National Resources Inventory
Rangeland Resource Assessment

Regional Interpretation

Intermountain West

October 2010

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, grass-like 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

Overview: The Intermountain West includes the Columbia River Basin and Snake River Plateau in the northwest, the Great Basin in Nevada and western Utah, and the Colorado Plateau in the Four Corners area of Utah, Arizona, New Mexico and Colorado. In addition to large areas of forest, this region has the highest proportion of Federal lands. Neither Federal land nor forest land was included in the NRI rangeland on-site data collection. Consequently, results in this region should be carefully interpreted. Although they accurately reflect the results on non-Federal rangeland, they reflect the status of a small proportion of the region as a whole.

Much of this region is characterized by ecosystems that were historically dominated by shrubs and bunchgrasses, with various species of sagebrush being the most dominant shrub. Interspaces between the shrubs are interspersed with bunchgrasses, forbs, and biological soil crusts (lichens, mosses and cyanobacteria at the soil surface). Dramatic soil variability, driven by geology (soil parent material) and subsequent landscape formation, contribute to large differences in potential plant community composition. Soil-driven differences in plant communities are particularly evident in many parts of Utah, where salt-affected soils cover large areas (e.g., Bonneville Salt Flats). Large precipitation gradients and differences in potential evaporation and transpiration associated with aspect (lower on north-facing slopes and higher on south- and west-facing slopes) also contribute to variability in ecological potential in this region. There are some significant localized areas of irrigated agriculture. Where fields have been abandoned, they revert to rangeland.

Soil and Site Stability: Soil and site stability shows moderate departure from reference condition on non-Federal lands in most of

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 2003-2006. 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.

Quality assurance and statistical procedures are designed/developed 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.

the southern part of this region (Figure 1). The southern areas typically have lower precipitation, and higher evaporation and transpiration. There are also fairly large areas of saline soils. Although shrub species such as greasewood (*Sarcobatus vermiculatus* (Hook.) Torr.) and saltbush (*Atriplex* spp.) tolerate these soils, there is typically little understory and interspace vegetation. All of these factors may contribute to lower resistance and resilience to degradation. These same factors, together with the greater departure from reference conditions, explain the high percentage of bare ground (Figure 2) and low soil aggregate stability (Figure 3) measured throughout the southern part of this region. The higher concentrations of bare ground also tend to be located in large intercanopy gaps (Figures 4-7). Shrub clusters and coppice dunes often accumulate windblown soil and litter and are associated with high rates of infiltration; these areas can collect runoff water from surrounding lands. Large intercanopy gaps devoid of vegetation and microbiotic crusts are highly susceptible to wind erosion, particularly following disturbance (e.g., by animals, vehicles, or machinery). Invasion and increase of juniper causes a decline in sagebrush (*Artemisia* spp.) species. As the amount of bare ground increases and patches of bare ground coalesce, the resulting areas become highly susceptible to sheet erosion. Water flow paths become eroded between mature shrubs and can develop into rills and gullies. Soil loss down to bedrock is common.

About the Protocols

The findings presented here are derived using data collected for four field protocols:

Rangeland health data are used to assess three broad attributes (soil and site stability, hydrologic function, and biotic integrity). Data collectors compare biological and physical characteristics of the sample site and record degrees of departures from reference conditions based on comprehensive materials describing the ecological site.

Line point intercept data are utilized in summaries of non-native plant species, non-native invasive herbaceous species, native invasive woody 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,

Figure 1. Non-Federal rangeland where soil and site stability shows at least moderate departure from reference conditions

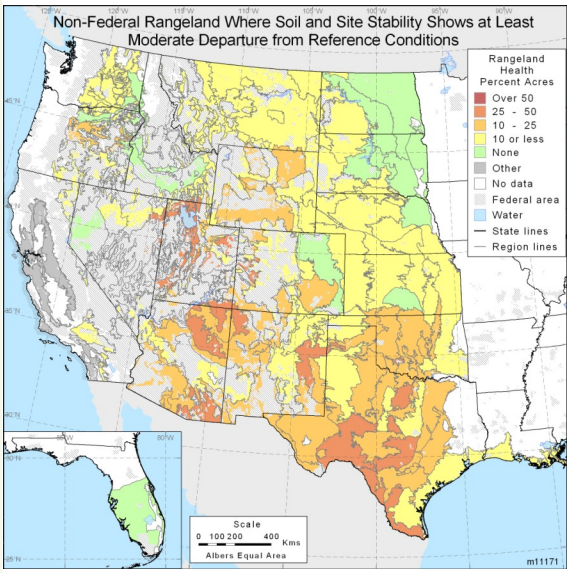
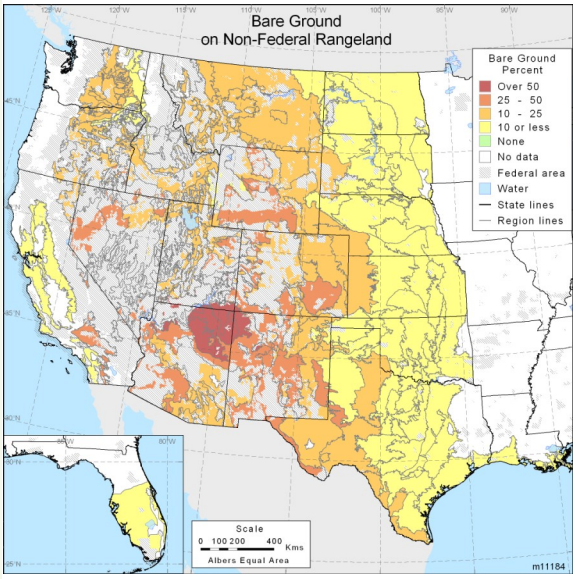


