

Ranching for Profit

Putting Profit into Agriculture

Newsletter #66

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Every year we make changes in the *Ranching for Profit School*. The most obvious this year was the workbook. It was thoroughly reworked to make it more "user friendly." We also added a unit on soils. Thirty alumni repeated the school this year (it is still only \$100 to repeat). For the other 1,720 of you who did not repeat the school this year, this newsletter will bring some of the new material on soils to you.

*"Humankind in some spite of its sophistication and accomplishments,
is dependent for its existence on a six inch layer of soil and the fact that it rains"*
Anon.

FROGS IN HOT WATER

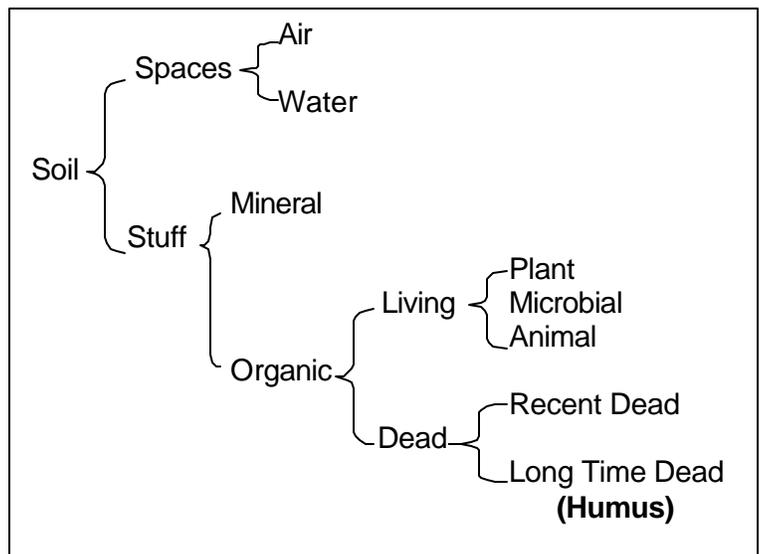
Ever hear the story about the two frogs? One is thrown in a pot of boiling water. It jumps out immediately. The other is in cool water that is warmed up to a boil gradually. That one, not noticing the gradual change, cooks to death.

Healthy soil is literally the foundation of a profitable ranch business. But, according to the Natural Resource Conservation Service (NRCS), the rate of soil loss on US rangelands is twice the rate of soil replacement. Their statistics show that we lose about 2 pounds of top soil from each square yard of rangeland each year. Soil loss from croplands is over 4 times the rate of replacement. To make matters worse, while our soil erodes, we are degrading the health of the soil that is left. I suppose if this happened suddenly we'd call it a crisis and do something. But this has been going on for years. Like the frogs, we are gradually cooking to death.

IT'S MORE THAN DIRT

If we are to rebuild soils and improve their health, first we need to understand the components of a healthy soil.

Soil consists of two things. Stuff, and spaces between the stuff. The spaces are filled with air and water. The stuff consists of minerals and organic matter (things that are, or were once, living). There are two kinds of organic matter. First there are things that are currently living, like roots, ground squirrels, insects, nematodes, bacteria, and many others. Most people aren't aware that 70-90% of the organisms in a rangeland ecosystem live underground, or that one cup of healthy soil contains more than 6 billion living organisms. That's approximately the human population of the earth. *The key to creating and maintaining a healthy soil is providing habitat and nourishment for the organisms in the soil.*



The second type of organic matter is dead material. There are two types of dead organic matter. First there is material that is recently dead and is in the process of decomposing. Second, there is material that has already been completely decomposed. That's called *humus*.

“THE PLANT’S STOMACH”

Think about the soil as the plant’s stomach. Just as microbes break down fiber in the cow’s rumen, microorganisms in the soil break down fiber and other organic matter. As the microorganisms decompose organic matter they create humus. Humus is dark brown, porous, spongy and has a pleasant earthy fragrance. It is essential in a healthy soil.

Humus stores nitrogen in the soil. With all of our technology, that’s something we have not figured out how to do. Humus holds 30 times more nutrients than clay. It absorbs 5 times its weight in water and increases oxygen availability in the soil. Micro-flora that live in humus attack soil pathogens. Clearly, this humus is pretty important “stuff.”

CARBON MAKES THINGS GO

We usually think about mineral elements like Nitrogen (N), Phosphorous (P), Sulfur (S) and Potassium (K) and several trace elements as important nutrients for plant nutrition. But the primary food required by plants is the same as the primary food required by cows and sheep (and people). It is carbon (C). Carbon is energy. It makes things go.

