

# Polluted objectivity?

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Delilah is frustrated; she's working on a report and presentation of her last season's data, due in 2 weeks, and her results aren't turning out as she planned. In fact, they're coming out quite the opposite of what she expected.

Let's back up a bit and explain how Delilah found herself in this situation. In tenth grade she was inspired by Rachael Carson's book *Silent Spring* and decided to make a career of combating environmental destruction. In college she majored in environmental studies, and planned to work for an environmental lobbying group. She duly joined a master's program at Northern State, thinking she would be more effective if she had a working knowledge of the science used to track humanity's negative effect on the environment.

For her research, she wanted to look at one specific human impact on the environment. She chose to study the effects of a paper mill's effluent on the insect community in a local stream, the Upper Swift. Her main questions revolved around how much insect diversity decreased downstream of the discharge point, and how far away you had to look before diversity recovered. Her advisor, Frank, knew some people at the paper mill and helped Delilah get permission to work on the property. She could sample the effluent itself (which meets all regulatory requirements) and the catchment area before it merged with the stream. In return, she agreed to give the company a report on her results. This is the deadline that looms.

Delilah sampled the stream every 20 m for 500 m up- and downstream from the discharge point. She was dismayed to find that diversity was actually greater in the polluted region downstream than it was upstream. She was encouraged that diversity climbed the farther downstream she sampled, but this wasn't statistically significant.

Frank reminded her that the sampling devices she used were cheap and easy to use, but they tended to miss some groups of insects that a more sophisticated sampling protocol would get. Perhaps more things were missed upstream than down. He also asked whether the substrate differed. When Delilah checked, it turned out that rocky areas were notably more common downstream. Unfortunately, her sampling stations were not located in a way that easily let her compare diversity in specific substrate types.

**Q:** How should Delilah frame her report to the paper mill? How much weight should she give the biodiversity comparison, the downstream trend, the potential sampler bias, and the confounding substrate difference?

**Q:** When Delilah repeats the experiment next year, she can improve the design. Are the weaknesses of her design themselves unethical, or just weaknesses?

**Q:** A local citizen's group has petitioned the county to insist that the paper mill install an additional treatment system for its effluent, one that would remove more contaminants and reduce its temperature. Delilah is worried that the paper mill might use her report to fight the treatment system. Does that change how she should present it?



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### ■ Commentary on “Polluted objectivity”

This case highlights the potential conflicts of interest that can arise when a person seeks to be both an ecologist and an environmental activist. This issue has long caused self-examination among ecological scientists, and it stimulates debate on our role in society at both the individual and discipline-wide levels. The case should encourage discussion participants to address what they believe is effective, honest presentation of experimental results. Conflicts of interest in research ethics are typically presented as financial issues, but in our field, political ones are more likely. This is of general concern for ecologists, because if our scientific efforts are to be used appropriately in public arenas, they must be widely perceived by non-scientists as objective and unbiased.

Is there really a conflict of values here? That is, what ethical obligations does Delilah have that suggest different courses of action? If your discussion group simply rejects the notion that she has any ethical obligation based on her environmental protection goals, perhaps she still has an obligation to minimize the negative consequences of her research. This is better achieved by thorough explanation, however, rather than by selective reporting. She needs to realize that even if her results are used to support a goal she dislikes, that doesn't necessarily constitute an unethical use of her research. Delilah clearly came into the project motivated by non-scientific considerations, and with a preconception of what she was going to find. What steps can ecologists take to ensure that their politics do not pollute their objectivity as scientists? Is there a fundamental conflict between being an ecological scientist and an environmental activist? Is this dual role any different than that of a pharmacologist with a financial stake in the company whose drugs he researches? If so, what are those differences; if not, why not?

Delilah's options are numerous, but fairly straightforward. Her frustration stems from what she perceives as a conflict between her values of scientific integrity and of environmental advocacy, because her data are at odds with her policy goals. As a result, she may be tempted to lie, stall, or obfuscate. She could report the results as they stand and mention the caveats, or even emphasize the caveats and the trend. There are probably other options as well. What “spin” should she ultimately put into her report? What kind of harm could result from her various options?

Putting Delilah's political interests aside, we see that she is in a position familiar to many scientists. Namely, her observations do not conform to her *a priori* hypothesis. This situation presents two possibilities. First, she can accept the data as conclusive; the hypothesis is determined to be wrong. Or, she could construct a *post hoc* hypothesis about how the data are flawed, or that the “real” effect is masked by other factors. Either option may be ethical, depending on the circumstances. The first seems best if careful peer critique and review (and perhaps repetition) fail to find flaws in the study. Intellectual honesty demands that we accept, at least provisionally, the dictates of the best available science. The other option seems better if the study can reason-

ably be shown to be flawed in ways that are important to the hypothesis in question. Delilah's political interests complicate the situation because they create a temptation to choose between alternate interpretations based on factors other than science.

It is important for Delilah to know whether the literature shows that substrate differences or sampler type produce changes in insect diversity consistent with what she observed. If so, there are good, empirically supported reasons to question her results, and emphasizing the caveats is justified. The literature may be silent on this issue, it may also be equivocal, or it may be limited to assumed effects. Stressing the caveats is less responsible in these cases. It is not enough for Delilah simply to guess how her results might be wrong. That's junk science. Note that none of these considerations depend on how urgent the situation is. Even though her results may be directly relevant to current political action, such as a petition for a new treatment system, these concerns do not shift the balance of scientific interpretation.

We hope this case opens discussion of whether presentation of the same results to different audiences can, ethically speaking, contain different information. Perhaps Delilah would be less troubled if she were presenting the information at a regional scientific meeting, although her reason for entering science makes even that questionable. Nonetheless, different audiences will have different backgrounds, and it is common to tailor introductory and explanatory material to the audience's anticipated level of understanding. Does the same thing apply to results, particularly if they could be dangerous, or misused by an audience? Some of Delilah's options clearly violate ESA's code of ethics, which prohibits suppression of results, and others may run afoul of the prohibition against “misrepresent[ing] research findings”. There can be multiple honest representations of research findings. The key is that they must be mutually concordant, and that the audiences must not be misled.

The second discussion question asks whether experimental design weaknesses are unethical. Scientists have a responsibility to conduct research competently. Potential harms that result from poorly designed experiments include wasted time and resources, equivocal or incorrect results, and the cascading effects that result from the application of such results. However, expecting research to be perfect and flawlessly thought out is unreasonable. Discussing research plans with peers will help identify potential problems, but you simply can't anticipate everything before you start. The essential question is whether the experimenter should have known (or did know) better at the outset. In this case, as a master's student Delilah may not know what sorts of covariates to include (perhaps Frank should have) or that substrate differences may be subtle. She should not be judged as harshly on this question as a 10-year veteran of stream insect ecology.

This is the third in our Ethical Issues series. For the introduction, please see the August issue (2003; 7: 330–33).