# Ecological site R042AB263TX
# Basalt Hill,
# Hot Desert Shrub

Accessed: 06/19/2026

## 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.

## Associated sites

| | |
|---|---|
| **R042AB585TX** | **Flagstone Hill, Hot Desert Shrub**<br><br>The Flagstone Hill site may be encountered on shoulders and crests above with limestone bedrock. |
| **R042AB735TX** | **Gravelly, Hot Desert Shrub**<br><br>The Gravelly site is encountered on lower piedmont slopes. |

## Similar sites

| | |
|---|---|
| **R042AB264TX** | **Igneous Hill and Mountain, Hot Desert Shrub**<br><br>The Igneous Hill & Mountain site is similar in that both sites are of igneous origin and are located on similar topography. The Basalt Hills site is less productive and the igneous material is basalt rather than rhyolite and/or trachyte. Very steep map units of basalt soils (Terlingua Series) will be correlated with Igneous Hill & Mountain ecological site. |

**Table 1. Dominant plant species**

| | |
|---|---|
| Tree | Not specified |
| Shrub | Not specified |
| Herbaceous | Not specified |

## Physiographic features

The Basalt Hill ecological site is located on mesas, ridges and side slopes of igneous hills. Rocky outcrops and gravelly surfaces are common in these areas. Slopes are mostly 5 to 20 percent but range from 2 to about 30 percent. Elevation ranges from 2,000 to 3,900 feet above sea level. The site is typically in a position to receive and generate runoff. North and South aspect influences species richness and productivity.

**Table 2. Representative physiographic features**

| | |
|---|---|
| Landforms | (1) Hill<br>(2) Mesa |
| Flooding frequency | None |
| Ponding frequency | None |
| Elevation | 610 – 1,190 m |
| Slope | 0 – 30 % |
| Aspect | N, S |

### Climatic features

The average annual precipitation ranges from 10 to 13 inches and highly variable from 2 to 21 inches. Most of the precipitation occurs as widely scattered thunderstorms of high intensity and short duration during the summer. Occasional precipitation occurs as light rainfall during the cool season. Negligible amounts of precipitation falls in the form of sleet or snow.

Mean annual air temperature is 70° F. Daytime temperatures exceeding 100° F are common from May through September. Frost free period ranges from 254 to 295 days.

The average relative humidity in mid-afternoon is about 25 percent. Relative humidity is higher at night, and the average at dawn is about 57 percent. The sun shines 81 percent of the time in summer and 75 percent in winter. The prevailing wind is from the southwest. Average wind speed is highest, around 11 miles per hour, in March and April.

The combination of low rainfall and relative humidity, warm temperatures, and high solar radiation creates a significant moisture deficit. The annual Class-A pan evaporation is approximately 94 inches.

**Table 3 Representative climatic features**

| | |
|---|---|
| Frost-free period (average) | 300 days |
| Freeze-free period (average) | 330 days |
| Precipitation total (average) | 330 mm |

### Influencing water features

None.

### Soil features

The site consists of shallow, well-drained, moderately permeable, gravelly soils that formed in material weathered from extrusive igneous bedrock. In a representative profile, the surface layer is yellowish brown very gravelly coarse sandy loam about four inches thick. From 4 to 8 inches is a very gravelly sandy loam. At a depth of 8 to 16 inches is weathered igneous bedrock with discontinuous and thin calcium carbonate coatings. Indurate igneous bedrock is usually found below 16 inches in depth. Igneous gravel, cobbles, stones, and boulders cover 50 to 80 percent of the soil surface. Available water capacity is very low. Maximum calcium carbonate equivalent to a depth of 40

inches is 15 percent. In the profile, there are neither saline, nor sodic horizons. Rock outcrops are common features within the mapunits. Due to high presence of surface fragments, the soil's susceptibility to sheet and rill erosion by water is low (erosion factor, Kw = 0.10 - 0.15). The soil temperature is classified as hyperthermic.

