The Role of Microbiotic Plants in the Sagebrush Steppe

-by Roger Rosentreter, PhD.

Microbiotic plants include mosses, lichens and algae that grow directly on the soil. They occur among and beneath the scattered clumps of shrubs and perennial grasses. These plants cushion the impact of rain drops and increase soil moisture infiltration. Once moisture is in the soil, microbiotic plants act as an organic mulch by shading, cooling, and decreasing evaporation of soil moisture. Thus, sites with well developed microbiotic plants will retain more soil moisture within the soil profile.

Some of the organisms in the soil and within the lichens are blue-green bacteria or "cyanobacteria" (note that these are sometimes called "blue-green algae"; they are not algae at all). Cyanobacteria will fix atmospheric nitrogen and change it into a form (nitrate) that other plants can utilize. Nitrogen is the second most limiting factor after moisture in the sagebrush steppe. Therefore, the additional input of nitrogen by the bacteria and lichens is important for them and for their neighbors. These lower plants lack a waxy epidermis for retaining the nitrogen, so it is simply "leaked out" into the surrounding soil.

Studies have shown that fewer seeds germinate in areas covered by microbiotic plants, but more total plants become established compared to bare soil sites (Harper and St. Clair, 1985). Without the microbiotic plants, the bare soil sites are harsh, with greater temperature extremes and less moisture retention. Microbiotic plants may also serve as a check for invasion by exotic annuals. For example, cheatgrass will invade bare soil sites much more densely than it will a site colonized by microbiotic plants.

During much of the summer and fall, the sagebrush steppe is dry and susceptible to extreme wind erosion. Where colonies of microbiotic plants are intact, they protect and hold the soil in place, reducing this wind erosion. When they are absent, much valuable topsoil is lost.

When microbiotic plants are moist, they are pliable and resistant to livestock trampling. Once the soil surface dries, however, trampling will break apart the plant's network of microscopic, root-like rhyzoids, severely damaging the crust they form. Historically, it appears that the native ungulates, such as deer and pronghorn antelope, stayed in the higher country until winter weather drove them down to the sagebrush steppe. With moist or frozen surface soils, the animals could walk on the microbiotic plants with minimal impact. In spring, the animals moved to higher elevations before the soils completely dried, again with minimal impact. Season of use for livestock should include consideration of microbiotic plants and soil moisture, for protection of the plants, and ultimately, for protection of the watershed.

Literature Cited

Harper, K.T. and L.L. St. Clair. 1985. Cryptogamic soil crusts on arid and semi-arid rangelands in Utah: effects on seedling establishment and soil stability. BLM contract report: Utah State Office; Salt Lake City, Utah.

Fungi can be classified into three groups. The first are the parasites which feed on, and eventually kill, their hosts. The second group are the saprophytes, which decompose dead material. The third group are the mycorrhizal fungi, which form a symbiotic relationship with their host organism.