Assessing Lost Ecosystem Service Benefits Due to Mining-Induced Stream Degradation in the Appalachian Region

Economic Approaches to Valuing Recreational Fishing Impacts

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Abstract

Sport fishing is a popular activity for Appalachian residents and visitors. The region's coldwater streams support a strong regional outdoor tourism industry. We examined the influence of surface coal mining, in the context of other stressors, on freshwater sport fishing in mountaintop removal mining regions of southern and central West Virginia.

We integrated ecological and economic models to estimate changes in recreational fishing values for two scenarios: partial (20%) and full (100%) mineout of existing leases in the study area relative to current conditions. The analysis comprised three spatially detailed model components: an ecological model that predicts changes in fish abundance and diversity due to surface mining; a meta-analysis of willingness to pay (WTP) for freshwater recreational fish species; and a spatial trip demand model that estimates fishing demand by location. The ecological modeling team applied empirical (boosted regression tree) models to characterize both overall effects on fish communities and to identify changes in key sport fish endpoints under the two mining scenarios (Petty et al. in prep). We used these results as inputs to a benefit transfer in order to evaluate welfare effects of changes in recreational angling values.

For the economic meta-regression model (MRM), we modified an existing MRM of recreational fishing values. We revised the model by incorporating additional recent studies, and refitting with alternative structures to reflect advances in meta-analysis methods. Because the region lacks creel survey data, we used a spatial trip demand model to estimate fishing participation. The demand model applied kernel density estimation modeling to apply an observed distribution of travel distances among angler participants to spread people (or trips) from origin points (residences) to destinations. This level of spatial detail allowed us to overlap ecological changes with levels of use to capture the spatial variability of welfare effects in this sparsely populated region.

Ecological and demand model results were aggregated to 10-digit Hydrologic Unit Code (HUC10) watersheds. The estimated total days demanded for freshwater fishing per HUC10 watershed in a given year ranged from 6,490 to 51,900. Watersheds closer to urban areas showed higher demand, as expected. We applied the MRM using expected changes in catch rates for the two mining scenarios

relative to current conditions. The total baseline willingness to pay for recreational angling in the study area is estimated as $1.7 million to $23.6 million per year, depending on assumptions regarding the baseline annual number of fish caught in the region. Estimated reductions in value for the partial mineout scenario range from $13.6 thousand to $182.2 thousand per year; estimated reductions in value for the full mineout scenario range from $76.2 thousand per year to $1.0 million per year. The spatial distribution of WTP values show that economic impacts tend to be greater in the southern portion of the study area. This pattern can be largely explained by greater ecological impacts in these streams; however, part of the effect is also due to expected differences in fishing participation within watersheds.

Petty, J. T., E. R. Merriam, A. Anderson, B. Rashleigh, L. Reynolds, M. J. Mazzotta, and L. A. Wainger. (in prep). Predicting Fishery Response To Mountaintop Removal Mining In Central Appalachian Watersheds. Division of Forestry And Natural Resources, West Virginia University, Morgantown, WV.