The representative soil mapunits is:

Rock outcrop-Terlingua complex, 10-30 percent slopes. (Terlingua component)

**Table 4. Representative soil features**

| | |
|---|---|
| Parent material | (1) Residuum – basalt |
| Surface texture | (1) Very gravelly coarse sandy loam<br>(2) Extremely gravelly sandy loam<br>(3) Loam |
| Family particle size | (1) Loamy |
| Drainage class | Moderately well drained to well drained |
| Permeability class | Slow to moderate |
| Soil depth | 10 – 40 cm |
| Surface fragment cover <=3" | 30 – 50 % |
| Surface fragment cover >3" | 20 – 30 % |
| Available water capacity (0-101.6cm) | 0.08 – 0.25 cm |
| Calcium carbonate equivalent (0-101.6cm) | 0 – 20 % |
| Electrical conductivity (0-101.6cm) | Not specified |
| Sodium adsorption ratio (0-101.6cm) | Not specified |

| | |
|---|---|
| Soil reaction (1:1 water)<br>(0-101.6cm) | 7.9 – 8.4 |
| Subsurface fragment volume <=3"<br>(Depth not specified) | 40 – 50 % |
| Subsurface fragment volume >3"<br>(Depth not specified) | 10 % |

**Ecological dynamics**

The Historic Climax Plant Community (HCPC) on the Basalt Hill (Hot Desert Shrub) site consists of bunch and stoloniferous grasses along with a variety of perennial forbs and woody shrubs.

Composition and production will vary with yearly weather conditions, location, aspect, and the natural variability of the soils. Probably the factor that most influenced the historic vegetative composition of the site was extended dry weather. High rainfall events did occur but were episodic. The perennial grasses dominating the site could survive the periodic droughts as long as the density of woody plants did not become excessive, and top-removal of the grass plants did not occur too frequently. Overgrazing amplifies the effects of drought. However, insects, rodents and herbivores such as, mule deer, desert bighorn sheep, and infrequent fire certainly played a part. Bison were not documented in the historical record as being present in any significant amount. A lack of water was probably a contributing factor.

Early records suggest cattle, sheep, and horses were introduced into the southwest from Mexico in the mid-1500's. However, extensive ranching began in the Trans-Pecos region in the 1880s. Early explorers described the lushness of vegetation in parts of the Trans-Pecos. Captain John Pope in 1854 described the Trans-Pecos area as "…destitute of wood and water, except at particular points, but covered with a luxuriant growth of the richest and most nutritious grasses known to this continent…". Other early travelers describe the springs and water sources that were found in the region. Wagon travel could be accomplished, under favorable conditions, with overnight stops having both water and forage. Livestock numbers peaked in the late 1880's following the arrival of railroads. Historical accounts document ranches with stocking rates as high as one animal unit per four acres.

Decades of overgrazing with loss of vegetation and erosion make it a slow process to return to the HCPC community. In 1944 the southernmost portion of the Trans-Pecos area was set aside as Big Bend National Park. Grazing activities with cattle ceased. In 1944, most of the Basalt Hill (Hot Desert Shrub) sites were probably degraded and dominated by woody shrubs. After 60 years of no grazing, the majority of sites have not recovered to the historic plant community which provides insight into the length of time it takes for recovery in this environment.

The large livestock herds brought in during the favorable years, mainly sheep, could not be sustained during the drought. Overgrazing became a major issue as the extended dry weather was a harsh taskmaster to the early stock growers.

Cattle use on rangeland declines significantly on slopes steeper than 15 percent, however cattle numbers were never very large. Sheep and goats however are able to utilize steeper slopes. It should be noted that abusive grazing by different kinds and classes of livestock will result in different impacts on the site. One effect of the removal of vegetated cover was to expose bare ground to erosion. Another effect was the deterioration of perennial grasses which removed the source of fine fuel to sustain periodic fires. More than likely, fires were not very frequent and when they did occur, the burn pattern was a mosaic governed by terrain and vegetative features.

