Final Report for USDA Ecological Site Description

State-and-Transition Models

for

Major Land Resource Area 24

April 2017

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Tamzen K. Stringham[1]
Patti Novak-Echenique[2]
Amanda Wartgow[3]
Devon Snyder[4]

Authors are [1]Professor, [3,4]Rangeland Ecologists, Dept. of Agriculture, Nutrition and Veterinary Sciences University of Nevada, Reno, NV, [2]State Rangeland Management Specialist, USDA-NRCS Reno, NV

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Group 9

Disturbance Response Group (DRG) 9 consists of two ecological sites. The precipitation zone for these sites is 6 to 10 inches. The soils correlated to these sites occur on floodplains, fan skirts, inset fans, ephemeral stream terraces and intermittent drainageways. Parent materials consist of alluvium from mixed rock sources. Slopes range from 0 to 4 percent, but less than 2 percent is typical. Elevations range from 3500 to 6000 feet. The soil temperature regime is mesic. These soils are susceptible to gullying, causing degradation of these sites. Runoff is slow to very slow and ponding may occur in some areas. Normal year production ranges from 800 to 1100 lbs/ac. The potential native plant community for these sites is dominated by basin wildrye. The modal site shrub component is dominated by basin big sagebrush (*Artemisia tridentata* spp. *tridentata)* with a smaller component of black greasewood (*Sarcobatus vermiculatus)*. The Gravelly Fan site shrub component is dominated by spiny hopsage (*Grayia spinosa)* and Wyoming big sagebrush (*Artemisia tridentata* spp. *wyomingensis)* with a small component of black greasewood.

Modal:
The Dry Floodplain (024XY006NV) is the modal site for this group as it has the most acres mapped. This site occurs on the outer margins of axial-stream floodplains, fan skirts and along intermittent drainageways. Slopes range from 0 to 4 percent, but are mostly less than 2 percent. Elevations are 4000 to 6000 feet. Average annual precipitation is 6 to 10 inches. The soils of this site are deep to very deep and have a high available water capacity. They are somewhat poorly to well drained and runoff is mostly slow to very slow. These soils are subject to occasional overflow by stream flooding or as run-in from higher landscapes which will supply additional moisture for plant growth. During the summer and fall months the water table is at depths below 6 feet. Most soils are slightly to moderately salt and sodium affected throughout. Soil reaction increases with soil depth and most soils are moderately to very strongly saline-sodic affected below 30 inches. These soils are susceptible to gullying which can intercept normal overflow patterns causing site degradation. The plant community is dominated by basin wildrye (*Leymus cinereus*). Basin big sagebrush and black greasewood are other important species associated with this site. Production for a normal year is 1100 lbs/acre.

Disturbance Response Group – 9

024XY006NV	Dry Floodplain MODAL
024XY041NV	Gravelly Fan

Ecological Dynamics and Disturbance Response

An ecological site is the product of all the environmental factors responsible for its development and it has a set of key characteristics that influence a site's resilience to disturbance and resistance to invasives. Key characteristics include 1) climate (precipitation, temperature), 2) topography (aspect, slope, elevation, and landform), 3) hydrology (infiltration, runoff), 4) soils (depth, texture, structure, organic matter), 5) plant communities (functional groups, productivity), and 6) natural disturbance regime (fire, herbivory, etc.) (Caudle et al 2013). Biotic factors that influence resilience include site productivity, species composition and structure, and population regulation and regeneration (Chambers et al. 2013).

The Great Basin sagebrush communities have high spatial and temporal variability in precipitation both among years and within growing seasons. Nutrient availability is typically low but increases with

elevation and closely follows moisture availability. The moisture resource supporting the greatest amount of plant growth is usually the water stored in the soil profile during the winter. The invasibility of plant communities is often linked to resource availability. Disturbance can decrease resource uptake due to damage or mortality of the native species and depressed competition or can increase resource pools by the decomposition of dead plant material following disturbance. The invasion of sagebrush communities by cheatgrass (*Bromus tectorum*) has been linked to disturbances (fire, abusive grazing) that have resulted in fluctuations in resources (Chambers et al 2007).

The ecological sites in this DRG are dominated by the deep-rooted cool season, perennial bunchgrasses such as basin wildrye and long-lived shrubs (50+ years) such as basin big sagebrush and Wyoming big sagebrush. These shrubs have high root to shoot ratios. Root length of mature big sagebrush plants was measured to a depth of 2 meters in alluvial soils in Utah (Richards and Caldwell 1987). These shrubs have a flexible generalized root system with development of both deep taproots and laterals near the surface (Comstock and Ehleringer 1992). Differences in root depth distribution between grasses and shrubs result in resource partitioning in this system.

The perennial bunchgrasses generally have somewhat shallower root systems than the shrubs, but root densities are often as high as or higher than those of shrubs in the upper 0.5 m but taper off more rapidly than shrubs. However, basin wildrye is weakly rhizomatous and has been found to root to depths of up to 2 meters and to exhibit greater lateral root spread than many other grass species (Abbott et al. 1991, Reynolds and Fraley 1989).