While there is a high proportion of carbon in the organic matter in the soil, plants get nearly all of the carbon they use from the atmosphere. Through the miracle of photosynthesis, plants take energy from sunshine, carbon from the carbon dioxide (CO₂) in the air and water from the soil and produce starch, cellulose, sugars, proteins and other carbon-based compounds. These substances are consumed by animals and decomposed by soil organisms, releasing CO₂ into the soil. *In nature, unless consumed by fire, nearly all carbon is recycled into the soil.*

Maintenance of organic matter is important for many reasons, not the least of which is providing adequate carbon to feed the soil microorganisms. It is critical that sufficient crop and root residues be provided to replenish the organic matter.

While nature returns nearly all-organic matter to the soil, modern agriculture removes most of the organic matter. Farming and ranching will not be ecologically (or economically) sustainable until we replenish and maintain soil organic matter.

According to Australian Soil Scientist, Dr. Christine Jones, “pulsed” grazing (short graze periods with adequate recovery periods) adds organic matter to the soil and is the most effective grazing method for maintaining healthy soils. Leaving adequate residue on the soil surface is also critical.

NITROGEN MAKES THINGS GROW

If carbon makes things go, nitrogen makes them grow.

Our atmosphere is 78% nitrogen, but unlike carbon, plants can not utilize nitrogen in its gaseous form. In order to pass from the atmosphere to plants, and ultimately to animals and people, nitrogen must first be “fixed” by the soil microorganisms. Almost all of the nitrogen in the soil is in the organic matter. But plants are not able to use the complex protein molecules in these materials. Only after the microorganisms have broken down these complex molecules into ammonium and nitrate molecules will the plants have a nitrogen source.

Humus is nature’s nitrogen storehouse. In a soil with 2% organic matter we would expect to find approximately 40,000 pounds of humus/acre containing about 2,000 pounds of nitrogen. A soil with 1% organic matter will contain about 1,000 pounds of nitrogen per acre.

Just like the microbes in the rumen of a cow or sheep, the soil microbes need protein (nitrogen) in order to use the energy (carbon) in the soil’s organic matter. And just like the rumen

microbes, the soil microbes need carbon and nitrogen in the correct proportion. Too much carbon (relative to available nitrogen) and the microbes can't convert the organic matter to humus. The microbes will tie up all of the available nitrogen, making it unavailable to plants. Too much nitrogen (relative to available carbon) and the microbes, in search of carbon, will devour the humus leaving the soil impoverished. A C:N ratio of 25 – 30: 1 is ideal for the microbes.

THE IMPACT OF AGRICULTURAL PRACTICES ON HUMUS

Returning adequate organic matter to the soil and encouraging its decomposition into humus are essential for healthy productive soils. But most farming practices deplete organic matter and destroy humus. Dr. Jones recently wrote, “*Conventional farming (and ranching) techniques create biological deserts.*”

MANAGEMENT PRACTICE	EFFECT ON ORGANIC MATTER
<i>Cultivation</i>	The majority of organisms in the soil are aerobic. In other words, in addition to energy (carbon) and protein (nitrogen) they require air. When soils are cultivated, increasing the exposure to air, it is like opening up the air intake on a wood stove. The microbes use up the organic matter faster. If they use it all up, the microbes will begin to consume the humus as their energy source.
<i>Turning in Crop Residues</i>	This obviously increases the organic matter in the soil. However, it may temporarily throw the C:N ratio out of whack. With abundant carbon, the microbes need more nitrogen. The microbes will use all of the nitrogen in the soil creating a nitrogen deficiency for the plants.
<i>Nitrogen Fertilization</i>	When excessive nitrogen is applied to the soil (in excess of what the microbes need to convert organic matter to humus) the microbes will begin consuming humus as their energy source. Every pound of excess nitrogen applied to a soil destroys 100 pounds of humus.
<i>Burning</i>	Burning removes organic residues and reduces the amount of organic matter returned to the soil. It also tends to expose the soil, making the surface more vulnerable to erosion and susceptible to capping.
<i>Grazing</i>	About 50% of plant growth occurs underground. Continuous grazing reduces total root volume and tends to decrease soil organic matter content. Grazing with adequate recovery periods for root and top growth tends to increase the contribution of roots to soil organic matter. It also increases soil porosity and improves the habitat for many desirable soil organisms.

The use of nitrogen fertilizer, which doubled crop yields, was considered a major breakthrough in agriculture. However, the cost was enormous. Farmers became miners, depleting their farms of their most valuable resource, humus.

You can't afford, economically or biologically, to lose the humus. Replenishing soil organic matter and maintaining a thriving soil microbe population are essential.

IF YOU WANT TO BE A COWBOY GET A JOB

The second shipment of Stan's new book, *If You Want To Be A Cowboy Get A Job*, has finally arrived. If you'd like to order a book, or if you ordered a book but have not received it yet please call (707-429-2292) or email us (pratt@ranchmanagement.com). The books cost \$20 including shipping & handling.