Why environmental data analytical results are challenged (and what to do about it) (Newsletter)*

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Have you missed a permit compliance monitoring or reporting event and been financially penalized?

Has your environmental impact statement approval been delayed by regulators' paralysis by analysis or by many challenges from project opponents?

Has your farm or livestock operation been accused of degrading a nearby water body although you comply with discharge permit monitoring requirements?

Have you suffered from the "battle of competing experts" in litigation confusing finders of fact on what your environmental data reveal about the case?

Has your reclamation bond release been delayed or denied because regulators or others lack confidence that the reclamation trajectory is that of natural plant secondary succession or fluvial geomorphic changes of the natural ecosystems in which it is located?

These situations, and many similar ones, share two underlying issues: lack of effective explanation to decision-makers of ecosystem complexity, and inappropriate models used to analyze environmental data. How environmental data are analyzed really matters.

Environmental data have two critical components commonly excluded from analyses, although they they are necessary to explain available data: space and time; i.e., where and when the observations or measurements were made. One reason space and time are so important in understanding environmental data is that they allow robust estimates of environmental values at locations not sampled. For example, location and time of geochemical samples are essential to properly evaluate the importance of toxic chemical concentrations in aquatic ecosystems such as mine pit lakes, streams and rivers, and contaminated soils at brownfield sites.

The standard tools for analyzing environmental data are statistical models designed for experimental data. These inappropriate models are a major cause of regulatory and legal issues.

Environmental data are observational, not experimental. Environmental science does not have replicates, treatments/controls, and hypothetical expectations of no change caused by human activities which are the basis for statistical analyses of experimental science. There is no "significance" to be found in data collected from geochemical, biological, geographical, geological, or physical data in natural ecosystems.

Ecosystems vary over space and time at different scales. To understand these complex and changing environments (particularly for compliance with environmental laws such as the CWA, CERCLA, RCRA, NEPA, and FIFRA) regulators, litigators, and the public must be confident that the statistical model's results appropriately represent ecosystem dynamics. Then decision-makers have a solid basis for evaluating whether a proposed or existing human operation might (or does) adversely affect a specific designated use at a specific location.

Because natural ecosystems and the human activities that occur in them are highly variable the analytical models used to analyze environmental data must accommodate the variability and uncertainties while producing robust, technically sound, and legally defensible results.

When you need, or want, to resolve and avoid issues due to inappropriate analyses of environmental data, and to provide finders of fact with clear and effective explanations of the data and what they mean, contact me. I will provide you with the knowledge and understanding you need using existing environmental data.

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