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Major Land Resource Area 070A
High Plateaus of the Southwestern Great Plains

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Description

MLRA 70A is a high elevation, generally rangeland subdivision of the Great Plains physiographic region. The region is characterized by the Canadian River and its tributaries, which cut through the Raton and Las Vegas Basins down into the Tucumcari Basin. Although there are isolated irrigated areas within perennial stream valleys that drain the mountain ranges, they are stark contrast to the mostly irrigated plains to the east that have vast but waning ground-water aquifers (Gutentag et al., 1984). The area, which is mostly within mesic soil temperature regimes, encompasses a large part of northeastern New Mexico east of the Rocky Mountains but also includes small portions of southeast Colorado and the western panhandle of Oklahoma. It is unique from much of the Great Plains in that it consists primarily of elevated plateau landscapes constructed from sedimentary or volcanic geologies. These western Great Plains, bracing against the Rocky Mountains, were influenced by proximity to a turbulent tectonic history that resulted in more rugged topographic relief than plains to the east. This MLRA is approximately 6 million acres.

Ecological site keys

ESD Key for the Canadian Plateaus LRU of the High Plateaus of the Southwestern Great Plains (MLRA 70A)

1a. Site occurs on one of the following water-collecting landforms: lower stream terraces, floodplains, drainageways, and bottoms of closed depressions (playas). The following landforms are excluded: fan remnants, alluvial flats, strath terraces, and toeslopes, as well as higher stream terraces where soils have ? 35% rounded fragments (old stream gravels and cobbles) in a layer at least 50 cm thick within the upper 100 cm. Site receives significant additional moisture.

2a. Site occurs in a closed depression (playa). ... GX070A01X017 – Playas

2b. Run-on sites that are along perennial streams of river valley bottomland. These sites include streams that were historically perennial but now have diverted water.

3a. Site has an active channel, active floodplain, and a floodplain step. The soils of either floodplain positions have one or more of the following: i. Stratified sediments within 100 cm of soil surface; ii. One or more soil layers within 100 cm have a matrix chroma < 2 (may have some high chroma mottles of iron concentrations); iii. Site has a historic flooding frequency of <10 years. ...

GX070A01X010 – Riparian

3b. Run-on sites occurring on stream terraces adjacent to perennial floodplains that do not have stratified sediment layers within 100 cm of the surface, but still have slopes less than 2%. ... GX070A01X012 – Low Terraces

2c. Other sites that occur in drainageway bottoms of an ephemeral waterway. Average flooding frequency is typically < 10 years but can vary due to order of waterway. ... GX070A01X008 – Ephemeral Drainageways

1b. Site does not meet the criteria for 1a.

4a. Site occurs on elevated terraces where soils have ? 35% rounded fragments (old stream gravels and cobbles) in a layer at least 50 cm thick within the upper 100 cm. ... GX070A01X019 – Gravelly Terraces

4b. All other sites.

5a. Slope ? 10% (this excludes microrelief such as cutbanks and gullies).

6a. Site meets all the following criteria: 1)Soil surface has strong or violent effervescence (immediate frothy reaction to an acid such as white vinegar or dilute HCl). 2) at least 5% cover of calcareous rock fragments (limestone or limy sandstone/shale, or carbonate-coated fragments). 3)Occurs on an escarpment (see Appendix Item B). 4)Contains bedrock outcrop somewhere on

escarpment (look for small exposed benches of limestone or gullies cut into shale; ... GX070A01X007 – Limy Escarpments

6b. All other steep sites. ... GX070A01X006 – Slopes

5b. Slope < 10% (this excludes tiny benches on otherwise steep slopes).

7a. Soils ? 50 cm to lithic contact.

8a. Soils are underlain by limestone bedrock. ... GX070A01X017 – Playas

8b. Soils are underlain by sandstone bedrock where rock outcrop is visible somewhere within the site and/or there is a minimum of 10% large fragments (cobbles or larger) on the soil surface. ... GX070A01X013 – Lithic Sandstone

8c. If neither 8a nor 8b apply, go to 9.

