Rangeland Health

The National Resources Inventory (NRI) is a statistical survey of natural resource conditions and trends on non-Federal land in the United States. Non-Federal land includes privately owned lands, tribal and trust lands, and lands controlled by state and local governments.

The NRI rangeland results presented here address current conditions. In the future, the NRI rangeland survey sample will include revisited sites and these data will allow estimates for change in rangeland resource conditions to be made.

Importance to the Nation

Rangeland health provides information on types, patterns and severity of problems in rangeland ecosystems relative to an agreed upon standard ("reference") for each site. Land managers and policy-makers need this information to support strategic decisions and to identify the ecosystem processes that must be restored to improve services that the land provides and to maintain or improve profitability.

Non-Federal rangeland makes up 21% of the total area of the lower 48 States and thus:

- The condition of these lands directly or indirectly influences the environment enjoyed by the Nation.
- Meeting the Nation's objectives for natural resources and environmental quality will depend on how these lands are used and conserved.

Introduction

The status of the three attributes of rangeland health (soil and site stability, hydrologic function, and biotic integrity) throughout the United States is reported based on an assessment of seventeen indicators at each point. These three attributes collectively reflect the status of key ecological processes which are related to the land's potential to support ecosystem services. Assessments were completed by all members of the team during the same visit when quantitative data were collected.

Plant and animal life depend on ecological processes such as the water cycle (the capture, storage, and safe release of precipitation), energy flow (conversion of sunlight to plant and then animal matter), and nutrient cycle (the cycle of nutrients through physical and biotic components of the environment). The rangeland health assessment provides information

about how ecological processes are functioning relative to ecological potential. Because ecological potential varies both locally and regionally, NRI assessments of rangeland health use unique reference information for ecological sites. Ecological sites are basically climate and soil groupings that differ in their ability to produce specific kinds, amounts and proportions of plants, and in their response to management.

Direct measures of the three attributes of rangeland health are difficult or expensive due to the complexity of their processes and interrelationships. Instead, biological and physical characteristics are used as indicators of the functionality of these processes. Taken together, these indicators are used to assess three rangeland health attributes (Table 1):

- **Soil and site stability** is the capacity of an area to limit redistribution and loss of soil resources (including nutrients and organic matter) by wind and water.
- **Hydrologic function** characterizes the capacity of an area to capture, store, and safely release water from rainfall, run-on and snowmelt (where relevant), to resist a reduction in this capacity and to recover this capacity when a reduction does occur.
- **Biotic integrity** is defined as the capacity of the biotic community to support ecological processes within the normal range of variability expected for the site, to resist a loss in the capacity to support these processes, and to recover this capacity when losses do occur. The biotic community includes plants, animals, and microorganisms occurring both above and below the ground.

Rangeland health assessments evaluate 17 separate but interrelated indicators associated with the three attributes, enabling identification of potential problems with respect to these attributes. The rangeland health tool is intended to communicate ecological concepts to the public and landowners, help identify possible land monitoring areas for more comprehensive programs, and provide "early warnings" of potential problems.

To standardize rangeland health attribute ratings at the national level, attribute ratings in this, and the previous NRI Rangeland Resource Assessment (2010), reports are calculated as the median of associated indicator ratings. For local and future NRI applications of the method, NRCS continues to advocate the use of the 'preponderance of evidence' approach to rate attributes, as described in the protocol, Interpreting Indicators of Rangeland Health (Pellant et al, 2005). Future NRI reports may include a comparison of both attribute-rating methods.

Key Findings

Over 80% of the Nation's 409 million acres of non-Federal rangeland in the 48 contiguous states is in a relatively healthy condition and has no significant soil, hydrologic or biotic integrity problems. Nationally, 18.9% (±0.7%) of the of non-Federal rangeland show at least moderate departure from reference conditions for at least one of the three attributes (Table 2, Figure 1) and 7.5% (±0.5%) show at least moderate departure for all three attributes (Table 2, Figure 2).

Figures 1-2. Non-Federal Rangeland Where at Least One or All Three Rangeland Health Attribute Shows at Least Moderate Departure from Reference Conditions. (Source: Table 2)

Figure 1.

