USDA Natural Resources
Conservation Service

Ecological site R070BY061NM
Sandhills

Last updated: 9/12/2023
Accessed: 05/10/2025

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.

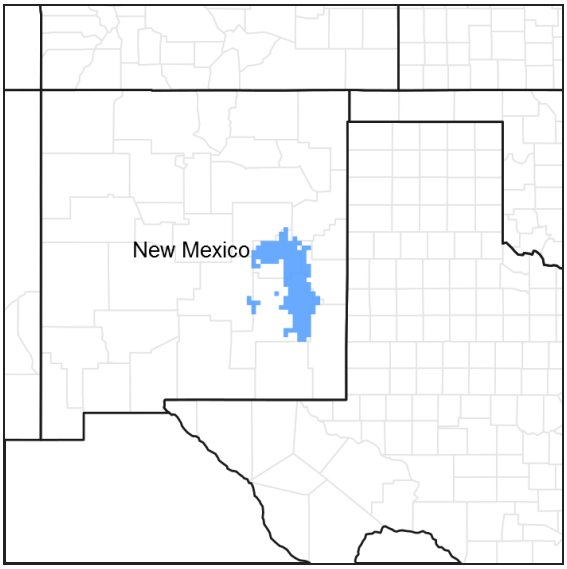


Figure 1. Mapped extent

Areas shown in blue indicate the maximum mapped extent of this ecological site. Other ecological sites likely occur within the highlighted areas. It is also possible for this ecological site to occur outside of highlighted areas if detailed soil survey has not been completed or recently updated.

Ecological site concept

The central concept of this ecological site is soils with textures of fine sand or loamy fine sand throughout. Slopes range from 1 to 25 percent. Parent material is eolian and/or alluvial.
The Sandhills ecological site intergrades with the Deep Sand site, and often occurs adjacent to the Sandy Plains or Sandy Loam sites. The distinguishing characteristic of Sandhills is a fine sand or loamy fine sand soil texture that extends to a depth of 60 inches or more.

Table 1. Dominant plant species

Tree	Not specified
Shrub	(1) *Quercus havardii* (2) *Artemisia filifolia*
Herbaceous	(1) *Andropogon hallii* (2) *Sporobolus cryptandrus*

Physiographic features

This ecological site occurs on coarse-textured eolian and alluvial sediments on upland plains. The landscape is typically a complex of vegetated sand ridges and sand swales. The ridges tend to arrange themselves in a chain,

extending parallel in the direction of the prevailing winds. These features generally extend to a tip and then collapse, causing this leeward side to be concave and the windward side to be convex. Slopes range from 1 to 25 percent. Exposure varies, but is generally not ecologically significant. Elevation ranges from 3,500 to 5,300 feet.

Table 2. Representative physiographic features

Landforms	(1) Dune (2) Hill (3) Fan remnant
Flooding frequency	None
Ponding frequency	None
Elevation	3,500–5,300 ft
Slope	1–25%
Water table depth	72 in
Aspect	Aspect is not a significant factor

Climatic features

The climate of this area can be classified as “semi-arid continental”.

Annual average precipitation ranges from 11 to 16 inches. Roughly 78 percent of the moisture falls during the 6-month period of May through October. Most of this summer precipitation falls in the form of brief and heavy afternoon and evening thunderstorms. Hail may accompany the more severe summer storms. In the winter, there is normally only one day a month when as much as one-tenth inch of moisture falls, usually in the form of snow. Snow seldom lies on the ground for more than a few days.

Temperatures are characterized by a distinct seasonal change and large annual and diurnal temperature ranges. Summers are moderately warm. Maximum temperature average above 90 degrees F from July to August, and an average summer includes about 80 days with high readings exceeding 90 degrees F and 10 days with readings above 100 degrees F. Temperatures usually fall rapidly after sundown and lows average 60 degrees F on most summer nights. Winters are mild, sunny, and dry. Daytime shade temperatures in midwinter usually rise to the 50’s. However, freezing temperatures normally occur at night from mid-November to mid-March.

