U:TEX	BSu-U:EX	ReplacementFire	0.0085	1.0000	135	999	0	No	0	9999
BSu-U:TEX	BSu-U:EX	Thin+Herbicide+Seed-BSu	0.0100	0.2000	135	999	0	No	0	9999
BSu-U:TEX	BSu-U:SD	Thin+Herbicide+Seed-BSu	0.0100	0.8000	135	999	0	No	0	9999
BSu-U:TEX	BSu-U:TEX	Drought	0.0056	0.9000	0	999	-999	No	0	9999
BT-A:AL	BT-A:AL	FuelBreak	0.0100	1.0000	0	499	0	No	0	9999
BT-A:AL	BT-A:AL	Managed-Herbivory	1.0000	0.0500	2	499	2	No	0	9999
BT-A:AL	BT-A:AL	ReplacementFire-Mojave	0.0001	1.0000	0	499	-999	No	3	9999
BT-A:AL	BT-U:BG	OHV	1.0000	0.0001	0	499	0	No	2	9999
BT-A:AL	BT-U:ES	Excessive-Herbivory	1.0000	0.0010	10	10	0	Yes	0	9999
BT-A:AL	BT-U:EX	EX-Invasion	0.0050	1.0000	0	4	0	Yes	0	9999
BT-A:AL	BT-U:SEP	EX-Invasion	0.0050	1.0000	5	499	0	Yes	0	9999
BT-C:CL	BT-A:AL	ReplacementFire-Mojave	0.0001	1.0000	500	999	0	No	3	9999
BT-C:CL	BT-C:CL	FuelBreak	0.0100	1.0000	0	999	0	No	0	9999
BT-C:CL	BT-C:CL	Managed-Herbivory	1.0000	0.0500	500	999	2	No	0	9999
BT-C:CL	BT-U:BG	OHV	1.0000	0.0001	500	999	0	No	2	9999
BT-C:CL	BT-U:ES	Excessive-Herbivory	1.0000	0.0010	510	510	0	Yes	0	9999
BT-C:CL	BT-U:EX	Utilities	0.0001	1.0000	500	999	0	No	0	9999
BT-C:CL	BT-U:SEP	EX-Invasion	0.0050	1.0000	500	999	0	Yes	0	9999
BT-U:BG	BT-U:BG	OHV	1.0000	0.0001	0	999	-999	No	2	9999
BT-U:BG	BT-U:EX	EX-Invasion	0.0050	1.0000	0	999	0	No	0	9999
BT-U:BG	BT-U:EX	Utilities	0.0001	1.0000	0	999	0	No	0	9999
BT-U:ES	BT-U:BG	OHV	1.0000	0.0001	0	999	0	No	2	9999
BT-U:ES	BT-U:ES	FuelBreak	0.0100	1.0000	0	999	0	No	0	9999
BT-U:ES	BT-U:ES	ReplacementFire-Mojave	0.0010	1.0000	0	999	-999	No	3	9999
BT-U:ES	BT-U:EX	Utilities	0.0001	1.0000	0	999	0	No	0	9999
BT-U:ES	BT-U:SEP	EX-Invasion	0.0050	1.0000	0	999	0	No	0	9999
BT-U:EX	BT-U:BG	OHV	1.0000	0.0001	0	999	0	No	2	9999
BT-U:EX	BT-U:ES	Excessive-Herbivory	1.0000	0.0010	0	999	0	No	0	9999

BT-U:EX	BT-U:EX	FuelBreak	0.0100	1.0000	0	999	0	No	0	9999
BT-U:EX	BT-U:EX	Hrbx+Current-Native-Seed-BT	0.0100	0.9900	0	999	-999	No	0	9999
BT-U:EX	BT-U:EX	Hrbx+Introduced-Seed-BT	0.0100	0.9500	0	999	-999	No	0	9999
BT-U:EX	BT-U:EX	Hrbx+New-Seed-BT	0.0500	0.9500	0	999	0	Yes	0	9999
BT-U:EX	BT-U:EX	Managed-Herbivory	1.0000	0.0500	2	999	1	No	0	9999
BT-U:EX	BT-U:EX	Planting+FOD-BT	0.0100	0.1000	0	999	0	No	0	9999
BT-U:EX	BT-U:EX	Planting+Herbicide-BT	0.0100	0.1000	0	999	0	No	0	9999
BT-U:EX	BT-U:EX2B	ReplacementFire-Mojave	0.0500	1.0000	0	999	-999	No	3	9999
BT-U:EX	BT-U:EX2B	Utilities	0.0001	1.0000	0	999	-999	No	0	9999
BT-U:EX	BT-U:PL	Planting+FOD-BT	0.0100	0.6950	0	999	0	No	0	9999
BT-U:EX	BT-U:PL	Planting+Herbicide-BT	0.0100	0.4500	0	999	0	No	0	9999
BT-U:EX	BT-U:SD	Hrbx+Current-Native-Seed-BT	0.0100	0.0100	0	999	0	Yes	0	9999
BT-U:EX	BT-U:SD	Hrbx+New-Seed-BT	0.0100	0.0500	0	999	0	Yes	0	9999
BT-U:EX	BT-U:SDI	Hrbx+Introduced-Seed-BT	0.0100	0.0500	0	999	0	Yes	0	9999
BT-U:EX	BT-U:SEP	Non-Joshua-Succession	0.1000	1.0000	20	999	0	Yes	0	9999
BT-U:EX	BT-U:SEP	Planting+FOD-BT	0.0100	0.2050	0	999	0	No	0	9999
BT-U:EX	BT-U:SEP	Planting+Herbicide-BT	0.0100	0.4500	0	999	0	No	0	9999
BT-U:EX2B	BT-U:BG	OHV	1.0000	0.0001	0	999	0	No	2	9999
BT-U:EX2B	BT-U:EX2B	FuelBreak	0.0100	1.0000	0	999	0	No	0	9999
BT-U:EX2B	BT-U:EX2B	Hrbx+New-Seed-BT	0.0100	0.9500	0	999	0	No	0	9999
BT-U:EX2B	BT-U:EX2B	Managed-Herbivory	1.0000	0.0500	2	999	0	No	0	9999
BT-U:EX2B	BT-U:EX2B	Planting+FOD-BT	0.0100	0.1000	0	999	0	No	0	9999
BT-U:EX2B	BT-U:EX2B	Planting+Herbicide-BT	0.0100	0.1000	0	999	0	No	0	9999
BT-U:EX2B	BT-U:EX2B	ReplacementFire-Mojave	0.1000	1.0000	0	999	-999	No	3	9999
BT-U:EX2B	BT-U:EX2B	Utilities	0.0001	1.0000	0	999	0	No	0	9999
BT-U:EX2B	BT-U:PL	Planting+FOD-BT	0.0100	0.6950	0	999	0	No	0	9999
BT-U:EX2B	BT-U:PL	Planting+Herbicide-BT	0.0100	0.4500	0	999	0	No	0	9999
BT-U:EX2B	BT-U:SD	Hrbx+New-Seed-BT	0.0100	0.0500	0	999	0	No	0	9999
BT-U:EX2B	BT-U:SEP	Planting+FOD-BT	0.0100	0.2050	0	999	0	No	0	9999
BT-U:EX2B	BT-U:SEP	Planting+Herbicide-BT	0.0100	0.4500	0	999	0	No	0	9999
BT-U:PL	BT-A:AL	Natural-Recovery	0.1000	1.0000	20	999	0	No	10	9999
BT-U:PL	BT-U:BG	OHV	1.0000	0.0001	0	999	0	No	2	9999

BT-U:PL	BT-U:ES	Excessive-Herbivory	1.0000	0.0010	10	10	0	No	10	9999
BT-U:PL	BT-U:EX	Drought	0.0056	0.0100	0	999	0	No	0	9999
BT-U:PL	BT-U:EX	Managed-Herbivory	1.0000	0.0500	2	999	-3	No	10	9999
BT-U:PL	BT-U:EX	Seedbank-Emergence	0.2000	1.0000	0	999	0	Yes	2	9999
BT-U:PL	BT-U:EX	Utilities	0.0001	1.0000	0	999	0	No	0	9999
BT-U:PL	BT-U:PL	Drought	0.0056	0.9900	0	999	-999	No	0	9999
BT-U:PL	BT-U:PL	Livestock-Closure	0.0100	1.0000	1	2	0	No	0	9999
BT-U:SD	BT-A:AL	Natural-Recovery	0.1000	1.0000	20	999	0	No	10	9999
BT-U:SD	BT-U:BG	OHV	1.0000	0.0001	0	999	0	No	2	9999
BT-U:SD	BT-U:ES	Excessive-Herbivory	1.0000	0.0010	10	10	0	Yes	10	9999
BT-U:SD	BT-U:EX	EX-Invasion	0.0050	1.0000	0	19	0	Yes	0	9999
BT-U:SD	BT-U:EX	Seedbank-Emergence	0.2000	1.0000	0	999	0	Yes	2	9999
BT-U:SD	BT-U:EX	Utilities	0.0001	1.0000	0	999	0	No	0	9999
BT-U:SD	BT-U:SD	Drought	0.0056	0.1000	0	999	-999	No	0	9999
BT-U:SD	BT-U:SD	Drought	0.0056	0.9000	0	999	0	No	0	9999
BT-U:SD	BT-U:SD	FuelBreak	0.0100	1.0000	0	999	0	No	0	9999
BT-U:SD	BT-U:SD	Livestock-Closure	0.0100	1.0000	1	2	0	No	0	9999
BT-U:SD	BT-U:SD	Managed-Herbivory	1.0000	0.0500	2	999	-1	No	10	9999
BT-U:SD	BT-U:SD	ReplacementFire-Mojave	0.0010	1.0000	0	19	-999	No	3	9999
BT-U:SD	BT-U:SEP	EX-Invasion	0.0050	1.0000	20	999	0	Yes	0	9999
BT-U:SDI	BT-A:AL	Natural-Recovery	0.0020	1.0000	0	999	0	No	10	9999
BT-U:SDI	BT-U:BG	OHV	1.0000	0.0001	0	999	0	No	2	9999
BT-U:SDI	BT-U:ES	Excessive-Herbivory	1.0000	0.0010	10	10	0	Yes	10	9999
BT-U:SDI	BT-U:EX	EX-Invasion	0.0010	1.0000	0	19	0	Yes	0	9999
BT-U:SDI	BT-U:EX	Seedbank-Emergence	0.2000	1.0000	0	999	0	Yes	2	9999
BT-U:SDI	BT-U:EX	Utilities	0.0001	1.0000	0	999	0	No	0	9999
BT-U:SDI	BT-U:SDI	Drought	0.0056	0.1000	0	999	-999	No	0	9999
BT-U:SDI	BT-U:SDI	Drought	0.0056	0.9000	0	999	0	No	0	9999
BT-U:SDI	BT-U:SDI	FuelBreak	0.0100	1.0000	0	999	0	No	0	9999
BT-U:SDI	BT-U:SDI	Livestock-Closure	0.0100	1.0000	1	2	0	No	0	9999
BT-U:SDI	BT-U:SDI	Managed-Herbivory	1.0000	0.0500	2	999	-1	No	10	9999
BT-U:SDI	BT-U:SDI	ReplacementFire-Mojave	0.0001	1.0000	0	999	-999	No	3	9999

BT-U:SDI	BT-U:SEP	EX-Invasion	0.0010	1.0000	20	999	0	No	0	9999
BT-U:SEP	BT-C:CL	Fingers-of-Death-BT	0.0100	0.7500	5	999	0	Yes	0	9999
BT-U:SEP	BT-U:BG	OHV	1.0000	0.0001	20	999	0	No	2	9999
BT-U:SEP	BT-U:ES	Excessive-Herbivory	1.0000	0.0010	30	30	0	No	0	9999
BT-U:SEP	BT-U:EX	Drought	0.0056	0.0100	20	999	0	No	0	9999
BT-U:SEP	BT-U:EX	ReplacementFire-Mojave	0.0050	1.0000	499	999	0	No	3	9999
BT-U:SEP	BT-U:EX	Utilities	0.0001	1.0000	20	999	0	No	0	9999
BT-U:SEP	BT-U:EX2B	ReplacementFire-Mojave	0.0500	1.0000	0	499	0	No	3	9999
BT-U:SEP	BT-U:EX2B	Utilities	0.0001	1.0000	0	999	0	No	0	9999
BT-U:SEP	BT-U:PL	Herbicide-BT	0.0100	0.5000	5	15	0	Yes	1	9999
BT-U:SEP	BT-U:SEP	Drought	0.0056	0.9900	20	999	-999	No	0	9999
BT-U:SEP	BT-U:SEP	Fingers-of-Death-BT	0.0100	0.2500	5	999	0	No	0	9999
BT-U:SEP	BT-U:SEP	FuelBreak	0.0100	1.0000	20	999	0	No	0	9999
BT-U:SEP	BT-U:SEP	Herbicide-BT	0.0100	0.5000	5	15	0	Yes	1	9999
BT-U:SEP	BT-U:SEP	Managed-Herbivory	1.0000	0.0500	20	999	2	No	0	9999
CB-A:OP	CB-A:OP	FuelBreak	0.0100	1.0000	0	19	0	No	0	9999
CB-A:OP	CB-A:OP	Managed-Herbivory	1.0000	0.0500	2	19	1	No	0	9999
CB-A:OP	CB-A:OP	ReplacementFire-Mojave	0.0005	1.0000	0	19	-999	No	3	9999
CB-A:OP	CB-U:BG	OHV	1.0000	0.0001	0	19	0	No	2	9999
CB-A:OP	CB-U:ES	Excessive-Herbivory	1.0000	0.0010	10	10	0	No	0	9999
CB-A:OP	CB-U:EX	EX-Invasion	0.0050	1.0000	0	19	0	No	0	9999
CB-A:OP	CB-U:EX	Utilities	0.0050	1.0000	0	19	0	No	0	9999
CB-C:OP	CB-A:OP	Drought	0.0056	1.0000	20	399	0	No	0	9999
CB-C:OP	CB-A:OP	ReplacementFire-Mojave	0.0005	1.0000	20	999	0	No	3	9999
CB-C:OP	CB-C:OP	FuelBreak	0.0100	1.0000	20	999	0	No	0	9999
CB-C:OP	CB-C:OP	Managed-Herbivory	1.0000	0.0500	20	999	3	No	0	9999
CB-C:OP	CB-U:BG	OHV	1.0000	0.0001	20	999	0	No	2	9999
CB-C:OP	CB-U:ES	Excessive-Herbivory	1.0000	0.0010	30	30	0	Yes	0	9999
CB-C:OP	CB-U:EX	Utilities	0.0001	1.0000	20	999	0	No	0	9999
CB-C:OP	CB-U:SEP	EX-Invasion	0.0050	1.0000	20	999	0	Yes	0	9999
CB-U:BG	CB-U:BG	OHV	1.0000	0.0001	0	999	-999	No	2	9999
CB-U:BG	CB-U:BG	Utilities	0.0001	1.0000	0	999	0	No	0	9999

CB-U:BG	CB-U:EX	EX-Invasion	0.0050	1.0000	0	999	0	No	0	9999
CB-U:ES	CB-U:BG	OHV	1.0000	0.0001	0	999	0	No	2	9999
CB-U:ES	CB-U:ES	Drought	0.0056	1.0000	0	999	-999	No	0	9999
CB-U:ES	CB-U:ES	FuelBreak	0.0100	1.0000	0	999	0	No	0	9999
CB-U:ES	CB-U:ES	ReplacementFire-Mojave	0.0015	1.0000	0	999	-999	No	3	9999
CB-U:ES	CB-U:EX	EX-Invasion	0.0050	1.0000	0	19	0	Yes	0	9999
CB-U:ES	CB-U:EX	Utilities	0.0001	1.0000	0	999	0	No	0	9999
CB-U:ES	CB-U:SEP	EX-Invasion	0.0050	1.0000	20	999	0	Yes	0	9999
CB-U:EX	CB-U:BG	OHV	1.0000	0.0001	0	999	0	No	2	9999
CB-U:EX	CB-U:ES	Excessive-Herbivory	1.0000	0.0010	0	999	0	No	0	9999
CB-U:EX	CB-U:EX	FuelBreak	0.0100	1.0000	0	999	0	No	0	9999
CB-U:EX	CB-U:EX	Hrbx+New-Seed-CB	0.0100	0.9500	0	999	0	Yes	0	9999
CB-U:EX	CB-U:EX	Managed-Herbivory	1.0000	0.0500	2	999	1	No	0	9999
CB-U:EX	CB-U:EX	Planting+FOD-CB	0.0100	0.1000	0	999	0	No	0	9999
CB-U:EX	CB-U:EX	Planting+Herbicide-CB	0.0100	0.1000	0	999	0	No	0	9999
CB-U:EX	CB-U:EX2B	ReplacementFire-Mojave	0.0500	1.0000	0	999	-999	No	3	9999
CB-U:EX	CB-U:EX2B	Utilities	0.0001	1.0000	0	999	-999	No	0	9999
CB-U:EX	CB-U:PL	Planting+FOD-CB	0.0100	0.6950	0	999	0	No	0	9999
CB-U:EX	CB-U:PL	Planting+Herbicide-CB	0.0100	0.4500	0	999	0	No	0	9999
CB-U:EX	CB-U:SD	Hrbx+New-Seed-CB	0.0100	0.0500	0	999	0	No	0	9999
CB-U:EX	CB-U:SEP	Non-Joshua-Succession	0.1000	1.0000	20	999	0	Yes	0	9999
CB-U:EX	CB-U:SEP	Planting+FOD-CB	0.0100	0.2050	0	999	0	No	0	9999
CB-U:EX	CB-U:SEP	Planting+Herbicide-CB	0.0100	0.4500	0	999	0	No	0	9999
CB-U:EX2B	CB-U:BG	OHV	1.0000	0.0001	0	999	0	No	2	9999
CB-U:EX2B	CB-U:EX2B	FuelBreak	0.0100	1.0000	0	999	0	No	0	9999
CB-U:EX2B	CB-U:EX2B	Hrbx+New-Seed-CB	0.0100	0.9500	0	999	0	No	0	9999
CB-U:EX2B	CB-U:EX2B	Managed-Herbivory	1.0000	0.0500	2	999	0	No	0	9999
CB-U:EX2B	CB-U:EX2B	Planting+FOD-CB	0.0100	0.1000	0	999	0	No	0	9999
CB-U:EX2B	CB-U:EX2B	Planting+Herbicide-CB	0.0100	0.1000	0	999	0	No	0	9999
CB-U:EX2B	CB-U:EX2B	ReplacementFire-Mojave	0.1000	1.0000	0	999	0	No	3	9999
CB-U:EX2B	CB-U:PL	Planting+FOD-CB	0.0100	0.6950	0	999	0	No	0	9999
CB-U:EX2B	CB-U:PL	Planting+Herbicide-CB	0.0100	0.4500	0	999	0	No	0	9999

CB-U:EX2B	CB-U:SD	Hrbx+New-Seed-CB	0.0100	0.0500	0	999	0	No	0	9999
CB-U:EX2B	CB-U:SEP	Planting+FOD-CB	0.0100	0.2050	0	999	0	No	0	9999
CB-U:EX2B	CB-U:SEP	Planting+Herbicide-CB	0.0100	0.4500	0	999	0	No	0	9999
CB-U:PL	CB-A:OP	Natural-Recovery	0.1000	1.0000	20	999	0	No	10	9999
CB-U:PL	CB-U:BG	OHV	1.0000	0.0001	0	999	0	No	2	9999
CB-U:PL	CB-U:ES	Excessive-Herbivory	1.0000	0.0010	10	10	0	No	10	9999
CB-U:PL	CB-U:EX	Drought	0.0056	0.0100	0	999	0	No	0	9999
CB-U:PL	CB-U:EX	Managed-Herbivory	1.0000	0.0500	2	999	-3	No	10	9999
CB-U:PL	CB-U:EX	Utilities	0.0001	1.0000	0	999	0	No	0	9999
CB-U:PL	CB-U:PL	Drought	0.0056	0.9900	0	999	-999	No	0	9999
CB-U:PL	CB-U:PL	Livestock-Closure	0.0100	1.0000	1	2	0	No	0	9999
CB-U:PL	CB-U:SEP	Seedbank-Emergence	0.2000	1.0000	0	999	0	No	2	9999
CB-U:SD	CB-A:OP	Natural-Recovery	0.1000	1.0000	20	999	0	No	10	9999
CB-U:SD	CB-U:BG	OHV	1.0000	0.0001	0	999	0	No	2	9999
CB-U:SD	CB-U:ES	Excessive-Herbivory	0.0010	1.0000	10	10	0	No	10	9999
CB-U:SD	CB-U:EX	EX-Invasion	0.0050	1.0000	0	19	0	Yes	0	9999
CB-U:SD	CB-U:EX	Managed-Herbivory	1.0000	0.0500	2	999	0	No	10	9999
CB-U:SD	CB-U:EX	Seedbank-Emergence	0.2000	1.0000	0	19	0	No	2	9999
CB-U:SD	CB-U:EX	Utilities	0.0001	1.0000	0	999	0	No	0	9999
CB-U:SD	CB-U:SD	FuelBreak	0.0100	1.0000	0	999	0	No	0	9999
CB-U:SD	CB-U:SD	Livestock-Closure	0.0100	1.0000	1	2	0	No	0	9999
CB-U:SD	CB-U:SD	ReplacementFire-Mojave	0.0015	1.0000	0	999	-999	No	3	9999
CB-U:SD	CB-U:SEP	EX-Invasion	0.0050	1.0000	20	999	0	Yes	0	9999
CB-U:SEP	CB-C:OP	Fingers-of-Death-CB	0.0100	0.7500	20	999	0	Yes	0	9999
CB-U:SEP	CB-U:BG	OHV	1.0000	0.0001	20	999	0	No	2	9999
CB-U:SEP	CB-U:ES	Excessive-Herbivory	1.0000	0.0010	30	30	0	No	0	9999
CB-U:SEP	CB-U:EX	Drought	0.0056	1.0000	21	999	0	No	0	9999
CB-U:SEP	CB-U:EX	ReplacementFire-Mojave	0.0015	1.0000	21	999	0	No	3	9999
CB-U:SEP	CB-U:EX	Utilities	0.0001	1.0000	21	999	0	No	0	9999
CB-U:SEP	CB-U:PL	Herbicide-CB	0.0100	0.0500	20	999	0	No	1	9999
CB-U:SEP	CB-U:SEP	Fingers-of-Death-CB	0.0100	0.2500	20	999	0	No	0	9999
CB-U:SEP	CB-U:SEP	FuelBreak	0.0100	1.0000	21	999	0	No	0	9999

CB-U:SEP	CB-U:SEP	Herbicide-CB	0.0100	0.0500	20	999	0	No	1	9999
CB-U:SEP	CB-U:SEP	Managed-Herbivory	1.0000	0.0500	21	999	3	No	0	9999
DSS-U:SEP	DSS-B:OP	FOD+Seed-DSS	0.0100	0.8000	0	999	0	No	0	9999
DSS-U:SEP	DSS-U:SEP	FOD+Seed-DSS	0.0100	0.2000	0	999	0	No	0	9999
GRL-A:AL	GRL-A:AL	Drought	0.0056	1.0000	0	19	-10	No	0	9999
GRL-A:AL	GRL-A:AL	FuelBreak	0.0100	1.0000	0	19	0	No	0	9999
GRL-A:AL	GRL-A:AL	Managed-Herbivory	1.0000	0.0500	2	19	1	No	0	9999
GRL-A:AL	GRL-A:AL	ReplacementFire-Mojave	0.0015	1.0000	0	19	-999	No	3	9999
GRL-A:AL	GRL-U:DP	Excessive-Herbivory	1.0000	0.0010	10	10	0	Yes	0	9999
GRL-A:AL	GRL-U:EX	EX-Invasion	0.0050	1.0000	0	19	0	Yes	0	9999
GRL-B:OP	GRL-A:AL	Drought	0.0056	0.1000	20	999	0	No	0	9999
GRL-B:OP	GRL-A:AL	ReplacementFire-Mojave	0.0015	1.0000	20	999	0	No	3	9999
GRL-B:OP	GRL-B:OP	Drought	0.0056	0.9000	20	999	-999	No	0	9999
GRL-B:OP	GRL-B:OP	FuelBreak	0.0100	1.0000	20	999	0	No	0	9999
GRL-B:OP	GRL-B:OP	Managed-Herbivory	1.0000	0.0500	20	999	1	No	0	9999
GRL-B:OP	GRL-U:DP	Excessive-Herbivory	1.0000	0.0010	30	30	0	Yes	0	9999
GRL-B:OP	GRL-U:SES	EX-Invasion	0.0050	1.0000	20	999	0	Yes	0	9999
GRL-U:DP	GRL-U:DP	Drought	0.0056	1.0000	0	999	-10	No	0	9999
GRL-U:DP	GRL-U:DP	Excessive-Herbivory	1.0000	0.0010	0	999	3	No	0	9999
GRL-U:DP	GRL-U:DP	FuelBreak	0.0100	1.0000	0	999	0	No	0	9999
GRL-U:DP	GRL-U:DP	Managed-Herbivory	1.0000	0.0500	0	999	1	No	0	9999
GRL-U:DP	GRL-U:DP	ReplacementFire-Mojave	0.0015	1.0000	0	999	-999	No	3	9999
GRL-U:DP	GRL-U:EEX	EX-Invasion	0.0050	1.0000	0	999	0	Yes	0	9999
GRL-U:EEX	GRL-A:AL	FOD+Seed-GRL	0.0100	0.6000	0	999	0	No	0	9999
GRL-U:EEX	GRL-A:AL	Hrbx+Seed-GRL	0.0100	0.4000	0	999	0	No	0	9999
GRL-U:EEX	GRL-U:EEX	Drought	0.0056	1.0000	0	999	-10	No	0	9999
GRL-U:EEX	GRL-U:EEX	FOD+Seed-GRL	0.0100	0.4000	0	999	0	No	0	9999
GRL-U:EEX	GRL-U:EEX	FuelBreak	0.0100	1.0000	0	999	0	No	0	9999
GRL-U:EEX	GRL-U:EEX	Hrbx+Seed-GRL	0.0100	0.6000	0	999	0	No	0	9999
GRL-U:EEX	GRL-U:EEX	Managed-Herbivory	1.0000	0.0500	0	999	1	No	0	9999
GRL-U:EEX	GRL-U:EEX	ReplacementFire-Mojave	0.0015	1.0000	0	999	-999	No	3	9999
GRL-U:EEX	GRL-U:SES	Excessive-Herbivory	1.0000	0.0010	20	20	0	Yes	0	9999

GRL-U:EX	GRL-A:AL	Herbicide-GRL	0.0100	0.5000	0	19	0	No	0	9999
GRL-U:EX	GRL-B:OP	Fingers-of-Death-GRL	0.0100	0.7500	0	19	0	No	0	9999
GRL-U:EX	GRL-U:EEX	Excessive-Herbivory	1.0000	0.0010	0	999	0	Yes	0	9999
GRL-U:EX	GRL-U:EX	Drought	0.0056	1.0000	0	19	-10	No	0	9999
GRL-U:EX	GRL-U:EX	Fingers-of-Death-GRL	0.0100	0.2500	0	19	0	No	0	9999
GRL-U:EX	GRL-U:EX	FuelBreak	0.0100	1.0000	0	19	0	No	0	9999
GRL-U:EX	GRL-U:EX	Herbicide-GRL	0.0100	0.5000	0	999	0	No	0	9999
GRL-U:EX	GRL-U:EX	Managed-Herbivory	1.0000	0.0500	2	19	1	No	0	9999
GRL-U:EX	GRL-U:EX	ReplacementFire-Mojave	0.0500	1.0000	0	19	-999	No	3	9999
GRL-U:SES	GRL-B:OP	Fingers-of-Death-GRL	0.0100	0.7500	20	999	0	Yes	0	9999
GRL-U:SES	GRL-B:OP	Herbicide-GRL	0.0100	0.6000	20	999	0	Yes	0	9999
GRL-U:SES	GRL-U:SES	Drought	0.0056	1.0000	20	999	-10	No	0	9999
GRL-U:SES	GRL-U:SES	Excessive-Herbivory	1.0000	0.0010	30	30	3	No	0	9999
GRL-U:SES	GRL-U:SES	Fingers-of-Death-GRL	0.0100	0.2500	20	999	0	No	0	9999
GRL-U:SES	GRL-U:SES	FuelBreak	0.0100	1.0000	20	999	0	No	0	9999
GRL-U:SES	GRL-U:SES	Herbicide-GRL	0.0100	0.4000	20	999	0	No	0	9999
GRL-U:SES	GRL-U:SES	Managed-Herbivory	1.0000	0.0500	20	999	1	No	0	9999
GRL-U:SES	GRL-U:SES	ReplacementFire-Mojave	0.0100	1.0000	20	999	-999	No	3	9999
MM-A:AL	MM-A:AL	NativeHerbivory	0.0200	1.0000	0	9	-999	No	0	9999
MM-A:AL	MM-A:AL	ReplacementFire	0.0020	1.0000	0	9	-999	No	0	9999
MM-A:AL	MM-A:AL	Wet-Year	0.1500	1.0000	0	999	-1	No	0	9999
MM-B:OP	MM-A:AL	ReplacementFire	0.0070	1.0000	10	29	0	No	0	9999
MM-C:CL	MM-A:AL	ReplacementFire	0.0070	1.0000	60	999	0	No	0	9999
MM-C:CL	MM-U:TEX	EX-Invasion	0.0001	1.0000	60	999	0	Yes	0	9999
MM-U:EX	MM-U:EX	ReplacementFire	0.0500	1.0000	0	999	-999	No	0	9999
MM-U:TEX	MM-U:EX	ReplacementFire	0.0070	1.0000	150	999	0	No	0	9999
MR-A:AL	MR-A:AL	Flooding-7yr	0.1300	1.0000	0	4	-5	No	0	9999
MR-A:AL	MR-A:AL	Managed-Herbivory	1.0000	0.0500	0	4	-5	No	0	9999
MR-A:AL	MR-A:AL	ReplacementFire	0.0010	1.0000	0	999	-999	No	0	9999
MR-A:AL	MR-A:AL	Weed-Inventory-MR	0.2500	1.0000	0	4	0	No	0	9999
MR-A:AL	MR-U:EF	Exotic-Riparian-Invasion-MR	0.0100	1.0000	0	4	0	No	5	9999
MR-A:AL	MR-U:SFE	Excessive-Herbivory	0.0010	1.0000	0	4	0	No	0	9999

MR-B:OP	MR-A:AL	Flooding-20yr	0.0500	1.0000	5	19	0	No	0	9999
MR-B:OP	MR-A:AL	ReplacementFire	0.0010	1.0000	5	19	0	No	0	9999
MR-B:OP	MR-B:OP	Managed-Herbivory	1.0000	0.0500	5	19	-1	No	0	9999
MR-B:OP	MR-B:OP	Weed-Inventory-MR	0.0100	1.0000	5	19	0	No	0	9999
MR-B:OP	MR-U:EF	Exotic-Riparian-Invasion-MR	0.0100	1.0000	5	19	0	No	5	9999
MR-B:OP	MR-U:SFE	Excessive-Herbivory	0.0010	1.0000	5	19	0	No	0	9999
MR-C:CL	MR-A:AL	Flooding-100yr	0.0100	1.0000	20	999	0	No	0	9999
MR-C:CL	MR-A:AL	ReplacementFire	0.0010	1.0000	20	999	0	No	0	9999
MR-C:CL	MR-C:CL	Managed-Herbivory	1.0000	0.0500	20	999	1	No	0	9999
MR-C:CL	MR-C:CL	Weed-Inventory-MR	0.0100	1.0000	20	999	0	No	0	9999
MR-C:CL	MR-U:EF	Exotic-Riparian-Invasion-MR	0.0100	1.0000	20	999	0	No	5	9999
MR-C:CL	MR-U:SFE	Excessive-Herbivory	0.0010	1.0000	20	999	0	No	0	9999
MR-U:DE	MR-A:AL	Flooding-100yr	0.0100	0.0100	0	999	0	No	0	9999
MR-U:DE	MR-A:AL	Floodplain-Recovery	0.0010	1.0000	0	999	0	No	10	9999
MR-U:DE	MR-A:AL	Floodplain-Restoration	0.0100	1.0000	0	999	0	No	0	9999
MR-U:DE	MR-U:DE	Flooding-100yr	0.0100	0.9900	0	999	-999	No	0	9999
MR-U:DE	MR-U:DE	ReplacementFire	0.0200	1.0000	0	999	-999	No	0	9999
MR-U:EF	MR-B:OP	Exotic-Control-MR	0.6000	1.0000	0	999	0	No	0	20
MR-U:EF	MR-U:EF	Exotic-Control-MR	0.4000	1.0000	0	999	0	No	0	20
MR-U:EF	MR-U:EF	ReplacementFire	0.0001	1.0000	0	999	-999	No	0	9999
MR-U:SFE	MR-A:AL	Flooding-100yr	0.0100	0.0100	0	999	0	No	0	9999
MR-U:SFE	MR-U:DE	Excessive-Herbivory	1.0000	0.0010	0	999	0	No	0	9999
MR-U:SFE	MR-U:EF	Exotic-Riparian-Invasion-MR	0.3300	1.0000	0	999	0	No	5	9999
MR-U:SFE	MR-U:SFE	Flooding-100yr	0.0100	0.9900	20	999	-999	No	0	9999
MR-U:SFE	MR-U:SFE	ReplacementFire	0.0010	1.0000	0	999	-999	No	0	9999
MR-U:SFE	MR-U:SFE	Weed-Inventory-MR	0.0100	1.0000	0	999	0	No	0	9999
MSD-A:AL	MSD-A:AL	Managed-Herbivory	1.0000	0.0500	2	4	1	No	0	9999
MSD-A:AL	MSD-A:AL	Very-Wet-Year	0.0100	1.0000	0	4	-4	No	0	9999
MSD-B:OP	MSD-A:AL	Managed-Herbivory	1.0000	0.0500	5	999	0	No	0	9999
MSD-B:OP	MSD-A:AL	ReplacementFire	0.0001	1.0000	5	999	0	No	0	9999
MSD-B:OP	MSD-A:AL	Very-Wet-Year	0.0180	1.0000	5	999	0	No	0	9999
MSD-B:OP	MSD-C:OP	Drought	0.0056	1.0000	5	999	0	No	0	9999

MSD-B:OP	MSD-U:SES	EX-Invasion	0.0050	1.0000	5	999	0	Yes	0	9999
MSD-C:OP	MSD-A:AL	Very-Wet-Year	0.0500	1.0000	10	59	0	No	0	9999
MSD-C:OP	MSD-C:OP	Drought	0.0056	1.0000	10	59	-999	No	0	9999
MSD-C:OP	MSD-U:SES	EX-Invasion	0.0050	1.0000	10	59	0	Yes	0	9999
MSD-U:EX	MSD-U:EX	ReplacementFire	0.1000	1.0000	0	999	-999	No	0	9999
MSD-U:SD	MSD-A:AL	Natural-Recovery	0.0010	1.0000	0	4	0	Yes	0	9999
MSD-U:SD	MSD-B:OP	Natural-Recovery	0.0050	1.0000	5	999	0	Yes	0	9999
MSD-U:SD	MSD-U:EX	EX-Invasion	0.0050	1.0000	0	4	0	No	0	9999
MSD-U:SD	MSD-U:SD	Drought	0.0056	1.0000	0	4	-999	No	0	9999
MSD-U:SD	MSD-U:SD	Drought	0.0056	1.0000	5	999	-1	No	0	9999
MSD-U:SD	MSD-U:SD	Managed-Herbivory	1.0000	0.0500	3	999	1	No	0	9999
MSD-U:SD	MSD-U:SD	Very-Wet-Year	0.0180	1.0000	0	999	-999	No	0	9999
MSD-U:SD	MSD-U:SES	EX-Invasion	0.0050	1.0000	5	999	0	No	0	9999
MSD-U:SES	MSD-U:EX	ReplacementFire	0.0250	1.0000	5	999	0	No	0	9999
MSD-U:SES	MSD-U:EX	Very-Wet-Year	0.0500	1.0000	5	999	0	No	0	9999
MSh-A:AL	MSh-A:AL	Managed-Herbivory	1.0000	0.0500	2	5	-999	No	0	9999
MSh-A:AL	MSh-A:AL	NativeHerbivory	1.0000	0.0200	0	999	-1	No	0	9999
MSh-A:AL	MSh-A:AL	Wet-Year	0.1500	1.0000	0	5	-1	No	0	9999
MSh-A:AL	MSh-U:ES	Excessive-Herbivory	0.0010	1.0000	5	5	0	Yes	0	9999
MSh-A:AL	MSh-U:EX	EX-Invasion	0.0025	1.0000	0	5	0	Yes	0	9999
MSh-B:CL	MSh-A:AL	ReplacementFire	0.0140	1.0000	6	19	0	No	0	9999
MSh-B:CL	MSh-B:CL	Managed-Herbivory	1.0000	0.0500	6	19	1	No	0	9999
MSh-B:CL	MSh-U:ES	Excessive-Herbivory	0.0010	1.0000	10	10	0	Yes	0	9999
MSh-B:CL	MSh-U:SEP	EX-Invasion	0.0025	1.0000	20	49	0	Yes	0	9999
MSh-C:CL	MSh-A:AL	ReplacementFire	0.0140	1.0000	20	999	0	No	0	9999
MSh-C:CL	MSh-C:CL	Managed-Herbivory	1.0000	0.0500	20	999	1	No	0	9999
MSh-C:CL	MSh-D:OP	Tree-Invasion	0.0010	1.0000	50	99	0	No	0	9999
MSh-C:CL	MSh-D:OP	Tree-Invasion	0.0050	1.0000	99	999	0	No	0	9999
MSh-C:CL	MSh-U:ES	Excessive-Herbivory	1.0000	0.0010	30	30	0	Yes	0	9999
MSh-C:CL	MSh-U:SEP	EX-Invasion	0.0025	1.0000	20	999	0	Yes	0	9999
MSh-D:OP	MSh-A:AL	Chainsaw-Thinning-MSh	0.0100	0.2000	50	999	0	No	0	9999
MSh-D:OP	MSh-A:AL	ReplacementFire	0.0067	1.0000	50	999	0	No	0	9999

MSh-D:OP	MSh-B:CL	Chainsaw-Thinning-MSh	0.0100	0.8000	50	999	0	No	0	9999
MSh-D:OP	MSh-C:CL	Drought	0.0056	0.1000	50	999	0	No	0	9999
MSh-D:OP	MSh-D:OP	Drought	0.0056	0.9000	50	999	-999	No	0	9999
MSh-D:OP	MSh-U:TE	Tree-Encroachment	0.0067	1.0000	150	999	0	Yes	0	9999
MSh-D:OP	MSh-U:TEX	EX-Invasion	0.0025	1.0000	50	999	0	Yes	0	9999
MSh-U:ES	MSh-U:ES	Managed-Herbivory	1.0000	0.0500	0	999	0	No	0	9999
MSh-U:ES	MSh-U:ES	ReplacementFire	0.0140	1.0000	0	999	-999	No	0	9999
MSh-U:EX	MSh-A:AL	Herbicide+SeedRose-MSh	0.0100	0.5000	0	999	0	No	0	9999
MSh-U:EX	MSh-U:EX	Herbicide+SeedRose-MSh	0.0100	0.5000	0	999	0	No	0	9999
MSh-U:EX	MSh-U:EX	Managed-Herbivory	1.0000	0.0500	2	999	0	No	0	9999
MSh-U:EX	MSh-U:EX	Planting+FOD-BM	0.1000	1.0000	0	999	-999	No	0	9999
MSh-U:EX	MSh-U:EX	Wet-Year	0.1500	1.0000	0	5	-5	No	0	9999
MSh-U:SEP	MSh-B:CL	Hrbx+SeedGrass-MSh	0.0100	0.7000	0	999	0	Yes	0	9999
MSh-U:SEP	MSh-U:EX	ReplacementFire	0.0250	1.0000	6	300	0	No	0	9999
MSh-U:SEP	MSh-U:SEP	Excessive-Herbivory	1.0000	0.0010	6	999	3	No	0	9999
MSh-U:SEP	MSh-U:SEP	Hrbx+SeedGrass-MSh	0.0100	0.3000	6	999	0	No	0	9999
MSh-U:SEP	MSh-U:SEP	Managed-Herbivory	1.0000	0.0500	6	999	1	No	0	9999
MSh-U:SEP	MSh-U:TEX	Tree-Invasion	0.0010	1.0000	50	99	0	No	0	9999
MSh-U:SEP	MSh-U:TEX	Tree-Invasion	0.0050	1.0000	100	999	0	No	0	9999
MSh-U:TE	MSh-A:AL	Thin+Hrbx+SeedRose-MSh	0.0100	0.9000	150	999	0	No	0	9999
MSh-U:TE	MSh-U:ES	Drought	0.0056	0.1000	150	999	0	No	0	9999
MSh-U:TE	MSh-U:ES	ReplacementFire	0.0067	1.0000	150	999	0	No	0	9999
MSh-U:TE	MSh-U:ES	Thin+Hrbx+SeedRose-MSh	0.0100	0.1000	150	999	0	No	0	9999
MSh-U:TE	MSh-U:TE	Drought	0.0056	0.9000	150	999	-999	No	0	9999
MSh-U:TE	MSh-U:TEX	EX-Invasion	0.0050	1.0000	150	999	0	Yes	0	9999
MSh-U:TEX	MSh-A:AL	Thin+Hrbx+SeedRose-MSh	0.0100	0.8000	50	999	0	No	0	9999
MSh-U:TEX	MSh-U:EX	Drought	0.0056	0.1000	50	999	0	No	0	9999
MSh-U:TEX	MSh-U:EX	ReplacementFire	0.0067	1.0000	150	999	0	No	0	9999
MSh-U:TEX	MSh-U:EX	Thin+Hrbx+SeedRose-MSh	0.0100	0.2000	50	999	0	No	0	9999
MSh-U:TEX	MSh-U:SEP	ReplacementFire	0.0067	1.0000	50	149	0	No	0	9999
MSh-U:TEX	MSh-U:TEX	Drought	0.0056	0.9000	50	999	-999	No	0	9999
PJ-A:AL	PJ-A:AL	ReplacementFire	0.0030	1.0000	0	9	-999	No	0	9999