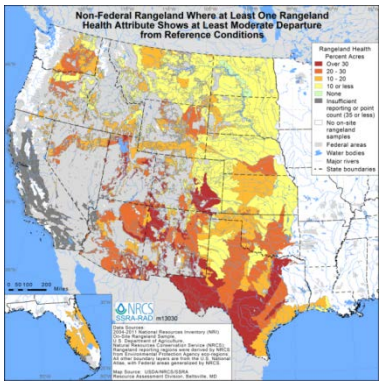
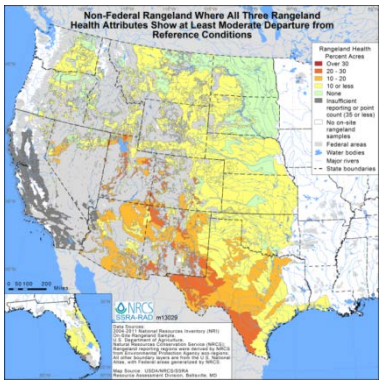


Figure 2.



Of the three attributes, soil and site stability (Table 2, Figure 3) nationally showed at least moderate departure from reference conditions on 9.6% (±0.5%) of non-Federal rangeland. Hydrologic function (Table 2, Figure 4) was second at 12.2% (±0.6%), while biotic integrity (Table 2, Figure 5) was the most widespread showing moderate, moderate-to-extreme, or extreme-to-total departure from reference conditions on 15.9% (±0.7%) of non-Federal rangeland.

Figure 3-5. Non-Federal Rangeland Where Soil and Site Stability, Hydrologic Function, and Biotic Integrity Show at Least Moderate Departure from Reference Conditions. (Source: Table 2)

Figure 3.

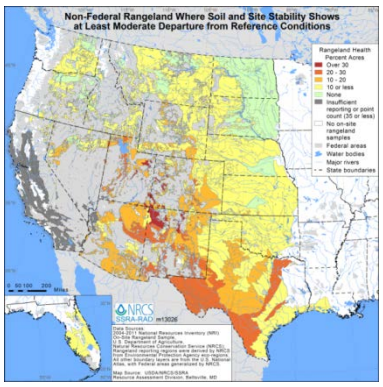


Figure 4.

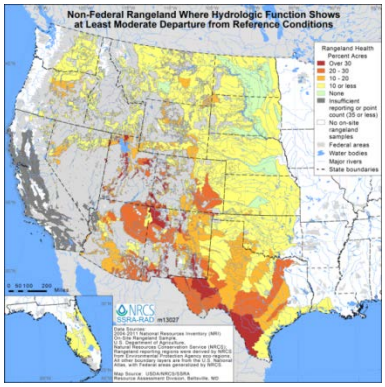
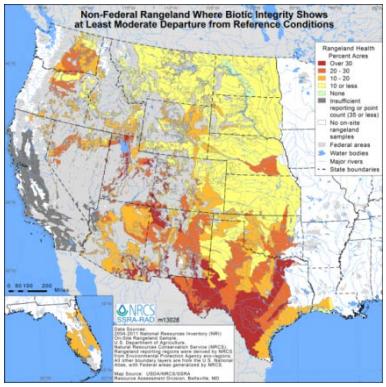


Figure 5.



Ecological sites where the rangeland health attributes show moderate departure from reference conditions are more likely to have the potential to be brought back to an improved status through good management practices than those with ratings of moderate-to-extreme or extreme-to-total departure. Nationally, the soil and site stability attribute shows moderate departure from reference conditions for 7.6% (±0.6%) of non-Federal rangeland (Table 3, Figure 6). Hydrologic function shows moderate departure from reference conditions for 9.6% (±0.6%) of the nation's non-Federal rangeland (Table 4, Figure 7), while biotic integrity shows moderate departure for 12.3% (±0.6%) of non-Federal rangeland (Table 5, Figure 8). At least one of the three attributes shows moderate departure from reference conditions on 16.9% (±0.8%) of non-Federal rangeland (Table 6, Figure 9).

Figures 6-9. Non-Federal Rangeland Where Soil and Site Stability, Hydrologic Function, Biotic Integrity, or At Least One Rangeland Health Attribute Shows Moderate Departure from Reference Conditions. (Source: Tables 3-6)

Figure 6.