The freeze-free season ranges from 196 to 218 days. Dates of the last freeze range from April 11th to April 17th and the first freeze ranges from October 20th to October 25th.

Both temperature and rainfall distribution favor warm-season, perennial plant communities in the area. However, sufficient late winter and early spring moisture allows cool-season species to occupy a minor component within the plant community.

Climate data was obtained from http://www.wrcc.dri.edu/summary/climsmnm.html web site. Data were interpreted utilizing NM Climate Summarizer spreadsheet.

Table 3. Representative climatic features

Frost-free period (average)	192 days
Freeze-free period (average)	218 days
Precipitation total (average)	16 in

Influencing water features

This site is not influenced by water from wetlands or streams.

Soil features

Soils are very deep and excessively drained. Surface textures are fine sand or loamy fine sand. Substratum textures are fine sand or loamy fine sand to a depth of 60 inches or more. Permeability is rapid and available water capacity is low. The plant-soil-air-water relationship is fair. Because of the coarse textures and rapid drying of the surface, if the soil surface is unprotected by plant cover and organic residue, it becomes wind-blown and converts rapidly to unstable dunes.

Characteristic Soils:
Berwolf
Roswell
Tivoli
Orthents

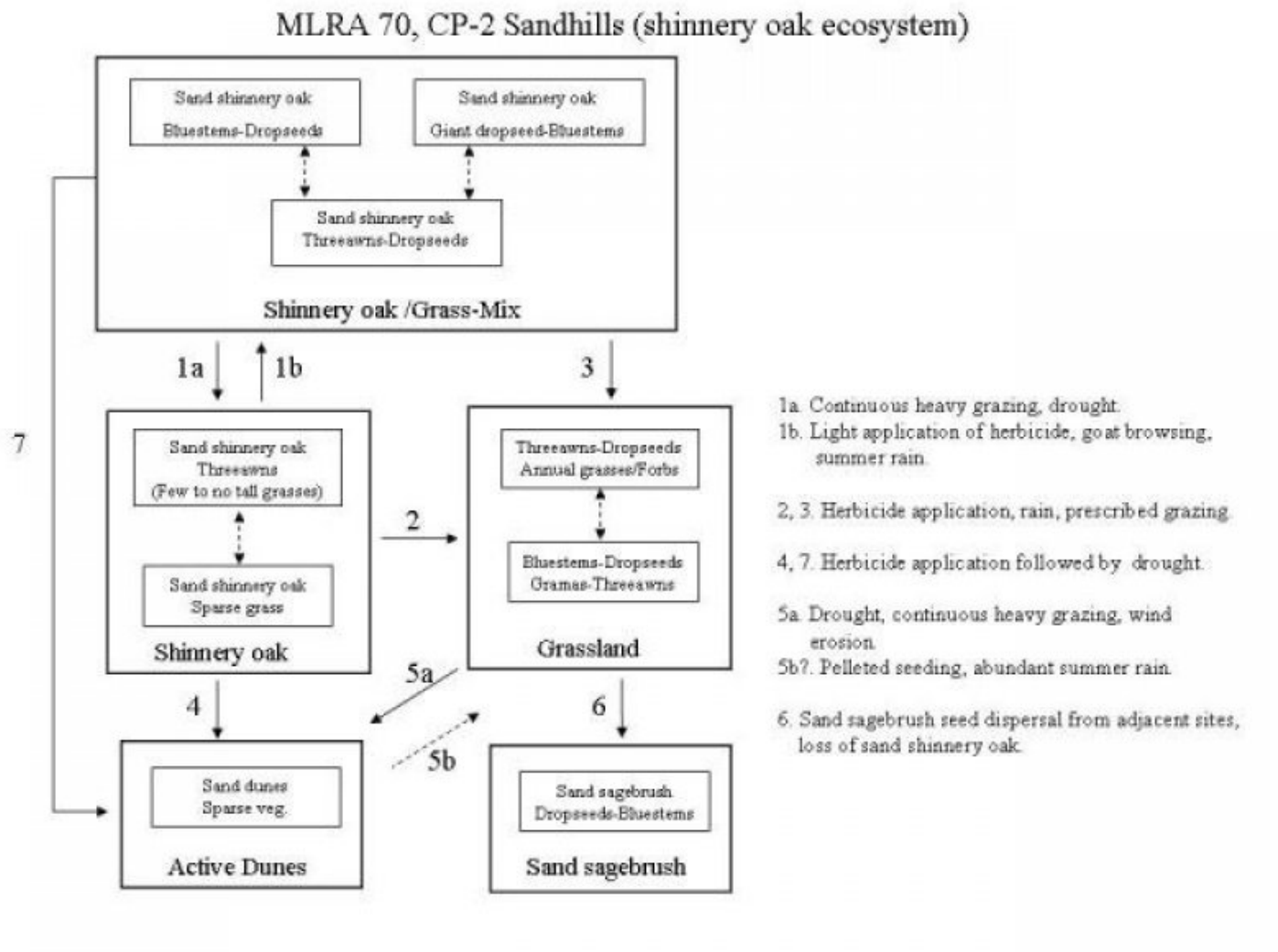
Table 4. Representative soil features

Surface texture	(1) Fine sand (2) Loamy fine sand
Family particle size	(1) Sandy
Drainage class	Well drained to excessively drained
Permeability class	Moderately rapid to rapid
Soil depth	60–80 in
Surface fragment cover <=3"	0–3%
Available water capacity (0-40in)	3–6 in
Calcium carbonate equivalent (0-40in)	0–5%
