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KEY TO ECOLOGICAL SITES - MLRA 32X – Northern Intermountain Desertic Basins
All LRU's - Refer to LRU Matrix to Identify LRU

NOTE: Part I of the key describes ecological sites existing individually within soil components. Part II of the key describes complexes of ecological sites that exist on the landscape.

Part I. Soil Component Ecological Site Key

A. Site receives additional effective moisture[1]

1a. Sites with a water table present for at least part of the growing season

2a. Soil saline and/or alkaline (pH ≥8.0, EC> 4 dS/m within mineral soil surface 4" (10 cm))

3a. Seasonal high water table 24-42" (60-105 cm) from ground surface; salt tolerant plants dominate site – Saline Subirrigated (SSb)

3b. Seasonal high water table ≥ 42" (105 cm) from ground surface; salt tolerant plants dominate site; site regularly receives more than normal soil moisture because of run-in or stream overflow – Saline lowland (SLL)

2b. Soils not as above

4a. Seasonal high water table < 42" (105 cm) from ground surface:

5a. Site very poorly drained (depth to water table is 0-12" (0-30 cm)) or poorly drained (12-24" (30-60 cm)) with water table above ground surface part of the growing season – Wetland (WL)

5b. Water table generally at 24-42" (Somewhat poorly drained), and is within 20" (51 cm) of ground surface during part of the growing season – Subirrigated (Sb)

4b. Site not as above:

6a. Seasonal high water table ≥ 42" (105 cm) from ground surface; site regularly receives more than normal soil moisture because of run-in or stream overflow – Lowland (LL)

1b. Site receives periodic overflow from adjacent slopes, but without a water table within rooting depth of woody plants

7a. Site receives periodic overflow from adjacent slopes but it is typically channeled into gullies so that plants are not receiving benefit of additional moisture, site has relic natric or alkaline characteristics (pH greater than 8.4 that has influenced the vegetation to salt tolerant or high pH tolerant plants – ie. Gardner's saltbush, Greasewood[2]) – Saline Lowland, drained (SLdr)

7b. Site not as above

8a. Site has a clay content of > 35% in the mineral soil surface 10" (25 cm) – Clayey Overflow (CyOv)

8b. Site has a clay content of < 35% in the mineral soil surface 10" (25 cm) – Overflow (Ov)

B. Site does not receive additional effective moisture[1]

1a. Soil saline or saline-sodic in surface 20" (51 cm) (includes natric and relic natric)

2a. Soil textures are within the Sandy to Coarse-Loamy particle-size classes, with < 18% clays in any horizon within 20" (51 cm) of mineral soil surface, has an EC (electrical conductivity)>4 dS/m, with no root restrictive layer, site dominated by salt tolerant plants – Saline Upland, Sandy (SUS)

2b. Soils with Fine particle-size class (Clay content is > 35% below mineral soil surface 4" (10 cm)) has an EC (electrical conductivity)>4 dS/m, with no root restrictive layer, site dominated by salt tolerant plants – Saline Upland, Clayey (SUC)

2c. Soils are Fine-Loamy particle-size class with >18% but less than 35% below mineral soil surface 4” (10 cm), has an EC (electrical conductivity)>4 dS/m, with no root restrictive layer, site dominated by salt tolerant plants – Saline Upland, Loamy (SUL)

1b. Site not as above

3a. Soils shallow to very shallow (< 20” (51 cm) deep to bedrock, lithic, or paralithic root restrictive layer)

4a. Weathered or Shale Bedrock that is saline and/or alkaline (pH greater than 8.0), productivity very low – Shale (Sh)

4b. Soil very shallow (< 10” (25 cm) deep) commonly on windswept ridges, fractured bedrock of various types, productivity very low (if productivity is high and rock fragments are present use 8b (Gr)) – Very Shallow (VS)

4c. Soil shallow (10” – 20” (25-51 cm) deep):

5a. Clay content ≤ 32% in mineral soil surface 4” (10 cm) (able to make a ribbon ≤ 2” (5 cm) long)

6a. Soil texture is sand to sandy loam within the upper 4” (10 cm) of mineral soil surface – Shallow Sandy (SwSy)

