Effects of Precipitation Patterns on Sediment, Nutrient, and Biofilm Dynamics in an Acid Mine Drainage Stream[1]

J. Brancho, N.A. Kruse Daniels*, and M. L. Vis[2]

Abstract: Although acid mine drainage (AMD) in the Appalachian Coal Basin has been studied for decades; the effects of climate change on these streams are not well documented. Climate change predictions for this area include increased storm frequencies and intensities, which may alter AMD generation and iron hydroxide precipitation. These processes substantially affect nutrient availability and the biological communities inhabiting these streams. This study investigates the potential effects of climate change on a treated AMD stream, Hewett Fork, by quantifying changes in nutrient concentrations, sediment transport, and algal biofilm biomass during normal and storm conditions. Nitrate, sulfate, and total reactive phosphorus concentrations were measured during each sampling event. Sediment transport was measured by quantifying sediment deposition and total suspended solids (TSS). The biological response to these conditions was measured by comparing algal biofilm biomass, quantified as chlorophyll a concentration, on stream rocks. Coupled with long-term meteorological, discharge, and chemistry data, the results of this study were used to create two conceptual models of Hewett Fork's behavior during normal and storm conditions, respectively. Antecedent precipitation index (API) was used as an indicator of runoff potential to analyze the effects of recurring storm events on stream behavior. As API increased during both normal and storm events, TSS concentrations increased, while chlorophyll a, conductivity, and sulfate concentrations decreased. TSS, nitrate concentration, and sediment deposition were higher overall during storm events. Total reactive phosphorous concentration remained low at all sites during the sample period, indicating that Hewett Fork may be phosphorous-limited. The results of this study indicate land use, mining, and treatment systems may contribute to lasting negative impacts on the biological community of Hewett Fork, if storms become more frequent and intense. Additionally, the inverse relationship between chlorophyll a values and sediment transport suggests current velocity may also exert significant control on the system.[3]

Additional Key Words: stream recovery, climate change, coal.

---

1. Oral paper presented at the 2019 National Meeting of the American Society of Mining and Reclamation, Big Sky, MT. Welcome Back to Montana: The Land of Reclamation Pioneers, June 3–7, 2019. Published by ASMR, 1305 Weathervane Dr., Champaign, IL 61821.

2. Jennie Brancho, student, Environmental Studies, Ohio University, Athens, OH 45701; Natalie A. Kruse Daniels (* presenter), associate professor, Environmental Studies, Ohio University, Athens, OH 45701; and Morgan L. Vis, professor, Environmental and Plant Biology, Ohio University, Athens, OH 45701.

3. Work reported here was conducted near 39°22'44" N, 82°15'57" W.