

# Restoration of the Soil Microbiome Following Mine Land Reclamation<sup>1</sup>

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**Abstract:** Federal law requires coal companies to restore a previously-mined site to equal or better condition as it was prior to the initiation of mining activities. In West Virginia alone, more than 500,000 acres of land have been reclaimed in the past 40 years. However, in many cases, even after reclamation standards have been met, poor soil quality still limits the potential for profitable post-mining land uses. One crucial knowledge-gap in mine land reclamation is how reclamation practices impact the assembly and recovery of the soil microbial community. Elucidating microbial community assembly processes in these lands is important, because the soil microbiome contributes to critical ecosystem services, for example, carbon (C), nitrogen (N), and phosphorous (P) cycling and storage. To address this knowledge gap, soil samples were taken at four sites in northern West Virginia which were reclaimed from strip mining activities 2, 10, 15, and 32 years ago; all four sites are within a 15-mile radius, experience a similar climate, and have similar soil types and reclamation strategies. It is hypothesized that, with increased time since reclamation, microbial activity, and diversity will increase, thus increasing soil quality. With increased time since reclamation, the soil microbiome displayed an increase in extracellular enzyme activity associated with labile C compound mineralization ( $\beta$ -glucosidase; + 61.6%,  $P < 0.05$ ) and N mineralization (N-acetyl- $\beta$ -D-glucosaminidase; + 121.4%,  $P < 0.05$ ), and a decrease in enzyme activity associated with complex C compound mineralization (peroxidase and phenol oxidase; - 71.5% and - 54.8%, respectively;  $P < 0.05$ ). The soil microbiome also increased in biomass (+ 53%;  $P < 0.05$ ) over time. Together, these data suggest the importance of labile C and organic N, as well as the lesser-importance of recalcitrant C to the recovery of the soil microbiome and thus, soil health following mine land reclamation.

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