6b. Soil texture is loam, clay loam, or silt loam within the upper 4” (10 cm) of mineral soil surface– Shallow Loamy (SwLy)

5b. Clay content > 32% in the mineral soil surface 4” (10 cm) (ribbon length > 2” (5 cm’s) long) with clay loam or heavier textured soils (<35% clay) in the particle-size control section over shale bedrock – Shallow Clayey (SwCy)

3b. Soils moderately deep, deep, or very deep (≥ 20” (51 cm) deep to bedrock, lithic, or paralithic root restrictive layer)

7a. Soil skeletal to within 20” (51cm) of mineral soil surface (averages > 35% rock fragments in the 10 - 20” (25-51 cm) layer)

8a. Soil Sandy-skeletal or Loamy-skeletal, has 60% surface fragments; fragments are dominantly < 3” (76mm) – Gravelly (Gr)

8b. Soil Loamy-skeletal or Clayey-skeletal (35% by volume rock fragments increasing with depth), and 35% surface fragments, fragments are dominantly > 3” (76mm) - Coarse Upland (CU)

7b. Soil not skeletal with in 20” (51 cm) of mineral soil surface (averages < 35% rock fragments in the 10”-20” (25-51 cm) layer)

9a. abrupt root or water restrictive clay layer (with >35% clay content) present within 8” (20 cm) of mineral soil surface, no or minimal soil chemistry (salts) present – Impervious Clay (IC)

9b. Site not as above

10a. Clay content is > 35% below the mineral soil surface 4” (10 cm) – Clayey (Cy)

10b. Site not as above:

11a. Sand or loamy sand texture below mineral soil surface 4” (10 cm) – Sands (Sa)

11b. Loamy sands to fine sandy loam texture below mineral soil surface 4” (10 cm), ≤ 18% clay content

12a. Argillic horizon (significant clay increase with evidence of clay movement), with ≥18% clay to ≤ 35% clay, in mineral soil surface 20” (50 cm) – Sandy Argillic (SyA)

12b. Argillic horizon, if present, has ≤ 18% clay – Sandy (Sy)

11c. Site not as above

13a. Calcic horizon or calcareous within 10-20” (25 to 51 cm) surface with a CCE of ≥15%, strong to violently effervescent – Loamy Calcareous (LyCa)

13b. Soil has ≥ 18% clay but ≤ 35% clay below the mineral soil surface 4” (10 cm) – Loamy (Ly)

[1]For areas recognized to have received additional moisture through snow trapping, consider adjusting to a moister LRU consistent with the vegetation observed for the site keyed. It is anticipated that most snow-trap sites will not have a water table. For high elevation, very cold environments, the snow trap effect may be neutral or negative and no LRU adjustment is anticipated.

[2]Specific plant species listed in the key are not to be used as the only determining factor, as management or disturbance may have removed them from the plant community.

Productivity Structural Tree:

WL > Sb ≥ SS > LL ≥ SL > Ov > CO > Sa > Ly = Sy = Cy > LyCa ≥ SUL ≥ SUS ≥ CU ≥ SUC > SwLy = SwSy = SwCy ≥ Gr > IC > VS ≥ Sh

Part II. Rangeland Ecological Site Complex Key (Site is a complex of intermingled ecological sites)

Within the MLRA there are landforms that have been identified as being very dissected or uplifted creating several pockets or quick transitions. As with the soils, the ecological sites are hard to distinguish, and in many cases, even though the soils have shifted, the plant community is not responding as would be expected. For example, a specific location on a landform is identified and the soils pit recognizes a deep, fine-loamy soil with minimal rock fragments. There is no chemistry, and nothing to impede root development including slope. When the plants are inventoried and production estimated it is half to one-fourth of the expected production and the plants resemble what one would expect on a very shallow or shallow site. There are many other reasons that this particular location is responding as it is, but the soils are not the influence. Within this same map unit, there could be other locations that classify exactly the same as this location, but do respond as a loamy site. And so even though they would be listed as the same component, and thus the same ecological site, they are inherently different. This is where the complex site would be used. The component would be correlated to the "Loamy" ecological site as the soils keyed to. But it would be assigned a secondary "complex" ecological site listed below, along with the other components that are identified as part of this complex.

