

# Effects of Grazing on Soil Properties

*G.J. Wang and K.K. Sedivec, NDSU Natural Resources Management  
P.E. Nyren and A.C. Nyren, NDSU CGREC, Streeter, N.D.*



**Graduate student Guojie Wang works with David Hopkins to classify soils types on the research pastures.**

**T**he Missouri Coteau region of North Dakota is a highland of rock, gravel and soil deposited in a broad band across the state by a receding glacier some 10,000 years ago. The land is characterized by rolling, grassy hills and rocky soils. Potholes and lakes are common. This is an important region for forage and livestock production.

Scientifically managing pastures in this region is a key factor affecting soil properties, water cycling, and ecological and economic productivity. Overgrazing by animals can alter soil physical and chemical properties due to trampling and defoliation, thus reducing productivity. Furthermore, soil properties can influence the region's water cycle and balance, directly altering wetland dynamics and wildlife habitats. The soil is considered a more stable constituent in an ecosystem compared with others such as vegetation. We are studying some important soil properties affected by grazing and are trying to find the key to understanding the "black box" of the ecosystem — soil.

This study was designed to determine the long-term effects (greater than 20 years) of different livestock grazing systems on selected soil properties such as soil profile, bulk density, organic matter, texture, aggregate size distribution and stability, water characteristics, infiltration rate, calcite carbonate equivalent and saturated hydraulic conductivity.

At the CGREC, four grazing treatments were studied: no-use to long-term light, rotational, seasonlong moderate and seasonlong extreme grazing. Each treatment was replicated three times in three different pastures. In 2006, each replicate pasture was stratified by soil series with the same soil type/ecological site. A location with a slope of 6 percent to 9 percent was selected and a transect was established parallel with the slope. The topographic locations of each transect included summit, backslope and toe.

The first soil property we recorded was the soil profile. Soil horizon arrangement and depths are indicators of the soil formation, quality and health. The A (or black) horizon can tell us about soil erosion, soil organic matter content and so on.

Trampling by grazing animals can impact soils, and bulk density is related to this phenomena. Compacted soil has a lower infiltration rate, a higher surface runoff and, accordingly, more erosion.

Soil organic matter is a very important component of the soil. Inorganic nutrients, soil structure and soil water movement are influenced by soil organic matter.

Soil aggregate size distribution and stability are quantitative measurements of soil structure. Several factors, such as soil texture, especially clay types and content, and organic matter, can influence these properties.

Water is the most constraining ecological factor in grasslands, so water movement in the soil is the most important soil property to understand. Grasslands receive water from precipitation, and if the rainfall rate is higher than the infiltration rate, runoff and erosion occur. The position of the calcic horizon in the soil profile is also an indicator of water movement in the soil.

Preliminary results show that the soils are indeed a stable constituent of the grassland ecosystem. The different grazing managements do not influence the selected soil properties consistently, but some subtle trends have been observed that will be examined in more detail next year. The soil in this region is extremely variable, making statistically accurate sampling difficult. Topography appears to be the most important source of variation in the soil properties.