



Rangeland Soil Health



Why is soil health important?

The management of South Dakota’s grasslands is paramount to the healthy functioning of our soil and water resources. Sound management practices not only lead to economic, but also to ecological sustainability, while improper management reduces the resources’ capacity to function. Assessing and monitoring the range and soil health and the associated ecological processes can provide valuable insight to grassland managers.

What is soil health?

Soil health on rangeland is an integral part of the ecosystem function, and is defined as the capacity of a soil to maintain its function and flow of ecosystem services given a specific set of physical, chemical, and environmental boundaries. Maintained or improved soil health is guided by four general principles:

- 1) use plant diversity to increase diversity in the soil;
- 2) manage soils more by disturbing them less;
- 3) keep plants growing throughout the year to feed the soil; and
- 4) keep the soil covered as much as possible. While these principles were developed primarily for agronomic systems, there is also a strong correlation between the 17 rangeland health indicators and these principles. Consequently, soil health on rangeland is considered a part of the rangeland health assessment, and both the range and soil health evaluations are strengthened when looking at them together.



Why use the Rangeland Health Assessment?

Evaluating an ecological process such as the hydrologic function of a site can be a complex endeavor. But if you break it down and look at it in smaller “pieces” (i.e., characteristics that relate to hydrologic function), it can be relatively easy to do. That is essentially the method used with rangeland health assessments, which utilizes 17 indicators to rate 3 attributes (or ecological processes).

Rangeland Health and Soil Health Principles: How they are connected

SOIL HEALTH PRINCIPLE 1 –

Plant diversity increases diversity in the soil

The plant community composition and distribution relative to infiltration and runoff (rangeland health indicator 10) relates to both the above and below ground structure of the plants/roots and directly affects the ability of a site to capture rainfall effectively.

This indicator can be assessed by looking at the plant species composition, diversity and distribution, and utilizing knowledge of plant root morphology and the effect on infiltration and runoff. It can also be evaluated by measuring the rate of infiltration using a single-ring “infiltrometer” and comparing the results between sites. In addition, the functional/structural plant groups, the plant mortality and decadence, the annual production, and



the level of invasive plants (rangeland health indicators 12, 13, 15, and 16, respectively) relate to the principle of plant diversity and biological diversity in the soil.

SOIL HEALTH PRINCIPLE 2 –

Manage soils more by disturbing them less

The soil surface resistance to erosion and the soil surface loss or degradation (rangeland health indicators 8 and 9) in part reflect the amount of previous soil disturbance that has occurred on a site. These indicators



can be assessed by observing the soil and organic matter at the surface. Look for signs that the plant litter is in contact with the soil, and often the surface layer should have a granular structure (i.e., similar to the appearance of chocolate cake).

Surface resistance to erosion can also be evaluated by placing a small soil “ped” in a bottle cap, adding water, and observing how well it holds together. Soil surface loss can be evaluated by comparing the existing soil profile to the official soil series description which describes the depth of dark colors and the expected soil structure. The presence of a management induced compaction layer (rangeland health indicator 11) may also indicate previous soil disturbance.

SOIL HEALTH PRINCIPLE 3 – Keep plants growing throughout the year to feed the soil

The functional/structural plant groups present on a site (rangeland health indicator 12) as compared to the corresponding Ecological Site Description will reflect the site’s capability to support plants that will be actively growing throughout the growing season. Actively growing plants support active soil biology and some plant species are more inter-dependent on soil mycorrhizal activity than others. This can be evaluated by observing the functional/structural groups (e.g., tall statured warm-season grasses, mid statured cool-season bunchgrasses, early season forbs, leguminous forbs, shrubs, etc.) present on the

site, and comparing to what is expected for that ecological site. The amount of bare ground, the annual production, and the level of invasive plants (rangeland indicators 4, 15, and 16, respectively) also relate to the capacity of a site to keep plants actively growing season-long.

SOIL HEALTH PRINCIPLE 4 –

Keep the soil covered as much as possible

In rangeland ecosystems, keeping the soil covered with actively growing plants and plant residues, moderates soil surface temperatures and reduces the potential for soil surface degradation (i.e. crusting, erosion) impact. Conversely, excessive plant litter can be detrimental to native plants resulting in invasive by exotic cool-season grasses.

Rangeland health assessments evaluate the amount of bare ground and litter cover for a site and assess these indicators based on the amount of each we would expect to see in reference condition. The amount of bare ground



(rangeland health indicator 4) and plant litter cover (rangeland health indicator 14) as compared to the reference value for the ecological site is a reflection of the past management and growing conditions for the site. Comparing the amount of litter to the reference for the ecological

site will help guide management.

Indicators are specific to the ecological site

As you look across a landscape, you see different plant communities associated with the different ecological sites reflecting the varied nature of the soils occurring across the landscape. For this reason, rangeland health assessments are compared to references that are unique to each ecological site. These references are called reference sheets, and one has been developed for each ecological site. Be sure to use the reference sheet for the ecological site you are evaluating.

For more information, contact your local USDA NRCS Service Center or visit <http://soils.usda.gov/> or <http://www.sd.nrcs.usda.gov>.

Additional information is published at: <http://www.jswnonline.org/content/69/3/73A.full.pdf>

Other suggested resources:

- [NRCS South Dakota](#) videos on YouTube.
- [NRCS Soil Health Awareness](#) web site.

