USDA Natural Resources
Conservation Service

# Ecological site R030XD045CA
# Hyperthermic Stable Sand Dunes And Sandsheets

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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): 030X–Mojave Basin and Range

The Mojave Desert Major Land Resource Area (MLRA 30) is found in southern California, southern Nevada, the extreme southwest corner of Utah and northwestern Arizona within the Basin and Range Province of the Intermontane Plateaus. The Mojave Desert is a transitional area between hot deserts and cold deserts where close proximity of these desert types exert enough influence on each other to distinguish these desert types from the hot and cold deserts beyond the Mojave. Kottek et. al 2006 defines hot deserts as areas where mean annual air temperatures are above 64 F (18 C) and cold deserts as areas where mean annual air temperatures are below 64 F (18 C). Steep elevation gradients within the Mojave create islands of low elevation hot desert areas surrounded by islands of high elevation cold desert areas.

The Mojave Desert receives less than 10 inches of mean annual precipitation. Mojave Desert low elevation areas are often hyper-arid while high elevation cold deserts are often semi-arid with the majority of the Mojave being an arid climate. Hyper-arid areas receive less than 4 inches of mean annual precipitation and semi-arid areas receive more than 8 inches of precipitation (Salem 1989). The western Mojave receives very little precipitation during the summer months while the eastern Mojave experiences some summer monsoonal activity.

In summary, the Mojave is a land of extremes. Elevation gradients contribute to extremely hot and dry summers and cold moist winters where temperature highs and lows can fluctuate greatly between day and night, from day to day and from winter to summer. Precipitation falls more consistently at higher elevations while lower elevations can experience long intervals without any precipitation. Lower elevations also experience a low

frequency of precipitation events so that the majority of annual precipitation may come in only a couple precipitation events during the whole year. Hot desert areas influence cold desert areas by increasing the extreme highs and shortening the length of below freezing events. Cold desert areas influence hot desert areas by increasing the extreme lows and increasing the length of below freezing events. Average precipitation and temperature values contribute little understanding to the extremes which govern wildland plant communities across the Mojave.

Hyper-Arid Mojave Land Resource Unit (XD)

## LRU notes

The Mojave Desert is currently divided into 4 Land Resource Units (LRUs). This ecological site is within the Hyper-Arid Mojave LRU, extremely hot and dry low elevation troughs within the Mojave Desert. The Hyper-Arid Mojave LRU is designated by the 'XD' symbol within the ecological site ID. This LRU is found within the Death Valley/Mojave Central Trough, as well as portions of the Mojave exposed to the Salton Sea Trough and the Colorado River Valley. This LRU is essentially equivalent to the Death Valley/Mojave Central Trough, Arid Valleys and Canyonlands, and associated Mojave Sand Dunes and Mojave Playas of EPA Level IV Ecoregions

Elevations range from -280 to 1650 feet and precipitation is less than 4 inches per year. This LRU is distinguished by its extremely aridity where a nearly barren landscape is occupied by widely spaced shrubs. Vegetation includes creosote bush, burrobush, big galleta grass with many annual species able to quickly take advantage of the few precipitation events which occur in this LRU. Playa species such as Mojave seablite and saltbush species are also common in this LRU.

## Ecological site concept

This ecological site is found on dunes and sand sheets within the fan piedmont, hills, and mountains which are too active to support shrubs. Sand accumulation and removal rates bury sprouting plants or remove seeds and seedlings. Only rhizomatous and stoloniferous perennial grasses are able to tolerate conditions at this site.

## Associated sites

| | |
|---|---|
| R030XD006CA | **Abandoned Fan**<br>This ecological site occurs on adjacent fan aprons. |
| R030XD014CA | **Hyperthermic Sandy Plains**<br>This ecological site occurs on adjacent sandsheets. |

| | |
|---|---|
| R030XD015CA | **Hyper-Arid Fans**<br>This ecological site occurs on adjacent fan remnants or fan aprons over fan remnants. |

## Similar sites

| | |
|---|---|
| R030XD014CA | **Hyperthermic Sandy Plains**<br>Occurs on more stable sandsheets. More productive site. Creosote bush is present. |

**Table 1. Dominant plant species**

| | |
|---|---|
| Tree | Not specified |
| Shrub | Not specified |
| Herbaceous | (1) *Pleuraphis rigida* |

## Physiographic features

This ecological site occurs on semi-active dunes and sand sheets at elevations of 1200 to 1800 feet. Slopes range from 2 to 5 percent.

**Table 2. Representative physiographic features**

| | |
|---|---|
| Landforms | (1) Sand sheet<br>(2) Dune |
| Flooding frequency | None |
| Elevation | 366–549 m |
| Slope | 2–5% |
| Aspect | Aspect is not a significant factor |

## Climatic features

## Influencing water features

## Soil features

This soils associated with this ecological site are very deep fine sands. Surface textures are very fine sands. The soil temperature regime is hyperthermic and the soil moisture regime is typic aridic. Soils are classified as Typic Torripsamments.