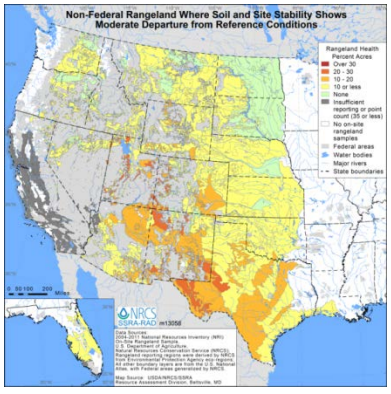


Figure 7.

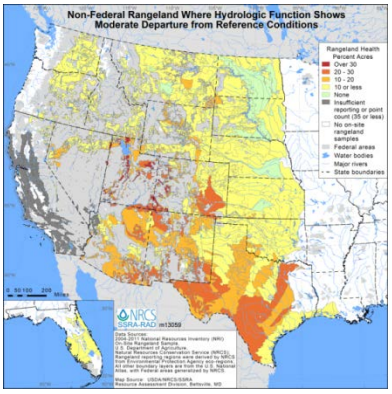


Figure 8.

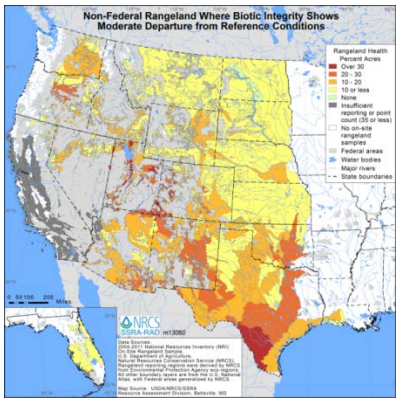
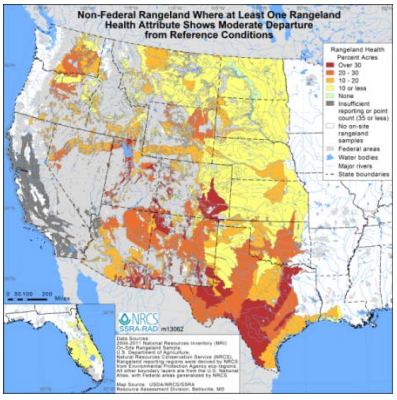


Figure 9.



Ecological sites where the rangeland health attributes have moderate-to-extreme or extreme-to-total departure from reference conditions are generally interpreted to be more degraded and may require intensive and expensive treatments to improve their health and condition. By attribute, the percentages of non-Federal rangeland with this condition are 2.1 (±0.2%) for soil and site stability (Table 3, Figure 10), 2.6 (±0.2%) for hydrologic function (Table 4, Figure 11), and 3.6 (±0.3%) for biotic integrity (Table 5, Figure 12). Nationally, only 1.3% (±0.2%) of non-Federal rangeland show moderate-to-extreme or extreme-to-total departure from reference conditions for all three rangeland health attributes (Table 6, Figure 13).

Figures 10-13. Non-Federal Rangeland Where Soil and Site Stability, Hydrologic Function, Biotic Integrity, or All Three Rangeland Health Attributes Show Above Moderate Departure from Reference Conditions. (Source: Table 3-6)

Figure 10.

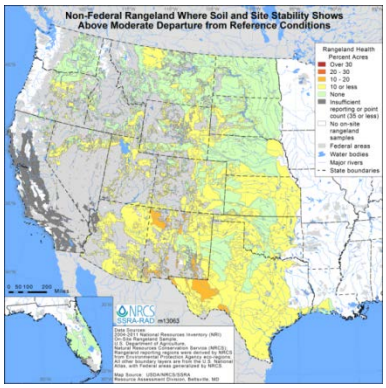


Figure 11.

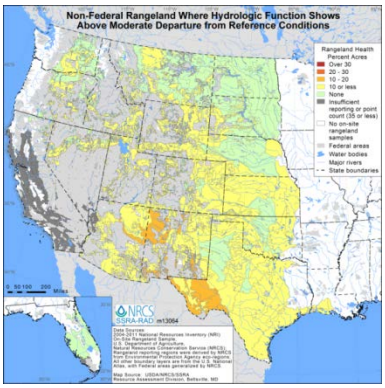


Figure 12.