Sandstone Breaks (StB) – A complex of ecological sites; dominantly shallow, coarse textured soils less than 20 inches to bedrock, with Sandy, Shallow Sandy and Very Shallow sites intermingled with sandstone outcrops. Vegetative patterns are influenced more by erosional patterns than on depth of soil characteristics.

Hilly Breaks (HiB) – A complex of ecological sites; within the Loamy textural family, that vary in depth to sandstone and shale. Slope is generally between 10 and 35%, and is characterized by the pockets of Wyoming Big Sagebrush. Depth to the bedrock does not influence the plants as clearly as expected and is difficult / implausible to separate the individual sites out. Complex includes Loamy, Shallow Loamy, Shallow Sandy, Very Shallow, and Gravelly as well as rock outcrop and badland sites.

Shallow Breaks (SwB) – A complex of ecological sites; comprised of soils within the Loamy textural family, varying in depth to sandstone and shale. Slope is up to 45% generally, and has 20-50% rock outcrop that has a minor tree component in the cracks and fractures of the sandstone and mudstone shelves. Site has pockets of dense vegetation, but generally does not have easy access to these vegetated sites.

Steep Shallow Breaks (StSwB) - A complex of ecological sites; comprised of a high percent cover of surface fragments, up to 75% coverage. Rimrock or predominate rock outcrop skirted by steep raw slopes are typical. Slopes are generally 45% and greater. Badlands is a general classification for a large percent of the site with isolated areas of vegetation.

Badlands (BL) A complex of ecological sites; composed of > 70% barren lands (paralithic sedimentary bedrock) broken by drainages and intermingled small vegetated areas. (NOT yet proposed but is warranted)

Rock Outcrop (RO) A complex of ecological sites; composed of >70% rock outcrop (lithic sedimentary bedrock) varying from sandstone, siltstone, and shale. The rock formations are fractured and capture blowing sediment providing small, isolated niches for vegetation to grow. (Not yet proposed but is warranted)

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LRU MATRIX for MLRA 32X

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32X		**Relative Effective Precipitation – RV (inches)** **<-- Drier -- Moisture Regime -- Wetter -->**			
		5-9" typic aridic	**7-12" typic aridic**	**10-14" ustic aridic**	**Ubiquitous sites**
Frost Free Days (RV) **<-- Colder -- Temperature Regime -- Warmer -->**	**100-170 Mesic Warm**	**LRU A –** Big Horn Basin tends to be warmer and possibly slightly drier on average than Wind River Basin. The transition is more gradual across the entire basin with unique breaks across the basin creating micro climates.			**LRU Y –** Typically includes ecological sites with water table less than 42" or complex/unique sites.
	95-175 Mesic Cool	**LRU C –** Wind River Basin trends towards a cooler wetter winter storm pattern than what is seen in the Big Horn Basin. The transition is abrupt at the foothills to the basin and then appears stable across the entire basin– general plant trend shift noted.	**LRU B –** Unique features extending from the base of the Pryor Mountains along the foothills transition –Chugwater, Goose Egg, Sundance and Gypsum Springs formations creates a distinct plant community and response cycle; i.e.: Utah Juniper and Mahogany. * The southern extent of this LRU maps within the boundaries of 46. However, the area is warmer and slightly drier than the foothills, and has not gained the elevation or relief of the foothills. So although the area maps as 46, it will be correlated as 32. GEOLOGY	**LRU D –** The transition from basin floor to the foothills and mountains MLRA 46 and 43B is gradual, hard to distinguish. Sites are more influenced by aspect, and are warmer than the foothill locations. But hold snow longer than LRU A.	
	75-150 Mesic Cool			**LRU E –** The transition from basin floor to the foothills, MLRA 46 is abrupt, but hard to distinguish. Transition into 34A is difficult to identify. Sites are warmer than the foothill locations. But hold snow longer than LRU C.	

