Predicting the likelihood of impaired stream segments using Geographic Information System on Abandoned Mine Land in Gangwon Province

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Abstract

The study in river basin has been performed for the identify water quality impaired stream segments, to create a priority ranking of those segments, and to calculate the heavy metal ion distribution for each impaired segment based on chemical and physical water quality standards. Two methods for modeling the potential area-specific heavy metal distribution are pursued in this study. First, a novel approach focuses on distance. Heavy metal distribution can be associated with a particular small geographic area. Based on the derived estimates an distribution map can be generated. Second, the approach is used the near watershed by means of kriging interpolation algorithm. These approaches provide an alternative distribution mapping of the area. The exposure estimates from both of these modeling methods are then compared with other environmental monitoring data. A GIS-based model will be used to mimic the hierarchical stream structure and processes found in natural watershed. Specifically, the relationship between landscape variables and reach scale habitat conditions most influential found in the Abandoned mine will be explored.

Key words: Impaired stream, Heavy metal ion, Watershed, River basin, AML

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1. Introduction

The Korean Water Environmental Act(KWEA)(2005) requires states and tribes to identify water quality imparied stream segment, to create a priority ranking of those segments, and to calculate the heavy metal ion load and non-point source load for each imparied segment based upon chemical and physical water quality standards. Especially, mining non-point sources include discharges from inactive mining operations as well as runoff from roads and old tailing and spoil piles. Active mines are considered as a point sources for which a discharge permits is required. Although mining is not as widespread as agriculture, water quality impairment resulting from mining is usually more harmful; sediment discharges and concentrations from mines can be extremely high, furthermore, entire streams may be biologically dead as a result of acid mine drainage. Erosion and sedimentation problems are associated with almost every abandoned surface coal mine.

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A GIS-based model will be used to mimic the hierarchcal stream structure and processes found on natural watershed. Specifically, the relationship between mining on land and stream water quality can be quantiified. Acid mine discharge flow according to landscape variable such as catchment area, landuse type and geology. These parameters can be used to predict impact of ecological and environmental aspects

2. Materials and Methods

2.1 Study area

1) Located within Kunsun river watershed
2) Approximately 195 km^2
3) Elevation: 850 m to 1300 meters
4) Elevational banding in temperature and precipitatin
5) Pattern of microclimate resulting from aspect
6) Vegetative patterns due to differences in elevation, latitude, direction of prevailing winds, and sloope exposure
7) Predominant landuse: Agricultural land and mining
   - total 3 mines exist in Kunsun river watershed but all closed

2.2 Environmental Monitoring and Assessment Program

1) Chemical and physical data collected in 2006 by KIST-Gangneung Institute
2) To determine whether increased metal concentrations were causing a decline in the biolological integrity of the stream(USEPA, 1993).

2.3 Prediction likelihood Conceptual Model
1) Stream and AML characterization and Habitat investigation
2) Develop conceptual Model
3) Spatial Analysis
4) Develop Statistical Models
5) Model Evaluation
6) AML and Stream Evaluation

3. Results

In Gangwon Province, while the impact of effluent on the stream communities where it is discharged is not well monitored, enhanced technique has been done for the direct assessment of ecotoxicological potential of AMD distribution. In this study, a statistical model will be produced using collected GIS datasets. Heavy metal distribution map shows the likelihood of water quality impairment for each stream network.

Acknowledgement

Reference

1. U.S.Environmental Protection Agency. Biological Indicators of Watershed Health; Design a Sampling Effort. 2002.3
2. U.S.Environmental Protection Agency. Regional Environmental Monitoring and Assessment Program. 93. Washington, D.C., U.S.Environmental Protection Agency, Office of Research and Development