CARBON AND NUTRIENT DYNAMICS IN REFORESTED MINE SITES WITHIN THE EASTERN KENTUCKY COAL FIELDS[1]

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Abstract: Kentucky has been heavily impacted by surface mining resulting in substantial loss of carbon from the lithosphere and biosphere, causing significant forest fragmentation. In the Eastern Kentucky coal fields alone, several hundred thousand acres of mined sites exist with the potential to sequester carbon, reduce erosion, and restore ecosystem processes if properly reclaimed. This study addressed nutrient cycling and the carbon sequestration potential of reforested uncompacted (loose dumped) mine sites. We examined six reforested mine sites of different ages (age after reclamation between 1 and 8 years) and six adjacent post-harvest forest sites of varying ages (between ages 3 and 20 years) for various ecosystem processes and parameters including soil CO_2 respiration, soil moisture and temperature, decomposition, litterfall, microbial biomass, microbial C and N, and microbial activity. We also examined soil organic matter changes occurring within homogeneous soil plugs. Initial results over the past year suggest that as the reforested mine sites age, they become similar to the younger post-harvest sites with respect to soil CO2 respiration, soil temperature and soil moisture. However, microbial analysis has shown that dehydrogenase activity on the older reforested mine sites is still not comparable to the younger post-harvest forests. This suggests that soil CO_2 flux on the older reforested mine sites has more root respiration as opposed to microbial respiration when compared to the younger post-harvest sites. With this study, we expect to gain insight as to how nutrients cycle on surface mine sites with newly established forests compared to forests regenerating after harvest, and we will address the potential for redeveloping forest ecosystems to store carbon in soils and biomass.

Additional Key Words: Reforestation, carbon sequestration, soil efflux

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