Electrical conductivity (0-40in)	0–2 mmhos/cm
Sodium adsorption ratio (0-40in)	0
Soil reaction (1:1 water) (0-40in)	6.6–8.4
Subsurface fragment volume <=3" (Depth not specified)	0–3%

Ecological dynamics

The reference plant community is believed to be a shinnery oak/grass mix composed predominantly of warm-season tall and mid-grasses and sand shinnery oak. Continuous heavy grazing, especially in conjunction with drought, can result in a decrease or loss of tallgrasses and initiate a transition to a state dominated by sand shinnery oak. Light application rates of herbicide or long term grazing by goats may decrease shinnery oak and allow grasses to re-colonize to conditions approximating reference plant community composition. Alternatively, heavier application rates of herbicide can dramatically reduce or kill sand shinnery oak, allowing grasses to dominate (Grassland state). This transition to grass dominance may be aided by decreased competition and a flush of nutrients from the decomposing oak. This transition requires the presence of perennial grasses prior to treatment, adequate rainfall necessary to establish grasses, and proper management. If drought and or mismanagement follow sand shinnery oak control, grasses may not establish and sparsely vegetated dunes and severe erosion (Active Dunes state) may result. Over a period of years, sand sagebrush may encroach on the Grassland state, perhaps due to reduced competition resulting from the loss of shinnery oak or proximity to seed source (Sand Sagebrush state).

State and transition model



State 1
Reference State

This state represents the most ecologically stable conditions in terms of resistance to erosion. Moreover, this state has the highest potential for productivity and plant diversity.