Basin wildrye is a large, cool-season perennial bunchgrass with an extensive deep coarse fibrous root system (Reynolds and Fraley 1989). Clumps may reach up to six feet in height (Ogle et al 2012b). Basin wildrye does not tolerate long periods of inundation; it prefers cycles of wet winters and dry summers and is most commonly found in deep soils with high water holding capacities or seasonally high water tables (Ogle et al 2012b, Perryman and Skinner 2007).

Millions of acres in the arid and semi-arid West have been brush-beaten and planted with crested wheatgrass in order to benefit both livestock and wildlife and to increase range production (Zlatnik 1999). Crested wheatgrass is a cool-season, medium height, exotic perennial bunchgrass. As a native of Russia, it is adapted to very cold and very dry climates which made it the common choice for range rehabilitation. Sites within this DRG may exhibit an understory of crested wheatgrass (*Agropyron cristatum*) in areas where historical seedings have been allowed to return to sagebrush.

Seasonally high water tables have been found to be necessary for maintenance of site productivity and reestablishment of basin wildrye stands following disturbances such as fire, drought or excessive herbivory (Eckert et al. 1973). The sensitivity of basin wildrye seedling establishment to reduced soil water availability is increased as soil pH increases (Stuart et al. 1971). Lowering of the water table through extended drought, channel incision or water pumping will decrease basin wildrye production and establishment, while sagebrush, black greasewood, rabbitbrush (*Ericameria Nauseosa*), and invasive weeds increase. Farming and abandonment may facilitate the creation of surface vesicular crust, increased surface ponding, and decreased infiltration; which leads to dominance by sprouting shrubs and an annual understory.

The ecological sites in this DRG have moderate resilience to disturbance and resistance to invasion. Primary disturbances on these ecological sites is drought, fire, flooding, Aroga infestation (*Aroga websteri*), and channel incision or other disturbance leading to a lowered seasonal water table. This facilitates an increase in shrubs and a decrease in basin wildrye. The introduction of annual weedy

species, like cheatgrass, may cause an increase in fire frequency and eventually lead to an annual state or a state dominated by rabbitbrush. Other troublesome non-native weeds such as broadleaved pepperweed or tall whitetop (*Lepidium latifolium*), hoary cress or whitetop (*Cardaria draba*), scotch cottonthistle *(Onopordum acanthium*) or bull thistle (*Cirsium vulgare)* are potential invaders on this site. Four possible alternative stable states have been identified for this DRG.

Fire Ecology:
Natural fire return intervals are estimated to vary between less than 35 years up to 100 years in sagebrush ecosystems with basin wildrye (Payson et al. 2000). Higher production sites would have experienced fire more frequently than lower production sites. Basin wildrye is relatively resistant to fire, particularly dormant season fire, as plants sprout from surviving root crowns and rhizomes (Zschaechner 1985). Fire maintained the grass dominance of these ecosystems therefore increases in the fire return interval favors increases in the shrub component of the plant community, potentially facilitating increases in bare ground, inland salt grass (and invasive weeds. Lack of fire combined with excessive herbivory converts these sites to sagebrush, black greasewood and rabbitbrush dominance.

The effect of fire on bunchgrasses relates to culm density, culm-leaf morphology, and the size of the plant. The initial condition of bunchgrasses within the site along with seasonality and intensity of the fire all factor into the individual species response. For most forbs and grasses the growing points are located at or below the soil surface providing relative protection from disturbances which decrease above ground biomass, such as grazing or fire. Thus, fire mortality is more correlated to duration and intensity of heat which is related to culm density, culm-leaf morphology, size of plant and abundance of old growth (Wright 1971, Young 1983). Season and severity of the fire will influence plant response as will post-fire soil moisture availability.

Basin wildrye is relatively resistant to fire, particularly dormant season fire, as plants sprout from surviving root crowns and rhizomes (Zschaechner 1985). Fire maintained the grass dominance of these ecosystems, therefore increases in the fire return interval favors increases in the shrub component of the plant community. The reduction of grasses potentially facilitates increases in bare ground, inland salt grass, and invasive weeds. Lack of fire combined with excessive herbivory converts these sites to sagebrush, black greasewood, and rabbitbrush dominance.

Basin big sagebrush and Wyoming big sagebrush are easily killed by fire and do not sprout after fire. Repeated fires may eliminate the onsite seed source; reinvasion into these areas may be extremely slow (Bunting et al. 1987). Basin big sagebrush and Wyoming big sagebrush reinvade a site primarily by off-site seed or seed from plants that survive in unburned patches. Approximately 90% of big sagebrush seed is dispersed within 30 feet (9 m) of the parent shrub (Goodrich et al. 1985) with maximum seed dispersal at approximately 108 feet (33 m) from the parent shrub (Shumar and Anderson 1986). Therefore regeneration of big sagebrush after stand replacing fires is difficult and dependent upon proximity of residual mature plants and favorable moisture conditions (Johnson and Payne 1968, Humphrey 1984). Reestablishment after fire may require 50 to 120 or more years (Baker 2006).

