Final Report
USDA Ecological Site Description
State-and-Transition Models
Major Land Resource Area 28A and 28B Nevada
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Disturbance Response Group 32AB

Contents **Page**

DRG 32AB – Modal Site POTR5 SYOR/BRMA4-ELTR7

Ecological sites within DRG 32AB 979
Narrative 980
Modal State-and-Transition model 992
References 994
Additional STMs within DRG 32AB 997

Ecological Sites within Disturbance Response Group 32AB:
Modal Site: POTR5 SYOR/BRMA4-ELTR7 028BY067NV

Group	Name	Site ID
32AB	**POTR5 SYOR/BRMA4-ELTR7**	**028BY067NV**
	POTR5-PIEN SYOR/BRMA4-ELTR7	028AY078NV
	Aspen Thicket	028AY073NV
	POTR5-ABCOC ROWO/POA-CARO2	028AY056NV
	POTR5-ABCO LEKI2-BRMA4-ELTR7	028BY055NV
	POTR5 ELTR7-PONE	028BY025NV

MLRA 28

Group 32

Disturbance Response Group (DRG) 32 consists of six sites. Precipitation ranges from 14 inches to greater than 25 inches. The slope ranges from 0 to 75 percent. Elevations range from 7,000 to 10,800 feet. Production ranges from 600 to 1300 lbs/acre under medium canopy class in a normal year. The soils on these sites are typically deep to very deep and well drained. The soil temperature regime is cryic and the soil moisture regime is xeric or xeric bordering on aridic. The dominant vegetation consists of an overstory of quaking aspen (*Populus tremuloides*) and other trees such as Englemann's spruce (*Picea engelmannii*) and Rocky Mountain white fir (*Abies concolor*). The understory is dominated by shrubs such as mountain big sagebrush (*Artemisia tridentata* ssp*. vaseyana*), mountain snowberry (*Symphoricarpos oreophilus*) and Wood's rose (*Rosa woodsii*). The herbaceous component consists of perennial grasses such as mountain brome (*Bromus marginatus*), slender wheatgrass (*Elymus trachycaulus*) and grass-like plants such as Ross' sedge (*Carex rossii*).

Modal Site:
The quaking aspen/snowberry/mountain brome/slender wheatgrass ecological site (F028BY067NV) is the modal that represents this DRG, as it has the most acres mapped. This forest site typically occurs on backslopes and shoulder positions of mountains. Slope gradients are from 8 to 75 percent. Elevations are 7000 to about 10,800 feet. Average annual precipitation is 16 inches to over 20 inches. The soils of this site are very deep and well drained. The soils have a mollic epipedon and a cambic horizon. The pH is neutral to slightly acidic. These soils are moist in winter, spring, and early summer and dry from July to early August. The soil accumulates additional moisture from wind deposited snow. The surface layer is comprised of decomposed organic material consisting of aspen leaves, twigs and grass residues. The A horizon has faint or distinct sand and silt coats on the bottom of the rock fragments. The underlying material is medium textured and the available water holding capacity is moderate to high. Without adequate plant cover, the surface runoff is medium to high, and the potential for sheet and rill erosion is slight to moderate depending on slope. The soil temperature regime is cryic and the soil moisture regime is typic xeric. This site is composed of one to several quaking aspen clones, each with a common genetic makeup and individual phenological and physiological characteristics. The mature overstory canopy cover ranges from 45 to 60 percent and tree heights may reach 80 feet or more. White fir may contribute up to 25 percent of the total tree canopy. Understory vegetation is dominated by mountain snowberry, wax currant (*Ribes cereum*), Wood's rose, slender wheatgrass, bluegrass (*Poa* spp.), Fendler's meadow-rue (*Thalictrum fendleri*), columbine (*Aquilegia* sp.) and common yarrow (*Achillea millefolium*). Production ranges from 1000 to 1600 pounds per acre under a 45 to 60 percent overstory canopy class.

Disturbance Response Group 32 Ecological sites:

POTR5/SYOR/BRMA4-ELTR7	028BY067NV
POTR5-PIEN/SYOR2/BRMA4-ELTR7	028AY078NV
Aspen Thicket	028AY073NV
POTR5-ABCOC/ROWO/POA-CARO2	028AY056NV
POTR5-ABCOC/LEKI2-BRMA4-ELTR7	028BY055NV
POTR5/ELTR7-PONE	028BY025NV

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 that influence resilience include site productivity, species composition and structure, and population regulation and regeneration (Chambers et al. 2013).