Community 1.1
Reference Plant Community

The reference plant community is believed to be a shinnery oak/grass mix, where tall and mid-grasses are co-dominant with shinnery oak. Sand bluestem, little bluestem, and dropseeds (sand, spike, and mesa) are the dominant grasses. In the southeastern portion of Chaves County, giant dropseed may become the dominant grass with little bluestem and sand bluestem occurring as the sub-dominants. Other common grasses across this ecological site include threeawns, fall witchgrass, Plains bristlegrass, hairy grama, sand paspalum, red lovegrass, and sand lovegrass. Shinnery oak is the dominant shrub. Other shrubs that occur on this site include yucca, mesquite, sand sagebrush, and broom snakeweed. Forbs fluctuate from year to year, being most abundant in years with considerable early spring moisture. Annual sunflower, annual buckwheat, and western ragweed are a few of the common forbs. Continuous heavy grazing, especially in conjunction with drought, can result in a decrease of tallgrasses and result in a community with threeawns or dropseeds occurring as the dominant grass species and bluestems sub-dominant. Application of foliar (phenoxy) herbicides or perhaps prescribed fire may temporarily suppress shinnery oak, reducing resource competition, and accelerate a community shift back towards the reference community. Diagnosis: Shinnery oak and grasses are co-dominant. Tallgrasses such as sand bluestem or giant dropseed are present in substantial amounts. Threeawns, sand dropseed, spike dropseed, or mesa dropseed may be dominant in some instances. Grass cover is variable. Shifting sands and large irregular dunes produce considerable variation in the spatial distribution and composition of the plant community. Grass cover is not

continuous, but is fairly uniform across the more stable areas. Shinnery oak and grasses limit erosion.

Table 5. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Grass/Grasslike	820	1350	1870
Shrub/Vine	160	270	370
Forb	110	180	250
Total	**1090**	**1800**	**2490**

Table 6. Ground cover

Tree foliar cover	0%
Shrub/vine/liana foliar cover	5-15%
Grass/grasslike foliar cover	20-30%
Forb foliar cover	1-5%
Non-vascular plants	0%
Biological crusts	0%
Litter	25-35%
Surface fragments >0.25" and <=3"	0-3%
Surface fragments >3"	0-3%
Bedrock	0%
Water	0%
Bare ground	30-40%

Figure 5. Plant community growth curve (percent production by month). NM4061, R070BY061NM Sandhills Reference State. R070BY061NM Sandhills Reference State.

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	5	7	10	15	25	25	12	1	0	0

State 2
Shinnery oak

This state contains robust stands of shinnery oak.

Community 2.1
Shinnery oak

Shinnery oak dominates this phase. Other shrubs that typically occur include yucca, mesquite, broom snakeweed, sand sagebrush, and pricklypear. Two communities have been recognized in this state. In the first, shinnery oak is dominant with threeawns and other subordinate grasses occurring as the sub-dominant. There are few or no tall grasses. Subordinate grasses typically present in this community include dropseeds, hairy grama, fall witchgrass, lovegrass species, and field sandbur. Shinnery oak is the sole dominant in the second community with only sparse grass cover. This second community is believed to develop during extended periods of drought, which may cause a large-scale reduction in threeawns and other grasses. Favorable rainfall conditions and a persistent seed bank of threeawns may cause a shift back to a shinnery oak/threeawn community. When shinnery oak is the main source of forage, livestock should not be allowed to graze pastures during the spring, when shinnery oak is in the late bud and early leaf stage. During this period (normally six weeks), tannin concentrations are highest and livestock poisoning can occur. In the fall, care must be taken during years of high acorn production. The acorns are both relished by livestock and poisonous. Diagnosis: Shinnery oak is dominant with threeawns occurring as the sub-dominant, or

shinnery oak is the sole dominant with few grasses present. Tallgrasses are sparsely scattered across the site or are absent. The cover of shinnery oak helps to limit erosion. Key indicators of approach to transition: A decrease in tallgrass and more palatable mid-grass species. An increase in threeawns. Transition to Shinnery oak (1a) Transitions to this state are believed to occur in response to grazing pressure, especially in conjunction with drought, or in response to long term severe drought. Shinnery oak has low palatability for cattle and is primarily used as emergency food during droughts. The extensive root system of shinnery oak and its ability to store water enable it to withstand drought better than associated grasses. Low palatability and high drought resistance enable shinnery oak to remain relatively stable. Transition back to Shinnery oak/Grass-Mix (1b) Light application rates of root-absorbed herbicides can reduce shinnery oak and under favorable rainfall conditions initiate this transition. Long-term browsing by goats has shown promise in reducing shinnery oak and helping to reestablish co-dominance between shinnery oak and grass.

