

Abstract

Hinds (1984) observed that successful monitoring programs must be ecologically relevant, statistically credible, and cost-effective. Programs that neglect any one of these critical areas will face problems and likely fail.

Here, I present a conceptual model that explores the relationships among relevancy, statistics and cost. This model suggests questions to consider during the development of monitoring plans, focusing on these relationships.

If we ignore the cost-statistics connection, the statistician can recommend a Cadillac design that will answer the monitoring question, but won't run because we can only afford a Volkswagen. If we ignore the cost-relevancy connection, we may monitor things that are not important. Ignoring the relevancy-statistics connection may result in monitoring that produces questionable data.

This simple paradigm--keeping the connections between cost, relevancy and statistics in mind--will help develop monitoring programs with better chances of surviving over the long haul.

References

Caughlan, L., and K.L. Oakley. 2001. Cost considerations for long-term ecological monitoring. *Ecological Indicators* 1:123-134.

Hinds, W.T. 1984. Towards monitoring of long-term trends in terrestrial ecosystems. *Environmental Conservation* 11:11-18.

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Statistics

- Use a probability design to avoid bias.
- Work with a statistician to optimize your design.
- Working with a statistician requires you to be very clear about what your question is--they cannot suggest a design until they understand what it is you are trying to do.



Statistics

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Can we afford to collect the data (needed to answer the question)?

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Will the data (we can afford to collect) answer the question?

Optimization of the sampling design.

Must know the question to come up with a sampling design.

Hinds (1984) tripartite requirement for success in long-term monitoring:

- Ecologically relevant
- Statistically-sound
- Cost-effective

Cost

- Carefully consider all the costs, including costs for scientific oversight, data collection, management, analysis and reporting, program management and support.
- Once the full budgetary costs are known, you are in a better position to evaluate costs and benefits. If you lowball costs, you will have an in ated picture of cost-benefit. Underestimating costs will catch up with you in the end.

Relevancy

- Develop logical linkages between your overall monitoring goal and the indicators selected for monitoring.
- Conceptual modeling helps to explore relevancy because it forces you to be explicit about your understanding of ecological relationships and management concerns.
- Be clear about the spatial and temporal scales of interest.

Cost

Relevancy

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What is the "cost" of a Type II error (failing to detect a change that has occurred)? If the cost of a Type II error is high, then the benefit of monitoring is also high.

What is the opportunity cost of monitoring? Would the money be better spent on monitoring other things, or on other things entirely (outhouses, for example?)

Use costs to help understand if the proposed monitoring is going to be relevant. If the cost seems "high" rather than the "best investment you ever made", you might have a relevancy problem. Keep in mind, however, that most of the benefits of long-term monitoring will accrue in the future. Put yourself in the shoes of a Resource Manager in 2025: Would they think the money was well-spent?