BRIEF DESCRIPTION of ECOLOGICAL SITES

SITE NAME	Symbol	Site Code	Brief Description for MLRA 32 Ecological Sites across all LRU's.
Badlands	BL	102	Warranted for Proposed ESD - A complex of ecological sites composed of > 70% barren lands (paralithic sedimentary bedrock) broken by drainages and intermingled small vegetated areas. Runoff is rapid and erosion often severe. Principal vegetation: decreasers – Indian ricegrass; increasers – Sandberg bluegrass, forbs such as Woodyaster, Cottonthorn Horsebrush and Birdfoot sagebrush.
Clayey	Cy	104	These are deep, Clayey (silty clay loam to clay) soils occurring on an upland position. Principal vegetation: decreasers – Indian ricegrass and Bluebunch wheatgrass; Increasers –Bottlebrush squirreltail, Sandberg bluegrass, Wyoming big sagebrush and Birdfoot sagebrush. Western wheatgrass, Winterfat, and Gardner's saltbush and Woodyaster are common species.
Clayey Overflow	CyO	106	Not currently identified in all LRU's – located in LRU D. This site is comprised of clay soils that are found along drainage ways and open depression areas. Principal vegetation: decreasers – Basin wildrye; increasers – rhizomatous wheatgrasses, Sandberg bluegrass, and Basin big sagebrush.
Coarse Upland	CU	108	These are deep skeletal soils, generally rock fragments are cobble up to boulders in size (fragments ≥3" (76 mm) in size, 35% or greater in top 20 inches (51cm)). Productivity of this site is relatively normal for a deep soil, however, site will look droughty. Principle vegetation: decreasers – Bluebunch wheatgrass, Needleandthread, and Indian ricegrass; increasers – rhizomatous wheatgrasses, upland sedges, and Wyoming big sagebrush. Sagebrush will be sparse and stunted compared to other deep soils. Snowberry, Skunkbush sumac, Rose and other shrubs will increase in frequency as move closer to the transition between the Basin and Foothills.
Gravelly	Gr	112	These soils are high in coarse fragments (>60% by volume) in the top 20 inches. Fragments are dominantly <3" (76 mm) in size. Productivity of this site is very low. And appears wind swept with a gravell cap. Sporadic patches of Bluebunch with a high dominance of pin cushin or low forbs is the key indicator species. Principal vegetation: decreasers – Bluebunch wheatgrass, Indian ricegrass, and Needleandthread; increasers – Blue grama, Sand dropseed, Sandberg bluegrass, and Wyoming big sagebrush. Black Sagebrush is possible along the transition between the Basin and Foothills.
Hilly Breaks	HiB	116	Provisional ESD – A complex of ecological sites with Loamy soils and varying in depth to sandstone and shale. Slopes are 10 to 35%, and are characterized by the pockets of Wyoming Big Sagebrush. Depth to the bedrock does not influence the plants as clearly as expected and is difficult / implausible to separate the individual sites out. Principal vegetation: decreasers – Bluebunch wheatgrass, Indian ricegrass, Needleandthread, and Wyoming big sagebrush; Increasers – Sandberg bluegrass, upland sedges, and pin cushion forbs. Rocky Mountain juniper and Limber pine are found along the transition between Basin and Foothills.
Impervious Clay	IC	118	Not currently identified in all LRU's. Found in LRU A, B, and C. These are heavy clay soils (>40% clay within top 4-8" (10-20 cm)) lacking salts or sodium. Principal vegetation: decreasers – Indian ricegrass; increasers – Bottlebrush squirreltail, Sandberg bluegrass, and Birdfoot sagebrush. Most sites present with a dominant cover of Birdfoot sagebrush and minimal other vegetation.
Loamy	Ly	122	These are deep, loam to clay loam soils that occur in an upland position. Principal vegetation:

			decreasers – Needleandthread and Bluebunch wheatgrass, Green needlegrass in wetter areas; increasers – Blue grama, Sandberg bluegrass, and Wyoming big sagebrush.
Loamy Calcareous	LyCa	124	Provisional ESD – Currently this is identified as a "Y" LRU, occurring across LRU breaks. These loamy, deep soils have a distinctive accumulation of carbonates or calcic horizon (CCE >15%) within the top 20 inches (51 cm) of the profile. Productivity is very similar to a Loamy site, with the dominance of Bluebunch wheatgrass and the key indicator for this site. Principal vegetation: decreasers – Bluebunch wheatgrass, Needleandthread, and Winterfat; increasers – rhizomatous wheatgrasses, Wyoming big sagebrush, and forbs. Black Sagebrush is possible along the transition between the Basin and Foothills.
Lowland	LL	128	These are well drained soils along streams with a water table below 3 feet (1 m) (growing season), within rooting depth of woody plants (generally water table is >42" (1.07 m)). Principal vegetation: decreasers – Basin wildrye, Slender wheatgrass; increasers – Wild rose, Silver buffaloberry, rhizomatous wheatgrasses, upland sedges, and weedy forbs; invaders – Canada thistle and Russian olive.
Overflow	Ov	130	Not currently identified in all LRU's. Identified in LRU D. These are loamy to sandy soils that are found along drainage ways and in playa areas that receive extra water from overflow. Principal vegetation: decreasers – Basin wildrye and Green needlegrass; increasers – rhizomatous wheatgrasses, Sandberg bluegrass, and Basin big sagebrush.
Rock Outcrop	RO	132	Warranted for Proposed ESD - A complex of sites composed of >70% rock outcrops (lithic sedimentary bedrock) varying from sandstone, siltstone, and shale. The rock formations are fractured and capture blowing sediment providing small, isolated niches for vegetation to grow. Principle vegetation: decreasers – Indian ricegrass, Needleandthread; increasers – Threeawn, Sand dropseed, Sandberg bluegrass, forbs, Shadscale, Spiny hopsage, Skunkbush sumac, Rubber rabbitbrush and Wyoming big sagebrush. Rocky Mountain juniper and Limber pine are found along the transition between Basin and Foothills.
Saline Lowland	SL	138	These are soils that are deep, saline, and usually found along a stream with a water table below 3 feet (1 m) (growing season) or 42" (1.07 m) (generally), but within rooting depth of woody plants; or receive extra water from run-in. Principal vegetation: decreasers – Alkali sacaton and Basin wildrye; increasers – Inland saltgrass and Greasewood.
Saline Lowland, Drained	SLdr	140	Not currently identified in all LRU's. Currently identified in LRU C(Y) and D(Y). These are saline soils found along drainage ways with a water table below rooting depth of woody plants, usually as a result of down cutting or gully erosion. Principal vegetation: decreasers – Basin wildrye and Alkali sacaton; increasers – Inland saltgrass, rhizomatous wheatgrasses and Greasewood.
Saline Subirrigated	SS	142	These soils are saline with a water table near the surface for most of the growing season. Principal vegetation: decreasers – Alkali sacaton, Basin wildrye, and Nuttall's alkaligrass; increasers – Alkali bluegrass and Inland saltgrass.
Saline Upland, Clayey	SUC	143	Provisional ESD - These are deep; fine textured (clayey) saline soils usually in a low or flat upland position, but with no associated water table. Principal vegetation: decreasers – Gardner's saltbush, and Winterfat; increasers – Seepweed, Alkali Sacaton, Sandberg bluegrass, and forbs.
Saline Upland, Loamy	SUL	144	Provisional ESD - These are deep; loamy textured saline soils usually in a low or flat upland position, but with no associated water table. Principal vegetation: decreasers – Gardner's saltbush, Winterfat, Bud