7b. No lithic contact in the upper 50 cm.

9a. Soils ? 50 cm to paralithic materials (soft shale bedrock or weathered calcareous sandstone). ... GX070A01X004 – Shallow Loamy

9b. All other sites.

10a. Eolian sites where soils have surface textures of sandy loam or sandier, with sandy clay loam or sandier textures throughout. User tip: these sites are usually downwind of larger stream channels, canyons or playas. ... GX070A01X021 – Sandy

10b. Sites that meet both of the following conditions: 1) Site has slopes less than 1 percent and occurs on a broad alluvial fan, alluvial flat, or terrace. 2) Soils have ? 35% clay starting within 6" (15 cm) of the surface. ... GX070A01X015 – Clayey Flats

10c. All other sites.

11a. Sites where soils have both of the following conditions at the soil surface: strong or violent effervescence, and at least 5% calcareous rock fragments (limestone or limy sandstone/shale, or carbonate coated fragments). ... GX070A01X005 – Limy

11b. [Criteria]

12a. Soils contain materials within the upper 50 cm with ? 35% clay. Occurs on well drained landforms such as plateaus, as well as on some strath terraces. ... GX070A01X002 – Clayey Uplands

12b. Soils lack materials within the upper 50 cm with ? 35% clay. ... GX070A01X003 – Loamy Uplands

[D] Appendix D . D. Lithic Contact- solid bedrock underlying soil or other unconsolidated material, strongly cemented or harder, and usually performs a structural role in the landform (i.e. Dakota Sandstone, photo 5).

[C] Appendix C . C. Bedrock Contact- Cretaceous bedrock contact can be either lithic (Limestone, photo 3) or non-lithic (Shale, photo 4).

[E] Appendix E . E. Sandy Textures (>50% sand) - to determine sandy textures, place a small sample (coffee bean sized) in the palm, puddle with water and smear with finger. Then pour off suspended liquid so that only sand grains remain. If at least 50% of volume remains, then textures are sandy.

[F] Appendix F . F. Fine textures (>35% clay) - a soil texture that has 35% clay will, when moistened and worked into a texture ball, usually form a wire (3mm thick when rolled between fingers or palm) or ribbon that supports its own weight when at least 2" long

[4a] User Tip 4a . (User tip: User tip: These are dynamic hydrologic systems which, in most cases, have been impaired due to diversion or withdrawals of water resources leading to lowered water tables and reduced streamflow or flooding frequency. As such, they are drier than their historic condition. A general rule for identifying Riparian sites, if the watershed source begins within the Rocky Mountains, it is probably a Riparian site, regardless of current hydrology.)

[A] Appendix A . A. Argillic Horizon - a subsurface horizon with any pronounced increase in clay relative to the surface horizons. This will act to perch, or retain moisture within the horizon/s directly above.

[B] Appendix B . B. Escarpment - a break in the plateau from a canyon, faulting, or by regional erosion where a steep drop occurs that breaks the general continuity of more gently sloping land above.

LRU Key for High Plateaus of the Southwestern Great Plains (MLRA 70A)

I. The site exists on a landform of volcanic origin, such as a basalt plateau, or is part of an escarpment system that rises directly to a volcanic structure. These escarpments are included if they have volcanic alluvium or colluvium overlying non-volcanic residuum or bedrock. Summits of volcanic plateaus are included unless they are overlain by thick layers of water- or wind-transported material. ? VOLCANIC PLATEAUS LRU (VP)

II. Site either does not meet the criteria above, or user is uncertain about whether it does. Common sources of uncertainty are thick deposits of transported material on summits of volcanic mesas and plateaus, and gently-sloping landforms beneath volcanic escarpments.

A. The site exists in the annulus or floor of a playa. User tip: Within MLRA 70A, playas either fit the CP or the VP LRU. However, small islands of playas occur within large areas of the HP-LRU. These sites may be far from the nearest CP landform but will still key-out to the CP-LRU. The playa rim and dune components, however, may key out to the CP, VP, or HP LRUs, so it is important to properly identify their soil properties.