The majority of research concerning rabbitbrush has been conducted on green rabbitbrush. Green rabbitbrush has a large taproot and is known to be shorter-lived and less competitive than sagebrush. Seedling density, flower production, and shoot growth decline as competition from other species increases (McKell and Chilcote 1957, Miller et al. 2013). Depending on fire severity, rabbitbrush may increase after fire. Rubber rabbitbrush is top-killed by fire, but can resprout after fire and can also establish from seed (Young 1983).

Livestock/Wildlife Grazing Interpretations:
Basin wildrye is valuable forage for livestock (Ganskopp et al. 2007) and wildlife, but is intolerant of heavy, repeated, or spring grazing (Krall et al. 1971). Basin wildrye is used often as a winter feed for livestock and wildlife; not only providing roughage above the snow but also cover in the early spring months (Majerus 1992). Inadequate rest and recovery from defoliation causes a decrease in basin wildrye and an increase in basin big sagebrush and rubber rabbitbrush along with western wheatgrass *(Pascopyrum smithii*) and beardless wildrye. Further deterioration of the sites promotes shrub dominance, increased bare ground and the invasion of annual weeds, primarily cheatgrass and Russian thistle.

During settlement, many of the cattle in the Great Basin were wintered on extensive basin wildrye stands however due to sensitivity to spring use many stands were decimated by early in the 20th century (Young et al. 1975). Less palatable species such as black greasewood, rabbitbrush and inland salt grass increased in dominance along with invasive non-native/weedy species such as povertyweed, Russian thistle, mustards and cheatgrass (Roundy 1985). Spring defoliation of basin wildrye and/or consistent, heavy grazing during the growing season has been found to significantly reduce basin wildrye production and density (Krall et al. 1971). Thus, inadequate rest and recovery from defoliation can cause a decrease in basin wildrye and an increase in rabbitbrush and black greasewood, along with inland saltgrass and non-native weeds (Young et al. 1975, Roundy 1985). Additionally, natural great basin wildrye seed viability has been found to be low and seedlings lack vigor (Young and Evans 1981). Roundy (1985) found that although basin wildrye is adapted to seasonally dry saline soils, high and frequent spring precipitation is necessary to establish it from seed suggesting that establishment of natural basin wildrye seedlings occurs only during years of unusually high precipitation. Therefore, reestablishment of a stand that has been decimated by grazing may be episodic.

Hydrology of these basin wildrye dominated sites is also critical for site function and maintenance. Seasonally high water tables have been found necessary for maintenance of site productivity and reestablishment of basin wildrye stands following disturbances such as fire, drought or excessive herbivory (Eckert et al. 1973). The sensitivity of basin wildrye seedling establishment to reduced soil water availability is increased as soil pH increases (Stuart et al. 1971). Lowering of the water table through extended drought, channel incision or water pumping will decrease basin wildrye production and establishment while sagebrush, black greasewood, rabbitbrush, and invasive weeds increase. Farming and abandonment may facilitate the creation of surface vesicular crust, increased surface ponding and decreased infiltration; which leads to dominance by sprouting shrubs with annual understory.

State and Transition Model Narrative – Group 9

Reference State 1.0: The Reference State 1.0 is a representative of the natural range of variability under pristine conditions. The Reference State has three general community phases: a shrub-grass dominant phase, a perennial grass dominant phase and a shrub dominant phase. State dynamics are maintained by interactions between climatic patterns and disturbance regimes. Negative feedbacks enhance ecosystem resilience and contribute to the stability of the state. These include the presence of all structural and functional groups, low fine fuel loads, and retention of organic matter and nutrients. Plant community phase changes are primarily driven by fire, periodic drought and/or insect or disease attack.

Community Phase 1.1:
This community is dominated by basin wildrye and basin big sagebrush. Forbs and other grasses make up smaller components. Wyoming big sagebrush may also be present.

Community Phase Pathway 1.1a: Fire will decrease or eliminate the overstory of big sagebrush and allow the perennial bunchgrasses to dominate the site. Fires will typically be low severity, resulting in a mosaic pattern due to low fuel loads. A fire following an unusually wet spring may be more severe and reduce sagebrush cover to trace amounts. A severe infestation of Aroga moth or prolonged flooding could also cause a large decrease in big sagebrush giving a competitive advantage to the perennial grasses and forbs.

Community Phase Pathway 1.1b: Time and lack of disturbance such as fire allows for sagebrush to increase and become decadent. Long term drought, herbivory, or combinations of these will cause a decline in perennial bunchgrasses and fine fuels, leading to a reduced fire frequency and allowing big sagebrush to dominate the site.

Community Phase 1.2:
This community phase is characteristic of a post-disturbance, early-seral community. Basin wildrye and other perennial bunchgrasses dominate. Rubber rabbitbrush may be sprouting. Depending on fire severity or intensity of Aroga moth infestations, patches of intact big sagebrush may remain.

