USDA Natural Resources
Conservation Service

Ecological site DX034A02X144
Saline Upland Pinedale Plateau (SU PP)

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General information

Provisional. A provisional ecological site description has undergone quality control and quality assurance review. It contains a working state and transition model and enough information to identify the ecological site.

MLRA notes

Major Land Resource Area (MLRA): 034A–Cool Central Desertic Basins and Plateaus

Major Land Resource Area (MLRA) 34A, Cool Central Desertic Basins and Plateaus, consists of approximately 21 million acres in Wyoming, Colorado and Utah, it consists of 10 Land Resource Units (LRU). These units are divisions of the MLRA based on geology, landscape, common soils, water resources and plant community potentials. The elevation ranges from approximately 5600 feet (1700 m) along the Green River in UT and CO to approximately 9500 feet (2900m) near Jeffrey City, WY. Annual precipitation ranges from 7 to 16 inches (177 to 406 mm), with the driest areas in the Green River and Great Divide Basins and the wettest areas in northern Carbon County, Southeast Fremont County and Albany County. There is a seasonal weather pattern that trends west to east, with more winter precipitation in the west and more spring/summer in the east, illustrated by diminishing amounts of Big Sagebrush in the eastern part of the MLRA.

LRU notes

The Pinedale Plateau LRU is in the upper Green River Drainage from Pinedale, Wyoming at the north working southward to Farson, Wyoming and easterly to South Pass, Wyoming. It is situated between the Wyoming Range and Wind River Range largely in Sublette County with some areas in Lincoln County, northern Sweetwater County, and a small portion of Fremont County. The total area of this LRU is approximately 1,210,000 acres. It shares a boundary with MLRA 46-Northern Rocky Mountain Foothills (proposed for the foothills of western Wyoming).
This LRU is dominated by the New Fork Tongue of the Wasatch formation, a large artesian aquifer that is estimated to hold large amounts of water with relatively quick recharge (Martin, 1997). It is also home to the Lance Formation, a cretaceous strata that is part of the Mesaverde Group, which holds large amounts of hydrocarbons, giving way to one of the largest on shore natural gas fields (Jonah Field) (Bowker et al 2000). The soils in the Pinedale Plateau are dominated by older Alfisols with thick argillic and calcic horizons and younger deep alluvial soils along drainage ways and in river bottoms. Salts are not a major influence in the Pinedale Plateau compared to the adjacent Green River Basin LRU but do occur, including sodium, calcium carbonate, and other soluble salts. Soils are tied closely to their parent geology but are more developed and older so typically do not have bedrock contact within six feet.
This LRU has an aridic ustic soil moisture regime and frigid (bordering on cryic) soil temperature regime. The precipitation pattern is bimodal with a slight spikes in the spring and fall. Winter temperatures are cold allowing snow to accumulated and stay until spring. This lends perfectly to cool season grasses and forbs to flourish, also allowing Big Sagebrush to establish and dominate the landscape. The mean annual soil temperatures are between 36 to 40 degrees Fahrenheit (2.2 to 4.4 degrees Celsius) and average precipitation is between 9 and 12 inches (230 to 305 mm) annually. Elevations of this LRU range between 6500 and 7500 feet (1980 to 2280 m).

Classification relationships

Relationship to Other Established Classification Systems
National Vegetation Classification System (NVC):
3 Desert & Semi-Desert Class
3.B Cool Semi-Desert Scrub & Grassland Subclass

3.B.1 Cool Semi-Desert Scrub & Grassland Formation
3.B.1.Ne Western North American Cool Semi-Desert Scrub & Grassland Division
M093 Great Basin Saltbush Scrub Macrogroup
G301 Intermountain Dwarf Saltbush - Sagebrush Scrub Group
A1110 Gardner's Saltbush Low Scrub Alliance
CEGL001444 Atriplex gardneri / Achnatherum hymenoides Dwarf-shrubland

Ecoregions (EPA):
Level I: 10 North American Deserts
Level II: 10.1 Cold Deserts
Level III: 10.1.4 Wyoming Basin

Ecological site concept

• This site not does receive any additional water.
• These soils:
o are saline or saline-sodic
o are moderately deep to very deep
o are not skeletal within 20 inches (50 cm) of the soil surface; they have less than 35 percent rock fragments by volume in the top 20 inches (50 cm)
o are not violently effervescent in the surface mineral layer (within top 10 inches; 25 cm)
o have surface textures that usually range from clay loam to clay in surface mineral layer (4 inches; 10 cm)
• have slopes less than 15 percent
• clay content in the subsurface is greater than 35% and a natric horizon is present.
Climate:
aridic ustic moisture regime (ustic bordering on aridic)
frigid (bordering on cryic) temperature regime

Associated sites

DX034A02X122	**Loamy Pinedale Plateau (Ly PP)** Lower salt content (EC and SAR) and soil surface textures typically have less clay.
DX034A02X104	**Clayey Pinedale Plateau (Cy PP)** Lower salt content (EC and SAR)

Similar sites

R034AY240WY	**Saline Lowland Drained Foothills and Basins West (SLDr)** Saline Lowland, drained 10-14W has somewhat higher production with greasewood as a dominant woody species and a small amount of Gardners saltbush. It is located in the drainage bottom and associated with down-cutting in the drainageway.
R034AY238WY	**Saline Lowland Foothills and Basins West (SL)** Saline Lowland 10-14W has a deep water table and much higher production with greasewood as a dominant woody species and a small amount of Gardners saltbush. It is located in the drainage botton.
R034AY244WY	**Saline Upland Foothills and Basins West (SU)** Previous version on this site, but applied to a larger geographic area.

Table 1. Dominant plant species

Tree	Not specified
Shrub	(1) *Atriplex gardneri*
Herbaceous	(1) *Achnatherum hymenoides* (2) *Elymus elymoides*

Legacy ID

R034AC144WY

Physiographic features

The Saline Upland Pinedale Plateau (SU-PP) ecological site occurs in intermontane basin landscapes on hillslope, alluvial fan, and alluvial flat landforms (see following definitions). The slopes range from 0 to 15 percent, but could occur on sites up to 30 percent. This site occurs on all aspects.