Due to a combination of climate, soils, and geology, the Basalt Hill ecological site is highly susceptible to disturbances and management prescriptions, either alone or in combination. Disturbances may quickly cause one stable community to cross a compositional and functional threshold into an alternative and often nonreversible stable community.

Indication of vegetation change because of disturbance, namely overgrazing, includes a shift from a shrub/mid and short grass community to a shrub/short grass community and ultimately to a nonreversible annual grass (or no grass) shrub community. Drought conditions can hasten this transition. Loss of herbaceous cover caused from frequent disturbance can create more of an inhospitable environment for some shrubs and forbs to encroach or even survive. This is probably due to higher soil temperatures and less water infiltration and soil stability. A few species, such as creosotebush, are able to increase and colonize following retrogression mostly due to their preference for gravelly and droughty soils that provides a competitive advantage over other plants. However, in many ecosystems, few plants are able to colonize and complete their life cycle between frequent or continuous disturbance. Consequently, the degraded shrub state is a sparse and less diverse plant community.

The following diagram suggests general pathways that the vegetation on this site might follow. There may be other states not shown on the diagram. This information is intended to show what might happen in a given set of circumstances; it does not mean that this would happen the same way in every instance. Local professional guidance should always be sought before pursuing a treatment scenario.

## State and transition model

**Figure 3. Basalt Hill (Hot Desert Shrub) - State & Transitio**

## Additional community tables

**Table 5. Community 1.1 plant community composition**

| Group | Common Name | Symbol | Scientific Name | Annual Production () | Foliar Cover (%) |
|---|---|---|---|---|---|
| **Grass/Grasslike** | | | | | |
| 1 | **Midgrass-bunchgrass-warm season-perennial** | | | 50-118 | |
| | Chino grama | BORA4 | *Bouteloua ramosa* | 34-78 | – |
| | tanglehead | HECO10 | *Heteropogon contortus* | 17-39 | – |
| 2 | **Stoloniferous shortgrasses** | | | 17-39 | |
| | black grama | BOER4 | *Bouteloua eriopoda* | 9-20 | – |
| | false grama | CAER2 | *Cathestecum erectum* | 9-20 | – |
| 3 | **Midgrass-bunchgrass-warm season -perennial** | | | 9-20 | |
| | sideoats grama | BOCU | *Bouteloua curtipendula* | 4-10 | – |
| | Arizona cottontop | DICA8 | *Digitaria californica* | 4-10 | – |
| 4 | **Warm season, perennial bunchgrasses** | | | 6-17 | |
| | threeawn | ARIST | *Aristida* | 3-8 | – |
| | slim tridens | TRMU | *Tridens muticus* | 3-8 | – |
| | low woollygrass | DAPU7 | *Dasyochloa pulchella* | 2-4 | – |
| **Shrub/Vine** | | | | | |
| 5 | **Shrubs** | | | 26-59 | |
| | lechuguilla | AGLE | *Agave lechuguilla* | 9-20 | – |
| | ocotillo | FOSP2 | *Fouquieria splendens* | 9-20 | – |
| | leatherstem | JADI | *Jatropha dioica* | 9-20 | – |
| 6 | **Shrubs** | | | 17-39 | |
| | shortleaf jefea | JEBR | *Jefea brevifolia* | 6-12 | – |
| | littleleaf ratany | KRER | *Krameria erecta* | 6-12 | – |
| | plumed crinklemat | TIGR | *Tiquilia greggii* | 6-12 | – |
| | featherplume | DAFO | *Dalea formosa* | 3-8 | – |
| 7 | **Shrubs** | | | 17-39 | |
| | creosote bush | LATR2 | *Larrea tridentata* | 9-20 | – |
| | whitethorn acacia | ACCO2 | *Acacia constricta* | 6-12 | – |
| | catclaw acacia | ACGR | *Acacia greggii* | 3-8 | – |
| 8 | **Succulents** | | | 9-20 | |
| | Christmas cactus | CYLE8 | *Cylindropuntia leptocaulis* | 3-8 | – |
| | pricklypear | OPUNT | *Opuntia* | 3-8 | – |
| | Big Bend pricklypear | GRSC6 | *Grusonia schottii* | 2-4 | – |
| **Forb** | | | | | |
| 9 | **Perennials** | | | 17-34 | |
| | Shrub, other | 2S | *Shrub, other* | 6-11 | – |
| | Forb, perennial | 2FP | *Forb, perennial* | 3-7 | – |