			sagebrush, and Indian ricegrass, Bottlebrush squirreltail; increasers – Blue grama, Sandberg bluegrass, Birdfoot sagebrush and forbs.
Saline Upland, Sandy	SUS	145	Provisional ESD - These are deep, Sandy (coarse textured) saline soils usually in a low or flat upland position, but with no associated water table. Principal vegetation: decreasers – Gardner's saltbush, Winterfat, and Indian ricegrass; increasers – Blue grama, Sandberg bluegrass, and forbs.
Sands	Sa	146	These are coarse textured soils that sometimes form dunes. Principal vegetation: decreasers – Indian ricegrass, Needleandthread and Prairie sandreed; increasers – Silver sagebrush, Green and Rubber rabbitbrush, and Wyoming big sagebrush.
Sandstone Breaks	SaB	148	Not currently identified in all LRU's. Identified in LRU C. These soils are typically shallow (less than 20" to bedrock), well to excessively drained soils. They are sands, shallow sandy, and sandy ecological sites intermingled. Principal vegetation: decreasers – rhizomatous wheatgrass, Bluebunch wheatgrass, Needleandthread, and Indian ricegrass; increasers – Threadleaf sedge, Prairie sandreed, forbs, Skunkbush sumac and Yucca.
Sandy	Sy	150	These are deep, sandy loam soils that occur in an upland position. Principal vegetation: decreasers – Indian ricegrass and Needleandthread; increasers – Threadleaf sedge, Blue grama and Wyoming big sagebrush.
Sandy Argillic	SyA	151	Provisional ESD - These are deep, sandy loam soils that have a significant increase in clay content and structure within the upper 10" (25 cm) of the soil, occurring in an upland position generally along alluvial fans or drainages. Principal vegetation: decreasers – Needleandthread, Bluebunch wheatgrass, and Indian ricegrass; increasers – Blue grama, Sandberg bluegrass, and Wyoming big sagebrush.
Shale	Sh	154	These are very shallow, often salt influenced soils with areas of exposed clay shale bedrock. Runoff is rapid and erosion often severe. Principal vegetation: decreasers – Indian ricegrass, Gardner's saltbush, and Winterfat; increasers – Blue grama, Sandberg bluegrass, forbs such as Woodyaster, and Birdfoot sagebrush.
Shallow Breaks	SwB	156	Provisional ESD - A complex of Loamy soils varying in depth to sandstone and shale. Slope is up to 45% generally, and has 20-50% rock outcrop with a minor tree component in the cracks and fractures of the sandstone shelves. Site has pockets of dense vegetation with poor access. Principal vegetation: decreasers – Bluebunch wheatgrass, Indian ricegrass, Needleandthread, and Wyoming big sagebrush; increasers – Sandberg bluegrass, upland sedges, and low forbs. Rocky Mountain juniper and Limber pine are found along the transition between Basin and Foothills.
Shallow Clayey	SwCy	158	These are shallow soils that are clayey, usually overlying shale. Principal vegetation: decreasers – Bluebunch wheatgrass, rhizomatous wheatgrass and Indian ricegrass; increasers – Blue grama, Sandberg bluegrass, Wyoming big sagebrush and Birdfoot sagebrush.
Shallow Loamy	SwLy	162	These are shallow soils that are loamy, usually over bedrock. Principal vegetation: decreasers – Bluebunch wheatgrass and Indian ricegrass; increasers – Blue grama, Sandberg bluegrass, and Wyoming big sagebrush.
Shallow Sandy	SwSy	166	These are shallow soils that are sandy, usually overlying sandstone or limestone. Principal vegetation: decreasers – Indian ricegrass, Bluebunch wheatgrass and Needleandthread; increasers – Blue grama, Threadleaf sedge, and Wyoming big sagebrush.
Steep Shallow Breaks	StSwB	170	Provisional ESD - A complex of intermingled sites comprised of high percent cover of surface

			fragments, up to 75% coverage. Rock outcrop skirted by steep raw slopes (badlands) are typical. Site slope is generally 45% and greater. Principal vegetation: decreasers – Bluebunch wheatgrass, Indian ricegrass, Needleandthread, and Wyoming big sagebrush; increasers – Sandberg bluegrass, upland sedges, and pin cushion forbs. Rocky Mountain juniper and Limber pine are found along the transition between Basin and Foothills.
Subirrigated	Sb	174	Not currently identified in all LRU's. Currently identified in LRU D(Y). These are deep, highly organic soils that have a water table near the ground surface for part or most of the growing season. Principal vegetation: decreasers – Basin wildrye, Tufted hairgrass and Nebraska sedge; increasers – inland sedges, rhizomatous wheatgrasses, forbs and shrubby cinquefoil; invaders – Canada thistle and Kentucky bluegrass.
Very Shallow	VS	176	These are very shallow soils, with areas of exposed bedrock. Principal vegetation: decreasers – Bluebunch wheatgrass, and Indian ricegrass; increasers – Threadleaf sedge, Blue grama, and Wyoming big sagebrush.
Wetland	WL	178	These are poorly drained soils that have a water table above the ground surface for part of the growing season. Principal vegetation: decreasers – Nebraska sedge, Tufted hairgrass, Northern reedgrass and willows; increasers - inland sedges, Baltic rush, and weedy forbs.