Figure 6. Plant community growth curve (percent production by month). NM4061, R070BY061NM Sandhills Reference State. R070BY061NM Sandhills Reference State.

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	5	7	10	15	25	25	12	1	0	0

State 3
Grassland

This state is dominated by grasses.

Community 3.1
Grassland

This phase is dominated by herbaceous vegetation with little to no shinnery oak present. There are various communities that can express themselves depending on the grass component prior to treatment and amount of precipitation following treatment. Generally there is an initial increase in threeawns, dropseeds, annual grasses, and forbs. Over time and with proper management, the community may shift to dominance by bluestems and dropseeds with gramas, threeawns, and other subordinate grasses as sub-dominants. Proper management is essential to maintain grass cover and limit erosion. Diagnosis: Shinnery oak occurs as scattered individuals or is not present. Grasses are dominant. Bluestems, dropseeds, or threeawns are typically the dominant species. Litter cover is less than in either the Shinnery oak or Shinnery oak/Grass-Mix states. Transition to Grassland (2, 3) Transitions to the Grassland state from either the Shinnery oak/Grass-Mix or Shinnery oak state can occur with the use of root-absorbed herbicides such as tebuthiuron. The results are dependent on the initial vegetation, herbicide application rate, adequate rainfall, and management practices following treatment. Control of shinnery oak should be limited to those sites with adequate perennial grasses present and during years exhibiting favorable climatic conditions. Thus, this practice should be carefully evaluated due to the extreme erosion hazard associated with cover loss. Transition to Grassland (5b?) Theoretically this transition is accomplished by utilizing pelleted seed to reestablish vegetation and stabilize the dunes. The seed is designed to germinate only after receiving rainfall in amounts necessary to confer a high probability of survival. Abundant summer rain following germination would be necessary to enable the plants to establish. The chance of seedling survival is limited by erosion potential.

Figure 7. Plant community growth curve (percent production by month). NM4061, R070BY061NM Sandhills Reference State. R070BY061NM Sandhills Reference State.

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	5	7	10	15	25	25	12	1	0	0

State 4
Sand Sagebrush

This state contains abundant sand sagebrush.

Community 4.1

Sand Sagebrush

This phase is characterized by the predominance of sand sagebrush. Dropseeds and bluestems are typically the main grasses. Subordinate grasses common on this site include threeawns, fall witchgrass, Plains bristlegrass, hairy grama, sand paspalum, red lovegrass, and sand lovegrass. Diagnosis: Sand sagebrush is dominant. Grass cover is variable, ranging from fairly evenly distributed to patchy. Blowouts and bare areas may be common. Litter cover is less than in states with similar densities of shinnery oak. Transition to Sand Sagebrush (6) Transitions to this state are thought to occur as the result of the introduction of sand sagebrush seeds from adjacent sites, along with low competition for soil moisture resulting from the loss of shinnery oak.

Figure 8. Plant community growth curve (percent production by month). NM4061, R070BY061NM Sandhills Reference State. R070BY061NM Sandhills Reference State.

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	5	7	10	15	25	25	12	1	0	0

State 5
Active Dunes

This state is characterized by active dunes.

Community 5.1
Active Dunes

Active Dunes: Sparsely vegetated dunes and active erosion characterize this state. Grass cover is minimal. Threeawns and dropseeds are sparsely scattered across the site. Small soapweed yucca is typically present. Diagnosis: Vegetation is sparse. Erosion is active and severe. Transition to Active Dunes (4, 7) Transitions to this state result from herbicide application and unsuccessful grass establishment. Drought following herbicide treatment may decrease seedling survival and reduce cover of established grasses beyond the point necessary to protect the site from accelerated erosion. Transition to Active Dunes (5a) Drought, especially in conjunction with heavy greasing pressure may cause this transition.

Figure 9. Plant community growth curve (percent production by month). NM4061, R070BY061NM Sandhills Reference State. R070BY061NM Sandhills Reference State.