PJ-B:OP	PJ-A:AL	ReplacementFire	0.0050	1.0000	10	29	0	No	0	9999
PJ-C:OP	PJ-A:AL	ReplacementFire	0.0050	1.0000	30	99	0	No	0	9999
PJ-C:OP	PJ-B:OP	Drought	0.0056	0.1000	30	99	0	No	0	9999
PJ-C:OP	PJ-C:OP	Drought	0.0056	0.9000	30	99	-999	No	0	9999
PJ-C:OP	PJ-U:TEX	EX-Invasion	0.0001	1.0000	50	99	0	Yes	0	9999
PJ-D:OP	PJ-A:AL	ReplacementFire	0.0010	1.0000	100	999	0	No	0	9999
PJ-D:OP	PJ-B:OP	Drought	0.0067	0.0300	100	999	0	No	0	9999
PJ-D:OP	PJ-C:OP	Drought	0.0057	0.0700	100	999	0	No	0	9999
PJ-D:OP	PJ-D:OP	Drought	0.0056	0.9000	100	999	-999	No	0	9999
PJ-D:OP	PJ-U:TEX	EX-Invasion	0.0010	1.0000	100	999	0	Yes	0	9999
PJ-U:EX	PJ-A:AL	Hrbx+Seed-PJ	0.0100	0.6000	0	999	0	No	0	9999
PJ-U:EX	PJ-U:EX	Hrbx+Seed-PJ	0.0100	0.4000	0	999	0	No	0	9999
PJ-U:EX	PJ-U:EX	ReplacementFire	0.1000	1.0000	0	999	-999	No	0	9999
PJ-U:TEX	PJ-C:OP	Herbicide-PJ	0.0100	0.6000	30	99	0	Yes	0	9999
PJ-U:TEX	PJ-D:OP	Herbicide-PJ	0.0100	0.6000	100	999	0	Yes	0	9999
PJ-U:TEX	PJ-U:EX	Drought	0.0056	0.1000	100	999	0	No	0	9999
PJ-U:TEX	PJ-U:EX	ReplacementFire	0.0050	1.0000	100	999	0	No	0	9999
PJ-U:TEX	PJ-U:TEX	Drought	0.0056	0.9000	100	999	-999	No	0	9999
PJ-U:TEX	PJ-U:TEX	Herbicide-PJ	0.0100	0.4000	0	999	0	No	0	9999
SWA-A:AL	SWA-A:AL	Flash-Flood	0.1400	1.0000	0	4	-999	No	0	9999
SWA-A:AL	SWA-A:AL	FuelBreak	0.0100	1.0000	0	999	0	No	0	9999
SWA-A:AL	SWA-A:AL	Livestock-Closure	0.0100	1.0000	1	999	0	No	0	9999
SWA-A:AL	SWA-A:AL	Managed-Herbivory	1.0000	0.0500	2	4	1	No	10	9999
SWA-A:AL	SWA-A:AL	ReplacementFire-Mojave	0.0001	1.0000	0	4	-999	No	3	9999
SWA-A:AL	SWA-A:AL	Utilities	0.0001	0.3000	0	999	-999	No	0	9999
SWA-A:AL	SWA-A:AL	Weed-Inventory-WAS	0.0100	1.0000	0	999	0	No	0	9999
SWA-A:AL	SWA-U:BG	OHV	1.0000	0.0001	0	4	0	No	2	9999
SWA-A:AL	SWA-U:ES	Excessive-Herbivory	1.0000	0.0005	10	10	0	No	10	9999
SWA-A:AL	SWA-U:ET	Exotic-Tree-Invasion	0.0001	1.0000	0	4	0	Yes	5	9999
SWA-A:AL	SWA-U:SEP	EX-Invasion	0.0050	1.0000	0	4	0	Yes	0	9999
SWA-A:AL	SWA-U:SES	Utilities	0.0001	0.7000	0	999	0	No	0	9999
SWA-B:CL	SWA-A:AL	Flash-Flood	0.0500	1.0000	5	19	0	No	0	9999

SWA-B:CL	SWA-A:AL	Utilities	0.0001	0.3000	5	999	0	No	0	9999
SWA-B:CL	SWA-B:CL	FuelBreak	0.0100	1.0000	5	999	0	No	0	9999
SWA-B:CL	SWA-B:CL	Livestock-Closure	0.0100	1.0000	1	999	0	No	0	9999
SWA-B:CL	SWA-B:CL	Managed-Herbivory	1.0000	0.0500	5	19	1	No	10	9999
SWA-B:CL	SWA-B:CL	ReplacementFire-Mojave	0.0010	1.0000	5	19	0	No	3	9999
SWA-B:CL	SWA-B:CL	Weed-Inventory-WAS	0.0100	1.0000	0	999	0	No	0	9999
SWA-B:CL	SWA-U:BG	OHV	1.0000	0.0001	5	19	0	No	2	9999
SWA-B:CL	SWA-U:ES	Excessive-Herbivory	1.0000	0.0005	10	10	0	No	10	9999
SWA-B:CL	SWA-U:ET	Exotic-Tree-Invasion	0.0001	1.0000	5	19	0	Yes	5	9999
SWA-B:CL	SWA-U:SEP	EX-Invasion	0.0050	1.0000	5	19	0	Yes	0	9999
SWA-B:CL	SWA-U:SES	Utilities	0.0001	0.7000	5	999	0	No	0	9999
SWA-C:CL	SWA-A:AL	Flash-Flood	0.0100	1.0000	20	999	-999	No	0	9999
SWA-C:CL	SWA-A:AL	Utilities	0.0001	0.3000	0	999	0	No	0	9999
SWA-C:CL	SWA-B:CL	ReplacementFire-Mojave	0.0010	1.0000	20	999	0	No	3	9999
SWA-C:CL	SWA-C:CL	FuelBreak	0.0100	1.0000	0	999	0	No	0	9999
SWA-C:CL	SWA-C:CL	Livestock-Closure	0.0100	1.0000	1	999	0	No	0	9999
SWA-C:CL	SWA-C:CL	Managed-Herbivory	1.0000	0.0500	20	999	1	No	10	9999
SWA-C:CL	SWA-C:CL	Weed-Inventory-WAS	0.0100	1.0000	20	999	0	No	0	9999
SWA-C:CL	SWA-U:BG	OHV	1.0000	0.0001	20	999	0	No	2	9999
SWA-C:CL	SWA-U:ES	Excessive-Herbivory	1.0000	0.0005	10	10	0	Yes	10	9999
SWA-C:CL	SWA-U:ET	Exotic-Tree-Invasion	0.0001	1.0000	20	999	0	No	5	9999
SWA-C:CL	SWA-U:SEP	EX-Invasion	0.0050	1.0000	20	999	0	Yes	0	9999
SWA-C:CL	SWA-U:SES	Utilities	0.0001	0.7000	0	999	0	No	0	9999
SWA-U:BG	SWA-A:AL	Utilities	0.0001	0.3000	0	999	0	No	0	9999
SWA-U:BG	SWA-U:BG	OHV	1.0000	0.0001	0	999	-999	No	2	9999
SWA-U:BG	SWA-U:BG	Weed-Inventory-WAS	0.0100	1.0000	0	999	0	No	0	9999
SWA-U:BG	SWA-U:ET	Exotic-Tree-Invasion	0.0050	1.0000	0	999	0	Yes	5	9999
SWA-U:BG	SWA-U:SES	EX-Invasion	0.0050	1.0000	0	999	0	Yes	0	9999
SWA-U:BG	SWA-U:SES	Utilities	0.0001	0.7000	0	999	0	No	0	9999
SWA-U:ES	SWA-A:AL	Utilities	0.0001	0.3000	0	999	0	No	0	9999
SWA-U:ES	SWA-U:BG	OHV	1.0000	0.0001	0	999	0	No	2	9999
SWA-U:ES	SWA-U:ES	FuelBreak	0.0100	1.0000	0	999	0	No	0	9999

SWA-U:ES	SWA-U:ES	Livestock-Closure	0.0100	1.0000	1	999	0	No	0	9999
SWA-U:ES	SWA-U:ES	ReplacementFire-Mojave	0.0015	1.0000	0	999	0	No	3	9999
SWA-U:ES	SWA-U:ES	Weed-Inventory-WAS	0.0100	1.0000	0	999	0	No	0	9999
SWA-U:ES	SWA-U:ET	Exotic-Tree-Invasion	0.0050	1.0000	0	999	0	Yes	5	9999
SWA-U:ES	SWA-U:SES	EX-Invasion	0.0050	1.0000	0	999	0	Yes	0	9999
SWA-U:ES	SWA-U:SES	Utilities	0.0001	0.7000	0	999	0	No	0	9999
SWA-U:ET	SWA-A:AL	Beetle-Mortality	0.2500	1.0000	0	4	0	Yes	0	9999
SWA-U:ET	SWA-A:AL	Exotic-Control-WAS	0.0100	0.9000	0	4	0	No	0	50
SWA-U:ET	SWA-A:AL	Flash-Flood	0.0100	0.0100	0	999	0	No	0	9999
SWA-U:ET	SWA-A:AL	Utilities	0.0001	0.3000	0	999	0	No	0	9999
SWA-U:ET	SWA-B:CL	Beetle-Mortality	0.2500	1.0000	5	19	0	Yes	0	9999
SWA-U:ET	SWA-B:CL	Exotic-Control-WAS	0.0100	0.9000	5	19	0	No	0	50
SWA-U:ET	SWA-C:CL	Beetle-Mortality	0.2500	1.0000	20	999	0	Yes	0	9999
SWA-U:ET	SWA-C:CL	Exotic-Control-WAS	0.0100	0.9000	20	999	0	No	0	50
SWA-U:ET	SWA-U:BG	OHV	1.0000	0.0001	0	999	0	No	2	9999
SWA-U:ET	SWA-U:ET	Excessive-Herbivory	1.0000	0.0010	0	999	3	No	0	9999
SWA-U:ET	SWA-U:ET	Exotic-Control-WAS	0.0100	0.1000	0	999	0	No	0	50
SWA-U:ET	SWA-U:ET	Flash-Flood	0.0100	0.9900	0	999	-999	No	0	9999
SWA-U:ET	SWA-U:ET	FuelBreak	0.0100	1.0000	0	999	0	No	0	9999
SWA-U:ET	SWA-U:ET	Livestock-Closure	0.0100	1.0000	1	999	0	No	0	9999
SWA-U:ET	SWA-U:ET	Managed-Herbivory	1.0000	0.0500	0	999	1	No	0	9999
SWA-U:ET	SWA-U:ET	ReplacementFire-Mojave	0.0200	1.0000	0	999	-999	No	3	9999
SWA-U:ET	SWA-U:ET	Utilities	0.0001	0.7000	0	999	-999	No	0	9999
SWA-U:SEP	SWA-A:AL	Fingers-of-Death-SWA	0.0100	0.7500	0	4	0	Yes	0	9999
SWA-U:SEP	SWA-A:AL	Flash-Flood	0.0100	0.0100	0	999	0	No	0	9999
SWA-U:SEP	SWA-A:AL	Herbicide-WAS	0.0100	0.5000	0	4	0	Yes	0	9999
SWA-U:SEP	SWA-A:AL	Utilities	0.0001	0.3000	0	999	0	No	0	9999
SWA-U:SEP	SWA-B:CL	Fingers-of-Death-SWA	0.0100	0.7500	5	19	0	Yes	0	9999
SWA-U:SEP	SWA-B:CL	Herbicide-WAS	0.0100	0.5000	5	19	0	Yes	0	9999
SWA-U:SEP	SWA-C:CL	Fingers-of-Death-SWA	0.0100	0.7500	20	999	0	Yes	0	9999
SWA-U:SEP	SWA-C:CL	Herbicide-WAS	0.0100	0.5000	20	999	0	Yes	0	9999
SWA-U:SEP	SWA-U:BG	OHV	1.0000	0.0001	0	999	0	No	2	9999

SWA-U:SEP	SWA-U:ES	Excessive-Herbivory	1.0000	0.0010	10	10	0	No	10	9999
SWA-U:SEP	SWA-U:ET	Exotic-Tree-Invasion	0.0001	1.0000	0	999	0	Yes	5	9999
SWA-U:SEP	SWA-U:SEP	Fingers-of-Death-SWA	0.0100	0.2500	0	999	0	No	0	9999
SWA-U:SEP	SWA-U:SEP	Flash-Flood	0.0100	0.9900	0	999	0	No	0	9999
SWA-U:SEP	SWA-U:SEP	FuelBreak	0.0100	1.0000	0	999	0	No	0	9999
SWA-U:SEP	SWA-U:SEP	Herbicide-WAS	0.0100	0.5000	0	999	0	No	0	9999
SWA-U:SEP	SWA-U:SEP	Livestock-Closure	0.0100	1.0000	1	999	0	No	0	9999
SWA-U:SEP	SWA-U:SEP	ReplacementFire-Mojave	0.0200	1.0000	0	999	-999	No	3	9999
SWA-U:SEP	SWA-U:SEP	Weed-Inventory-WAS	0.0100	1.0000	0	999	0	Yes	0	9999
SWA-U:SEP	SWA-U:SES	Managed-Herbivory	1.0000	0.0500	20	999	0	No	10	9999
SWA-U:SEP	SWA-U:SES	Managed-Herbivory	1.0000	0.0500	0	19	1	No	10	9999
SWA-U:SEP	SWA-U:SES	Utilities	0.0001	0.7000	0	999	0	No	0	9999
SWA-U:SES	SWA-A:AL	Fingers-of-Death-SWA	0.0100	0.7500	0	4	0	Yes	0	9999
SWA-U:SES	SWA-A:AL	Flash-Flood	0.0100	0.0100	0	999	0	No	0	9999
SWA-U:SES	SWA-A:AL	Herbicide-WAS	0.0100	0.5000	0	4	0	Yes	0	9999
SWA-U:SES	SWA-A:AL	Utilities	0.0001	0.3000	0	999	0	No	0	9999
SWA-U:SES	SWA-B:CL	Fingers-of-Death-SWA	0.0100	0.7500	5	19	0	Yes	0	9999
SWA-U:SES	SWA-B:CL	Herbicide-WAS	0.0100	0.5000	5	19	0	Yes	0	9999
SWA-U:SES	SWA-C:CL	Fingers-of-Death-SWA	0.0100	0.7500	20	999	0	No	0	9999
SWA-U:SES	SWA-C:CL	Herbicide-WAS	0.0100	0.5000	20	999	0	Yes	0	9999
SWA-U:SES	SWA-U:BG	OHV	1.0000	0.0001	0	999	0	No	2	9999
SWA-U:SES	SWA-U:ES	Excessive-Herbivory	1.0000	0.0010	10	10	0	Yes	10	9999
SWA-U:SES	SWA-U:ET	Exotic-Tree-Invasion	0.0001	1.0000	0	999	0	Yes	5	9999
SWA-U:SES	SWA-U:SES	Fingers-of-Death-SWA	0.0100	0.2500	0	999	0	No	0	9999
SWA-U:SES	SWA-U:SES	Flash-Flood	0.0100	0.9900	0	999	0	No	0	9999
SWA-U:SES	SWA-U:SES	FuelBreak	0.0100	1.0000	0	999	0	No	0	9999
SWA-U:SES	SWA-U:SES	Herbicide-WAS	0.0100	0.5000	0	999	0	No	0	9999
SWA-U:SES	SWA-U:SES	Livestock-Closure	0.0100	1.0000	1	999	0	No	0	9999
SWA-U:SES	SWA-U:SES	Managed-Herbivory	1.0000	0.0500	2	999	1	No	10	9999
SWA-U:SES	SWA-U:SES	ReplacementFire-Mojave	0.0500	1.0000	0	999	-999	No	3	9999
SWA-U:SES	SWA-U:SES	Utilities	0.0001	0.7000	0	999	0	No	0	9999
SWA-U:SES	SWA-U:SES	Weed-Inventory-WAS	0.0100	1.0000	0	999	0	No	0	9999

WDR-A:AL	WDR-A:AL	Flooding-7yr	0.1300	1.0000	0	4	-999	No	0	9999
WDR-A:AL	WDR-A:AL	Managed-Herbivory	1.0000	0.0500	2	4	-999	No	0	9999
WDR-A:AL	WDR-A:AL	Weed-Inventory	0.0100	1.0000	0	4	0	No	0	9999
WDR-A:AL	WDR-U:DE	Excessive-Herbivory	0.0010	1.0000	0	4	0	Yes	0	9999
WDR-A:AL	WDR-U:EF	Exotic-Forb-Invasion	0.0100	1.0000	0	4	0	No	5	9999
WDR-A:AL	WDR-U:ET	Exotic-Tree-Invasion	0.0100	1.0000	0	4	0	No	5	9999
WDR-A:AL	WDR-U:TEX	EX-Invasion	0.0050	1.0000	0	4	0	Yes	0	9999
WDR-B:CL	WDR-A:AL	Flooding-20yr	0.0500	1.0000	5	19	0	No	0	9999
WDR-B:CL	WDR-B:CL	Managed-Herbivory	1.0000	0.0500	5	19	-1	No	0	9999
WDR-B:CL	WDR-B:CL	Weed-Inventory	0.0100	1.0000	5	19	0	No	0	9999
WDR-B:CL	WDR-U:DE	Excessive-Herbivory	0.0010	1.0000	5	19	0	Yes	0	9999
WDR-B:CL	WDR-U:EF	Exotic-Forb-Invasion	0.0075	1.0000	5	19	0	No	5	9999
WDR-B:CL	WDR-U:ET	Exotic-Tree-Invasion	0.0075	1.0000	5	19	0	No	5	9999
WDR-B:CL	WDR-U:TEX	EX-Invasion	0.0050	1.0000	0	19	0	Yes	0	9999
WDR-C:OP	WDR-A:AL	Flooding-20yr	0.0500	1.0000	1	89	0	No	0	9999
WDR-C:OP	WDR-C:OP	Managed-Herbivory	1.0000	0.0500	1	89	-1	No	0	9999
WDR-C:OP	WDR-U:DE	Excessive-Herbivory	0.0010	1.0000	1	89	0	Yes	0	9999
WDR-C:OP	WDR-U:EF	Exotic-Forb-Invasion	0.0075	1.0000	5	89	0	Yes	5	9999
WDR-C:OP	WDR-U:EF	Exotic-Forb-Invasion	0.0100	1.0000	1	4	0	Yes	5	9999
WDR-C:OP	WDR-U:ET	Exotic-Tree-Invasion	0.0075	1.0000	5	89	0	Yes	5	9999
WDR-C:OP	WDR-U:ET	Exotic-Tree-Invasion	0.0100	1.0000	1	4	0	Yes	5	9999
WDR-C:OP	WDR-U:TEX	EX-Invasion	0.0050	1.0000	1	89	0	Yes	0	9999
WDR-D:CL	WDR-A:AL	Flooding-100yr	0.0100	1.0000	20	89	0	No	0	9999
WDR-D:CL	WDR-C:OP	ReplacementFire	0.0013	1.0000	20	89	0	No	0	9999
WDR-D:CL	WDR-D:CL	Managed-Herbivory	1.0000	0.0500	20	89	1	No	0	9999
WDR-D:CL	WDR-D:CL	Weed-Inventory	0.0100	1.0000	20	89	0	No	0	9999
WDR-D:CL	WDR-U:DE	Excessive-Herbivory	0.0010	1.0000	20	89	0	Yes	0	9999
WDR-D:CL	WDR-U:EF	Exotic-Forb-Invasion	0.0050	1.0000	20	89	0	No	5	9999
WDR-D:CL	WDR-U:ET	Exotic-Tree-Invasion	0.0050	1.0000	20	89	0	No	5	9999
WDR-D:CL	WDR-U:TEX	EX-Invasion	0.0050	1.0000	20	89	0	Yes	0	9999
WDR-E:CL	WDR-A:AL	Flooding-100yr	0.0020	1.0000	90	999	0	No	0	9999
WDR-E:CL	WDR-C:OP	Flooding-100yr	0.0100	1.0000	90	999	0	No	0	9999

WDR-E:CL	WDR-C:OP	ReplacementFire	0.0040	1.0000	90	999	0	No	0	9999
WDR-E:CL	WDR-C:OP	Senescence	0.0200	1.0000	450	999	0	No	0	9999
WDR-E:CL	WDR-E:CL	Managed-Herbivory	1.0000	0.0500	90	999	0	No	0	9999
WDR-E:CL	WDR-E:CL	Weed-Inventory	0.0100	1.0000	90	999	0	No	0	9999
WDR-E:CL	WDR-U:DE	Excessive-Herbivory	1.0000	0.0010	90	999	0	Yes	0	9999
WDR-E:CL	WDR-U:EF	Exotic-Forb-Invasion	0.0050	1.0000	90	999	0	No	5	9999
WDR-E:CL	WDR-U:ET	Exotic-Tree-Invasion	0.0050	1.0000	90	999	0	Yes	5	9999
WDR-E:CL	WDR-U:TEX	EX-Invasion	0.0050	1.0000	90	999	0	Yes	0	9999
WDR-U:DE	WDR-A:AL	Flooding-100yr	0.0100	0.0100	1	999	0	No	0	9999
WDR-U:DE	WDR-A:AL	Floodplain-Restoration	0.0100	0.9000	1	999	0	No	0	9999
WDR-U:DE	WDR-U:DE	Flooding-100yr	0.0100	0.9900	1	999	-999	No	0	9999
WDR-U:DE	WDR-U:DE	Floodplain-Restoration	0.0100	0.1000	1	999	0	No	0	9999
WDR-U:DE	WDR-U:DE	Weed-Inventory	0.0100	1.0000	0	999	0	No	0	9999
WDR-U:DE	WDR-U:DEF	Exotic-Forb-Invasion	0.0075	1.0000	1	999	0	Yes	5	9999
WDR-U:DE	WDR-U:DET	Exotic-Tree-Invasion	0.0075	1.0000	1	999	0	Yes	5	9999
WDR-U:DEF	WDR-U:DE	Exotic-Forb-Control	0.0100	0.6000	1	999	0	No	0	20
WDR-U:DEF	WDR-U:DEF	Exotic-Forb-Control	0.0100	0.4000	1	999	0	No	0	20
WDR-U:DEF	WDR-U:DEF	Flooding-100yr	0.0100	0.9900	1	999	-999	No	0	9999
WDR-U:DEF	WDR-U:EF	Flooding-100yr	0.0100	0.0100	1	999	0	No	0	9999
WDR-U:DET	WDR-U:DE	Beetle-Mortality	0.2500	0.2500	0	999	0	Yes	0	9999
WDR-U:DET	WDR-U:DE	Exotic-Tree-Control	0.0100	0.8000	1	999	0	No	0	20
WDR-U:DET	WDR-U:DEF	Beetle-Mortality	0.2500	0.7500	0	999	0	Yes	0	9999
WDR-U:DET	WDR-U:DEF	Exotic-Tree-Control	0.0100	0.1000	1	999	0	No	0	20
WDR-U:DET	WDR-U:DET	Exotic-Tree-Control	0.0100	0.1000	1	999	0	No	0	20
WDR-U:DET	WDR-U:DET	Flooding-100yr	0.0100	0.9900	1	999	-999	No	0	9999
WDR-U:DET	WDR-U:DET	ReplacementFire	0.0500	1.0000	5	999	-999	No	0	9999
WDR-U:DET	WDR-U:ET	Flooding-100yr	0.0100	0.0100	1	999	0	No	0	9999
WDR-U:DEX	WDR-A:AL	Flooding-100yr	0.0100	0.0100	0	999	0	No	0	9999
WDR-U:DEX	WDR-U:DEF	Exotic-Forb-Invasion	0.0050	1.0000	0	999	0	Yes	5	9999
WDR-U:DEX	WDR-U:DET	Exotic-Tree-Invasion	0.0050	1.0000	0	999	0	Yes	5	9999
WDR-U:DEX	WDR-U:DEX	Excessive-Herbivory	1.0000	0.0010	0	999	3	No	0	9999
WDR-U:DEX	WDR-U:DEX	Flooding-100yr	0.0100	0.9900	0	999	-999	No	0	9999

WDR-U:DEX	WDR-U:DEX	Managed-Herbivory	1.0000	0.0500	0	999	1	No	0	9999
WDR-U:DEX	WDR-U:DEX	ReplacementFire	0.0500	1.0000	0	999	-999	No	0	9999
WDR-U:DEX	WDR-U:DEX	Weed-Inventory	0.0100	1.0000	0	999	0	No	0	9999
WDR-U:EF	WDR-A:AL	Exotic-Forb-Control	0.0100	0.6000	0	999	0	No	0	20
WDR-U:EF	WDR-U:EF	Exotic-Forb-Control	0.0100	0.4000	0	999	0	No	0	20
WDR-U:EF	WDR-U:EF	Flooding-100yr	0.0100	1.0000	0	999	-999	No	0	9999
WDR-U:ET	WDR-A:AL	Beetle-Mortality	0.2500	1.0000	0	4	0	Yes	0	9999
WDR-U:ET	WDR-A:AL	Exotic-Tree-Control	0.0100	0.8000	0	999	0	No	0	20
WDR-U:ET	WDR-A:AL	Flooding-100yr	0.0100	0.0100	0	999	0	No	0	9999
WDR-U:ET	WDR-B:CL	Beetle-Mortality	0.2500	1.0000	5	19	0	Yes	0	9999
WDR-U:ET	WDR-C:OP	Beetle-Mortality	0.2500	1.0000	0	999	0	Yes	0	9999
WDR-U:ET	WDR-D:CL	Beetle-Mortality	0.2500	1.0000	20	89	0	Yes	0	9999
WDR-U:ET	WDR-E:CL	Beetle-Mortality	0.2500	1.0000	90	999	0	Yes	0	9999
WDR-U:ET	WDR-U:DET	Entrenchment	0.0001	1.0000	0	999	0	Yes	10	9999
WDR-U:ET	WDR-U:EF	Exotic-Tree-Control	0.0100	0.1000	0	999	0	No	0	20
WDR-U:ET	WDR-U:ET	Exotic-Tree-Control	0.0100	0.1000	0	999	0	No	0	20
WDR-U:ET	WDR-U:ET	Flooding-100yr	0.0100	0.9900	0	999	-999	No	0	9999
WDR-U:ET	WDR-U:ET	ReplacementFire	0.0500	1.0000	0	999	-999	No	0	9999
WDR-U:EX	WDR-A:AL	Flooding-100yr	0.0100	0.0100	0	500	-999	No	0	9999
WDR-U:EX	WDR-U:DE	Excessive-Herbivory	1.0000	0.0010	0	500	0	Yes	0	9999
WDR-U:EX	WDR-U:EF	Exotic-Forb-Invasion	0.0075	1.0000	0	500	0	Yes	5	9999
WDR-U:EX	WDR-U:ET	Exotic-Tree-Invasion	0.0075	1.0000	0	500	0	Yes	5	9999
WDR-U:EX	WDR-U:EX	Flooding-100yr	0.0100	0.9900	0	500	-999	No	0	9999
WDR-U:EX	WDR-U:EX	Managed-Herbivory	1.0000	0.0500	2	500	-999	No	0	9999
WDR-U:EX	WDR-U:EX	ReplacementFire	0.0500	1.0000	0	500	-999	No	0	9999
WDR-U:TEX	WDR-A:AL	Flooding-100yr	0.0100	0.0100	20	999	0	No	0	9999
WDR-U:TEX	WDR-A:AL	Hrbx-EX-WDR	0.0100	0.5000	0	4	0	Yes	0	9999
WDR-U:TEX	WDR-B:CL	Hrbx-EX-WDR	0.0100	0.5000	5	19	0	Yes	0	9999
WDR-U:TEX	WDR-D:CL	Hrbx-EX-WDR	0.0100	0.5000	20	89	0	Yes	0	9999
WDR-U:TEX	WDR-E:CL	Hrbx-EX-WDR	0.0100	0.5000	90	999	0	Yes	0	9999
WDR-U:TEX	WDR-U:DE	Excessive-Herbivory	1.0000	0.0001	5	19	0	Yes	0	9999
WDR-U:TEX	WDR-U:EF	Exotic-Forb-Invasion	0.0075	1.0000	5	999	0	Yes	5	9999

WDR-U:TEX	WDR-U:ET	Exotic-Tree-Invasion	0.0075	1.0000	5	999	0	No	5	9999
WDR-U:TEX	WDR-U:EX	Flooding-100yr	0.0100	0.9900	20	999	0	No	0	9999
WDR-U:TEX	WDR-U:EX	Flooding-20yr	0.0500	1.0000	5	19	0	No	0	9999
WDR-U:TEX	WDR-U:EX	ReplacementFire	0.0015	1.0000	5	999	0	No	0	9999
WDR-U:TEX	WDR-U:TEX	Hrbx-EX-WDR	0.0100	0.5000	0	999	0	No	0	9999
WDR-U:TEX	WDR-U:TEX	Managed-Herbivory	1.0000	0.0500	5	999	1	No	0	9999
WDR-U:TEX	WDR-U:TEX	Weed-Inventory	0.0100	1.0000	5	999	0	No	0	9999
Beaver Dam Wash NCA										
DSS-A:OP	DSS-A:OP	NativeHerbivory	0.0050	1.0000	0	2	1	No	0	9999
DSS-A:OP	DSS-A:OP	ReplacementFire	0.0083	1.0000	0	2	-2	No	0	9999
DSS-A:OP	DSS-U:SEP	EX-Invasion	0.0010	1.0000	0	2	0	Yes	0	9999
DSS-B:OP	DSS-A:OP	ReplacementFire	0.0106	1.0000	3	999	0	No	0	9999
DSS-B:OP	DSS-B:OP	Drought	0.0056	1.0000	3	999	-999	No	0	9999
DSS-B:OP	DSS-B:OP	Managed-Herbivory	1.0000	0.0500	3	999	2	No	0	9999
DSS-B:OP	DSS-U:DP	Excessive-Herbivory	0.0010	1.0000	3	999	0	Yes	0	9999
DSS-B:OP	DSS-U:SEP	EX-Invasion	0.0010	1.0000	3	999	0	Yes	0	9999
DSS-U:DP	DSS-U:DP	Drought	0.0056	1.0000	0	999	-999	No	0	9999
DSS-U:DP	DSS-U:DP	ReplacementFire	0.0083	1.0000	0	999	-999	No	0	9999
DSS-U:DP	DSS-U:SEP	EX-Invasion	0.0010	1.0000	0	999	0	Yes	0	9999
DSS-U:SEP	DSS-B:OP	Hrbx+Seed-DSS	0.0100	0.8000	0	999	0	Yes	0	9999
DSS-U:SEP	DSS-U:DP	Excessive-Herbivory	1.0000	0.0010	0	999	0	Yes	0	9999
DSS-U:SEP	DSS-U:SEP	Drought	0.0056	1.0000	0	999	-999	No	0	9999
DSS-U:SEP	DSS-U:SEP	Hrbx+Seed-DSS	0.0100	0.2000	0	999	0	No	0	9999
DSS-U:SEP	DSS-U:SEP	Managed-Herbivory	1.0000	0.0500	0	999	1	No	0	9999
DSS-U:SEP	DSS-U:SEP	ReplacementFire	0.0106	1.0000	3	999	-999	No	0	9999
DSS-U:SEP	DSS-U:SEP	ReplacementFire	0.0500	1.0000	0	2	-999	No	0	9999
BM-A:AL	BM-A:AL	FuelBreak	0.0100	1.0000	0	999	0	No	0	9999
BM-A:AL	BM-A:AL	Law-Inforcement	0.0100	1.0000	0	999	0	No	0	9999
BM-A:AL	BM-A:AL	Managed-Herbivory	1.0000	0.0500	2	199	1	No	0	9999
BM-A:AL	BM-A:AL	ReplacementFire-Mojave	0.0001	1.0000	0	199	-999	No	3	9999
BM-A:AL	BM-B:JT	Joshua-Succession	0.6300	1.0000	198	198	0	No	0	9999
BM-A:AL	BM-U:BG	OHV	1.0000	0.0001	0	999	0	No	2	9999

BM-A:AL	BM-U:ES	Excessive-Herbivory	1.0000	0.0010	0	999	0	Yes	0	9999
BM-A:AL	BM-U:EX	EX-Invasion	0.0050	1.0000	0	4	0	Yes	0	9999
BM-A:AL	BM-U:EX	Utilities	0.0001	1.0000	0	999	0	No	0	9999
BM-A:AL	BM-U:SEP	EX-Invasion	0.0050	0.5000	5	199	0	Yes	0	9999
BM-A:AL	BM-U:SEPJ	EX-Invasion	0.0050	0.5000	5	999	0	Yes	0	9999
BM-B:JT	BM-A:AL	ReplacementFire-Mojave	0.0005	1.0000	200	999	0	No	3	9999
BM-B:JT	BM-B:JT	FuelBreak	0.0100	1.0000	200	999	0	No	0	9999
BM-B:JT	BM-B:JT	Law-Inforcement	0.0100	1.0000	0	999	0	No	0	9999
BM-B:JT	BM-B:JT	Managed-Herbivory	1.0000	0.0500	200	999	3	No	0	9999
BM-B:JT	BM-E:JT	Tree-Invasion	0.0025	1.0000	400	999	0	Yes	0	9999
BM-B:JT	BM-U:BG	OHV	1.0000	0.0001	200	999	0	No	2	9999
BM-B:JT	BM-U:ES	Excessive-Herbivory	1.0000	0.0010	200	999	0	Yes	0	9999
BM-B:JT	BM-U:EX	Utilities	0.0001	1.0000	200	999	0	No	0	9999
BM-B:JT	BM-U:SEPJ	EX-Invasion	0.0050	1.0000	200	999	0	Yes	0	9999
BM-C:OP	BM-A:AL	ReplacementFire-Mojave	0.0005	1.0000	200	999	0	No	3	9999
BM-C:OP	BM-C:OP	FuelBreak	0.0100	1.0000	200	999	0	No	0	9999
BM-C:OP	BM-C:OP	Law-Inforcement	0.0100	1.0000	0	999	0	No	0	9999
BM-C:OP	BM-C:OP	Managed-Herbivory	1.0000	0.0500	200	999	3	No	0	9999
BM-C:OP	BM-D:OP	Tree-Invasion	0.0025	1.0000	400	999	0	Yes	0	9999
BM-C:OP	BM-U:BG	OHV	1.0000	0.0001	200	999	0	No	2	9999
BM-C:OP	BM-U:ES	Excessive-Herbivory	1.0000	0.0010	200	999	0	Yes	0	9999
BM-C:OP	BM-U:EX	Utilities	0.0001	1.0000	200	999	0	No	0	9999
BM-D:OP	BM-A:AL	Drought	0.0056	0.0100	400	999	0	No	0	9999
BM-D:OP	BM-A:AL	ReplacementFire-Mojave	0.0010	1.0000	400	999	0	No	3	9999
BM-D:OP	BM-C:OP	Drought	0.0056	0.9900	400	999	0	No	0	9999
BM-D:OP	BM-D:OP	FuelBreak	0.0100	1.0000	400	999	0	No	0	9999
BM-D:OP	BM-D:OP	Law-Inforcement	0.0100	1.0000	0	999	0	No	0	9999
BM-D:OP	BM-D:OP	Managed-Herbivory	1.0000	0.0500	400	999	3	No	0	9999
BM-D:OP	BM-U:BG	OHV	1.0000	0.0001	400	999	0	No	2	9999
BM-D:OP	BM-U:EX	Utilities	0.0001	1.0000	400	999	0	No	0	9999
BM-D:OP	BM-U:TEX	EX-Invasion	0.0050	1.0000	400	999	0	Yes	0	9999
BM-D:OP	BM-U:TEX	Tree-Encroachment	0.0050	1.0000	600	999	0	No	0	9999

BM-E:JT	BM-A:AL	Drought	0.0056	0.0100	400	999	0	No	0	9999
BM-E:JT	BM-A:AL	ReplacementFire-Mojave	0.0010	1.0000	400	999	0	No	3	9999
BM-E:JT	BM-B:JT	Drought	0.0056	0.9900	400	999	0	No	0	9999
BM-E:JT	BM-E:JT	FuelBreak	0.0100	1.0000	400	999	0	No	0	9999
BM-E:JT	BM-E:JT	Law-Inforcement	0.0100	1.0000	0	999	0	No	0	9999
BM-E:JT	BM-E:JT	Managed-Herbivory	1.0000	0.0500	400	999	3	No	0	9999
BM-E:JT	BM-U:BG	OHV	1.0000	0.0001	400	999	0	No	2	9999
BM-E:JT	BM-U:EX	Utilities	0.0001	1.0000	400	999	0	No	0	9999
BM-E:JT	BM-U:TEX	EX-Invasion	0.0050	1.0000	400	999	0	Yes	0	9999
BM-E:JT	BM-U:TEX	Tree-Encroachment	0.0050	1.0000	600	999	0	No	0	9999
BM-U:BG	BM-U:BG	Law-Inforcement	0.0100	1.0000	0	999	0	No	0	9999
BM-U:BG	BM-U:BG	OHV	1.0000	0.0001	0	999	-999	No	2	9999
BM-U:BG	BM-U:EX	EX-Invasion	0.0050	1.0000	0	999	0	No	0	9999
BM-U:BG	BM-U:EX	Utilities	0.0001	1.0000	0	999	0	No	0	9999
BM-U:ES	BM-U:BG	OHV	1.0000	0.0001	0	999	0	No	2	9999
BM-U:ES	BM-U:ES	FuelBreak	0.0100	1.0000	0	999	0	No	0	9999
BM-U:ES	BM-U:ES	Law-Inforcement	0.0100	1.0000	0	999	0	No	0	9999
BM-U:ES	BM-U:ES	ReplacementFire-Mojave	0.0010	1.0000	0	999	-999	No	3	9999
BM-U:ES	BM-U:EX	Utilities	0.0001	1.0000	0	999	0	No	0	9999
BM-U:ES	BM-U:SEP	EX-Invasion	0.0050	0.3700	0	999	0	No	0	9999
BM-U:ES	BM-U:SEPJ	EX-Invasion	0.0050	0.6300	0	999	0	No	0	9999
BM-U:EX	BM-U:BG	OHV	1.0000	0.0001	0	999	0	No	2	9999
BM-U:EX	BM-U:ES	Excessive-Herbivory	1.0000	0.0010	0	999	0	No	0	9999
BM-U:EX	BM-U:EX	FuelBreak	0.0100	1.0000	0	999	0	No	0	9999
BM-U:EX	BM-U:EX	Hrbx+Current-Native-Seed-BM	0.0100	0.9900	0	999	-999	No	0	9999
BM-U:EX	BM-U:EX	Hrbx+Introduced-Seed-BM	0.0100	0.9500	0	999	-999	No	0	9999
BM-U:EX	BM-U:EX	Hrbx+New-Seed-BM	0.0100	0.9500	0	999	0	Yes	0	9999
BM-U:EX	BM-U:EX	Law-Inforcement	0.0100	1.0000	0	999	0	No	0	9999
BM-U:EX	BM-U:EX	Managed-Herbivory	1.0000	0.0500	2	999	1	No	0	9999
BM-U:EX	BM-U:EX	Planting+FOD-BM	0.0100	0.1000	0	999	0	Yes	0	9999
BM-U:EX	BM-U:EX	Planting+Herbicde-BM	0.0100	0.1000	0	999	0	No	0	9999
BM-U:EX	BM-U:EX2B	ReplacementFire-Mojave	0.0500	1.0000	21	999	-999	No	3	9999

BM-U:EX	BM-U:EX2B	ReplacementFire-Mojave	0.1000	1.0000	0	20	-999	No	3	9999
BM-U:EX	BM-U:EX2B	Utilities	0.0001	1.0000	0	999	0	No	0	9999
BM-U:EX	BM-U:PL	Planting+FOD-BM	0.0100	0.6950	0	999	0	No	0	9999
BM-U:EX	BM-U:PL	Planting+Herbicde-BM	0.0100	0.4500	0	999	0	Yes	0	9999
BM-U:EX	BM-U:SD	Hrbx+Current-Native-Seed-BM	0.0100	0.0100	0	999	0	Yes	0	9999
BM-U:EX	BM-U:SD	Hrbx+New-Seed-BM	0.0100	0.0500	0	999	0	Yes	0	9999
BM-U:EX	BM-U:SDI	Hrbx+Introduced-Seed-BM	0.0100	0.0500	0	999	0	No	0	9999
BM-U:EX	BM-U:SEP	Non-Joshua-Succession	0.1000	0.3700	20	999	0	No	0	9999
BM-U:EX	BM-U:SEP	Planting+FOD-BM	0.0100	0.0850	0	999	0	No	0	9999
BM-U:EX	BM-U:SEP	Planting+Herbicde-BM	0.0100	0.1700	0	999	0	Yes	0	9999
BM-U:EX	BM-U:SEPJ	Joshua-Succession	0.1000	0.6300	20	999	0	No	0	9999
BM-U:EX	BM-U:SEPJ	Planting+FOD-BM	0.0100	0.1400	0	999	0	No	0	9999
BM-U:EX	BM-U:SEPJ	Planting+Herbicde-BM	0.0100	0.2800	0	999	0	Yes	0	9999
BM-U:EX2B	BM-U:BG	OHV	1.0000	0.0001	0	999	0	No	2	9999
BM-U:EX2B	BM-U:EX2B	FuelBreak	0.0100	1.0000	0	999	0	No	0	9999
BM-U:EX2B	BM-U:EX2B	Hrbx+New-Seed-BM	0.0100	0.9500	0	999	0	No	0	9999
BM-U:EX2B	BM-U:EX2B	Law-Inforcement	0.0100	1.0000	0	999	0	No	0	9999
BM-U:EX2B	BM-U:EX2B	Managed-Herbivory	1.0000	0.0500	0	999	0	No	0	9999
BM-U:EX2B	BM-U:EX2B	Planting+FOD-BM	0.0100	0.1000	0	999	0	No	0	9999
BM-U:EX2B	BM-U:EX2B	Planting+Herbicde-BM	0.0100	0.1000	0	999	0	No	0	9999
BM-U:EX2B	BM-U:EX2B	ReplacementFire-Mojave	0.1000	1.0000	0	999	-999	No	3	9999
BM-U:EX2B	BM-U:PL	Planting+FOD-BM	0.0100	0.6950	0	999	0	No	0	9999
BM-U:EX2B	BM-U:PL	Planting+Herbicde-BM	0.0100	0.4500	0	999	0	No	0	9999
BM-U:EX2B	BM-U:SD	Hrbx+New-Seed-BM	0.0100	0.0500	0	999	0	No	0	9999
BM-U:EX2B	BM-U:SEP	Planting+FOD-BM	0.0100	0.0850	0	999	0	No	0	9999
BM-U:EX2B	BM-U:SEP	Planting+Herbicde-BM	0.0100	0.1700	0	999	0	No	0	9999
BM-U:EX2B	BM-U:SEPJ	Planting+FOD-BM	0.0100	0.1400	0	999	0	No	0	9999
BM-U:EX2B	BM-U:SEPJ	Planting+Herbicde-BM	0.0100	0.2800	0	999	0	No	0	9999
BM-U:PL	BM-A:AL	Natural-Recovery	0.1000	1.0000	20	999	0	No	10	9999
BM-U:PL	BM-U:BG	OHV	1.0000	0.0001	0	999	-999	No	2	9999
BM-U:PL	BM-U:ES	Excessive-Herbivory	1.0000	0.0010	2	999	0	Yes	10	9999
BM-U:PL	BM-U:EX	Drought	0.0056	0.1000	0	999	0	No	0	9999