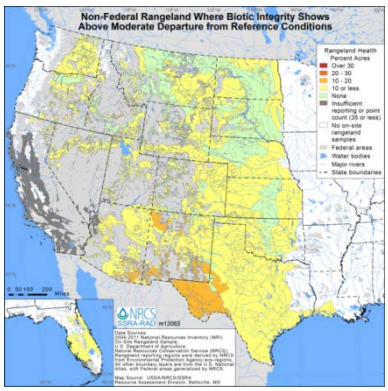
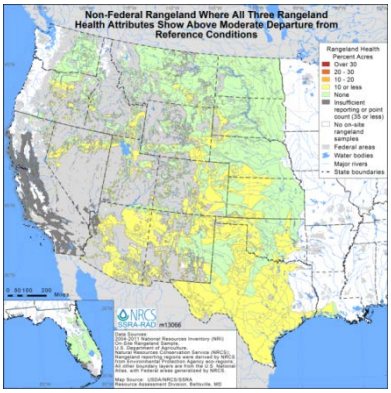


Figure 13.



The spatial patterns provide general information on the extent to which different types of ecosystem services from rangeland have been modified. Those services that depend on minimizing soil degradation, including soil erosion, should be relatively intact across much of the northern U.S. (Figures 6 and 10), while greater changes are likely to have occurred in those services that depend

on a diverse, productive, native plant community (Figures 8 and 12). In the more arid Southwest, degradation of both soils and vegetation has significant implications for the capacity of the land to support a wide variety of ecosystem services, including those related to water (Figures 7 and 11).

As for any general assessment, additional interpretation and a more detailed examination of the data is critical for application of the results to management. For example, the soil and site stability attribute is based on indicators of both short-term (e.g. rills) and long-term (e.g. soil surface loss and degradation) soil degradation. The former can often be controlled through a simple change in management, while more profound long-term impacts may require extensive inputs.

Tables and Results

Estimates presented here are based upon rangeland data collected on-site as part of the National Resources Inventory (NRI), a sample survey using scientific statistical principles and procedures. These results are based upon NRI rangeland data collected in the field on rangeland during the period 2004 to 2011 and address current conditions. These estimates cover non-Federal rangeland in 17 western states (extending from North Dakota south to Texas and west) and to a limited extent in Florida and Louisiana.

Margins of error are reported for each NRI estimate and must be considered at all scales of analysis. The margin of error is used to construct the 95 percent confidence interval for the estimate. The lower bound of the interval is obtained by subtracting the margin of error from the estimate; the upper bound is obtained by adding the margin of error to the estimate. A 95 percent confidence interval means that in repeated samples from the same population, 95 percent of the time the true underlying population parameter will be contained within the lower and upper bounds of the interval. In the following tables, if there are instances where the margin of error is greater than or equal to the estimate, the confidence interval includes zero and the estimate should not be used. In those cases, the estimate in the table is replaced by the word "Trace."

Table 1. Standard indicators included in the Rangeland Health protocol and attribute (soil and site stability, hydrologic function, and/or biotic integrity) to which each indicator applies (Pellant et.al. 2005). The “X” indicates that the indicator is applied to the attribute.

Rangeland Health Indicator	Rangeland Health Attribute		
	Soil and Site Stability	Hydrologic Function	Biotic Integrity
1. Rills	X	X	
2. Water flow patterns	X	X	
3. Pedestals and/or Terracettes	X	X	
4. Bare ground	X	X	
5. Gullies	X	X	
6. Wind scoured, blowouts, and/or deposition areas	X		
7. Litter movement	X		
8. Soil surface resistance to erosion	X	X	X
9. Soil surface loss or degradation	X	X	X
10. Plant community composition and distribution relative to infiltration and runoff		X	
11. Compaction layer	X	X	X
12. Functional/structural groups			X
13. Plant mortality/decadence			X
14. Litter amount		X	X
15. Annual aboveground production			X
16. Invasive plants			X
17. Reproductive capability of perennial plants			X

Table 2. Non-Federal rangeland by state where rangeland health attribute ratings are moderate, moderate-to-extreme, or extreme-to-total departures from expected. Margins of error included.

