Uncertainty in sample estimates and the implicit loss function for soil information.

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One significant challenge in the communication of uncertain information is how to enable the sponsors of sampling exercises to make a rational choice of sample size. One way to do this is to compute the value of additional information given the loss function for errors. The loss function expresses the costs that result from decisions made using erroneous information. In certain circumstances, such as remediation of contaminated land prior to development, loss functions can be computed and used to guide rational decision making on the amount of resource to spend on sampling to collect soil information. In many circumstances the loss function cannot be obtained prior to decision making. This may be the case when multiple decisions may be based on the soil information and the costs of errors are hard to predict. The implicit loss function is proposed as a tool to aid decision making in these circumstances. Conditional on a logistical model which expresses costs of soil sampling as a function of effort, and statistical information from which the error of estimates can be modelled as a function of effort, the implicit loss function is the loss function which makes a particular decision on effort rational. In this presentation the loss function is defined and computed for a number of arbitrary decisions on sampling effort for a hypothetical soil monitoring problem. This is based on a logistical model of sampling cost parameterized from a recent geochemical survey of soil in Donegal, Ireland and on statistical parameters estimated with the aid of a process model for change in soil organic carbon. It is shown how the implicit loss function might provide a basis for reflection on a particular choice of sample size by comparing it with the values attributed to soil properties and functions. Scope for further research to develop and apply the implicit loss function to help decision making by policy makers and regulators is then discussed.