Landscape Definitions:
intermontane basin—-A generic term for wide structural depressions between mountain ranges that are partly filled with alluvium and called "valleys" in the vernacular.

Landform Definitions:
hillslope - A generic term for the steeper part of a hill between its summit and the drainage line, valley flat, or depression floor at the base of the hill.

alluvial fan--A low, outspread mass of loose materials and rock material, commonly with gentle slopes. It is shaped like an open fan or a segment of a cone. The material was deposited by a stream at the place where it issues from a narrow mountain valley or upland
valley, or where a tributary stream is near or at its junction with the main stream. The fan is steepest near its apex, which points upstream and slopes gently and convexly outward (downstream) with a gradual decrease in gradient.

alluvial flat - (a) (colloquial: western U.S.A.) A nearly level, graded, alluvial surface in bolsons (closed basins) and semi-bolsons that lacks distinct channels, terraces or flood plain levels. Similar terms = flood-plain step, terrace, valley flat. (b) (not preferred) A general term for a small flood plain bordering a river, on which alluvium is deposited during floods.

Table 2. Representative physiographic features

Landforms	(1) Intermontane basin > Hillslope (2) Alluvial fan (3) Alluvial flat
Runoff class	Medium to very high
Flooding frequency	None
Ponding frequency	None to rare
Elevation	1,981–2,286 m
Slope	0–15%
Aspect	Aspect is not a significant factor

Climatic features

Annual precipitation ranges from 9 to 12 inches per year. Wide fluctuations may occur in yearly precipitation and result in more below average years than those with above average precipitation. Temperatures show a wide range between summer and winter and between daily maximums and minimums. This is predominantly due to the high elevation and dry air, which permits rapid incoming and outgoing radiation. Cold air outbreaks in winter move rapidly from northwest to southeast and account for extreme minimum temperatures. Much of the precipitation accumulation (45 percent) comes in the winter in the form of snow (October to April). The wettest month is May (1.69 inches). The dominant plants (sagebrush and cool season grasses) are well adapted to these conditions. Daytime winds are generally stronger than nighttime and occasional strong storms may bring brief periods of high winds with gusts to more than 50 miles per hour. The growing season is short (less than 60 day) and cool (critical growth period): primary growth typically occurs between May and June.
Growth of native cool-season plants begins about mid-April and continues to approximately early July. Some green-up of cool-season plants usually occurs in September with adequate fall moisture.

All data is based on the 30-year average from 1981-2010.

Table 3. Representative climatic features

Frost-free period (characteristic range)	30-70 days
Freeze-free period (characteristic range)	50-80 days
Precipitation total (characteristic range)	229-305 mm
Frost-free period (actual range)	15-70 days
Freeze-free period (actual range)	45-90 days
Precipitation total (actual range)	229-330 mm
Frost-free period (average)	36 days
Freeze-free period (average)	64 days
Precipitation total (average)	279 mm