Figure 2. Bare ground on non-Federal rangeland

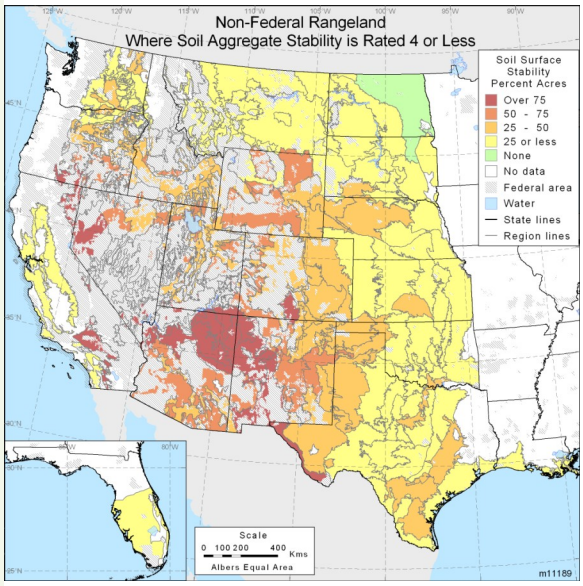


moss, rock fragment, bedrock, and/or bare soil present at each 3-foot interval.

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

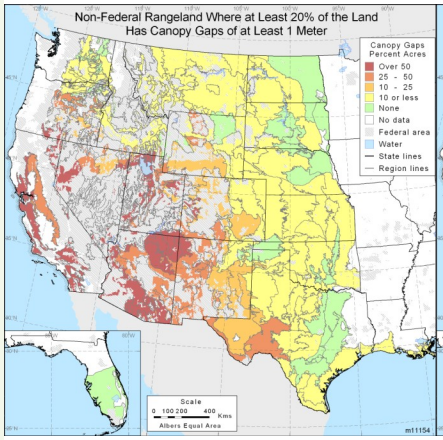
Soil aggregate stability is a recognized indicator of soil quality and rangeland health. Data collectors immerse soil surface peds collected at the sample site in water and subject the soil peds to five dipping cycles. Soil stability is rated based on the outcomes of these water exposure techniques.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

Figure 3. Non-Federal rangeland where soil aggregate stability is 4 or less

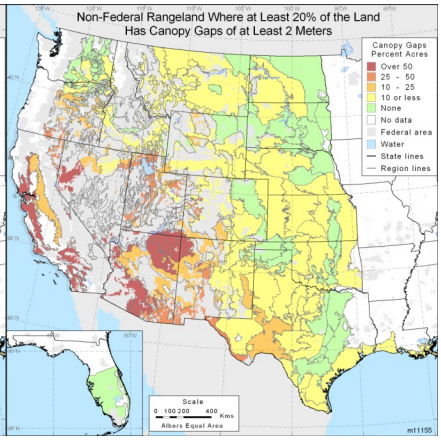


Figures 4-5. Non-Federal rangeland where at least 20 percent of the land has canopy gaps of at least 1 or 2 meters

4. Gaps at least 1 m



5. Gaps at least 2 m



About the Maps

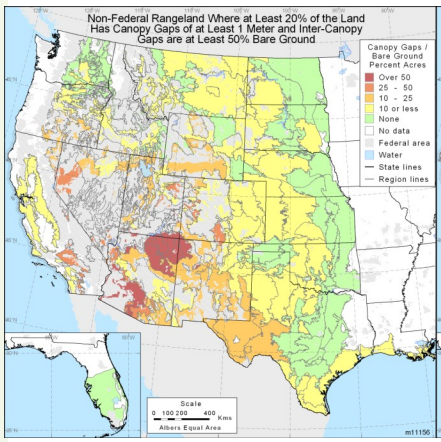
The maps are constructed with NRI rangeland data collected in the field on rangeland during the period 2003-2006. The mapping regions are based on Common Resource Area (CRA) boundaries; in some cases CRAs were combined to include more sample sites. Regions without non-Federal rangeland are described as "No data". Areas of Federal land are depicted with cross-hatching. Legend categories differ by map theme (e.g., rangeland health, invasive plant species, etc.)

