Other (California annual grasslands and Florida)

The unique characteristics of California annual grasslands and Florida (Figures 1-2) limit the ability to apply and interpret assessments of the three rangeland health attributes, albeit in slightly different ways. In the case of California, continuing debate about the reference conditions to be used for evaluations and incomplete implementation of ecological sites prevented development of the ecological site-specific reference sheets necessary to carry out the evaluations. In the case of Florida, the qualitative evaluation protocol has not been well tested and may need refinement to meet the needs of a subtropical system. Therefore, we are not reporting Rangeland Health attribute data for these areas, but only the quantitative data related to the attributes.

**Figure 1. Acres of Non-Federal Rangeland, 2012**
Much of California’s annual grassland surrounds the flat central valley which is primarily dominated by cropland. Surrounding the central valley are the Klamath Mountains to the north, the Coast Ranges to the west and the Sierra Nevada to the east (Figures 1-2). Annual grasslands form a ring surrounding of the central valley at lower elevations. Lower precipitation on these lands combined with the fine soil texture tend to favor grasslands over woody chaparral and savannahs generally more common at higher elevations receiving greater precipitation and having courser soil structure. Chaparral and oak savannas occupy areas between the grasslands and the mixed coniferous forests at higher elevations and higher precipitation. This area’s Mediterranean climate, with mild and moist winters and hot and dry summers, is typical of other mid-latitude areas located on the west side of continents. The Coast Range also impacts this area by creating a rain-shadow effect on the western side of the central valley. Annual precipitation in rangelands surrounding the central valley decreases from north to south and increases with elevation. Coastal regions receive greater annual precipitation and cooler temperatures than the interior region’s precipitation (Kottek, Grieser, Beck, Rudolf, & Rubel, 2006; Bartolome & Spiegal, Ecological history, 2016; George, 2016; Griffith, et al., 2016).

The California coast lies along the border of two tectonic plates. Soils of the Coast Range were formed by accretions of the sea floor scraped off by subduction of the western plate. As the two plates came together, volcanic action formed the Klamath Mountains to the north and the Sierra Nevada to the east of the Central valley. Soil eroded over millennia from the Coast Range into the Central Valley is generally of fine texture. Landslides are common in the Coast Range due to the soil structure (Bartolome & Spiegal, Ecological history, 2016).

California’s grasslands were transformed over the last 250 years by a series of events. Spaniards introduced the first cattle, horses, and sheep to the area in 1769. Although settlement and livestock increased over the next 80 years, the Gold Rush which began in 1848 dramatically increased numbers of settlers, livestock, and conversion of rangelands to cropland. Major flooding in 1862 followed by two years...
of severe drought further impacted native plant communities. The Homestead Act of 1862 accelerated the conversion of arable lands in the valley to cropland. Areas not suitable for farming became known as “open range” and the high concentration of livestock grazing during the 1880s and 1890s decimated those lands. Together the combination of grazing, introduction of alien plants, drought from 1862-1864, and cultivation changed the California grasslands forever (Bartolome, Barry, Griggs, & Hopkinson, 2007; Larson-Praplan, 2014).

The California annual grasslands represent an area where a group of non-native plant species (primarily annual grasses) have replaced pre-European historic plant communities that included grasslands, chaparrals, savannas, and woodlands with what has been speculated to be a perennial grass-dominated understory, although others suggest many of these grasslands were actually made up primarily of forbs and native annual grasses (Menke, 1989; Bartolome, Barry, Griggs, & Hopkinson, 2007; D'Antonio, Malmstrom, Reynolds, & Gerlach, 2007; Evett & Bartolome, 2013; Larson-Praplan, 2014). Restoration of the original vegetation in the drier regions of the annual grassland is difficult as invasive exotic species are now ubiquitous and native grass and forb species occur in trace amounts. The annual grasslands are now dominated by and managed as annual grasslands. There is continuing debate about the extent to which original plant communities can be restored, since reseeding of perennial grasses is difficult due to erratic temperatures, low rainfall, competitiveness of annual grasses, and the availability and cost of native species (Daehler, 2003; Moyes, Witter, & Gamon, 2005). The challenge of assessing, monitoring, and managing land that has crossed an ecological threshold in annual grasslands is similar to that encountered in many other parts of the country where native plant communities have been replaced by functionally and structurally different invasive species that may be either native or non-native. California is unique because of the spatial extent of the transformation by non-native plant species.

