Coal-Mine Hollow Fill and Settling Pond Influences on Headwater Streams In Southern West Virginia

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Abstract[1]

The attributes and long-term influences of four coal-mine hollow fills and associated settling ponds were assessed in three headwater stream watersheds of southern West Virginia. Drainages originating from the hollow fills had elevated conductivities compared to a regional reference station at all monitoring locations, and elevated metal concentrations at all monitoring locations above the settling ponds; elevated conductivities and metal concentrations are a common occurrence in waters draining mining operations because the fracturing of consolidated overburden materials into particles and fragments that can be handled by earth-moving equipment exposes unweathered mineral surfaces to elevated rates of mineral dissolution when groundwater flows through the void spaces. All pHs were in the range of 7.1 to 8.2. The fact that aluminum concentrations were high relative to aluminum solubility at circumneutral pH, the lack of a visible precipitate, and the high water hardness levels suggest some portion of the metals analyzed occurred in non-bioavailable forms, such as colloidal mineral structures, despite the fact that samples were filtered at 0.47 microns.

Benthic macroinvertebrate sampling and *in situ* Asian clam testing were utilized to assess the hollow fills' influences upon these low order streams. Benthic macroinvertebrate richness was not affected consistently by the hollow fill drainages. Most monitoring stations in the fill drainages, including all stations with average conductivities of approximately 1500 μS/cm or above, lacked *Ephemeroptera* taxa. Chlorophyll *a* concentrations were higher in the ponds than at monitoring locations above the ponds, indicating the presence of algal populations stimulated by nutrients released from the hollow fills revegetation. Collector filterer populations were elevated at monitoring stations directly below the sedimentation ponds, relative to both the regional reference stream and other monitoring stations, indicating that organic enrichment by the ponds influenced macroinvertebrate community structure downstream from the ponds. Asian clam growth was enhanced by the presence of the settling ponds, as the greatest 60-day growth occurred directly downstream of the ponds growth deceased moving downstream from the ponds, providing further evidence of influence by organic enrichment by the ponds. The ponds also appear to serve as sinks in collecting some trace metals from the hollow fill drainages, as sediment Al, Fe, As, Hg, Pb, and Se diminished at all sites below the sediment ponds relative to the ponds and drainages above the ponds.

Macroinvertebrate communities of streams influenced by coal-mine hollow fills differed from a regional reference station due to organic enrichment from ponds constructed below the fills to prevent sediment release; the ponds also appear to capture metals being released from the fills, and the influence of organic enrichment dissipates moving downstream below the ponds.

[1] Abstract of research publication that is being submitted to a peer-reviewed scientific journal.