Rangeland Health Maps

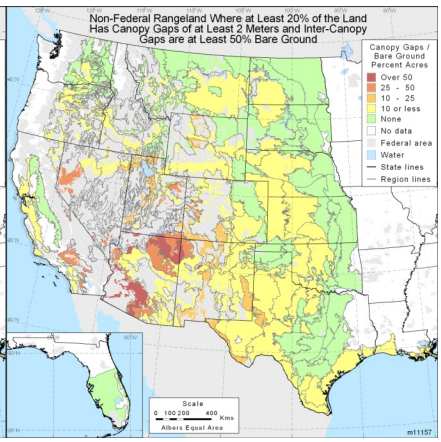
The rangeland health maps present the percent by classes (none, <10%, 10-25%, 25-50%, and >50%) of non-Federal rangeland where rangeland health attributes have at least moderate departures from the reference conditions. An additional category,

Figures 6-7. Non-Federal rangeland where at least 20 percent of the land has canopy gaps of at least 1 or 2 meters and intercanopy gaps are at least 50% bare ground

6. 50% bare ground in gaps of at least 1 m



7. 50% bare ground in gaps of at least 2 m



Hydrologic Function: The pattern of hydrologic function (Figure 8) is nearly identical to that for soil and site stability, and for virtually identical reasons. A loss of herbaceous understory and associated increases of bare ground lead to reduced infiltration capacity and increased runoff. Where bare ground is concentrated in large intercanopy gaps, the effect is even more pronounced. In this region, when soil and site stability and hydrologic function are compromised by excessive soil loss, thresholds are crossed and recovery to original historical ecological states is unlikely.

referred to as "Other", represents areas for which the ecological site descriptions are under development and there is no reported rangeland health data.

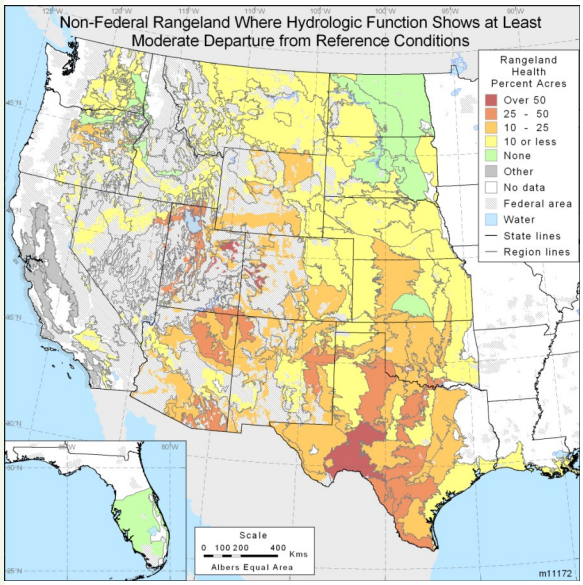
Invasive Herbaceous and Woody Species Maps

The maps display the percent by classes (None, 1% or less, 1-5%, 5-20%, and over 20%) of non-Federal rangeland where non-native invasive herbaceous species groups and native invasive woody species groups are present or make up at least 15, 30, or 50 percent of the plant cover.

Bare Ground and Foliar Canopy Gap Maps

The bare ground and canopy gap maps present the percent by classes (none, 10% or less, 10-25%, 25-50%, over 50%) of non-Federal rangeland for the average proportion of bare ground; where

Figure 8. Non-Federal rangeland where hydrologic function shows at least moderate departure from reference conditions



Biotic integrity: Biotic integrity in much of this region has been reduced (Figure 9) by the replacement of native grasses with non-native annual grasses (e.g., medusahead (*Taeniatherum caput-medusae (L.) Nevski*), wildrye, and invasive brome grasses such as cheatgrass (*Bromus tectorum* L.*)*) and forb species such as the knapweed complex (*Centaurea* spp.), and by the associated loss of native perennial grass species (Figures 10-12). Sagebrush stands have been reduced by the invasion of juniper and the occurrence and frequency of wildfires, which then perpetuate invasion of non-native annual grasses. Rehabilitation of invasive plant -dominated lands has often involved the seeding of non-native introduced forage grasses, such as crested wheatgrass (*Agropyron cristatum* (L.) Gaertn.*)*, that may dominate plant communities and reduce the native plant diversity. A number of studies have demonstrated that shifts in species composition to either invasive plants or competitive introduced forage grasses may have negative effects on nutrient cycling, hydrologic function, and wildlife habitat, both directly and through its effects on the fire regimes (Fire intensity and frequency often increases with an increase in invasive plant species).