Results in this report are based on NRI rangeland on-site data collected over two periods, 2004-2010 and 2011-2015. Drought impacted the area during the second period (Figure 3-5). While this region was abnormally dry during the early period (2004-2010), much of this region experienced moderate to severe drought during the more recent period (2011-2015). The figures provide context for subsequent summary results.
Figures 3-4. Maps of Average Drought Monitor Rating (0 to 4 scale, where 0 is mild drought and 4 is extreme) Across the Two NRI Sampling Periods

Drought severity is displayed in five categories:

- **D0 (Abnormally Dry)**
- **D1 (Moderate Drought)**
- **D2 (Severe Drought)**
- **D3 (Extreme Drought)**
- **D4 (Exceptional Drought)**

Figure 5. Average drought severity in the California portion of the Other: California and Florida region.
Rangeland Health

Rangeland health assessments included in other sections of the NRI Rangeland Resource Assessment evaluate the function of ecological processes for rangeland sites relative to their ecological site descriptions, which define expected ecological processes based on climate and soil. For much of the California annual grasslands, no ecological site description has been developed. The extensive invasion of non-native plant species in the California annual grasslands has thwarted attempts to develop ecological site descriptions for in much of this area. Reference conditions characterized in ecological site descriptions are used for evaluations and incomplete implementation of ecological sites prevented development of the ecological site-specific reference sheets necessary to carry out the evaluations. Instead, the quantitative indicators provide an appropriate and useful baseline for monitoring.

Soil and Site Stability

Moderate to severe drought conditions affected much of the California during 2011-2015 (Figures 3-5) and may have impacted the results described in this report. In the California annual grasslands (Figure 2), average bare ground on non-Federal rangelands increased from 9.2 (±1.9) to 14.8 (± 3.1) percent between 2004-2010 and 2011-2015, although there was no change in the percent of non-Federal rangeland that was at least 50 percent bare ground (Figures 6-10). Numerous large canopy gaps (gaps of 2 meters or greater that account for at least 20 percent of the land) were present on 29.0 (±6.4) percent of non-Federal rangeland during 2004-2010 and on 18.8 (±7.7) percent during 2011-2015 (Figures 11-12, 15). Rangelands along the Coast Range generally have more bare ground and areas where large canopy gaps are numerous, than those along the Sierra Nevada (Figures 8-9, 11-15). Areas with at least 50% bare ground within large canopy gaps are also more common in non-Federal rangelands of the Coast Range (Figures 13-14). In addition, rangelands along the Coast Range generally have greater areas where soil aggregate stability is rated 4 or less, indicating less stable soil (Figures 16-17). Together these indicators characterize rangelands in the Coast Range that are more susceptible to erosion and establishment of invasive species.
Figures 6-7. Average Bare Ground on Non-Federal Rangeland (Source: Bare Ground, Inter-Canopy Gaps, and Soil Aggregate Stability Table 111, Table 112)

Figure 6. 2004-2010

Figure 7. 2011-2015

Figures 8-9. Non-Federal Rangeland That is at Least 50% Bare Ground (Source: Bare Ground, Inter-Canopy Gaps, and Soil Aggregate Stability Table 114, Table 115)

Figure 8. 2004-2010

Figure 9. 2011-2015
Figure 10. Average bare ground and non-Federal rangeland that is at least 50 percent bare ground in the California annual grasslands. Error bars represent margins of error.