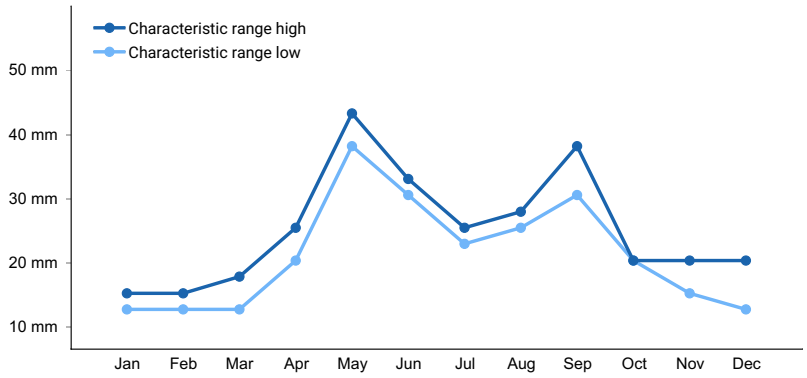


Figure 1. Monthly precipitation range

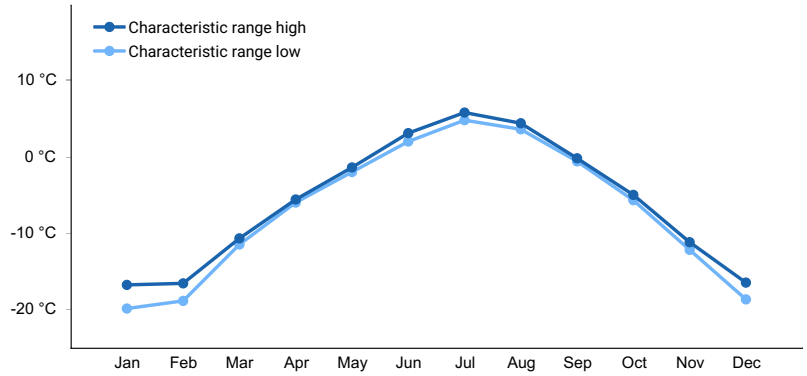


Figure 2. Monthly minimum temperature range

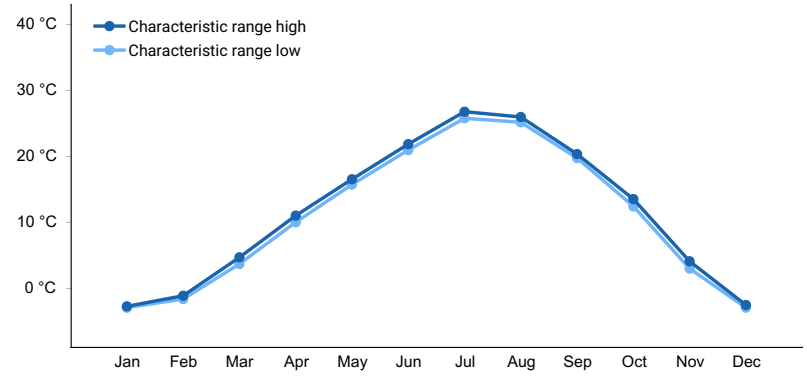


Figure 3. Monthly maximum temperature range

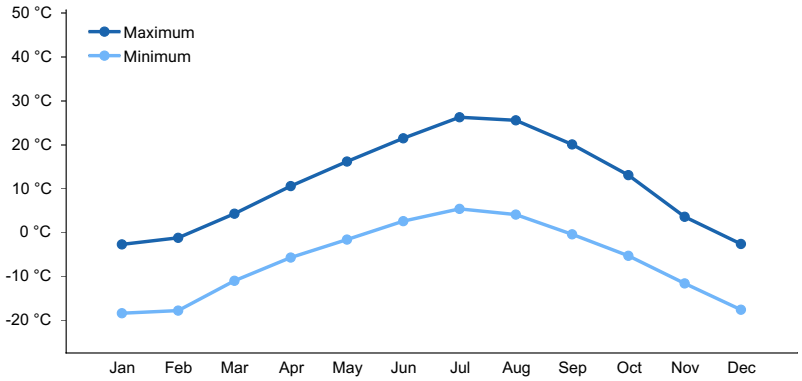


Figure 4. Monthly average minimum and maximum temperature

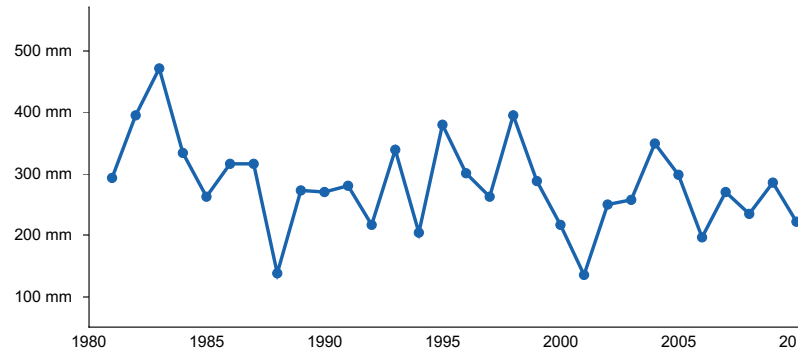


Figure 5. Annual precipitation pattern

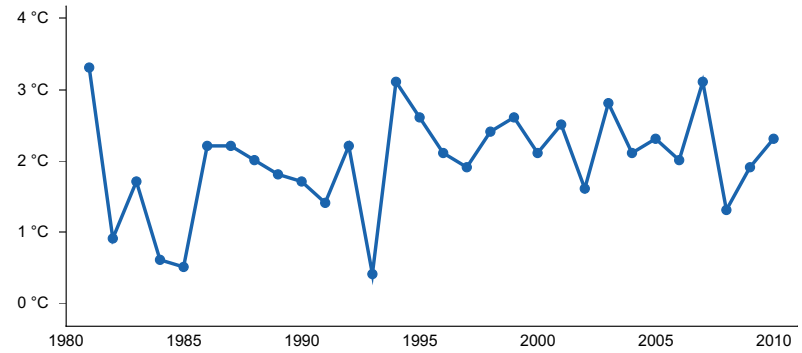


Figure 6. Annual average temperature pattern

Climate stations used

- (1) BOULDER REARING STN [USC00480951], Boulder, WY
- (2) PINEDALE [USC00487260], Pinedale, WY
- (3) CORA [USC00482054], Cora, WY

Influencing water features

There are no influencing water features in the Saline Upland Pinedale Plateau ecological site.

Wetland description

N/A

Soil features

The soils of this site are moderately deep to very deep (at least 20 inches deep) well drained soils with an increase of clay percentage and salt concentration in the subsoil. Some soil cracking (not severe) may occur during the dry summer months, especially where the plant cover has been reduced. Water-holding capacity is moderate to high,

but intake is restricted which causes reduces effectiveness of precipitation.
A common scenario is to have a one to two inch cap of sandy loam over other dominant surface textures due to young soil development from adjacent rock outcrops of weathered shale, mudstone, and sandstone parent materials.

Major Soil Series correlated to this site include: Zealot, Squaretop, Lauzer and Jewel
Representative soil taxonomy: Fine, smectitic, frigid Torrertic Natrustalfs and Fine-loamy, mixed, superactive, frigid Aridic Haplustalfs

Table 4. Representative soil features

Parent material	(1) Alluvium–clayey shale (2) Slope alluvium–sandstone and shale
Surface texture	(1) Gravelly loam (2) Silty clay loam (3) Fine sandy loam (4) Coarse sandy loam
Drainage class	Well drained
Permeability class	Moderate to very slow
Soil depth	51–508 cm
Surface fragment cover <=3"	0–15%
Surface fragment cover >3"	0–5%
Available water capacity (0-101.6cm)	5.84–17.02 cm
Calcium carbonate equivalent (0-50.8cm)	0–15%
Clay content (0-50.8cm)	25–45%
Electrical conductivity (Depth not specified)	4–16 mmhos/cm
Sodium adsorption ratio (Depth not specified)	5–15
Soil reaction (1:1 water) (Depth not specified)	8.4–9
Subsurface fragment volume <=3" (Depth not specified)	0–10%
Subsurface fragment volume >3" (Depth not specified)	0–5%

Ecological dynamics

A State-and-Transition Model (STM) diagram is depicted below. Thorough descriptions of each state, transition, plant community phase, and pathway are found after the model in this document. This diagram is based on available experimental research, field observations, professional consensus, and interpretations. While based on the best available information, the STM will change over time as knowledge of ecological processes increases.

Plant community composition within the same ecological site has a natural range of variability across the LRU due to the naturally occurring variability in weather, soils, and aspect. Not all managers will choose the Reference Plant Community as the management goal. Other plant communities may be desired to meet land management objectives. This is valid as long as the rangeland health attributes assessment departures are none to slight or slight to moderate from the Reference State. The biological processes on this site are complex; therefore, representative values are presented in a land management context. The species lists are representative and are not botanical descriptions of all species occurring, or potentially occurring, on this site. They are not intended to cover every situation or the full range of conditions, species, and responses for the site.

Both percent species composition by weight and percent cover are used in this ESD. Most observers find it easier to visualize or estimate percent cover for woody species (trees and shrubs). Foliar cover is used to define plant community phases and states in the State-and-Transition Model. Cover drives the transitions between communities and states because of the influence of shade and interception of rainfall.