1 Volcanic fragments are visible on the soil surface of the playa rim and/or playa floor. ? Volcanic Plateaus LRU (VP)

2 Volcanic fragments are not visible on the soil surface of the playa rim and/or playa floor. ? Canadian Plateaus LRU (CP)

B. All other sites.

1 4a. The site exists either on a landform directly below a volcanic escarpment system, or on a portion of a volcanic plateau summit that is overlain by a deposit of non-volcanic materials such as strath terrace cobbles or High Plains deposits. Common examples of landforms underlying volcanic escarpments are fan remnants, stream terraces, drainageways, and the summits of underlying plateaus.

i. The largest fragments on the soil surface are volcanic. ? Volcanic Plateaus LRU (VP)

ii. Either no fragments are visible on the soil surface, or the largest surface fragments are not volcanic in origin.

a. Site on escarpment or in canyon directly below a zone that meets at least 4 of the following 5 criteria: I. Soils less than 50 cm deep in at least 50 percent of the landform area; II. Soils underlain by sandstone of Dakota Formation or older; III. Presence of at least 2 percent conifers; IV. Landform has a slope of at least 10 percent; V. Immediate landscape drains towards a steep-walled escarpment or canyon that drops below the Dakota Fm.

1) Mesozoic Canyons and Breaks LRU (MCB)

b. Fewer than 4 of the above criteria are met at the upper end of the escarpment complex.

1) The site is on a plateau summit position (tread or flat-topped part) and soil depth is within 50 cm to contact with either plateau bedrock (non-soil bedrock of cemented sandstone, limestone, or shale) or strath terrace cobbles, but not a petrocalcic contact (caprock or caliche of cemented calcium carbonate). ? CANADIAN PLATEAUS LRU (CP)

2) No plateau bedrock or strath terrace cobbles within 50 cm.

a) Fragments (>2 mm) are visible within the soil profile and/or on the surface. If fragments cannot be found in the profile, it is acceptable to look nearby on ant mounds or around burrows. If site is in a drainageway, one can look for fragments on landforms immediately upslope.

(1) Fragments are mostly petronodes or High Plains gravels (rounded fragments less than 75 mm across that are of mixed lithology--most often quartzite and igneous). ? HIGH PLAINS LRU (HP)

(2) Fragments are mostly plateau bedrock fragments (sandstone, limestone, or shale of Cretaceous age). ? CANADIAN PLATEAUS LRU

b) Fragments are entirely absent.

(1) No horizons in the upper 100 cm of soil have textures of sand, loamy sand, or sandy loam (variants such as loamy fine sand and fine sandy loam are included in this list). ? CANADIAN PLATEAUS LRU (CP)

(2) At least one horizon in the upper 100 cm of soil has a texture of sand, loamy sand, or sandy loam (variants such as loamy fine sand and fine sandy loam are included in this list). ? HIGH PLAINS LRU (HP)

2 All other sites.

i. Site on escarpment or in canyon directly below a zone that meets at least 4 of the following 5 criteria: I. Soils less than 50 cm deep in at least 50 percent of the landform area; II. Soils underlain by sandstone of Dakota Formation or older; III. Presence of at least 2 percent conifers; IV. Landform has a slope of at least 10 percent; V. Immediate landscape drains towards a steep-

walled escarpment or canyon that drops below the Dakota Fm.

a. Mesozoic Canyons and Breaks LRU (MCB)

ii. Fewer than 4 of the above criteria are met at the upper end of the escarpment complex.

a. The site is on a plateau summit position (tread or flat-topped part) and soil depth is within 50 cm to contact with either plateau bedrock (non-soil bedrock of cemented sandstone, limestone, or shale) or strath terrace cobbles, but not a petrocalcic contact (caprock or caliche of cemented calcium carbonate). ? CANADIAN PLATEAUS LRU (CP)

c. No plateau bedrock or strath terrace cobbles within 50 cm.