| | | | | | |
|---|---|---|---|---|---|
| | slimstalk spiderling | BOGR | *Boerhavia gracillima* | 1-3 | – |
| | croton | CROTO | *Croton* | 1-3 | – |
| | beetle spurge | EUER2 | *Euphorbia eriantha* | 1-3 | – |
| | snakecotton | FROEL | *Froelichia* | 1-3 | – |
| | paleface | HIDE | *Hibiscus denudatus* | 1-3 | – |
| | plains blackfoot | MELE2 | *Melampodium leucanthum* | 1-3 | – |
| | menodora | MENOD | *Menodora* | 1-3 | – |
| | Durango senna | SEDU | *Senna durangensis* | 1-3 | – |
| 10 | **Annuals** | | | 0-6 | |
| | Forb, annual | 2FA | *Forb, annual* | 0-3 | – |
| | mustard | BRASS2 | *Brassica* | 0-1 | – |
| | golden crownbeard | VEEN | *Verbesina encelioides* | 0-1 | – |

**Table 6. Community 1.2 plant community composition**

| Group | Common Name | Symbol | Scientific Name | Annual Production () | Foliar Cover (%) |
|---|---|---|---|---|---|

**Table 7. Community 2.1 plant community composition**

| Group | Common Name | Symbol | Scientific Name | Annual Production () | Foliar Cover (%) |
|---|---|---|---|---|---|

## Animal community

The site at or near HCPC is suited for a properly managed (proper stocking rates) grazing system for the production of livestock, including cattle, sheep, and goats. Continuous grazing causes a gradual decline in range health reducing livestock nutrition and habitat quality for wildlife. Livestock should be stocked at carrying capacity in proportion to the grazeable grass, forb, and browse. Vegetative growth is episodic mirroring the rainfall. For that reason, stocker type livestock operations may be more suitable than year-round stocking. Many types of wildlife used the HCPC of this site. Invertebrates, reptiles, birds, and mammals either use the sit as their primary habitat or visit from adjacent sites. Common mammals include mule deer, jackrabbit, cottontail rabbit, javelina, coyote, ground squirrel, skunk, woodrats, many nocturnal mice, and occasionally mountain lions. Game birds include scaled quail and dove. Numerous songbirds and raptors also occur in the area. Desert bighorn sheep are currently being restored to the region. Plant Preference by Animal Kind: These preferences are somewhat general in nature as the preferences for plants is dependent upon grazing experience, time of year, availability of choices, and total forage supply. Legend: P=Preferred D=Desirable U=Undesirable N=Not Consumed T=Toxic X=Used, but not degree of utilization unknown Preferred – Percentage of plant in animal diet is greater than it occurs on the land Desirable – Percentage of plant in animal diet is similar to the percentage composition on the land Undesirable – Percentage of plant in animal diet is less than it occurs on the land Not Consumed – Plant would not be eaten under normal conditions. Only consumed when other forages not available. Toxic – Rare occurrence in diet and, if consumed in any tangible amounts results in death or severe illness in animal

