United States Department of Agriculture

NRCS

Natural Resources Conservation Service
National Soil Survey Center
11 Campus Blvd., Suite 200
Newtown Square, PA 19073

Phone: (610) 557-4233
FAX: (610) 557-4136

SUBJECT: Cornell University's Soil Coring Devices May 1, 2012

TO: Larry West
National leader
Soil Research and Laboratory Staff
National Soil Survey Center
Lincoln, NE

On April 4 and 5, I observed the operation of Cornell University's soil coring device at sites located in Franklin and Northumberland Counties, Pennsylvania. Both sites were located within the Northern Appalachian Ridge and Valley (MLRA 147). The Franklin County site is located in an area of Murrill gravelly loam, 3 to 8 % slopes (MrB). The Murrill (fine-loamy, mixed, semiactive, mesic Typic Hapludults) soil formed in colluvium over limestone residuum. The Northumberland County site is located in an area of Shelmadine silt loam, 3 to 8 % slopes moderately eroded (SdB2). The Shelmadine (fine-loamy, mixed, semiactive, mesic Typic Fragiaquults) formed in glacial or periglacial materials. Both soils have fine textured 2Bt horizons. More rock fragments were observed on the surface of the Shelmadine soil than the Murrill soil.

The Cornell University Wolfe Lab crew brought two coring devices with them. The power generator for the Bosch Rotary Hammer failed to turn over. As a consequence, the operation of a 4-cm diameter core with this rotary hammer was not observed (Fig. 1). This device is manufactured by JMC Soil Samplers (http://store.jmcsoil.com/product.php?productid=16177). This lighter-weight core is reportedly easier to punch-down through soil materials than the 4-in diameter core, but it suffers from increased soil compaction resulting in greater errors in soil bulk density calculations. The unit price for this rotary hammer is listed at about $1418. Cores are extracted from the soil using a proprietary adapter (Fig. 2) that comes with the unit.

A Briggs and Stratton rotary power head was used to muscle the 4-in diamond-tipped rotary core bit (Fig. 3). The rotary power head cost about $400. A Tools Direct, 4" wet, concrete-fast cutting, diamond-tipped rotary core bit was used in this investigation (Fig. 4). The diamond-tipped rotary core bit costs about $140 and the extender bar about $100. Along the outer surface of the 60-cm core barrel, marks are etched at 10 cm intervals. These marks are used to guide the extraction of soil cores in 10 cm depth intervals. Because of the build-up of excessive friction, cores are extracted in 10 cm intervals. The contents of the core bit are then removed with trowel and bagged (Fig. 5). This is a rather slow and tedious process. The Cornell Crew reported that it takes about 40 minutes to complete sampling to a depth of 75 cm with this device.

Figure 1. The Bosch Rotary Hammer with 4 cm diameter core is manufactured by JMC Soil Samplers.

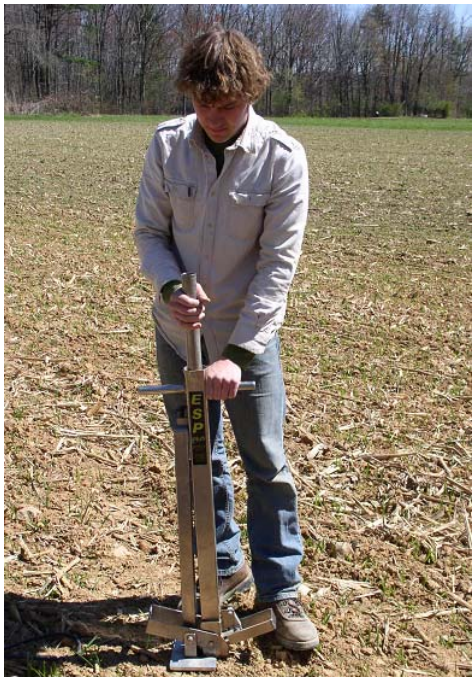

Figure 2. A core extractor comes with the Bosch Rotary Hammer.

Figure 3. Coring with a Briggs and Stratton rotary power head motor and a 4" dia. diamond-tipped core bit with extender bar.

Figure 4. Diamond-tipped rotary core bit is manufactured by Tools Direct. Etched marks at 10 cm intervals are evident on the core bit.

Figure 5. Extracting soil materials from 4" core bit is a rather slow and tedious process.

Figure 6. A sharp eye is needed to match the soil surface with the etched marks on the core barrel.

Although a 4-inch diamond-tipped rotary core bit was used in this investigation, the Cornell Crew observed that other options are available. The 4-inch core bit provided the most accurate measurements of bulk soil density. At both sites, fine textured 2Bt horizons noticeably (but not excessively) slowed coring. At the Shelmadine soil site, a rock fragment in the upper part of the soil profile caused the core bit to move laterally necessitating moving the coring device to a second hole. Another rock fragment was hit and this slide into the core. On extracting the soil sediments from the core, it was observed that the rock fragment had a noticeably incision from the drill. The effectiveness of this device in coarse-textured sediments needs to be evaluated.

These coring devices can drill through rock. They are relatively cheap and easy to operate. However, the Briggs and Stratton rotary power head with 4-in diamond-tipped rotary core bit is rather bulky and cumbersome to carry over long distances. In rocky, forested, rugged and steeply sloping terrains that are inaccessible with a Giddings probe truck; this tool can be used. Guidelines have been prepared for the use of these devices by the Assessment Team. The extraction of 75 cm cores is rather slow (sampling a 4-inch dia. core will take about 40 minutes). This is a serious detraction, as survey design requires economy and the completion of multiple cores and sites by a small survey crew each day.

With kind regards,

Jim Doolittle
Research Soil Scientist