State	Area Not Reporting Rangeland Health[1]	Soil and Site Stability	Hydrologic Function	Biotic Integrity	All 3 Attributes	At Least One Attribute
	Percent	Percent	Percent	Percent	Percent	Percent
Arizona	0	15.0 ±2.8	19.1 ±3.2	15.9 ±4.1	8.8 ±2.8	24.4 ±4.0
California	57.5 ±5.9	Trace	1.1 ±1.0	4.7 ±2.9	Trace	4.7 ±2.9
Colorado	0	8.3 ±2.7	12.4 ±3.1	11.6 ±2.3	5.3 ±1.9	17.6 ±3.5
Florida	12.5 ±8.8	Trace	Trace	9.8 ±4.5	Trace	9.8 ±4.5
Idaho	0	2.6 ±1.9	3.6 ±2.1	8.6 ±2.6	1.5 ±1.3	10.1 ±3.1
Kansas	0	3.8 ±1.1	5.1 ±1.1	5.2 ±1.3	1.7 ±0.8	8.1 ±1.5
Louisiana	0	0	0	0	0	0
Montana	0	2.4 ±0.9	3.9 ±1.2	4.1 ±1.8	1.1 ±0.7	6.4 ±1.8
Nebraska	0	2.0 ±0.8	2.7 ±1.0	5.2 ±1.3	0.7 ±0.4	6.8 ±1.4
Nevada	0	3.8 ±3.2	5.4 ±3.3	14.4 ±4.9	3.1 ±3.0	15.5 ±5.1
New Mexico	0	17.7 ±2.9	20.0 ±2.9	23.7 ±3.1	14.5 ±2.7	27.4 ±3.2
North Dakota	0	0.9 ±0.6	2.3 ±1.0	3.1 ±1.2	Trace	4.2 ±1.3
Oklahoma	0	3.1 ±1.3	5.1 ±1.3	16.7 ±2.7	2.0 ±0.8	18.6 ±2.9
Oregon	0	4.5 ±2.1	6.3 ±2.5	15.4 ±3.6	3.7 ±1.9	16.6 ±3.7

South Dakota	0	0.8 ±0.5	1.2 ±0.8	4.7 ±1.4	0.4 ±0.3	5.3 ±1.4
Texas	Trace	16.6 ±2.2	21.3 ±2.4	28.8 ±2.9	15.3 ±2.0	30.6 ±2.8
Utah	0	25.7 ±4.4	30.8 ±4.8	34.5 ±5.1	20.9 ±4.2	40.9 ±4.8
Washington	0	4.7 ±2.8	6.4 ±3.2	22.3 ±4.5	2.7 ±2.4	24.8 ±4.3
Wyoming	Trace	7.4 ±2.4	8.4 ±2.4	8.9 ±1.5	2.9 ±1.2	13.9 ±2.4
Nation	2.6 ±0.3	9.6 ±0.5	12.2 ±0.6	15.9 ±0.7	7.5 ±0.5	18.9 ±0.7

[1] Areas where ecological site descriptions are still under development. Without an ecological site description and reference worksheet, no rangeland health assessment can be made.

Note:Estimates where margins of error are at least as large as the estimates are denoted as "Trace."

Table 3. Non-Federal rangeland by state where soil and site stability ratings are none-to-slight or slight-to-moderate; moderate; or moderate-to-extreme or extreme-to-total departures from expected. Margins of error included.

State	Area Not Reporting Rangeland Health[1]	None-to-slight or slight-to-moderate	Moderate	Moderate-to-extreme or extreme-to-total
	Percent	Percent	Percent	Percent
Arizona	0	85.0 ±2.8	10.8 ±2.0	4.2 ±2.1
California	57.5 ±5.9	41.6 ±5.9	Trace	Trace
Colorado	0	91.7 ±2.7	7.9 ±2.7	Trace
Florida	12.5 ±8.8	86.4 ±9.2	Trace	0
Idaho	0	97.4 ±1.9	2.6 ±1.9	Trace
Kansas	0	96.2 ±1.1	3.0 ±1.0	0.8 ±0.6
Louisiana	0	100.0	0	0
Montana	0	97.6 ±0.9	2.3 ±1.0	Trace
Nebraska	0	98.0 ±0.8	1.8 ±0.9	Trace
Nevada	0	96.2 ±3.2	3.3 ±2.9	Trace
New Mexico	0	82.3 ±2.9	11.6 ±2.1	6.1 ±1.7
North Dakota	0	99.1 ±0.6	0.9 ±0.6	0
Oklahoma	0	96.9 ±1.3	2.8 ±1.2	Trace