1) Fragments (>2 mm) are visible within the soil profile and/or on the surface. If fragments cannot be found in the profile, it is acceptable to look nearby on ant mounds or around burrows. If site is in a drainageway, one can look for fragments on landforms immediately upslope.

a) Fragments are mostly petronodes or High Plains gravels (rounded fragments less than 75 mm across that are of mixed lithology--most often quartzite and igneous). ? HIGH PLAINS LRU (HP)

b) Fragments are mostly plateau bedrock fragments (sandstone, limestone, or shale of Cretaceous age). ? CANADIAN PLATEAUS LRU

2) Fragments are entirely absent.

a) Fragments are mostly petronodes or High Plains gravels (rounded fragments less than 75 mm across that are of mixed lithology--most often quartzite and igneous). ? HIGH PLAINS LRU (HP)

b) Fragments are mostly plateau bedrock fragments (sandstone, limestone, or shale of Cretaceous age). ? CANADIAN PLATEAUS LRU

[1] User Tip 1 . Other alluvial or colluvial landform features extending below the escarpments are not included unless they have a predominance of volcanic fragments. Also, note that playas atop volcanic plateaus fit in the VP LRU.

[2] User Tip 2 . The site may also occur on any colluvial or alluvial bottomlands contained within these escarpments or canyons.? MESOZOIC CANYONS AND BREAKS LRU (MCB) User tip: some river valleys transition from CP to MCB, and the turning point can be difficult to determine. Generally, the valley becomes MCB when entrenched between Dakota sandstone breaks or escarpments on both sides. Much of this acreage in the MCB is aproned by colluvial debris fans—composed of sandy materials with lots of sandstone fragments, including large stones or boulders. The soils in the bottoms of these valleys will also be in the MCB.

Key to the LRU Subsets (Climate Zones) of the Volcanic Plateaus (70A.3)

I. Site is forested or is known to have been forested in the past.

A. Overstory is dominated by “mixed conifer zone” species such as Douglas-fir (Pseudotsuga menziesii), white fir (Abies concolor), quaking aspen (Populus tremuloides), and Engelmann spruce (Picea engelmanii) OR site is known to have been dominated by such species prior to major disturbance (e.g. high intensity fire and/or logging). ? Cold Climate Zone

B. All other sites.

1 Overstory dominated by twooneedle pinyon (Pinus edulis), oneseed juniper (Juniperus monosperma), and/or Rocky Mountain juniper (Juniperus scopulorum).

i. Any of the following species are present: Douglas-fir (Pseudotsuga menziesii), white fir (Abies concolor), quaking aspen (Populus tremuloides), and Engelmann spruce (Picea engelmanii). ? Cold Climate Zone

ii. Rocky Mountain juniper is the dominant tree species, and ponderosa pine is present. ? Cool Climate Zone

iii. All other sites dominated by pinyon-juniper. ? Warm Climate Zone

2 Overstory dominated by ponderosa pine and/or Gambel oak, AND no known history of dominance by “mixed conifer zone” species such as: such as Douglas-fir (Pseudotsuga menziesii), white fir (Abies concolor), quaking aspen (Populus tremuloides), and Engelmann spruce (Picea engelmanii).

i. Parry’s oatgrass (Danthonia parryi) covers ? 2% of the ground and, if present, concave slope positions such as swales contain quaking aspen. (Populus tremuloides). ? Cold Climate Zone

ii. All other sites.

a. Cool Climate Zone

II. Site is not forested and has no known history of being forested.

A. Shrubby cinquefoil (Potentilla fruticosa) present, and/or Parry's oatgrass (Danthonia parryi) covers at least 2% of the ground. ? Cold Climate Zone

B. All other sites.

1 On the site, or on adjacent upland positions that can reasonably be assumed to have escaped heavy continuous grazing, plants from the following list comprise at least 10 percent combined canopy cover: prairie junegrass (Koeleria macrantha), fescues (Festuca ssp.), timothy (Phleum ssp.), pine dropseed (Blepharoneuron tricholepis), mountain muhly (Muhlenbergia montana), and Kentucky bluegrass (Poa pratensis). ? Cool Climate Zone

