

## Range Health: Understanding the relationship between the five biological spheres.

**OBJECTIVE:** A healthy soil is the result of a “*Soil Health Management System*” which promotes synergy among the soils **Biological, Chemical** and **Physical** processes and develops the 5 spheres.

The above ground diverse plant community develops & maintains the spheres, when using a Range Soil Health Management System.

**Rhizosphere:** area surrounding the roots (1-2 cm approx.) that is directly influenced by live root secretions and associated soil microorganisms.

- ✓ Main source of carbon energy for bacteria and fungi (exudates)
- ✓ Vital for the process of forming water stable aggregates (roots, biotic glues & fungal hyphae bind soil particles)
- ✓ Where nutrient cycling occurs

**Aggregatusphere:** soil structure (aggregates) influenced by fungal hyphae, roots, Glomalin, other plant & microbial exudates.

- ✓ Protects organic matter from decomposition
- ✓ Habitat for microorganisms (bacteria, fungi, others)
- ✓ Protects and maintains ‘porosphere’ integrity
- ✓ Increases available water holding capacity
- ✓ Decreased compaction
- ✓ Filtering & buffering of toxic compounds & recycles nutrients
- ✓ Influenced by fungal hyphae, root fibers, exudates and soil glues (Glomalin) in building soil structure

**Porosphere:** the macro and micro pore space between and within soil aggregates of various sizes (voids in soils).

- ✓ Regulates water and aeration flow
- ✓ Burrow walls are often enriched in nutrients, promoting root growth and increasing the potential for nutrient uptake by plants
- ✓ Site of aquatic habitat for soil microorganisms & nutrient cycling
- ✓ The high plant diversity, have the lowest bulk density (most pore space) and highest permeability.

A bare soil surface will:

- ✗ Harm the natural system in many ways: erosion, loss of nutrients, loss of organic matter and soil.
- ✗ Harm the soil biota (reduces soil moisture in micro pores).
- ✗ Have lower organic matter which will reduce the amount of available water for native vegetation.
- ✗ Have increased soil temperature, makes the soil less hospitable to soil microbes and oxidizes organic matter.



The five sphere's are interconnected by the biological, chemical and physical components of the soil.

A hierarchical approach to evaluating the significance of soil biodiversity to biogeochemical cycling by M.H. Beare, D.C. Coleman, D.A. Crossley Jr., P.F. Hendrix and E.P. Odum (1995)

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**Detritosphere:** the layer of plant debris/litter and dead organisms that have started decomposing at the soil surface.

- ✓ Protects the soil surface from erosion
- ✓ Lowers soil temperature
- ✓ Reduces evaporation
- ✓ Provides food for soil microbes
- ✓ Provides habitat for soil microbes
- ✓ High in biological activity

**Drilosphere:** is the part of the soil influenced by earthworms, micro arthropods, millipedes, plant roots and other soil organisms.

- ✓ Increased water infiltration & respiration
- ✓ Provides a bio-pore for growing plant roots
- ✓ Increase soil bio-diversity
- ✓ Castings: have higher humic substance content as a result of microbial degradation of organic matter
- ✓ Soils are enriched with N, P and humic substances contained in the castings
- ✓ Pathway for redistribution of organic matter (plant litter) throughout the soil profile

### Pasture & Range Health (Soil Health Management System)

- Adaptive Grazing Management
- Plant diversity
- Living roots throughout the year
- Keep the soil covered (plants growing throughout the year)
- Less soil disturbance
- Livestock integration
- Grazing - Rest & Recovery
- Drought planning
- Monitoring
- Alternate season use