Figures 11-12. Non-Federal Rangeland Where 2-Meter Canopy Gaps Account for at Least 20 Percent of the Land (Source: Bare Ground, Inter-Canopy Gaps, and Soil Aggregate Stability Table 117, Table 118)

Figure 11. 2004-2010

Figure 12. 2011-2015
Figures 13-14. Non-Federal Rangeland Where 2-Meter Canopy Gaps Account for at Least 20 Percent of the Land and Inter-Canopy Gaps Are at Least 50% Bare Ground (Source: Bare Ground, Inter-Canopy Gaps, and Soil Aggregate Stability Table 117, Table 118)

Figure 13. 2004-2010

Figure 14. 2011-2015

Figure 15. Percent non-Federal rangeland in the California annual grasslands where 2-m gaps account for at least 20 percent of the land and where 2-m gaps account for at least 20 percent of the land and the inter-canopy gaps are at least 50 percent bare ground. Error bars represent margins of error.
Figures 16-17. Non-Federal Rangeland Where Soil Aggregate Stability\(^1\) is Rated 4 or Less (Source: Bare Ground, Inter-Canopy Gaps, and Soil Aggregate Stability Table 120, Table 121)

TABLE 120: Soil Aggregate Stability Ratings

<table>
<thead>
<tr>
<th>Soil Aggregate Stability Rating</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>50% of structural integrity lost, (melts) within 5 seconds of immersion in water and less than 10% remains after 5 dipping cycles or soil too unstable to sample (falls through the sieve).</td>
</tr>
<tr>
<td>2</td>
<td>50% of structural integrity lost (melts) 5–30 seconds after immersion and less than 10% remains after 5 dipping cycles.</td>
</tr>
<tr>
<td>3</td>
<td>50% of structural integrity lost, (melts) 30–300 seconds after immersion or less than 10% remains on the sieve after five dipping cycles.</td>
</tr>
<tr>
<td>4</td>
<td>10–25% of original soil material remains on the sieve after five dipping cycles.</td>
</tr>
<tr>
<td>5</td>
<td>25–75% of original soil material remains on the sieve after five dipping cycles.</td>
</tr>
<tr>
<td>6</td>
<td>75–100% of original soil material remains on the sieve after five dipping cycles.</td>
</tr>
</tbody>
</table>

Hydrologic Function

Bare ground and canopy gaps on rangelands lead to reduced infiltration capacity and increased runoff. Where bare ground is concentrated in large inter-canopy gaps, the effect is even more pronounced. These contributing characteristics are generally greater in rangelands along the Coast Range than those along the Sierra Nevada (Figures 8-14).

Biotic Integrity

Non-native species are present on 91.2 (±5.1) percent of non-Federal rangeland in the California annual grasslands and cover at least 50 percent of the soil surface on 60.2 (± 7.5) percent (Figures 18-22). Annual bromes (Bromus spp.) are present on 82.5 (± 6.3) percent of non-Federal California annual grasslands and cover at least 50 percent of the soil surface on 8.3 (± 4.2) percent (Figures 23-27). Medusahead (Taeniatherum caput-medusae) is present on 18.5 (± 6.3) percent of non-Federal rangelands in the California annual grasslands and more widespread along the eastern part of the central valley.
Centaurea species, including diffuse knapweed (*Centaurea diffusa*) and yellow starthistle (*Centaurea solstitialis*) are present on 19.1 (± 7.7) percent of non-Federal rangelands in the California annual grasslands and more prevalent on the western side of the central valley (Figures 30-31).

**Figures 18-19. Non-Federal Rangeland Where Non-Native Plant Species are Present (Source: Non-Native Plant Species Table 17, Table 18)**

Figure 18. 2004-2010

Figure 19. 2011-2015

**Figures 20-21. Non-Federal Rangeland Where Non-Native Plant Species Cover at Least 50% of the Soil Surface (Source: Non-Native Plant Species Table 17, Table 18)**

Figure 20. 2004-2010

Figure 21. 2011-2015
Figure 22. Non-Federal rangeland in the California grasslands where non-native plant species are present or cover at least 50 percent of the soil surface. Error bars represent margins of error.