Oregon	0	95.5 ±2.1	3.4 ±1.6	Trace
South Dakota	0	99.2 ±0.5	Trace	0.5 ±0.3
Texas	Trace	83.3 ±2.1	13.3 ±2.0	3.4 ±0.8
Utah	0	74.3 ±4.4	22.1 ±4.0	3.6 ±1.9
Washington	0	95.3 ±2.8	4.7 ±2.8	0
Wyoming	Trace	91.6 ±2.7	6.5 ±2.2	0.9 ±0.8
Nation	2.6 ±0.3	87.8 ±0.5	7.6 ±0.5	2.1 ±0.2

[1] Areas where ecological site descriptions are still under development. Without an ecological site description and reference worksheet, no rangeland health assessment can be made.

Note:Estimates where margins of error are at least as large as the estimates are denoted as "Trace."

Table 4. Non-Federal rangeland by state where hydrologic function ratings are none-to-slight or slight-to-moderate; moderate; or moderate-to-extreme or extreme-to-total departures from expected. Margins of error included.

State	Area Not Reporting Rangeland Health[1]	None-to-slight or slight-to-moderate	Moderate	Moderate-to-extreme or extreme-to-total
	Percent	Percent	Percent	Percent
Arizona	0	80.9 ±3.2	14.1 ±3.1	5.0 ±2.1
California	57.5 ±5.9	41.4 ±6.1	1.1 ±1.0	Trace
Colorado	0	87.6 ±3.1	11.1 ±2.9	1.3 ±0.7
Florida	12.5 ±8.8	86.4 ±9.2	Trace	0
Idaho	0	96.4 ±2.1	2.9 ±1.6	Trace
Kansas	0	94.9 ±1.1	4.1 ±1.0	1.0 ±0.6
Louisiana	0	100.0	0	0
Montana	0	96.1 ±1.2	3.8 ±1.2	Trace
Nebraska	0	97.3 ±1.0	2.5 ±1.0	Trace
Nevada	0	94.6 ±3.3	4.8 ±3.0	Trace
New Mexico	0	80.0 ±2.9	13.0 ±2.0	6.9 ±1.7
North Dakota	0	97.7 ±1.0	2.2 ±1.0	Trace
Oklahoma	0	94.9 ±1.3	4.4 ±1.3	0.6 ±0.4

Oregon	0	93.7 ±2.5	5.1 ±2.0	1.3 ±1.1
South Dakota	0	98.8 ±0.8	0.8 ±0.6	0.4 ±0.3
Texas	Trace	78.7 ±2.4	16.6 ±2.0	4.6 ±1.0
Utah	0	69.2 ±4.8	26.1 ±3.8	4.7 ±2.1
Washington	0	93.6 ±3.2	5.9 ±3.1	Trace
Wyoming	Trace	90.6 ±2.6	7.1 ±2.2	1.3 ±1.1
Nation	2.6 ±0.3	85.2 ±0.6	9.6 ±0.6	2.6 ±0.2

[1] Areas where ecological site descriptions are still under development. Without an ecological site description and reference worksheet, no rangeland health assessment can be made.

Note:Estimates where margins of error are at least as large as the estimates are denoted as "Trace."

Table 5. Non-Federal rangeland by state where biotic integrity ratings are none-to-slight or slight-to-moderate; moderate; or moderate-to-extreme or extreme-to-total departures from expected. Margins of error included.

State	Area Not Reporting Rangeland Health[1]	None-to-slight or slight-to-moderate	Moderate	Moderate-to-extreme or extreme-to-total
	Percent	Percent	Percent	Percent
Arizona	0	84.1 ±4.1	11.2 ±3.3	4.7 ±1.9
California	57.5 ±5.9	37.8 ±5.7	3.3 ±2.4	Trace
Colorado	0	88.4 ±2.3	10.7 ±2.2	0.9 ±0.5
Florida	12.5 ±8.8	77.6 ±10.0	7.0 ±4.2	Trace
Idaho	0	91.4 ±2.6	7.8 ±2.6	0.8 ±0.7
Kansas	0	94.8 ±1.3	4.5 ±1.1	0.8 ±0.5
Louisiana	0	100	0	0
Montana	0	95.9 ±1.8	3.8 ±1.7	Trace
Nebraska	0	94.8 ±1.3	4.8 ±1.3	Trace
Nevada	0	85.6 ±4.9	10.8 ±3.2	3.7 ±2.8
New Mexico	0	76.3 ±3.1	16.6 ±2.3	7.2 ±1.7
North Dakota	0	96.9 ±1.2	2.8 ±1.2	Trace
Oklahoma	0	83.3 ±2.7	15.4 ±2.7	1.3 ±0.9
Oregon	0	84.6 ±3.6	12.3 ±3.0	3.1 ±2.0