Common disturbances in aspen stands include fire, insect and disease outbreaks, wind storms and avalanches. Aspen stands have also shown some sensitivity to drought (Hogg et al 2008). Quaking aspen is considered one of the most widely distributed forest plants in North America (Potter 1998). Mature aspen stands (80 to 100 years) can reach heights up to 100 feet depending on the site. Most stands contain a variety of medium-high shrubs and tall herbs in the understory (DeByle and Winokur 1985). Wildfire maintained the dynamics of these communities, but with fire suppression mature aspen stands can be susceptible to stand decline. Typically as stands begin to decline aspen suckers and saplings are able to regenerate the stand. As aspen trees mature and tree canopy begins to close the perennial understory becomes dominated by shade tolerant species. Conifers, when present, can eventually increase and overtop the aspen trees. The increase in conifers can be attributed to both fire suppression and grazing pressure by both livestock and wildlife (Potter 2005, Strand et al. 2009, Bartos and Campbell 1998). Using a habitat model Strand et al. 2009 computed aspen occurrence probability across the landscape of the Owyhee Plateau. They visited 41 sites where they modeled aspen occurrence; 37% they found dead aspen stems with no aspen regeneration, 51% had scattered aspen ramets and aspen was regenerating in forest gaps, and 12% there was no evidence that aspen had ever occurred on or near the site. Their aspen successional model theorized that non-producing aspen stands can be permanently converted to a conifer stand and the aspen clone can be lost. They estimated that over 60% of aspen woodlands have been or are in the process of converting to conifer woodlands within 80-200 years. Whether or not these stands can be converted back to aspen with disturbance is inconclusive.

An additional threat to aspen sustainability is limited aspen regeneration due to the shading by conifer trees or herbivory. Overstory clearing, whether in small gaps or in large openings, provides the needed light for aspen suckers to sprout (Shepperd et al 2006). A limited aspen root system resulting from previous conifer dominance and/or persistent shading from surrounding uncut trees may require additional disturbance to initiate suckering. Additional management actions such as root ripping may be needed to stimulate root suckering (Shepperd et al 2006). Continuous browsing by livestock or wildlife may also limit aspen regeneration. Herbivory can reduce community resilience and alter future aspen cover (Rogers et al 2013).

There are many environmental factors that can contribute to stand decline or die-off. The major underlying cause can be attributed to tree and/or stand stress. Drought, low soil oxygen, and cold soil temperatures all limit soil water uptake and can contribute to xylem cavitation. Cavitation causes much of the aspen die-off but the created stress can also leave the stand open to secondary factors such as wood boring insects and fungal pathogens (Frey et al. 2004). Drought has been attributed to the decline and death of aspen trees, but also contributes to secondary factors such as insects (Frey et al. 2004).

Aspen stands possess three characteristics that provide suitable sites for invasive plants: 1) deep, rich soils, 2) proximity to moist meadows and riparian areas with open water, 3) their dependency on disturbance and open light. This site has moderate resilience to disturbance and resistance to invasion. Human disturbance associated with recreation and animal (domestic and wildlife) disturbance may lead

to the spread of invasive species such as Kentucky bluegrass (*Poa pratensis*), common dandelion (*Taraxacum officinale*) and thistles (*Cirsium sp*.). Additionally, the ecological sites contained within this DRG are moderately resilient and resistant due to productive soils, additional soil moisture and aspens ability to sprout following fire or other stand or tree removal processes. Three stable states have been identified for this DRG, a reference state, current potential state and a third state where conifers have encroached and dominated the site. The research is inconclusive if these conifer dominated aspen stands can regenerate with fire.

Fire Ecology:
Wildfire is recognized as a natural disturbance that influenced the structure and composition of the historic climax vegetation of this woodland site. It is hypothesized that many of the fires that maintained these communities were set by the Native population, who used fire to manage plant communities for human benefit (Kay 1997). Specific fire intervals are dependent upon surrounding vegetation communities. Intense fires that kill the aspen overstory usually stimulate abundant suckering (DeByle and Winokur 1985). Although aspen stands rely on fire for successful regeneration, aspen stands don't readily carry fire (Fechner and Barrows 1976, Debyle and Winokur 1985, Debyle et al. 1987). The tree itself is extremely fire sensitive (Baker 1925); with its thin bark most aspens are killed by fire, and those left with scarring are usually killed within the next growing season from rot and disease (Bradley et al. 1992,Davidson et al. 1959, Meinecke 1929). Periodic wildfires prevent over-mature aspen stands and maintain a naturally stratified mosaic of even-aged aspen communities in various stages of successional development. Uneven-aged stands form under stable conditions where the overstory gradually disintegrates with disease or age, and is replaced by aspen suckers. Historic heavy grazing has been attributed to the reduction of fine fuels within stands; without the fuels to burn fires seldom occur within aspen forests (DeByle and Winokur 1985).

Mountain big sagebrush is killed by fire (Neuenschwander 1980, Blaisdell et al. 1982), and does not resprout (Blaisdell 1953). Post fire regeneration occurs from seed and will vary depending on site characteristics, seed source, and fire characteristics. Mountain big sagebrush seedlings can grow rapidly and may reach reproductive maturity within 3 to 5 years (Bunting et al. 1987). Mountain big sagebrush may return to pre-burn density and cover within 15-20 years following fire, but establishment after severe fires may proceed more slowly and can take up to 50 years (Bunting et al. 1987, Ziegenhagen 2003, Miller and Heyerdahl 2008, Ziegenhagen and Miller 2009).

Mountain snowberry is top-killed by fire, but resprouts after fire from rhizomes (Leege and Hickey 1971, Noste and Bushey 1987). Snowberry has been noted to regenerate well and exceed pre-burn biomass in the third season after fire (Merrill et al. 1982). Was currant, a minor component of this site, is known as a weak sprouter from the root crown but usually regenerates from soil stored seeds after fire. It is susceptible to fire kill and rarely survives fire (Crane and Fischer 1986). If balsamroot or mules ear is common before fire, these plants will increase after fire or with heavy grazing (Wright 1985).