Figures 23-24. Non-Federal Rangeland Where Annual Bromes are Present (Source: Invasive Plant Species Table 17, Table 18)

Figure 23. 2004-2010

Figure 24. 2011-2015
Figures 25-26. Non-Federal Rangeland Annual Brome Species Cover at Least 50% of the Soil Surface (Source: Invasive Plant Species Table 17, Table 18)

Figure 25. 2004-2010

Figure 26. 2011-2015

Figure 27. California annual grasslands where annual brome species are present and where they cover at least 50% of the soil surface on non-Federal rangeland. Error bars represent margins of error.
Summary and Conclusions

Moderate to severe drought conditions in the California grasslands during 2011-2015 were accompanied increased area of bare ground. The Coast Range have generally greater percentages of bare ground, large canopy gaps with bare ground in the interspaces, and less stable soil than areas along the Sierra Nevada.
Non-native species are present on over 90 percent of California grasslands and cover at half the soils surface on over 60 percent of that area. Some of the most prevalent of these species are annual bromes, medusahead, knapweed and star thistles.

Florida

Rangeland vegetation in Florida has a combination of temperate and sub-tropical floristic elements. These plant communities developed with a long growing season, more than 48 inches of seasonal rainfall and high rates of lightning ignited fires (Korosy, Reece, & Noss, 2013). Where rangelands still occur in the peninsula the physiognomy is influenced by high near-surface water tables, low topographic relief, and sandy soils with wet to sub-xeric moisture regimes. The naturally low fertility of the sandy soils is reflected in the emblematic presence of plants in the genera of Bejaria, Drosera, and Sarracenia which have primitive characteristics of capturing nutrients from insects to supplement the sparse resources stored in sterile sandy soil.

The NRI database tallies 365 unique plant symbols with data collected in Florida during these two time periods. The species diversity can be high under a rather monotypic dominance layers of pyrogenic pine, palmetto, and wiregrass. Floristic studies documented Florida prairies have among the highest fine-scale vascular plant species richness values recorded in North America. Up to 27 species in 0.1 m², 49 species in 1 m², and 171 species in 1000 m² (Orzell & Bridges, 2006).

Reference conditions and rangeland health assessments must recognize that Florida rangeland vegetation developed under a closely timed disturbance regime of fire and flooding. Annually, the frequent (dry) lightning strikes in April-June occurs at the same time that the rain-free interval reaches a maximum and the below-ground water levels have dropped away from the surface. Frequent landscape fires are expected at this time. Within a few weeks the frequency of thunderstorms with rainfall increases rapidly saturating the soil and water table. Consequently, early lightning season fires are followed soon by flooding.

Florida’s settlement history from the 1500 to 1900s caused minor changes. But one change was the altered timing of fires from the lightning season to earlier in the winter when cold fronts are followed by several days of weather with consistent wind direction and speeds. Settlers avoided wildfire dangers and improved livestock husbandry were benefits.

Fire suppression efforts in the 1930s and water table drainage further disconnected the closely timed disturbance regimes and began the systemic encroachment of shrubs and trees. Significant peninsular hydrology alterations occurred after the 1949 flood death toll led to Federal help in drainage and flood control. After the 1970 channelization of the Kissimmee River between Lake Kissimmee and Lake Okeechobee, the wetland system impact was recognized as undesirable and an effort to restore the Kissimmee River as part of the Everglades Restoration was initiated. In 2003 the first flows returned to Kissimmee River’s old oxbows. However, the hydrology is permanently lowered in depth and timing which favor the more deeply rooted woody vegetation encroachment.

This disconnection and other broken pieces limit the composition and functional group dynamics of vegetation, particularly the herbaceous species, which are identified in a reference plant community phase in the Ecological Site Descriptions and the Range Health reference sheets (https://esis.sc.egov.usda.gov/).