BM-U:PL	BM-U:EX	Managed-Herbivory	1.0000	0.0500	2	999	0	No	10	9999
BM-U:PL	BM-U:EX	Utilities	0.0001	1.0000	0	999	0	No	0	9999
BM-U:PL	BM-U:PL	Drought	0.0056	0.9000	0	999	-999	No	0	9999
BM-U:PL	BM-U:PL	Law-Inforcement	0.0100	1.0000	0	999	0	No	0	9999
BM-U:PL	BM-U:PL	Livestock-Closure	0.0100	1.0000	1	2	0	No	0	9999
BM-U:PL	BM-U:SEP	Seedbank-Emergence	0.2000	0.6800	0	999	0	No	2	9999
BM-U:PL	BM-U:SEPJ	Seedbank-Emergence	0.2000	0.3200	0	999	0	No	2	9999
BM-U:SD	BM-A:AL	Natural-Recovery	0.1000	1.0000	20	999	0	No	10	9999
BM-U:SD	BM-U:BG	OHV	1.0000	0.0001	0	999	0	No	2	9999
BM-U:SD	BM-U:ES	Excessive-Herbivory	1.0000	0.0010	0	999	0	Yes	10	9999
BM-U:SD	BM-U:EX	EX-Invasion	0.0050	1.0000	0	19	0	Yes	0	9999
BM-U:SD	BM-U:EX	Managed-Herbivory	1.0000	0.0500	2	999	0	No	10	9999
BM-U:SD	BM-U:EX	Seedbank-Emergence	0.2000	1.0000	0	999	0	Yes	2	9999
BM-U:SD	BM-U:EX	Utilities	0.0001	1.0000	0	999	0	No	0	9999
BM-U:SD	BM-U:SD	FuelBreak	0.0100	1.0000	0	999	0	No	0	9999
BM-U:SD	BM-U:SD	Law-Inforcement	0.0100	1.0000	0	999	0	No	0	9999
BM-U:SD	BM-U:SD	Livestock-Closure	0.0100	1.0000	1	2	0	No	0	9999
BM-U:SD	BM-U:SD	ReplacementFire-Mojave	0.0010	1.0000	0	999	-999	No	3	9999
BM-U:SD	BM-U:SEP	EX-Invasion	0.0050	1.0000	20	999	0	Yes	0	9999
BM-U:SDI	BM-A:AL	Natural-Recovery	0.0010	1.0000	20	199	0	Yes	10	9999
BM-U:SDI	BM-U:BG	OHV	1.0000	0.0001	0	999	0	No	2	9999
BM-U:SDI	BM-U:ES	Excessive-Herbivory	1.0000	0.0001	0	999	0	Yes	10	9999
BM-U:SDI	BM-U:EX	EX-Invasion	0.0010	1.0000	0	19	0	Yes	0	9999
BM-U:SDI	BM-U:EX	Utilities	0.0001	1.0000	0	999	0	No	0	9999
BM-U:SDI	BM-U:SDI	FuelBreak	0.0100	1.0000	0	999	0	No	0	9999
BM-U:SDI	BM-U:SDI	Law-Inforcement	0.0100	1.0000	0	999	0	No	0	9999
BM-U:SDI	BM-U:SDI	Livestock-Closure	0.0100	1.0000	1	2	0	No	0	9999
BM-U:SDI	BM-U:SDI	Managed-Herbivory	1.0000	0.0500	2	999	1	No	10	9999
BM-U:SDI	BM-U:SDI	ReplacementFire-Mojave	0.0001	1.0000	0	999	-999	No	3	9999
BM-U:SDI	BM-U:SEP	EX-Invasion	0.0010	1.0000	20	999	0	Yes	0	9999
BM-U:SDI	BM-U:SEP	Seedbank-Emergence	0.2000	1.0000	0	999	0	No	2	9999
BM-U:SEP	BM-C:OP	Fingers-of-Death-BM	0.0100	0.7500	5	399	0	Yes	0	9999

BM-U:SEP	BM-D:OP	Fingers-of-Death-BM	0.0100	0.7500	400	999	0	Yes	0	9999
BM-U:SEP	BM-U:BG	OHV	1.0000	0.0001	5	999	0	No	2	9999
BM-U:SEP	BM-U:ES	Excessive-Herbivory	1.0000	0.0010	5	999	0	Yes	10	9999
BM-U:SEP	BM-U:EX	Drought	0.0056	0.0100	5	999	0	No	0	9999
BM-U:SEP	BM-U:EX	ReplacementFire-Mojave	0.0050	1.0000	200	999	0	No	3	9999
BM-U:SEP	BM-U:EX	Utilities	0.0001	1.0000	200	999	0	No	0	9999
BM-U:SEP	BM-U:EX2B	ReplacementFire-Mojave	0.0050	1.0000	5	199	0	No	3	9999
BM-U:SEP	BM-U:EX2B	Utilities	0.0001	1.0000	0	199	0	No	0	9999
BM-U:SEP	BM-U:PL	Herbicide-BM	0.0100	0.5000	5	15	0	No	1	9999
BM-U:SEP	BM-U:SEP	Drought	0.0056	0.9900	5	999	-999	No	0	9999
BM-U:SEP	BM-U:SEP	Fingers-of-Death-BM	0.0100	0.2500	5	999	0	No	0	9999
BM-U:SEP	BM-U:SEP	FuelBreak	0.0100	1.0000	5	999	0	No	0	9999
BM-U:SEP	BM-U:SEP	Herbicide-BM	0.0100	0.5000	5	15	0	No	1	9999
BM-U:SEP	BM-U:SEP	Law-Inforcement	0.0100	1.0000	5	999	0	No	0	9999
BM-U:SEP	BM-U:SEP	Managed-Herbivory	1.0000	0.0500	5	999	1	No	10	9999
BM-U:SEP	BM-U:TEX	Tree-Invasion	0.0025	1.0000	400	999	0	Yes	0	9999
BM-U:SEPJ	BM-B:JT	Fingers-of-Death-BM	0.0100	0.7500	5	399	0	No	0	9999
BM-U:SEPJ	BM-E:JT	Fingers-of-Death-BM	0.0100	0.7500	400	999	0	Yes	0	9999
BM-U:SEPJ	BM-U:BG	OHV	1.0000	0.0001	5	999	0	No	2	9999
BM-U:SEPJ	BM-U:ES	Excessive-Herbivory	1.0000	0.0010	5	999	0	Yes	10	9999
BM-U:SEPJ	BM-U:EX	Drought	0.0056	0.0100	5	999	0	No	0	9999
BM-U:SEPJ	BM-U:EX	ReplacementFire-Mojave	0.0050	1.0000	200	999	0	No	3	9999
BM-U:SEPJ	BM-U:EX	Utilities	0.0001	1.0000	200	999	0	No	0	9999
BM-U:SEPJ	BM-U:EX2B	ReplacementFire-Mojave	0.0050	1.0000	5	199	0	No	3	9999
BM-U:SEPJ	BM-U:EX2B	Utilities	0.0001	1.0000	0	199	0	No	0	9999
BM-U:SEPJ	BM-U:PL	Herbicide-BM	0.0100	0.5000	5	15	0	No	1	9999
BM-U:SEPJ	BM-U:SEPJ	Drought	0.0056	0.9900	20	999	-999	No	0	9999
BM-U:SEPJ	BM-U:SEPJ	Fingers-of-Death-BM	0.0100	0.2500	5	999	0	No	0	9999
BM-U:SEPJ	BM-U:SEPJ	FuelBreak	0.0100	1.0000	20	999	0	No	0	9999
BM-U:SEPJ	BM-U:SEPJ	Herbicide-BM	0.0100	0.5000	5	15	0	No	1	9999
BM-U:SEPJ	BM-U:SEPJ	Law-Inforcement	0.0100	1.0000	0	999	0	No	0	9999
BM-U:SEPJ	BM-U:SEPJ	Managed-Herbivory	1.0000	0.0500	20	999	1	No	10	9999

BM-U:SEPJ	BM-U:TEX	Tree-Invasion	0.0025	1.0000	400	999	0	Yes	0	9999
BM-U:TEX	BM-U:EX	Drought	0.0056	0.0100	400	999	0	No	0	9999
BM-U:TEX	BM-U:EX	ReplacementFire-Mojave	0.0025	1.0000	400	999	0	No	3	9999
BM-U:TEX	BM-U:SD	Utilities	0.0001	1.0000	0	999	0	No	0	9999
BM-U:TEX	BM-U:SEP	Drought	0.0056	0.0330	400	999	0	No	0	9999
BM-U:TEX	BM-U:SEPJ	Drought	0.0056	0.0570	400	999	0	No	0	9999
BM-U:TEX	BM-U:TEX	Drought	0.0056	0.9000	400	999	-999	No	0	9999
BM-U:TEX	BM-U:TEX	FuelBreak	0.0100	1.0000	0	999	0	No	0	9999
BM-U:TEX	BM-U:TEX	Law-Inforcement	0.0100	1.0000	0	999	0	No	0	9999
BSu-A:AL	BSu-A:AL	Managed-Herbivory	1.0000	0.0500	2	19	1	No	0	9999
BSu-A:AL	BSu-A:AL	ReplacementFire	0.0125	1.0000	0	19	-999	No	0	9999
BSu-A:AL	BSu-U:ES	Excessive-Herbivory	1.0000	0.0010	0	19	0	Yes	0	9999
BSu-B:OP	BSu-A:AL	ReplacementFire	0.0200	1.0000	20	74	0	No	0	9999
BSu-B:OP	BSu-B:OP	Managed-Herbivory	1.0000	0.0500	20	74	1	No	0	9999
BSu-B:OP	BSu-U:ES	Excessive-Herbivory	1.0000	0.0010	20	74	0	Yes	0	9999
BSu-B:OP	BSu-U:SEP	EX-Invasion	0.0050	1.0000	20	74	0	Yes	0	9999
BSu-C:CL	BSu-A:AL	ReplacementFire	0.0200	1.0000	75	999	0	No	0	9999
BSu-C:CL	BSu-B:OP	Drought	0.0060	0.1000	75	999	0	No	0	9999
BSu-C:CL	BSu-C:CL	Drought	0.0056	0.9000	75	999	-999	No	0	9999
BSu-C:CL	BSu-C:CL	Managed-Herbivory	1.0000	0.0500	75	999	1	No	0	9999
BSu-C:CL	BSu-D:OP	Tree-Invasion	0.0050	1.0000	100	999	0	Yes	0	9999
BSu-C:CL	BSu-U:DP	Excessive-Herbivory	1.0000	0.0010	75	999	0	Yes	0	9999
BSu-C:CL	BSu-U:SEP	EX-Invasion	0.0050	1.0000	75	999	0	Yes	0	9999
BSu-D:OP	BSu-A:AL	ReplacementFire	0.0200	1.0000	76	134	0	No	0	9999
BSu-D:OP	BSu-B:OP	Drought	0.0056	0.3000	76	134	0	No	0	9999
BSu-D:OP	BSu-C:CL	Drought	0.0056	0.6000	76	134	0	No	0	9999
BSu-D:OP	BSu-D:OP	Chainsaw-Thinning-BSu	0.0100	1.0000	76	134	-999	No	0	9999
BSu-D:OP	BSu-D:OP	Drought	0.0056	0.1000	76	134	-999	No	0	9999
BSu-D:OP	BSu-D:OP	Excessive-Herbivory	0.0010	0.7500	76	134	3	No	0	9999
BSu-D:OP	BSu-D:OP	Managed-Herbivory	1.0000	0.0500	76	134	1	No	0	9999
BSu-D:OP	BSu-U:DP	Excessive-Herbivory	0.0010	0.2500	86	86	0	Yes	0	9999
BSu-D:OP	BSu-U:SEP	EX-Invasion	0.0050	1.0000	76	134	0	No	0	9999

BSu-E:CL	BSu-A:AL	Chainsaw-Thinning-BSu	0.0100	1.0000	135	999	0	No	0	9999
BSu-E:CL	BSu-A:AL	ReplacementFire	0.0130	1.0000	135	999	0	No	0	9999
BSu-E:CL	BSu-B:OP	Drought	0.0056	0.1000	135	999	0	No	0	9999
BSu-E:CL	BSu-E:CL	Drought	0.0056	0.9000	135	999	5	No	0	9999
BSu-E:CL	BSu-U:TE	Tree-Encroachment	0.0200	1.0000	250	999	0	Yes	0	9999
BSu-U:DP	BSu-U:DP	Chainsaw-Lopping-BSu	0.0100	1.0000	100	999	-999	No	0	9999
BSu-U:DP	BSu-U:DP	Drought	0.0056	0.9000	75	999	-999	No	0	9999
BSu-U:DP	BSu-U:ES	Drought	0.0056	0.1000	75	999	0	No	0	9999
BSu-U:DP	BSu-U:ES	ReplacementFire	0.0200	1.0000	75	999	0	No	0	9999
BSu-U:DP	BSu-U:SES	EX-Invasion	0.0050	1.0000	75	999	0	Yes	0	9999
BSu-U:DP	BSu-U:TE	Tree-Invasion	0.0050	1.0000	134	999	0	No	0	9999
BSu-U:ES	BSu-A:AL	ReplacementFire	0.0200	0.0100	0	999	0	No	0	9999
BSu-U:ES	BSu-B:OP	Natural-Recovery	0.0010	1.0000	12	49	10	Yes	0	9999
BSu-U:ES	BSu-C:CL	Natural-Recovery	0.0010	1.0000	50	999	10	Yes	0	9999
BSu-U:ES	BSu-U:ES	ReplacementFire	0.0200	0.9900	0	999	0	No	0	9999
BSu-U:EX	BSu-U:EX	Herbicide+Seed-BSu	0.0100	0.2000	0	999	0	No	0	9999
BSu-U:EX	BSu-U:EX	ReplacementFire	0.1000	0.1000	0	999	-999	No	0	9999
BSu-U:EX	BSu-U:SD	Herbicide+Seed-BSu	0.0100	0.8000	0	999	0	No	0	9999
BSu-U:SD	BSu-A:AL	Natural-Recovery	0.0010	1.0000	5	19	0	Yes	0	9999
BSu-U:SD	BSu-B:OP	Natural-Recovery	0.0100	1.0000	20	74	0	Yes	0	9999
BSu-U:SD	BSu-C:CL	Natural-Recovery	0.0500	1.0000	75	999	0	Yes	0	9999
BSu-U:SD	BSu-D:OP	Tree-Invasion	0.0050	1.0000	75	999	0	No	0	9999
BSu-U:SD	BSu-U:ES	Excessive-Herbivory	1.0000	0.0010	75	999	0	Yes	0	9999
BSu-U:SD	BSu-U:EX	EX-Invasion	0.0050	1.0000	0	19	0	Yes	0	9999
BSu-U:SD	BSu-U:SD	Drought	0.0056	1.0000	0	999	-999	No	0	9999
BSu-U:SD	BSu-U:SD	Managed-Herbivory	1.0000	0.0500	2	999	1	No	0	9999
BSu-U:SD	BSu-U:SD	ReplacementFire	0.0125	1.0000	0	19	-999	No	0	9999
BSu-U:SD	BSu-U:SD	ReplacementFire	0.0125	1.0000	135	999	-999	No	0	9999
BSu-U:SD	BSu-U:SD	ReplacementFire	0.0200	1.0000	20	134	-999	No	0	9999
BSu-U:SD	BSu-U:SEP	EX-Invasion	0.0010	1.0000	20	134	0	Yes	0	9999
BSu-U:SD	BSu-U:TEX	EX-Invasion	0.0050	1.0000	135	999	0	Yes	0	9999
BSu-U:SEP	BSu-A:AL	Drought	0.0056	0.0100	75	999	0	No	0	9999

BSu-U:SEP	BSu-A:AL	ReplacementFire	0.0400	0.1000	75	999	0	No	0	9999
BSu-U:SEP	BSu-C:CL	Herbicide+Seed-BSu	0.0100	0.9000	75	999	0	No	0	9999
BSu-U:SEP	BSu-C:CL	Natural-Recovery	0.0010	1.0000	75	999	0	Yes	10	9999
BSu-U:SEP	BSu-U:EX	Drought	0.0056	0.0900	75	999	0	No	0	9999
BSu-U:SEP	BSu-U:EX	ReplacementFire	0.0400	0.9000	75	999	0	No	0	9999
BSu-U:SEP	BSu-U:SEP	Chainsaw-Lopping-BSu	0.0100	1.0000	0	999	-999	No	0	9999
BSu-U:SEP	BSu-U:SEP	Drought	0.0056	0.9000	75	999	-999	No	0	9999
BSu-U:SEP	BSu-U:SEP	Herbicide+Seed-BSu	0.0100	0.1000	75	999	0	No	0	9999
BSu-U:SEP	BSu-U:SEP	Managed-Herbivory	1.0000	0.0500	75	99	1	No	0	9999
BSu-U:SEP	BSu-U:SES	Excessive-Herbivory	1.0000	0.0010	75	99	0	Yes	0	9999
BSu-U:SEP	BSu-U:SES	Managed-Herbivory	1.0000	0.0500	100	999	0	No	0	9999
BSu-U:SEP	BSu-U:TEX	Tree-Invasion	0.0050	1.0000	134	999	0	No	0	9999
BSu-U:SES	BSu-U:EX	Drought	0.0056	0.1000	75	999	0	No	0	9999
BSu-U:SES	BSu-U:EX	ReplacementFire	0.0400	1.0000	75	999	0	No	0	9999
BSu-U:SES	BSu-U:SES	Drought	0.0056	0.9000	75	999	-999	No	0	9999
BSu-U:SES	BSu-U:TEX	Tree-Invasion	0.0050	1.0000	134	999	0	Yes	0	9999
BSu-U:TE	BSu-U:ES	Drought	0.0056	0.0500	135	999	0	No	0	9999
BSu-U:TE	BSu-U:ES	ReplacementFire	0.0085	0.4500	135	999	0	No	0	9999
BSu-U:TE	BSu-U:EX	Drought	0.0056	0.0500	135	999	0	No	0	9999
BSu-U:TE	BSu-U:EX	ReplacementFire	0.0085	0.4500	135	999	0	No	0	9999
BSu-U:TE	BSu-U:SES	ReplacementFire	0.0085	0.1000	135	999	0	No	0	9999
BSu-U:TE	BSu-U:TE	Drought	0.0056	0.9000	135	999	-999	No	0	9999
BSu-U:TE	BSu-U:TEX	EX-Invasion	0.0050	1.0000	135	999	0	Yes	0	9999
BSu-U:TEX	BSu-U:EX	Drought	0.0056	0.1000	135	999	0	No	0	9999
BSu-U:TEX	BSu-U:EX	ReplacementFire	0.0085	1.0000	135	999	0	No	0	9999
BSu-U:TEX	BSu-U:EX	Thin+Herbicide+Seed-BSu	0.0100	0.2000	135	999	0	No	0	9999
BSu-U:TEX	BSu-U:SD	Thin+Herbicide+Seed-BSu	0.0100	0.8000	135	999	0	No	0	9999
BSu-U:TEX	BSu-U:TEX	Drought	0.0056	0.9000	0	999	-999	No	0	9999
BT-A:AL	BT-A:AL	FuelBreak	0.0100	1.0000	0	499	0	No	0	9999
BT-A:AL	BT-A:AL	Managed-Herbivory	1.0000	0.0500	2	499	2	No	0	9999
BT-A:AL	BT-A:AL	ReplacementFire-Mojave	0.0001	1.0000	0	499	-999	No	3	9999
BT-A:AL	BT-B:JT	Joshua-Succession	0.5400	1.0000	498	498	0	No	0	9999

BT-A:AL	BT-U:BG	OHV	1.0000	0.0001	0	499	0	No	2	9999
BT-A:AL	BT-U:ES	Excessive-Herbivory	1.0000	0.0010	2	499	0	Yes	0	9999
BT-A:AL	BT-U:EX	EX-Invasion	0.0050	1.0000	0	4	0	Yes	0	9999
BT-A:AL	BT-U:SEP	EX-Invasion	0.0050	0.5000	5	499	0	Yes	0	9999
BT-A:AL	BT-U:SEPJ	EX-Invasion	0.0050	0.5000	5	499	0	Yes	0	9999
BT-B:JT	BT-A:AL	ReplacementFire-Mojave	0.0001	1.0000	500	999	0	No	3	9999
BT-B:JT	BT-B:JT	FuelBreak	0.0100	1.0000	500	999	0	No	0	9999
BT-B:JT	BT-B:JT	Managed-Herbivory	1.0000	0.0500	500	999	2	No	0	9999
BT-B:JT	BT-U:BG	OHV	1.0000	0.0001	500	999	0	No	2	9999
BT-B:JT	BT-U:ES	Excessive-Herbivory	1.0000	0.0010	500	999	0	Yes	0	9999
BT-B:JT	BT-U:EX	Utilities	0.0001	1.0000	500	999	0	No	0	9999
BT-B:JT	BT-U:SEPJ	EX-Invasion	0.0050	1.0000	500	999	0	Yes	0	9999
BT-C:CL	BT-A:AL	ReplacementFire-Mojave	0.0001	1.0000	500	999	0	No	3	9999
BT-C:CL	BT-C:CL	FuelBreak	0.0100	1.0000	0	999	0	No	0	9999
BT-C:CL	BT-C:CL	Managed-Herbivory	1.0000	0.0500	500	999	2	No	0	9999
BT-C:CL	BT-U:BG	OHV	1.0000	0.0001	500	999	0	No	2	9999
BT-C:CL	BT-U:ES	Excessive-Herbivory	1.0000	0.0010	500	999	0	Yes	0	9999
BT-C:CL	BT-U:EX	Utilities	0.0001	1.0000	500	999	0	No	0	9999
BT-C:CL	BT-U:SEP	EX-Invasion	0.0050	1.0000	500	999	0	Yes	0	9999
BT-U:BG	BT-U:BG	OHV	1.0000	0.0001	0	999	-999	No	2	9999
BT-U:BG	BT-U:EX	EX-Invasion	0.0050	1.0000	0	999	0	No	0	9999
BT-U:BG	BT-U:EX	Utilities	0.0001	1.0000	0	999	0	No	0	9999
BT-U:ES	BT-U:BG	OHV	1.0000	0.0001	0	999	0	No	2	9999
BT-U:ES	BT-U:ES	FuelBreak	0.0100	1.0000	0	999	0	No	0	9999
BT-U:ES	BT-U:ES	ReplacementFire-Mojave	0.0010	1.0000	0	999	-999	No	3	9999
BT-U:ES	BT-U:EX	Utilities	0.0001	1.0000	0	999	0	No	0	9999
BT-U:ES	BT-U:SEP	EX-Invasion	0.0050	0.3500	0	999	0	No	0	9999
BT-U:ES	BT-U:SEPJ	EX-Invasion	0.0050	0.6500	0	999	0	No	0	9999
BT-U:EX	BT-U:BG	OHV	1.0000	0.0001	0	999	0	No	2	9999
BT-U:EX	BT-U:ES	Excessive-Herbivory	1.0000	0.0010	0	999	0	No	0	9999
BT-U:EX	BT-U:EX	FuelBreak	0.0100	1.0000	0	999	0	No	0	9999
BT-U:EX	BT-U:EX	Hrbx+Current-Native-Seed-BT	0.0100	0.9900	0	999	-999	No	0	9999

BT-U:EX	BT-U:EX	Hrbx+Introduced-Seed-BT	0.0100	0.9500	0	999	-999	No	0	9999
BT-U:EX	BT-U:EX	Hrbx+New-Seed-BT	0.0100	0.9500	0	999	0	Yes	0	9999
BT-U:EX	BT-U:EX	Managed-Herbivory	1.0000	0.0500	0	999	1	No	0	9999
BT-U:EX	BT-U:EX	Planting+FOD-BT	0.0100	0.1000	0	999	0	No	0	9999
BT-U:EX	BT-U:EX	Planting+Herbicide-BT	0.0100	0.1000	0	999	0	No	0	9999
BT-U:EX	BT-U:EX2B	ReplacementFire-Mojave	0.0500	1.0000	0	999	-999	No	3	9999
BT-U:EX	BT-U:EX2B	Utilities	0.0001	1.0000	0	999	-999	No	0	9999
BT-U:EX	BT-U:PL	Planting+FOD-BT	0.0100	0.6950	0	999	0	No	0	9999
BT-U:EX	BT-U:PL	Planting+Herbicide-BT	0.0100	0.4500	0	999	0	No	0	9999
BT-U:EX	BT-U:SD	Hrbx+Current-Native-Seed-BT	0.0100	0.0100	0	999	0	Yes	0	9999
BT-U:EX	BT-U:SD	Hrbx+New-Seed-BT	0.0100	0.0500	0	999	0	Yes	0	9999
BT-U:EX	BT-U:SDI	Hrbx+Introduced-Seed-BT	0.0100	0.0500	0	999	0	Yes	0	9999
BT-U:EX	BT-U:SEP	Non-Joshua-Succession	0.1000	0.5400	20	999	0	Yes	0	9999
BT-U:EX	BT-U:SEP	Planting+FOD-BT	0.0100	0.1050	0	999	0	No	0	9999
BT-U:EX	BT-U:SEP	Planting+Herbicide-BT	0.0100	0.1800	0	999	0	No	0	9999
BT-U:EX	BT-U:SEPJ	Joshua-Succession	0.1000	0.4600	20	999	0	Yes	0	9999
BT-U:EX	BT-U:SEPJ	Planting+FOD-BT	0.0100	0.1200	0	999	0	No	0	9999
BT-U:EX	BT-U:SEPJ	Planting+Herbicide-BT	0.0100	0.2700	0	999	0	No	0	9999
BT-U:EX2B	BT-U:BG	OHV	1.0000	0.0001	0	999	0	No	2	9999
BT-U:EX2B	BT-U:EX2B	FuelBreak	0.0100	1.0000	0	999	0	No	0	9999
BT-U:EX2B	BT-U:EX2B	Hrbx+New-Seed-BT	0.0100	0.9500	0	999	0	No	0	9999
BT-U:EX2B	BT-U:EX2B	Planting+FOD-BT	0.0100	0.1000	0	999	0	No	0	9999
BT-U:EX2B	BT-U:EX2B	Planting+Herbicide-BT	0.0100	0.1000	0	999	0	No	0	9999
BT-U:EX2B	BT-U:EX2B	ReplacementFire-Mojave	0.1000	1.0000	0	999	-999	No	3	9999
BT-U:EX2B	BT-U:EX2B	Utilities	0.0001	1.0000	0	999	-999	No	0	9999
BT-U:EX2B	BT-U:PL	Planting+FOD-BT	0.0100	0.6950	0	999	0	No	0	9999
BT-U:EX2B	BT-U:PL	Planting+Herbicide-BT	0.0100	0.4500	0	999	0	No	0	9999
BT-U:EX2B	BT-U:SD	Hrbx+New-Seed-BT	0.0100	0.0500	0	999	0	No	0	9999
BT-U:EX2B	BT-U:SEP	Planting+FOD-BT	0.0100	0.1050	0	999	0	No	0	9999
BT-U:EX2B	BT-U:SEP	Planting+Herbicide-BT	0.0100	0.1800	0	999	0	No	0	9999
BT-U:EX2B	BT-U:SEPJ	Managed-Herbivory	1.0000	0.0500	0	999	0	No	0	9999
BT-U:EX2B	BT-U:SEPJ	Planting+FOD-BT	0.0100	0.1200	0	999	0	No	0	9999

BT-U:EX2B	BT-U:SEPJ	Planting+Herbicide-BT	0.0100	0.2700	0	999	0	No	0	9999
BT-U:PL	BT-A:AL	Natural-Recovery	0.1000	1.0000	20	999	0	No	10	9999
BT-U:PL	BT-U:BG	OHV	1.0000	0.0001	0	999	0	No	2	9999
BT-U:PL	BT-U:ES	Excessive-Herbivory	1.0000	0.0010	0	999	0	Yes	10	9999
BT-U:PL	BT-U:EX	Drought	0.0056	0.0100	0	999	0	No	0	9999
BT-U:PL	BT-U:EX	Managed-Herbivory	1.0000	0.0500	2	999	-3	No	10	9999
BT-U:PL	BT-U:EX	Utilities	0.0001	1.0000	0	999	0	No	0	9999
BT-U:PL	BT-U:PL	Drought	0.0056	0.9900	0	999	-999	No	0	9999
BT-U:PL	BT-U:PL	Livestock-Closure	0.0100	1.0000	1	2	0	No	0	9999
BT-U:PL	BT-U:SEP	Seedbank-Emergence	0.2000	0.4600	0	999	0	No	2	9999
BT-U:PL	BT-U:SEPJ	Seedbank-Emergence	0.2000	0.5400	0	999	0	No	2	9999
BT-U:SD	BT-A:AL	Natural-Recovery	0.1000	1.0000	20	999	0	No	10	9999
BT-U:SD	BT-U:BG	OHV	1.0000	0.0001	0	999	0	No	2	9999
BT-U:SD	BT-U:ES	Excessive-Herbivory	1.0000	0.0010	0	999	0	Yes	10	9999
BT-U:SD	BT-U:EX	EX-Invasion	0.0050	1.0000	0	19	0	Yes	0	9999
BT-U:SD	BT-U:EX	Seedbank-Emergence	0.2000	1.0000	0	999	0	No	2	9999
BT-U:SD	BT-U:EX	Utilities	0.0001	1.0000	0	999	0	No	0	9999
BT-U:SD	BT-U:SD	Drought	0.0056	0.1000	0	999	-999	No	0	9999
BT-U:SD	BT-U:SD	Drought	0.0056	0.9000	0	999	0	No	0	9999
BT-U:SD	BT-U:SD	FuelBreak	0.0100	1.0000	0	999	0	No	0	9999
BT-U:SD	BT-U:SD	Livestock-Closure	0.0100	1.0000	1	2	0	No	0	9999
BT-U:SD	BT-U:SD	Managed-Herbivory	1.0000	0.0500	2	999	-1	No	10	9999
BT-U:SD	BT-U:SD	ReplacementFire-Mojave	0.0010	1.0000	0	19	-999	No	3	9999
BT-U:SD	BT-U:SEP	EX-Invasion	0.0050	1.0000	20	999	0	Yes	0	9999
BT-U:SDI	BT-A:AL	Natural-Recovery	0.0020	1.0000	0	999	0	No	10	9999
BT-U:SDI	BT-U:BG	OHV	1.0000	0.0001	0	999	0	No	2	9999
BT-U:SDI	BT-U:ES	Excessive-Herbivory	1.0000	0.0010	0	999	0	Yes	10	9999
BT-U:SDI	BT-U:EX	EX-Invasion	0.0010	1.0000	0	19	0	Yes	0	9999
BT-U:SDI	BT-U:EX	Seedbank-Emergence	0.2000	1.0000	0	999	0	No	2	9999
BT-U:SDI	BT-U:EX	Utilities	0.0001	1.0000	0	999	0	No	0	9999
BT-U:SDI	BT-U:SDI	Drought	0.0056	0.1000	0	999	-999	No	0	9999
BT-U:SDI	BT-U:SDI	Drought	0.0056	0.9000	0	999	0	No	0	9999

BT-U:SDI	BT-U:SDI	FuelBreak	0.0100	1.0000	0	999	0	No	0	9999
BT-U:SDI	BT-U:SDI	Livestock-Closure	0.0100	1.0000	1	2	0	No	0	9999
BT-U:SDI	BT-U:SDI	Managed-Herbivory	1.0000	0.0500	2	999	-1	No	10	9999
BT-U:SDI	BT-U:SDI	ReplacementFire-Mojave	0.0001	1.0000	0	999	-999	No	3	9999
BT-U:SDI	BT-U:SEP	EX-Invasion	0.0010	1.0000	20	999	0	No	0	9999
BT-U:SEP	BT-C:CL	Fingers-of-Death-BT	0.0100	0.7500	5	499	0	Yes	0	9999
BT-U:SEP	BT-U:BG	OHV	1.0000	0.0001	5	999	0	No	2	9999
BT-U:SEP	BT-U:ES	Excessive-Herbivory	1.0000	0.0010	5	999	0	Yes	10	9999
BT-U:SEP	BT-U:EX	Drought	0.0056	0.0100	5	999	0	No	0	9999
BT-U:SEP	BT-U:EX	ReplacementFire-Mojave	0.0050	1.0000	500	999	0	No	3	9999
BT-U:SEP	BT-U:EX	Utilities	0.0001	1.0000	500	999	0	No	0	9999
BT-U:SEP	BT-U:EX2B	ReplacementFire-Mojave	0.0050	1.0000	5	499	0	No	3	9999
BT-U:SEP	BT-U:EX2B	Utilities	0.0001	1.0000	0	499	0	No	0	9999
BT-U:SEP	BT-U:PL	Herbicide-BT	0.0100	0.5000	5	15	0	Yes	1	9999
BT-U:SEP	BT-U:SEP	Drought	0.0056	0.9900	5	999	-999	No	0	9999
BT-U:SEP	BT-U:SEP	Fingers-of-Death-BT	0.0100	0.2500	5	999	0	No	0	9999
BT-U:SEP	BT-U:SEP	FuelBreak	0.0100	1.0000	5	999	0	No	0	9999
BT-U:SEP	BT-U:SEP	Herbicide-BT	0.0100	0.5000	5	15	0	Yes	1	9999
BT-U:SEP	BT-U:SEP	Managed-Herbivory	1.0000	0.0500	5	999	2	No	10	9999
BT-U:SEPJ	BT-B:JT	Fingers-of-Death-BT	0.0100	0.7500	5	999	0	Yes	0	9999
BT-U:SEPJ	BT-U:BG	OHV	1.0000	0.0001	5	999	0	No	2	9999
BT-U:SEPJ	BT-U:ES	Excessive-Herbivory	1.0000	0.0010	5	999	0	Yes	10	9999
BT-U:SEPJ	BT-U:EX	Drought	0.0056	0.0100	5	999	0	No	0	9999
BT-U:SEPJ	BT-U:EX	ReplacementFire-Mojave	0.0050	1.0000	500	999	0	No	3	9999
BT-U:SEPJ	BT-U:EX	Utilities	0.0000	1.0000	500	999	0	No	0	9999
BT-U:SEPJ	BT-U:EX2B	ReplacementFire-Mojave	0.0050	1.0000	5	499	0	No	3	9999
BT-U:SEPJ	BT-U:EX2B	Utilities	0.0001	1.0000	0	499	0	No	0	9999
BT-U:SEPJ	BT-U:PL	Herbicide-BT	0.0100	0.5000	5	15	0	Yes	1	9999
BT-U:SEPJ	BT-U:SEPJ	Drought	0.0056	0.9900	5	999	-999	No	0	9999
BT-U:SEPJ	BT-U:SEPJ	Fingers-of-Death-BT	0.0100	0.2500	5	999	0	No	0	9999
BT-U:SEPJ	BT-U:SEPJ	FuelBreak	0.0100	1.0000	5	999	0	No	0	9999
BT-U:SEPJ	BT-U:SEPJ	Herbicide-BT	0.0100	0.5000	5	15	0	Yes	1	9999

BT-U:SEPJ	BT-U:SEPJ	Managed-Herbivory	1.0000	0.0500	5	999	2	No	10	9999
CB-A:OP	CB-A:OP	FuelBreak	0.0100	1.0000	0	19	0	No	0	9999
CB-A:OP	CB-A:OP	Managed-Herbivory	1.0000	0.0500	2	19	1	No	0	9999
CB-A:OP	CB-A:OP	ReplacementFire-Mojave	0.0005	1.0000	0	19	-999	No	3	9999
CB-A:OP	CB-B:JT	Joshua-Succession	0.6500	1.0000	18	18	0	No	0	9999
CB-A:OP	CB-U:BG	OHV	1.0000	0.0001	0	19	0	No	2	9999
CB-A:OP	CB-U:ES	Excessive-Herbivory	1.0000	0.0010	0	19	0	Yes	0	9999
CB-A:OP	CB-U:EX	EX-Invasion	0.0050	1.0000	0	19	0	No	0	9999
CB-A:OP	CB-U:EX	Utilities	0.0050	1.0000	0	19	0	No	0	9999
CB-B:JT	CB-A:OP	Drought	0.0056	1.0000	20	399	0	No	0	9999
CB-B:JT	CB-A:OP	ReplacementFire-Mojave	0.0005	1.0000	20	399	0	No	3	9999
CB-B:JT	CB-B:JT	FuelBreak	0.0100	1.0000	20	399	0	No	0	9999
CB-B:JT	CB-B:JT	Managed-Herbivory	1.0000	0.0500	20	399	3	No	0	9999
CB-B:JT	CB-U:BG	OHV	1.0000	0.0001	20	399	0	No	2	9999
CB-B:JT	CB-U:ES	Excessive-Herbivory	1.0000	0.0010	20	399	0	Yes	0	9999
CB-B:JT	CB-U:EX	Utilities	0.0001	1.0000	20	399	0	No	0	9999
CB-B:JT	CB-U:SEPJ	EX-Invasion	0.0050	1.0000	20	399	0	Yes	0	9999
CB-C:OP	CB-A:OP	Drought	0.0056	1.0000	20	399	0	No	0	9999
CB-C:OP	CB-A:OP	ReplacementFire-Mojave	0.0005	1.0000	20	999	0	No	3	9999
CB-C:OP	CB-C:OP	FuelBreak	0.0100	1.0000	20	999	0	No	0	9999
CB-C:OP	CB-C:OP	Managed-Herbivory	1.0000	0.0500	20	999	3	No	0	9999
CB-C:OP	CB-U:BG	OHV	1.0000	0.0001	20	999	0	No	2	9999
CB-C:OP	CB-U:ES	Excessive-Herbivory	1.0000	0.0010	20	999	0	Yes	0	9999
CB-C:OP	CB-U:EX	Utilities	0.0001	1.0000	20	999	0	No	0	9999
CB-C:OP	CB-U:SEP	EX-Invasion	0.0050	1.0000	20	999	0	Yes	0	9999
CB-D:JT	CB-A:OP	Drought	0.0056	1.0000	200	999	0	No	0	9999
CB-D:JT	CB-A:OP	ReplacementFire-Mojave	0.0010	1.0000	200	999	0	No	3	9999
CB-D:JT	CB-D:JT	FuelBreak	0.0100	1.0000	200	999	0	No	0	9999
CB-D:JT	CB-D:JT	Managed-Herbivory	1.0000	0.0500	200	999	3	No	0	9999
CB-D:JT	CB-U:BG	OHV	1.0000	0.0001	200	999	0	No	2	9999
CB-D:JT	CB-U:ES	Excessive-Herbivory	1.0000	0.0010	200	999	0	Yes	0	9999
CB-D:JT	CB-U:EX	Utilities	0.0001	1.0000	200	999	0	No	0	9999

CB-D:JT	CB-U:SEPJ	EX-Invasion	0.0050	1.0000	200	999	0	Yes	0	9999
CB-U:BG	CB-U:BG	OHV	1.0000	0.0001	0	999	-999	No	2	9999
CB-U:BG	CB-U:BG	Utilities	0.0001	1.0000	0	999	0	No	0	9999
CB-U:BG	CB-U:EX	EX-Invasion	0.0050	1.0000	0	999	0	No	0	9999
CB-U:ES	CB-U:BG	OHV	1.0000	0.0001	0	999	0	No	2	9999
CB-U:ES	CB-U:ES	Drought	0.0056	1.0000	0	999	-999	No	0	9999
CB-U:ES	CB-U:ES	FuelBreak	0.0100	1.0000	0	999	0	No	0	9999
CB-U:ES	CB-U:ES	ReplacementFire-Mojave	0.0015	1.0000	0	999	-999	No	3	9999
CB-U:ES	CB-U:EX	EX-Invasion	0.0050	1.0000	0	19	0	Yes	0	9999
CB-U:ES	CB-U:EX	Utilities	0.0001	1.0000	0	999	0	No	0	9999
CB-U:ES	CB-U:SEP	EX-Invasion	0.0050	0.3500	20	999	0	Yes	0	9999
CB-U:ES	CB-U:SEPJ	EX-Invasion	0.0050	0.6500	20	999	0	Yes	0	9999
CB-U:EX	CB-U:BG	OHV	1.0000	0.0001	0	999	0	No	2	9999
CB-U:EX	CB-U:ES	Excessive-Herbivory	1.0000	0.0010	0	999	0	No	0	9999
CB-U:EX	CB-U:EX	FuelBreak	0.0100	1.0000	0	999	0	No	0	9999
CB-U:EX	CB-U:EX	Hrbx+New-Seed-CB	0.0100	0.9500	0	999	0	Yes	0	9999
CB-U:EX	CB-U:EX	Managed-Herbivory	1.0000	0.0500	0	999	1	No	0	9999
CB-U:EX	CB-U:EX	Planting+FOD-CB	0.0100	0.1000	0	999	0	No	0	9999
CB-U:EX	CB-U:EX	Planting+Herbicide-CB	0.0100	0.1000	0	999	0	No	0	9999
CB-U:EX	CB-U:EX2B	ReplacementFire-Mojave	0.0500	1.0000	0	999	-999	No	3	9999
CB-U:EX	CB-U:EX2B	Utilities	0.0001	1.0000	0	999	-999	No	0	9999
CB-U:EX	CB-U:PL	Planting+FOD-CB	0.0100	0.6950	0	999	0	No	0	9999
CB-U:EX	CB-U:PL	Planting+Herbicide-CB	0.0100	0.4500	0	999	0	No	0	9999
CB-U:EX	CB-U:SD	Hrbx+New-Seed-CB	0.0100	0.0500	0	999	0	No	0	9999
CB-U:EX	CB-U:SEP	Non-Joshua-Succession	0.1000	0.3500	20	999	0	Yes	0	9999
CB-U:EX	CB-U:SEP	Planting+FOD-CB	0.0100	0.0750	0	999	0	No	0	9999
CB-U:EX	CB-U:SEP	Planting+Herbicide-CB	0.0100	0.1600	0	999	0	No	0	9999
CB-U:EX	CB-U:SEPJ	Joshua-Succession	0.1000	0.6500	20	999	0	Yes	0	9999
CB-U:EX	CB-U:SEPJ	Planting+FOD-CB	0.0100	0.1500	0	999	0	No	0	9999
CB-U:EX	CB-U:SEPJ	Planting+Herbicide-CB	0.0100	0.2900	0	999	0	No	0	9999
CB-U:EX2B	CB-U:BG	OHV	1.0000	0.0001	0	999	0	No	2	9999
CB-U:EX2B	CB-U:EX2B	FuelBreak	0.0100	1.0000	0	999	0	No	0	9999