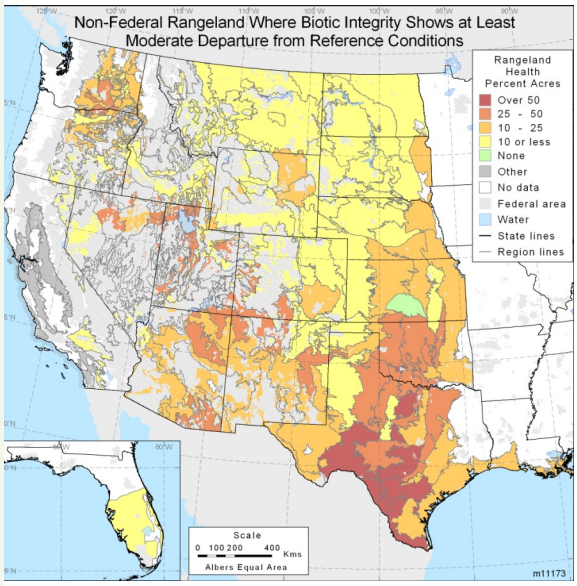
at least 20, 30, 40, or 50 percent is bare ground; where at least 20 percent of the area is covered with intercanopy gaps of at least 1 or 2 meters in size; and where at least 20 percent of the area is covered with intercanopy gaps of at least 1 or 2 meters in size and intercanopy gaps are at least 50 percent bare ground.

Soil Aggregate Stability Maps

The soil aggregate stability maps present the percent by classes (none, 25% or less, 25-50%, 50-75%, over 75%) of non-Federal rangeland where soil aggregate stability

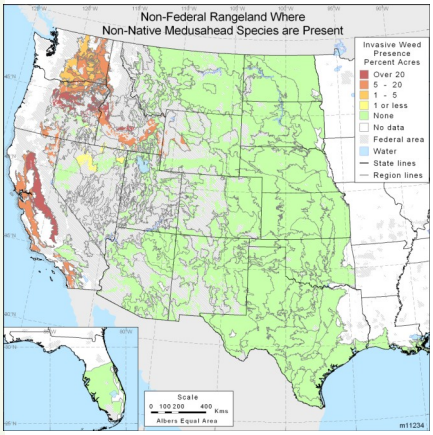
ratings are 4 or less, indicating less stable soil.

Figure 9. Non-Federal rangeland where biotic integrity shows at least moderate departure from reference conditions



Figures 10-11. Non-Federal rangeland where non-native medusahead and annual brome grasses species are present

10. Medusahead



11. Annual brome grasses

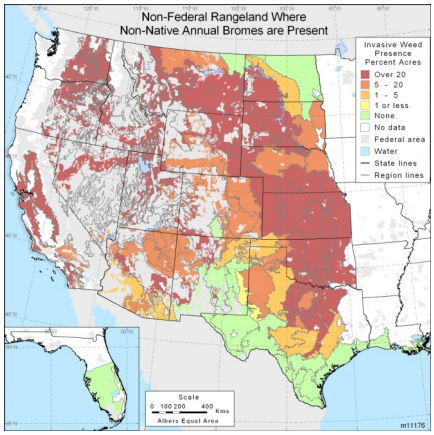
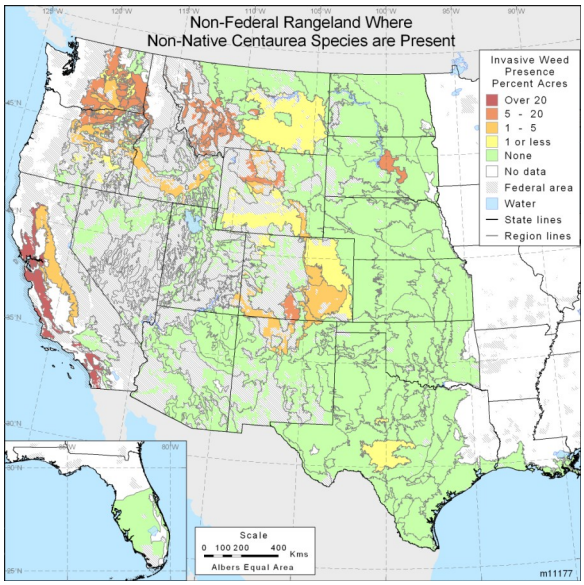


Figure 12. Non-Federal rangeland where non-native Centaurea species are present



More Information

For more information about the NRI, visit http://www.nrcs.usda.gov/technical/NRI/.

Send comments and questions to the NRI Help Desk (nri@wdc.usda.gov).