INVITED DISCUSSION ON "WHAT SHALL WE TEACH IN ENVIRONMENTAL STATISTICS?" BY: WALTER PIEGORSCH AND DON EDWARDS

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Invited discussion on "What shall we teach in environmental statistics?"

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In contrast to the course outlined by Piegorsch and Edwards that aims at providing a survey of statistical methods that might prove useful in studying the environment, the Environmental Statistics course at Cornell operates as a capstone course oriented towards quantitative environmental problem solving. The Environmental Statistics training grant at Cornell is geared towards students who have already demonstrated a strong commitment to statistical training as either a major, or as a minor within one of the many environmental programs on campus. Most students in the course thus already have a background in basic statistics, linear models, probability and statistical theory, although students who have taken only the applied sequence can participate.

The course was developed to facilitate project-based collaborative learning. Individual projects are pursued by a team of 2 to 5 students. Students who are part of the training program are expected to act as project leaders, but projects may be proposed by any student. We try to keep a mix of environmental and statistic or biometry students on each team, and encourage skills transfer by insisting that every member of the team be able to discuss and defend the final product of the research, which most often results in a publishable manuscript. Since the trainees take this course every semester, we encourage the students to select among a variety of projects each semester. In recent semesters we have modeled the spread of an invasive bird species using Markov random fields (in progress), modeled ancient sea level changes at several sites off the Maine coast using errors-in-variables and segmented regression (Altman et al, 2001), analyzed a complex crop rotation experiment (Ceesay and Staudenmayer, 2000), used Poisson regression to determine if leukemia cases cluster around putative chemical dump sites (Altman et al, 2001) and considered sampling designs for entrainment samples (Conners et al, 1999).

Statistical subject areas that are available through existing courses, but not required for a graduate minor in biometry at Cornell, include sampling, Poisson regression, multivariate statistics, Bayesian Hierarchical modeling, time series,spatial statistics and spatial modeling. Students who have taken these courses bring to Cornell's Environmental Statistics course a certain perspective and depth to the problems that are being addressed that semester. The variety of backgrounds and experiences these students have reflects, to some degree, the quantitative and environmental paths they have chosen. Sometimes this leads to a variety of approaches directed at a single environmental project, and having this variety of perspectives benefits the entire group.A number of quantitative courses are offered in other environmental disciplines at Cornell. These include Quantitative Population Analysis, Applied Population Ecology, Quantitative Ecology of Fisheries Resources, and Wildlife Demographic Analysis in Natural Resources, Theoretical Ecology in Ecology and Evolutionary Biology, Risk Analysis and Management and Stochastic Hydrology in Civil and Environmental Engineering. As with the Environmental Statistics course, these special topics courses build upon a strong statistical foundation, but ground it with application.

It is encouraging to see the nation-wide development in the training of statistical methods as they are applied to environmental issues. And while an objective and well thought out statistical approach is likely a productive way to examine such issues, one should recognize that the greatest thing we can provide is how to consider, address and communicate the uncertainties and risks of environmental problems to the health and welfare of humans and the ecosystem. It is this thought process, more than just the methods alone, that our students should take with them.