CB-U:EX2B	CB-U:EX2B	Hrbx+New-Seed-CB	0.0100	0.9500	0	999	0	No	0	9999
CB-U:EX2B	CB-U:EX2B	Managed-Herbivory	1.0000	0.0500	0	999	0	No	0	9999
CB-U:EX2B	CB-U:EX2B	Planting+FOD-CB	0.0100	0.1000	0	999	0	No	0	9999
CB-U:EX2B	CB-U:EX2B	Planting+Herbicide-CB	0.0100	0.1000	0	999	0	No	0	9999
CB-U:EX2B	CB-U:EX2B	ReplacementFire-Mojave	0.1000	1.0000	0	999	-999	No	3	9999
CB-U:EX2B	CB-U:EX2B	Utilities	0.0001	1.0000	0	999	-999	No	0	9999
CB-U:EX2B	CB-U:PL	Planting+FOD-CB	0.0100	0.6950	0	999	0	No	0	9999
CB-U:EX2B	CB-U:PL	Planting+Herbicide-CB	0.0100	0.4500	0	999	0	No	0	9999
CB-U:EX2B	CB-U:SD	Hrbx+New-Seed-CB	0.0100	0.0500	0	999	0	No	0	9999
CB-U:EX2B	CB-U:SEP	Planting+FOD-CB	0.0100	0.0750	0	999	0	No	0	9999
CB-U:EX2B	CB-U:SEP	Planting+Herbicide-CB	0.0100	0.1600	0	999	0	No	0	9999
CB-U:EX2B	CB-U:SEPJ	Planting+FOD-CB	0.0100	0.1400	0	999	0	No	0	9999
CB-U:EX2B	CB-U:SEPJ	Planting+Herbicide-CB	0.0100	0.2900	0	999	0	No	0	9999
CB-U:PL	CB-A:OP	Natural-Recovery	0.1000	1.0000	20	999	0	No	10	9999
CB-U:PL	CB-U:BG	OHV	1.0000	0.0001	0	999	0	No	2	9999
CB-U:PL	CB-U:ES	Excessive-Herbivory	1.0000	0.0010	0	999	0	Yes	10	9999
CB-U:PL	CB-U:EX	Drought	0.0056	0.0100	0	999	0	No	0	9999
CB-U:PL	CB-U:EX	Managed-Herbivory	1.0000	0.0500	2	999	-3	No	10	9999
CB-U:PL	CB-U:EX	Utilities	0.0001	1.0000	0	999	0	No	0	9999
CB-U:PL	CB-U:PL	Drought	0.0056	0.9900	0	999	-999	No	0	9999
CB-U:PL	CB-U:PL	Livestock-Closure	0.0100	1.0000	1	2	0	No	0	9999
CB-U:PL	CB-U:SEP	Seedbank-Emergence	0.2000	0.3500	0	999	0	No	2	9999
CB-U:PL	CB-U:SEPJ	Seedbank-Emergence	0.2000	0.6500	0	999	0	No	2	9999
CB-U:SD	CB-A:OP	Natural-Recovery	0.1000	1.0000	20	999	0	No	10	9999
CB-U:SD	CB-U:BG	OHV	1.0000	0.0001	0	999	0	No	2	9999
CB-U:SD	CB-U:ES	Excessive-Herbivory	1.0000	0.0010	0	999	0	Yes	10	9999
CB-U:SD	CB-U:EX	EX-Invasion	0.0050	1.0000	0	19	0	Yes	0	9999
CB-U:SD	CB-U:EX	Managed-Herbivory	1.0000	0.0500	2	999	0	No	10	9999
CB-U:SD	CB-U:EX	Seedbank-Emergence	0.2000	1.0000	0	19	0	No	2	9999
CB-U:SD	CB-U:EX	Utilities	0.0001	1.0000	0	999	0	No	0	9999
CB-U:SD	CB-U:SD	FuelBreak	0.0100	1.0000	0	999	0	No	0	9999
CB-U:SD	CB-U:SD	Livestock-Closure	0.0100	1.0000	1	2	0	No	0	9999

CB-U:SD	CB-U:SD	ReplacementFire-Mojave	0.0015	1.0000	0	999	-999	No	3	9999
CB-U:SD	CB-U:SEP	EX-Invasion	0.0050	0.3500	20	999	0	Yes	0	9999
CB-U:SD	CB-U:SEPJ	EX-Invasion	0.0050	0.6500	20	999	0	Yes	0	9999
CB-U:SEP	CB-C:OP	Fingers-of-Death-CB	0.0100	0.7500	20	999	0	Yes	0	9999
CB-U:SEP	CB-U:BG	OHV	1.0000	0.0001	20	999	0	No	2	9999
CB-U:SEP	CB-U:ES	Excessive-Herbivory	1.0000	0.0010	21	999	0	Yes	10	9999
CB-U:SEP	CB-U:EX	Drought	0.0056	1.0000	21	999	0	No	0	9999
CB-U:SEP	CB-U:EX	ReplacementFire-Mojave	0.0015	1.0000	21	999	0	No	3	9999
CB-U:SEP	CB-U:EX	Utilities	0.0001	1.0000	21	999	0	No	0	9999
CB-U:SEP	CB-U:PL	Herbicide-CB	0.0100	0.0500	20	999	0	No	1	9999
CB-U:SEP	CB-U:SEP	Fingers-of-Death-CB	0.0100	0.2500	20	999	0	No	0	9999
CB-U:SEP	CB-U:SEP	FuelBreak	0.0100	1.0000	21	999	0	No	0	9999
CB-U:SEP	CB-U:SEP	Herbicide-CB	0.0100	0.0500	20	999	0	No	1	9999
CB-U:SEP	CB-U:SEP	Managed-Herbivory	1.0000	0.0500	21	999	3	No	10	9999
CB-U:SEPJ	CB-B:JT	Fingers-of-Death-CB	0.0100	0.7500	20	199	0	Yes	0	9999
CB-U:SEPJ	CB-D:JT	Fingers-of-Death-CB	0.0100	0.7500	200	999	0	Yes	0	9999
CB-U:SEPJ	CB-U:BG	OHV	1.0000	0.0001	20	999	0	No	2	9999
CB-U:SEPJ	CB-U:ES	Excessive-Herbivory	1.0000	0.0010	20	999	0	Yes	10	9999
CB-U:SEPJ	CB-U:EX	Drought	0.0056	1.0000	20	999	0	No	0	9999
CB-U:SEPJ	CB-U:EX	ReplacementFire-Mojave	0.0015	1.0000	20	999	0	No	3	9999
CB-U:SEPJ	CB-U:EX	Utilities	0.0001	1.0000	20	999	0	No	0	9999
CB-U:SEPJ	CB-U:PL	Herbicide-CB	0.0100	0.5000	20	999	0	No	1	9999
CB-U:SEPJ	CB-U:SEPJ	Fingers-of-Death-CB	0.0100	0.2500	20	199	0	No	0	9999
CB-U:SEPJ	CB-U:SEPJ	Fingers-of-Death-CB	0.0100	0.2500	200	999	0	No	0	9999
CB-U:SEPJ	CB-U:SEPJ	FuelBreak	0.0100	1.0000	20	999	0	No	0	9999
CB-U:SEPJ	CB-U:SEPJ	Herbicide-CB	0.0100	0.5000	20	999	0	No	1	9999
CB-U:SEPJ	CB-U:SEPJ	Managed-Herbivory	1.0000	0.0500	20	999	3	No	10	9999
GRL-A:AL	GRL-A:AL	Drought	0.0056	1.0000	0	19	-10	No	0	9999
GRL-A:AL	GRL-A:AL	FuelBreak	0.0100	1.0000	0	19	0	No	0	9999
GRL-A:AL	GRL-A:AL	Managed-Herbivory	1.0000	0.0500	2	19	1	No	0	9999
GRL-A:AL	GRL-A:AL	ReplacementFire-Mojave	0.0015	1.0000	0	19	-999	No	3	9999
GRL-A:AL	GRL-U:DP	Excessive-Herbivory	1.0000	0.0010	0	19	0	Yes	0	9999

GRL-A:AL	GRL-U:EX	EX-Invasion	0.0050	1.0000	0	19	0	Yes	0	9999
GRL-B:OP	GRL-A:AL	Drought	0.0056	0.1000	20	999	0	No	0	9999
GRL-B:OP	GRL-A:AL	ReplacementFire-Mojave	0.0015	1.0000	20	999	0	No	3	9999
GRL-B:OP	GRL-B:OP	Drought	0.0056	0.9000	20	999	-999	No	0	9999
GRL-B:OP	GRL-B:OP	FuelBreak	0.0100	1.0000	20	999	0	No	0	9999
GRL-B:OP	GRL-B:OP	Managed-Herbivory	1.0000	0.0500	20	999	1	No	0	9999
GRL-B:OP	GRL-U:DP	Excessive-Herbivory	1.0000	0.0010	20	999	0	Yes	0	9999
GRL-B:OP	GRL-U:SES	EX-Invasion	0.0050	1.0000	20	999	0	Yes	0	9999
GRL-U:DP	GRL-U:DP	Drought	0.0056	1.0000	0	999	-10	No	0	9999
GRL-U:DP	GRL-U:DP	Excessive-Herbivory	1.0000	0.0010	0	999	3	No	0	9999
GRL-U:DP	GRL-U:DP	FuelBreak	0.0100	1.0000	0	999	0	No	0	9999
GRL-U:DP	GRL-U:DP	Managed-Herbivory	1.0000	0.0500	2	999	1	No	0	9999
GRL-U:DP	GRL-U:DP	ReplacementFire-Mojave	0.0015	1.0000	0	999	-999	No	3	9999
GRL-U:DP	GRL-U:EEX	EX-Invasion	0.0050	1.0000	0	999	0	Yes	0	9999
GRL-U:EEX	GRL-U:EEX	Drought	0.0056	1.0000	0	999	-10	No	0	9999
GRL-U:EEX	GRL-U:EEX	FuelBreak	0.0100	1.0000	0	999	0	No	0	9999
GRL-U:EEX	GRL-U:EEX	Managed-Herbivory	1.0000	0.0500	2	999	1	No	0	9999
GRL-U:EEX	GRL-U:EEX	ReplacementFire-Mojave	0.0015	1.0000	0	999	-999	No	3	9999
GRL-U:EEX	GRL-U:SES	Excessive-Herbivory	1.0000	0.0010	0	999	0	Yes	0	9999
GRL-U:EX	GRL-U:EEX	Excessive-Herbivory	1.0000	0.0010	0	999	0	Yes	0	9999
GRL-U:EX	GRL-U:EX	Drought	0.0056	1.0000	0	19	-10	No	0	9999
GRL-U:EX	GRL-U:EX	FuelBreak	0.0100	1.0000	0	19	0	No	0	9999
GRL-U:EX	GRL-U:EX	Managed-Herbivory	1.0000	0.0500	2	19	1	No	0	9999
GRL-U:EX	GRL-U:EX	ReplacementFire-Mojave	0.0500	1.0000	0	19	-999	No	3	9999
GRL-U:SES	GRL-B:OP	Herbicide-GRL	0.0100	0.6000	0	999	0	No	0	9999
GRL-U:SES	GRL-U:SES	Drought	0.0056	1.0000	20	999	-10	No	0	9999
GRL-U:SES	GRL-U:SES	Excessive-Herbivory	1.0000	0.0010	20	999	3	No	0	9999
GRL-U:SES	GRL-U:SES	FuelBreak	0.0100	1.0000	20	999	0	No	0	9999
GRL-U:SES	GRL-U:SES	Herbicide-GRL	0.0100	0.4000	0	999	0	No	0	9999
GRL-U:SES	GRL-U:SES	Managed-Herbivory	1.0000	0.0500	20	999	1	No	0	9999
GRL-U:SES	GRL-U:SES	ReplacementFire-Mojave	0.0100	1.0000	20	999	-999	No	3	9999
MM-A:AL	MM-A:AL	NativeHerbivory	0.0200	1.0000	0	9	-999	No	0	9999

MM-A:AL	MM-A:AL	ReplacementFire	0.0020	1.0000	0	9	-999	No	0	9999
MM-A:AL	MM-A:AL	Wet-Year	0.1500	1.0000	0	999	-1	No	0	9999
MM-B:OP	MM-A:AL	ReplacementFire	0.0070	1.0000	10	29	0	No	0	9999
MM-C:CL	MM-A:AL	ReplacementFire	0.0070	1.0000	60	999	0	No	0	9999
MM-C:CL	MM-U:TEX	EX-Invasion	0.0001	1.0000	60	999	0	Yes	0	9999
MM-U:EX	MM-U:EX	ReplacementFire	0.0500	1.0000	0	999	-999	No	0	9999
MM-U:TEX	MM-U:EX	ReplacementFire	0.0070	1.0000	150	999	0	No	0	9999
MR-A:AL	MR-A:AL	Flooding-7yr	0.1300	1.0000	0	4	-5	No	0	9999
MR-A:AL	MR-A:AL	Managed-Herbivory	1.0000	0.0500	2	4	-5	No	0	9999
MR-A:AL	MR-A:AL	ReplacementFire	0.0010	1.0000	0	999	-999	No	0	9999
MR-A:AL	MR-A:AL	Weed-Inventory-MR	0.2500	1.0000	0	4	0	No	0	9999
MR-A:AL	MR-U:EF	Exotic-Riparian-Invasion-MR	0.0100	1.0000	0	4	0	No	5	9999
MR-A:AL	MR-U:SFE	Excessive-Herbivory	0.0010	1.0000	0	4	0	No	0	9999
MR-B:OP	MR-A:AL	Flooding-20yr	0.0500	1.0000	5	19	0	No	0	9999
MR-B:OP	MR-A:AL	ReplacementFire	0.0010	1.0000	5	19	0	No	0	9999
MR-B:OP	MR-B:OP	Managed-Herbivory	1.0000	0.0500	5	19	-1	No	0	9999
MR-B:OP	MR-B:OP	Weed-Inventory-MR	0.0100	1.0000	5	19	0	No	0	9999
MR-B:OP	MR-U:EF	Exotic-Riparian-Invasion-MR	0.0100	1.0000	5	19	0	No	5	9999
MR-B:OP	MR-U:SFE	Excessive-Herbivory	0.0010	1.0000	5	19	0	No	0	9999
MR-C:CL	MR-A:AL	Flooding-100yr	0.0100	1.0000	20	999	0	No	0	9999
MR-C:CL	MR-A:AL	ReplacementFire	0.0010	1.0000	20	999	0	No	0	9999
MR-C:CL	MR-C:CL	Managed-Herbivory	1.0000	0.0500	20	999	1	No	0	9999
MR-C:CL	MR-C:CL	Weed-Inventory-MR	0.0100	1.0000	20	999	0	No	0	9999
MR-C:CL	MR-U:EF	Exotic-Riparian-Invasion-MR	0.0100	1.0000	20	999	0	No	5	9999
MR-C:CL	MR-U:SFE	Excessive-Herbivory	0.0010	1.0000	20	999	0	No	0	9999
MR-U:DE	MR-A:AL	Flooding-100yr	0.0100	0.0100	0	999	0	No	0	9999
MR-U:DE	MR-A:AL	Floodplain-Recovery	0.0010	1.0000	0	999	0	No	10	9999
MR-U:DE	MR-A:AL	Floodplain-Restoration	0.0100	1.0000	0	999	0	No	0	9999
MR-U:DE	MR-U:DE	Flooding-100yr	0.0100	0.9900	0	999	-999	No	0	9999
MR-U:DE	MR-U:DE	ReplacementFire	0.0200	1.0000	0	999	-999	No	0	9999
MR-U:EF	MR-B:OP	Exotic-Control-MR	0.6000	1.0000	0	999	0	No	0	20
MR-U:EF	MR-U:EF	Exotic-Control-MR	0.4000	1.0000	0	999	0	No	0	20

MR-U:EF	MR-U:EF	ReplacementFire	0.0001	1.0000	0	999	-999	No	0	9999
MR-U:SFE	MR-A:AL	Flooding-100yr	0.0100	0.0100	0	999	0	No	0	9999
MR-U:SFE	MR-U:DE	Excessive-Herbivory	1.0000	0.0010	0	999	0	No	0	9999
MR-U:SFE	MR-U:EF	Exotic-Riparian-Invasion-MR	0.3300	1.0000	0	999	0	No	5	9999
MR-U:SFE	MR-U:SFE	Flooding-100yr	0.0100	0.9900	20	999	-999	No	0	9999
MR-U:SFE	MR-U:SFE	ReplacementFire	0.0010	1.0000	0	999	-999	No	0	9999
MR-U:SFE	MR-U:SFE	Weed-Inventory-MR	0.0100	1.0000	0	999	0	No	0	9999
MSD-A:AL	MSD-A:AL	Managed-Herbivory	1.0000	0.0500	2	4	1	No	0	9999
MSD-A:AL	MSD-A:AL	Very-Wet-Year	0.0100	1.0000	0	4	-4	No	0	9999
MSD-B:OP	MSD-A:AL	Managed-Herbivory	1.0000	0.0500	5	999	0	No	0	9999
MSD-B:OP	MSD-A:AL	ReplacementFire	0.0001	1.0000	5	999	0	No	0	9999
MSD-B:OP	MSD-A:AL	Very-Wet-Year	0.0180	1.0000	5	999	0	No	0	9999
MSD-B:OP	MSD-C:OP	Drought	0.0056	1.0000	5	999	0	No	0	9999
MSD-B:OP	MSD-U:SES	EX-Invasion	0.0050	1.0000	5	999	0	Yes	0	9999
MSD-C:OP	MSD-A:AL	Very-Wet-Year	0.0500	1.0000	10	59	0	No	0	9999
MSD-C:OP	MSD-C:OP	Drought	0.0056	1.0000	10	59	-999	No	0	9999
MSD-C:OP	MSD-U:SES	EX-Invasion	0.0050	1.0000	10	59	0	Yes	0	9999
MSD-U:EX	MSD-U:EX	ReplacementFire	0.1000	1.0000	0	999	-999	No	0	9999
MSD-U:SD	MSD-A:AL	Natural-Recovery	0.0010	1.0000	0	4	0	Yes	0	9999
MSD-U:SD	MSD-B:OP	Natural-Recovery	0.0050	1.0000	5	999	0	Yes	0	9999
MSD-U:SD	MSD-U:EX	EX-Invasion	0.0050	1.0000	0	4	0	No	0	9999
MSD-U:SD	MSD-U:SD	Drought	0.0056	1.0000	0	4	-999	No	0	9999
MSD-U:SD	MSD-U:SD	Drought	0.0056	1.0000	5	999	-1	No	0	9999
MSD-U:SD	MSD-U:SD	Managed-Herbivory	1.0000	0.0500	3	999	1	No	0	9999
MSD-U:SD	MSD-U:SD	Very-Wet-Year	0.0180	1.0000	0	999	-999	No	0	9999
MSD-U:SD	MSD-U:SES	EX-Invasion	0.0050	1.0000	5	999	0	No	0	9999
MSD-U:SES	MSD-U:EX	ReplacementFire	0.0250	1.0000	5	999	0	No	0	9999
MSD-U:SES	MSD-U:EX	Very-Wet-Year	0.0500	1.0000	5	999	0	No	0	9999
MSh-A:AL	MSh-A:AL	Managed-Herbivory	1.0000	0.0500	2	5	-999	No	0	9999
MSh-A:AL	MSh-A:AL	NativeHerbivory	1.0000	0.0200	0	999	-1	No	0	9999
MSh-A:AL	MSh-A:AL	Wet-Year	0.1500	1.0000	0	5	-1	No	0	9999
MSh-A:AL	MSh-U:ES	Excessive-Herbivory	0.0010	1.0000	0	5	0	Yes	0	9999

MSh-A:AL	MSh-U:EX	EX-Invasion	0.0025	1.0000	0	5	0	Yes	0	9999
MSh-B:CL	MSh-A:AL	ReplacementFire	0.0140	1.0000	6	19	0	No	0	9999
MSh-B:CL	MSh-B:CL	Managed-Herbivory	1.0000	0.0500	6	19	1	No	0	9999
MSh-B:CL	MSh-U:ES	Excessive-Herbivory	0.0010	1.0000	5	19	0	Yes	0	9999
MSh-B:CL	MSh-U:SEP	EX-Invasion	0.0025	1.0000	20	49	0	Yes	0	9999
MSh-C:CL	MSh-A:AL	ReplacementFire	0.0140	1.0000	20	999	0	No	0	9999
MSh-C:CL	MSh-C:CL	Managed-Herbivory	1.0000	0.0500	20	999	1	No	0	9999
MSh-C:CL	MSh-D:OP	Tree-Invasion	0.0010	1.0000	50	99	0	No	0	9999
MSh-C:CL	MSh-D:OP	Tree-Invasion	0.0050	1.0000	99	999	0	No	0	9999
MSh-C:CL	MSh-U:ES	Excessive-Herbivory	1.0000	0.0010	20	999	0	Yes	0	9999
MSh-C:CL	MSh-U:SEP	EX-Invasion	0.0025	1.0000	20	999	0	Yes	0	9999
MSh-D:OP	MSh-A:AL	Chainsaw-Thinning-MSh	0.0100	0.2000	50	999	0	No	0	9999
MSh-D:OP	MSh-A:AL	ReplacementFire	0.0067	1.0000	50	999	0	No	0	9999
MSh-D:OP	MSh-B:CL	Chainsaw-Thinning-MSh	0.0100	0.8000	50	999	0	No	0	9999
MSh-D:OP	MSh-C:CL	Drought	0.0056	0.1000	50	999	0	No	0	9999
MSh-D:OP	MSh-D:OP	Drought	0.0056	0.9000	50	999	-999	No	0	9999
MSh-D:OP	MSh-U:TE	Tree-Encroachment	0.0067	1.0000	150	999	0	Yes	0	9999
MSh-D:OP	MSh-U:TEX	EX-Invasion	0.0025	1.0000	50	999	0	Yes	0	9999
MSh-U:ES	MSh-U:ES	Managed-Herbivory	1.0000	0.0500	0	999	0	No	0	9999
MSh-U:ES	MSh-U:ES	ReplacementFire	0.0140	1.0000	0	999	-999	No	0	9999
MSh-U:EX	MSh-A:AL	Herbicide+SeedRose-MSh	0.0100	0.5000	0	999	0	No	0	9999
MSh-U:EX	MSh-U:EX	Herbicide+SeedRose-MSh	0.0100	0.5000	0	999	0	No	0	9999
MSh-U:EX	MSh-U:EX	Managed-Herbivory	1.0000	0.0500	2	999	0	No	0	9999
MSh-U:EX	MSh-U:EX	ReplacementFire	0.1000	1.0000	0	999	-999	No	0	9999
MSh-U:EX	MSh-U:EX	Wet-Year	0.1500	1.0000	0	5	-5	No	0	9999
MSh-U:SEP	MSh-B:CL	Hrbx+SeedGrass-MSh	0.0100	0.7000	0	999	0	Yes	0	9999
MSh-U:SEP	MSh-U:EX	ReplacementFire	0.0250	1.0000	6	300	0	No	0	9999
MSh-U:SEP	MSh-U:SEP	Excessive-Herbivory	1.0000	0.0010	6	999	3	No	0	9999
MSh-U:SEP	MSh-U:SEP	Hrbx+SeedGrass-MSh	0.0100	0.3000	6	999	0	No	0	9999
MSh-U:SEP	MSh-U:SEP	Managed-Herbivory	1.0000	0.0500	6	999	1	No	0	9999
MSh-U:SEP	MSh-U:TEX	Tree-Invasion	0.0010	1.0000	50	99	0	No	0	9999
MSh-U:SEP	MSh-U:TEX	Tree-Invasion	0.0050	1.0000	100	999	0	No	0	9999

MSh-U:TE	MSh-A:AL	Thin+Hrbx+SeedRose-MSh	0.0100	0.9000	150	999	0	No	0	9999
MSh-U:TE	MSh-U:ES	Drought	0.0056	0.1000	150	999	0	No	0	9999
MSh-U:TE	MSh-U:ES	ReplacementFire	0.0067	1.0000	150	999	0	No	0	9999
MSh-U:TE	MSh-U:ES	Thin+Hrbx+SeedRose-MSh	0.0100	0.1000	150	999	0	No	0	9999
MSh-U:TE	MSh-U:TE	Drought	0.0056	0.9000	150	999	-999	No	0	9999
MSh-U:TE	MSh-U:TEX	EX-Invasion	0.0050	1.0000	150	999	0	Yes	0	9999
MSh-U:TEX	MSh-A:AL	Thin+Hrbx+SeedRose-MSh	0.0100	0.8000	50	999	0	No	0	9999
MSh-U:TEX	MSh-U:EX	Drought	0.0056	0.1000	50	999	0	No	0	9999
MSh-U:TEX	MSh-U:EX	ReplacementFire	0.0067	1.0000	150	999	0	No	0	9999
MSh-U:TEX	MSh-U:EX	Thin+Hrbx+SeedRose-MSh	0.0100	0.2000	50	999	0	No	0	9999
MSh-U:TEX	MSh-U:SEP	ReplacementFire	0.0067	1.0000	50	149	0	No	0	9999
MSh-U:TEX	MSh-U:TEX	Drought	0.0056	0.9000	50	999	-999	No	0	9999
PJ-A:AL	PJ-A:AL	ReplacementFire	0.0030	1.0000	0	9	-999	No	0	9999
PJ-B:OP	PJ-A:AL	ReplacementFire	0.0050	1.0000	10	29	0	No	0	9999
PJ-C:OP	PJ-A:AL	ReplacementFire	0.0050	1.0000	30	99	0	No	0	9999
PJ-C:OP	PJ-B:OP	Drought	0.0056	0.1000	30	99	0	No	0	9999
PJ-C:OP	PJ-C:OP	Drought	0.0056	0.9000	30	99	-999	No	0	9999
PJ-C:OP	PJ-U:TEX	EX-Invasion	0.0001	1.0000	50	99	0	Yes	0	9999
PJ-D:OP	PJ-A:AL	ReplacementFire	0.0010	1.0000	100	999	0	No	0	9999
PJ-D:OP	PJ-B:OP	Drought	0.0067	0.0300	100	999	0	No	0	9999
PJ-D:OP	PJ-C:OP	Drought	0.0057	0.0700	100	999	0	No	0	9999
PJ-D:OP	PJ-D:OP	Drought	0.0056	0.9000	100	999	-999	No	0	9999
PJ-D:OP	PJ-U:TEX	EX-Invasion	0.0010	1.0000	100	999	0	Yes	0	9999
PJ-U:EX	PJ-A:AL	Hrbx+Seed-PJ	0.0100	0.6000	0	999	0	No	0	9999
PJ-U:EX	PJ-U:EX	Hrbx+Seed-PJ	0.0100	0.4000	0	999	0	No	0	9999
PJ-U:EX	PJ-U:EX	ReplacementFire	0.1000	1.0000	0	999	-999	No	0	9999
PJ-U:TEX	PJ-C:OP	Herbicide-PJ	0.0100	0.6000	30	99	0	Yes	0	9999
PJ-U:TEX	PJ-D:OP	Herbicide-PJ	0.0100	0.6000	100	999	0	Yes	0	9999
PJ-U:TEX	PJ-U:EX	Drought	0.0056	0.1000	100	999	0	No	0	9999
PJ-U:TEX	PJ-U:EX	ReplacementFire	0.0050	1.0000	100	999	0	No	0	9999
PJ-U:TEX	PJ-U:TEX	Drought	0.0056	0.9000	100	999	-999	No	0	9999
PJ-U:TEX	PJ-U:TEX	Herbicide-PJ	0.0100	0.4000	0	999	0	No	0	9999

SWA-A:AL	SWA-A:AL	Flash-Flood	0.1400	1.0000	0	4	-999	No	0	9999
SWA-A:AL	SWA-A:AL	FuelBreak	0.0100	1.0000	0	4	0	No	0	9999
SWA-A:AL	SWA-A:AL	Livestock-Closure	0.0100	1.0000	1	4	0	No	0	9999
SWA-A:AL	SWA-A:AL	Managed-Herbivory	1.0000	0.0500	2	4	1	No	10	9999
SWA-A:AL	SWA-A:AL	ReplacementFire-Mojave	0.0001	1.0000	0	4	-999	No	3	9999
SWA-A:AL	SWA-A:AL	Utilities	0.0001	0.3000	0	4	-999	No	0	9999
SWA-A:AL	SWA-A:AL	Weed-Inventory-WAS	0.0100	1.0000	0	4	0	No	0	9999
SWA-A:AL	SWA-U:BG	OHV	1.0000	0.0001	0	4	0	No	2	9999
SWA-A:AL	SWA-U:ES	Excessive-Herbivory	1.0000	0.0005	0	4	0	No	10	9999
SWA-A:AL	SWA-U:ET	Exotic-Tree-Invasion	0.0001	1.0000	0	4	0	Yes	5	9999
SWA-A:AL	SWA-U:SEP	EX-Invasion	0.0050	1.0000	0	4	0	Yes	0	9999
SWA-A:AL	SWA-U:SES	Utilities	0.0001	0.7000	0	4	0	No	0	9999
SWA-B:CL	SWA-A:AL	Flash-Flood	0.0500	1.0000	5	19	0	No	0	9999
SWA-B:CL	SWA-A:AL	Utilities	0.0001	0.3000	5	19	0	No	0	9999
SWA-B:CL	SWA-B:CL	FuelBreak	0.0100	1.0000	5	19	0	No	0	9999
SWA-B:CL	SWA-B:CL	Livestock-Closure	0.0100	1.0000	1	19	0	No	0	9999
SWA-B:CL	SWA-B:CL	Managed-Herbivory	1.0000	0.0500	5	19	1	No	10	9999
SWA-B:CL	SWA-B:CL	ReplacementFire-Mojave	0.0010	1.0000	5	19	0	No	3	9999
SWA-B:CL	SWA-B:CL	Weed-Inventory-WAS	0.0100	1.0000	5	19	0	No	0	9999
SWA-B:CL	SWA-U:BG	OHV	1.0000	0.0001	5	19	0	No	2	9999
SWA-B:CL	SWA-U:ES	Excessive-Herbivory	1.0000	0.0005	5	19	0	No	10	9999
SWA-B:CL	SWA-U:ET	Exotic-Tree-Invasion	0.0001	1.0000	5	19	0	Yes	5	9999
SWA-B:CL	SWA-U:SEP	EX-Invasion	0.0050	1.0000	5	19	0	Yes	0	9999
SWA-B:CL	SWA-U:SES	Utilities	0.0001	0.7000	5	999	0	No	0	9999
SWA-C:CL	SWA-A:AL	Flash-Flood	0.0100	1.0000	20	999	0	No	0	9999
SWA-C:CL	SWA-A:AL	Utilities	0.0001	0.3000	20	999	0	No	0	9999
SWA-C:CL	SWA-B:CL	ReplacementFire-Mojave	0.0010	1.0000	20	999	0	No	3	9999
SWA-C:CL	SWA-C:CL	FuelBreak	0.0100	1.0000	20	999	0	No	0	9999
SWA-C:CL	SWA-C:CL	Livestock-Closure	0.0100	1.0000	20	999	0	No	0	9999
SWA-C:CL	SWA-C:CL	Managed-Herbivory	1.0000	0.0500	20	999	1	No	10	9999
SWA-C:CL	SWA-C:CL	Weed-Inventory-WAS	0.0100	1.0000	20	999	0	No	0	9999
SWA-C:CL	SWA-U:BG	OHV	1.0000	0.0001	20	999	0	No	2	9999

SWA-C:CL	SWA-U:ES	Excessive-Herbivory	1.0000	0.0005	20	999	0	Yes	10	9999
SWA-C:CL	SWA-U:ET	Exotic-Tree-Invasion	0.0001	1.0000	20	999	0	No	5	9999
SWA-C:CL	SWA-U:SEP	EX-Invasion	0.0050	1.0000	20	999	0	Yes	0	9999
SWA-C:CL	SWA-U:SES	Utilities	0.0001	0.7000	20	999	0	No	0	9999
SWA-U:BG	SWA-A:AL	Utilities	0.0001	0.3000	0	999	0	No	0	9999
SWA-U:BG	SWA-U:BG	OHV	1.0000	0.0001	0	999	-999	No	2	9999
SWA-U:BG	SWA-U:BG	Weed-Inventory-WAS	0.0100	1.0000	0	999	0	No	0	9999
SWA-U:BG	SWA-U:ET	Exotic-Tree-Invasion	0.0050	1.0000	0	999	0	Yes	5	9999
SWA-U:BG	SWA-U:SES	EX-Invasion	0.0050	1.0000	0	999	0	Yes	0	9999
SWA-U:BG	SWA-U:SES	Utilities	0.0001	0.7000	0	999	0	No	0	9999
SWA-U:ES	SWA-A:AL	Utilities	0.0001	0.3000	0	999	0	No	0	9999
SWA-U:ES	SWA-U:BG	OHV	1.0000	0.0001	0	999	0	No	2	9999
SWA-U:ES	SWA-U:ES	Excessive-Herbivory	1.0000	0.0010	0	999	3	No	10	9999
SWA-U:ES	SWA-U:ES	FuelBreak	0.0100	1.0000	0	999	0	No	0	9999
SWA-U:ES	SWA-U:ES	Livestock-Closure	0.0100	1.0000	1	999	0	No	0	9999
SWA-U:ES	SWA-U:ES	Managed-Herbivory	1.0000	0.0500	0	999	1	No	10	9999
SWA-U:ES	SWA-U:ES	ReplacementFire-Mojave	0.0015	1.0000	0	999	0	No	3	9999
SWA-U:ES	SWA-U:ES	Weed-Inventory-WAS	0.0100	1.0000	0	999	0	No	0	9999
SWA-U:ES	SWA-U:ET	Exotic-Tree-Invasion	0.0050	1.0000	0	999	0	Yes	5	9999
SWA-U:ES	SWA-U:SES	EX-Invasion	0.0050	1.0000	0	999	0	Yes	0	9999
SWA-U:ES	SWA-U:SES	Utilities	0.0001	0.7000	0	999	0	No	0	9999
SWA-U:ET	SWA-A:AL	Beetle-Mortality	0.2500	1.0000	0	4	0	Yes	0	9999
SWA-U:ET	SWA-A:AL	Exotic-Control-WAS	0.0100	0.9000	0	4	0	No	0	50
SWA-U:ET	SWA-A:AL	Flash-Flood	0.0100	0.0100	0	999	0	No	0	9999
SWA-U:ET	SWA-A:AL	Utilities	0.0001	0.3000	0	999	0	No	0	9999
SWA-U:ET	SWA-B:CL	Beetle-Mortality	0.2500	1.0000	5	19	0	Yes	0	9999
SWA-U:ET	SWA-B:CL	Exotic-Control-WAS	0.0100	0.9000	5	19	0	No	0	50
SWA-U:ET	SWA-C:CL	Beetle-Mortality	0.2500	1.0000	20	999	0	Yes	0	9999
SWA-U:ET	SWA-C:CL	Exotic-Control-WAS	0.0100	0.9000	20	999	0	No	0	50
SWA-U:ET	SWA-U:BG	OHV	1.0000	0.0001	0	999	0	No	2	9999
SWA-U:ET	SWA-U:ET	Excessive-Herbivory	1.0000	0.0010	0	999	3	No	10	9999
SWA-U:ET	SWA-U:ET	Exotic-Control-WAS	0.0100	0.1000	0	999	0	No	0	50

SWA-U:ET	SWA-U:ET	Flash-Flood	0.0100	0.9900	0	999	-999	No	0	9999
SWA-U:ET	SWA-U:ET	FuelBreak	0.0100	1.0000	0	999	0	No	0	9999
SWA-U:ET	SWA-U:ET	Livestock-Closure	0.0100	1.0000	1	999	0	No	0	9999
SWA-U:ET	SWA-U:ET	Managed-Herbivory	1.0000	0.0500	0	999	1	No	10	9999
SWA-U:ET	SWA-U:ET	ReplacementFire-Mojave	0.0200	1.0000	0	999	-999	No	3	9999
SWA-U:ET	SWA-U:ET	Utilities	0.0001	0.7000	0	999	-999	No	0	9999
SWA-U:SEP	SWA-A:AL	Fingers-of-Death-SWA	0.0100	0.7500	0	4	0	Yes	0	9999
SWA-U:SEP	SWA-A:AL	Flash-Flood	0.0100	0.0100	0	999	0	No	0	9999
SWA-U:SEP	SWA-A:AL	Herbicide-WAS	0.0100	0.5000	0	4	0	Yes	0	9999
SWA-U:SEP	SWA-A:AL	Utilities	0.0001	0.3000	0	999	0	No	0	9999
SWA-U:SEP	SWA-B:CL	Fingers-of-Death-SWA	0.0100	0.7500	5	19	0	Yes	0	9999
SWA-U:SEP	SWA-B:CL	Herbicide-WAS	0.0100	0.5000	5	19	0	Yes	0	9999
SWA-U:SEP	SWA-C:CL	Fingers-of-Death-SWA	0.0100	0.7500	20	999	0	Yes	0	9999
SWA-U:SEP	SWA-C:CL	Herbicide-WAS	0.0100	0.5000	20	999	0	Yes	0	9999
SWA-U:SEP	SWA-U:BG	OHV	1.0000	0.0001	0	999	0	No	2	9999
SWA-U:SEP	SWA-U:ES	Excessive-Herbivory	1.0000	0.0010	0	999	0	No	10	9999
SWA-U:SEP	SWA-U:ET	Exotic-Tree-Invasion	0.0001	1.0000	0	999	0	Yes	5	9999
SWA-U:SEP	SWA-U:SEP	Fingers-of-Death-SWA	0.0100	0.2500	0	999	0	No	0	9999
SWA-U:SEP	SWA-U:SEP	Flash-Flood	0.0100	0.9900	0	999	0	No	0	9999
SWA-U:SEP	SWA-U:SEP	FuelBreak	0.0100	1.0000	0	999	0	No	0	9999
SWA-U:SEP	SWA-U:SEP	Herbicide-WAS	0.0100	0.5000	0	999	0	No	0	9999
SWA-U:SEP	SWA-U:SEP	Livestock-Closure	0.0100	1.0000	1	999	0	No	0	9999
SWA-U:SEP	SWA-U:SEP	ReplacementFire-Mojave	0.0200	1.0000	0	999	-999	No	3	9999
SWA-U:SEP	SWA-U:SEP	Weed-Inventory-WAS	0.0100	1.0000	0	999	0	Yes	0	9999
SWA-U:SEP	SWA-U:SES	Managed-Herbivory	1.0000	0.0500	20	999	0	No	10	9999
SWA-U:SEP	SWA-U:SES	Managed-Herbivory	1.0000	0.0500	0	19	1	No	10	9999
SWA-U:SEP	SWA-U:SES	Utilities	0.0001	0.7000	0	999	0	No	0	9999
SWA-U:SES	SWA-A:AL	Fingers-of-Death-SWA	0.0100	0.7500	0	4	0	Yes	0	9999
SWA-U:SES	SWA-A:AL	Flash-Flood	0.0100	0.0100	0	999	0	No	0	9999
SWA-U:SES	SWA-A:AL	Herbicide-WAS	0.0100	0.5000	0	4	0	Yes	0	9999
SWA-U:SES	SWA-A:AL	Utilities	0.0001	0.3000	0	999	0	No	0	9999
SWA-U:SES	SWA-B:CL	Herbicide-WAS	0.0100	0.5000	5	19	0	Yes	0	9999

SWA-U:SES	SWA-C:CL	Fingers-of-Death-SWA	0.0100	0.7500	5	19	0	Yes	0	9999
SWA-U:SES	SWA-C:CL	Fingers-of-Death-SWA	0.0100	0.7500	20	999	0	No	0	9999
SWA-U:SES	SWA-C:CL	Herbicide-WAS	0.0100	0.5000	20	999	0	Yes	0	9999
SWA-U:SES	SWA-U:BG	OHV	1.0000	0.0001	0	999	0	No	2	9999
SWA-U:SES	SWA-U:ES	Excessive-Herbivory	1.0000	0.0010	0	999	0	Yes	10	9999
SWA-U:SES	SWA-U:ET	Exotic-Tree-Invasion	0.0001	1.0000	0	999	0	Yes	5	9999
SWA-U:SES	SWA-U:SES	Fingers-of-Death-SWA	0.0100	0.2500	0	999	0	No	0	9999
SWA-U:SES	SWA-U:SES	Flash-Flood	0.0100	0.9900	0	999	0	No	0	9999
SWA-U:SES	SWA-U:SES	FuelBreak	0.0100	1.0000	0	999	0	No	0	9999
SWA-U:SES	SWA-U:SES	Herbicide-WAS	0.0100	0.5000	0	999	0	No	0	9999
SWA-U:SES	SWA-U:SES	Livestock-Closure	0.0100	1.0000	1	999	0	No	0	9999
SWA-U:SES	SWA-U:SES	Managed-Herbivory	1.0000	0.0500	2	999	1	No	10	9999
SWA-U:SES	SWA-U:SES	ReplacementFire-Mojave	0.0500	1.0000	0	999	-999	No	3	9999
SWA-U:SES	SWA-U:SES	Utilities	0.0001	0.7000	0	999	0	No	0	9999
SWA-U:SES	SWA-U:SES	Weed-Inventory-WAS	0.0100	1.0000	0	999	0	No	0	9999
WDR-A:AL	WDR-A:AL	Flooding-7yr	0.1300	1.0000	0	4	-999	No	0	9999
WDR-A:AL	WDR-A:AL	Managed-Herbivory	1.0000	0.0500	2	4	-999	No	0	9999
WDR-A:AL	WDR-A:AL	Weed-Inventory	0.0100	1.0000	0	4	0	No	0	9999
WDR-A:AL	WDR-U:DE	Excessive-Herbivory	1.0000	0.0010	0	4	0	Yes	0	9999
WDR-A:AL	WDR-U:EF	Exotic-Forb-Invasion	0.0100	1.0000	0	4	0	No	5	9999
WDR-A:AL	WDR-U:ET	Exotic-Tree-Invasion	0.0100	1.0000	0	4	0	No	5	9999
WDR-A:AL	WDR-U:TEX	EX-Invasion	0.0050	1.0000	0	4	0	Yes	0	9999
WDR-B:CL	WDR-A:AL	Flooding-20yr	0.0500	1.0000	5	19	0	No	0	9999
WDR-B:CL	WDR-B:CL	Managed-Herbivory	1.0000	0.0500	5	19	-1	No	0	9999
WDR-B:CL	WDR-B:CL	Weed-Inventory	0.0100	1.0000	5	19	0	No	0	9999
WDR-B:CL	WDR-U:DE	Excessive-Herbivory	1.0000	0.0010	5	19	0	Yes	0	9999
WDR-B:CL	WDR-U:EF	Exotic-Forb-Invasion	0.0075	1.0000	5	19	0	No	5	9999
WDR-B:CL	WDR-U:ET	Exotic-Tree-Invasion	0.0075	1.0000	5	19	0	No	5	9999
WDR-B:CL	WDR-U:TEX	EX-Invasion	0.0050	1.0000	0	19	0	Yes	0	9999
WDR-C:OP	WDR-A:AL	Flooding-20yr	0.0500	1.0000	1	89	0	No	0	9999
WDR-C:OP	WDR-C:OP	Managed-Herbivory	1.0000	0.0500	1	89	-1	No	0	9999
WDR-C:OP	WDR-U:DE	Excessive-Herbivory	1.0000	0.0010	1	89	0	Yes	0	9999