Community Phase Pathway 1.2a: Time and lack of disturbance will allow basin big sagebrush to increase.

Community Phase 1.3:
Basin big sagebrush increases in the absence of disturbance. Decadent big sagebrush and/or rubber rabbitbrush dominates the overstory and the deep-rooted perennial bunchgrasses in the understory are reduced either from competition with shrubs and/or from herbivory. Wyoming big sagebrush and black greasewood may also be present.

Community Phase Pathway 1.3a: A low severity fire, Aroga moth, prolonged flooding or combinations will reduce some of the big sagebrush overstory and allow grass species to increase.

Community Phase Pathway 1.3b: Fire will decrease or eliminate the overstory of big sagebrush and allow the perennial bunchgrasses to dominate the site. Fires will typically be low severity resulting in a mosaic pattern due to low fine fuel loads. A fire following an unusually wet spring or a change in management favoring an increase in fine fuels may be more severe and reduce sagebrush cover to trace amounts. A severe infestation of Aroga moth or prolonged flooding could also cause a large decrease in big sagebrush within the community, giving a competitive advantage to the perennial grasses and forbs.

T1A: Transition from Reference State 1.0 to Current Potential State 2.0:
Trigger: This transition is caused by the introduction of non-native annual plants, such as cheatgrass and mustards.
Slow variables: Over time the annual non-native species will increase within the community.

Threshold: Any amount of introduced non-native species causes an immediate decrease in the resilience of the site. Annual non-native species cannot be easily removed from the system and have the potential to significantly alter disturbance regimes from their historic range of variation.

Current Potential State 2.0: This state is similar to the Reference State 1.0 with three similar community phases. Ecological function has not changed, however the resiliency of the state has been reduced by the presence of invasive weeds. Non-natives may increase in abundance but will not become dominant within this State. These non-natives can be highly flammable and can promote fire where historically fire had been infrequent. Negative feedbacks enhance ecosystem resilience and contribute to the stability of the state. These feedbacks include the presence of all structural and functional groups, low fine fuel loads, and retention of organic matter and nutrients. Positive feedbacks decrease ecosystem resilience and stability of the state. These include the non-natives' high seed output, persistent seed bank, rapid growth rate, ability to cross pollinate, and adaptations for seed dispersal. A site may be considered to be in the Current Potential State if the non-native seeded species crested wheatgrass is present.

Community Phase 2.1:
This community phase is similar to the Reference State Community Phase 1.1, but non-native species are present in trace amounts. Basin wildrye and basin big sagebrush dominate the site. Wyoming big sagebrush may also be present. Seeded species such as crested wheatgrass may be present and/or dominate the understory. Forbs and other shrubs and grasses make up smaller components of this site.

Dry Floodplain (024XY006NV) Phase 2.1 T. Stringham April 2010

Community Phase Pathway 2.1a: Fire reduces the shrub overstory and allows for perennial bunchgrasses to dominate the site. Fires are typically low severity resulting in a mosaic pattern due to low fuel loads. A fire following an unusually wet spring or a change in management favoring an increase in fine fuels may be more severe and reduce sagebrush cover to trace amounts. A severe infestation of Aroga moth, prolonged flooding and/or shrub treatments could also cause a large decrease in sagebrush within the community, giving a competitive advantage to the perennial grasses and forbs. Annual non-native species are likely to increase after fire.

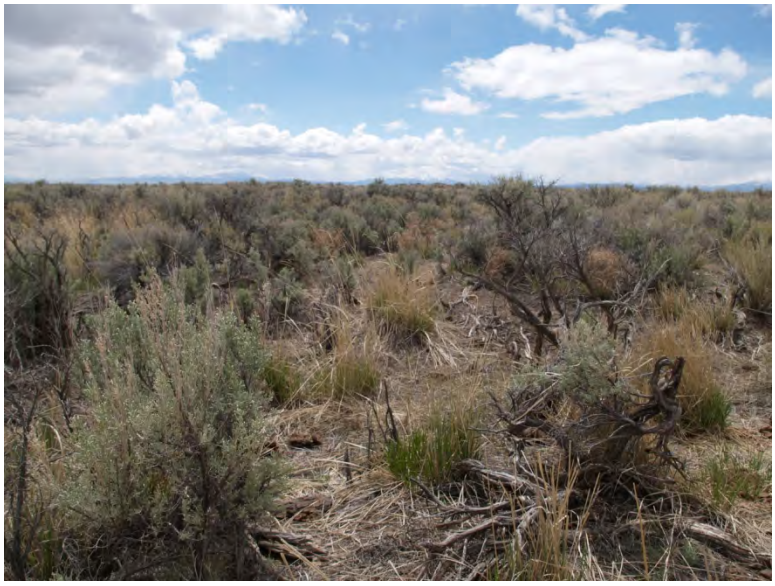
Community Phase Pathway 2.1b: Time and lack of disturbance allows for sagebrush to increase and become decadent. Long term drought reduces fine fuels and leads to a reduced fire frequency, allowing big sagebrush to dominate the site. Inappropriate grazing management reduces the perennial bunchgrass understory; conversely Sandberg bluegrass may increase in the understory depending on grazing management.

