



SOIL AND PLANT SCIENCE DIVISION

Technical Soil Services

Northwest Soil Survey Region

Havre, Montana, Major Land Resource Area (MLRA) Soil Survey Office (SSO)

Soil Science at North Star Schools

Purpose

The staff from the Havre, Montana, MLRA SSO had the pleasure of bringing the wonders of soil science to students at North Star Schools twice during the 2024–2025 school year. Staff presented to the sixth-grade class on December 5, 2024, and to the sophomore class on March 27, 2025. The Havre MLRA SSO staff has presented to the sixth-grade class at North Star Schools for 3 years running, but this was the first time presenting at the high-school level.

Background

For the sixth-grade class, the presentation focused on the five soil forming factors and the five principles of soil health. Following a brief introduction, MLRA Soil Survey Leader Scott Brady moved right into soil science 101 beginning with the enduring dirt versus soil discussion (fig. 1). Next, Brady and the students discussed why we care about soil, and the students provided interesting examples for important functions of soil, such as food production and wildlife habitat. The students had fun learning and saying the acronym CLORPT to help them remember the five soil forming factors: climate, organisms, relief (topography), parent material, and time. Brady concluded this segment with a timeline of significant events in local history that occurred while 1 inch of soil was formed and a brief video of a local dust storm that most likely obliterated that 1 inch of soil in minutes.

The next segment included fun activities for the students. First, Brady used a volleyball for sand, a tennis ball for silt, and two flat magnets for clay to discuss the different size of soil particles. The magnets demonstrated clay's electric charge and its ability to bond to other substances, which led nicely into the next activity. Soil Scientist Jenna Fultz walked the students through the activity in which two students joined hands, and a third student tried to break them apart. The students varied the strength of their handholds to replicate the different bonds between soil particles: weak for sand, strong for clay, and medium for silt.



Figure 1.—Scott Brady teaching soil science 101 and the five soil forming factors to sixth grade students.

Next, Fultz talked about the five principles of soil health, and the students learned that keeping the soil covered is an important part of conservation (fig. 2). They also learned how minimizing disturbance, increasing diversity, keeping live roots, and integrating livestock contribute to conservation. She ended with another activity where each student received two cups: one filled with cake mix (representing compacted soil) and one filled with chocolate puffs (representing healthy soil). The best part (for staff) of this activity was listening to the students predict what would happen when they poured milk into each cup. Students were surprised to see the milk pond on top of the cake mix. Of course, they thought the best part was getting to eat it all when we finished the activity.

For the final segment of the presentation, Soil Scientist Willa Nagel brought the students over to a table display of different kinds of rocks and minerals. Nagel reviewed the name and basic properties of each item and answered students' questions, many of which related to what they learned about soil forming factors and soil particles. Brady brought out some of the tools of the professional soil scientist and let the students handle them. Students looked at bucket augers, step probes, and the perennial favorite, the Montana sharpshooter, which is a special heavy-duty shovel made just for soil surveys.



Figure 2.—Jenna Fultz teaching the five principles of soil health to sixth graders.

On March 27, 2025, Brady and Nagel returned along with Resource Soil Scientist Matti Osterman and helped the sophomore class put soil science to use in a real-world situation. After a brief introduction, Brady explained the mission of the Soil Survey Program and demonstrated the staff's commitment to collecting soil data by displaying a Montana sharpshooter. Staff had welded the sharpshooter back together after a particularly tough dig in the field broke the handle of the 10-pound steel shovel. Brady then brought the discussion back to the students' home court. Knowing basketball is a very popular sport at North Star Schools, he explained how basketball would not be possible without soil. Corn for popcorn, cotton for North Star sweatshirts (Go Knights!), and even the wooden floor of the basketball court come from crops or trees grown in the soil. After this, Brady, Nagel, and Osterman covered the basics of soil texture, soil structure, and soil biology before segueing into the Web Soil Survey activity.



To prepare students for the activity, staff provided a brief demonstration of Web Soil Survey and explained how to retrieve soils information and ratings. The students had to design a new windbreak for the North Star football facility. They used Web Soil Survey to determine the soil map unit and conservation tree and shrub suitability group (CTSG). Then, they used the NRCS booklet Conservation Trees and Shrubs for Montana to select trees and shrubs appropriate for that soil type and CTSG.

The students dove right into the activity, and they totally rocked it! In a few minutes, students had identified their map unit and CTSG and were busily thumbing through their booklets searching for the perfect trees and shrubs for their windbreak. While students worked, Brady, Nagel, and Osterman heard comments like “do we get enough rain for this tree to grow?” and “shrubby cinquefoil is listed, but it only grows 3 feet tall, and that’s not going to make a good windbreak.” Several students who finished early excitedly explored the soils on their family’s farm or ranch. After about 20 minutes, the students had designed their windbreaks, and we had a brief discussion about what trees and shrubs they had selected and why. It was great to see these students engaged and putting our soil survey products to use. It was a great demonstration that had a meaningful impact on this great group of students.

Key Outcomes

Growing up in north-central Montana in the heart of an area known locally as The Golden Triangle, known for its significant wheat production, many of these students already have deep ties to the land around them. Through hands-on demonstrations and fun activities, staff and students discuss how natural resource topics and natural resource conservation affect their daily lives. These events at North Star Schools provided an excellent opportunity to elevate students’ knowledge of soil science, ecology, and geology—students who will become Montana’s next generation of conservationists, ecologists, farmers, ranchers, and soil scientists.