The emergent wetlands and shallow sloughs generally remain with native tall grass herbaceous vegetation. These are embedded throughout the landscape. Some of which have organic or muck soils. Rangeland health assessments are designed primarily for uplands. Use of rangeland health assessments on these wetlands are problematic and other hydro-geomorphic assessments are used more validly.
Rapid population growth and land conversions in the 1990s had impacts far from population centers too. High demand for turf sod for residential yards and highway rights of way increased the amount of rangeland changed to introduced sod grasses and pasture. Prescribed burn smoke management was a growing public concern from the rapid population growth. This reduced the incentive for private landowners to maintain native vegetation. The State of Florida, however, owns and manages large tracts of native rangeland vegetation as part of watershed, water supply and salt-water intrusion avoidance projects.

Results in this report are based on NRI rangeland on-site data collected over two periods, 2004-2010 and 2011-2015. Estimates of change on Florida rangelands during the two time periods is hampered by the relatively small size of Florida compared to other regions, resulting in fewer sites with collected data.

Abnormally dry conditions were present in this region during both periods (Figure 3-5) and the figures provide context for subsequent summary results.

**Figures 3-4. Map of average drought monitor rating (0 to 4 scale, where 0 is mild drought and 4 is extreme) across the two NRI sampling periods.**

Drought severity is displayed in five categories:

- **D0 (Abnormally Dry)**
- **D1 (Moderate Drought)**
- **D2 (Severe Drought)**
- **D3 (Extreme Drought)**
- **D4 (Exceptional Drought)**
Figure 5. Average drought severity in the Florida portion of the Other: California and Florida region.

Rangeland Health

The fire and flooding regime, under which Florida’s rangeland vegetation developed, has been altered. Changes in hydrology and native plant communities limit the ability to characterize reference conditions. Although native tall grass herbaceous vegetation generally remains in emergent wetlands and shallow sloughs interspersed throughout the landscape, current rangeland health assessments are designed primarily for uplands. Further refinement is needed to adapt them to a subtropical system. For Florida, this report instead relies on quantitative assessments related to the three rangeland health attributes: soil and site stability, hydrologic function, and biotic integrity.

Soil and Site Stability

Quantitative indicators related to the rangeland health attribute soil and site stability are less sensitive and informative in Florida than in other regions. For example, soil aggregate stability ratings used to quantify the location’s surface resistance to erosion are obtained by dipping soil peds in water and observing the portions that fall through a screen. The peds are rated 1 to 6, where a rating of 1 is assigned if at least half of the ped completely falls apart during the dipping cycle or a rating of 6 is assigned if the ped is a root mat or the opportunistic fungi hyphae that held the sand grains together as the surface dried. Although the percent of non-Federal rangeland in Florida where soil aggregate stability is rated 4 or less is 18.2 (±15.9) during 2011-2015 and 32.2 (±13.4) during 2004-2010 (Figures 6-7), in much of Florida rangelands single grain structure and organics being stripped in the top 6 inches due to water table fluctuations complicates interpretation of soil aggregate stability and other soil and site stability range health indicators. Litter movement is accomplished during flooding but the litter is already waterlogged so there is no first flush and there seems to be replacement.
Figures 6-7. Non-Federal Rangeland Where Soil Aggregate Stability\(^1\) is Rated 4 or Less (Source: Bare Ground, Inter-Canopy Gaps, and Soil Aggregate Stability Table 120, Table 121)

**Figure 6. 2004-2010**

**Figure 7. 2011-2015**

\(^1\) Soil aggregate stability ratings:

1. 50% of structural integrity lost, (melts) within 5 seconds of immersion in water and less than 10% remains after 5 dipping cycles or soil too unstable to sample (falls through the sieve).

2. 50% of structural integrity lost (melts) 5–30 seconds after immersion and less than 10% remains after 5 dipping cycles.

3. 50% of structural integrity lost, (melts) 30–300 seconds after immersion or less than 10% remains on the sieve after five dipping cycles.

4. 10–25% of original soil material remains on the sieve after five dipping cycles.

5. 25–75% of original soil material remains on the sieve after five dipping cycles.