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	5	7	10	15	25	25	12	1	0	0

Additional community tables

Table 7. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
Grass/Grasslike					
1				290–360	
	sand bluestem	ANHA	*Andropogon hallii*	288–360	–
2				180–220	
	spike dropseed	SPCO4	*Sporobolus contractus*	0–216	–
	sand dropseed	SPCR	*Sporobolus cryptandrus*	0–216	–
	mesa dropseed	SPFL2	*Sporobolus flexuosus*	0–216	–
3				140–180	
	little bluestem	SCSC	*Schizachyrium scoparium*	144–180	–
4				90–130	
	giant sandreed	CAGI3	*Calamovilfa gigantea*	90–126	–

5				70–110	
	Indiangrass	SONU2	*Sorghastrum nutans*	72–108	–
6				50–90	
	lovegrass	ERAGR	*Eragrostis*	0–90	–
	thin paspalum	PASE5	*Paspalum setaceum*	0–90	–
7				50–90	
	plains bristlegrass	SEVU2	*Setaria vulpiseta*	54–90	–
	plains bristlegrass	SEVU2	*Setaria vulpiseta*	54–90	–
8				50–90	
	hairy grama	BOHI2	*Bouteloua hirsuta*	54–90	–
9				40–70	
	threeawn	ARIST	*Aristida*	36–72	–
10				0–40	
	mat sandbur	CELO3	*Cenchrus longispinus*	0–36	–
11				40–70	
	Hall's panicgrass	PAHA	*Panicum hallii*	0–72	–
12				0–40	
	Grass, annual	2GA	*Grass, annual*	0–36	–
Forb					
13				40–70	
	common sunflower	HEAN3	*Helianthus annuus*	36–72	–
14				40–70	
	annual buckwheat	ERAN4	*Eriogonum annuum*	36–72	–
15				40–70	
	mustard	BRASS2	*Brassica*	36–72	–
16				20–40	
	beeblossom	GAURA	*Gaura*	18–36	–
17				20–40	
	pingue rubberweed	HYRI	*Hymenoxys richardsonii*	18–36	–
18				20–40	
	great ragweed	AMTR	*Ambrosia trifida*	0–36	–
	Adonis blazingstar	MEMU3	*Mentzelia multiflora*	0–36	–
	globemallow	SPHAE	*Sphaeralcea*	0–36	–
19				40–70	
	Forb, annual	2FA	*Forb, annual*	36–72	–
20				40–70	
	Forb, perennial	2FP	*Forb, perennial*	36–72	–
Shrub/Vine					
21				0–180	
	Havard oak	QUHA3	*Quercus havardii*	0–180	–
22				90–130	
	sand sagebrush	ARFI2	*Artemisia filifolia*	90–126	–
23				20–50	
	heath	ERICA	*Erica*	18–54	–

24				0–40	
	soapweed yucca	YUGL	*Yucca glauca*	0–36	–
25				0–50	
	broom snakeweed	GUSA2	*Gutierrezia sarothrae*	0–54	–
	plains pricklypear	OPPO	*Opuntia polyacantha*	0–54	–
	ragwort	SENEC	*Senecio*	0–54	–

Animal community

Habitat for Wildlife: This site provides habitat which supports a resident animal community characterized by pronghorn antelope, badger, desert cottontail, spotted ground squirrel, plains pocket mouse, Ord's kangaroo rat, prairie falcon, lesser prairie chicken, burrowing owl, bullsnake, ornate box turtle, and round-tailed horned lizard. The upland plover breeds in these sites.

Hydrological functions

The runoff curve numbers are determined by field investigations using hydrologic cover conditions and hydrologic soil groups.

Hydrologic Interpretations
Soil Series Hydrologic Group
Berwolf ----------A
Dunes ----------A
Roswell ----------A
Tivoli ----------A

Recreational uses

Recreation potential is limited due to the lack of access roads for two-wheel drive vehicles, loose sands, lack of live water, and the lack of shade. The "wide open spaces" of the area enhance aesthetic appeal. Hunting for prairie chickens is good to excellent. Hunting for antelope is fair to good. Photography of prairie chickens during their "booming" season is excellent to good. The natural beauty is enhanced by the varying hues of bluestems and the large variety of forbs that bloom from early spring to late fall.