WDR-C:OP	WDR-U:EF	Exotic-Forb-Invasion	0.0075	1.0000	5	89	0	Yes	5	9999
WDR-C:OP	WDR-U:EF	Exotic-Forb-Invasion	0.0100	1.0000	1	4	0	Yes	5	9999
WDR-C:OP	WDR-U:ET	Exotic-Tree-Invasion	0.0075	1.0000	5	89	0	Yes	5	9999
WDR-C:OP	WDR-U:ET	Exotic-Tree-Invasion	0.0100	1.0000	1	4	0	Yes	5	9999
WDR-C:OP	WDR-U:TEX	EX-Invasion	0.0050	1.0000	1	89	0	Yes	0	9999
WDR-D:CL	WDR-A:AL	Flooding-100yr	0.0100	1.0000	20	89	0	No	0	9999
WDR-D:CL	WDR-C:OP	ReplacementFire	0.0013	1.0000	20	89	0	No	0	9999
WDR-D:CL	WDR-D:CL	Managed-Herbivory	1.0000	0.0500	20	89	1	No	0	9999
WDR-D:CL	WDR-D:CL	Weed-Inventory	0.0100	1.0000	20	89	0	No	0	9999
WDR-D:CL	WDR-U:DE	Excessive-Herbivory	1.0000	0.0010	20	89	0	Yes	0	9999
WDR-D:CL	WDR-U:EF	Exotic-Forb-Invasion	0.0050	1.0000	20	89	0	No	5	9999
WDR-D:CL	WDR-U:ET	Exotic-Tree-Invasion	0.0050	1.0000	20	89	0	No	5	9999
WDR-D:CL	WDR-U:TEX	EX-Invasion	0.0050	1.0000	20	89	0	Yes	0	9999
WDR-E:CL	WDR-A:AL	Flooding-100yr	0.0020	1.0000	90	999	0	No	0	9999
WDR-E:CL	WDR-C:OP	Flooding-100yr	0.0100	1.0000	90	999	0	No	0	9999
WDR-E:CL	WDR-C:OP	ReplacementFire	0.0040	1.0000	90	999	0	No	0	9999
WDR-E:CL	WDR-C:OP	Senescence	0.0200	1.0000	450	999	0	No	0	9999
WDR-E:CL	WDR-E:CL	Managed-Herbivory	1.0000	0.0500	90	999	0	No	0	9999
WDR-E:CL	WDR-E:CL	Weed-Inventory	0.0100	1.0000	90	999	0	No	0	9999
WDR-E:CL	WDR-U:DE	Excessive-Herbivory	1.0000	0.0010	90	999	0	Yes	0	9999
WDR-E:CL	WDR-U:EF	Exotic-Forb-Invasion	0.0050	1.0000	90	999	0	No	5	9999
WDR-E:CL	WDR-U:ET	Exotic-Tree-Invasion	0.0050	1.0000	90	999	0	Yes	5	9999
WDR-E:CL	WDR-U:TEX	EX-Invasion	0.0050	1.0000	90	999	0	Yes	0	9999
WDR-U:DE	WDR-A:AL	Flooding-100yr	0.0100	0.0100	1	999	0	No	0	9999
WDR-U:DE	WDR-A:AL	Floodplain-Restoration	0.0100	0.9000	1	999	0	No	0	9999
WDR-U:DE	WDR-U:DE	Flooding-100yr	0.0100	0.9900	1	999	-999	No	0	9999
WDR-U:DE	WDR-U:DE	Floodplain-Restoration	0.0100	0.1000	1	999	0	No	0	9999
WDR-U:DE	WDR-U:DE	Weed-Inventory	0.0100	1.0000	0	999	0	No	0	9999
WDR-U:DE	WDR-U:DEF	Exotic-Forb-Invasion	0.0075	1.0000	1	999	0	Yes	5	9999
WDR-U:DE	WDR-U:DET	Exotic-Tree-Invasion	0.0075	1.0000	1	999	0	Yes	5	9999
WDR-U:DEF	WDR-U:DE	Exotic-Forb-Control	0.0100	0.6000	1	999	0	No	0	20
WDR-U:DEF	WDR-U:DEF	Exotic-Forb-Control	0.0100	0.4000	1	999	0	No	0	20

WDR-U:DEF	WDR-U:DEF	Flooding-100yr	0.0100	0.9900	1	999	-999	No	0	9999
WDR-U:DEF	WDR-U:EF	Flooding-100yr	0.0100	0.0100	1	999	0	No	0	9999
WDR-U:DET	WDR-U:DE	Beetle-Mortality	0.2500	0.2500	0	999	0	Yes	0	9999
WDR-U:DET	WDR-U:DE	Exotic-Tree-Control	0.0100	0.8000	1	999	0	No	0	20
WDR-U:DET	WDR-U:DEF	Beetle-Mortality	0.2500	0.7500	0	999	0	Yes	0	9999
WDR-U:DET	WDR-U:DEF	Exotic-Tree-Control	0.0100	0.1000	1	999	0	No	0	20
WDR-U:DET	WDR-U:DET	Exotic-Tree-Control	0.0100	0.1000	1	999	0	No	0	20
WDR-U:DET	WDR-U:DET	Flooding-100yr	0.0100	0.9900	1	999	-999	No	0	9999
WDR-U:DET	WDR-U:DET	ReplacementFire	0.0500	1.0000	5	999	-999	No	0	9999
WDR-U:DET	WDR-U:ET	Flooding-100yr	0.0100	0.0100	1	999	0	No	0	9999
WDR-U:DEX	WDR-A:AL	Flooding-100yr	0.0100	0.0100	0	999	0	No	0	9999
WDR-U:DEX	WDR-U:DEF	Exotic-Forb-Invasion	0.0050	1.0000	0	999	0	Yes	5	9999
WDR-U:DEX	WDR-U:DET	Exotic-Tree-Invasion	0.0050	1.0000	0	999	0	Yes	5	9999
WDR-U:DEX	WDR-U:DEX	Excessive-Herbivory	1.0000	0.0010	0	999	3	No	0	9999
WDR-U:DEX	WDR-U:DEX	Flooding-100yr	0.0100	0.9900	0	999	-999	No	0	9999
WDR-U:DEX	WDR-U:DEX	Managed-Herbivory	1.0000	0.0500	0	999	1	No	0	9999
WDR-U:DEX	WDR-U:DEX	ReplacementFire	0.0500	1.0000	0	999	-999	No	0	9999
WDR-U:DEX	WDR-U:DEX	Weed-Inventory	0.0100	1.0000	0	999	0	No	0	9999
WDR-U:EF	WDR-A:AL	Exotic-Forb-Control	0.0100	0.6000	0	999	0	No	0	20
WDR-U:EF	WDR-U:EF	Exotic-Forb-Control	0.0100	0.4000	0	999	0	No	0	20
WDR-U:EF	WDR-U:EF	Flooding-100yr	0.0100	1.0000	0	999	-999	No	0	9999
WDR-U:ET	WDR-A:AL	Beetle-Mortality	0.2500	1.0000	0	4	0	Yes	0	9999
WDR-U:ET	WDR-A:AL	Exotic-Tree-Control	0.0100	0.8000	0	999	0	No	0	20
WDR-U:ET	WDR-A:AL	Flooding-100yr	0.0100	0.0100	0	999	0	No	0	9999
WDR-U:ET	WDR-B:CL	Beetle-Mortality	0.2500	1.0000	5	19	0	Yes	0	9999
WDR-U:ET	WDR-C:OP	Beetle-Mortality	0.2500	1.0000	0	89	0	Yes	0	9999
WDR-U:ET	WDR-D:CL	Beetle-Mortality	0.2500	1.0000	20	89	0	Yes	0	9999
WDR-U:ET	WDR-E:CL	Beetle-Mortality	0.2500	1.0000	90	999	0	Yes	0	9999
WDR-U:ET	WDR-U:DET	Entrenchment	0.0001	1.0000	0	999	0	Yes	10	9999
WDR-U:ET	WDR-U:EF	Exotic-Tree-Control	0.0100	0.1000	0	999	0	No	0	20
WDR-U:ET	WDR-U:ET	Exotic-Tree-Control	0.0100	0.1000	0	999	0	No	0	20
WDR-U:ET	WDR-U:ET	Flooding-100yr	0.0100	0.9900	0	999	-999	No	0	9999

WDR-U:ET	WDR-U:ET	ReplacementFire	0.0500	1.0000	0	999	-999	No	0	9999
WDR-U:EX	WDR-A:AL	Flooding-100yr	0.0100	0.0100	0	500	-999	No	0	9999
WDR-U:EX	WDR-U:DE	Excessive-Herbivory	1.0000	0.0010	0	500	0	Yes	0	9999
WDR-U:EX	WDR-U:EF	Exotic-Forb-Invasion	0.0075	1.0000	0	500	0	Yes	5	9999
WDR-U:EX	WDR-U:ET	Exotic-Tree-Invasion	0.0075	1.0000	0	500	0	Yes	5	9999
WDR-U:EX	WDR-U:EX	Flooding-100yr	0.0100	0.9900	0	500	-999	No	0	9999
WDR-U:EX	WDR-U:EX	Managed-Herbivory	1.0000	0.0500	0	500	-999	No	0	9999
WDR-U:EX	WDR-U:EX	ReplacementFire	0.0500	1.0000	0	500	-999	No	0	9999
WDR-U:TEX	WDR-A:AL	Flooding-100yr	0.0100	0.0100	20	999	0	No	0	9999
WDR-U:TEX	WDR-A:AL	Hrbx-EX-WDR	0.0100	0.5000	0	5	0	No	0	9999
WDR-U:TEX	WDR-B:CL	Hrbx-EX-WDR	0.0100	0.5000	5	19	0	No	0	9999
WDR-U:TEX	WDR-D:CL	Hrbx-EX-WDR	0.0100	0.5000	20	89	0	No	0	9999
WDR-U:TEX	WDR-E:CL	Hrbx-EX-WDR	0.0100	0.5000	90	999	0	No	0	9999
WDR-U:TEX	WDR-U:DE	Excessive-Herbivory	1.0000	0.0010	5	19	0	Yes	0	9999
WDR-U:TEX	WDR-U:EF	Exotic-Forb-Invasion	0.0075	1.0000	5	999	0	Yes	5	9999
WDR-U:TEX	WDR-U:ET	Exotic-Tree-Invasion	0.0075	1.0000	5	999	0	No	5	9999
WDR-U:TEX	WDR-U:EX	Flooding-100yr	0.0100	0.9900	20	999	0	No	0	9999
WDR-U:TEX	WDR-U:EX	Flooding-20yr	0.0500	1.0000	5	19	0	No	0	9999
WDR-U:TEX	WDR-U:EX	ReplacementFire	0.0015	1.0000	5	999	0	No	0	9999
WDR-U:TEX	WDR-U:TEX	Hrbx-EX-WDR	0.0100	0.5000	0	999	0	No	0	9999
WDR-U:TEX	WDR-U:TEX	Managed-Herbivory	1.0000	0.0500	5	999	1	No	0	9999
WDR-U:TEX	WDR-U:TEX	Weed-Inventory	0.0100	1.0000	5	999	0	No	0	9999

Appendix 4. Temporal multipliers.

Fire Activity

Federal data were available for fire activity between 1980 and 2009 for both NCAs. Data from the Federal Fire Occurrence Website were downloaded for the whole western U.S.A. and time series of fire size from 1980 to 2009 were extracted from "clipped" NCAs with ARC GIS 10. Five time series of fire activity were used as replicates for all scenarios. The Red Cliffs and Beaver Dam Wash time series were each 29 years long; time series for 50 years were created by re-sampling the original fire series data (the original 29-year data sequence was not used in any replicate) using the yearly total area burned divided by the temporal average of total area burned. All fire activity was assumed replacement fire.

The 10 time series (i.e., 5 replicates × 2 landscapes) were uploaded into PATH. For strictly management reasons, we used the same variability time series for two different parameters: Mojave replacement fire and (upper elevation) replacement fire. Each yearly value in a replicate temporal multiplier multiplied the average wildfire rate in the models for a specific time step. All replicates had several peaks of fire activity with the fourth replicate being the least active (Figure 4-1).

Upland Variability

Remaining upland temporal multipliers were climate related: drought-induced mortality, annual grass invasion rate, and tree invasion rate. The Palmer Drought Severity Index (PDSI; Heddinghaus and Sabol 1991) was used for all multipliers. PDSI is a long-term drought measure because it incorporates the cumulative influence of past monthly observations (Heddinghaus and Sabol 1991). PDSI values are available from 1895 to current for the four climatic regions of Nevada and Utah. The Mojave Desert is in climate division #4. PDSI values starting in 1935 to 2009 were extracted and this original 75-year time series was resampled five times times for 50 years to obtain a total of five replicates. Negative PDSI values indicate drought, whereas positive ones represent wetter than average years. Severe droughts and very wet periods, respectively, have PDSI values <-3 and >3. Taylor and Beaty (2005) showed that the PDSI is highly negatively correlated to fire frequency and total area burned for forest types during pre-settlement in the northern Sierra Nevada: more fire was observed during increasingly drier years. The same relationship holds for average temperature (Westerling et al. 2006). This, however, does not apply to shrublands that must first experience consecutive wetter than average years to accumulate fine fuels that will more likely burn in a dry year immediately following the wet year sequence (Westerling and Bryant 2008; Westerling, *in press*).

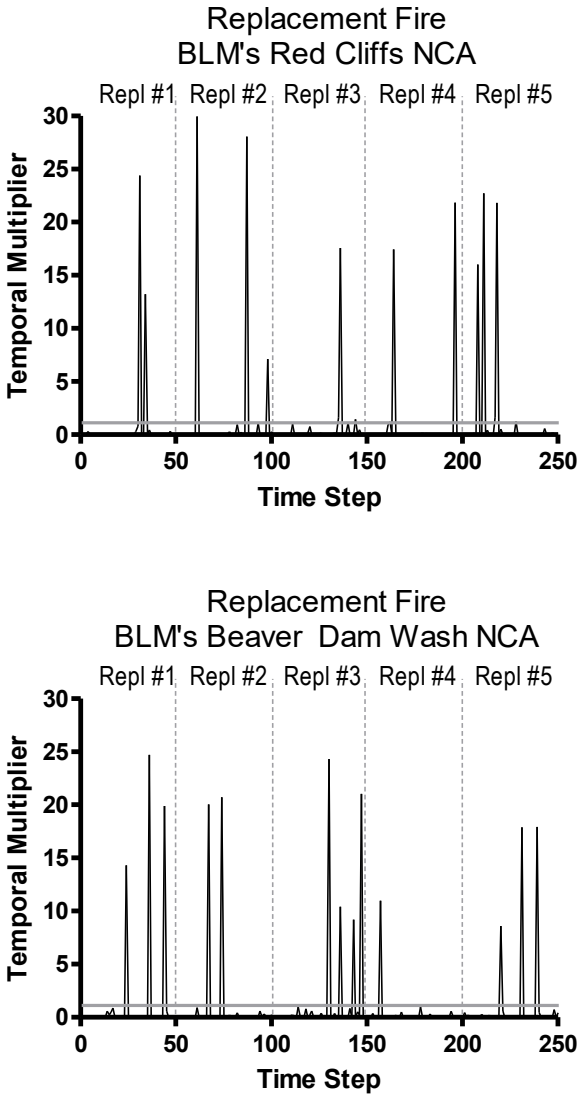


Figure 4-1. Five replicates of temporal probability multipliers for fire activity. Each replicate is numbered and represented by 50-year period. The horizontal gray line for temporal multiplier = 1 represents the "no-change" or neutral parameter line.

We assumed that more severe droughts cause increased mortality, whereas wetter conditions suppress mortality. Because PDSI can be negative, therefore incompatible with VDDT, we chose a negative exponential function to create positive values that increased exponentially with smaller (more negative) PDSI values:

Temporal multiplier for drought mortality
$= 0.6 \times e^{-0.6 \times PDSI}$

The parameters of this function were chosen such that PDSI values close to -3 were slightly greater than 3 (actually, 3.63) and that very severe droughts with PDSI as high as -5.2 translated into slightly more than doubling of the temporal multipliers (13.8). Another consideration was that a mild drought characterized

by a PDSI of -1 would about equal to a neutral temporal multiplier value of 1. Figure 4-2 demonstrates the relationship between PDSI and the temporal multiplier for climatic division #4.

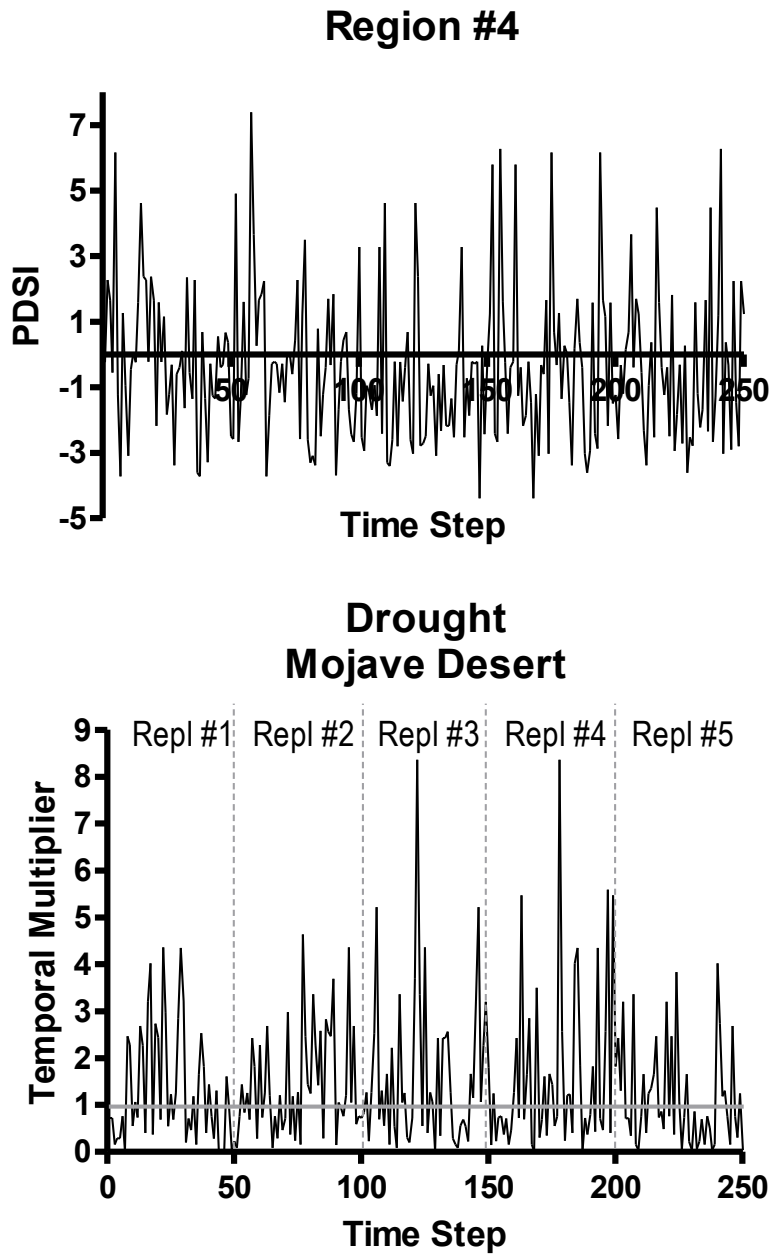


Figure 4-2. Palmer drought severity index (PDSI) time series (top) and calculated drought temporal multipliers (bottom) for the fourth climatic divisions of Nevada and Utah. Five replicates (Repl) are shown each per 50-year period. The gray line for PDSI = 0 represented average drought conditions, whereas the gray line for the drought temporal multiplier = 1 represented the "no-change" or neutral parameter line.

Temporal variability for non-native annual grass and forb invasion and tree (mostly pinyon and juniper) invasion rates were dependent on drought levels: greater drought severity, therefore lower soil moisture, was detrimental to recruitment and growth and, conversely, greater soil moisture favored the spread of annual grasses and trees (Bradley 2009; Brown et al. 2004; Smith et al. 2000). We assumed that tree invasion was a much slower process than annual grass invasion. This implies that PDSI was directly related to the variability of these invasion rates:

Annual grass invasion (Figure 4-3 top)

PDSI > 0, temporal multiplier = $(0.75 \times e^{0.75 \times PDSI})^{0.5}$

PDSI ≤ 0, temporal multiplier = $0.75 \times e^{0.75 \times PDSI}$

Tree invasion (Figure 4-3 bottom)

PDSI > 0, temporal multiplier = $(0.2 \times e^{0.8 \times PDSI})^{0.5}$

PDSI ≤ 0, temporal multiplier = $0.2 \times e^{0.8 \times PDSI}$

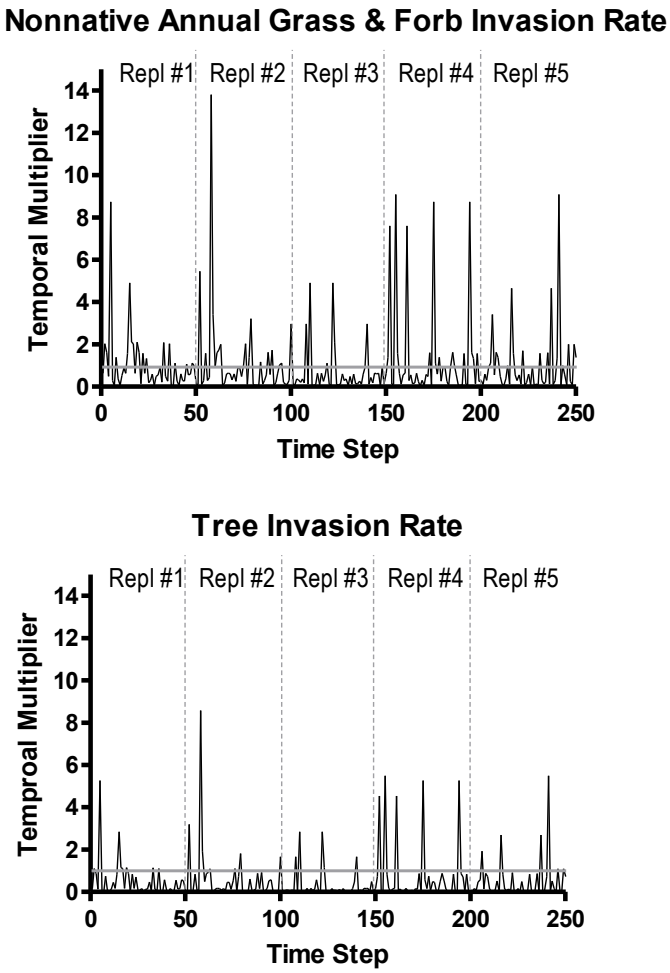


Figure 4-3. Temporal multipliers of annual grass invasion and tree invasion for the fourth climatic division of Nevada and Utah. Five replicates (Repl) are shown each per 50-year period. The gray line for the drought temporal multiplier = 1 represented the "no-change" or neutral parameter line.

Riparian Variability

Montane, warm desert riparian, and desert washes systems were strongly dependent on flood events and their discharge variation **(Rood et al. 2003; McBride and Strahan 1984).** For perennial reaches, we used flow data from the Santa Clara River at Gunlock, Utah, measured between 1970 and 2010 (US Geological Survey: # USGS 09409880 SANTA CLARA RIVER AT GUNLOCK, UT). **We created five replicates of 50 years each by resampling the original time series using random numbers and MS Excel®'s vlookup function. Each resampled peak discharge values were divided by the temporal average discharge of that gage, thus generating a dimensionless time series of peak flow with an average of one (i.e., the temporal multiplier).**

Peak flow data from the Santa Clara River were used to calculate temporal variability for the 7-year, 20-year, and 100-year flood events, whereas annual flow data were used to derived exotic species invasion rates. Seven-year, 20-year, and 100-year flood events were all based on filtering for increasingly higher values of annual peak flow. **The three levels of flooding corresponded to 7-year events that killed or removed only herbaceous vegetation; 20-year events that killed or removed shrubs and young trees; and 100-year events that top-killed larger trees (i.e., these are three distinct disturbances in the riparian models).** The 7-year flood events encompass the full time series of peak flow divided by the temporal average (Figure 4-4). The 20-year flood event for the Santa Clara River at Gunlock was determined to correspond to a temporal multiplier of 3.062, whereas the threshold for 100-year event was 7.8399 (Natural Channel Design, Inc. 2005: Table 2.2).

Flash flooding was obtained from USGS peak flow data at Beaver Dam, Arizona (USGS 09414900 BEAVER DAM WASH AT BEAVER DAM, AZ), from 1998 to 2010. Most of Beaver Dam Wash is dry and flows are frequently null, except during major events. The same dimensionless transformation used for peak flow in the Santa Clara River was used here. The original time series was resampled because it contained only one major flood event and practically no flow for other years (Figure 4-4).

Annual discharge from the Santa Clara River at Gunlock was used to determine exotic forb and exotic tree invasion rates. For simplicity, exotic-species invasion was identical for three related temporal multipliers: exotic invasion (mostly saltcedar) in the montane riparian ecological system, and exotic-forb invasion and exotic-tree invasion in the warm desert riparian ecological system. The exotic-invasion disturbance generally encompasses forbs and trees, whereas the disturbance was split by forb and tree species in the Mojave Desert. We assumed that the variability of exotic species invasion was entirely dependent on average annual discharge (annual discharge is the average discharge among months, whereas peak discharge is the maximum discharge recorded). Years of greater than average annual discharge would favor the invasion of exotic forbs and trees. The rate of exotic forb invasion in PATH/VDDT models was, therefore, multiplied by the annual flow temporal multiplier. The temporal multipliers were obtained exactly as done for peak discharge, except annual discharge was used. Data are shown in Figure 4-5.

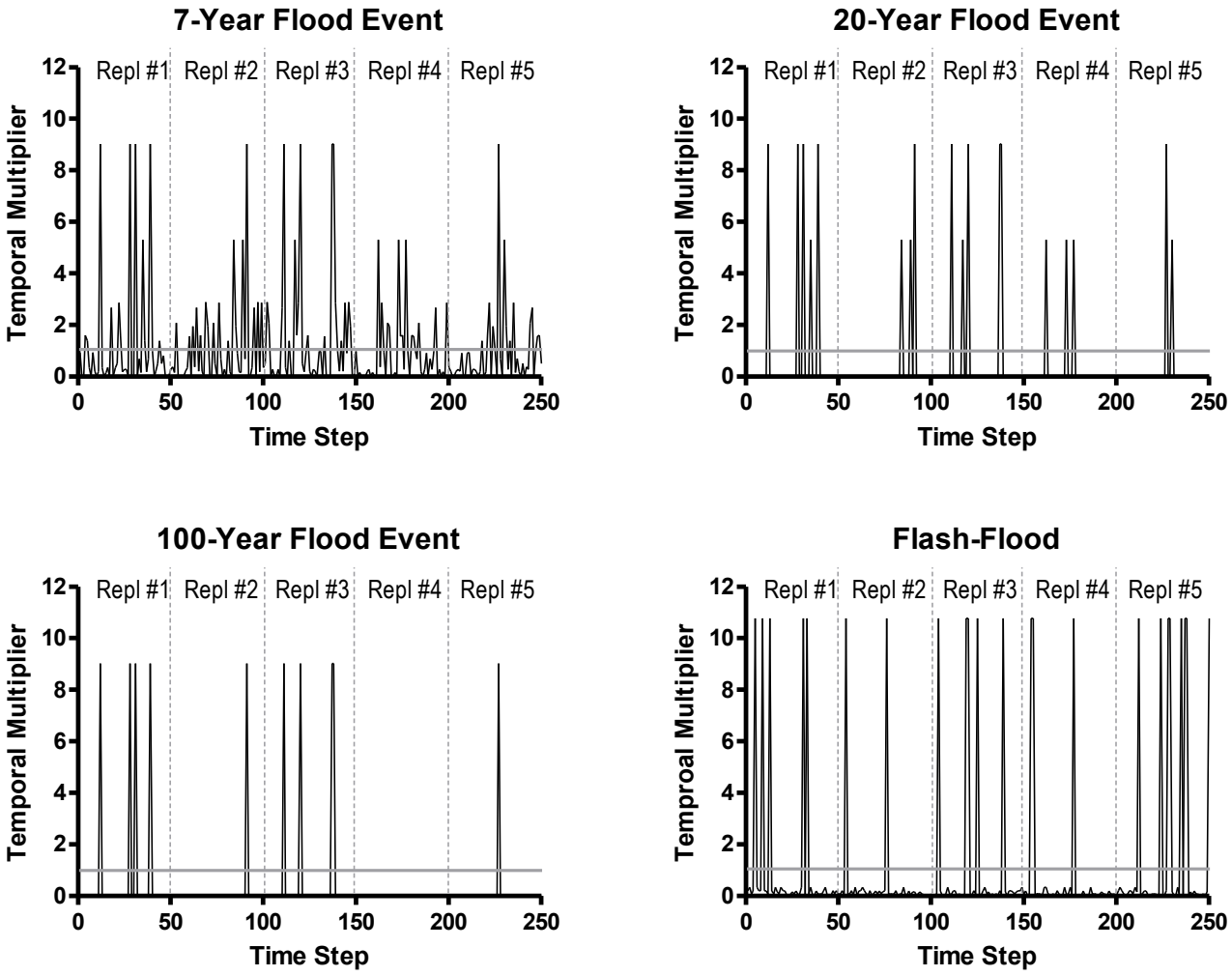


Figure 4-4. Riparian temporal multipliers for 7-year, 20-year, 100-year flood events, and flash flooding. For the 20-year and 100-year flood events all values below their threshold are zero. Data from U.S. Geological Survey gage obtained from the Santa Clara River at Gunlock, UT, for 7-year, 20-year, and 100-year flood events. Flash flooding data were from the U.S. Geological Survey gage on the Beaver Dam Wash at Beaver Dam, Arizona. The horizontal gray line for temporal multiplier = 1 represents the "no-change" or neutral parameter line.

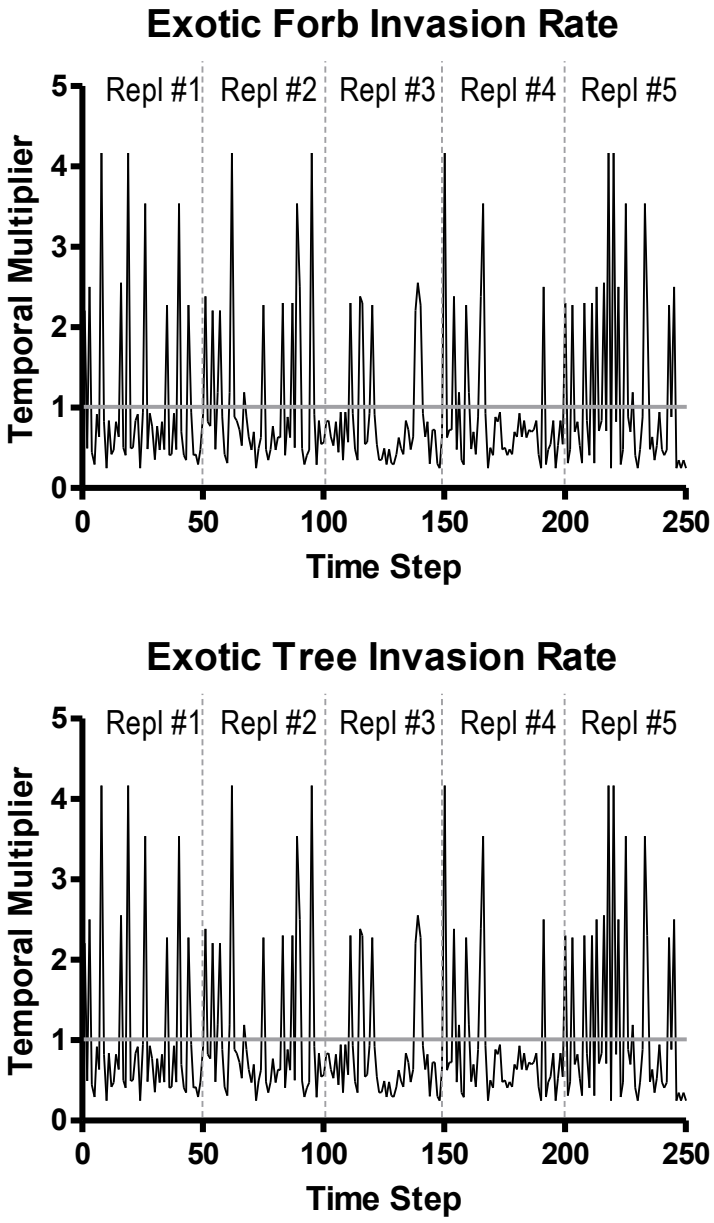


Figure 4-5. Riparian temporal multipliers for exotic forb invasion and exotic tree invasion. Annual discharge data from U.S. Geological Survey gage obtained from the Santa Clara River at Gunlock, UT. The horizontal gray line for temporal multiplier = 1 represents the "no-change" or neutral parameter line.

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Appendix 5. Management actions and cost by ecological systems.

Ecological System	Management Action in Model	Management Action Description	From Class	To Class	Cost/ Acre	Success Rate	Comment
Multiple Systems: Blackbrush-mesic and thermic, and Cresotebush-White Bursage, Desert Washes, Warm-Season Grassland	Fuel breaks	Aerial spraying to create 250 feet wide fuel breaks along roads, rights-of-ways, and boundaries (all that are in several BpS) to maintain the SEP/SEPJ class; Reduces the frequency of fires for 3 years.	ALL	ALL	$ 11	3 years less fire activity	Reapply every wet year of good exotic annual species productivity (i.e., about 7 years with El Nino cycle): $80/acre but spreadout over every 7 years. Arizona Strip BLM uses 8oz vs 4-6oz for St George BLM.
Multiple Systems of Beaver Dam Wash NCA	Law-enforcement	Reduces bare ground creation caused by OHV in BDW only.	ALL	ALL	$0.8	90%	Law enforcement only affects OHV and in BDW; too inefficient to model large acres of law enforcement with PATH, therefore, we reduced OHV rate to 5% with static transition multiplier. Salary of one law enforcement person maybe 1/3 FTE: $50K divided by 64K acres $0.80/acre
Multiple Systems: Blackbrush-mesic and thermic, Cresotebush-White Bursage, Desert Wash	Livestock-Closure	Beaver Dam Wash only; Reduction of stocking rate in Desert Washes and 10-year closure of plantings and seedings in blackbrush and creosotebush-white bursage	All in Desert Washes and seedings and plantings	All classes, except BG	$ 11	10 yrs no grazing for selected pixels	This is modeled as a reduction of stocking rate, however, closing the allotment, if chosen, is different (No-Grazing-only scenario) would be better done with static transition multiplier setting Managed-Herbivory = 0 and Excessive-Herbivory = 0.

Big Sagebrush Steppe	Herbicide+Seed	Control cheatgrass and Erodium and broadcast seed or harrow on some plateaus	EX, SEP	A, C (respectively)	$ 250	80% & 90%	
Big Sagebrush Steppe	Thin+Herbicide+Seed	Chainsaw invading PJ, apply herbicide to control exotic annuals, and seed native species	TEX, TE	SD	$ 350	80%	
Blackbrush-mesic	Herbicide+Current Native Species Seeding	Aerial spraying Plateau on non-native annuals followed by native seeding with mechanical covering	EX	SD	$ 1,000	1%	Not used due to low success rate of current quality of native seed and granivory; Success rate assumes no grazing
Blackbrush-mesic	Herbicide+Mixed Introduced and Native Species Seeding	Aerial spraying Plateau on non-native annuals followed by introduced and native species seeding with mechanical covering	EX	SDI	$ 450	5%	Not used as most of BLM's Beaver Dam Wash is below the elevation suitable ofr forage koshia (~3500 feet): need to track success fo forage koshia with low preciipitation. Can still have grazing with introduced species; $200 seed; 5 applications of herbicide over 10 yrs.
Blackbrush-mesic and thermic, and Cresotebush-White Bursage	Herbicide+ New Native cultivar Seeding	Aerial spraying Plateau on non-native annuals followed by new native species cultivar seeding, including seedballing (ball of clay with seeds that prevents granivory)	EX	SD	$ 150	5%	In experimental development. Seed new native cultivar after 20 years of development. The new seed mix would incorporate new proven technologies such as "seedballing" and seed coating. Seedballing. Simulations assumed that the new seed mix would include all new technological development. Cost: $100 lb native/10 lbs acre, plus application costs.
Blackbrush-mesic	Carbon addition	Add sugar or wood chips to soil	EX	SD	TBD	TBD	Not used: Supplemental treatment to seeding, or perhaps standalone, to reduce nitrogen availability to exotic species by stimulating bacterial and fungal uptake of nitrogen

							during carbon processing
Blackbrush - mesic	Chainsaw-Lopping	Thin juniper and pinyon in late class	TEX	SEP	$ 70	100%	Not used. Release blackbrush by removing trees in Red Cliffs were a large amount of shrubland has been lost.
Blackbrush-mesic and thermic, and Cresotebush-White Bursage	Herbicide+Planting	From Scott Abella's: Aerial spraying of Plateau on non-native annuals and plant containerized desert shrubs and forbs (but not blackbrush) with gel caps included in potting soil.	EX	PL, SEP, SEPJ	$ 650	90%	In experimental development: commercial scaling up needs to be demonstrated. Main pathway is to Planting state, but then slower succession pathway to SEP or SEPJ if herbicide fails. Seedbank emergence of exotics after 2-3 years in the Planting state will also cause a transition to SEP or SEPJ. Six dollars for plant, gel cap and labor; 100 plants per acre; add $50/acre for brome control.
Blackbrush-mesic and thermic, and Cresotebush-White Bursage	Fngers-of-Death+Planting	From Scott Abella's: Application of fingers-of-death on non-native annuals and plant containerized desert shrubs and forbs (but not blackbrush) with gel caps included in potting soil.	EX	PL, SEP, SEPJ	$ 650	90%	In experimental development: commercial scaling up needs to be demonstrated. Main pathway is to Planting state, but then slower succession pathway to SEP or SEPJ if herbicide fails. Seedbank emergence of exotics after 2-3 years in the Planting state will also cause a transition to SEP or SEPJ. Six dollars for plant, gel cap and labor; 100 plants per acre; add $50/acre for brome control.
Blackbrush-mesic and thermic, and Cresotebush-White Bursage	Fingers-of-Death-BM, BT, CB, & WAS	Apply the fingers-of-death fungi to kill exotic annual species	SES & SEP	A,B,C	$ 300	25% to 75%	In experimental development: Patent filed for fungi. Expect fungi to be ready for commercial release in 5 years. Curent research estimates success rate of 75% at killing seed, but simulations tested success artes at 25%, 50%,

							and 75%. Mode of application (liquid or granular) undecided and in feasibility research.
Desert Sand Sagebrush	Herbicide+Seed	Seed with native perennial grasses after application of Plateau to control exotic annual species; had 80% back with 10 years	SEP	B	$ 250	80%	For SEP, the cover of exotic annual species is not high and not considered high risk; quick recovery
Desert Wash	Herbicide-WAS	Aerial spraying Plateau on non-native annuals	SES & SEP	A, B, or C	$ 25	50%	Lasts for 2 years because of seedbank emergence and invasion; must be done every 3-5 years
Desert Wash	Fingers-of-Death-WAS	Apply the fingers-of-death fungi to kill exotic annual species	SES & SEP	A,B,C	$ 300	25% to 75%	In experimental development: Patent filed for fungi. Expect fungi to be ready for commercial release in 5 years. Curent research estimates success rate of 75% at killing seed, but simulations tested success artes at 25%, 50%, and 75%. Mode of application (liquid or granular) undecided and in feasibility research.
Desert Wash	Exotic-Control-WAS	Cut tamarisk and immediately apply Garlon to stumps	ET	A,B,C	$ 200	90%	If biocpntrol beetle doesn't kill enough tamarisk
Montane Riparian	Exotic Control	Cut tamarisk and immediately apply Garlon to stumps.			$ 200	90%	If biocpntrol beetle doesn't kill enough tamarisk
Mountain Shrub	Herbicide+SeedRose	Application of Plateau (perhaps by ATV) to control cheatgrass and Erodium in burned areas, followed by seeding of cliffrose during drier years.	EX	A	$ 100	70%	Rehabilitation of mine sites and degraded range with seeded cliffrose is a common and successful practice. Cliffrose has a greater germination success during drought years and wet years can set back reestablishment after fire. Cliffrose seedlings do not tolerate plant competition. Ability to reprouts varies a lot by ecotype and uncommon, but seeding is successful and seed

							caching by rodents contributes to success.
Mountain Shrub	Herbicide+SeedGrass	Application of Plateau (perhaps by ATV or spot treatment) to control cheatgrass and Erodium in SEP, followed by seeding of grass species during wet years.	SEP	B	$ 250	70%	Cliffrose may come back from seedbank; however cheatgrass competes strongly against seedlings.
Pinyon-Juniper	Herbicide	Spot treatment of brome with Plateau under canopy of mature trees.	TEX	C, D	$ 75	60%	Very difficult to spray and and applied by hand.
Pinyon-Juniper	Herbicide+Seed	Aerial application of herbicide to control annual exotic species (Bromus & Erodium) in burned areas followed by aerial seeding in burned areas	EX	A	$ 250	60%	Need to consider constraints on aerial application over Red Cliffs wilderness.
Warm Desert Riparian	Weed Inventory	Periodic inventory of invasive weeds / tamarisk. Assumes spot treatment of small patches and tamarisk, and identifies a need to return to control larger trees and patches.	ALL, except ET, EF, DEF, DET	ALL	$ 55		Visit every 3-5 years
Warm Desert Riparian	Exotic Tree Control	Cut tamarisk and immediately apply Garlon to stumps: replant native shrubs/trees and seed native forbs if needed.	ET, DET	A	$ 200	90%	If the beetle doesn't do the job
Warm Desert Riparian	Herbicide-EX	Spot treatment of Plateau to control exotic annual species (Bromus and Erodium) under mature riparian vegetation	TEX	A, B, D, E	$ 50	50%	Spot treatment mostly along Beaver Dam Wash.
Warm Desert Riparian	Exotic Forb Control	Control exotic forbs (Knapweed spp., tall whitetop, others) with herbicide	EF, DEF	A	$ 150	60%	
Warm Season Grassland	Herbicide+Seed	Spray exotic annual species and seed in grass species (Galleta and others) to increase grass cover	EEX	A	$ 250	40%	Literature reports difficulty of seeding galleta grass.