South Dakota	0	95.3 ±1.4	4.5 ±1.3	Trace
Texas	Trace	71.2 ±2.9	21.5 ±2.5	7.3 ±1.3
Utah	0	65.5 ±5.1	26.9 ±3.7	7.7 ±3.1
Washington	0	77.7 ±4.5	17.8 ±4.6	4.5 ±1.9
Wyoming	Trace	90.1 ±2.0	8.4 ±1.4	Trace
Nation	2.6 ±0.3	81.5 ±0.8	12.3 ±0.6	3.6 ±0.3

[1] Areas where ecological site descriptions are still under development. Without an ecological site description and reference worksheet, no rangeland health assessment can be made.

Note:Estimates where margins of error are at least as large as the estimates are denoted as "Trace."

Table 6. Non-Federal rangeland by state where all three attribute ratings are none-to-slight or slight-to-moderate; all three attribute ratings are moderate-to-extreme or extreme-to-total; and where at least one attribute is rated moderate departures from expected. Margins of error included.

State	Area Not Reporting Rangeland Health[1]	All three attributes rated none-to-slight or slight-to-moderate	All three attributes rated moderate-to-extreme or extreme-to-total	At least one attribute rated moderate
	Percent	Percent	Percent	Percent
Arizona	0	75.6 ±4.0	2.0 ±1.2	21.1 ±3.7
California	57.5 ±5.9	37.8 ±5.7	0	3.6 ±2.4
Colorado	0	82.4 ±3.5	Trace	16.9 ±3.4
Florida	12.5 ±8.8	77.6 ±10.0	0	7.0 ±4.2
Idaho	0	89.9 ±3.1	Trace	9.8 ±3.0
Kansas	0	91.9 ±1.5	Trace	7.2 ±1.4
Louisiana	0	100	0	0
Montana	0	93.6 ±1.8	Trace	6.2 ±1.9
Nebraska	0	93.2 ±1.4	0	6.5 ±1.5
Nevada	0	84.5 ±5.1	Trace	13.3 ±4.3
New Mexico	0	72.6 ±3.2	4.1 ±1.4	22.2 ±2.6
North Dakota	0	95.8 ±1.3	0	4.0 ±1.3

Oklahoma	0	81.4 ±2.9	Trace	17.6 ±2.9
Oregon	0	83.4 ±3.7	Trace	15.0 ±3.3
South Dakota	0	94.7 ±1.4	Trace	5.0 ±1.4
Texas	Trace	69.4 ±2.8	2.4 ±0.6	27.0 ±2.9
Utah	0	59.1 ±4.8	2.1 ±1.6	38.0 ±4.2
Washington	0	75.2 ±4.3	0	21.7 ±4.3
Wyoming	Trace	85.1 ±2.7	Trace	13.6 ±2.3
Nation	2.6 ±0.3	78.5 ±0.7	1.3 ±0.2	16.9 ±0.8

[1] Areas where ecological site descriptions are still under development. Without an ecological site description and reference worksheet, no rangeland health assessment can be made.

Note:Estimates where margins of error are at least as large as the estimates are denoted as "Trace."

About the Data

Estimates presented here are based upon rangeland data collected on-site as part of the National Resources Inventory (NRI). Rangeland is defined by the NRI as a land cover/use category on which the climax or potential plant cover is composed principally of native grasses, grasslike plants, forbs, or shrubs suitable for grazing and browsing, and introduced forage species that are managed like rangeland. This includes areas where introduced hardy and persistent grasses, such as crested wheatgrass, are planted and such practices as deferred grazing, burning, chaining, and rotational grazing are used, with little or no chemicals or fertilizer being applied. Grasslands, savannas, many wetlands, some deserts, and tundra are considered to be rangeland. Certain communities of low forbs and shrubs, such as mesquite, chaparral, mountain shrub, and pinyon-juniper, are also included as rangeland.