Wood products

This site produces no wood products.

Other products

Grazing: This ecological site can be grazed any season of the year except during the spring when shinnery oak is in the late bud and early leaf stage. During this period (normally six weeks), domestic livestock should be removed from pastures because shinnery oak is toxic. Care must be taken in years of high production of acorns, which are both poisonous and relished by livestock. Immediately following this stage, shinnery oak provides forage for livestock for about six weeks before the leaf becomes tough and brittle. Cattle, goats and sheep can graze this site due to the variety of grasses, forbs and shrubs. However, cattle most efficiently utilize it. Continuous, yearlong grazing by cattle results in a plant community of low forage value, characterized by plants such as threeawn spp., field sandbur, shinnery oak, small soapweed, sand sagebrush, and forbs. This condition is usually accompanied by reduced ground cover causing wind erosion. A system of deferred grazing, which varies the seasons of grazing and rest, is needed to maintain or improve a healthy, well-balanced plant community. Rest in different seasons benefits different plants. Winter rest will benefit all woody species. Spring rest will encourage forb production and benefit New Mexico feathergrass. Summer rest (July-September) allows species such as sand bluestem and little bluestem to grow and reproduce. Fall rest allows all warm-season species to complete their growth cycle and mature. Shinnery oak can be best utilized if cattle are concentrated into a small pasture immediately following the toxic state until leaves become tough and brittle.

Other information

Guide to Suggested Initial Stocking Rate Acres per Animal Unit Month

Similarity Index Ac/AUM
100 - 76 2.3 – 5.5
75 – 51 3.5 – 6.7
50 – 26 5.3 – 12.0
25 – 0 12.0+

Inventory data references

Data collection for this site was performed in conjunction with the progressive soil surveys within the Pecos-Canadian Plains and Valleys, Major Land Resource Area 70 of New Mexico. This ecological site has been mapped and correlated to soils in the following counties: San Miguel, Quay, Guadalupe, De Baca, and Chaves.

Other references

References

1. Boyd. C. S. and T. G. Bidwell. 2002. Effects of prescribed fire on shinnery oak (Quercus havardii) plant communities in western Oklahoma. Restoration Ecology 10: 324-333.

2. Harrell, W. C., S. D. Fuhlendorf, and T. G. Bidwell. 2001. Effects of prescribed fire on sand shinnery oak communities. Journal of Range Management. 54: 685-690.

3. Jacoby, P. W., J. E. Slosser, and C. H. Meadors. 1983. Vegetational responses following control of sand shinnery oak with tebuthiuron. Journal of Range Management. 36: 510-512.

4. Peterson, R. S. and C. S. Boyd. 1998. Ecology and management of sand shinnery communities: a literature review. Gen Tech. Rep. RMRS-GTR-16. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fort Collins, CO. 44 P.

5. Pettit, R. D. 1979. Effects of picloram and tebuthiuron pellets on sand shinnery oak communities. Journal of Range Management. 32: 196-200.

6. Sears, W. E., C. M. Britton, D. B. Wester, and R. D. Pettit. 1986a. Herbicide conversion of sand shinnery oak (Quercus havardii) community: Effects on biomass. Journal of Range Management. 39: 399-403.

7. Vermeire, L. T. and D. B. Wester. 2001. Shinnery oak poisoning of rangeland cattle: causes, effects, and solutions. Rangelands. 23: 19-21.

8. Villena, F. and J. A. Pfister. 1990. Sand shinnery oak as forage for Angora and Spanish goats. Journal of Range Management. 43: 116-122.

Contributors

Christine Bishop
David Trujillo
Don Sylvester
John Tunberg

Approval

Kendra Moseley, 9/12/2023

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	05/10/2025
Approved by	Kendra Moseley
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):**

---

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):**

---

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:**

---

17. **Perennial plant reproductive capability:**
