

LONG-TERM EFFECTS OF ROCK TYPE AND WEATHERING ON SOUTHWEST VIRGINIA MINE SOILS¹

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Abstract: In Southwest Virginia and the central Appalachian coal fields, native soils are often rocky, shallow, infertile and acidic which limits their use in coal mine reclamation and frequently leads to the utilization of topsoil substitutes derived from blasted rock spoils. The Rock Mix (RM) experiment reported here compares five different combinations of sandstone (SS) and siltstone (SiS) spoils that were constructed and revegetated in 1982. The plots have been split between forest and herbaceous vegetation since 1983 and have been sampled and studied on multiple occasions over time. This paper presents a summary of earlier study data from the 1980's and 1990's compared with new findings from our 2008 sampling event related to pedogenesis, vegetation response and long-term treatment effects on the herbaceous portion of the experiment. Overall, our results indicate significant weathering and soil development over 26 years. Rock fragment content has declined in all treatments, but was most pronounced in the 2:1 SS:SiS mix with a net decline of 17% between 1982 and 2008. Rock type differential effects are still evident, however, in the particle size distribution, pH and electrical conductivity of the different resultant mine soils. Fine earth sand content has decreased over time as silt has increased, particularly in the higher SiS mixes. Extractable Fe-oxides increased significantly in all treatments over time, particularly in the earlier years, while extractable P dropped due to fixation and possibly incorporation into organic fractions. Macro and micronutrients were sufficient in all treatments over the 26 years and CEC increased dramatically with increasing SiS proportion due to higher fine silt + clay contributions and higher pH. No long-term effects of rock type were evident on standing herbaceous biomass, however. By using a novel new approach to quantify net organic C accumulation with corrections for geogenic-C in the original spoils, we have quantified net whole soil C-sequestration rates of approximately 0.6 Mg ha⁻¹ per year over the study period. Spoil type recommendations for long-term establishment and maintenance of pasture and hayland should be mixtures of SS and SiS whereas for reforestation, a pure SS or 2:1 blended mix appears superior.

Additional Key Words: Revegetation, topsoil substitute.

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