Understanding the Effects of Soil Compaction and Porosity on Rangeland

Disadvantages of not considering soil health in a poorly managed grazing management System.
- Collapsed macro pores leads to micro-aggregates & micropores (micropores = 0.005 to 0.03 )
- Increased oxidation of surface and soil organic matter.
- Increased wind and water erosion.
- Reduced water holding capacity.
- Increased CO2 and O2 exchange in the soil.
- Increased soil Bulk density.
- Adequate plant cover results in increases soil temperatures.
- Decreased diversity of soil biota.
- Diminished biodiversity, stability, ecosystem functional traits and resource use.

Indicators of a compacted soil layer
- Platy, blocky, dense or massive appearance
- Significant resistance to penetration with a penetrometer (increased PSI)
- High bulk density (low pore space)
- Restricted, flattened, turned, horizontal or stubby plant roots

Note: Dry soils are much more resistant to compaction than moist or wet soils (ARS-USDA).

Advantages when considering soil health in a properly planned & managed grazing management system.
- Water stable aggregation influenced by microorganisms & root interactions.
- Increased surface and soil OM.
- Reduction of soil and water erosion.
- Increased water holding capacity in soil aggregate and pores.
- Optimization of nutrient cycling.
- Improved CO2 and O2 exchange in the top soil.
- Increased ability of plants to withstand drought conditions.
- Improved filtering of soil toxins and animal waste.
- Increased biodiversity, stability, and ecosystem functional traits and resource use.

Overgrazing diminishes plan productivity and capability.

Improving the effectiveness of rainfall
- Improved plant vigor and range condition.

Prescribed grazing increases plant productivity and capability.

Sustainable forage production
- Increased diversity of soil biota.

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http://www.nrcs.usda.gov/wps/portal/nrcs/detail/nm/technical/?cid=nrcs144p2_068965

Ref: The Biology of Soil Compaction: 2009, J. J. Hoorman, J. C. De Moraes Sa, R. Reeder. Ohio State University

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Total porosity (%) = [1 – (Bulk density/Particle Density)] x 100%