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).

Mountain brome the dominate grass found on this site is a robust, coarse-stemmed, short lived perennial bunchgrass that can grow from 1 to 5 feet in height (Dayton 1937, Tilley et al. 2004). It is commonly seeded after wildfires due to its ability to establish quickly and reduce erosion (Tilley et al. 2004). Mountain brome significantly decreases after burning (Nimir and Payne 1978). Slender wheatgrass, a sub-dominate grass on this site, may increase after fire. In a study by Nimir and Payne (1978) slender wheatgrass increased significantly in burned than in non-burned sites, although the species did not appear in measurable quantities until mid-July.

Sandberg bluegrass (*Poa secunda*), a minor component of this ecological site, has been found to increase following fire likely due to its low stature and productivity (Daubenmire 1975). Sandberg bluegrass may retard reestablishment of deeper rooted bunchgrasses. Mutton grass (*Poa fendleriana*), also a minor component on this site, is top killed by fire but will resprout after low to moderate severity fires. A study by Vose and White (1991) in an open sawtimber site, found minimal difference in overall effect of burning on mutton grass.

Livestock/Wildlife Grazing Interpretations:
Domestic livestock, wild ungulates, rodents and hares utilize aspen stands and can have a measurable impact. A study by Krebill (1972) found that the majority of aspen decline within their study area was due to a combination of pathogenic fungi and insects which invade aspen trees damaged by big game (Krebill 1972). Browsing during the sapling stage reduces aspen growth, vigor and numbers (DeByle and Winokur 1985). Heavy browsing on aspen suckers may result in lower clone vigor to the point that suckering no longer takes place. Browsing pressure may allow aspen to regenerate but prevent the development of trees, and the aspen will grow instead as a dense shrub (Bradley et al. 1992). Because aspen stands are grazed by cattle and/or sheep and also have a significant population of wild ungulates, grazing management and game management are important for the health of aspen communities.

Fecal samples from ungulates in Montana showed that bighorn sheep, mule deer, and elk all consumed mountain big sagebrush in small amounts in winter, while cattle had no sign of sagebrush use. This same study found that juniper (mostly *Juniperus horizontalis*) constituted half of the diet of mule deer and approximately 1/6 of the late winter diets of elk and bighorn sheep (Kasworm et al. 1984).

Mountain brome increases with grazing (Leege et al. 1981). A study by Mueggler (1967), found that with clipping, mountain brome increased in herbage production when clipped in June. When clipped in July mountain brome increased due to reduced competition from forb species. The study also found that after three successive years of clipping mountain brome started to show adverse effects. Mountain brome is ranked as highly valuable as elk winter forage (Kufeld 1973).

Slender wheatgrass is a perennial bunchgrass that tends to be short lived, however it spreads well by natural reseeding (Monsen et al. 2004). It is widely used in restoration seedings (Monsen et al. 2004). Slender wheatgrass tends to persists for a longer time than other perennial grasses when subjected to heavy grazing (Monsen et al. 1996, Monsen et al. 2004). Slender wheatgrass is palatable and nutritious for livestock. It is also grazed by wild ungulates and used for cover by small birds and mammals (Tilley et al. 2011, Hallsten et al. 1987).

Sandberg bluegrass increases under grazing pressure (Tisdale and Hironaka 1981) and is capable of co-existing with cheatgrass (*Bromus tectorum*). Excessive sheep grazing favors Sandberg bluegrass; however, where cattle are the dominant grazers, cheatgrass often dominates (Daubenmire 1970). Thus, depending on the season of use, the grazer and site conditions, either Sandberg bluegrass or cheatgrass may become the dominant understory with inappropriate grazing management.

State and Transition Model Narrative - Group 32

Reference State 1.0: The Reference State 1.0 is a representative of the natural range of variability under pristine conditions. This site has four general community phases; a mature woodland phase, a sucker/sapling phase, an immature woodland phase and an over mature woodland/conifer 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, fuel loads, and retention of organic matter and nutrients. Plant community phase changes are primarily driven by fire, periodic long-term drought and/or insect or disease attack.

Community Phase 1.1:
The visual aspect and vegetal structure are dominated by single-storied aspen that have reached or are near maximal heights for the site. Tree heights range from 60 to 80 feet, depending upon site. Tree canopy cover ranges from 25 to about 35 percent. Despite considerable understory forage production, the overstory trees compete with the undergrowth plants for moisture, light, nutrients, and space. Vegetative shoots and/or saplings of aspen occur in the understory, but they are inconspicuous and have a high mortality rate. Engelmann's spruce, Rocky Mountain fir, and other conifers may be present to increasing in the understory, because of their shade tolerance these trees can multiply and eventually dominate the site.

Community Phase Pathway 1.1a: Fire would reduce the mature aspen and allow for the suckers, saplings and the herbaceous understory to increase.

Community Phase Pathway 1.1b: Time and lack of disturbance will allow for the conifer trees in the understory to mature and dominate the site.

