Social Science and Water Resources Relationship Mapping for Informed Planning and Management in Minnesota

Project Background

Although much progress has been made in monitoring and engineering technology, comprehensive assessments of the human dimensions of water resource management lag behind. This project builds on and synthesizes ongoing research at the Center for Changing Landscapes (CCL), University of Minnesota investigating conservation decision making in rural, urban, and mixed-use watersheds across Minnesota. Researchers at CCL have thus far collected survey data from nine Minnesota watersheds examining landowner values, beliefs, and norms associated with clean water conservation behavior. The purpose of this study is to synthesize and visualize social data from two of these watersheds, Sand Creek and Middle Minnesota River, using geospatial techniques.

Approach

Existing survey data are synthesized using ArcGIS Pro to create geospatially referenced data visualizations and findings for water resource decision making. Survey data from the study watersheds is imported into ArcGIS Pro and attached to parcel data for spatial analysis. Using survey data from Middle Minnesota and Sand Creek watersheds as a pilot model, various graphic strategies were tested within GIS (geo-referencing, heat mapping and various interpolation methods) to find the best representation of the data while still protecting survey respondent privacy.

Inverse distance weighted interpolation (IDW) was determined to be the best method, given that individual survey responses and respondent locations are collected into and masked by a local value maintaining privacy and thus, meeting IRB requirements for protecting human subject anonymity. Shaded polygons represent a calculated statistical average of responses in a cluster of parcels, not specific to individual responses or parcels. Each graphic model provides visual results of one dataset or survey question with consideration to the possible range of values.

Findings

This visualization study can be used to identify conservation opportunity hot spots or areas that are socially suitable for future conservation initiatives.

Conclusions

After evaluating the results of each interpolation, some benefits and limitations emerge from this study. In neighborhoods which the community holds strong consensus of opinions and values, the resulting maps provide clear guidance from which planners can successfully identify conservation opportunity areas and create targeted program efforts. These maps can be integrated as a layer with other biophysical data to evaluate if there are correlations. However, when opinions vary within the same neighborhood the efficacy of this type of study is reduced; this methodology cancels out opposing views, meaning when opinions are mixed the visualization results skew to neutral. This is evident when comparing the Middle Minnesota watershed with the Sand Creek watershed. Sand Creek had more mixed opinions in each neighborhood, thus a casual review of the data gives the impression that the communities are less motivated one way or another for each topic addressed. Nevertheless, whether skewed to neutral or highly-opinionated, these visualizations can provide quick comprehension of the values and opinions of community areas and can be used to establish successful priorities and mobilization of conservation efforts.

References


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