**Spatial Analysis of Mountaintop Mining’s Impact on Water Quality**

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**Introduction**

- Since the 1970s, mountaintop mining (MTM) has been an important driver of land use change.
- MTM has been shown to have extensive effects on both biological communities and water quality downstream of the mining.
- The effects of MTM can persist for decades after mining has ceased.
- Little is known about the influence of other potentially confounding land-covers and the spatial scale upon which they act.
- Our research is focused on the Southern Appalachian Mountains in Kentucky, a biologically diverse region that has been heavily mined since the 1970s.

**Research Questions**

- How does mountaintop mining affect water quality and macroinvertebrate communities?
- What are the relative influences of mining, agriculture, and urbanization on water quality?

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**Methods**

- Water chemistry data were collected by the KY Department of Environmental Protection.
- Mining data were provided by SkyTruth; SkyTruth uses Landsat imagery and digital mapping to identify areas affected by coal mining.
- Agriculture and urbanization data were obtained from the StreamCat dataset.
- Geospatial statistical analysis in ArcGIS and the R statistical environment were used to calculate the amount of mining in each catchment and watershed.
- We used Generalized Linear Mixed Models (GLMMs) and multimodel inference to predict conductivity as a function of mining, cropland, pasture, and urban land-covers at multiple spatial scales, stream size, and Julian day of sampling (n=527 sampling occasions across 285 unique sampling stations).

**Results**

- Best model (lowest AICc):
  \[ \text{Cond} \sim \text{Mining}_{ws} + \text{Crop}_{ws} + \text{Urban}_{ws} + \text{Pasture}_{ws} + \text{Pasture}_{cat} + \text{JDay} + \text{JDay}^2 + (1|\text{Reach}) + (1|\text{Station}) + (1|\text{Ecoregion}) + (1|\text{Year}) \]
- Coal mine, cropland, and urban area at the watershed scale are positively correlated to stream conductivity.
- Pasture area is positively correlated with conductivity at the catchment scale but negatively correlated at the watershed scale.

**Conclusions**

- Although other land-use variables affect conductivity, mining has the largest impact.
- In general, all stressors have a larger impact at the watershed scale than at the catchment scale.

**Future Directions**

- Analyze the effects of land-covers on other water chemistry variables in a multivariate framework.
- Relating land-cover and water chemistry to macroinvertebrate community structure.

**References**


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