



STATISTICAL APPLICATIONS AND GEOGRAPHIC INFORMATION SYSTEMS

USING CUTTING-EDGE TECHNIQUES TO SUPPORT EPA DECISIONMAKING

Since the mid-1990s, CSC has supported multimillion-dollar sediment assessment and remediation projects and large-scale environmental monitoring projects for EPA. Our statistical support to EPA programs includes projects under the Clean Water Act and the Great Lakes Legacy Program. Our clients include the Office of Water, including the Office of Science and Technology, and the Great Lakes National Program Office.

Supporting Effective Contaminant Assessment and Cleanup

CSC uses Geographic Information Systems (GISs) and geostatistical tools in planning and implementing major sediment assessment and remediation projects to assist EPA in describing the nature and extent of sediment contamination and to evaluate the achievement of cleanup goals.

These state-of-the-art tools facilitate information accessibility and dissemination to stakeholders while improving the decision-making capabilities of project managers.

Through the use of GIS and geostatistical tools, such as kriging, CSC has generated site maps illustrating contaminants of concern to assist project planners in conducting remedial investigations and feasibility studies. CSC also uses these tools to develop remedial designs and estimate sediment volumes that need to be removed to achieve specific cleanup goals for the targeted contaminants of concern.

Who We Are and What We Do

CSC's statistical applications and GIS staff members include biostatisticians and GIS experts. Staff experience includes statistical analysis methods,

"Kriging" refers to a group of geostatistical techniques used to interpolate sediment concentrations at an unsampled location from observations at nearby sampled locations. Through generating kriging maps for EPA, CSC has helped the agency save resources by efficiently identifying the areas of highest contamination for cleanup and providing a means to assess whether cleanup goals have been reached.



**Benefits to EPA**

- *Saves resources and generates cost savings through delivering full and accurate descriptions of sediment contamination*
- *Provides methods for establishing and assessing the achievement of cleanup goals*
- *Improves availability of data for use by stakeholders*
- *Promotes more-informed decision making by project managers*
- *CSC's geostatistical support was credited with saving approximately \$100,000 in dredging costs. The award nomination cited the geostatistics conducted by CSC as an innovation in technology.*

statistical software programming, analysis and management of environmental and health-based data, spatial data analyses and 3-D hydrogeologic modeling for feasibility and remediation system design. Project support provided by these staff members encompasses areas including:

- Spatial modeling (kriging)
- Statistical sampling designs
- Analytical data verification
- Remedial design
- Pre- and post-remedial sediment volume calculations
- Report development
- Interpreting method validation studies
- Quality assurance
- Technical training

The CSC-EPA Collaboration: What We've Accomplished

Geostatistics and GIS. CSC calculated surface weighted average concentrations and prepared kriging maps for several contaminants of concern in support of a sediment contaminant baseline assessment project in the Ashtabula River in Ohio. In support of a potential sediment remedial action at the Division Street Outfall in Michigan, we developed kriging maps of mercury concentration data and calculated sediment volume estimates.

Statistical Sampling Designs. CSC developed statistical sampling designs and associated data quality objectives (DQOs) for a major sediment assessment project encompassing more than 1,000 acres within the St. Louis River Area of Concern (AOC), including a sampling design for the toxicity sampling and analysis. CSC has prepared statistical sampling designs for more than 10 major sediment assessment and remediation projects.

Data Interpretation. CSC provides data interpretation support to EPA on the Great Lakes Water Quality Survey Biology Program. Our support includes evaluating species-specific environmental preferences of diatoms across all of the Great Lakes. We evaluate monitoring data to identify possible dreissenid effects in the offshore waters of the Great Lakes by assessing trends in nutrients,

chlorophyll and transparency across all the lakes, assessing bottom turbidity as a possible station-specific indicator of dreissenid population development and examining relationships between bottom turbidity and variables potentially impacted by dreissenid filtration activities. CSC has published results of these analyses in partnership with EPA in several journals including the *Journal of Great Lakes Research*.

Detection and Quantitation Issues. CSC has provided statistical support in the validation of a wide variety of new chemical and microbiological methods, including study design and establishment of acceptance criteria for laboratory quality control samples. As an extension of these activities, CSC provides support to EPA under the Federal Advisory Committee on Detection and Quantitation (FACDQ), including performing statistical analyses of a large-scale study of various methods of establishing method detection limits, and providing guidance and independent evaluations of various statistical concepts and methodologies.

Success Story: Saving \$100,000 in Dredging Costs

CSC supported the Ruddiman Creek cleanup project, which was named Project of the Year for the State of Michigan by the American Public Works Association. This sediment remediation project, led by EPA and the Michigan Department of Environmental Quality (MDEQ), focused on the removal of substantial amounts of contaminated sediments from the creek that were threatening human health and the environment.

CSC provided state-of-the-art geostatistical support to monitor dredging activities and verify that cleanup goals were met. CSC created maps of the contaminants in the sediments and assisted EPA and MDEQ in focusing dwindling resources on the most contaminated areas of the site. CSC also was responsible for conducting data verification of all of the analytical data generated during the project, tracking and uploading field and analytical data to the GLNPO sediment database (which CSC developed) and conducting an onsite audit of field activities.

CSC's innovative use of geostatistical tools in support of sediment assessment and remediation projects has been presented at multiple conferences, including at the Society of Environmental Toxicology and Chemistry (SETAC) North America 28th Annual Meeting in a presentation entitled "Borrowing Tools from Goldiggers: Using Geostatistics in Sediment Assessment and Remediation Projects."

For More Information

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