## Hydrological functions

The existing plant community with representative plant species, current soil conditions (soil health), current management, and climate determine the dynamics of the water cycle. Plant and litter cover are important factors, which protect the site from erosion. However, total production and the types of plant species present have greater impact on hydrologic dynamics (infiltration capacity, runoff, and soil losses). With reference to the transitional pathway diagram, the Mixed Shrub/Grass State (1.1 & 1.2) is associated with optimum hydrologic function within this site. The high degree of hydrologic function in state 1 is due to the adequate vegetative cover and dominance of deep-rooted midgrasses compared to more shallow rooted shortgrasses. When properly managed, these species provide adequate cover that will minimize runoff. One of the key concepts to high hydrologic function is the structure and morphology of the root system and other biotic and abiotic factors as explained above. During high rainfall periods, water will percolate beyond the immediate surface root zone via fractures in the bedrock. As this water moves downward, it contributes to the recharge of groundwater. In the HCPC, some runoff naturally occurs due to the low overall biomass production and common occurrence of high intensity summer rainfall. However, his site has a high percentage of rock fragments that assist with minimizing runoff and reducing raindrop impact. In the Shrubland State 2, improper grazing accelerated by periodic drought has caused loss or reduction of most of the grasses. Lack of sufficient herbaceous vegetative cover has impaired hydrologic function on this site. During the transition phase from Mixed Shrub/Grass State 1 to the Shrubland State 2, infiltration decreases, runoff increases, and significant soil loss occurs due to loss of herbaceous plant cover and organic matter. Hydrologic conditions worsen with continued improper management. Rock surface fragments helps minimize some soil loss. Restoration to State 1 hydrology may not be possible or realistic.

## Recreational uses

The Basalt Hills Site is limited for outdoor recreational uses. Small stones, slope, and depth to bedrock make campsite preparation difficult. Hiking and horseback riding is difficult because of surface stones and bedrock.

## Wood products

Ocotillo branches are used for fencing and landscaping. When harvesting, it is important not to remove an entire plant, but only a few stems to help preserve the integrity of the donor plant.

## Other products

None.

## Other information

None.

## Inventory data references

Information presented here has been derived from the revised Hot Rocky Range Site description, literature, NRCS clipping and cover data, field observations, and personal contacts with range and wildlife trained personnel.

## Other references

Anderson, A.W. 1949. Early summer foods and movements of the mule deer (Odocoileus hemionus) in the Sierra Vieja Range of southwestern Texas. Texas Journal of Science 1:45-50.

Briske, D. D., J.D. Derner, J.R. Brown, S.D. Fuhlendorf, W.R. Teague, K.M. Havstad, R.L. Gillen, A.J. Ash, and W.D. Willms. 2008. Rotational grazing on rangelands: Reconciliation of perception and experimental evidence. Rangeland Ecology and Management 61: 3-17.

Briske, D. D., S. D. Fuhlendorf, F. E. Smeins. 2005. State-and-transition models, thresholds, and rangeland health: A synthesis of ecological concepts and perspectives. Rangeland Ecology & Management 58: 1-10.

Gould, F.W. 1978. Common Texas grasses. Texas A&M University Press, College Station.

Hatch, S. L., J. Pluhar. 1993. Texas Range Plants. Texas A&M University Press, College Station.

Henklein, D.C. 2003. Vegetation alliances and associations of the Bofecillos Mountains and plateau. Thesis, Sul Ross State University, Alpine, TX.

Krausman P.R. 1978. Forage relationships between two deer species in Big Bend National Park, Texas. Journal of Wildlife Management 42: 101-107.

McDougall, W.B. and Sperry, O.E. 1951. Plants of Big Bend National Park. United States Government Printing Office, Washington, D.C.

Medina, A.L. 1988. Diets of Scaled Quail in Southern Arizona. The Journal of Wildlife Management 52: 753-757.

Molles, M.C. Jr. 1999. Ecology: concepts and applications. WCB/McGraw-Hill, Boston, MA, USA.

Taylor, R., J. Rutledge, and J.G. Herrera. 1997. A field guide to common south Texas shrubs. Texas Parks and Wildlife Press, Austin, TX.

Texas Parks and Wildlife Department, s.v. “West Texas Wildlife Management,” http://www.tpwd.state.tx.us/landwater/land/habitats/trans_pecos/ (accessed January 2008).

USDA Forest Service, s.v. “Fire Effects Information,” http://www.fs.fed.us/database/feis/plants/ (accessed July 2008).

