

## 4. Continued Live Plant/Roots

Our perennial grasslands consist of cool season grasses, warm season grasses, and flowering forbs. Consequently, adaptable plants are able to grow during the spring, fall, and summer.



*"Cocktail mix" cover crop seed (left); Crimson clover cover crop (right)*  
Photo credit: USDA-NRCS (left); Marlon Winger, USDA-NRCS

Our cropland systems typically grow cool or warm season annual cash crops, which have a dormant period before planting and/or after harvest. Cover crops are able to fill in the dormant period and provide the missing live root exudate, which is the primary food source for the soil food web. Cover crops may be incorporated into a cropping system as annuals, biennials, or perennials. Starting on a small acre scale will allow farmers and ranchers to find the best fit for their operation.

*Cover crops can address a number of resource concerns:*

- Harvesting carbon dioxide and sunlight
- Building soil aggregates and pore spaces
- Covering the soil
- Catching and releasing inorganic nutrients
- Salinity management
- Pollinator food and habitat
- Weed suppression
- Wildlife food, habitat and space
- Livestock integration
- Adding crop diversity
- Adjusting the crop combination's carbon/nitrogen ratio

## 5. Livestock Integration

Animals, plants, and soils have played a synergistic role over geological time. In recent years, animals are playing a reduced role due to being placed in confinement and fewer farms now include livestock as part of their overall operation.

*Returning livestock to the landscape:*

- Fall or winter grazing: converts high carbon annual crop residue to low carbon organic material; balances the carbon/nitrogen ratio.
- Spring or summer grazing: short grazing exposure periods followed by long recovery periods allows the plants to regrow.
- Reduces nutrient export from our cropland and hayland fields by having the livestock graze the material in place.
- Seed rotational perennials, graze and manage in rotation
- Grazing cover crops and/or crop residue allows us to remove livestock from perennial grasslands earlier in the fall.
- Winter feeding on hayland, bale grazing, and rolling out bales reduces livestock waste associated with confinement.



*Cattle grazing multi-species cover crops.*  
Photo credit: Marlon Winger, USDA-NRCS N

## Soil Health: *Universal Principles for a Healthier Soil Ecosystem*



*Image courtesy of Willie Durham*

**The soil health foundation consists of five principles:**

1. Minimize soil disturbance; 2. Maximize soil cover;
3. Plant diversity; 4. Continual live plant/root; and
5. Livestock integration.

*Information was modified from the North Dakota USDA-NRCS state soil webpage.*

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## 1. Minimize Soil Disturbance

*Soil disturbance can generally occur in different forms:*

- Biological disturbance, such as overgrazing
- Chemical disturbance, such as over application of nutrients and pesticides
- Physical disturbance, such as tillage

A typical soil is mineral, soil organic matter, water, and air. The water and air portions exist in the pore spaces between the soil aggregates. Over time, tillage reduces and removes those spaces from our soils, restricting infiltration and destroying the biological glues which hold our soils together.

*Ultimately tillage results in one or more of the following:*

- Water erosion
- Wind erosion
- Ponding water
- Soil crusting
- Soil organic matter depletion

Minimizing soil disturbance is a good start to rebuilding soil aggregates, pore spaces, soil glue, and soil organic matter. This is an essential step for long term soil productivity.



*Winter wheat being planted with a no-till drill.  
Photo credit: Marlon Winger, USDA-NRCS  
National Soil Health Division Specialist WY, MT, ID*

## 2. Soil Armor

Soil armor, or cover, provides numerous benefits for cropland, rangeland, hayland, gardens, orchards, road ditches, and more.

*Benefits of soil armor:*

- Controlling wind and water erosion
- Reduces evaporation rates
- Moderates soil temperatures
- Compaction: armor dissipates raindrop energy
- Suppresses weed growth
- Habitat: provides protection for soil organisms



*Soil armor: “If you’re trying to make your soil healthier, you shouldn’t see it very often,”  
USDA-NRCS photo by Alice Welch*

## 3. Plant Diversity

The Journals of Lewis and Clark describe the northern plains landscape as having abundant plant diversity. Numerous species were observed, working together as a plant community to provide forage for large herbivore populations.

Settlement of the plains brought agriculture, which resulted in the polyculture perennial landscape being replaced by a monoculture annual landscape. Where the soil food web used to receive carbon exudates from a diversity of plants harvesting sunlight and carbon dioxide, it now receives carbon exudates from one plant species at a time.

We can start to mimic the original plant community by using crop rotations, which are important to the long term sustainability of our soil resource and food security. Diverse crop rotations provide more biodiversity, which in turn improves rainfall infiltration and nutrient cycling while reducing disease and pests.

*Four crop types with examples of each:*

- Warm Season Grass – corn, sudan, and millet
- Warm Season Broadleaf – sunflower, and soybean
- Cool Season Grass – wheat, oat, barley, and rye
- Cool Season Broadleaf – flax, pea, and lentil



*A producer in Payette, ID incorporates corn, winter wheat, onion, and alfalfa into his crop rotation.  
This is a picture of corn residue in a winter wheat crop.  
Photo credit: Marlon Winger, USDA-NRCS*