LEAF LITTER BREAKDOWN IN RECONSTRUCTED APPALACHIAN COAL-MINE STREAMS: RELATIONSHIPS TO ENVIRONMENTAL VARIABLES[1]

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Abstract: Compensatory stream mitigation projects are intended to produce ecological benefits to offset those lost due to mining impacts to streams. Historically, post-construction assessment of streams reconstructed as compensatory mitigation has focused on structural measures such as water chemistry, channel stability, habitat features, and biotic assemblage metrics. Recent guidance from the USEPA requires functional replacement for stream losses. Allochthonous organic matter serves as essential habitat and an energy source within headwater and downstream environments. Therefore, organic matter dynamics are essential to functional assessment of reconstructed stream condition. This research is measuring leaf litter breakdown rates of *Quercus alba* leaves for eight low-order mining-impacted stream reconstructions, evaluating those rates through comparisons to four minimally impacted reference streams, and determining relationships of chemical and physical factors with those rates. Coarse-mesh and fine-mesh bags were loaded with 6.5 g (±0.01 g) of *Q. alba* leaves, and 288 of each type were deployed in study streams in December 2010. Bags were retrieved in triplicate monthly through April 2011, and bi-monthly thereafter through October 2011. After washing, mean percent ash-free dry mass remaining was determined, and an exponential decay model was used to determine breakdown rates (day^{-1} and $degree\text{-}day^{-1}$). Mean coarse-mesh leaf breakdown in forested reference streams ($0.023 \pm 0.003\ d^{-1}$) was nearly twice as fast as that measured in mined streams ($0.012 \pm 0.005\ d^{-1}$). Similarly, fine-mesh leaf breakdown in mined streams ($0.007 \pm 0.003\ d^{-1}$) was approximately half the rate measured in forested reference streams ($0.013 \pm 0.003\ d^{-1}$). We anticipate that relating these measures with structural factors will be useful in guiding both stream reconstruction projects, which seek to re-establish functional processes, and functional assessments of such projects.

Additional Key Words: stream restoration, leaf litter breakdown, stream function, stream structure, mitigation, organic matter dynamics.

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