Warm Season Grassland	Fingers-fo-Death	Spot treatment of fingers-of-death fungi in SES.	SES	B	$ 300	75%	In experimental development: Patent filed for fungi. Expect fungi to be ready for commercial release in 5 years. Already high cover of Galleta grass.
Warm Season Grassland	Fingers-fo-Death +Seed	Apply fingers-of-death on exotic annual species and seed in grass species (Galleta and others) to increase grass cover	EEX	A	$ 600	63%	In experimental development: Patent filed for fungi. Expect fungi to be ready for commercial release in 5 years. Literature reports difficulty of seeding Galleta grass.

Appendix 6. Current acres by vegetation class, natural range of variability (NRV) and ecological departure (ED) calculations for ecological systems of the Red Cliffs and Beaver Dam Wash NCAs.

Red Cliffs NCA																
BpS ↓	Class→	A	B	C	D	E	EEX	EF	ET	EX	SEP	SEPJ	SES	TE	TEX	Total
Big Sagebrush Steppe-upland	Current acres	0	0	0	0	0				2408	505			148		3061
	NRV	30	47	20	1	2	0	0	0	0	0	0	0	0	0	
	Current % area	0	0	0	0	0				79	17		0	5		
	Ecol Departure															100
Blackbrush-mesic	Current acres	0	0	0	0					6750	10510					17260
	NRV	11	0	73	16		0	0	0	0	0	0	0	0	0	
	Current % area	0	0	0	0					39	61					
	Ecol Departure															100
Blackbrush-thermic	Current acres	0	0	0						583	4422					5005
	NRV	5	0	95			0	0	0	0	0	0	0	0	0	
	Current % area	0	0	0			0	0	0	12	88	0	0	0	0	
	Ecol Departure															100
Creosotebush-White Bursage	Current acres	0	0	0	0					1661	1382					3043
	NRV	8	0	92	0		0	0	0	0	0	0	0	0	0	
	Current % area	0	0	0	0					55	45					
	Ecol Departure															100
Desert Sand Sagebrush	Current acres	0	0								1586					1586
	NRV	2	98				0	0	0	0	0	0	0	0	0	
	Current % area	0	0								100					
	Ecol Departure															100
Montane Riparian	Current acres	0.02	0	0.33				39.5								40
	NRV	10	19	71			0	0	0	0	0	0	0	0	0	
	Current % area	0	0	1				99								
	Ecol Departure															99
Mountain Mahogany	Current acres															
	NRV															

	Current % area															
	Ecol Departure															
Mountain Shrub	Current acres	0	0	0	0					2.7	0.3			1.2		4.2
	NRV	7	15	63	14		0	0	0	0	0	0	0	0	0	
	Current % area	0	0	0	0					64	7			29		
	Ecol Departure															100
Pinyon-Juniper	Current acres	0	0	0	0										3719	3719
	NRV	2	3	13	82		0	0	0	0	0	0	0	0	0	
	Current % area	0	0	0	0										100	
	Ecol Departure															100
Warm Desert Riparian	Current acres	0	0	0	0	0			34						126	160
	NRV	10	19	8	40	23	0	0	0	0	0	0	0	0	0	
	Current % area	0	0	0	0	0			21						79	
	Ecol Departure															100
Warm Desert Riparian-Wash	Current acres	171	0	0									231			402
	NRV	10	18	72			0	0	0	0	0	0	0	0	0	
	Current % area	43	0	0									57			
	Ecol Departure															90
Warm-Season Grassland	Current acres	0	0				3			7			108			118
	NRV	4	96				0	0	0	0	0	0	0	0	0	
	Current % area	0	0				3			6			91			
	Ecol Departure															100

Beaver Dam Wash NCA																
BpS ↓	Class→	A	B	C	D	E	EEX	EF	ET	EX	SEP	SEPJ	SES	TE	TEX	Total
Big Sagebrush Steppe-upland	Current acres	0	0	0	0	0				12			2			14
	NRV	30	47	20	1	2	0	0	0	0	0	0	0	0	0	
	Current % area	0	0	0	0	0	0	0	0	83	0	0	17	0	0	
	Ecol Departure															100
Blackbrush-	Current acres	0	0	0	0	0				24629	3364	5629			6	33628

mesic	NRV	10	39	35	8	8	0	0	0	0	0	0	0	0	0	
	Current % area	0	0	0	0	0	0	0	0	73	10	17	0	0	0	
	Ecol Departure															100
Blackbrush-thermic	Current acres	0	0	0						1211	1133	1309				3653
	NRV	5	48	47			0	0	0	0	0	0	0	0	0	
	Current % area	0	0	0			0	0	0	33	31	36	0	0	0	
	Ecol Departure															100
Creosotebush-White Bursage	Current acres	0	0	0	0					1960	7024	13057				22041
	NRV	9	36	38	17		0	0	0	0	0	0	0	0	0	
	Current % area	0	0	0	0		0	0	0	9	32	59	0	0	0	
	Ecol Departure															100
Desert Sand Sagebrush	Current acres															
	NRV															
	Current % area															
	Ecol Departure															
Montane Riparian	Current acres															
	NRV															
	Current % area															
	Ecol Departure															
Mountain Mahogany	Current acres	0.1	0	0.4												0.5
	NRV	6	10	84			0	0	0	0	0	0	0	0	0	
	Current % area	20	0	80			0	0	0	0	0	0	0	0	0	
	Ecol Departure															14
Mountain Shrub	Current acres	0	0	0	0					143						143
	NRV	7	15	63	14		0	0	0	0	0	0	0	0	0	
	Current % area	0	0	0	0		0	0	0	100	0	0	0	0	0	
	Ecol Departure															100
Pinyon-Juniper	Current acres	0	0	0	16					220					34	270
	NRV	2	3	13	82		0	0	0	0	0	0	0	0	0	
	Current % area	0	0	0	6		0	0	0	82	0	0	0	0	13	
	Ecol Departure															94

Warm Desert Riparian	**Current acres**	0	0	0	0	0			4						110	114
	NRV	10	19	8	40	23	0	0	0	0	0	0	0	0	0	
	Current % area	0	0	0	0	0	0	0	4	0	0	0	0	0	96	
	Ecol Departure															100
Warm Desert Riparian-Wash	**Current acres**	2646	0	0									699			3345
	NRV	10	18	72			0	0	0	0	0	0	0	0	0	
	Current % area	79	0	0			0	0	0	0	0	0	21	0	0	
	Ecol Departure															90
Warm-Season Grassland	**Current acres**															
	NRV															
	Current % area															
	Ecol Departure															

Appendix 6. MINIMUM MANAGEMENT scenario areas (acre) by vegetation class for ecological systems of the Red Cliffs and Beaver Dam Wash NCAs.

Red Cliffs NCA					
Ecological System × Vegetation class	Run 1	Run 2	Run 3	Run 4	Run 5
BSu-A:AL: 0%	1%	0%	1%	0%	1%
BSu-B:OP: 0%	0%	2%	1%	1%	1%
BSu-C:CL: 0%	0%	0%	0%	0%	0%
BSu-D:OP: 0%	0%	0%	0%	0%	0%
BSu-E:CL: 0%	0%	0%	0%	0%	0%
BSu-U:DP: 0%	0%	0%	0%	0%	0%
BSu-U:ES: 0%	1%	1%	1%	0%	1%
BSu-U:EX: 0%	94%	93%	95%	87%	94%
BSu-U:SD: 0%	0%	0%	0%	0%	0%
BSu-U:SEP: 0%	0%	0%	0%	6%	0%
BSu-U:SES: 0%	0%	0%	0%	0%	0%
BSu-U:TE: 0%	2%	2%	2%	3%	2%
BSu-U:TEX: 0%	1%	2%	1%	3%	1%
BM-A:AL: 0%	0%	0%	0%	0%	0%
BM-B:JT: 0%	0%	0%	0%	0%	0%
BM-C:OP: 0%	0%	0%	0%	0%	0%
BM-D:OP: 0%	0%	0%	0%	0%	0%
BM-E:JT: 0%	0%	0%	0%	0%	0%
BM-U:BG: 0%	0%	0%	0%	0%	0%
BM-U:ES: 0%	0%	0%	0%	0%	0%
BM-U:EX: 0%	3%	2%	3%	1%	3%
BM-U:EX2B: 0%	73%	64%	76%	35%	67%
BM-U:PL: 0%	0%	0%	0%	0%	0%
BM-U:SD: 0%	0%	0%	0%	0%	0%
BM-U:SDI: 0%	0%	0%	0%	0%	0%
BM-U:SEP: 0%	23%	33%	21%	63%	29%
BM-U:SEPJ: 0%	0%	0%	0%	0%	0%
BM-U:TEX: 0%	1%	1%	1%	2%	1%
BT-A:AL: 0%	0%	0%	0%	0%	0%
BT-B:JT: 0%	0%	0%	0%	0%	0%
BT-C:CL: 0%	0%	0%	0%	0%	0%
BT-U:BG: 0%	0%	0%	0%	0%	0%
BT-U:ES: 0%	0%	0%	0%	0%	0%
BT-U:EX: 0%	3%	2%	3%	1%	3%
BT-U:EX2B: 0%	73%	63%	76%	35%	66%
BT-U:PL: 0%	0%	0%	0%	0%	0%
BT-U:SD: 0%	0%	0%	0%	0%	0%
BT-U:SDI: 0%	0%	0%	0%	0%	0%

BT-U:SEP: 0%	24%	35%	21%	64%	30%
BT-U:SEPJ: 0%	0%	0%	0%	0%	0%
CB-A:OP: 0%	0%	0%	0%	0%	0%
CB-B:JT: 0%	0%	0%	0%	0%	0%
CB-C:OP: 0%	0%	0%	0%	0%	0%
CB-D:JT: 0%	0%	0%	0%	0%	0%
CB-U:BG: 0%	0%	0%	0%	0%	0%
CB-U:ES: 0%	0%	0%	0%	0%	0%
CB-U:EX: 0%	3%	16%	5%	20%	8%
CB-U:EX2B: 0%	37%	26%	38%	20%	26%
CB-U:PL: 0%	0%	0%	0%	0%	0%
CB-U:SD: 0%	0%	0%	0%	0%	0%
CB-U:SDI: 0%	0%	0%	0%	0%	0%
CB-U:SEP: 0%	60%	58%	57%	60%	65%
CB-U:SEPJ: 0%	0%	0%	0%	0%	0%
DSS-A:OP: 0%	0%	0%	0%	0%	0%
DSS-B:OP: 0%	0%	0%	0%	0%	0%
DSS-U:DP: 0%	0%	0%	0%	0%	0%
DSS-U:SEP: 0%	100%	100%	100%	100%	100%
MR-A:AL: 0%	0%	0%	0%	0%	0%
MR-B:OP: 0%	0%	0%	0%	0%	0%
MR-C:CL: 0%	0%	0%	0%	0%	0%
MR-U:DE: 0%	0%	0%	0%	0%	0%
MR-U:EF: 0%	100%	100%	100%	100%	100%
MR-U:SFE: 0%	0%	0%	0%	0%	0%
MSh-A:AL: 0%	0%	0%	0%	0%	0%
MSh-B:CL: 0%	0%	0%	0%	0%	0%
MSh-C:CL: 0%	0%	0%	0%	0%	0%
MSh-D:OP: 0%	0%	0%	0%	0%	0%
MSh-U:ES: 0%	33%	0%	0%	25%	25%
MSh-U:EX: 0%	0%	0%	50%	0%	25%
MSh-U:SEP: 0%	67%	75%	25%	75%	50%
MSh-U:TE: 0%	0%	25%	25%	0%	0%
PJ-A:AL: 0%	0%	0%	0%	0%	0%
PJ-B:OP: 0%	0%	0%	0%	0%	0%
PJ-C:OP: 0%	0%	0%	0%	0%	0%
PJ-D:OP: 0%	0%	0%	0%	0%	0%
PJ-U:EX: 0%	24%	20%	26%	10%	19%
PJ-U:TEX: 0%	76%	80%	74%	90%	81%
SWA-A:AL: 0%	1%	0%	1%	0%	14%
SWA-B:CL: 0%	20%	0%	15%	1%	12%
SWA-C:CL: 0%	11%	29%	19%	31%	7%
SWA-U:BG: 0%	0%	0%	0%	0%	0%
SWA-U:ES: 0%	0%	0%	0%	0%	0%

SWA-U:ET: 0%	0%	0%	0%	0%	0%
SWA-U:SEP: 0%	10%	13%	8%	11%	10%
SWA-U:SES: 0%	58%	57%	57%	57%	57%
WDR-A:AL: 0%	0%	3%	1%	0%	2%
WDR-B:CL: 0%	13%	8%	15%	3%	7%
WDR-C:OP: 0%	4%	7%	6%	8%	11%
WDR-D:CL: 0%	7%	4%	3%	7%	9%
WDR-E:CL: 0%	7%	3%	4%	10%	7%
WDR-U:DE: 0%	0%	0%	0%	0%	0%
WDR-U:DEF: 0%	0%	0%	0%	0%	0%
WDR-U:DET: 0%	0%	0%	0%	0%	0%
WDR-U:DEX: 0%	0%	0%	0%	0%	0%
WDR-U:EF: 0%	28%	34%	30%	31%	30%
WDR-U:ET: 0%	1%	1%	2%	1%	0%
WDR-U:EX: 0%	0%	0%	4%	0%	0%
WDR-U:TEX: 0%	41%	40%	35%	41%	34%
GRL-A:AL: 0%	0%	0%	0%	0%	0%
GRL-B:OP: 0%	0%	0%	0%	0%	0%
GRL-U:DP: 0%	0%	0%	0%	0%	0%
GRL-U:EEX: 0%	3%	3%	3%	3%	3%
GRL-U:EX: 0%	0%	0%	0%	0%	1%
GRL-U:SES: 0%	97%	97%	97%	97%	96%

Beaver Dam Wash NCA					
Ecological System × Vegetation class	Run 1	Run 2	Run 3	Run 4	Run 5
BSu-A:AL: 0%	0%	0%	0%	0%	0%
BSu-B:OP: 0%	0%	0%	0%	0%	0%
BSu-C:CL: 0%	0%	0%	0%	0%	0%
BSu-D:OP: 0%	0%	0%	0%	0%	0%
BSu-E:CL: 0%	0%	0%	0%	0%	0%
BSu-U:DP: 0%	0%	0%	0%	0%	0%
BSu-U:ES: 0%	0%	0%	0%	0%	0%
BSu-U:EX: 0%	89%	100%	100%	89%	100%
BSu-U:SD: 0%	0%	0%	0%	0%	0%
BSu-U:SEP: 0%	0%	0%	0%	0%	0%
BSu-U:SES: 0%	0%	0%	0%	11%	0%
BSu-U:TE: 0%	0%	0%	0%	0%	0%
BSu-U:TEX: 0%	11%	0%	0%	0%	0%
BM-A:AL: 0%	0%	0%	0%	0%	0%
BM-B:JT: 0%	0%	0%	0%	0%	0%
BM-C:OP: 0%	0%	0%	0%	0%	0%
BM-D:OP: 0%	0%	0%	0%	0%	0%
BM-E:JT: 0%	0%	0%	0%	0%	0%

BM-U:BG: 0%	0%	0%	0%	0%	0%
BM-U:ES: 0%	0%	0%	0%	0%	0%
BM-U:EX: 0%	1%	1%	1%	1%	1%
BM-U:EX2B: 0%	32%	30%	34%	27%	27%
BM-U:PL: 0%	0%	0%	0%	0%	0%
BM-U:SD: 0%	0%	0%	0%	0%	0%
BM-U:SDI: 0%	0%	0%	0%	0%	0%
BM-U:SEP: 0%	24%	25%	24%	26%	26%
BM-U:SEPJ: 0%	41%	42%	40%	45%	44%
BM-U:TEX: 0%	1%	1%	0%	1%	1%
BT-A:AL: 0%	0%	0%	0%	0%	0%
BT-B:JT: 0%	0%	0%	0%	0%	0%
BT-C:CL: 0%	0%	0%	0%	0%	0%
BT-U:BG: 0%	1%	0%	0%	0%	0%
BT-U:ES: 0%	0%	0%	0%	0%	0%
BT-U:EX: 0%	3%	3%	2%	1%	3%
BT-U:EX2B: 0%	14%	5%	17%	2%	9%
BT-U:PL: 0%	0%	0%	0%	0%	0%
BT-U:SD: 0%	0%	0%	0%	0%	0%
BT-U:SDI: 0%	0%	0%	0%	0%	0%
BT-U:SEP: 0%	33%	35%	33%	41%	37%
BT-U:SEPJ: 0%	49%	56%	48%	55%	51%
CB-A:OP: 0%	0%	0%	0%	0%	0%
CB-B:JT: 0%	0%	0%	0%	0%	0%
CB-C:OP: 0%	0%	0%	0%	0%	0%
CB-D:JT: 0%	0%	0%	0%	0%	0%
CB-U:BG: 0%	1%	0%	1%	0%	0%
CB-U:ES: 0%	0%	0%	0%	0%	0%
CB-U:EX: 0%	3%	18%	5%	22%	8%
CB-U:EX2B: 0%	33%	19%	37%	6%	23%
CB-U:PL: 0%	0%	0%	0%	0%	0%
CB-U:SD: 0%	0%	0%	0%	0%	0%
CB-U:SDI: 0%	0%	0%	0%	0%	0%
CB-U:SEP: 0%	22%	22%	20%	26%	24%
CB-U:SEPJ: 0%	41%	41%	37%	46%	45%
MSh-A:AL: 0%	0%	0%	0%	0%	0%
MSh-B:CL: 0%	0%	0%	0%	0%	0%
MSh-C:CL: 0%	0%	0%	0%	0%	0%
MSh-D:OP: 0%	0%	0%	0%	0%	0%
MSh-U:ES: 0%	0%	0%	0%	0%	0%
MSh-U:EX: 0%	28%	2%	79%	1%	29%
MSh-U:SEP: 0%	72%	98%	21%	99%	71%
MSh-U:TE: 0%	0%	0%	0%	0%	0%
PJ-A:AL: 0%	0%	0%	0%	0%	0%

PJ-B:OP: 0%	1%	0%	1%	1%	1%
PJ-C:OP: 0%	0%	0%	0%	1%	0%
PJ-D:OP: 0%	5%	5%	5%	4%	5%
PJ-U:EX: 0%	84%	85%	84%	82%	85%
PJ-U:TEX: 0%	10%	10%	11%	12%	9%
SWA-A:AL: 0%	1%	0%	1%	0%	26%
SWA-B:CL: 0%	27%	2%	25%	1%	19%
SWA-C:CL: 0%	33%	57%	41%	56%	17%
SWA-U:BG: 0%	0%	1%	0%	0%	0%
SWA-U:ES: 0%	0%	0%	0%	0%	0%
SWA-U:ET: 0%	0%	0%	0%	0%	0%
SWA-U:SEP: 0%	4%	5%	3%	7%	7%
SWA-U:SES: 0%	34%	35%	28%	36%	31%
WDR-A:AL: 0%	4%	10%	6%	4%	6%
WDR-B:CL: 0%	0%	0%	1%	1%	0%
WDR-C:OP: 0%	4%	6%	1%	3%	4%
WDR-D:CL: 0%	0%	0%	0%	0%	0%
WDR-E:CL: 0%	1%	0%	0%	0%	1%
WDR-U:DE: 0%	0%	4%	1%	3%	0%
WDR-U:DEF: 0%	1%	1%	1%	3%	0%
WDR-U:DET: 0%	0%	0%	0%	0%	0%
WDR-U:DEX: 0%	0%	0%	0%	0%	0%
WDR-U:EF: 0%	19%	14%	24%	6%	24%
WDR-U:ET: 0%	0%	1%	1%	0%	0%
WDR-U:EX: 0%	19%	7%	13%	1%	7%
WDR-U:TEX: 0%	50%	57%	51%	79%	58%

Appendix 7. MAXIMUM MANAGEMENT scenario 50-year area results (acre) by vegetation class for ecological systems of Red Cliffs and Beaver Dam Wash NCA, Utah.

Red Cliffs NCA					
Ecological System × Vegetation Class	Run 1	Run 2	Run 3	Run 4	Run 5
BSu-A:AL: 0%	1%	6%	1%	2%	3%
BSu-B:OP: 0%	0%	0%	0%	0%	0%
BSu-C:CL: 0%	14%	8%	15%	9%	13%
BSu-D:OP: 0%	0%	0%	0%	0%	0%
BSu-E:CL: 0%	0%	0%	0%	0%	0%
BSu-U:DP: 0%	0%	0%	0%	0%	0%
BSu-U:ES: 0%	0%	0%	0%	0%	0%
BSu-U:EX: 0%	3%	1%	0%	1%	2%
BSu-U:SD: 0%	80%	84%	83%	86%	81%
BSu-U:SEP: 0%	0%	0%	0%	0%	0%
BSu-U:SES: 0%	0%	0%	0%	0%	0%
BSu-U:TE: 0%	1%	1%	1%	1%	1%
BSu-U:TEX: 0%	1%	1%	0%	1%	0%
BM-A:AL: 0%	3%	3%	3%	2%	3%
BM-B:JT: 0%	0%	0%	0%	0%	0%
BM-C:OP: 0%	0%	0%	0%	0%	0%
BM-D:OP: 0%	0%	0%	0%	0%	0%
BM-E:JT: 0%	0%	0%	0%	0%	0%
BM-U:BG: 0%	0%	0%	0%	0%	0%
BM-U:ES: 0%	0%	0%	0%	0%	0%
BM-U:EX: 0%	0%	1%	0%	0%	1%
BM-U:EX2B: 0%	0%	18%	1%	0%	13%
BM-U:PL: 0%	2%	7%	1%	3%	1%
BM-U:SD: 0%	0%	0%	0%	0%	0%
BM-U:SDI: 0%	0%	0%	0%	0%	0%
BM-U:SEP: 0%	94%	69%	95%	93%	82%
BM-U:SEPJ: 0%	0%	0%	0%	0%	0%
BM-U:TEX: 0%	2%	2%	1%	1%	1%
BT-A:AL: 0%	0%	0%	0%	0%	0%
BT-B:JT: 0%	0%	0%	0%	0%	0%
BT-C:CL: 0%	0%	0%	0%	0%	0%
BT-U:BG: 0%	0%	0%	0%	0%	0%
BT-U:ES: 0%	0%	0%	0%	0%	0%
BT-U:EX: 0%	1%	1%	0%	1%	1%
BT-U:EX2B: 0%	0%	9%	1%	2%	14%
BT-U:PL: 0%	2%	10%	2%	6%	2%
BT-U:SD: 0%	0%	0%	0%	0%	0%

BT-U:SDI: 0%	0%	0%	0%	0%	0%
BT-U:SEP: 0%	97%	79%	97%	90%	83%
BT-U:SEPJ: 0%	0%	0%	0%	0%	0%
CB-A:OP: 0%	0%	0%	0%	0%	0%
CB-B:JT: 0%	0%	0%	0%	0%	0%
CB-C:OP: 0%	0%	0%	0%	0%	0%
CB-D:JT: 0%	0%	0%	0%	0%	0%
CB-U:BG: 0%	0%	0%	0%	0%	0%
CB-U:ES: 0%	0%	0%	0%	0%	0%
CB-U:EX: 0%	3%	0%	1%	1%	2%
CB-U:EX2B: 0%	0%	0%	0%	0%	0%
CB-U:PL: 0%	4%	3%	3%	3%	4%
CB-U:SD: 0%	0%	0%	0%	0%	0%
CB-U:SDI: 0%	0%	0%	0%	0%	0%
CB-U:SEP: 0%	93%	96%	97%	95%	94%
CB-U:SEPJ: 0%	0%	0%	0%	0%	0%
DSS-A:OP: 0%	0%	0%	0%	0%	3%
DSS-B:OP: 0%	40%	41%	41%	40%	37%
DSS-U:DP: 0%	0%	0%	0%	0%	0%
DSS-U:SEP: 0%	60%	59%	59%	60%	60%
MM-A:AL: 0%	0%	0%	0%	0%	0%
MM-B:OP: 0%	0%	0%	0%	0%	0%
MM-C:CL: 0%	0%	0%	0%	0%	0%
MM-U:EX: 0%	0%	0%	0%	0%	0%
MM-U:TEX: 0%	0%	0%	0%	0%	0%
MR-A:AL: 0%	0%	2%	50%	0%	2%
MR-B:OP: 0%	62%	36%	24%	58%	34%
MR-C:CL: 0%	32%	62%	18%	40%	60%
MR-U:DE: 0%	0%	0%	0%	0%	0%
MR-U:EF: 0%	6%	0%	8%	2%	4%
MR-U:SFE: 0%	0%	0%	0%	0%	0%
MSh-A:AL: 0%	0%	20%	0%	0%	0%
MSh-B:CL: 0%	60%	60%	20%	75%	50%
MSh-C:CL: 0%	20%	0%	60%	25%	50%
MSh-D:OP: 0%	0%	0%	0%	0%	0%
MSh-U:ES: 0%	0%	0%	0%	0%	0%
MSh-U:EX: 0%	0%	0%	0%	0%	0%
MSh-U:SEP: 0%	0%	0%	0%	0%	0%
MSh-U:TE: 0%	20%	20%	20%	0%	0%
PJ-A:AL: 0%	2%	2%	1%	1%	1%
PJ-B:OP: 0%	0%	0%	0%	0%	0%
PJ-C:OP: 0%	3%	3%	3%	3%	3%
PJ-D:OP: 0%	28%	28%	30%	29%	29%
PJ-U:EX: 0%	1%	6%	1%	4%	4%

PJ-U:TEX: 0%	67%	60%	64%	62%	63%
SWA-A:AL: 0%	4%	2%	40%	1%	0%
SWA-B:CL: 0%	42%	31%	6%	42%	29%
SWA-C:CL: 0%	45%	64%	51%	52%	70%
SWA-U:BG: 0%	0%	0%	0%	0%	0%
SWA-U:ES: 0%	0%	0%	0%	0%	0%
SWA-U:ET: 0%	0%	0%	0%	0%	0%
SWA-U:SEP: 0%	3%	2%	1%	2%	0%
SWA-U:SES: 0%	6%	2%	2%	3%	1%
WDR-A:AL: 0%	3%	2%	20%	4%	6%
WDR-B:CL: 0%	9%	13%	4%	10%	9%
WDR-C:OP: 0%	8%	9%	5%	6%	8%
WDR-D:CL: 0%	7%	10%	4%	8%	9%
WDR-E:CL: 0%	56%	48%	49%	59%	52%
WDR-U:DE: 0%	0%	0%	0%	0%	0%
WDR-U:DEF: 0%	0%	0%	0%	0%	0%
WDR-U:DET: 0%	0%	0%	0%	0%	0%
WDR-U:DEX: 0%	0%	0%	0%	0%	0%
WDR-U:EF: 0%	0%	1%	1%	1%	3%
WDR-U:ET: 0%	0%	0%	1%	1%	2%
WDR-U:EX: 0%	1%	1%	4%	0%	0%
WDR-U:TEX: 0%	17%	15%	12%	12%	11%
GRL-A:AL: 0%	4%	5%	5%	4%	5%
GRL-B:OP: 0%	93%	93%	87%	95%	90%
GRL-U:DP: 0%	0%	0%	0%	0%	0%
GRL-U:EEX: 0%	0%	1%	0%	0%	1%
GRL-U:EX: 0%	0%	0%	0%	0%	0%
GRL-U:SES: 0%	3%	1%	7%	1%	4%

Beaver Dam Wash NCA					
Ecological System × Vegetation Class	Run 1	Run 2	Run 3	Run 4	Run 5
BSu-A:AL: 0%	0%	0%	0%	0%	0%
BSu-B:OP: 0%	0%	0%	0%	0%	0%
BSu-C:CL: 0%	0%	0%	0%	0%	0%
BSu-D:OP: 0%	0%	0%	0%	0%	0%
BSu-E:CL: 0%	0%	0%	0%	0%	0%
BSu-U:DP: 0%	0%	0%	0%	0%	0%
BSu-U:ES: 0%	0%	0%	0%	0%	0%
BSu-U:EX: 0%	90%	90%	100%	90%	100%
BSu-U:SD: 0%	0%	0%	0%	0%	0%
BSu-U:SEP: 0%	0%	0%	0%	0%	0%
BSu-U:SES: 0%	0%	0%	0%	10%	0%
BSu-U:TE: 0%	0%	0%	0%	0%	0%

BSu-U:TEX: 0%	10%	10%	0%	0%	0%
BM-A:AL: 0%	2%	2%	2%	1%	2%
BM-B:JT: 0%	0%	0%	0%	0%	0%
BM-C:OP: 0%	0%	0%	0%	0%	0%
BM-D:OP: 0%	0%	0%	0%	0%	0%
BM-E:JT: 0%	0%	0%	0%	0%	0%
BM-U:BG: 0%	0%	0%	0%	0%	0%
BM-U:ES: 0%	0%	0%	0%	0%	0%
BM-U:EX: 0%	0%	0%	0%	0%	0%
BM-U:EX2B: 0%	0%	0%	1%	0%	0%
BM-U:PL: 0%	2%	0%	3%	0%	1%
BM-U:SD: 0%	0%	0%	0%	0%	0%
BM-U:SDI: 0%	0%	0%	0%	0%	0%
BM-U:SEP: 0%	40%	41%	39%	40%	40%
BM-U:SEPJ: 0%	55%	56%	54%	57%	56%
BM-U:TEX: 0%	1%	1%	1%	1%	1%
BT-A:AL: 0%	0%	0%	0%	0%	0%
BT-B:JT: 0%	0%	0%	0%	0%	0%
BT-C:CL: 0%	0%	0%	0%	0%	0%
BT-U:BG: 0%	0%	0%	0%	0%	0%
BT-U:ES: 0%	0%	0%	0%	0%	0%
BT-U:EX: 0%	0%	0%	0%	0%	0%
BT-U:EX2B: 0%	0%	0%	0%	0%	0%
BT-U:PL: 0%	2%	0%	3%	0%	1%
BT-U:SD: 0%	0%	0%	0%	0%	0%
BT-U:SDI: 0%	0%	0%	0%	0%	0%
BT-U:SEP: 0%	46%	47%	45%	45%	46%
BT-U:SEPJ: 0%	52%	53%	51%	55%	53%
CB-A:OP: 0%	0%	0%	0%	0%	0%
CB-B:JT: 0%	0%	0%	0%	0%	0%
CB-C:OP: 0%	0%	0%	0%	0%	0%
CB-D:JT: 0%	0%	0%	0%	0%	0%
CB-U:BG: 0%	0%	0%	0%	0%	0%
CB-U:ES: 0%	0%	0%	0%	0%	0%
CB-U:EX: 0%	0%	1%	2%	2%	0%
CB-U:EX2B: 0%	0%	0%	0%	0%	0%
CB-U:PL: 0%	1%	3%	4%	4%	2%
CB-U:SD: 0%	0%	0%	0%	0%	0%
CB-U:SDI: 0%	0%	0%	0%	0%	0%
CB-U:SEP: 0%	35%	35%	33%	33%	35%
CB-U:SEPJ: 0%	64%	62%	61%	60%	63%
MSh-A:AL: 0%	7%	0%	27%	1%	6%
MSh-B:CL: 0%	42%	3%	20%	3%	30%
MSh-C:CL: 0%	35%	74%	26%	78%	38%

MSh-D:OP: 0%	15%	22%	26%	17%	25%
MSh-U:ES: 0%	0%	0%	0%	0%	0%
MSh-U:EX: 0%	0%	0%	0%	0%	0%
MSh-U:SEP: 0%	0%	1%	1%	0%	0%
MSh-U:TE: 0%	0%	0%	0%	0%	0%
PJ-A:AL: 0%	9%	1%	16%	1%	2%
PJ-B:OP: 0%	21%	12%	15%	3%	17%
PJ-C:OP: 0%	56%	72%	53%	80%	67%
PJ-D:OP: 0%	5%	5%	6%	5%	5%
PJ-U:EX: 0%	0%	0%	1%	0%	0%
PJ-U:TEX: 0%	10%	10%	9%	12%	9%
SWA-A:AL: 0%	1%	0%	1%	0%	11%
SWA-B:CL: 0%	14%	1%	13%	1%	23%
SWA-C:CL: 0%	85%	97%	85%	97%	64%
SWA-U:BG: 0%	0%	0%	0%	0%	0%
SWA-U:ES: 0%	0%	0%	0%	0%	0%
SWA-U:ET: 0%	0%	0%	0%	0%	0%
SWA-U:SEP: 0%	1%	2%	1%	1%	1%
SWA-U:SES: 0%	0%	0%	0%	0%	0%
WDR-A:AL: 0%	0%	5%	3%	0%	3%
WDR-B:CL: 0%	51%	18%	25%	8%	15%
WDR-C:OP: 0%	12%	15%	15%	3%	11%
WDR-D:CL: 0%	7%	8%	14%	19%	21%
WDR-E:CL: 0%	23%	47%	36%	64%	47%
WDR-U:DE: 0%	4%	5%	5%	3%	3%
WDR-U:DEF: 0%	0%	0%	0%	0%	0%
WDR-U:DET: 0%	0%	0%	0%	0%	0%
WDR-U:DEX: 0%	0%	0%	0%	0%	0%
WDR-U:EF: 0%	3%	1%	1%	3%	0%
WDR-U:ET: 0%	0%	0%	0%	0%	0%
WDR-U:EX: 0%	0%	0%	0%	0%	0%
WDR-U:TEX: 0%	0%	0%	1%	0%	1%

Appendix 8. STREAMLINED MANAGEMENT scenario areas (acre) by vegetation class for ecological systems of the Red Cliffs and Beaver Dam Wash NCAs.

Red Cliffs NCA					
Ecological System × Vegetation Class	Run 1	Run 2	Run 3	Run 4	Run 5
BSu-A:AL: 0%	14%	1%	12%	0%	7%
BSu-B:OP: 0%	6%	18%	9%	14%	13%
BSu-C:CL: 0%	4%	5%	2%	11%	6%
BSu-D:OP: 0%	0%	0%	0%	0%	0%
BSu-E:CL: 0%	0%	0%	0%	0%	0%
BSu-U:DP: 0%	0%	0%	0%	0%	0%
BSu-U:ES: 0%	0%	0%	0%	0%	0%
BSu-U:EX: 0%	0%	0%	0%	0%	0%
BSu-U:SD: 0%	76%	74%	76%	73%	73%
BSu-U:SEP: 0%	0%	0%	0%	0%	0%
BSu-U:SES: 0%	0%	0%	0%	0%	0%
BSu-U:TE: 0%	0%	0%	0%	1%	0%
BSu-U:TEX: 0%	0%	0%	0%	1%	0%
BM-A:AL: 0%	2%	2%	2%	1%	2%
BM-B:JT: 0%	0%	0%	0%	0%	0%
BM-C:OP: 0%	0%	0%	0%	0%	0%
BM-D:OP: 0%	0%	0%	0%	0%	0%
BM-E:JT: 0%	0%	0%	0%	0%	0%
BM-U:BG: 0%	0%	0%	0%	0%	0%
BM-U:ES: 0%	0%	0%	0%	0%	0%
BM-U:EX: 0%	0%	0%	0%	0%	0%
BM-U:EX2B: 0%	1%	0%	7%	0%	1%
BM-U:PL: 0%	9%	0%	9%	0%	2%
BM-U:SD: 0%	0%	0%	0%	0%	0%
BM-U:SDI: 0%	0%	0%	0%	0%	0%
BM-U:SEP: 0%	87%	95%	80%	95%	93%
BM-U:SEPJ: 0%	0%	0%	0%	0%	0%
BM-U:TEX: 0%	2%	2%	1%	3%	2%
BT-A:AL: 0%	0%	0%	0%	0%	0%
BT-B:JT: 0%	0%	0%	0%	0%	0%
BT-C:CL: 0%	0%	0%	0%	0%	0%
BT-U:BG: 0%	0%	0%	0%	0%	0%
BT-U:ES: 0%	0%	0%	0%	0%	0%
BT-U:EX: 0%	4%	1%	3%	0%	2%
BT-U:EX2B: 0%	0%	0%	4%	0%	1%
BT-U:PL: 0%	12%	2%	12%	1%	5%
BT-U:SD: 0%	0%	0%	0%	0%	0%

BT-U:SDI: 0%	0%	0%	0%	0%	0%
BT-U:SEP: 0%	84%	97%	81%	99%	92%
BT-U:SEPJ: 0%	0%	0%	0%	0%	0%
CB-A:OP: 0%	0%	0%	0%	0%	0%
CB-B:JT: 0%	0%	0%	0%	0%	0%
CB-C:OP: 0%	0%	0%	0%	0%	0%
CB-D:JT: 0%	0%	0%	0%	0%	0%
CB-U:BG: 0%	0%	0%	0%	0%	0%
CB-U:ES: 0%	0%	0%	0%	0%	0%
CB-U:EX: 0%	0%	2%	4%	5%	0%
CB-U:EX2B: 0%	0%	0%	0%	0%	0%
CB-U:PL: 0%	1%	3%	2%	3%	2%
CB-U:SD: 0%	0%	0%	0%	0%	0%
CB-U:SDI: 0%	0%	0%	0%	0%	0%
CB-U:SEP: 0%	99%	95%	94%	91%	97%
CB-U:SEPJ: 0%	0%	0%	0%	0%	0%
DSS-A:OP: 0%	0%	0%	0%	0%	0%
DSS-B:OP: 0%	100%	100%	100%	100%	100%
DSS-U:DP: 0%	0%	0%	0%	0%	0%
DSS-U:SEP: 0%	0%	0%	0%	0%	0%
MR-A:AL: 0%	0%	4%	2%	0%	0%
MR-B:OP: 0%	56%	18%	46%	6%	16%
MR-C:CL: 0%	42%	74%	48%	92%	84%
MR-U:DE: 0%	0%	0%	0%	0%	0%
MR-U:EF: 0%	2%	4%	4%	2%	0%
MR-U:SFE: 0%	0%	0%	0%	0%	0%
MSh-A:AL: 0%	0%	0%	0%	20%	0%
MSh-B:CL: 0%	40%	0%	50%	0%	20%
MSh-C:CL: 0%	20%	80%	50%	60%	40%
MSh-D:OP: 0%	20%	0%	0%	20%	20%
MSh-U:ES: 0%	20%	0%	0%	0%	0%
MSh-U:EX: 0%	0%	0%	0%	0%	0%
MSh-U:SEP: 0%	0%	0%	0%	0%	0%
MSh-U:TE: 0%	0%	20%	0%	0%	20%
PJ-A:AL: 0%	4%	0%	7%	0%	1%
PJ-B:OP: 0%	9%	11%	10%	5%	11%
PJ-C:OP: 0%	15%	19%	16%	18%	15%
PJ-D:OP: 0%	61%	61%	57%	62%	64%
PJ-U:EX: 0%	0%	0%	0%	0%	0%
PJ-U:TEX: 0%	10%	8%	10%	15%	9%
SWA-A:AL: 0%	2%	0%	1%	0%	20%
SWA-B:CL: 0%	16%	2%	19%	3%	29%
SWA-C:CL: 0%	80%	96%	80%	91%	49%
SWA-U:BG: 0%	0%	0%	0%	0%	0%

SWA-U:ES: 0%	0%	0%	0%	0%	0%
SWA-U:ET: 0%	0%	0%	0%	0%	0%
SWA-U:SEP: 0%	1%	2%	0%	4%	2%
SWA-U:SES: 0%	0%	0%	0%	1%	0%
WDR-A:AL: 0%	1%	12%	5%	1%	2%
WDR-B:CL: 0%	46%	18%	40%	7%	14%
WDR-C:OP: 0%	9%	12%	11%	9%	14%
WDR-D:CL: 0%	16%	17%	14%	23%	31%
WDR-E:CL: 0%	25%	38%	24%	57%	33%
WDR-U:DE: 0%	0%	0%	0%	0%	0%
WDR-U:DEF: 0%	0%	0%	0%	0%	0%
WDR-U:DET: 0%	0%	0%	0%	0%	0%
WDR-U:DEX: 0%	0%	0%	0%	0%	0%
WDR-U:EF: 0%	3%	2%	6%	2%	2%
WDR-U:ET: 0%	1%	0%	1%	1%	0%
WDR-U:EX: 0%	0%	0%	0%	0%	0%
WDR-U:TEX: 0%	0%	2%	1%	1%	3%
GRL-A:AL: 0%	0%	2%	1%	2%	1%
GRL-B:OP: 0%	100%	97%	98%	96%	98%
GRL-U:DP: 0%	0%	0%	0%	0%	0%
GRL-U:EEX: 0%	0%	0%	0%	0%	1%
GRL-U:EX: 0%	0%	0%	0%	0%	0%
GRL-U:SES: 0%	0%	2%	2%	2%	1%

Beaver Dam Wash NCA					
Ecological System × Vegetation Class	Run 1	Run 2	Run 3	Run 4	Run 5
BSu-A:AL: 0%	0%	0%	0%	0%	0%
BSu-B:OP: 0%	0%	0%	0%	0%	0%
BSu-C:CL: 0%	0%	0%	0%	0%	0%
BSu-D:OP: 0%	0%	0%	0%	0%	0%
BSu-E:CL: 0%	0%	0%	0%	0%	0%
BSu-U:DP: 0%	0%	0%	0%	0%	0%
BSu-U:ES: 0%	0%	0%	0%	0%	0%
BSu-U:EX: 0%	89%	100%	89%	100%	100%
BSu-U:SD: 0%	0%	0%	0%	0%	0%
BSu-U:SEP: 0%	0%	0%	0%	0%	0%
BSu-U:SES: 0%	0%	0%	0%	0%	0%
BSu-U:TE: 0%	0%	0%	0%	0%	0%
BSu-U:TEX: 0%	11%	0%	11%	0%	0%
BM-A:AL: 0%	1%	1%	2%	1%	1%
BM-B:JT: 0%	0%	0%	0%	0%	0%
BM-C:OP: 0%	0%	0%	0%	0%	0%
BM-D:OP: 0%	0%	0%	0%	0%	0%

BM-E:JT: 0%	0%	0%	0%	0%	0%
BM-U:BG: 0%	0%	0%	0%	0%	0%
BM-U:ES: 0%	0%	0%	0%	0%	0%
BM-U:EX: 0%	0%	0%	0%	0%	0%
BM-U:EX2B: 0%	0%	0%	2%	0%	0%
BM-U:PL: 0%	2%	0%	3%	0%	1%
BM-U:SD: 0%	0%	0%	0%	0%	0%
BM-U:SDI: 0%	0%	0%	0%	0%	0%
BM-U:SEP: 0%	40%	41%	38%	40%	40%
BM-U:SEPJ: 0%	56%	57%	54%	58%	57%
BM-U:TEX: 0%	1%	1%	1%	1%	1%
BT-A:AL: 0%	0%	0%	0%	0%	0%
BT-B:JT: 0%	0%	0%	0%	0%	0%
BT-C:CL: 0%	0%	0%	0%	0%	0%
BT-U:BG: 0%	0%	0%	0%	0%	0%
BT-U:ES: 0%	0%	0%	0%	0%	0%
BT-U:EX: 0%	0%	0%	0%	0%	0%
BT-U:EX2B: 0%	0%	0%	0%	0%	0%
BT-U:PL: 0%	2%	0%	3%	0%	1%
BT-U:SD: 0%	0%	0%	0%	0%	0%
BT-U:SDI: 0%	0%	0%	0%	0%	0%
BT-U:SEP: 0%	45%	47%	44%	46%	46%
BT-U:SEPJ: 0%	53%	52%	52%	53%	53%
CB-A:OP: 0%	0%	0%	0%	0%	0%
CB-B:JT: 0%	0%	0%	0%	0%	0%
CB-C:OP: 0%	0%	0%	0%	0%	0%
CB-D:JT: 0%	0%	0%	0%	0%	0%
CB-U:BG: 0%	0%	0%	0%	0%	0%
CB-U:ES: 0%	0%	0%	0%	0%	0%
CB-U:EX: 0%	0%	1%	2%	2%	0%
CB-U:EX2B: 0%	0%	0%	0%	0%	0%
CB-U:PL: 0%	2%	3%	4%	4%	2%
CB-U:SD: 0%	0%	0%	0%	0%	0%
CB-U:SDI: 0%	0%	0%	0%	0%	0%
CB-U:SEP: 0%	35%	34%	33%	34%	34%
CB-U:SEPJ: 0%	63%	63%	60%	60%	63%
MSh-A:AL: 0%	9%	1%	25%	0%	1%
MSh-B:CL: 0%	40%	1%	21%	1%	29%
MSh-C:CL: 0%	33%	75%	32%	83%	45%
MSh-D:OP: 0%	17%	22%	22%	16%	24%
MSh-U:ES: 0%	0%	0%	0%	0%	1%
MSh-U:EX: 0%	0%	0%	0%	0%	0%
MSh-U:SEP: 0%	0%	2%	0%	0%	0%
MSh-U:TE: 0%	0%	0%	0%	0%	0%

PJ-A:AL: 0%	9%	2%	10%	1%	2%
PJ-B:OP: 0%	16%	10%	15%	1%	19%
PJ-C:OP: 0%	60%	73%	62%	82%	64%
PJ-D:OP: 0%	5%	6%	4%	5%	5%
PJ-U:EX: 0%	0%	0%	0%	1%	0%
PJ-U:TEX: 0%	10%	9%	9%	11%	10%
SWA-A:AL: 0%	1%	0%	1%	0%	12%
SWA-B:CL: 0%	14%	2%	13%	1%	21%
SWA-C:CL: 0%	85%	96%	85%	97%	66%
SWA-U:BG: 0%	0%	0%	0%	0%	0%
SWA-U:ES: 0%	0%	0%	0%	0%	0%
SWA-U:ET: 0%	0%	0%	0%	0%	0%
SWA-U:SEP: 0%	1%	1%	1%	1%	2%
SWA-U:SES: 0%	0%	0%	0%	0%	0%
WDR-A:AL: 0%	0%	5%	3%	0%	3%
WDR-B:CL: 0%	51%	18%	25%	8%	15%
WDR-C:OP: 0%	12%	15%	15%	3%	11%
WDR-D:CL: 0%	7%	8%	14%	19%	21%
WDR-E:CL: 0%	23%	47%	36%	64%	47%
WDR-U:DE: 0%	4%	5%	5%	3%	3%
WDR-U:DEF: 0%	0%	0%	0%	0%	0%
WDR-U:DET: 0%	0%	0%	0%	0%	0%
WDR-U:DEX: 0%	0%	0%	0%	0%	0%
WDR-U:EF: 0%	3%	1%	1%	3%	0%
WDR-U:ET: 0%	0%	0%	0%	0%	0%
WDR-U:EX: 0%	0%	0%	0%	0%	0%
WDR-U:TEX: 0%	0%	0%	1%	0%	1%

Appendix 9. PLANTING AND HERBICIDE-ONLY MANAGEMENT scenario areas (acre) by vegetation class for ecological systems of the Red Cliffs and Beaver Dam Wash NCAs.