Community Phase 2.2:
This community phase is characteristic of a post-disturbance, early seral community where annual non-native species are present. Sagebrush is present in trace amounts; perennial bunchgrasses dominate the site. Depending on fire severity or intensity of Aroga moth infestations, patches of intact sagebrush may remain. Rabbitbrush may be sprouting. Seeded species such as crested wheatgrass may be present and/or dominate the understory. Perennial forbs may be a significant component after fire for several years. Annual non-native species are stable or increasing within the community.

Dry Floodplain (024XY006NV) Phase 2.2. T.K. Stringham, UNR Gund Ranch, summer 2011

Community Phase Pathway 2.2a: Time and lack of disturbance and/or grazing management that favors the establishment and growth of sagebrush allows the shrub component to recover. The establishment of big sagebrush can take many years.

Community Phase 2.3 (At risk):
This community is at risk of crossing a threshold to another state. Basin big sagebrush dominates the overstory and perennial bunchgrasses in the understory are reduced, either from competition with shrubs or from inappropriate grazing, or from both. Wyoming big sagebrush and black greasewood may also be present. Rabbitbrush may be a significant component. Inland saltgrass may increase and become co-dominate with deep rooted bunchgrasses. Annual non-natives species may be stable or increasing due to lack of competition with perennial bunchgrasses. Seeded species such as crested wheatgrass (*Agropyron cristatum*) may be present. This site is susceptible to further degradation from grazing, drought, and fire.



Dry Floodplain (024XY006NV) Phase 2.3 T. Stringham April 2010

Dry Floodplain (024XY006NV) Phase 2.3 T. Stringham April 2010

Community Phase Pathway 2.3a: Heavy late-fall or winter grazing may cause mechanical damage and subsequent death to big sagebrush, facilitating an increase in the herbaceous understory. An infestation of Aroga moth or low severity fire will reduce some big sagebrush overstory and allow perennial grasses to increase in the community. Brush treatments with minimal soil disturbance will also decrease sagebrush and release the perennial understory. Annual non-native species are present and may increase in the community.

Community Phase Pathway 2.3b: Fire eliminates/reduces the overstory of sagebrush and allows for the understory perennial grasses to increase. Fires will typically be low severity resulting in a mosaic pattern due to low fine fuel loads. A fire that follows an unusually wet spring or change

in management favoring an increase in fine fuels may be more severe and reduce the shrub component to trace amounts. A severe infestation of Aroga moth will also cause a large decrease in sagebrush within the community, giving a competitive advantage to the perennial grasses and forbs. Annual non-native species respond well to fire and may increase post-burn.

T2A: Transition from Current Potential State 2.0 to Shrub State 3.0

Trigger: Repeated, heavy, growing season grazing will decrease or eliminate basin wildrye and favor shrub growth and establishment. Grazing and/or fire may couple with hydrologic changes and accelerate the transition to state 3.0.

Slow variables: Long term decrease in basin wildrye density due to grazing or lowering water table.

Threshold: Loss of the large, deep-rooted basin wildrye changes nutrient cycling, nutrient redistribution, and reduces soil organic matter.

T2B: Transition from Current Potential State 2.0 to Annual State 4.0

Trigger: Severe fire likely in at risk community phase 2.3.

Slow variables: Increased production and cover of non-native annual species.

Threshold: Loss of deep-rooted perennial bunchgrasses and shrubs truncates, spatially and temporally, nutrient capture and cycling within the community. Increased, continuous fine fuels from annual non-native plants modify the fire regime by changing intensity, size and spatial variability of fires.

Shrub State 3.0: This state is a product of many years of heavy grazing during time periods harmful to perennial bunchgrasses. Sites within this DRG with high water tables may transition to a shrub state if the hydrology of the area is affected. In both cases, basin wildrye is significantly reduced and other perennial grasses such as beardless wildrye will increase. Big sagebrush dominates the overstory and rabbitbrush may be a significant component. Big sagebrush cover exceeds site concept and may be decadent, reflecting stand maturity and lack of seedling establishment due to competition with mature plants. The shrub overstory and shallower rooted grasses dominate site resources such that soil water, nutrient capture, nutrient cycling and soil organic matter are temporally and spatially redistributed.

Community Phase 3.1:

Decadent big sagebrush dominates the overstory. Rabbitbrush and black greasewood may be significant components. Deep-rooted perennial bunchgrasses may be present in trace amounts or absent from the community. Creeping wildrye is present but may be found only in patches. Annual non-native species increase. Crested wheatgrass may be a significant component in this phase if the site has a history of seeding treatments. Bare ground is significant.

Dry Floodplain (024XY006NV) Phase 3.1 T. Stringham April 2010

Dry Floodplain (024XY006NV) Phase 3.1 T. Stringham April 2010

T3A: Transition from Shrub State 3.0 to Annual State 4.0:

Trigger: Severe fire.