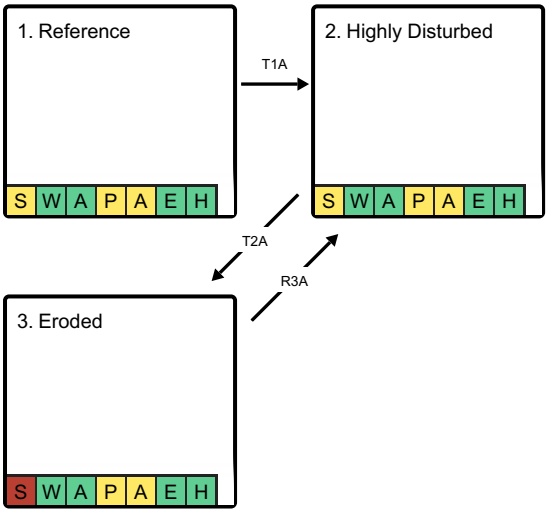
Species composition by dry weight remains an important descriptor of the herbaceous community and of site productivity as a whole and includes both herbaceous and woody species. Calculating similarity index requires data on species composition by dry weight.

Although there is considerable qualitative experience supporting the pathways and transitions within the State-and-Transition Model, no quantitative information exists that specifically identifies threshold parameters between reference states and degraded states in this ecological site. For information on STMs, see the following citations: Bestelmeyer et. al. 2003, Bestelmeyer et. al. 2004, Bestelmeyer and Brown 2005, and Stringham et. al. 2003.

A resource concern risk assessment and dominant resource concerns are provided for each Land Use, State, Plant Community Phase based on NRCS resource concern and planning criteria used to determine resource treatment levels during the conservation planning process. A resource concern is the resource condition that does not meet the minimum accepted levels established by planning criteria as shown in Section III of the NRCS Field Office Technical Guide (https://efotg.sc.egov.usda.gov/#/).
• Low risk means a low probability for the category of resource concerns and additional assessment is typically not necessary.
• Medium risk means that the category of resource concerns could occur, and additional assessment is recommended if the identified resource is a client concern and/or objective.
• High risk means that a resource concern in that category is likely to occur.
The resource categories are: S (soil), W (water), A (air), P (plant), A (animal), E (energy), and H (human). The dominant resource concerns further refine the resource category to a specific resource concern within that category.

State and transition model

Ecosystem states

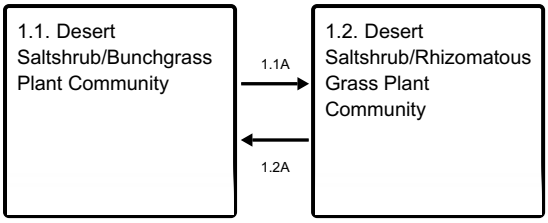


T1A - Extreme soil-disturbance (e.g. oil and gas development, road construction, heavy use areas)

T2A - Erosional event (high intensity storm) after extreme drought or herbivory (continuous, high intensity)

R3A - Seeding (Critical Area Planting or Range Seeding) and Prescribed Grazing

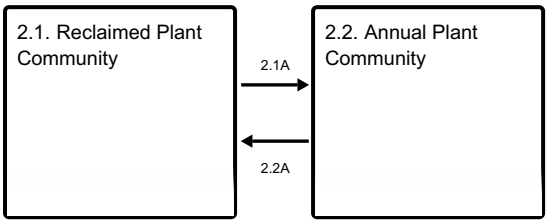
State 1 submodel, plant communities



1.1A - Herbivory (prairie dogs) and prolonged drought

1.2A - Natural Succession

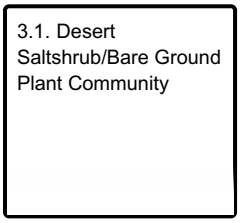
State 2 submodel, plant communities



2.1A - Extreme soil disturbance (oil and gas development, construction, heavy use areas)

2.2A - Reclamation (contouring, deep ripping, re-seeding, prescribed grazing)

State 3 submodel, plant communities



State 1
Reference

The Reference State consists of two communities: the Desert Saltbush/Bunchgrass Community and the Desert Saltbush/Rhizomatous Grass Community. Each community differs in percent composition of bunchgrasses and percent shrub canopy cover. Shrub canopy cover is typically less than 25 percent. The dominant shrub species is Gardner's saltbush with winterfat sub-dominant. Dominant bunchgrasses are Indian ricegrass and bottlebrush squirreltail. Thickspike wheatgrass is the predominant rhizomatous grass. Annual and perennial forbs are a very minor component on this site. Two important processes occur in the reference state and result in plant community changes: 1) grass-reducing disturbances such as drought and herbivory from small mammals (i.e. prairie dogs); and 2) time without those disturbances, generally referred to as "natural succession". Prairie dogs select these sites

for the protection they provide from predators by providing a clear line of site not provided for in sagebrush dominated sites. The white-tailed prairie dog, with intact pest and predator cycles, is thought to form smaller, more spread out colonies, likely due to habitat suitability and lower forage productivity in a desert environment compared to the large black-tailed prairie dog colonies of the prairies in the Great Plains. Predators and disease kept these small colonies on the move, preventing depletion of forage resources and allowed for recovery of the short-lived perennial bunchgrasses that dominate this site. As an example, Indian ricegrass lives approximately six years and relies upon an adequate seedbank to self-perpetuate. The reference prairie dog disturbance cycle is thought to fit within this timeframe.

Characteristics and indicators. This state is dependent upon an episodic herbivory regime that varies over time, allowing for recovery of shrub and bunchgrass components. When used as winter range, the shrub component is reduced to allow for grass dominance. When occupied by a prairie dog colony, the grass component is reduced to allow shrub dominance on the site. Management actions or treatments are not typically used to mimic the natural disturbance regime due to fragile nature of the soils and lower productivity potential on this site. Prescribed fire is not used due to lack of fine fuels (Clause and Randall, 2014).