USDA, National Water and Climate Center, “Climate Reports,” http://www.wcc.nrcs.usda.gov/climate/ (accessed January 2007).

USDA, Natural Resources Conservation Service, “Plants Database,” http://plants.usda.gov/ (accessed July 2008).

Powell, M.A. 2000. Grasses of the Trans-Pecos and adjacent areas. Iron Mountain Press, Marathon, TX.

Powell, M.A. 1998. Trees and shrubs of the Trans-Pecos and adjacent areas. University of Texas Press, Austin.

Wallmo, O.C. 1956. Ecology of scaled quail in west Texas. Contribution of the Federal Aid in Wildlife Restoration Act, Special Report from Project W-57-R, and the Department of Wildlife Management, A&M College of Texas. Division of Wildlife Restoration, Texas Game and Fish Commission, Austin, TX.

Warnock, B. H. 1970. Wildflowers of the Big Bend Country. Sul Ross State University, Alpine, TX.

Reviewers:
Charles Anderson, Zone Rangeland Management Specialist, San Angelo, TX
Rusty Dowell, Resource Soil Scientist, San Angelo, TX
Dr. Lynn Loomis, Soil Scientist, Marfa, TX
Laurie Meadows, Soil Conservation Technician, Marfa, TX
Dr. Nelson Rolong, Soil Scientist, Marfa, TX
Wayne Seipp, Resource Team Leader, Alpine, TX
Craig Thomas, Rangeland Management Specialist, Alpine, TX
Sha Thomas, District Conservationist, Marfa, TX
David Trujillo, Rangeland Management Specialist, Las Cruces, NM
Dr. Bonnie Warnock, Assistant Professor, Sul Ross State University, Alpine, TX

### Contributors

Michael Margo, RMS, NRCS, Marfa, Texas
Unknown

### 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) | Michael Margo and Laurie Meadows, USDA-NRCS |
| Contact for lead author | Zone RMS, NRCS, San Angelo, TX 325-944-0147 |
| Date | 11/17/2011 |
| Approved by | |
| Approval date | |
| Composition (Indicators 10 and 12) based on | Annual Production |

### Indicators

1. **Number and extent of rills:** None

---

2. **Presence of water flow patterns:** None, except following high intesity storms, when short (less than 1 m) and discontinuous flow patterns may appear. Flow patterns in drainages are linear and continuous.

---

3. **Number and height of erosional pedestals or terracettes:** None

---

4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):** 1-5% bareground.

---

5. **Number of gullies and erosion associated with gullies:** None

---

6. **Extent of wind scoured, blowouts and/or depositional areas:** None

---

7. **Amount of litter movement (describe size and distance expected to travel):** In drainages, there can be significant amounts of litter moved long distances. On most of the site, minimal and short distance (<5ft) of litter movement associated with high intense rainfall.

---

8. **Soil surface (top few mm) resistance to erosion (stability values are averages - most sites will show a range of values):** Soil stability values of 4-6 under vegetation and 2-3 in the interspaces

---

9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):** 1-4 inches thick brown surface horizon with a medium granular structure.

---

10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:** A high canopy cover of midgrass bunch and stoliniferous grasses will help minimize runoff and maximize infiltration. Grasses should comprise at least 30% of total plant compostion by weight. Shrubs will always dominate.

---

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

---

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: Mid/tall shrubs > bunchgrasses**

    **Sub-dominant: Stoloniferous grasses > subshrubs**

    **Other: perennial forbs = succulents > annual forbs and grasses**

**Additional:**

---

13. **Amount of plant mortality and decadence (include which functional groups are expected to show mortality or decadence):** **All grasses will show some mortality and decadence in addition to annual forbs. Mid/tall perennial shrubs will show some mortality or decadence only after prolonged and severe droughts. Subshrubs will be less resistant to severe droughts than mid/tall perennial shrubs.**

---

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

---

15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):** **150-350 lbs**

---

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:** **None**

---

17. **Perennial plant reproductive capability:** **All species should be capable of reproducing.**

---