Slow variables: Increased production and cover of non-native annual species.

Threshold: Increased, continuous fine fuels modify the fire regime by changing intensity, size and spatial variability of fires. Changes in plant community composition and spatial variability of vegetation due to the loss of perennial bunchgrasses and sagebrush truncate energy capture spatially and temporally thus impacting nutrient cycling and distribution.

R3A: Restoration Pathway from Shrub State 3.0 to Current Potential State 2.0:

Restoration of this state would require mechanical or chemical brush treatment and control of annual invasive weed species. Seeding of grasses may be necessary if basin wildrye is severely

reduced or no longer present in the community. Prescribed burning is not recommended if there is a significant component of cheatgrass or other non-native weeds in the understory. If channel incision has lowered the water table or altered spring soil moisture the probability of establishment of a basin wildrye seeding will be significantly reduced.

Annual State 4.0: This state has two community phases. One community phase is characterized by the dominance of annual non-native species such as cheatgrass and tansy mustard in the understory. The other community phase is dominated by rabbitbrush with an understory of cheatgrass and mustards. Big sagebrush and/or rabbitbrush may dominate the overstory.

Community Phase 4.1:
Annual non-native plants such as tansy mustard *(Descurainia pinnata*) and cheatgrass dominate this site. Crested wheatgrass may be a significant component in this phase if the site has a history of seeding treatments.

Community Phase Pathway 4.1a: Time and lack of disturbance allows sprouting shrubs to recover and mature. Sagebrush may re-establish in a limited extent.

Community Phase 4.2:
Annual non-native plants such as tansy mustard *(Descurainia pinnata*) and cheatgrass dominate the understory while sprouting shrubs such as rabbitbrush dominate the overstory. Big sagebrush may be present in trace amounts. Crested wheatgrass may be a significant component in this phase if the site has a history of seeding treatments.

Community Phase Pathway 4.2a: Fire.

Potential Resilience Differences with other Ecological Sites

Gravelly Fan 024XY041NV: The soils of this site are very deep and well drained. Surface soils are medium textured and less than 10 inches thick. These soils have the potential for the formation of gullies, especially in areas near shallow drainage ways. Normal year production for this site is 800 lbs/acre. This site is much less resilient than modal site due to the lower production and lack rhizomatous plant species. This site was not seen on field visits. However it likely has a similar state-and-transition model with 4 alternative states.

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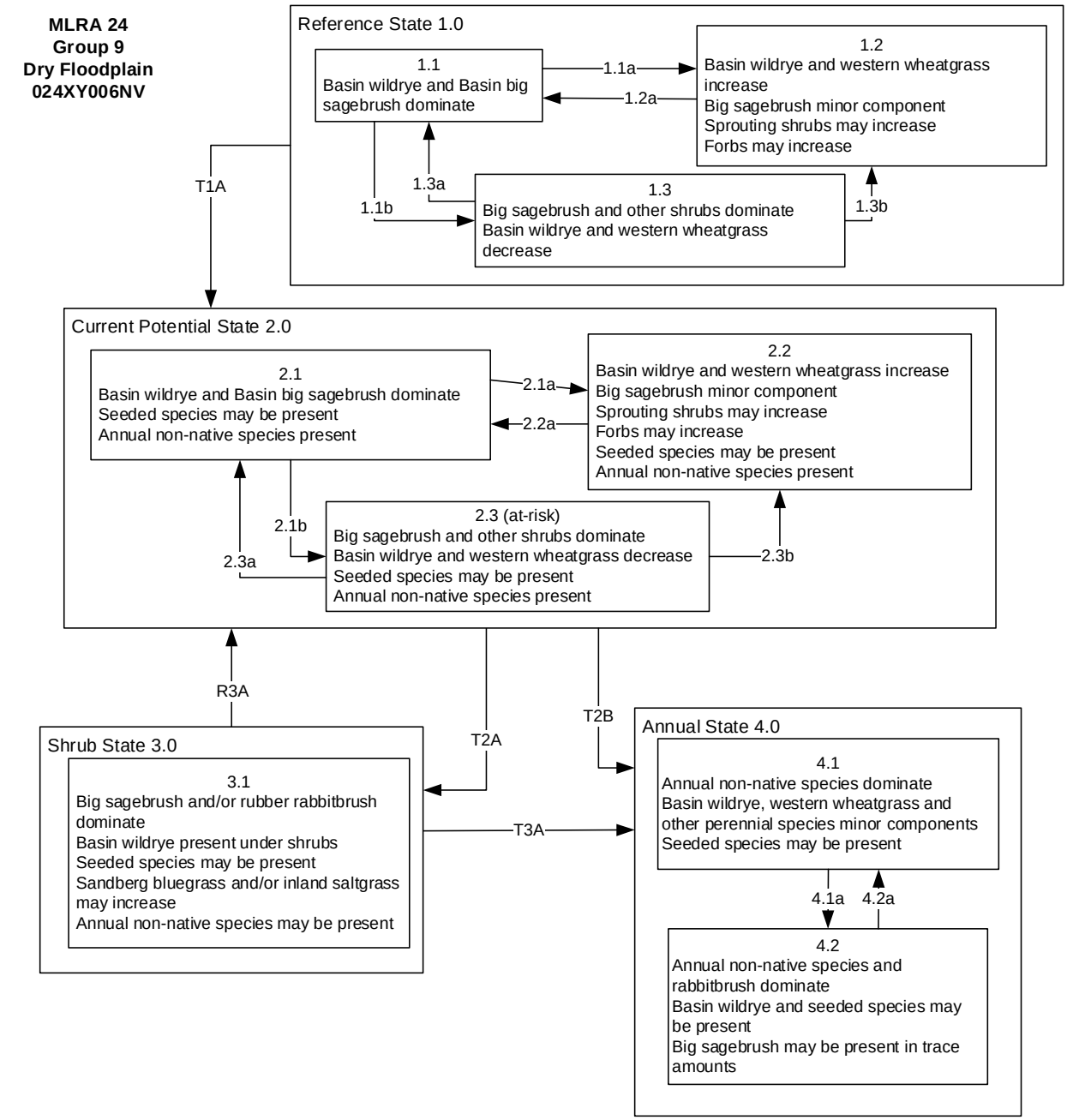
State and Transition Models