Resilience management. This site has moderate to moderately high resilience due to its aridic ustic (ustic bordering on aridic) soil moisture regime and frigid bordering on cryic temperature regime (Chambers et.al. 2014). Precipitation is typically low, but more effective with cooler temperatures and present when needed during the critical growth period (May through June). The site can usually recover after disturbance but is susceptible to delays in recovery during extreme climatic events such as drought. The site has moderately high resistance to invasion by annual grasses because of climate limitations (dry and cold). The site may be susceptible to invasion after extreme disturbance during warmer climatic periods. At the LRU scale, this site is less resilient than Sandy, Loamy, or Clayey sites, but is more resistant to invasion by annual invasive grasses. Lower resiliency and higher resistance is caused by soil chemistry, heavier soil textures, and reduced infiltration, making this site more susceptible to dry and drought conditions and harder for new plants to become established.

Dominant plant species

- Gardner's saltbush (*Atriplex gardneri*), shrub
- Indian ricegrass (*Achnatherum hymenoides*), grass
- squirreltail (*Elymus elymoides*), grass

Dominant resource concerns

- Sheet and rill erosion
- Plant productivity and health
- Plant structure and composition
- Terrestrial habitat for wildlife and invertebrates
- Feed and forage imbalance
- Inadequate livestock water quantity, quality, and distribution

Community 1.1
Desert Saltshrub/Bunchgrass Plant Community

This community is well adapted to Pinedale Plateau climatic conditions. The diversity in plant species allows for drought tolerance, and natural plant mortality is very low. These plants have strong, healthy root systems that allow production to increase significantly with favorable moisture conditions. Abundant plant litter is available for soil building and moisture retention. Plant litter is properly distributed with very little movement off-site. This plant community provides for soil stability and a properly functioning hydrologic cycle. Desert saltshrubs and mid-size, cool season perennial bunchgrasses are co-dominant. Saltshrub foliar cover ranges from 15 to 25 percent. There are generally few canopy gaps, and most are small (one to two feet). Rock cover on the soil surface is low to nonexistent. Many plant interspaces have canopy or litter cover. The Reference State herbivory regime in this plant community phase is light and episodic by small to medium-sized ungulates (pronghorn, mule deer, elk) and occurs mostly in the winter.

Table 5. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	185	308	432
Shrub/Vine	135	224	314
Forb	17	28	39
Total	**337**	**560**	**785**

Community 1.2
Desert Saltshrub/Rhizomatous Grass Plant Community

This community is a response to herbivory, primarily the intensity and disturbances seen with a white-tailed prairie dog colony with its pest and predator cycles intact. Due to these fluctuations and temporary colonies on the landscape, adequate seed bank of the mid-size bunchgrasses, exists although they are not dominant on the landscape during this plant community phase. There is less plant litter onsite during this plant community phase, but it is adequate to protect the site from soil erosion. Desert saltshrubs are dominant with rhizomatous grasses in the under-story. Saltshrub foliar cover ranges from 15 to 25 percent. There are a moderate amount of canopy gaps and most are small (one to two feet) with small amounts of large (three to six feet) gaps associated with prairie dog holes. Rock cover on the soil surface is low to nonexistent. Total annual production ranges from 300 to 700 pounds per acre with a Representative Value (RV) of 500 pounds per acre.

Pathway 1.1A
Community 1.1 to 1.2

Herbivory by prairie dogs is the primary driver in this pathway. However, prolonged drought conditions could be another contributor.

Context dependence. Colonies were low density, small, and dispersed in response to low forage production and existing predator populations. Colonies did not stay on a particular site until forage resources were completely depleted. Instead, they moved frequently in response to forage conditions , disease, and predators.

Pathway 1.2A
Community 1.2 to 1.1

Natural succession is the primary driver in this pathway.

Context dependence. The time period for pathway is dependent upon weather events such as drought and above normal precipitation years as well as pest and predator cycles associated with prairie dogs. Drought results in slower pathway while favorable precipitation can result in a faster pathway. A grazing regime that mimics the historic regime (light intensity, episodic grazing events) will not alter the pathway, but a continuous grazing regime at moderate to heavy intensity puts the site at risk to transition to the Grazing Resistant State.

State 2
Highly Disturbed

The Disturbed State is a result of extreme soil-disturbing activities outside of the normal disturbance regime expected for this site. Primary examples include road construction, oil and gas exploration, as well as livestock and recreation heavy use areas.

Characteristics and indicators. Primary indicators of this state are extreme soil disturbance associate with anthropogenic activities. Depending on the time since disturbance, recent climatic events, and reclamation efforts, the plant community could be dominated by annual weeds or it could be reclaimed to a variety of introduced or native species. This state could also be represented as a restoration from the Eroded State by a range planting dominated by non-natives such as Russian wildrye or crested wheatgrass dominant with Gardner's saltbush sub-dominant.

Resilience management. Site resilience is lower than the Reference State, but potentially higher than the Grazing

Resistant or Eroded States. Site hydrology modifications exist, but may be temporary if proper reclamation occurs. Site resistance to invasion by annual forbs is lower due to an increase in soil disturbance allowing niches in the understory for establishment. Common annuals to invade this site include kochia, Russian thistle, and halogeton. Cheatgrass may be present if introduced with seeding efforts, but does not dominate the site or influence site dynamics.

Dominant resource concerns

- Sheet and rill erosion
- Classic gully erosion
- Compaction
- Organic matter depletion
- Concentration of salts or other chemicals
- Plant productivity and health
- Plant structure and composition
- Plant pest pressure
- Terrestrial habitat for wildlife and invertebrates
- Inadequate livestock water quantity, quality, and distribution

Community 2.1
Reclaimed Plant Community

This plant community is highly variable based on weather conditions during restoration activities, the management practices used, the seed mix, and how soil was stockpiled during the disturbance. Total annual production ranges from 300 to 700 pounds per acre with a Representative Value (RV) of 500 pounds per acre. The soil is is typically adequately protected, but erosion can occur during high runoff events. The biotic integrity is dependent on the seed mix used to reclaim the site. There is high variability in watershed function depending on reclamation success.

Community 2.2
Annual Plant Community

As part of succession, all sites that are severely disturbed will go through this plant community as part of their restoration. Weather is the largest determining factor in how long a site will be in this plant community phase, but is approximately two to five years on sites that use Best Management Practices for site restoration (http://www.uwyo.edu/wrrc/). The site has low potential for recovery. Seeding is needed to restore functional structural groups. Productivity in this plant community phase is highly variable based on current year's weather. Total annual production ranges from 100 to 300 pounds per acre with a Representative Value (RV) of 200 pounds per acre.