Community Phase 1.2:
Herbaceous vegetation dominates the site. Quaking aspen suckers are evident. If the aspen stand is healthy, this stage will only last from one to two years. However, if competing brush and herbaceous plants grow for a full season before aspen suckers emerge, or with excessive herbivory from large ungulates such as elk, a reduction in growth and survival of aspen suckers may occur. Early growth of quaking aspen suckers ranges from less than 1 foot to more than 3 feet per year for shoots having good competitive position. In the absence of disturbance, suckers develop into saplings (to 4½ feet in height) with a range in canopy cover of about 5 to 15 percent. Vegetation consists of grasses, forbs and a few shrubs in association with tree saplings.

Community Phase Pathway 1.2a: Time and lack of disturbance, release from herbivory will allow for the aspen suckers to mature.

Community Phase 1.3:
This stage is characterized by rapid growth of the aspen trees, both in height and canopy cover. Aspen stands are self-thinning, especially at young ages. After the canopy closes, trees stratify into crown classes quickly, despite genetic uniformity within clones. The visual aspect and vegetal structure are dominated by aspen ranging from about 10 to 20 feet in height, and having a diameter at breast height of about 2 to 4 inches. Understory vegetation is moderately influenced by a tree overstory canopy of about 40 to over 60 percent. Growth of the aspen

begins to slow and there is a fairly continual adjustment of trees to growing space. As competition becomes intense enough to affect the diameter growth of dominants, mortality quickly reduces the number of trees in the lower crown classes. There are periodic surges in mortality, with a large number of trees dying within a short time. The visual aspect and vegetal structure are dominated by aspen mostly greater than 25 feet in height. Understory vegetation is moderately influenced by a tree overstory canopy of about 25 to 40 percent.

Community Phase Pathway 1.3a: Time and lack of disturbance, release from herbivory will allow for the aspen trees to mature.

Community Phase Pathway 1.3b: Fire, insects, disease or wind damage can reduce the aspen canopy and the subsequent competition with the understory allowing the understory herbaceous community to increase. Excessive herbivory while trees are still within reach to browse may also reduce aspen growth.

Community Phase 1.4:
In the absence of wildfire or other naturally occurring disturbances, the tree canopy on this site can become very dense. This stage is normally dominated by aspen and/or conifers that have reached maximal heights for the site. Engelmann's spruce, Rocky Mountain fir, and other conifers may dominate the overstory canopy in over-mature, aspen stands. Aspen trees may be decadent. In the absence of disturbance, over-mature, even-aged aspen stands slowly die. Tree canopy cover is commonly more than 50 percent. Understory production is strongly influenced by the overstory, as is species composition. Shade tolerant forbs and a few grasses will dominate the understory.

Community Phase Pathway 1.4a: Fire would decrease the conifer canopy and allow for the aspen suckers to increase.

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 Kentucky bluegrass, thistles and common dandelion.
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 four 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.

Community Phase 2.1:

This community phase is similar to the Reference State Community Phase 1.1, with the presence of non-native species in trace amounts such as common dandelion and cheatgrass. The visual aspect and vegetal structure are dominated by single-storied aspen that have reached or are near maximal heights for the site. Tree heights range from 60 to 80 feet, depending upon site. Tree canopy cover ranges from 25 to about 35 percent. Despite considerable understory forage production, the overstory trees do compete with the undergrowth plants for moisture, light, nutrients, and space. Vegetative shoots and/or saplings of aspen occur in the understory, but they are inconspicuous and have a high mortality rate.

POTR5 (F028BY067NV) T. Stringham, July 2012
Community Phase 2.1

POTR5 (F028BY067NV) T. Stringham, July 2013
Community Phase 2.1

POTR5-ABCO (F028BY055NV) T. Stringham, August 2014
Community Phase 2.1

Community Phase Pathway 2.1a: Fire would reduce the mature aspen and allow for the suckers, saplings and the herbaceous understory to increase. Annual non-natives are likely to increase after fire.

Community Phase Pathway 2.1b: Time and lack of disturbance will allow for the conifers in the understory to mature and dominate the site.

Community Phase 2.2:
Herbaceous vegetation dominates the site. Quaking aspen suckers are evident. If the aspen stand is healthy, these first two stages will only last from one to two years. However, if competing brush and herbaceous plants grow for a full season before aspen suckers emerge sucker survival and growth may be reduced. With excessive grazing from large ungulates such as elk and cattle, a reduction in growth and survival of aspen suckers may occur, this may last until season of grazing is changed, or grazing is reduced/excluded. Early growth of quaking aspen suckers ranges from less than 1 foot to more than 3 feet per year for shoots having good competitive position. In the absence of disturbance, suckers develop into saplings (to 4½ feet in height) with a range in canopy cover of about 5 to 15 percent. Vegetation consists of grasses, forbs and a few shrubs in association with tree saplings. Annual non-native species are stable to increasing within the community.

POTR5 (F028BY067NV) T. Stringham
Community Phase 2.2

Community Phase Pathway 2.2a: Time and lack of disturbance, changing of grazing season or grazing reduction/exclusion will allow for the aspen suckers to mature.