Dry Floodplain



MLRA 24
Group 9
Dry Floodplain
024XY006NV

Reference State 1.0 Community Phase Pathways
1.1a: Low severity fire/ Aroga moth infestation creates grass/sagebrush mosaic; high severity fire significantly reduces sagebrush cover and leads to early/mid-seral community dominated by grasses and forbs.
1.1b: Time and lack of disturbance such as fire. Drought and/or excessive herbivory may also decrease perennial understory.
1.2a: Time and lack of disturbance allows for shrub regeneration.
1.3a: A low severity fire, Aroga moth, or combinations will reduce some of the sagebrush overstory and allow grass species to increase.
1.3b: High severity fire significantly reduces sagebrush cover and allows grass species to dominate. A severe infestation of Aroga moth can also decrease the sagebrush overstory.

Transition T1A: Introduction of annual non-native species.

Current Potential State 2.0 Community Phase Pathways
2.1a: Low severity fire creates grass/sagebrush mosaic; high severity fire significantly reduces sagebrush cover and leads to early/mid-seral community dominated by grasses and forbs. Prolonged flooding, Aroga moth and/or brush treatment can also reduce the sagebrush overstory. Non-native annual species present.
2.1b: Time and lack of disturbance such as fire. Drought and/or inappropriate grazing management may also reduce perennial understory.
2.2a: Time and lack of disturbance allows for regeneration of sagebrush. Grazing management that favors sagebrush also allows the shrub component to recover.
2.3a: A low severity fire, Aroga moth, or combinations will reduce some of the sagebrush overstory and allow grass species to increase. Brush management with minimal soil disturbance or late-fall/winter grazing that causes mechanical damage to sagebrush.
2.3b: High severity fire and/or a severe Aroga moth infestation significantly reduces sagebrush cover and allows grass species to dominate.

Transition T2A: Time and lack of disturbance, may be coupled with grazing management and/or hydrologic changes that favor shrubs over perennial grasses
Transition T2B: Severe fire likely from community phase 2.3

Shrub State 3.0 Community Phase Pathways
None.