Pathway 2.1A
Community 2.1 to 2.2

Extreme soil-disturbance from anthropogenic activity such as oil and gas development, road construction, or heavy use areas for livestock production or recreation.

Context dependence. Soils are very fragile, and this pathway could occur from one severe disturbance or multiple consecutive disturbances (e.g. salting areas) or extreme conditions such as hot temperatures, extreme drought, or high intensity grazing will exacerbate this pathway to an annual dominated system.

Pathway 2.2A
Community 2.2 to 2.1

Reclamation efforts include replacing topsoil and reseeding. In cases where heavy equipment caused the disturbance, contouring or deep ripping may be necessary to provide a suitable site for re-seeding. Prescribed grazing is necessary to facilitate successful seeding of perennial species.

Context dependence. Drought conditions and herbivory pressure may hinder restoration efforts, and multiple seeding efforts may be necessary if failure is caused by drought. Mulch can be effective for soil moisture retention

and erosion control on slopes greater than eight percent.

Conservation practices

Critical Area Planting
Prescribed Grazing
Range Planting

State 3
Eroded

This state occurs when the "A" soil horizon has been lost and the subsoil is exposed, bringing the heavy clay soil layer or natric horizon closer to the surface.

Characteristics and indicators. There will be indicators of reduced soil and site stability as well as reduced hydrologic function, mainly water flow patterns, pedestals, rills, and gullies. Bare ground increases along with plant gap inter-space. Soil surface loss and degradation has occurred. Biotic integrity is affected by missing functional/structural groups and the loss of species diversity within functional/structural groups. The site experiences little fluctuation in annual production from year to year because it is basically a monoculture of Gardner's saltbush. The site is less diverse with lower quality habitat for wildlife and pollinators.

Resilience management. Site resilience is lower than all other states because the site hydrology has been modified resulting in greater runoff during spring melt and rainfall events. Therefore, the site is drier and unable to recover as quickly after a disturbance. Soil loss and degradation prevents natural regeneration or restoration of the site.

Dominant plant species

- Gardner's saltbush (*Atriplex gardneri*), shrub

Dominant resource concerns

- Sheet and rill erosion
- Classic gully erosion
- Organic matter depletion
- Concentration of salts or other chemicals
- Plant productivity and health
- Plant structure and composition
- Plant pest pressure
- Terrestrial habitat for wildlife and invertebrates
- Inadequate livestock water quantity, quality, and distribution

Community 3.1

Desert Saltshrub/Bare Ground Plant Community

This community is a response to soil erosion, often as a result of cumulative impacts from multiple herbivores depleting forage resources. An example includes wintering big game and summer/winter livestock and yearlong wild horses and a prairie dog colony existing outside normal reference conditions (broken disease or predator cycles). Gardner's saltbush dominates, often greater than 60 percent species composition by dry weight. Foliar cover of this species often exceeds 30 percent with the inter-spaces largely bare ground. Soil loss and degradation has occurred, resulting in a moderate or greater departure of soil site stability. Hydrologic function has been impaired due to reduced infiltration, resulting in water flow patterns, pedestalling, rills, and gullies. Total annual production ranges from 100 to 300 pounds per acre with a RV of 200 pounds per acre. The biotic integrity is reduced due to low vegetative production, relative dominance and missing structural/functional groups. Soil site stability and the hydrologic cycle have departed from reference conditions with a high amount of bare ground, rills, water flow pattern, soil loss and reduced infiltration due to the lack of perennial herbaceous vegetation.

Transition T1A
State 1 to 2

Extreme soil-disturbance from anthropogenic activity such as oil and gas development, road construction, and heavy use areas for livestock production or recreation.

Constraints to recovery. Recovery can be inhibited by soil chemistry (salinity), herbivory pressure, and prolonged drought conditions.

Context dependence. The transition to the Highly Disturbed State can occur quickly with one severe disturbance or over time as a result of the cumulative impacts of several recurring smaller disturbances such as salting areas for livestock production or continued recreational uses.

Transition T2A
State 2 to 3

Extreme herbivory resulting in removal of perennial herbaceous vegetation followed by erosional event, typically associated with post-drought high intensity storms. This transition could also occur as a results of the cumulative impacts of many kinds and classes of herbivores such as livestock, wild horses, big game, and prairie dogs.

Constraints to recovery. Recovery can be inhibited by soil chemistry (salinity), herbivory pressure, and modified hydrology on the site.

Context dependence. This transition could also occur as a results of the cumulative impacts of many kinds and classes of herbivores such as livestock, wild horses, big game, and prairie dogs when not managed or occurring within the normal reference conditions (i.e. functioning pest and predator cycles). The timing and intensity of drought, herbivory, and intensity of post-drought storms can affect the resulting level of erosion and hydrologic modifications.

Restoration pathway R3A
State 3 to 2

Restoration activities typically involve replacing top soil when it has been removed and deep ripping when site is compacted (after oil and gas exploration or other heavy equipment operations) followed by re-seeding efforts. Historically, the eroded state was targeted for range seeding with introduced species such as Russian wildrye (*Psathyrostachys juncea*) which may not have completely restored the site hydrology, but by reintroducing mid-sized cool-season bunchgrasses, infiltration improves with structural/functional groups similar to the reference state.

Context dependence. This site has low potential for recovery due to soil chemistry and frequent drought conditions (https://www.nrcs.usda.gov/wps/cmis_proxy/https/ecm.nrcs.usda.gov%3a443/fncmis/resources/WEBP/ContentStream/idd_D0F7186E-0000-C21A-845D-CD210097FF99/0/PMC_Tech_Note_PM9A.pdf). Drought and herbivory pressure will affect restoration success, and multiple attempts may be necessary before a reclamation or range seeding will succeed. If seeding of perennial vegetation is successful, it is possible for the site to provide some of the same ecosystem services as the Reference State.