6. 75–100% of original soil material remains on the sieve after five dipping cycles.

Bare Ground is one of the lowest for the 19 states in the report at 3.6 (±1.6) percent (Figures 8-9). Canopy Gaps greater than 1 or 2 meters is rare and the gaps generally have a good covering of litter so they are not bare (Figures 10-13). The average wind speed at Orlando, Florida is 8.6 mph (including hurricane winds) while Dodge City, Kansas is at 13.9 mph. Wind erosion is a minimal concern for ecological function.
Figures 8-9. Bare Ground on Non-Federal Rangeland (Source: Bare Ground, Inter-Canopy Gaps, and Soil Aggregate Stability Table 111, Table 112)

Figure 8. 2004-2010
Figure 9. 2011-2015

Figures 10-11. Non-Federal Rangeland Where 2-Meter Canopy Gaps Account for at Least 20 Percent of the Land (Source: Bare Ground, Inter-Canopy Gaps, and Soil Aggregate Stability Table 117, Table 118)

Figure 10. 2004-2010
Figure 11. 2011-2015
Hydrologic Function

Functional group composition relative to precipitation and runoff has a slight impact in the amount of interception rate but both canopies are dense, just different in height. Florida’s sub-surface water table hydrology has been greatly affected but the hydrologic function indicators instead address water flow patterns to gullies which are non-existent on the low relief landscape. The mean slope percent for 85 locations on a South Florida Flatwoods ecological site is 0.4%. Water does flow once elevated above the surface but the weight and speed seems to compress sediment movement.

Biotic Integrity

Non-native plant species were present on 30.6 (±11.6) percent of Florida non-Federal rangeland during 2011-2015 and remained unchanged between the two time periods (Figures 14-18). The entire Florida flora is about 32 percent introduced species (Wunderlin & Hansen, 2003).
Figures 14-15. Non-Federal Rangeland Where Non-Native Plant Species are Present (Source: Non-Native Plant Species Table 17, Table 18)

Figure 14. 2004-2010

Figure 15. 2011-2015

Figures 16-17. Non-Federal Rangeland Where Non-Native Plant Species Cover at Least 50% of the Soil Surface (Source: Table 17, Table 18)

Figure 16. 2004-2010

Figure 17. 2011-2015
Figure 18. Non-Federal rangeland where non-native plant species are present and where they cover at least 50% of the soil surface. Error bars represent margins of error.

Range Health indicators that are important for reflecting changes in Biotic Integrity are sensitive and informative in Florida. Changes in functional groups do effect litter accumulation rate and type. Data collectors noted a higher prevalence of woody litter following a series of hurricanes. However, frequent prescribed fires and rapid oxidation soon altered the litter composition. Prescribed fire frequency changes plant height and structure and therefore, relative composition for interception.

Invasive species departures rated on range health assessments seem to point to an overabundance of the presence of native species such as small saw palmetto (*Serenoa repens*), inkberry (*Ilex glabra*), or pineland threeawn (*Aristida stricta*). Trace amounts of two non-native invasive species, Buffelgrass (*Pennisetum ciliare*), and Cogongrass (*Imperata cylindrica*), were observed in the Florida non-Federal rangeland data. Buffelgrass was introduced as a stabilizing cover grass on the deep sandy soils of the central Florida Ridge where former orange groves had frozen out in the early 1980s. Buffelgrass survives in Florida, but is not listed as one of the 16 problematic forage grasses that has been introduced to Florida (Overholt & Franck, 2017). Cogongrass (*Imperata cylindrica*) is one of the 16 grasses introduced and is a common invasive species in relatively natural rangeland vegetation. Similar to the fire stimulated spread of the annual cheatgrass (*Bromus tectorum*), cogongrass is a perennial whose seed production is stimulated by fire, has strong rhizomatous spreading, is non-palatable, and has high volume biomass which make herbicide treatments difficult. Trace amounts of other non-native invasive species such as torpedo grass (*Panicum repens*), Brazilian peppertree (*Schinus terebinthifolius*), and Caesarweed (*Urena lobate*) were detected in the data.
Summary and Conclusions