These results are based upon NRI rangeland data collected in the field on rangeland during the period 2004 to 2011. Current estimates cover non-Federal rangeland in 17 western states (extending from North Dakota south to Texas and west) and to a limited extent in Florida and Louisiana.

The findings presented here summarize departures from reference conditions for three rangeland health attributes:

- Soil and site stability
- Hydrologic function
- Biotic integrity

Quality assurance and statistical procedures are designed and implemented to ensure data are scientifically legitimate. Irrespective of the scale of analysis, margins of error must be considered. Margins of error (at the 95 percent confidence level) are presented for all NRI estimates.

About the Rangeland Health Protocol

A reference sheet is developed for each ecological site by experts with knowledge of soil, hydrology, and plant relationships to facilitate consistent application of the rangeland health assessment by integrating all available sources of data and knowledge for each of 17 rangeland health indicators including the ecological site description, scientific literature, local knowledge and reference sites, if any are known and available (Pyke et al., 2002). The range of reference conditions is based on the natural variation of plant communities within the reference state which includes but is not limited to the historic climax plant community. The 17 indicators are evaluated on degree of departure (none-to-slight, slight-to-moderate, moderate, moderate-to-extreme, and extreme-to-total) from the reference sheet (Pellant et al., 2005). The rangeland health attribute ratings for soil and site stability, hydrologic function, and biotic integrity were determined by calculating as the median rating for the group of indicators evaluated at the NRI sample location and associated with each attribute (See Table 1 for the list of indicators and associated attribute). The median was used in place of the 'preponderance of evidence' approach prescribed by the original method in order to standardize the method at the national level. For local and future NRI applications of the method, the NRCS continues to advocate the use of the 'preponderance of evidence' approach.

About the Rangeland Health Maps

The maps are constructed with NRI rangeland data collected in the field on rangeland during the period 2004 to 2011. The rangeland health maps present the percent by classes (none, 10% or less, 10-20%, 20-30%, and over 30%) of non-Federal rangeland where rangeland health attributes have at least moderate departures from the reference conditions. The regions are based on level IV ecoregion boundaries defined by the U.S. Environmental Protection Agency Western Ecology Division (http://www.epa.gov/wed/pages/ecoregions/level_iii_iv.htm). In some cases level IV ecoregions were combined to include more sample sites. An additional category, referred to as "Insufficient reporting or point count (35 or less)", represents areas where there were too few data points or areas for which the ecological site descriptions are under development and there is no reported rangeland health data reported for over 10 percent of the region. Estimates were mapped for regions where less than 10 percent of the region did not report rangeland health data. Regions without non-Federal rangeland are described as "No on-site rangeland samples". Areas of Federal land are depicted with cross-hatching.

The figures in this module represent rangeland health at a regional scale where the three attributes (soil and site stability, hydrologic function, and biotic integrity) represent various levels (e.g., moderate, moderate-to-extreme, or extreme-to-total) 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 will 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 none-to-slight and slight-to-moderate departure, the median rating was at least moderate.

More Information

Herrick, J.E., V.C. Lessard, K.E. Spaeth, P.L. Shaver, R.S. Dayton, D.A. Pyke, L. Jolley, J.J. Goebel. 2010. National ecosystem assessments supported by scientific and local knowledge. *Frontiers in Ecology and the Environment*. 8, pp.

Miller, M. E. 2008. Broad-scale assessment of rangeland health, Grand Staircase-Escalante National Monument, USA. *Range. Ecol. Manage*. 61, 249-262.

Pellant, M., P. Shaver, D.A. Pyke, and J.E. Herrick. 2005. Interpreting indicators of rangeland health, version 4. Technical Reference 1734-6. U.S. Department of the Interior, Bureau of Land Mangement, National Science and Technology Center, Denver, CO. BLM/WO/ST-00/001+1734/REV05. 122pp.

Pyke, D.A., J. E. Herrick, P. Shaver, M. Pellant, 2002. Rangeland health attributes and indicators for qualitative assessment. *Journal of Range Management*. 55, 584-597.

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