Bringing Environmental Policy and Regulation into the 21st Century, Part 4 (Newsletter)*

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The three previous parts of this series described statistical frameworks for objectively analyzing environmental data and explaining where each is appropriate. Correct statistical models applied to environmental concerns are powerful tools for regulators, permit holders, attorneys, and consultants. Results are more technically sound and legally defensible than the commonly used methods. Appropriate statistical analyses can demonstrate compliance with statutory goals and objectives.

The Clean Water, Endangered Species, and National Environmental Policy Acts are three statutes affecting natural resource industries.

Section 101(a)(2) of the Clean Water Act (CWA) states, "it is the national goal that wherever attainable, an interim goal of water quality which provides for the protection and propagation of fish, shellfish, and wildlife and provides for recreation in and on the water be achieved ..." The best way to assess attainment of this goal is measurement of aquatic ecosystem variables, their statistical analysis, and interpretation of results in appropriate ecological contexts.

The EPA's approach is "Guidelines for Deriving Numerical National Water Quality Criteria for the Protection Of Aquatic Organisms and Their Uses" that aims to develop "a national criterion ... needed for a particular material." There are so many differences in aquatic ecosystems within the US that a more pragmatic approach uses the most sensitive aquatic biota – benthic macroinvertebrates – to quantify the local community's variability and response to anthropogenic activities. Natural variability will change over time, even in areas with no immediate anthropogenic activities. Natural variability establishes a baseline against which anthropogenic operations can be quantitatively compared.

The Endangered Species Act (ESA) has laudable goals but the details of implementation continue to be subject to scientific and legal dispute (e.g., the white paper, "Distinct Vertebrate Population Segments/Evolutionarily Significant Units," on the library page of our web site.)

Advanced statistical models appropriate to quantify relationships between animal populations, distributions, and habitats have been developed in the past quarter-century. These include quantile regression examining population-habitat relationships depending on the population size quantiles rather than the mean, Bayesian and Markov Chain Monte Carlo models to assess a species' presence or absence at a location and estimate the probability distribution of a population given dozens, or hundreds, of potential explanatory variables.

The National Environmental Policy Act (NEPA) publicly discloses the process used by lead agencies when selecting the preferred alternative for a project such as a mine or electrical power generator. NEPA's Section 101 (a) states that "environmental quality is to be maintained consistent with fulfilling the social, economic, and other requirements of present and future generations of Americans."

Advanced statistical models quantify existing conditions and cause-and-effect relationships. Ecological interpretation of results provide objective criteria for federal decision-making. These models quantify the dynamics of the existing ecosystems, forecast potential effects of each alternative, and objectively describe future conditions. These situations frequently occur when a species of concern is thought to be present in a project's area.

Regulators should adopt these procedures because they justify decisions based on project-specific science and data analyses. Operators need to adopt these environmental data analytic models because they quantify environmental stewardship and sustainability and are metrics that can reduce or eliminate environmental risks. Results inform decisions by site managers, corporate executives and Boards, investors, and lenders.

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