Red Cliffs NCA					
Ecological System × Vegetation Class	Run 1	Run 2	Run 3	Run 4	Run 5
BSu-A:AL: 0%	1%	0%	1%	0%	1%
BSu-B:OP: 0%	0%	2%	1%	1%	1%
BSu-C:CL: 0%	0%	0%	0%	0%	0%
BSu-D:OP: 0%	0%	0%	0%	0%	0%
BSu-E:CL: 0%	0%	0%	0%	0%	0%
BSu-U:DP: 0%	0%	0%	0%	0%	0%
BSu-U:ES: 0%	1%	0%	1%	0%	1%
BSu-U:EX: 0%	95%	93%	94%	87%	93%
BSu-U:SD: 0%	0%	0%	0%	0%	0%
BSu-U:SEP: 0%	0%	1%	0%	7%	1%
BSu-U:SES: 0%	0%	0%	0%	0%	0%
BSu-U:TE: 0%	2%	3%	2%	3%	2%
BSu-U:TEX: 0%	1%	2%	1%	3%	1%
BM-A:AL: 0%	3%	3%	3%	1%	2%
BM-B:JT: 0%	0%	0%	0%	0%	0%
BM-C:OP: 0%	0%	0%	0%	0%	0%
BM-D:OP: 0%	0%	0%	0%	0%	0%
BM-E:JT: 0%	0%	0%	0%	0%	0%
BM-U:BG: 0%	0%	0%	0%	0%	0%
BM-U:ES: 0%	0%	0%	0%	0%	0%
BM-U:EX: 0%	0%	0%	2%	0%	0%
BM-U:EX2B: 0%	0%	1%	27%	0%	1%
BM-U:PL: 0%	20%	1%	19%	1%	7%
BM-U:SD: 0%	0%	0%	0%	0%	0%
BM-U:SDI: 0%	0%	0%	0%	0%	0%
BM-U:SEP: 0%	74%	93%	49%	95%	88%
BM-U:SEPJ: 0%	0%	0%	0%	0%	0%
BM-U:TEX: 0%	2%	2%	1%	3%	2%
BT-A:AL: 0%	0%	0%	0%	0%	0%
BT-B:JT: 0%	0%	0%	0%	0%	0%
BT-C:CL: 0%	0%	0%	0%	0%	0%
BT-U:BG: 0%	0%	0%	0%	0%	0%
BT-U:ES: 0%	0%	0%	0%	0%	0%
BT-U:EX: 0%	7%	2%	8%	1%	4%
BT-U:EX2B: 0%	0%	1%	5%	0%	1%
BT-U:PL: 0%	31%	6%	37%	2%	17%
BT-U:SD: 0%	0%	0%	0%	0%	0%
BT-U:SDI: 0%	0%	0%	0%	0%	0%

BT-U:SEP: 0%	62%	91%	50%	96%	78%
BT-U:SEPJ: 0%	0%	0%	0%	0%	0%
CB-A:OP: 0%	0%	0%	0%	0%	0%
CB-B:JT: 0%	0%	0%	0%	0%	0%
CB-C:OP: 0%	0%	0%	0%	0%	0%
CB-D:JT: 0%	0%	0%	0%	0%	0%
CB-U:BG: 0%	0%	0%	0%	0%	0%
CB-U:ES: 0%	0%	0%	0%	0%	0%
CB-U:EX: 0%	0%	0%	4%	2%	0%
CB-U:EX2B: 0%	0%	0%	1%	0%	0%
CB-U:PL: 0%	2%	2%	4%	3%	2%
CB-U:SD: 0%	0%	0%	0%	0%	0%
CB-U:SDI: 0%	0%	0%	0%	0%	0%
CB-U:SEP: 0%	98%	97%	91%	94%	98%
CB-U:SEPJ: 0%	0%	0%	0%	0%	0%
DSS-A:OP: 0%	0%	0%	0%	0%	0%
DSS-B:OP: 0%	0%	0%	0%	0%	0%
DSS-U:DP: 0%	0%	0%	0%	0%	0%
DSS-U:SEP: 0%	100%	100%	100%	100%	100%
MR-A:AL: 0%	0%	0%	0%	0%	0%
MR-B:OP: 0%	0%	0%	0%	0%	0%
MR-C:CL: 0%	0%	0%	0%	0%	0%
MR-U:DE: 0%	0%	0%	0%	0%	0%
MR-U:EF: 0%	100%	100%	100%	100%	100%
MR-U:SFE: 0%	0%	0%	0%	0%	0%
MSh-A:AL: 0%	0%	0%	0%	0%	0%
MSh-B:CL: 0%	0%	0%	0%	0%	0%
MSh-C:CL: 0%	0%	0%	0%	0%	0%
MSh-D:OP: 0%	0%	0%	0%	0%	0%
MSh-U:ES: 0%	25%	0%	0%	0%	0%
MSh-U:EX: 0%	50%	0%	25%	0%	0%
MSh-U:SEP: 0%	25%	75%	50%	75%	75%
MSh-U:TE: 0%	0%	25%	25%	25%	25%
PJ-A:AL: 0%	0%	0%	0%	0%	0%
PJ-B:OP: 0%	0%	0%	0%	0%	0%
PJ-C:OP: 0%	0%	0%	0%	0%	0%
PJ-D:OP: 0%	0%	0%	0%	0%	0%
PJ-U:EX: 0%	22%	21%	24%	9%	19%
PJ-U:TEX: 0%	78%	79%	76%	91%	81%
SWA-A:AL: 0%	0%	0%	0%	0%	15%
SWA-B:CL: 0%	23%	2%	16%	1%	11%
SWA-C:CL: 0%	9%	29%	20%	29%	9%
SWA-U:BG: 0%	0%	0%	0%	0%	0%
SWA-U:ES: 0%	0%	0%	0%	0%	0%

SWA-U:ET: 0%	0%	0%	0%	0%	0%
SWA-U:SEP: 0%	11%	13%	7%	12%	9%
SWA-U:SES: 0%	56%	57%	56%	57%	56%
WDR-A:AL: 0%	0%	3%	1%	0%	2%
WDR-B:CL: 0%	13%	8%	15%	3%	7%
WDR-C:OP: 0%	4%	7%	6%	8%	11%
WDR-D:CL: 0%	7%	4%	3%	7%	9%
WDR-E:CL: 0%	7%	3%	4%	10%	7%
WDR-U:DE: 0%	0%	0%	0%	0%	0%
WDR-U:DEF: 0%	0%	0%	0%	0%	0%
WDR-U:DET: 0%	0%	0%	0%	0%	0%
WDR-U:DEX: 0%	0%	0%	0%	0%	0%
WDR-U:EF: 0%	28%	34%	30%	31%	30%
WDR-U:ET: 0%	1%	1%	2%	1%	0%
WDR-U:EX: 0%	0%	0%	4%	0%	0%
WDR-U:TEX: 0%	41%	40%	35%	41%	34%
GRL-A:AL: 0%	0%	0%	0%	0%	0%
GRL-B:OP: 0%	0%	0%	0%	0%	0%
GRL-U:DP: 0%	0%	0%	0%	0%	0%
GRL-U:EEX: 0%	3%	3%	3%	3%	3%
GRL-U:EX: 0%	0%	0%	0%	0%	0%
GRL-U:SES: 0%	97%	97%	97%	97%	97%

Beaver Dam Wash NCA					
Ecological System × Vegetation Class	Run 1	Run 2	Run 3	Run 4	Run 5
BSu-A:AL: 0%	0%	0%	0%	0%	0%
BSu-B:OP: 0%	0%	0%	0%	0%	0%
BSu-C:CL: 0%	0%	0%	0%	0%	0%
BSu-D:OP: 0%	0%	0%	0%	0%	0%
BSu-E:CL: 0%	0%	0%	0%	0%	0%
BSu-U:DP: 0%	0%	0%	0%	0%	0%
BSu-U:ES: 0%	0%	0%	0%	0%	0%
BSu-U:EX: 0%	100%	100%	100%	89%	100%
BSu-U:SD: 0%	0%	0%	0%	0%	0%
BSu-U:SEP: 0%	0%	0%	0%	0%	0%
BSu-U:SES: 0%	0%	0%	0%	11%	0%
BSu-U:TE: 0%	0%	0%	0%	0%	0%
BSu-U:TEX: 0%	0%	0%	0%	0%	0%
BM-A:AL: 0%	2%	2%	2%	1%	2%
BM-B:JT: 0%	0%	0%	0%	0%	0%
BM-C:OP: 0%	0%	0%	0%	0%	0%
BM-D:OP: 0%	0%	0%	0%	0%	0%
BM-E:JT: 0%	0%	0%	0%	0%	0%

BM-U:BG: 0%	0%	0%	0%	0%	0%
BM-U:ES: 0%	0%	0%	0%	0%	0%
BM-U:EX: 0%	0%	0%	1%	0%	0%
BM-U:EX2B: 0%	0%	0%	2%	0%	0%
BM-U:PL: 0%	3%	0%	5%	0%	1%
BM-U:SD: 0%	0%	0%	0%	0%	0%
BM-U:SDI: 0%	0%	0%	0%	0%	0%
BM-U:SEP: 0%	40%	41%	37%	41%	40%
BM-U:SEPJ: 0%	54%	56%	53%	56%	56%
BM-U:TEX: 0%	1%	1%	1%	1%	1%
BT-A:AL: 0%	0%	0%	0%	0%	0%
BT-B:JT: 0%	0%	0%	0%	0%	0%
BT-C:CL: 0%	0%	0%	0%	0%	0%
BT-U:BG: 0%	0%	0%	0%	0%	0%
BT-U:ES: 0%	0%	0%	0%	0%	0%
BT-U:EX: 0%	0%	0%	1%	0%	0%
BT-U:EX2B: 0%	0%	0%	1%	0%	0%
BT-U:PL: 0%	3%	0%	4%	0%	1%
BT-U:SD: 0%	0%	0%	0%	0%	0%
BT-U:SDI: 0%	0%	0%	0%	0%	0%
BT-U:SEP: 0%	44%	45%	42%	45%	46%
BT-U:SEPJ: 0%	53%	55%	51%	54%	53%
CB-A:OP: 0%	0%	0%	0%	0%	0%
CB-B:JT: 0%	0%	0%	0%	0%	0%
CB-C:OP: 0%	0%	0%	0%	0%	0%
CB-D:JT: 0%	0%	0%	0%	0%	0%
CB-U:BG: 0%	0%	0%	0%	0%	0%
CB-U:ES: 0%	0%	0%	0%	0%	0%
CB-U:EX: 0%	0%	1%	1%	2%	0%
CB-U:EX2B: 0%	0%	0%	0%	0%	0%
CB-U:PL: 0%	1%	2%	5%	4%	1%
CB-U:SD: 0%	0%	0%	0%	0%	0%
CB-U:SDI: 0%	0%	0%	0%	0%	0%
CB-U:SEP: 0%	35%	34%	33%	34%	35%
CB-U:SEPJ: 0%	63%	63%	61%	60%	63%
MSh-A:AL: 0%	0%	0%	0%	0%	0%
MSh-B:CL: 0%	0%	0%	0%	0%	0%
MSh-C:CL: 0%	0%	0%	0%	0%	0%
MSh-D:OP: 0%	0%	0%	0%	0%	0%
MSh-U:ES: 0%	0%	0%	0%	0%	0%
MSh-U:EX: 0%	24%	2%	73%	1%	30%
MSh-U:SEP: 0%	76%	98%	27%	99%	70%
MSh-U:TE: 0%	0%	0%	0%	0%	0%
PJ-A:AL: 0%	0%	0%	0%	0%	0%

PJ-B:OP: 0%	0%	0%	0%	0%	0%
PJ-C:OP: 0%	0%	0%	0%	1%	0%
PJ-D:OP: 0%	6%	3%	6%	5%	5%
PJ-U:EX: 0%	83%	85%	85%	82%	85%
PJ-U:TEX: 0%	11%	11%	9%	12%	9%
SWA-A:AL: 0%	1%	0%	1%	0%	26%
SWA-B:CL: 0%	27%	1%	26%	1%	20%
SWA-C:CL: 0%	33%	56%	41%	55%	16%
SWA-U:BG: 0%	0%	0%	0%	0%	0%
SWA-U:ES: 0%	0%	0%	0%	0%	0%
SWA-U:ET: 0%	0%	0%	0%	0%	0%
SWA-U:SEP: 0%	4%	6%	4%	6%	6%
SWA-U:SES: 0%	35%	36%	29%	37%	32%
WDR-A:AL: 0%	0%	1%	1%	0%	3%
WDR-B:CL: 0%	18%	1%	8%	1%	1%
WDR-C:OP: 0%	5%	5%	3%	3%	8%
WDR-D:CL: 0%	3%	1%	1%	4%	7%
WDR-E:CL: 0%	0%	1%	0%	0%	0%
WDR-U:DE: 0%	3%	0%	1%	1%	0%
WDR-U:DEF: 0%	0%	0%	0%	0%	0%
WDR-U:DET: 0%	0%	0%	0%	0%	0%
WDR-U:DEX: 0%	0%	0%	0%	0%	0%
WDR-U:EF: 0%	36%	40%	32%	30%	40%
WDR-U:ET: 0%	0%	0%	4%	0%	0%
WDR-U:EX: 0%	0%	0%	7%	0%	0%
WDR-U:TEX: 0%	36%	49%	42%	60%	41%

Appendix 10. PLANTING AND HERBICIDE & LLVESTOCK CLOSURE-ONLY MANAGEMENT scenario areas (acre) by vegetation class for ecological systems of the Beaver Dam Wash NCA.

Ecological System × Vegetation Class	Run 1	Run 2	Run 3	Run 4	Run 5
BSu-A:AL: 0%	0%	0%	0%	0%	0%
BSu-B:OP: 0%	0%	0%	0%	0%	0%
BSu-C:CL: 0%	0%	0%	0%	0%	0%
BSu-D:OP: 0%	0%	0%	0%	0%	0%
BSu-E:CL: 0%	0%	0%	0%	0%	0%
BSu-U:DP: 0%	0%	0%	0%	0%	0%
BSu-U:ES: 0%	0%	0%	0%	0%	0%
BSu-U:EX: 0%	100%	100%	100%	100%	100%
BSu-U:SD: 0%	0%	0%	0%	0%	0%
BSu-U:SEP: 0%	0%	0%	0%	0%	0%
BSu-U:SES: 0%	0%	0%	0%	0%	0%
BSu-U:TE: 0%	0%	0%	0%	0%	0%
BSu-U:TEX: 0%	0%	0%	0%	0%	0%
BM-A:AL: 0%	2%	2%	2%	1%	2%
BM-B:JT: 0%	0%	0%	0%	0%	0%
BM-C:OP: 0%	0%	0%	0%	0%	0%
BM-D:OP: 0%	0%	0%	0%	0%	0%
BM-E:JT: 0%	0%	0%	0%	0%	0%
BM-U:BG: 0%	0%	0%	0%	0%	0%
BM-U:ES: 0%	0%	0%	0%	0%	0%
BM-U:EX: 0%	0%	0%	0%	0%	0%
BM-U:EX2B: 0%	0%	0%	1%	0%	0%
BM-U:PL: 0%	3%	0%	5%	0%	1%
BM-U:SD: 0%	0%	0%	0%	0%	0%
BM-U:SDI: 0%	0%	0%	0%	0%	0%
BM-U:SEP: 0%	40%	41%	39%	41%	41%
BM-U:SEPJ: 0%	54%	56%	52%	56%	55%
BM-U:TEX: 0%	1%	1%	1%	1%	1%
BT-A:AL: 0%	0%	0%	0%	0%	0%
BT-B:JT: 0%	0%	0%	0%	0%	0%
BT-C:CL: 0%	0%	0%	0%	0%	0%
BT-U:BG: 0%	0%	0%	0%	0%	0%
BT-U:ES: 0%	0%	0%	0%	0%	0%
BT-U:EX: 0%	0%	0%	0%	0%	0%
BT-U:EX2B: 0%	0%	0%	1%	0%	0%
BT-U:PL: 0%	4%	0%	5%	0%	1%
BT-U:SD: 0%	0%	0%	0%	0%	0%
BT-U:SDI: 0%	0%	0%	0%	0%	0%
BT-U:SEP: 0%	44%	45%	41%	45%	45%

BT-U:SEPJ: 0%	52%	54%	53%	55%	54%
CB-A:OP: 0%	0%	0%	0%	0%	0%
CB-B:JT: 0%	0%	0%	0%	0%	0%
CB-C:OP: 0%	0%	0%	0%	0%	0%
CB-D:JT: 0%	0%	0%	0%	0%	0%
CB-U:BG: 0%	0%	0%	0%	0%	0%
CB-U:ES: 0%	0%	0%	0%	0%	0%
CB-U:EX: 0%	0%	1%	1%	1%	0%
CB-U:EX2B: 0%	0%	0%	0%	0%	0%
CB-U:PL: 0%	2%	3%	6%	4%	2%
CB-U:SD: 0%	0%	0%	0%	0%	0%
CB-U:SDI: 0%	0%	0%	0%	0%	0%
CB-U:SEP: 0%	35%	35%	33%	34%	35%
CB-U:SEPJ: 0%	63%	62%	60%	60%	63%
MSh-A:AL: 0%	0%	0%	0%	0%	0%
MSh-B:CL: 0%	0%	0%	0%	0%	0%
MSh-C:CL: 0%	0%	0%	0%	0%	0%
MSh-D:OP: 0%	0%	0%	0%	0%	0%
MSh-U:ES: 0%	0%	0%	0%	0%	0%
MSh-U:EX: 0%	26%	5%	78%	1%	17%
MSh-U:SEP: 0%	74%	95%	22%	99%	83%
MSh-U:TE: 0%	0%	0%	0%	0%	0%
PJ-A:AL: 0%	0%	0%	0%	0%	0%
PJ-B:OP: 0%	0%	0%	0%	0%	0%
PJ-C:OP: 0%	0%	0%	1%	1%	1%
PJ-D:OP: 0%	5%	6%	5%	5%	5%
PJ-U:EX: 0%	85%	86%	85%	84%	83%
PJ-U:TEX: 0%	10%	8%	9%	10%	12%
SWA-A:AL: 0%	0%	0%	0%	0%	9%
SWA-B:CL: 0%	10%	1%	10%	1%	15%
SWA-C:CL: 0%	60%	67%	62%	65%	46%
SWA-U:BG: 0%	0%	0%	0%	0%	0%
SWA-U:ES: 0%	0%	0%	0%	0%	0%
SWA-U:ET: 0%	0%	0%	0%	0%	0%
SWA-U:SEP: 0%	9%	11%	7%	13%	10%
SWA-U:SES: 0%	21%	21%	21%	21%	21%
WDR-A:AL: 0%	0%	1%	1%	0%	3%
WDR-B:CL: 0%	18%	1%	8%	1%	1%
WDR-C:OP: 0%	5%	5%	3%	3%	8%
WDR-D:CL: 0%	3%	1%	1%	4%	7%
WDR-E:CL: 0%	0%	1%	0%	0%	0%
WDR-U:DE: 0%	3%	0%	1%	1%	0%
WDR-U:DEF: 0%	0%	0%	0%	0%	0%
WDR-U:DET: 0%	0%	0%	0%	0%	0%

WDR-U:DEX: 0%	0%	0%	0%	0%	0%
WDR-U:EF: 0%	36%	40%	32%	30%	40%
WDR-U:ET: 0%	0%	0%	4%	0%	0%
WDR-U:EX: 0%	0%	0%	7%	0%	0%
WDR-U:TEX: 0%	36%	49%	42%	60%	41%

Appendix 11. FUEL-BREAK-ONLY MANAGEMENT scenario areas (acre) by vegetation class for ecological systems of the Red Cliffs and Beaver Dam Wash NCAs.

Red Cliffs NCA					
Ecological System × Vegetation Class	Run 1	Run 2	Run 3	Run 4	Run 5
BSu-A:AL: 0%	1%	0%	1%	0%	1%
BSu-B:OP: 0%	0%	2%	1%	1%	1%
BSu-C:CL: 0%	0%	0%	0%	0%	0%
BSu-D:OP: 0%	0%	0%	0%	0%	0%
BSu-E:CL: 0%	0%	0%	0%	0%	0%
BSu-U:DP: 0%	0%	0%	0%	0%	0%
BSu-U:ES: 0%	1%	1%	1%	0%	1%
BSu-U:EX: 0%	94%	93%	94%	87%	93%
BSu-U:SD: 0%	0%	0%	0%	0%	0%
BSu-U:SEP: 0%	0%	0%	0%	6%	1%
BSu-U:SES: 0%	0%	0%	0%	0%	0%
BSu-U:TE: 0%	2%	2%	2%	3%	2%
BSu-U:TEX: 0%	2%	2%	1%	3%	1%
BM-A:AL: 0%	0%	0%	0%	0%	0%
BM-B:JT: 0%	0%	0%	0%	0%	0%
BM-C:OP: 0%	0%	0%	0%	0%	0%
BM-D:OP: 0%	0%	0%	0%	0%	0%
BM-E:JT: 0%	0%	0%	0%	0%	0%
BM-U:BG: 0%	0%	0%	0%	0%	0%
BM-U:ES: 0%	0%	0%	0%	0%	0%
BM-U:EX: 0%	3%	1%	3%	1%	3%
BM-U:EX2B: 0%	59%	52%	62%	23%	51%
BM-U:PL: 0%	0%	0%	0%	0%	0%
BM-U:SD: 0%	0%	0%	0%	0%	0%
BM-U:SDI: 0%	0%	0%	0%	0%	0%
BM-U:SEP: 0%	37%	44%	34%	73%	44%
BM-U:SEPJ: 0%	0%	0%	0%	0%	0%
BM-U:TEX: 0%	2%	2%	1%	3%	2%
BT-A:AL: 0%	0%	0%	0%	0%	0%
BT-B:JT: 0%	0%	0%	0%	0%	0%
BT-C:CL: 0%	0%	0%	0%	0%	0%
BT-U:BG: 0%	0%	0%	0%	0%	0%
BT-U:ES: 0%	0%	0%	0%	0%	0%
BT-U:EX: 0%	3%	2%	3%	1%	3%
BT-U:EX2B: 0%	57%	42%	61%	18%	46%
BT-U:PL: 0%	0%	0%	0%	0%	0%
BT-U:SD: 0%	0%	0%	0%	0%	0%
BT-U:SDI: 0%	0%	0%	0%	0%	0%

BT-U:SEP: 0%	41%	56%	36%	81%	50%
BT-U:SEPJ: 0%	0%	0%	0%	0%	0%
CB-A:OP: 0%	0%	0%	0%	0%	0%
CB-B:JT: 0%	0%	0%	0%	0%	0%
CB-C:OP: 0%	0%	0%	0%	0%	0%
CB-D:JT: 0%	0%	0%	0%	0%	0%
CB-U:BG: 0%	0%	0%	0%	0%	0%
CB-U:ES: 0%	0%	0%	0%	0%	0%
CB-U:EX: 0%	9%	19%	11%	22%	12%
CB-U:EX2B: 0%	18%	11%	21%	9%	13%
CB-U:PL: 0%	0%	0%	0%	0%	0%
CB-U:SD: 0%	0%	0%	0%	0%	0%
CB-U:SDI: 0%	0%	0%	0%	0%	0%
CB-U:SEP: 0%	73%	70%	69%	69%	76%
CB-U:SEPJ: 0%	0%	0%	0%	0%	0%
DSS-A:OP: 0%	0%	0%	0%	0%	0%
DSS-B:OP: 0%	0%	0%	0%	0%	0%
DSS-U:DP: 0%	0%	0%	0%	0%	0%
DSS-U:SEP: 0%	100%	100%	100%	100%	100%
MR-A:AL: 0%	0%	0%	0%	0%	0%
MR-B:OP: 0%	0%	0%	0%	0%	0%
MR-C:CL: 0%	0%	0%	0%	0%	0%
MR-U:DE: 0%	0%	0%	0%	0%	0%
MR-U:EF: 0%	100%	100%	100%	100%	100%
MR-U:SFE: 0%	0%	0%	0%	0%	0%
MSh-A:AL: 0%	0%	0%	0%	0%	0%
MSh-B:CL: 0%	0%	0%	0%	0%	0%
MSh-C:CL: 0%	0%	0%	0%	0%	0%
MSh-D:OP: 0%	0%	0%	0%	0%	0%
MSh-U:ES: 0%	25%	0%	0%	0%	0%
MSh-U:EX: 0%	0%	25%	50%	0%	0%
MSh-U:SEP: 0%	75%	50%	25%	75%	100%
MSh-U:TE: 0%	0%	25%	25%	25%	0%
PJ-A:AL: 0%	0%	0%	0%	0%	0%
PJ-B:OP: 0%	0%	0%	0%	0%	0%
PJ-C:OP: 0%	0%	0%	0%	0%	0%
PJ-D:OP: 0%	0%	0%	0%	0%	0%
PJ-U:EX: 0%	23%	19%	25%	9%	20%
PJ-U:TEX: 0%	77%	81%	75%	91%	80%
SWA-A:AL: 0%	1%	0%	1%	0%	16%
SWA-B:CL: 0%	16%	1%	14%	1%	8%
SWA-C:CL: 0%	17%	31%	20%	32%	11%
SWA-U:BG: 0%	0%	0%	0%	0%	0%
SWA-U:ES: 0%	0%	0%	0%	0%	0%

SWA-U:ET: 0%	0%	0%	0%	0%	0%
SWA-U:SEP: 0%	9%	11%	7%	10%	10%
SWA-U:SES: 0%	57%	57%	57%	57%	56%
WDR-A:AL: 0%	0%	3%	1%	0%	2%
WDR-B:CL: 0%	13%	8%	15%	3%	7%
WDR-C:OP: 0%	4%	7%	6%	8%	11%
WDR-D:CL: 0%	7%	4%	3%	7%	9%
WDR-E:CL: 0%	7%	3%	4%	10%	7%
WDR-U:DE: 0%	0%	0%	0%	0%	0%
WDR-U:DEF: 0%	0%	0%	0%	0%	0%
WDR-U:DET: 0%	0%	0%	0%	0%	0%
WDR-U:DEX: 0%	0%	0%	0%	0%	0%
WDR-U:EF: 0%	28%	34%	30%	31%	30%
WDR-U:ET: 0%	1%	1%	2%	1%	0%
WDR-U:EX: 0%	0%	0%	4%	0%	0%
WDR-U:TEX: 0%	41%	40%	35%	41%	34%
GRL-A:AL: 0%	0%	0%	0%	0%	0%
GRL-B:OP: 0%	0%	0%	0%	0%	0%
GRL-U:DP: 0%	0%	0%	0%	0%	0%
GRL-U:EEX: 0%	3%	3%	3%	3%	3%
GRL-U:EX: 0%	0%	0%	0%	0%	0%
GRL-U:SES: 0%	97%	97%	97%	97%	97%

Beaver Dam Wash NCA					
Ecological System × Vegetation Class	Run 1	Run 2	Run 3	Run 4	Run 5
BSu-A:AL: 0%	0%	0%	0%	0%	0%
BSu-B:OP: 0%	0%	0%	0%	0%	0%
BSu-C:CL: 0%	0%	0%	0%	0%	0%
BSu-D:OP: 0%	0%	0%	0%	0%	0%
BSu-E:CL: 0%	0%	0%	0%	0%	0%
BSu-U:DP: 0%	0%	0%	0%	0%	0%
BSu-U:ES: 0%	0%	0%	0%	0%	0%
BSu-U:EX: 0%	100%	100%	100%	100%	89%
BSu-U:SD: 0%	0%	0%	0%	0%	0%
BSu-U:SEP: 0%	0%	0%	0%	0%	0%
BSu-U:SES: 0%	0%	0%	0%	0%	0%
BSu-U:TE: 0%	0%	0%	0%	0%	0%
BSu-U:TEX: 0%	0%	0%	0%	0%	11%
BM-A:AL: 0%	0%	0%	0%	0%	0%
BM-B:JT: 0%	0%	0%	0%	0%	0%
BM-C:OP: 0%	0%	0%	0%	0%	0%
BM-D:OP: 0%	0%	0%	0%	0%	0%
BM-E:JT: 0%	0%	0%	0%	0%	0%

BM-U:BG: 0%	0%	0%	0%	0%	0%
BM-U:ES: 0%	0%	0%	0%	0%	0%
BM-U:EX: 0%	1%	1%	1%	1%	1%
BM-U:EX2B: 0%	20%	19%	22%	15%	18%
BM-U:PL: 0%	0%	0%	0%	0%	0%
BM-U:SD: 0%	0%	0%	0%	0%	0%
BM-U:SDI: 0%	0%	0%	0%	0%	0%
BM-U:SEP: 0%	29%	31%	28%	31%	30%
BM-U:SEPJ: 0%	48%	49%	48%	52%	50%
BM-U:TEX: 0%	1%	1%	0%	1%	1%
BT-A:AL: 0%	0%	0%	0%	0%	0%
BT-B:JT: 0%	0%	0%	0%	0%	0%
BT-C:CL: 0%	0%	0%	0%	0%	0%
BT-U:BG: 0%	0%	0%	0%	0%	0%
BT-U:ES: 0%	0%	0%	0%	0%	0%
BT-U:EX: 0%	3%	2%	3%	1%	3%
BT-U:EX2B: 0%	8%	2%	10%	1%	4%
BT-U:PL: 0%	0%	0%	0%	0%	0%
BT-U:SD: 0%	0%	0%	0%	0%	0%
BT-U:SDI: 0%	0%	0%	0%	0%	0%
BT-U:SEP: 0%	40%	43%	39%	44%	41%
BT-U:SEPJ: 0%	49%	53%	48%	54%	52%
CB-A:OP: 0%	0%	0%	0%	0%	0%
CB-B:JT: 0%	0%	0%	0%	0%	0%
CB-C:OP: 0%	0%	0%	0%	0%	0%
CB-D:JT: 0%	0%	0%	0%	0%	0%
CB-U:BG: 0%	0%	0%	0%	0%	0%
CB-U:ES: 0%	0%	0%	0%	0%	0%
CB-U:EX: 0%	8%	19%	10%	23%	10%
CB-U:EX2B: 0%	22%	11%	24%	3%	14%
CB-U:PL: 0%	0%	0%	0%	0%	0%
CB-U:SD: 0%	0%	0%	0%	0%	0%
CB-U:SDI: 0%	0%	0%	0%	0%	0%
CB-U:SEP: 0%	24%	25%	23%	26%	26%
CB-U:SEPJ: 0%	46%	45%	43%	48%	49%
MSh-A:AL: 0%	0%	0%	0%	0%	0%
MSh-B:CL: 0%	0%	0%	0%	0%	0%
MSh-C:CL: 0%	0%	0%	0%	0%	0%
MSh-D:OP: 0%	0%	0%	0%	0%	0%
MSh-U:ES: 0%	0%	0%	0%	0%	0%
MSh-U:EX: 0%	19%	2%	72%	1%	26%
MSh-U:SEP: 0%	81%	98%	28%	99%	74%
MSh-U:TE: 0%	0%	0%	0%	0%	0%
PJ-A:AL: 0%	1%	0%	0%	0%	1%

PJ-B:OP: 0%	0%	0%	0%	0%	0%
PJ-C:OP: 0%	0%	0%	0%	0%	0%
PJ-D:OP: 0%	5%	6%	4%	6%	5%
PJ-U:EX: 0%	83%	84%	85%	84%	83%
PJ-U:TEX: 0%	12%	10%	11%	10%	11%
SWA-A:AL: 0%	1%	0%	1%	0%	27%
SWA-B:CL: 0%	23%	2%	24%	1%	20%
SWA-C:CL: 0%	38%	59%	42%	56%	14%
SWA-U:BG: 0%	0%	0%	0%	0%	0%
SWA-U:ES: 0%	0%	0%	0%	0%	0%
SWA-U:ET: 0%	0%	0%	0%	0%	0%
SWA-U:SEP: 0%	5%	4%	4%	7%	7%
SWA-U:SES: 0%	34%	35%	29%	35%	33%
WDR-A:AL: 0%	1%	4%	1%	1%	1%
WDR-B:CL: 0%	18%	8%	11%	8%	5%
WDR-C:OP: 0%	3%	1%	4%	5%	11%
WDR-D:CL: 0%	1%	3%	7%	11%	4%
WDR-E:CL: 0%	0%	0%	0%	1%	0%
WDR-U:DE: 0%	3%	0%	1%	0%	1%
WDR-U:DEF: 0%	1%	0%	0%	0%	0%
WDR-U:DET: 0%	0%	0%	1%	0%	0%
WDR-U:DEX: 0%	0%	0%	0%	0%	0%
WDR-U:EF: 0%	40%	34%	25%	21%	37%
WDR-U:ET: 0%	0%	3%	1%	1%	1%
WDR-U:EX: 0%	0%	0%	12%	0%	0%
WDR-U:TEX: 0%	33%	47%	36%	51%	38%

Appendix 12. FINGERS-OF-DEATH WITH 75% SUCCESS RATE MANAGEMENT scenario areas (acre) by vegetation class for ecological systems of the Red Cliffs and Beaver Dam Wash NCAs.

