

CARBON ACCUMULATION AND STABILIZATION FOLLOWING MINERAL SANDS MINING IN EASTERN VIRGINIA¹

A.F. Wick², W.L. Daniels, Z.W. Orndorff, and M.M. Alley

Abstract: Soil development and carbon (C) storage associated with prime farmland reclamation following mining are vital for cropping system sustainability and of broader scientific interest due to growing concerns over global warming and C budgeting. The short-term (5-year) effectiveness of soil reconstruction treatments and management practices on soil development and C accumulation were evaluated at the Carraway-Winn Reclamation Research Farm, Dinwiddie VA, USA. Treatments included: biosolids applied at a rate of 78 Mg ha⁻¹ managed with conventional tillage (BIO-CT) and no-till (BIO-NT), 15 cm topsoil cap (TS), and a lime + fertilized control (CON). Few differences were observed among the treatments after four years of soil development. Between 25-30% of the reclaimed soils were aggregated, consisting primarily of microaggregates (53-250 µm). However, C concentrations were two to three times higher in the large macroaggregate (2000-8000 µm; 2.2 – 3.5 g kg⁻¹) fraction with similar concentrations observed in small macroaggregate (250-2000 µm) and microaggregate fractions for the 0-5 cm depth. A more even distribution of C concentrations across aggregate size classes was observed in the 5-20 cm depth. Total C pool values ranged from 7.10 to 11.1 Mg ha⁻¹ in the 0-5 cm and 14.2 to 25.8 Mg ha⁻¹ in the 5-20 cm depths. Between 40-60% of total C was in the organo-mineral pool and 30-40% in the aggregate protected pool. Though short-term treatment and management effects on soil aggregation and C were similar, there was strong evidence that future analyses (perhaps after five additional years) of these soils for the same parameters would be beneficial for assessing soil development and fine-tuning C storage potential predictions.

Additional Key Words: microbial biomass, mineral sands mining, nitrogen, tailings, sequestration

¹ Paper was presented at the 2012 National Meeting of the American Society of Mining and Reclamation, Tupelo, MS *Sustainable Reclamation* June 8 – 15, 2012. R.I. Barnhisel (Ed.) Published by ASMR, 3134 Montavesta Rd., Lexington, KY 40502

² Abbey F. Wick, Senior Research Associate, W. Lee Daniels, Professor, Zenah Orndorff, Senior Research Associate, Mark Alley, Professor, Dept. of Crop and Soil Environ. Sciences, Virginia Tech, Blacksburg, VA 24061-0404.