**Table 3. Representative soil features**

| | |
|---|---|
| Parent material | (1) Eolian deposits–granite |
| Surface texture | (1) Very fine sand |

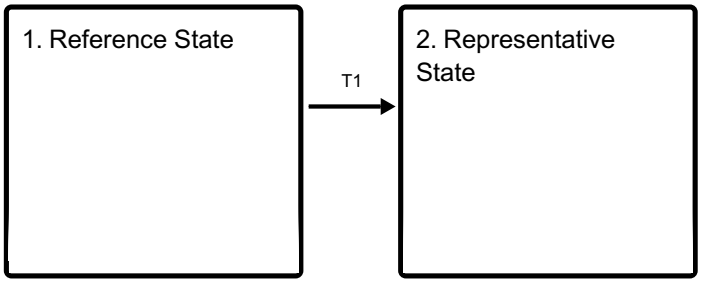
## Ecological dynamics

This ecological site is found on semi-active dunes and sandsheets. The semi-active nature of the site limits shrub colonization, and the somewhat stable nature of the site prevents dune stabilizers like desert panicgrass from success. The native perennial C4 grass big galleta (*Pleuraphis rigida*) is the sole dominant species on this site. Annual species may be abundant on this site, and important species include small wirelettuce (Stephanomaria exigua), birdcage evening primrose (*Oenothera deltoides*), pincushion flower (*Chaenactis fremontii*), smooth desertdandelion (*Malacothrix glabrata*), and Cryptantha species. The non-native annual grass Mediterranean grass (*Schismus barbatus*) is often present.

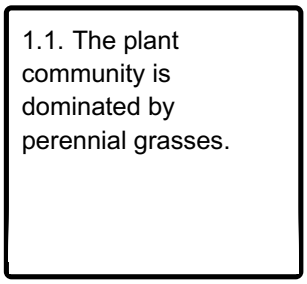
This site is highly susceptible to invasion by Asian mustard (*Brassica tournefortii*) and Russian thistle (*Salsola tragus*).

## State and transition model

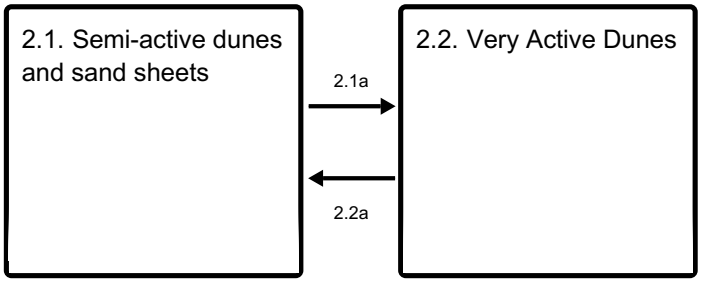
**Ecosystem states**




**State 1 submodel, plant communities**




**State 2 submodel, plant communities**



## State 1
## Reference State

State 1 represents the historic-natural condition for this ecological site. It is similar to State 2, but has only native species. If we were to include dynamics for this state it would be similar to that displayed in State 2.

### Community 1.1
### The plant community is dominated by perennial grasses.

## State 2
## Representative State

This state represents the current potential plant community for this site.

### Community 2.1
### Semi-active dunes and sand sheets

**Figure 1. Community Phase 2.1 Big Galleta**

The current potential plant community is dominated solely by big galleta (*Pleuraphis rigida*). The historic plant community would have consisted of the current potential plant community without the non-native species component. The historic plant community has not been observed and data collected represents the current potential plant community.

**Table 4. Annual production by plant type**

| Plant Type | Low (Kg/Hectare) | Representative Value (Kg/Hectare) | High (Kg/Hectare) |
|---|---|---|---|
| Grass/Grasslike | 322 | 460 | 597 |
| Forb | 34 | 45 | 67 |
| **Total** | **356** | **505** | **664** |

## Community 2.2
## Very Active Dunes

Panic grass stabilizes activated dunes. Big galleta grass is able to become established to aid in dune stabilization. Big galleta increases during non-drought years and decreases during drought years or in areas with repeated surface disturbance.