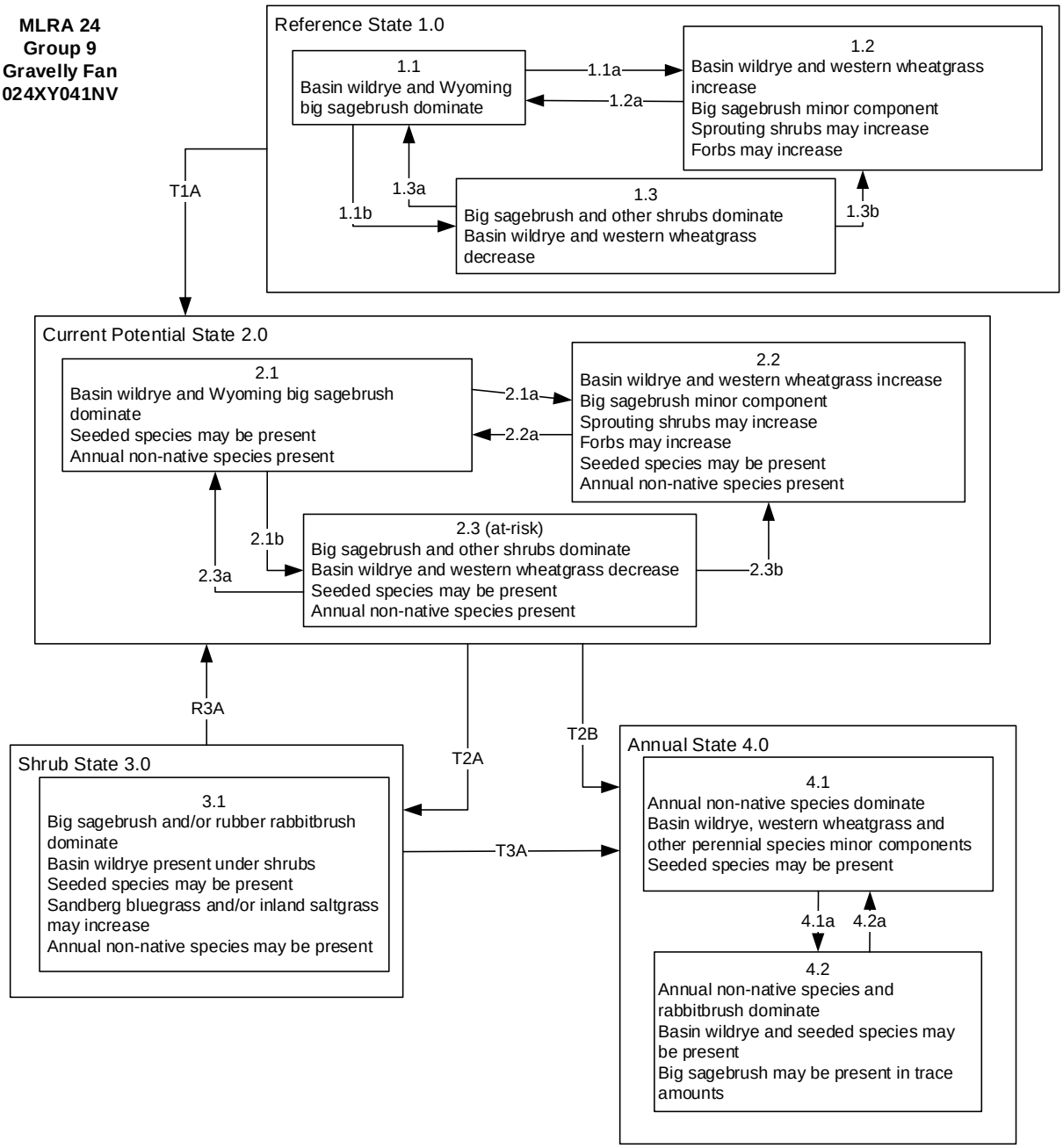
Transition T3A: Severe fire.

Restoration Pathway R3A: Mechanical/chemical brush treatment coupled with herbicide. Seeding of perennial bunchgrasses may be necessary.

Annual State 4.0 Community Phase Pathways
4.1a: Time and lack of disturbance
4.2a: Fire

Gravelly Fan

MLRA 24
Group 9
Gravelly Fan
024XY041NV



MLRA 24
Group 9
Gravelly Fan
024XY041NV

Reference State 1.0 Community Phase Pathways
1.1a: Low severity fire/ Aroga moth infestation creates grass/sagebrush mosaic; high severity fire significantly reduces sagebrush cover and leads to early/mid-seral community dominated by grasses and forbs.
1.1b: Time and lack of disturbance such as fire. Drought and/or excessive herbivory may also decrease perennial understory.
1.2a: Time and lack of disturbance allows for shrub regeneration.
1.3a: A low severity fire, Aroga moth, or combinations will reduce some of the sagebrush overstory and allow grass species to increase.
1.3b: High severity fire significantly reduces sagebrush cover and allows grass species to dominate. A severe infestation of Aroga moth can also decrease the sagebrush overstory.

Transition T1A: Introduction of annual non-native species.

Current Potential State 2.0 Community Phase Pathways
2.1a: Low severity fire creates grass/sagebrush mosaic; high severity fire significantly reduces sagebrush cover and leads to early/mid-seral community dominated by grasses and forbs. Prolonged flooding, Aroga moth and/or brush treatment can also reduce the sagebrush overstory. Non-native annual species present.
2.1b: Time and lack of disturbance such as fire. Drought and/or inappropriate grazing management may also reduce perennial understory.
2.2a: Time and lack of disturbance allows for regeneration of sagebrush. Grazing management that favors sagebrush also allows the shrub component to recover.
2.3a: A low severity fire, Aroga moth, or combinations will reduce some of the sagebrush overstory and allow grass species to increase. Brush management with minimal soil disturbance or late-fall/winter grazing that causes mechanical damage to sagebrush.
2.3b: High severity fire and/or a severe Aroga moth infestation significantly reduces sagebrush cover and allows grass species to dominate.

Transition T2A: Time and lack of disturbance, may be coupled with grazing management and/or hydrologic changes that favor shrubs over perennial grasses
Transition T2B: Severe fire likely from community phase 2.3

Shrub State 3.0 Community Phase Pathways
None.

Transition T3A: Severe fire.

Restoration Pathway R3A: Mechanical/chemical brush treatment coupled with herbicide. Seeding of perennial bunchgrasses may be necessary.

Annual State 4.0 Community Phase Pathways
4.1a: Time and lack of disturbance
4.2a: Fire