2 On the site, or on adjacent upland positions that can reasonably be assumed to have escaped heavy, continuous grazing, the following species comprise less than 10 percent combined canopy cover: prairie junegrass (Koeleria macrantha), fescues (Festuca ssp.), timothy (Phleum ssp.), pine dropseed (Blepharoneuron tricholepis), mountain muhly (Muhlenbergia montana), and Kentucky bluegrass (Poa pratensis). ? Warm Climate Zone

3 User has reason to believe that the site has been continuously grazed in recent years and/or has experienced significant topsoil loss in post-colonial time, and less-disturbed adjacent sites don't exist.

i. Site has a slope greater than or equal to 25 percent with a northern aspect (315 to 45 degrees).

a. Elevation is 7,500 feet or higher. ? Cold Climate Zone

b. Elevation is 6,250 to 7,500 feet. ? Cool Climate Zone

c. Elevation is less than 6,250 feet. ? Warm Climate Zone

ii. Site has a slope greater than or equal to 25 percent with a southern aspect (135 to 225 degrees).

a. Elevation is 9,000 feet or higher. ? Cold Climate Zone

b. 7,750 to 9,000 feet. ? Cool Climate Zone

c. Elevation is less than 7,750 feet. ? Warm Climate Zone

iii. Site has a neutral aspect and/or a slope of less than 25 percent.

a. Elevation is greater than 8,250 feet. ? Cold Climate Zone

b. Elevation is between 7,000 and 8,250 feet. ? Cool Climate Zone

c. Elevation is less than 7,000 feet. ? Warm Climate Zone

Ecological Site Key for the Volcanic Plateaus LRU of MLRA 70A (70A.3)

I. Site occurs in the "cold" climate zone. Refer to the Key to Climate Zones of the Volcanic Plateaus LRU.

A. Site occurs on one of the following water-collecting landforms: floodplains, drainageways, swales, bottoms of closed depressions (playas). Site receives significant run-on or throughflow moisture (not to be confused with irrigation water). The following landforms are excluded: fan remnants, alluvial flats, stream terraces.

1 Site occurs in the bottom of a closed depression (playa). ... GX070A03A001 – Playas, Cold

2 Site does not occur in the bottom of a closed depression.

i. Site occurs on the floodplain or channel of a perennial or historically perennial stream. ... GX070A03B011 – Riparian, Cool

ii. Site occurs in a swale or ephemeral drainageway on the summit of a mesa or plateau. ... GX070A03A002 – Summit Swales, Cold

iii. Site occurs on in the channel or on the floodplain of an ephemeral drainageway on an escarpment complex. ...

GX070A03B008 – Ephemeral Drainageways, Cool

B. Site does not occur on one of the following water-collecting landforms: floodplains, drainageways, swales, bottoms of closed depressions (playas).

1 Site occurs on the summit or flank of a cinder cone AND at least 10 percent of the soil surface is covered by large (greater than 3 inches in diameter) cinder fragments. ... GX070A03B009 – Cinders, Cool

2 All other sites.

i. Site occurs on an escarpment or escarpment complex. Overall slope of the landform is 25 percent or greater, excluding micro-features such as structural benches.

a. Site occurs on a bench (slopes less than 10 percent) within an escarpment complex. ... GX070A03A004 – Benches, Cool/Cold

b. Site occurs on an extremely steep slope (greater than 50 percent) of an upper escarpment which is situated on or directly underneath a cliff face or a talus field. ... GX070A03A003 – Active Escarpments, Cold

c. All other sites on escarpments. ... GX070A03A005 – Stable Escarpments, Cold

ii. All other sites.

a. At least 5 percent of surface is covered by large (greater than 10 inches in diameter) rock fragments and/or rock outcrop. ... GX070A03A006 – Rubbly Summits, Cold

b. All other sites. ... GX070A03A007 – Summits, Cold

II. Site occurs in the "cool" climate zone. Refer to the Key to Climate Zones of the Volcanic Plateaus LRU.

A. Site occurs on one of the following water-collecting landforms: floodplains, drainageways, swales, bottoms of closed depressions (playas). Site receives significant run-on or throughflow moisture (not to be confused with irrigation water). The following landforms are excluded: fan remnants, alluvial flats, stream terraces.