Red Cliffs NCA					
Ecological System × Vegetation Class	Run 1	Run 2	Run 3	Run 4	Run 5
BSu-A:AL: 0%	0%	0%	0%	0%	0%
BSu-B:OP: 0%	0%	1%	0%	1%	0%
BSu-C:CL: 0%	0%	0%	0%	0%	0%
BSu-D:OP: 0%	0%	0%	0%	0%	0%
BSu-E:CL: 0%	0%	0%	0%	0%	0%
BSu-U:DP: 0%	0%	0%	0%	0%	0%
BSu-U:ES: 0%	1%	1%	1%	0%	1%
BSu-U:EX: 0%	95%	94%	96%	87%	95%
BSu-U:SD: 0%	0%	0%	0%	0%	0%
BSu-U:SEP: 0%	0%	0%	0%	1%	0%
BSu-U:SES: 0%	0%	0%	0%	6%	1%
BSu-U:TE: 0%	2%	2%	2%	3%	2%
BSu-U:TEX: 0%	1%	1%	1%	2%	1%
BM-A:AL: 0%	3%	1%	3%	0%	2%
BM-B:JT: 0%	0%	0%	0%	0%	0%
BM-C:OP: 0%	69%	61%	66%	76%	68%
BM-D:OP: 0%	18%	15%	16%	15%	19%
BM-E:JT: 0%	0%	0%	0%	0%	0%
BM-U:BG: 0%	0%	0%	0%	0%	0%
BM-U:ES: 0%	0%	0%	0%	0%	0%
BM-U:EX: 0%	0%	2%	1%	0%	0%
BM-U:EX2B: 0%	0%	6%	2%	0%	0%
BM-U:PL: 0%	3%	6%	5%	0%	3%
BM-U:SD: 0%	0%	0%	0%	0%	0%
BM-U:SDI: 0%	0%	0%	0%	0%	0%
BM-U:SEP: 0%	2%	2%	2%	0%	1%
BM-U:SEPJ: 0%	0%	0%	0%	0%	0%
BM-U:TEX: 0%	5%	7%	5%	9%	6%
BT-A:AL: 0%	1%	0%	1%	0%	0%
BT-B:JT: 0%	0%	0%	0%	0%	0%
BT-C:CL: 0%	96%	78%	98%	94%	93%
BT-U:BG: 0%	0%	0%	0%	0%	0%
BT-U:ES: 0%	0%	0%	0%	0%	0%
BT-U:EX: 0%	1%	4%	0%	1%	1%
BT-U:EX2B: 0%	0%	0%	0%	0%	0%
BT-U:PL: 0%	1%	15%	0%	3%	3%
BT-U:SD: 0%	0%	0%	0%	0%	0%
BT-U:SDI: 0%	0%	0%	0%	0%	0%

BT-U:SEP: 0%	1%	3%	1%	2%	2%
BT-U:SEPJ: 0%	0%	0%	0%	0%	0%
CB-A:OP: 0%	6%	6%	8%	8%	5%
CB-B:JT: 0%	0%	0%	0%	0%	0%
CB-C:OP: 0%	93%	91%	91%	90%	93%
CB-D:JT: 0%	0%	0%	0%	0%	0%
CB-U:BG: 0%	0%	0%	0%	0%	0%
CB-U:ES: 0%	0%	0%	1%	0%	0%
CB-U:EX: 0%	0%	0%	0%	0%	0%
CB-U:EX2B: 0%	0%	0%	0%	0%	0%
CB-U:PL: 0%	0%	0%	0%	1%	0%
CB-U:SD: 0%	0%	0%	0%	0%	0%
CB-U:SDI: 0%	0%	0%	0%	0%	0%
CB-U:SEP: 0%	0%	2%	0%	1%	1%
CB-U:SEPJ: 0%	0%	0%	0%	0%	0%
DSS-A:OP: 0%	0%	0%	0%	0%	0%
DSS-B:OP: 0%	100%	100%	100%	100%	99%
DSS-U:DP: 0%	0%	0%	0%	0%	0%
DSS-U:SEP: 0%	0%	0%	0%	0%	0%
MR-A:AL: 0%	0%	0%	0%	0%	0%
MR-B:OP: 0%	0%	0%	0%	0%	0%
MR-C:CL: 0%	0%	0%	0%	0%	0%
MR-U:DE: 0%	0%	0%	0%	0%	0%
MR-U:EF: 0%	100%	100%	100%	100%	100%
MR-U:SFE: 0%	0%	0%	0%	0%	0%
MSh-A:AL: 0%	0%	0%	0%	0%	0%
MSh-B:CL: 0%	0%	0%	0%	0%	0%
MSh-C:CL: 0%	0%	0%	0%	0%	0%
MSh-D:OP: 0%	0%	0%	0%	0%	0%
MSh-U:ES: 0%	0%	0%	25%	0%	25%
MSh-U:EX: 0%	75%	75%	75%	67%	75%
MSh-U:SEP: 0%	0%	0%	0%	0%	0%
MSh-U:TE: 0%	25%	25%	0%	33%	0%
PJ-A:AL: 0%	0%	0%	0%	0%	0%
PJ-B:OP: 0%	0%	0%	0%	0%	0%
PJ-C:OP: 0%	0%	0%	0%	0%	0%
PJ-D:OP: 0%	0%	0%	0%	0%	0%
PJ-U:EX: 0%	23%	21%	25%	10%	19%
PJ-U:TEX: 0%	77%	79%	75%	90%	81%
SWA-A:AL: 0%	2%	0%	2%	1%	38%
SWA-B:CL: 0%	35%	2%	27%	3%	27%
SWA-C:CL: 0%	63%	97%	70%	96%	33%
SWA-U:BG: 0%	0%	0%	0%	0%	0%
SWA-U:ES: 0%	0%	0%	0%	0%	0%

SWA-U:ET: 0%	0%	0%	0%	0%	0%
SWA-U:SEP: 0%	1%	1%	1%	1%	1%
SWA-U:SES: 0%	0%	0%	0%	0%	0%
WDR-A:AL: 0%	1%	4%	1%	1%	1%
WDR-B:CL: 0%	9%	11%	10%	3%	8%
WDR-C:OP: 0%	6%	6%	7%	6%	11%
WDR-D:CL: 0%	2%	3%	3%	7%	6%
WDR-E:CL: 0%	8%	6%	2%	9%	4%
WDR-U:DE: 0%	3%	1%	1%	2%	2%
WDR-U:DEF: 0%	0%	1%	0%	0%	1%
WDR-U:DET: 0%	0%	0%	0%	0%	0%
WDR-U:DEX: 0%	0%	0%	0%	0%	0%
WDR-U:EF: 0%	28%	30%	25%	25%	30%
WDR-U:ET: 0%	1%	0%	2%	2%	1%
WDR-U:EX: 0%	3%	1%	6%	0%	0%
WDR-U:TEX: 0%	40%	38%	44%	46%	38%
GRL-A:AL: 0%	7%	0%	8%	4%	4%
GRL-B:OP: 0%	81%	90%	84%	79%	75%
GRL-U:DP: 0%	0%	0%	0%	0%	0%
GRL-U:EEX: 0%	0%	0%	0%	0%	0%
GRL-U:EX: 0%	0%	0%	0%	0%	1%
GRL-U:SES: 0%	13%	10%	7%	17%	20%

Beaver Dam Wash NCA					
Ecological System × Vegetation Class	Run 1	Run 2	Run 3	Run 4	Run 5
BSu-A:AL: 0%	0%	0%	0%	0%	0%
BSu-B:OP: 0%	0%	0%	0%	0%	0%
BSu-C:CL: 0%	0%	0%	0%	0%	0%
BSu-D:OP: 0%	0%	0%	0%	0%	0%
BSu-E:CL: 0%	0%	0%	0%	0%	0%
BSu-U:DP: 0%	0%	0%	0%	0%	0%
BSu-U:ES: 0%	0%	0%	0%	0%	0%
BSu-U:EX: 0%	100%	100%	100%	89%	100%
BSu-U:SD: 0%	0%	0%	0%	0%	0%
BSu-U:SEP: 0%	0%	0%	0%	0%	0%
BSu-U:SES: 0%	0%	0%	0%	11%	0%
BSu-U:TE: 0%	0%	0%	0%	0%	0%
BSu-U:TEX: 0%	0%	0%	0%	0%	0%
BM-A:AL: 0%	2%	1%	3%	0%	2%
BM-B:JT: 0%	49%	48%	49%	48%	48%
BM-C:OP: 0%	38%	41%	39%	42%	39%
BM-D:OP: 0%	3%	2%	3%	3%	3%
BM-E:JT: 0%	5%	4%	4%	4%	5%

BM-U:BG: 0%	0%	0%	0%	0%	0%
BM-U:ES: 0%	0%	0%	0%	0%	0%
BM-U:EX: 0%	0%	0%	0%	0%	0%
BM-U:EX2B: 0%	0%	0%	0%	0%	0%
BM-U:PL: 0%	0%	0%	0%	0%	0%
BM-U:SD: 0%	0%	0%	0%	0%	0%
BM-U:SDI: 0%	0%	0%	0%	0%	0%
BM-U:SEP: 0%	0%	0%	0%	0%	0%
BM-U:SEPJ: 0%	0%	1%	0%	0%	1%
BM-U:TEX: 0%	2%	3%	2%	3%	2%
BT-A:AL: 0%	0%	0%	0%	0%	0%
BT-B:JT: 0%	52%	49%	53%	52%	53%
BT-C:CL: 0%	33%	32%	34%	32%	30%
BT-U:BG: 0%	0%	0%	0%	0%	0%
BT-U:ES: 0%	0%	0%	0%	0%	0%
BT-U:EX: 0%	0%	1%	0%	0%	0%
BT-U:EX2B: 0%	0%	3%	0%	0%	0%
BT-U:PL: 0%	1%	1%	1%	0%	1%
BT-U:SD: 0%	0%	0%	0%	0%	0%
BT-U:SDI: 0%	0%	0%	0%	0%	0%
BT-U:SEP: 0%	13%	13%	10%	15%	15%
BT-U:SEPJ: 0%	0%	1%	1%	0%	1%
CB-A:OP: 0%	6%	9%	11%	11%	6%
CB-B:JT: 0%	20%	18%	19%	17%	17%
CB-C:OP: 0%	32%	31%	32%	30%	31%
CB-D:JT: 0%	33%	32%	31%	30%	34%
CB-U:BG: 0%	0%	0%	0%	0%	0%
CB-U:ES: 0%	0%	0%	0%	0%	0%
CB-U:EX: 0%	1%	2%	1%	1%	0%
CB-U:EX2B: 0%	2%	1%	2%	0%	0%
CB-U:PL: 0%	2%	2%	2%	2%	2%
CB-U:SD: 0%	0%	0%	0%	0%	0%
CB-U:SDI: 0%	0%	0%	0%	0%	0%
CB-U:SEP: 0%	1%	2%	1%	3%	4%
CB-U:SEPJ: 0%	2%	3%	1%	5%	6%
MSh-A:AL: 0%	0%	0%	0%	0%	0%
MSh-B:CL: 0%	0%	0%	0%	0%	0%
MSh-C:CL: 0%	0%	0%	0%	0%	0%
MSh-D:OP: 0%	0%	0%	0%	0%	0%
MSh-U:ES: 0%	0%	0%	0%	0%	0%
MSh-U:EX: 0%	28%	2%	72%	1%	23%
MSh-U:SEP: 0%	72%	98%	28%	99%	77%
MSh-U:TE: 0%	0%	0%	0%	0%	0%
PJ-A:AL: 0%	0%	0%	1%	0%	0%

PJ-B:OP: 0%	1%	0%	1%	0%	0%
PJ-C:OP: 0%	0%	0%	0%	0%	0%
PJ-D:OP: 0%	5%	5%	5%	6%	6%
PJ-U:EX: 0%	83%	85%	84%	84%	83%
PJ-U:TEX: 0%	12%	9%	10%	10%	11%
SWA-A:AL: 0%	1%	0%	3%	0%	40%
SWA-B:CL: 0%	52%	3%	38%	2%	29%
SWA-C:CL: 0%	47%	95%	59%	97%	30%
SWA-U:BG: 0%	0%	0%	0%	0%	0%
SWA-U:ES: 0%	0%	0%	0%	0%	0%
SWA-U:ET: 0%	0%	0%	0%	0%	0%
SWA-U:SEP: 0%	0%	1%	0%	0%	1%
SWA-U:SES: 0%	0%	0%	0%	0%	0%
WDR-A:AL: 0%	0%	4%	0%	0%	0%
WDR-B:CL: 0%	14%	14%	8%	3%	7%
WDR-C:OP: 0%	10%	4%	5%	8%	7%
WDR-D:CL: 0%	0%	3%	3%	1%	10%
WDR-E:CL: 0%	0%	0%	0%	3%	1%
WDR-U:DE: 0%	0%	0%	0%	0%	0%
WDR-U:DEF: 0%	0%	0%	0%	0%	0%
WDR-U:DET: 0%	0%	0%	0%	0%	0%
WDR-U:DEX: 0%	0%	0%	0%	0%	0%
WDR-U:EF: 0%	25%	36%	38%	29%	30%
WDR-U:ET: 0%	0%	0%	1%	1%	0%
WDR-U:EX: 0%	0%	0%	7%	0%	0%
WDR-U:TEX: 0%	52%	40%	37%	55%	45%

Appendix 13. FINGERS-OF-DEATH WITH 50% SUCCESS RATE MANAGEMENT scenario areas (acre) by vegetation class for ecological systems of the Red Cliffs and Beaver Dam Wash NCAs.

Red Cliffs NCA					
Ecological System × Vegetation Class	Run 1	Run 2	Run 3	Run 4	Run 5
BSu-A:AL: 0%	0%	0%	0%	0%	0%
BSu-B:OP: 0%	0%	1%	0%	1%	0%
BSu-C:CL: 0%	0%	0%	0%	0%	0%
BSu-D:OP: 0%	0%	0%	0%	0%	0%
BSu-E:CL: 0%	0%	0%	0%	0%	0%
BSu-U:DP: 0%	0%	0%	0%	0%	0%
BSu-U:ES: 0%	1%	1%	1%	0%	1%
BSu-U:EX: 0%	96%	94%	96%	87%	95%
BSu-U:SD: 0%	0%	0%	0%	0%	0%
BSu-U:SEP: 0%	0%	0%	0%	1%	0%
BSu-U:SES: 0%	0%	1%	0%	6%	1%
BSu-U:TE: 0%	2%	3%	2%	3%	2%
BSu-U:TEX: 0%	1%	1%	0%	2%	1%
BM-A:AL: 0%	2%	1%	2%	0%	1%
BM-B:JT: 0%	0%	0%	0%	0%	0%
BM-C:OP: 0%	56%	57%	54%	69%	54%
BM-D:OP: 0%	18%	15%	16%	15%	18%
BM-E:JT: 0%	0%	0%	0%	0%	0%
BM-U:BG: 0%	0%	0%	0%	0%	0%
BM-U:ES: 0%	0%	0%	0%	0%	0%
BM-U:EX: 0%	1%	2%	1%	0%	2%
BM-U:EX2B: 0%	12%	12%	16%	0%	13%
BM-U:PL: 0%	4%	4%	3%	0%	4%
BM-U:SD: 0%	0%	0%	0%	0%	0%
BM-U:SDI: 0%	0%	0%	0%	0%	0%
BM-U:SEP: 0%	3%	3%	3%	9%	3%
BM-U:SEPJ: 0%	0%	0%	0%	0%	0%
BM-U:TEX: 0%	5%	6%	4%	7%	5%
BT-A:AL: 0%	1%	0%	1%	0%	0%
BT-B:JT: 0%	0%	0%	0%	0%	0%
BT-C:CL: 0%	96%	94%	98%	98%	96%
BT-U:BG: 0%	0%	0%	0%	0%	0%
BT-U:ES: 0%	0%	0%	0%	0%	0%
BT-U:EX: 0%	1%	1%	0%	0%	0%
BT-U:EX2B: 0%	0%	0%	0%	0%	0%
BT-U:PL: 0%	2%	3%	0%	0%	1%
BT-U:SD: 0%	0%	0%	0%	0%	0%
BT-U:SDI: 0%	0%	0%	0%	0%	0%

BT-U:SEP: 0%	1%	2%	1%	1%	2%
BT-U:SEPJ: 0%	0%	0%	0%	0%	0%
CB-A:OP: 0%	5%	7%	9%	8%	5%
CB-B:JT: 0%	0%	0%	0%	0%	0%
CB-C:OP: 0%	94%	90%	90%	90%	93%
CB-D:JT: 0%	0%	0%	0%	0%	0%
CB-U:BG: 0%	0%	0%	0%	0%	0%
CB-U:ES: 0%	0%	0%	0%	0%	0%
CB-U:EX: 0%	0%	0%	0%	0%	0%
CB-U:EX2B: 0%	0%	0%	0%	0%	0%
CB-U:PL: 0%	0%	0%	0%	0%	0%
CB-U:SD: 0%	0%	0%	0%	0%	0%
CB-U:SDI: 0%	0%	0%	0%	0%	0%
CB-U:SEP: 0%	0%	2%	1%	1%	2%
CB-U:SEPJ: 0%	0%	0%	0%	0%	0%
DSS-A:OP: 0%	0%	0%	0%	0%	0%
DSS-B:OP: 0%	72%	68%	74%	70%	70%
DSS-U:DP: 0%	0%	0%	0%	0%	0%
DSS-U:SEP: 0%	28%	32%	26%	30%	30%
MR-A:AL: 0%	0%	0%	0%	0%	0%
MR-B:OP: 0%	0%	0%	0%	0%	0%
MR-C:CL: 0%	0%	0%	0%	0%	0%
MR-U:DE: 0%	0%	0%	0%	0%	0%
MR-U:EF: 0%	100%	100%	100%	100%	100%
MR-U:SFE: 0%	0%	0%	0%	0%	0%
MSh-A:AL: 0%	0%	0%	0%	0%	0%
MSh-B:CL: 0%	0%	0%	0%	0%	0%
MSh-C:CL: 0%	0%	0%	0%	0%	0%
MSh-D:OP: 0%	0%	0%	0%	0%	0%
MSh-U:ES: 0%	0%	0%	25%	50%	25%
MSh-U:EX: 0%	0%	0%	25%	0%	25%
MSh-U:SEP: 0%	100%	75%	50%	50%	50%
MSh-U:TE: 0%	0%	25%	0%	0%	0%
PJ-A:AL: 0%	0%	0%	0%	0%	0%
PJ-B:OP: 0%	0%	0%	0%	0%	0%
PJ-C:OP: 0%	0%	0%	0%	0%	0%
PJ-D:OP: 0%	0%	0%	0%	0%	0%
PJ-U:EX: 0%	22%	20%	25%	10%	20%
PJ-U:TEX: 0%	78%	80%	75%	90%	80%
SWA-A:AL: 0%	1%	0%	2%	1%	38%
SWA-B:CL: 0%	33%	3%	32%	3%	23%
SWA-C:CL: 0%	66%	94%	65%	96%	36%
SWA-U:BG: 0%	0%	0%	0%	0%	0%
SWA-U:ES: 0%	0%	0%	0%	0%	0%

SWA-U:ET: 0%	0%	0%	0%	0%	0%
SWA-U:SEP: 0%	0%	2%	1%	0%	2%
SWA-U:SES: 0%	0%	0%	0%	0%	0%
WDR-A:AL: 0%	1%	4%	1%	1%	1%
WDR-B:CL: 0%	9%	11%	10%	3%	8%
WDR-C:OP: 0%	6%	6%	7%	6%	11%
WDR-D:CL: 0%	2%	3%	3%	7%	6%
WDR-E:CL: 0%	8%	6%	2%	9%	4%
WDR-U:DE: 0%	3%	1%	1%	2%	2%
WDR-U:DEF: 0%	0%	1%	0%	0%	1%
WDR-U:DET: 0%	0%	0%	0%	0%	0%
WDR-U:DEX: 0%	0%	0%	0%	0%	0%
WDR-U:EF: 0%	28%	30%	25%	25%	30%
WDR-U:ET: 0%	1%	0%	2%	2%	1%
WDR-U:EX: 0%	3%	1%	6%	0%	0%
WDR-U:TEX: 0%	40%	38%	44%	46%	38%
GRL-A:AL: 0%	9%	1%	5%	1%	3%
GRL-B:OP: 0%	81%	84%	84%	81%	81%
GRL-U:DP: 0%	0%	0%	0%	0%	0%
GRL-U:EEX: 0%	0%	0%	0%	0%	0%
GRL-U:EX: 0%	1%	0%	1%	1%	1%
GRL-U:SES: 0%	10%	15%	10%	16%	14%

Beaver Dam Wash NCA					
Ecological System × Vegetation Class	Run 1	Run 2	Run 3	Run 4	Run 5
BSu-A:AL: 0%	0%	0%	0%	0%	0%
BSu-B:OP: 0%	0%	0%	0%	0%	0%
BSu-C:CL: 0%	0%	0%	0%	0%	0%
BSu-D:OP: 0%	0%	0%	0%	0%	0%
BSu-E:CL: 0%	0%	0%	0%	0%	0%
BSu-U:DP: 0%	0%	0%	0%	0%	0%
BSu-U:ES: 0%	0%	0%	0%	0%	0%
BSu-U:EX: 0%	100%	100%	100%	89%	100%
BSu-U:SD: 0%	0%	0%	0%	0%	0%
BSu-U:SEP: 0%	0%	0%	0%	0%	0%
BSu-U:SES: 0%	0%	0%	0%	0%	0%
BSu-U:TE: 0%	0%	0%	0%	0%	0%
BSu-U:TEX: 0%	0%	0%	0%	11%	0%
BM-A:AL: 0%	2%	0%	2%	0%	1%
BM-B:JT: 0%	44%	45%	45%	43%	43%
BM-C:OP: 0%	31%	33%	32%	32%	31%
BM-D:OP: 0%	3%	3%	2%	2%	3%
BM-E:JT: 0%	4%	4%	4%	4%	5%

BM-U:BG: 0%	0%	0%	0%	0%	0%
BM-U:ES: 0%	0%	0%	0%	0%	0%
BM-U:EX: 0%	0%	0%	0%	0%	0%
BM-U:EX2B: 0%	0%	0%	0%	0%	0%
BM-U:PL: 0%	1%	0%	1%	0%	0%
BM-U:SD: 0%	0%	0%	0%	0%	0%
BM-U:SDI: 0%	0%	0%	0%	0%	0%
BM-U:SEP: 0%	5%	5%	5%	6%	6%
BM-U:SEPJ: 0%	8%	8%	6%	10%	9%
BM-U:TEX: 0%	2%	2%	2%	3%	2%
BT-A:AL: 0%	0%	0%	1%	0%	0%
BT-B:JT: 0%	53%	55%	51%	54%	52%
BT-C:CL: 0%	32%	28%	33%	30%	30%
BT-U:BG: 0%	0%	0%	0%	0%	0%
BT-U:ES: 0%	0%	0%	0%	0%	0%
BT-U:EX: 0%	0%	1%	1%	0%	1%
BT-U:EX2B: 0%	0%	0%	2%	0%	0%
BT-U:PL: 0%	1%	1%	1%	0%	1%
BT-U:SD: 0%	0%	0%	0%	0%	0%
BT-U:SDI: 0%	0%	0%	0%	0%	0%
BT-U:SEP: 0%	14%	14%	11%	15%	16%
BT-U:SEPJ: 0%	0%	1%	1%	0%	1%
CB-A:OP: 0%	4%	5%	7%	7%	4%
CB-B:JT: 0%	12%	11%	11%	10%	11%
CB-C:OP: 0%	21%	21%	21%	20%	20%
CB-D:JT: 0%	24%	23%	23%	21%	24%
CB-U:BG: 0%	0%	0%	0%	0%	0%
CB-U:ES: 0%	0%	0%	0%	0%	0%
CB-U:EX: 0%	2%	7%	2%	7%	3%
CB-U:EX2B: 0%	9%	3%	11%	1%	3%
CB-U:PL: 0%	1%	1%	1%	1%	1%
CB-U:SD: 0%	0%	0%	0%	0%	0%
CB-U:SDI: 0%	0%	0%	0%	0%	0%
CB-U:SEP: 0%	9%	10%	8%	11%	12%
CB-U:SEPJ: 0%	18%	19%	15%	21%	21%
MSh-A:AL: 0%	0%	0%	0%	0%	0%
MSh-B:CL: 0%	0%	0%	0%	0%	0%
MSh-C:CL: 0%	0%	0%	0%	0%	0%
MSh-D:OP: 0%	0%	0%	0%	0%	0%
MSh-U:ES: 0%	0%	0%	0%	0%	0%
MSh-U:EX: 0%	30%	1%	74%	0%	17%
MSh-U:SEP: 0%	70%	99%	26%	100%	83%
MSh-U:TE: 0%	0%	0%	0%	0%	0%
PJ-A:AL: 0%	0%	0%	0%	0%	0%

PJ-B:OP: 0%	0%	0%	0%	0%	1%
PJ-C:OP: 0%	1%	0%	0%	0%	0%
PJ-D:OP: 0%	3%	6%	6%	6%	5%
PJ-U:EX: 0%	85%	85%	85%	83%	83%
PJ-U:TEX: 0%	10%	9%	9%	11%	12%
SWA-A:AL: 0%	2%	0%	3%	0%	35%
SWA-B:CL: 0%	40%	2%	34%	2%	28%
SWA-C:CL: 0%	50%	87%	63%	84%	29%
SWA-U:BG: 0%	0%	0%	0%	0%	0%
SWA-U:ES: 0%	0%	0%	0%	0%	0%
SWA-U:ET: 0%	0%	0%	0%	0%	0%
SWA-U:SEP: 0%	3%	3%	1%	6%	4%
SWA-U:SES: 0%	5%	7%	0%	8%	3%
WDR-A:AL: 0%	0%	1%	1%	0%	3%
WDR-B:CL: 0%	18%	1%	8%	1%	1%
WDR-C:OP: 0%	5%	5%	3%	3%	8%
WDR-D:CL: 0%	3%	1%	1%	4%	7%
WDR-E:CL: 0%	0%	1%	0%	0%	0%
WDR-U:DE: 0%	3%	0%	1%	1%	0%
WDR-U:DEF: 0%	0%	0%	0%	0%	0%
WDR-U:DET: 0%	0%	0%	0%	0%	0%
WDR-U:DEX: 0%	0%	0%	0%	0%	0%
WDR-U:EF: 0%	36%	40%	32%	30%	40%
WDR-U:ET: 0%	0%	0%	4%	0%	0%
WDR-U:EX: 0%	0%	0%	7%	0%	0%
WDR-U:TEX: 0%	36%	49%	42%	60%	41%

Appendix 14. FINGERS-OF-DEATH WITH 25% SUCCESS RATE MANAGEMENT scenario areas (acre) by vegetation class for ecological systems of the Red Cliffs and Beaver Dam Wash NCAs.

Red Cliffs NCA					
Ecological System × Vegetation Class	Run 1	Run 2	Run 3	Run 4	Run 5
BSu-A:AL: 0%	0%	0%	0%	0%	0%
BSu-B:OP: 0%	0%	0%	0%	0%	1%
BSu-C:CL: 0%	0%	0%	0%	0%	0%
BSu-D:OP: 0%	0%	0%	0%	0%	0%
BSu-E:CL: 0%	0%	0%	0%	0%	0%
BSu-U:DP: 0%	0%	0%	0%	0%	0%
BSu-U:ES: 0%	1%	0%	1%	0%	1%
BSu-U:EX: 0%	96%	95%	96%	88%	95%
BSu-U:SD: 0%	0%	0%	0%	0%	0%
BSu-U:SEP: 0%	0%	0%	0%	1%	0%
BSu-U:SES: 0%	0%	1%	0%	6%	1%
BSu-U:TE: 0%	2%	2%	2%	3%	2%
BSu-U:TEX: 0%	1%	1%	1%	2%	1%
BM-A:AL: 0%	1%	0%	1%	0%	1%
BM-B:JT: 0%	0%	0%	0%	0%	0%
BM-C:OP: 0%	27%	29%	27%	34%	28%
BM-D:OP: 0%	15%	11%	13%	7%	14%
BM-E:JT: 0%	0%	0%	0%	0%	0%
BM-U:BG: 0%	0%	0%	0%	0%	0%
BM-U:ES: 0%	0%	0%	0%	0%	0%
BM-U:EX: 0%	2%	2%	1%	0%	2%
BM-U:EX2B: 0%	39%	19%	44%	0%	32%
BM-U:PL: 0%	2%	2%	2%	0%	2%
BM-U:SD: 0%	0%	0%	0%	0%	0%
BM-U:SDI: 0%	0%	0%	0%	0%	0%
BM-U:SEP: 0%	11%	32%	9%	53%	19%
BM-U:SEPJ: 0%	0%	0%	0%	0%	0%
BM-U:TEX: 0%	3%	4%	3%	5%	4%
BT-A:AL: 0%	0%	0%	0%	0%	0%
BT-B:JT: 0%	0%	0%	0%	0%	0%
BT-C:CL: 0%	96%	96%	95%	98%	94%
BT-U:BG: 0%	0%	0%	0%	0%	0%
BT-U:ES: 0%	0%	0%	0%	0%	0%
BT-U:EX: 0%	1%	1%	1%	0%	1%
BT-U:EX2B: 0%	0%	0%	0%	0%	0%
BT-U:PL: 0%	2%	1%	2%	0%	2%
BT-U:SD: 0%	0%	0%	0%	0%	0%
BT-U:SDI: 0%	0%	0%	0%	0%	0%

BT-U:SEP: 0%	1%	2%	2%	1%	3%
BT-U:SEPJ: 0%	0%	0%	0%	0%	0%
CB-A:OP: 0%	5%	6%	9%	8%	5%
CB-B:JT: 0%	0%	0%	0%	0%	0%
CB-C:OP: 0%	94%	91%	90%	89%	93%
CB-D:JT: 0%	0%	0%	0%	0%	0%
CB-U:BG: 0%	0%	0%	0%	0%	0%
CB-U:ES: 0%	1%	0%	0%	1%	0%
CB-U:EX: 0%	0%	0%	0%	0%	0%
CB-U:EX2B: 0%	0%	0%	0%	0%	0%
CB-U:PL: 0%	0%	0%	0%	1%	0%
CB-U:SD: 0%	0%	0%	0%	0%	0%
CB-U:SDI: 0%	0%	0%	0%	0%	0%
CB-U:SEP: 0%	1%	2%	1%	2%	1%
CB-U:SEPJ: 0%	0%	0%	0%	0%	0%
DSS-A:OP: 0%	0%	0%	0%	0%	0%
DSS-B:OP: 0%	37%	34%	37%	35%	34%
DSS-U:DP: 0%	0%	0%	0%	0%	0%
DSS-U:SEP: 0%	63%	66%	63%	64%	66%
MSh-A:AL: 0%	0%	0%	0%	0%	0%
MSh-B:CL: 0%	0%	0%	0%	0%	0%
MSh-C:CL: 0%	0%	0%	0%	0%	0%
MSh-D:OP: 0%	0%	0%	0%	0%	0%
MSh-U:ES: 0%	0%	33%	0%	0%	0%
MSh-U:EX: 0%	67%	0%	50%	0%	0%
MSh-U:SEP: 0%	33%	67%	25%	67%	50%
MSh-U:TE: 0%	0%	0%	25%	33%	50%
PJ-A:AL: 0%	0%	0%	0%	0%	0%
PJ-B:OP: 0%	0%	0%	0%	0%	0%
PJ-C:OP: 0%	0%	0%	0%	0%	0%
PJ-D:OP: 0%	0%	0%	0%	0%	0%
PJ-U:EX: 0%	22%	20%	24%	10%	19%
PJ-U:TEX: 0%	78%	80%	76%	90%	81%
SWA-A:AL: 0%	2%	1%	1%	0%	37%
SWA-B:CL: 0%	35%	4%	30%	3%	28%
SWA-C:CL: 0%	63%	94%	69%	95%	33%
SWA-U:BG: 0%	0%	0%	0%	0%	0%
SWA-U:ES: 0%	0%	0%	0%	0%	0%
SWA-U:ET: 0%	0%	0%	0%	0%	0%
SWA-U:SEP: 0%	1%	1%	0%	2%	1%
SWA-U:SES: 0%	0%	0%	0%	0%	0%
WDR-A:AL: 0%	1%	4%	1%	1%	1%
WDR-B:CL: 0%	9%	11%	10%	3%	8%
WDR-C:OP: 0%	6%	6%	7%	6%	11%

WDR-D:CL: 0%	2%	3%	3%	7%	6%
WDR-E:CL: 0%	8%	6%	2%	9%	4%
WDR-U:DE: 0%	3%	1%	1%	2%	2%
WDR-U:DEF: 0%	0%	1%	0%	0%	1%
WDR-U:DET: 0%	0%	0%	0%	0%	0%
WDR-U:DEX: 0%	0%	0%	0%	0%	0%
WDR-U:EF: 0%	28%	30%	25%	25%	30%
WDR-U:ET: 0%	1%	0%	2%	2%	1%
WDR-U:EX: 0%	3%	1%	6%	0%	0%
WDR-U:TEX: 0%	40%	38%	44%	46%	38%
GRL-A:AL: 0%	6%	1%	5%	1%	2%
GRL-B:OP: 0%	59%	66%	68%	60%	64%
GRL-U:DP: 0%	0%	1%	0%	0%	0%
GRL-U:EEX: 0%	0%	0%	1%	1%	0%
GRL-U:EX: 0%	0%	0%	1%	1%	1%
GRL-U:SES: 0%	35%	32%	25%	37%	32%

Beaver Dam Wash NCA					
Ecological System × Vegetation Class	Run 1	Run 2	Run 3	Run 4	Run 5
BSu-A:AL: 0%	0%	0%	0%	0%	0%
BSu-B:OP: 0%	0%	0%	0%	0%	0%
BSu-C:CL: 0%	0%	0%	0%	0%	0%
BSu-D:OP: 0%	0%	0%	0%	0%	0%
BSu-E:CL: 0%	0%	0%	0%	0%	0%
BSu-U:DP: 0%	0%	0%	0%	0%	0%
BSu-U:ES: 0%	0%	0%	0%	0%	0%
BSu-U:EX: 0%	100%	100%	100%	89%	100%
BSu-U:SD: 0%	0%	0%	0%	0%	0%
BSu-U:SEP: 0%	0%	0%	0%	0%	0%
BSu-U:SES: 0%	0%	0%	0%	11%	0%
BSu-U:TE: 0%	0%	0%	0%	0%	0%
BSu-U:TEX: 0%	0%	0%	0%	0%	0%
BM-A:AL: 0%	1%	0%	1%	0%	0%
BM-B:JT: 0%	23%	23%	23%	22%	21%
BM-C:OP: 0%	15%	15%	15%	15%	15%
BM-D:OP: 0%	1%	1%	1%	1%	1%
BM-E:JT: 0%	2%	2%	2%	2%	2%
BM-U:BG: 0%	0%	0%	0%	0%	0%
BM-U:ES: 0%	0%	0%	0%	0%	0%
BM-U:EX: 0%	0%	0%	1%	0%	0%
BM-U:EX2B: 0%	1%	0%	3%	0%	0%
BM-U:PL: 0%	1%	0%	1%	0%	0%
BM-U:SD: 0%	0%	0%	0%	0%	0%

BM-U:SDI: 0%	0%	0%	0%	0%	0%
BM-U:SEP: 0%	21%	23%	20%	22%	22%
BM-U:SEPJ: 0%	33%	34%	32%	34%	35%
BM-U:TEX: 0%	1%	1%	1%	2%	1%
BT-A:AL: 0%	0%	0%	0%	0%	0%
BT-B:JT: 0%	40%	40%	41%	40%	37%
BT-C:CL: 0%	29%	26%	27%	26%	24%
BT-U:BG: 0%	0%	0%	0%	0%	0%
BT-U:ES: 0%	0%	0%	0%	0%	0%
BT-U:EX: 0%	1%	0%	2%	0%	1%
BT-U:EX2B: 0%	5%	0%	6%	0%	3%
BT-U:PL: 0%	0%	0%	0%	0%	0%
BT-U:SD: 0%	0%	0%	0%	0%	0%
BT-U:SDI: 0%	0%	0%	0%	0%	0%
BT-U:SEP: 0%	16%	21%	15%	22%	22%
BT-U:SEPJ: 0%	9%	11%	8%	12%	13%
CB-A:OP: 0%	2%	3%	4%	3%	2%
CB-B:JT: 0%	6%	5%	6%	5%	5%
CB-C:OP: 0%	11%	10%	11%	10%	10%
CB-D:JT: 0%	12%	12%	12%	11%	12%
CB-U:BG: 0%	0%	0%	0%	0%	0%
CB-U:ES: 0%	0%	0%	0%	0%	0%
CB-U:EX: 0%	2%	10%	4%	12%	5%
CB-U:EX2B: 0%	13%	5%	16%	2%	5%
CB-U:PL: 0%	1%	1%	0%	1%	1%
CB-U:SD: 0%	0%	0%	0%	0%	0%
CB-U:SDI: 0%	0%	0%	0%	0%	0%
CB-U:SEP: 0%	18%	19%	16%	20%	21%
CB-U:SEPJ: 0%	34%	35%	31%	37%	39%
MSh-A:AL: 0%	0%	0%	0%	0%	0%
MSh-B:CL: 0%	0%	0%	0%	0%	0%
MSh-C:CL: 0%	0%	0%	0%	0%	0%
MSh-D:OP: 0%	0%	0%	0%	0%	0%
MSh-U:ES: 0%	0%	0%	0%	0%	0%
MSh-U:EX: 0%	23%	2%	73%	1%	17%
MSh-U:SEP: 0%	77%	98%	27%	99%	83%
MSh-U:TE: 0%	0%	0%	0%	0%	0%
PJ-A:AL: 0%	0%	0%	0%	0%	0%
PJ-B:OP: 0%	1%	0%	0%	0%	0%
PJ-C:OP: 0%	0%	0%	1%	1%	0%
PJ-D:OP: 0%	5%	6%	5%	5%	6%
PJ-U:EX: 0%	84%	84%	85%	84%	86%
PJ-U:TEX: 0%	10%	10%	10%	10%	8%
SWA-A:AL: 0%	1%	0%	2%	0%	30%

SWA-B:CL: 0%	32%	2%	30%	2%	24%
SWA-C:CL: 0%	41%	75%	51%	68%	23%
SWA-U:BG: 0%	0%	0%	0%	0%	0%
SWA-U:ES: 0%	0%	0%	0%	0%	0%
SWA-U:ET: 0%	0%	0%	0%	0%	0%
SWA-U:SEP: 0%	5%	4%	3%	7%	6%
SWA-U:SES: 0%	22%	19%	13%	24%	17%
WDR-A:AL: 0%	3%	3%	0%	3%	0%
WDR-B:CL: 0%	14%	3%	5%	0%	4%
WDR-C:OP: 0%	4%	5%	1%	7%	7%
WDR-D:CL: 0%	0%	3%	1%	3%	3%
WDR-E:CL: 0%	0%	0%	0%	0%	0%
WDR-U:DE: 0%	0%	0%	0%	3%	0%
WDR-U:DEF: 0%	0%	1%	0%	0%	0%
WDR-U:DET: 0%	0%	0%	0%	0%	0%
WDR-U:DEX: 0%	0%	0%	0%	0%	0%
WDR-U:EF: 0%	40%	38%	37%	29%	42%
WDR-U:ET: 0%	0%	0%	3%	0%	0%
WDR-U:EX: 0%	3%	0%	5%	0%	0%
WDR-U:TEX: 0%	37%	47%	47%	56%	44%

Appendix 15. NO-GRAZING-ONLY MANAGEMENT scenario areas (acre) by vegetation class for ecological systems of the Beaver Dam Wash NCA.

Beaver Dam Wash NCA					
Ecological System × Vegetation Class	Run 1	Run 2	Run 3	Run 4	Run 5
BSu-A:AL: 0%	0%	0%	0%	0%	0%
BSu-B:OP: 0%	0%	0%	0%	0%	0%
BSu-C:CL: 0%	0%	0%	0%	0%	0%
BSu-D:OP: 0%	0%	0%	0%	0%	0%
BSu-E:CL: 0%	0%	0%	0%	0%	0%
BSu-U:DP: 0%	0%	0%	0%	0%	0%
BSu-U:ES: 0%	0%	0%	0%	0%	0%
BSu-U:EX: 0%	100%	100%	100%	100%	100%
BSu-U:SD: 0%	0%	0%	0%	0%	0%
BSu-U:SEP: 0%	0%	0%	0%	0%	0%
BSu-U:SES: 0%	0%	0%	0%	0%	0%
BSu-U:TE: 0%	0%	0%	0%	0%	0%
BSu-U:TEX: 0%	0%	0%	0%	0%	0%
BM-A:AL: 0%	0%	0%	0%	0%	0%
BM-B:JT: 0%	0%	0%	0%	0%	0%
BM-C:OP: 0%	0%	0%	0%	0%	0%
BM-D:OP: 0%	0%	0%	0%	0%	0%
BM-E:JT: 0%	0%	0%	0%	0%	0%
BM-U:BG: 0%	0%	0%	0%	0%	0%
BM-U:ES: 0%	0%	0%	0%	0%	0%
BM-U:EX: 0%	1%	1%	1%	1%	1%
BM-U:EX2B: 0%	33%	31%	34%	27%	28%
BM-U:PL: 0%	0%	0%	0%	0%	0%
BM-U:SD: 0%	0%	0%	0%	0%	0%
BM-U:SDI: 0%	0%	0%	0%	0%	0%
BM-U:SEP: 0%	24%	25%	24%	26%	26%
BM-U:SEPJ: 0%	41%	42%	41%	45%	44%
BM-U:TEX: 0%	1%	1%	0%	1%	1%
BT-A:AL: 0%	0%	0%	0%	0%	0%
BT-B:JT: 0%	0%	0%	0%	0%	0%
BT-C:CL: 0%	0%	0%	0%	0%	0%
BT-U:BG: 0%	0%	0%	0%	0%	0%
BT-U:ES: 0%	0%	0%	0%	0%	0%
BT-U:EX: 0%	3%	2%	3%	1%	4%
BT-U:EX2B: 0%	30%	22%	31%	14%	23%
BT-U:PL: 0%	0%	0%	0%	0%	0%
BT-U:SD: 0%	0%	0%	0%	0%	0%

BT-U:SDI: 0%	0%	0%	0%	0%	0%
BT-U:SEP: 0%	32%	37%	32%	41%	35%
BT-U:SEPJ: 0%	36%	39%	35%	44%	38%
CB-A:OP: 0%	0%	0%	0%	0%	0%
CB-B:JT: 0%	0%	0%	0%	0%	0%
CB-C:OP: 0%	0%	0%	0%	0%	0%
CB-D:JT: 0%	0%	0%	0%	0%	0%
CB-U:BG: 0%	0%	0%	0%	0%	0%
CB-U:ES: 0%	0%	0%	0%	0%	0%
CB-U:EX: 0%	3%	17%	5%	23%	8%
CB-U:EX2B: 0%	34%	19%	37%	6%	23%
CB-U:PL: 0%	0%	0%	0%	0%	0%
CB-U:SD: 0%	0%	0%	0%	0%	0%
CB-U:SDI: 0%	0%	0%	0%	0%	0%
CB-U:SEP: 0%	22%	22%	21%	24%	24%
CB-U:SEPJ: 0%	41%	41%	37%	46%	45%
MSh-A:AL: 0%	0%	0%	0%	0%	0%
MSh-B:CL: 0%	0%	0%	0%	0%	0%
MSh-C:CL: 0%	0%	0%	0%	0%	0%
MSh-D:OP: 0%	0%	0%	0%	0%	0%
MSh-U:ES: 0%	0%	0%	0%	0%	0%
MSh-U:EX: 0%	24%	1%	75%	1%	25%
MSh-U:SEP: 0%	76%	99%	25%	99%	75%
MSh-U:TE: 0%	0%	0%	0%	0%	0%
PJ-A:AL: 0%	0%	0%	1%	0%	0%
PJ-B:OP: 0%	1%	0%	0%	0%	0%
PJ-C:OP: 0%	1%	1%	0%	1%	1%
PJ-D:OP: 0%	4%	5%	5%	5%	5%
PJ-U:EX: 0%	85%	85%	85%	83%	85%
PJ-U:TEX: 0%	9%	9%	10%	11%	10%
SWA-A:AL: 0%	1%	0%	1%	0%	26%
SWA-B:CL: 0%	37%	2%	29%	2%	19%
SWA-C:CL: 0%	24%	59%	36%	55%	15%
SWA-U:BG: 0%	0%	0%	0%	0%	0%
SWA-U:ES: 0%	0%	0%	0%	0%	0%
SWA-U:ET: 0%	0%	0%	0%	0%	0%
SWA-U:SEP: 0%	17%	18%	12%	22%	19%
SWA-U:SES: 0%	21%	21%	21%	21%	21%
WDR-A:AL: 0%	0%	4%	0%	0%	0%
WDR-B:CL: 0%	14%	14%	8%	3%	7%
WDR-C:OP: 0%	10%	4%	5%	8%	7%
WDR-D:CL: 0%	0%	3%	3%	1%	10%
WDR-E:CL: 0%	0%	0%	0%	3%	1%
WDR-U:DE: 0%	0%	0%	0%	0%	0%

WDR-U:DEF: 0%	0%	0%	0%	0%	0%
WDR-U:DET: 0%	0%	0%	0%	0%	0%
WDR-U:DEX: 0%	0%	0%	0%	0%	0%
WDR-U:EF: 0%	25%	36%	38%	29%	30%
WDR-U:ET: 0%	0%	0%	1%	1%	0%
WDR-U:EX: 0%	0%	0%	7%	0%	0%
WDR-U:TEX: 0%	52%	40%	37%	55%	45%