Conservation practices

Critical Area Planting
Prescribed Grazing
Range Planting

Additional community tables

Table 6. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Grass/Grasslike					
1	**Perennial Mid-Size Cool Season Bunchgrasses**			95–196	
	Indian ricegrass	ACHY	*Achnatherum hymenoides*	28–168	5–30
	squirreltail	ELEL5	*Elymus elymoides*	28–112	5–20
	Sandberg bluegrass	POSE	*Poa secunda*	0–56	0–10
	alkali sacaton	SPAI	*Sporobolus airoides*	0–28	0–5
	needle and thread	HECO26	*Hesperostipa comata*	0–28	0–5
2	**Rhizomatous Grasses**			28–56	
	thickspike wheatgrass	ELLAL	*Elymus lanceolatus ssp. lanceolatus*	28–56	1–10
	western wheatgrass	PASM	*Pascopyrum smithii*	28–56	1–10
3	**Misc Grasses/Grasslikes**			11–28	
	plains reedgrass	CAMO	*Calamagrostis montanensis*	0–28	0–5
	needleleaf sedge	CADU6	*Carex duriuscula*	0–28	0–5
	Sandberg bluegrass	POSE	*Poa secunda*	6–28	1–5
	Grass, perennial	2GP	*Grass, perennial*	0–28	0–5
Forb					
4	**Perennial Forbs**			11–28	
	spiny phlox	PHHO	*Phlox hoodii*	6–28	1–5
	longleaf phlox	PHLO2	*Phlox longifolia*	0–17	0–3
	flaxleaf plainsmustard	SCLI	*Schoenocrambe linifolia*	0–17	0–3
	scarlet globemallow	SPCO	*Sphaeralcea coccinea*	0–17	0–3
	princesplume	STANL	*Stanleya*	0–17	0–3
	stemless mock goldenweed	STAC	*Stenotus acaulis*	0–17	0–3
	agoseris	AGOSE	*Agoseris*	0–17	0–3
	fleabane	ERIGE2	*Erigeron*	0–17	0–3
	buckwheat	ERIOG	*Eriogonum*	0–17	0–3
	milkvetch	ASTRA	*Astragalus*	0–17	0–3
	hoary tansyaster	MACA2	*Machaeranthera canescens*	0–17	0–3
	evening primrose	OENOT	*Oenothera*	0–6	0–1
	cryptantha	CRYPT	*Cryptantha*	0–6	0–1
	western wallflower	ERAS2	*Erysimum asperum*	0–6	0–1
	ipomopsis	IPOMO2	*Ipomopsis*	0–6	0–1
	desertparsley	LOMAT	*Lomatium*	0–6	0–1

	onion	ALLIU	*Allium*	0–6	0–1
	rockcress	ARABI2	*Arabis*	0–6	0–1
	sandwort	ARENA	*Arenaria*	0–6	0–1
	violet	VIOLA	*Viola*	0–6	0–1
	deathcamas	ZIGAD	*Zigadenus*	0–6	0–1
	Forb, perennial	2FP	*Forb, perennial*	0–6	0–1
5	**Annual Forbs**			0–6	
	cryptantha	CRYPT	*Cryptantha*	0–6	0–1
	yellow owl's-clover	ORLU2	*Orthocarpus luteus*	0–6	0–1
	finebranched popcornflower	PLLE	*Plagiobothrys leptocladus*	0–6	0–1
	Forb, annual	2FA	*Forb, annual*	0–6	0–1
Shrub/Vine					
6	**Desert Salt Shrub**			106–224	
	Gardner's saltbush	ATGA	*Atriplex gardneri*	84–224	10–20
	winterfat	KRLA2	*Krascheninnikovia lanata*	28–84	5–10
	bud sagebrush	PIDE4	*Picrothamnus desertorum*	6–28	1–5
7	**Misc Shrubs**			11–28	
	greasewood	SAVE4	*Sarcobatus vermiculatus*	0–28	0–5
	spineless horsebrush	TECA2	*Tetradymia canescens*	0–17	0–3
	shortspine horsebrush	TESP2	*Tetradymia spinosa*	0–17	0–3
	yellow rabbitbrush	CHVI8	*Chrysothamnus viscidiflorus*	0–17	0–3
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	0–6	0–1

Animal community

The following table lists suggested stocking rates for cattle under continuous season-long grazing under normal growing conditions with a harvest efficiency (HE) of 25 percent. These are conservative estimates that should be used only as guidelines in the initial stages of the conservation planning process. Often, the current plant composition does not entirely match any particular plant community (as described in this ecological site description). A field visit is required to document actual plant composition and production. More precise carrying capacity estimates, considering forage preference and accessibility (slope, distance to water, etc.), should be calculated using field collected data, particularly when grazers other than cattle are involved. Under more intensive grazing management, improved harvest efficiencies (up to 35 percent) can result in an increased carrying capacity, but recovery time for upland sites is much longer. If distribution problems occur, stocking rates should be reduced or facilitating conservation practices (i.e., cross-fencing, water development) implemented to maintain plant health and vigor.

Stocking rates are expressed in Animal Unit Months (AUMs) which is defined as the amount of forage consumed by a 1,000 pound cow with a less than 4 month old calf at her side.

Initial Suggested Stocking Rate:
Plant Community Production (lbs./ac.) (AUMs/ac.)* Ac./AUM
1.1 Desert Saltshrub/Bunchgrass 300-500-700 0.12 8
1.2 Desert Saltshrub/Rhizomatous Grass 300-500-700 0.07 14
2.1 Desert Saltshrub/Short-stature Grass 200-400-600 0.07 14
3.1 Reclaimed 300-500-700 0.12 8
3.2 Annuals 100-200-300 0.02 50
4.1 Desert Salt Shrub/*Bare Ground* 100-200-300 0.05 20
* Continuous, season-long grazing by cattle under average growing conditions.

Calculation for stocking rates are as follows: Using representative values (RV) for production, take forage palatable to grazing cattle and multiply by 0.25 HE and divide by 912.5 pounds per AUM air-dry weight (ADW) to arrive at the initial suggested stocking rate in AUMs per acre.

Grazing by domestic livestock is one of the major income-producing industries in the area. Rangeland in this area may provide year-long forage for cattle, sheep, or horses. During the dormant period, the forage for livestock must be supplemented with protein because the quality does not meet minimum livestock requirements.