**Table 5. Annual production by plant type**

| Plant Type | Low (Kg/Hectare) | Representative Value (Kg/Hectare) | High (Kg/Hectare) |
|---|---|---|---|
| Grass/Grasslike | 135 | 202 | 258 |
| Forb | 45 | 67 | 90 |
| **Total** | **180** | **269** | **348** |

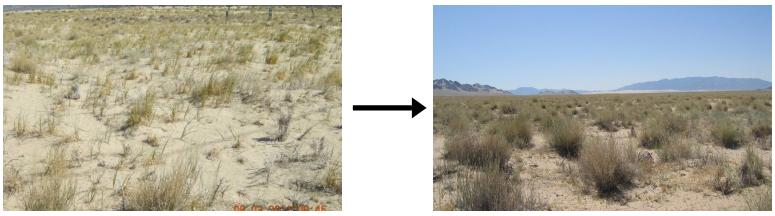
## Pathway 2.1a
## Community 2.1 to 2.2

Semi-active dunes and sand sheets

Very Active Dunes

Surface disturbance, drought or any other type of vegetation removal. Even a slight decrease in precipitation, as little as 10%, is suggested to be enough to destabilize dunes (Muhs & Maat 1993; Muhs & Holliday 2001).

## Pathway 2.2a
## Community 2.2 to 2.1



Very Active Dunes

Semi-active dunes and sand sheets

This pathway occurs during years with above average precipitation or less windy conditions allowing big galleta to increase and further stabilize dunes and sand sheets.

## Transition T1
## State 1 to 2

Introduction of non-native species due to a combination of factors including; surface disturbance, changes in the kinds of animals and their grazing patterns, drought, changes in fire history or any other type of vegetation removal. Non-natives can alter disturbance regimes significantly from their natural or historic range and change ecological processes therefore creating an unlikely scenario to restore the site back to reference.

## Additional community tables

**Table 6. Community 2.1 plant community composition**

| Group | Common Name | Symbol | Scientific Name | Annual Production (Kg/Hectare) | Foliar Cover (%) |
|---|---|---|---|---|---|
| **Grass/Grasslike** | | | | | |
| 1 | **Native perennial grasses** | | | 314–583 | |
| | big galleta | PLRI3 | *Pleuraphis rigida* | 314–583 | 15–20 |
| 3 | **Non-native annual grasses** | | | 8–15 | |
| | common Mediterranean grass | SCBA | *Schismus barbatus* | 8–15 | 5–15 |
| **Forb** | | | | | |
| 2 | **Native forbs** | | | 34–67 | |
| | small wirelettuce | STEX | *Stephanomeria exigua* | 28–56 | 4–8 |
| | birdcage evening primrose | OEDE2 | *Oenothera deltoides* | 3–8 | 0–3 |
| | smooth desertdandelion | MAGL3 | *Malacothrix glabrata* | 0–4 | 0–3 |
| | pincushion flower | CHFR | *Chaenactis fremontii* | 0–3 | 0–2 |

**Table 7. Community 2.2 plant community composition**

| Group | Common Name | Symbol | Scientific Name | Annual Production (Kg/Hectare) | Foliar Cover (%) |
|---|---|---|---|---|---|
| **Grass/Grasslike** | | | | | |
| 1 | **Native perennial grasses** | | | 129–241 | |
| | big galleta | PLRI3 | *Pleuraphis rigida* | 129–241 | 6–12 |
| 3 | **Non-native annual grasses** | | | 9–16 | |
| | common Mediterranean grass | SCBA | *Schismus barbatus* | 9–16 | 10–30 |
| **Forb** | | | | | |
| 2 | **Native forbs** | | | 45–90 | |
| | small wirelettuce | STEX | *Stephanomeria exigua* | 28–53 | 4–8 |
| | cryptantha | CRYPT | *Cryptantha* | 12–24 | 5–9 |
| | smooth desertdandelion | MAGL3 | *Malacothrix glabrata* | 7–11 | 0–3 |
| | pincushion flower | CHFR | *Chaenactis fremontii* | 0–3 | 0–2 |

## Inventory data references

The following NRCS vegetation plots were used to describe this ecological site:

2011CA071031
2011CA071033
2011CA071133
2011CA071228

## Other references

Kottek, M., Grieser, J., Beck, C., Rudolf, B., & Rubel, F. (2006). World map of the Köppen-Geiger climate classification updated. Meteorologische Zeitschrift, 15(3), 259-263.

Muhs, D.R. and P.B. Maat. 1993. The potential response of aeolian sands to greenhouse warming and precipitation reduction on the Great Plains of the USA. Journal of Arid Environments 25, 351–61.

Muhs, D.R. and Holliday, V.T. 2001. Origin of late Quaternary dune fields on the Southern High Plains of Texas and New Mexico. Geological Society of America Bulletin 113, 75–87.

Salem, B. B. (1989). Arid zone forestry: a guide for field technicians (No. 20). Food and Agriculture Organization (FAO).

## Contributors

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## Approval

Sarah Quistberg, 2/25/2025

## 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 | 05/21/2025 |
| Approved by | Sarah Quistberg |
| 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):**

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

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

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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:

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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:**

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