LONG-TERM CARBON AND NUTRIENT ACCRUAL IN COAL MINE TOPSOIL SUBSTITUTES IN SOUTHWEST VIRGINIA[1]

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Abstract: Topsoil substitute selection is fundamental for the long-term success of reclamation efforts to restore native vegetation to the post-mining landscape in the Appalachian Coal Region. Thirty years of continued research on the Controlled Overburden Placement Experiment at the Powell River Project in Wise County, Virginia is used to evaluate the status of soil carbon and nutrient accumulation and retention in reclaimed mine soils under forest and herbaceous vegetation over a gradient of topsoil substitutes. The topsoil substitutes range from pure sandstone (SS) to pure siltstone (SiS) and include ratios of 1:2, 1:1, and 2:1 SS to SiS mixes. Total carbon (TC) and total nitrogen (TN) were determined with dry combustion; soil organic carbon (SOC) with Walkley-Black wet oxidation digestion; available phosphorus with $NaHCO_3$ extraction and ICP analysis; and particle size analysis with the pipette method. Results show that carbon and nutrient concentrations are related to changes in SS:SiS ratios under forest vegetation; however, some nutrient contents were not different between rock mix types. Dependent on rock mix type, differences in carbon and nutrient concentrations and contents occurred between the herbaceous and forested vegetation. Results indicate that different topsoil substitutes have different capacities for soil carbon and nutrient accumulation, which can be related to vegetative cover. Comparison of carbon and nutrient characteristics in long-term, reclaimed soils to present-day, adjacent, un-mined soils have been explored and provide insight into the carbon and nutrient development and trajectory of varying topsoil substitutes. Choice of overburden rock type may differentially affect the success of revegetation and some ecosystem services (e.g., C sequestration, long-term nutrient availability, tree productivity), including the timeframe in which these services can be returned to the post-mining landscape.

Additional Keywords: phosphorus, nitrogen, revegetation

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