Community Phase 2.3:
This stage is characterized by rapid growth of the aspen trees, both in height and canopy cover. Aspen stands are self-thinning, especially at young ages. After the canopy closes, trees stratify into crown classes quickly, despite genetic uniformity within clones. The visual aspect and vegetal structure are dominated by aspen ranging from about 10 to 20 feet in height, and having a diameter at breast height of about 2 to 4 inches. Understory vegetation is moderately influenced by a tree overstory canopy of about 15 to over 40 percent.

POTR5-PIEN (F028AY078NV) T. Stringham, July 2012
Community Phase 2.3

Community Phase Pathway 2.3a: Time and lack of disturbance and/or release from browsing, will allow for the aspen trees to mature.

Community Phase Pathway 2.3b: Fire, insects, disease or wind damage can reduce the aspen canopy and the subsequent competition with the understory allowing the understory herbaceous community to increase. Inappropriate grazing especially by sheep, and/or herbivory by large ungulates while trees are still within reach to browse may also reduce aspen growth.

Community Phase 2.4:
In the absence of wildfire or other naturally occurring disturbances, the tree canopy on this site can become very dense. This stage is normally dominated by aspen that have reached maximal heights for the site. Engelmann's spruce, Rocky Mountain fir, and other conifers may comprise as much as 50 percent of the total tree canopy in stable, over-mature, aspen stands. Aspen trees have straight, clear stems with short, high-rounded crowns. In the absence of disturbance, over-mature, even-aged aspen stands slowly die. The aspen canopy opens up, and otherwise inconspicuous aspen suckers survive and grow in the openings not shaded by the remaining conifers. These suckers typically arise over a period of several years; the resulting stand is broadly even-aged. If broadly even-aged stands reach old age without disturbance, their deterioration is likely to extend over a longer period than before because of the range of tree ages. That, in turn, will result in a longer regeneration period and a new stand with an even greater range of ages. If this continues over several generations, all-aged stands will result. Tree canopy cover is commonly more than 50 percent. Understory production is strongly influenced by the overstory, as is species composition. Shade tolerant forbs and a few grasses will dominate the understory.

POTR5 (F028BY067NV) P. Novak-Echenique, September 2009
Community Phase 2.4

Community Phase Pathway 2.4a: Fire, or equivalent such as clearcutting/harvesting of the conifers would allow for the aspen suckers to increase and the understory plant community to increase of shrubs and grasses to increase.

T2A: Transition from Current Potential State 2.0 to Conifer Tree State 3.0:

Trigger: Time and a lack of disturbance allow conifer trees to establish, grow and mature grown in understory.
Slow variables: Over time the abundance and size of trees will increase.

Threshold: Conifer canopy cover is greater than 60% of the stand and conifer height exceeds aspen height. Aspen are decadent and dying with little to no regeneration. Little understory vegetation remains due to competition with trees for site resources.

Conifer Tree State 3.0: This state is characterized by one community phase dominated by Rocky Mountain fir and Engelmann's spruce. Aspen may be present in trace amounts however trees are decadent and little to no regeneration is present. Understory vegetation is sparse. Negative feedbacks enhance ecosystem resilience and contribute to the stability of the state. These feedbacks include the dense canopy cover of conifer creating a shade rich environment that facilitates the germination and establishment of conifers and retards the growth and suckering of aspen. Positive feedbacks decrease ecosystem resilience and stability of the state. These include high fuel loads from canopy closure and dead and down wood leading to the potential for stand replacing fire.

Community Phase 3.1:
This community phase is dominated by Rocky Mountain fir and Engelmann's spruce. Aspen trees may be present but show decadence and are significantly reduced. Understory vegetation is reduced due to competition of the overstory canopy. Annual non-native species may be present.

R3A Restoration from Conifer Tree State 3.0 to Current Potential State 2.0:
Prescribed fire or mechanical removal of trees potentially coupled with root ripping to stimulate suckering.