Distance to water, shrub density, and slope can affect grazing capacity within a management unit. Accessibility adjustments should be made for the planning area as necessary. For example, 30 percent of a management unit may have 25 percent slopes and distances of greater than one mile from water, resulting in a 50 percent reduction in grazing access; therefore, the adjustment is calculated for 30 percent of the unit (i.e. 50 percent reduction on 30 percent of the management unit). Fencing, slope length, management, access, terrain, kind and class of livestock, and breeds are all factors that can increase or decrease the percent of grazing access within a management unit. Adjustments should be made that incorporate these factors when calculating the carrying capacity of a management unit.

Wildlife:
Reference State
1.1 Desert Saltshrub/Bunchgrass: Although animal populations of salt-desert shrub ranges are seemingly sparse and simple, a considerable number of species varying in size from insects to large ungulates are normal inhabitants. This community phase provides excellent winter forage for mule deer, pronghorn, and elk, while also providing critical nutrients for migrating big game with the spring green up of grasses. Gardner's saltbush and winterfat are highly sought after plants throughout the year, but especially during winter months. This phase also provides excellent habitat for small mammals such as the white-tailed prairie dog and also provides some nesting and foraging opportunities for songbirds.
1.2 Desert Saltshrub/Rhizomatous Grass: While more variable in its value to large ungulates, this phase still provides good winter habitat for species such as mule deer and pronghorn that browse on salt-shrubs, however, due to the fluctuations in the bunchgrass cover the value of the grass component decreases some. In periods of high plant vigor, the herbaceous understory can still provide adequate habitat for small mammals and songbirds, but decreases during periods of drought or low vigor.

Grazing Resistant State
2.1 Desert Saltshrub/Short-stature Grass: Given the lack of or complete absence of mid-size bunch grasses, the value of this phase to wildlife is variable. The value of the saltshrub community is similar to the reference state while the herbaceous understory lacks diversity and height to provide optimal habitat during most years. In periods of high plant vigor, this phase can still provide an important nutritional component during spring green up for migrating big game with the presence of Sandberg bluegrass, but lacking during non-productive periods.

Highly Disturbed State
3.1 Reclaimed Plant Community: This community phase is highly variable in its value to wildlife. Reclamation success, size and configuration of the reclaimed area, the species planted, and the time it takes for plants to establish will determine the value of the site for wildlife. A fully reclaimed site containing a diversity of herbaceous and woody native plants can eventually provide the same wildlife habitat benefits as the reference state. In most cases, grasses and forbs establish early in the reclamation process, whereas shrubs take significantly longer to establish.
3.2 Annual Plant Community: This plant community exhibits a low level of plant species diversity, and thus, is less apt to meet the seasonal needs of most wildlife who frequent this community.

Eroded State
4.1 Desert Saltshrub/*Bare Ground*: The lack of plant diversity in this phase provides a much lower value to wildlife. Big game species such as pronghorn and mule deer will still forage on woody species on this site, but are likely not able to get the quantity or quality of forage they require for nutritional demands. Small mammals and birds are likely not going to prefer this State relative to the Reference State.

Hydrological functions

Water is the principal factor limiting forage production on this site. This site is highly variable and is dominated by

soils in hydrologic groups B and D, with localized areas in hydrologic group A and C. Infiltration ranges from very slow to moderate. Runoff potential for this site varies from moderate to high depending on soil hydrologic group, depth and fracturing of bedrock, slope, and ground cover (refer to Part 630, NRCS National Engineering Handbook for detailed hydrology information).

Rills and gullies are not typically present in the Reference State. Water flow patterns should be barely distinguishable. Pedestals are only slightly present in association with bunchgrasses. Litter typically falls in place, and signs of movement are not common. Chemical and physical crusts are rare to non-existent. Cryptogamic crusts are present, but only cover one to two percent of the soil surface.

Recreational uses

This site provides opportunities such as prairie dog hunting and Off-Road-Vehicle (ORV) recreational use.

Wood products

No wood products are present on the site.

Inventory data references

Information presented was derived from 1988 Range Site Descriptions, NRCS clipping data, literature, field observations (based on two sampled sites and observations from numerous others), and personal contacts with range-trained personnel (i.e., agency specialists, landowners, land managers, and scientists).

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Contributors

Bryan Christensen
Karen J. Clause

Approval

Kirt Walstad, 3/11/2025

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Shari Meeks, SCCD
Troy Fieseler, WGFD
Justin Feeman, BLM

Rangeland health reference sheet

Interpreting Indicators of Rangeland Health is a qualitative assessment protocol used to determine ecosystem condition based on benchmark characteristics described in the Reference Sheet. A suite of 17 (or more) indicators are typically considered in an assessment. The ecological site(s) representative of an assessment location must be known prior to applying the protocol and must be verified based on soils and climate. Current plant community cannot be used to identify the ecological site.

Author(s)/participant(s)	
Contact for lead author	
Date	02/24/2025

Approved by	Kirt Walstad
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

1. **Number and extent of rills:**

2. **Presence of water flow patterns:**

3. **Number and height of erosional pedestals or terracettes:**

4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):**

5. **Number of gullies and erosion associated with gullies:**

6. **Extent of wind scoured, blowouts and/or depositional areas:**

7. **Amount of litter movement (describe size and distance expected to travel):**

8. **Soil surface (top few mm) resistance to erosion (stability values are averages - most sites will show a range of values):**

9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):**

10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:**

11. **Presence and thickness of compaction layer (usually none; describe soil profile features which may be mistaken for compaction on this site):**

12. **Functional/Structural Groups (list in order of descending dominance by above-ground annual-production or live foliar cover using symbols: >>, >, = to indicate much greater than, greater than, and equal to):**

    Dominant:

Sub-dominant:

Other:

Additional:

---

13. **Amount of plant mortality and decadence (include which functional groups are expected to show mortality or decadence):**

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14. **Average percent litter cover (%) and depth (in):**

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15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):**

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16. **Potential invasive (including noxious) species (native and non-native). List species which BOTH characterize degraded states and have the potential to become a dominant or co-dominant species on the ecological site if their future establishment and growth is not actively controlled by management interventions. Species that become dominant for only one to several years (e.g., short-term response to drought or wildfire) are not invasive plants. Note that unlike other indicators, we are describing what is NOT expected in the reference state for the ecological site:**

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17. **Perennial plant reproductive capability:**