1 Site occurs in the bottom of a closed depression (playa). ... GX070A03B010 – Playas, Cool

2 Site occurs on the floodplain or channel of a perennial or historically perennial stream. ... GX070A03B011 – Riparian, Cool

3 Site occurs on in the channel or on the floodplain of an ephemeral drainageway or swale. ... GX070A03B008 – Ephemeral Drainageways, Cool

B. Site does not occur on one of the following water-collecting landforms: floodplains, drainageways, swales, bottoms of closed depressions (playas).

1 Site occurs on the summit or flank of a cinder cone AND at least 10 percent of the soil surface is covered by large (greater than 3 inches in diameter) cinder fragments. ... GX070A03B009 – Cinders, Cool

2 All other sites.

i. Site occurs on an escarpment or escarpment complex. Overall slope of the landform is 25 percent or greater, excluding micro-features such as structural benches.

a. Site occurs on a portion of an escarpment complex with slopes less than 10 percent.

1) Site occurs on a toreva terrace. Steep, rocky slopes occur directly downslope from this flat surface. ...

GX070A03B013 – Toreva Terraces, Cool

2) Site occurs on a valley side. Deep, alluvial soils grade into the valley bottom ... GX070A03B012 – Valley Sides, Cool

b. Site occurs on an extremely steep slope (greater than 50 percent) of an upper escarpment which is situated directly underneath a cliff face and/or a talus field. ... GX070A03B014 – Active Escarpments, Cool

c. All other sites on escarpments. ... GX070A03B015 – Stable Escarpments, Cool

ii. All other sites.

a. At least 5 percent of surface is covered by large (greater than 10 inches in diameter) rock fragments and/or rock outcrop.

... GX070A03B016 – Rubbly Summits, Cool

b. All other sites. ... GX070A03B017 – Summits, Cool

III. Site occurs in the "warm" climate zone. Refer to the Key to Climate Zones of the Volcanic Plateaus LRU.

A. Site occurs on one of the following water-collecting landforms: floodplains, drainageways, swales, bottoms of closed depressions (playas). Site receives significant run-on or throughflow moisture (not to be confused with irrigation water). The following landforms are excluded: fan remnants, alluvial flats, stream terraces.

1 Site occurs in the bottom of a closed depression (playa). ... GX070A03C018 – Playas, Warm

2 Site occurs in the bottom of a steep-walled canyon. ... GX070A03B019 – Riparian Canyons, Warm

3 If site neither occurs on a playa bottom nor along the bottom of a steep-walled canyon, it is not in the Volcanic Plateaus LRU. In this scenario, the most likely LRU fit is the Canadian Plateaus. Refer to the LRU key for MLRA 70A, noting that the Vpocanic Plateaus LRU has already been eliminated.

B. All other sites.

1 Site occurs on the summit or flank of a cinder cone AND at least 10 percent of the soil surface is covered by large (greater than 3 inches in diameter) cinder fragments. ... GX070A03B020 – Cinders, Warm

2 All other sites.

i. Site occurs on an escarpment or escarpment complex. Overall slope of the landform is 25 percent or greater, excluding micro-features such as structural benches.

a. Site occurs on a portion of an escarpment complex with slopes less than 10 percent.

1) Site occurs on a bench. Soils are too rocky to be excavated with a hand auger. ... GX070A03B021 – Benches, Warm

2) Site occurs on a toreva terrace. Soils can be excavated with a hand auger. ... GX070A03A022 – Escarpments, Warm

b. Slopes greater than 10 percent. ... GX070A03A023 – Toreva Terraces, Warm

ii. All other sites.

a. At least 5 percent of surface is covered by large (greater than 10 inches in diameter) rock fragments and/or rock outcrop.

... GX070A03A024 – Rubbly, Warm

b. All other sites. ... GX070A03A025 – Loamy, Warm