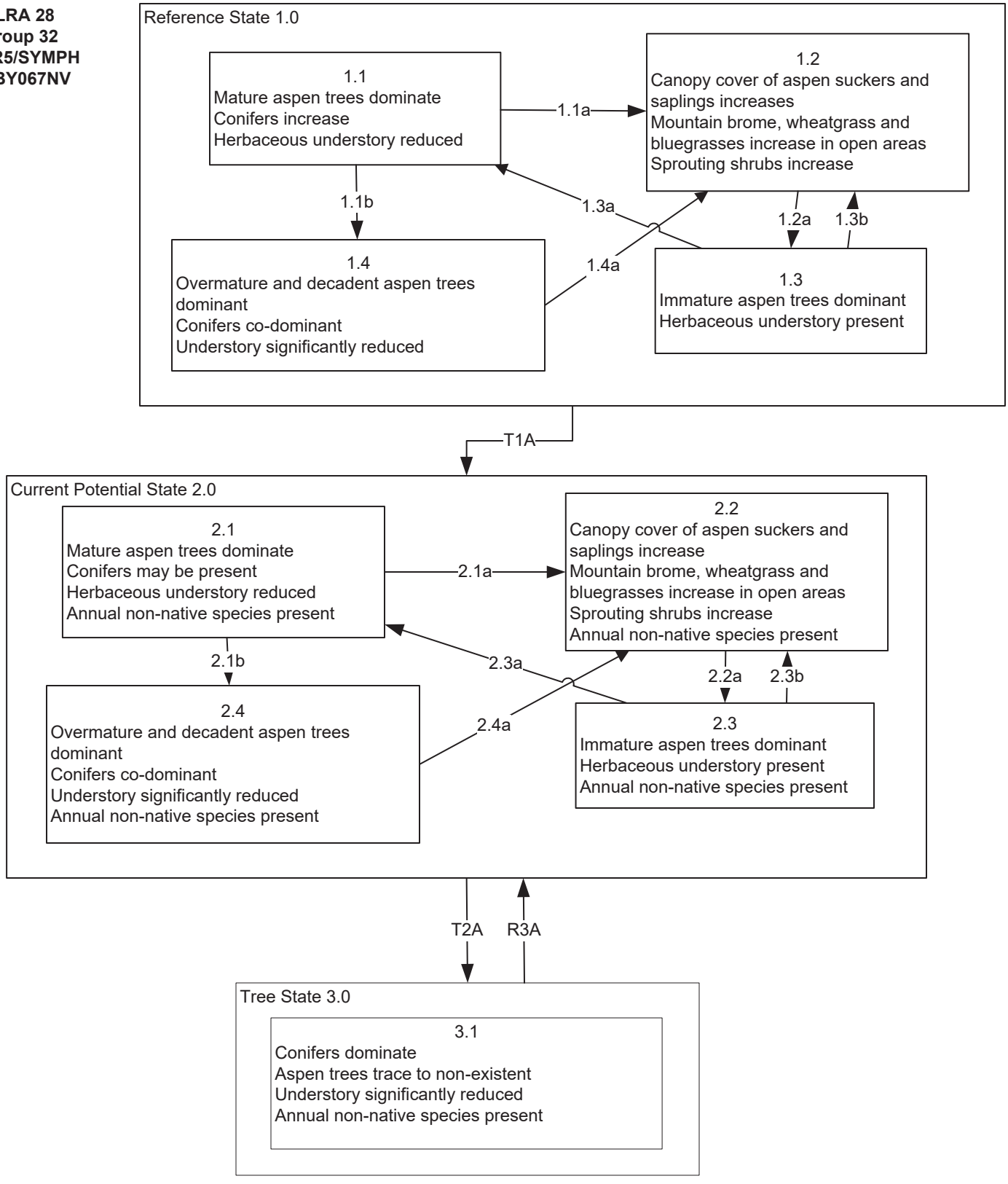
POTR5-ABCO (F028BY055NV) T. Stringham, August 2014
Community Phase 3.1

POTR5-ABCO (F028BY055NV) T. Stringham, August 2014
Community Phase 3.1

Potential Resilience Differences with other Ecological Sites:

POTR5-ABCOC (F028AY026NV) and POTR5 (F028BY025NV): The soils on these sites are generally deep to very deep and somewhat poorly drained. The soils normally have a seasonally high water table within 40 inches of the surface. They have a thick, dark, medium-textured surface layer. The underlying material is medium textured and is slightly acid to mildly alkaline in reaction. Available water holding capacity is high and surface runoff is very slow to medium depending on slope. The soils are susceptible to gullying which intercepts normal overflow patterns causing site degradation. The seasonable high water table increases production to 1300 lbs/acre for a normal year with 26-40% canopy cover. These sites may be more resilient to disturbance.

MLRA 28
Group 32
POTR5/SYMPH
028BY067NV



MLRA 28
Group 32
POTR5/SYMPH
028BY067NV
KEY

Reference State 1.0
1.1a: Fire, insects, disease, wind
1.1b: Time and lack of disturbance
1.2a: Time and lack of disturbance, release from herbivory
1.3a: Time and lack of disturbance, release from herbivory
1.3b: Fire, insects, disease, wind, herbivory when young trees are within browsing reach
1.4a: Fire

T1A: Introduction of non-native species (ex: Kentucky bluegrass, dandelion, thistles)

Current Potential State 2.0
2.1a: Fire, insects, disease, wind or equivalent via harvesting/cutting
2.1b: Time and lack of disturbance
2.2a: Time and lack of disturbance, and/or release from browsing/grazing
2.3a: Time and lack of disturbance, and/or release from browsing/grazing
2.3b: Fire, insects, disease, wind or equivalent via harvesting/cutting, or grazing when young trees are within reach
2.4a: Fire or equivalent via harvesting/cutting

T2A: Time and lack of disturbance allows for conifers to shade out aspen.

R3A: Prescribed fire or other conifer removal via harvesting/cutting may be coupled with root ripping to stimulate suckering.

Notes: Fire intervals are dependent upon surrounding vegetation communities. Open areas/localized aspen death can occur from disease, insects, heavy snow loading, windfall, etc.