The long-term abiotic drivers of climate, soil, and time since settlement are unique factors in the regional reports. Florida’s unique and isolated rangelands create interesting challenges to a National assessment of change in conditions. Florida is well known for 500 years of European settlement but the rangeland ecology has been relatively unaltered till these last 50 years when rapid changes occurred. The NRI Grazing Land on-site data collection began shortly after a major hydrologic restoration on the Kissimmee River in 2003. So change is expected but has not been captured in this report. This is partly caused by the need to test and evaluate an optional 18th indicator for the specifics to Florida’s climate and soil. There is also the need to focus rangeland health assessments on reference condition descriptions or the departure descriptions relative to the ecological functions being addressed.
About the Maps

The maps are constructed with NRI rangeland data collected in the field on rangeland during the periods 2004 to 2010 and 2011 to 2015. The regions are based on level IV ecoregion boundaries defined by the U.S. Environmental Protection Agency Western Ecology Division. In some cases level IV ecoregions were combined to include more sample sites. An additional category, referred to as "Insufficient data", represents areas where there were too few data points. Regions without non-Federal rangeland are described as "No data". Areas of Federal land are depicted with cross-hatching.

The rangeland health maps represent various levels of departure from the reference state as described in the ecological site description for that land area based on the indicators listed in Table 1. Note that some indicators are associated with more than one attribute while others are specific to a single attribute; this is intentional and is part of the evaluation process. Although these maps portray percentages of non-Federal rangeland with specific attribute ratings, not all of the indicators associated with that attribute may have that rating. For example, one map displays non-Federal rangeland where soil and site stability shows at least moderate departure from reference conditions. Although some of the indicators associated with soil and site stability may have been rated on a scale representing none-to-slight and slight-to-moderate departure, the median rating was at least moderate. Rangeland health assessments evaluate the function of ecological processes for rangeland sites relative to their ecological site descriptions, which define expected ecological processes based on climate and soil. For some rangeland sites, no soil survey exists and no ecological site description has been developed. For those areas the no rangeland health data are reported. Maps exclude rangeland health estimates for mapping regions where at least 10 percent of non-Federal rangeland does not report rangeland health data. Rangeland health attribute assessments in the maps are based on percentages of non-Federal rangeland where rangeland health evaluations are reported.

Line point intercept data are utilized in summaries of non-native plant species, invasive plant species, and bare ground. Line point intercept data are collected along two intersecting 150-foot transects centered on each sample location. Data collectors record plant species, litter, lichen, moss, rock fragment, bedrock, and/or bare soil present at each 3-foot interval (mark).

Canopy gap data are used to identify areas with large foliar inter-canopy gaps which have more exposure to erosion and may provide opportunity for invasive plants to become established. Data collectors record lengths of plant inter-canopy gaps along the two intersecting 150-foot transects.

Soil aggregate stability is a recognized indicator of soil quality and rangeland health. Data collectors water immerse soil surface peds collected at the sample site and subject the soil peds to five dipping cycles. Soil stability is rated based on the outcomes of these water exposure techniques. Ratings range from 1 (very unstable) to 6 (very stable).

The source data used to construct the drought figures are from the National Drought Mitigation Center, and follow the drought monitor categories: [http://droughtmonitor.unl.edu/AboutUSDM/DroughtClassification.aspx](http://droughtmonitor.unl.edu/AboutUSDM/DroughtClassification.aspx). The weekly drought monitor data were converted to a 1/8-degree grid, and the state and broad region polygons were used to clip out the grid cells within each region for the two time periods. Both the stack plots show the distribution of 1/8-degree grid cells of each drought monitor class for each year.

Drought severity is displayed in five categories:

- D0 (Abnormally Dry)
- D1 (Moderate Drought)
- D2 (Severe Drought)
- D3 (Extreme Drought)
- D4 (Exceptional Drought)
More Information