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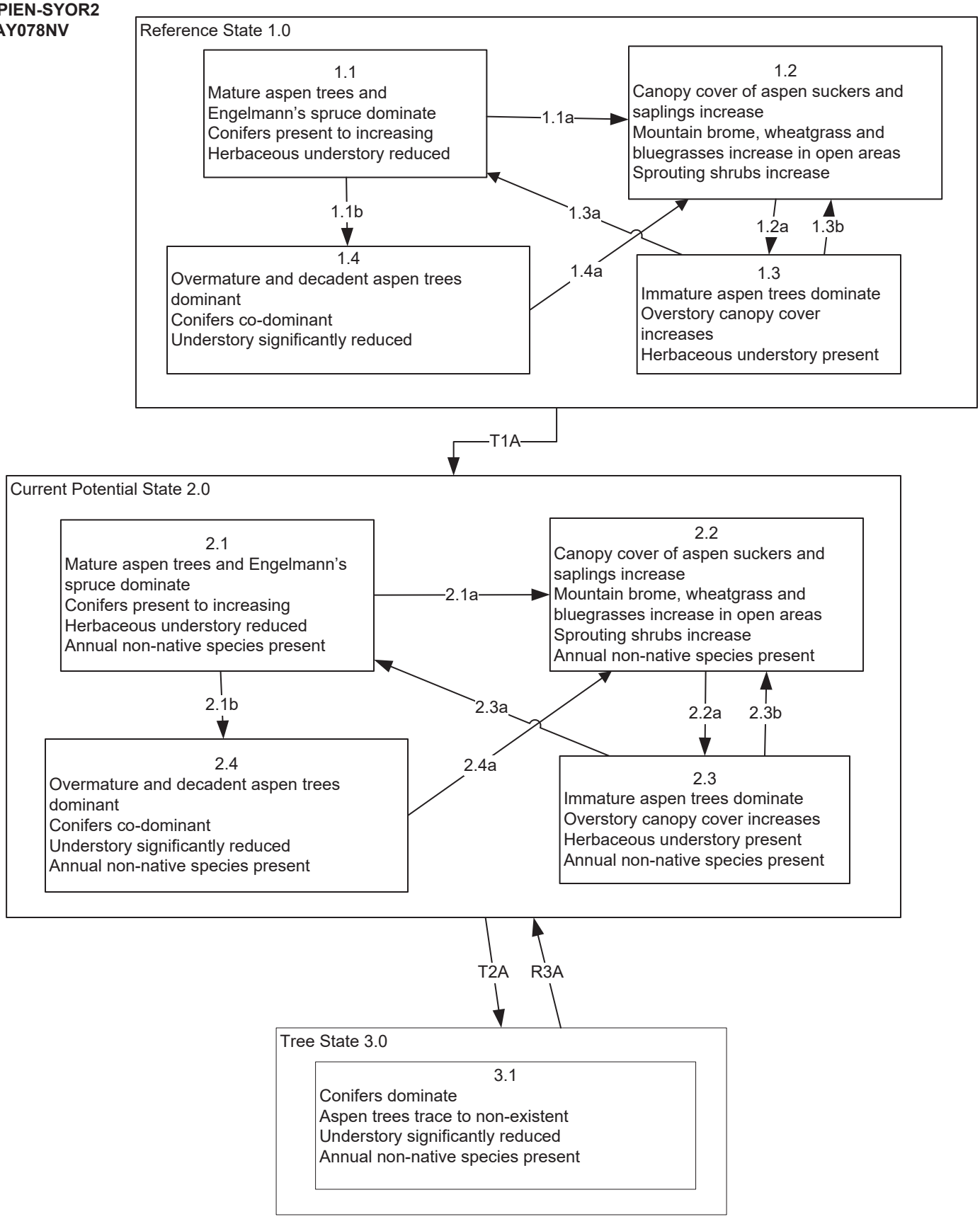
Group 32AB:

Additional State - and -Transition Models:

Name	Site ID
POTR5-PIEN SYOR/BRMA4-ELTR7	028AY078NV
Aspen Thicket Model not included	028AY073NV
POTR5-ABCOC ROWO/POA-CARO2 Model not included	028AY056NV
POTR5-ABCO LEKI2-BRMA4-ELTR7	028BY055NV
POTR5 ELTR7-PONE Model not included	028BY025NV

MLRA 28
Group 32
POTR5-PIEN-SYOR2
028AY078NV



MLRA 28
Group 32
POTR5-PIEN-SYOR2
028AY078NV

Reference State 1.0
1.1a: Fire, insects, disease, wind
1.1b: Time and lack of disturbance
1.2a: Time and lack of disturbance
1.3a: Time and lack of disturbance
1.3b: Fire, insects, disease, wind, herbivory when young trees are within browsing reach
1.4a: Fire

T1A: Introduction of non-native species (ex: Kentucky bluegrass, dandelion, thistles)

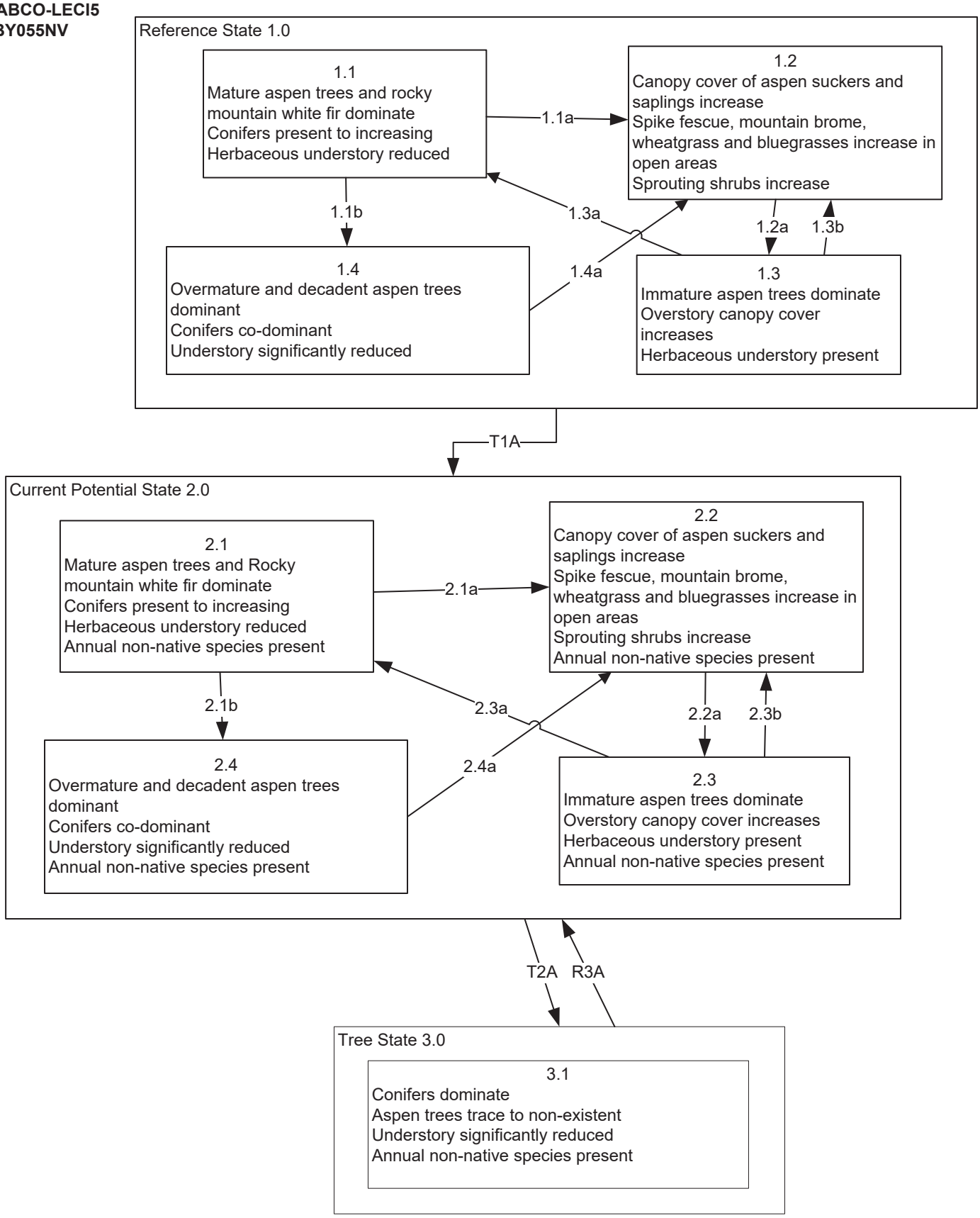
Current Potential State 2.0
2.1a: Fire, insects, disease, wind or equivalent via harvesting/cutting
2.1b: Time and lack of disturbance, may be coupled with inappropriate grazing
2.2a: Time and lack of disturbance, may be coupled with inappropriate grazing
2.3a: Time and lack of disturbance, may be coupled with inappropriate grazing
2.3b: Fire, insects, disease, wind or equivalent via harvesting/cutting
2.4a: Fire or equivalent via harvesting/cutting

T2A: Time and lack of disturbance allows for conifers to increase and shade out aspen trees.

R3A: Prescribed fire or other conifer removal via harvesting/cutting may be coupled with root ripping to stimulate suckering.

Notes: Fire intervals are dependent upon surrounding vegetation communities. Open areas/localized aspen death can occur from disease, insects, heavy snow loading, windfall, etc.

MLRA 28
Group 32
POTR5-ABCO-LECI5
028BY055NV



MLRA 28
Group 32
POTR5-ABCO-LECI5
028BY055NV

Reference State 1.0
1.1a: Fire, insects, disease, wind
1.1b: Time and lack of disturbance
1.2a: Time and lack of disturbance
1.3a: Time and lack of disturbance
1.3b: Fire, insects, disease, wind, herbivory when young trees are within browsing reach
1.4a: Fire

T1A: Introduction of non-native species (ex: Kentucky bluegrass, dandelion, thistles)

Current Potential State 2.0
2.1a: Fire, insects, disease, wind or equivalent via harvesting/cutting
2.1b: Time and lack of disturbance, may be coupled with inappropriate grazing
2.2a: Time and lack of disturbance, may be coupled with inappropriate grazing
2.3a: Time and lack of disturbance, may be coupled with inappropriate grazing
2.3b: Fire, insects, disease, wind or equivalent via harvesting/cutting
2.4a: Fire or equivalent via harvesting/cutting

T2A: Time and lack of disturbance allows for conifers to increase and shade out aspen clones.

R3A: Prescribed fire or other conifer removal via harvesting/cutting may be coupled with root ripping to stimulate suckering

Notes: Fire intervals are dependent upon surrounding vegetation communities. Open areas/localized aspen death can occur from disease, insects, heavy snow loading, windfall, etc.