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Short communication

How to be a more effective environmental scientist in management and policy contexts

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ABSTRACT

This paper is intended for young researchers with an environmental conscience, alerting them that a self-centred ecology can work against conservation and other desirable goals. I propose that there is confusion in the biophysical ecologists' community about the role of knowledge, stemming from several already surpassed beliefs that have been strongly criticized by scholars in the field of science and technology studies. In particular, environmental scientists still often seem trapped in the information deficit model, assuming a linear and unidirectional flow of knowledge from experts to users. This leads to an incomplete understanding and unrealistic expectations of ongoing processes of citizen participation (co-production of knowledge), impatience regarding the speed at which issues can be dealt with by politics, and a fuzzy notion of the role of our convictions regarding the value of nature conservation when we are consulted as experts. I analyse the consequences of disregarding tacit knowledge, i.e. the one knowledge beyond that codified in academic papers and books. I emphasize that preferences and values have a large influence on how we perceive, process, and act (or postpone to act) on information on our non-exclusive roles as scientists, decision makers or citizens. I argue that this is why political and ideological preferences have a large influence not only on which teams are appointed to solve problems, but also on which situations are perceived as problematic and given higher priorities. I include a cheat-sheet to enhance communication with decision-makers and other non-scientists that could prevent environmental zeal to be transformed into society's annoyance and our eventual irrelevance. I plea for a more realistic attitude towards ecological research, highlighting that in environmental debates we are also long-term stakeholders, and not only casual, external and aseptic observers.

1. Introduction

> *The notion that science . . . can and should settle disputes and guide political action remains a core operating principle [and a flawed one at that!] . . . on both sides of . . . environmental controversies*—Sarewitz (2004)

Despite a long tradition in the social sciences to the contrary, there is still confusion in the biophysical research community (to which I feel honoured to belong) about the role of ecological knowledge in decision making. I propose that this derives from four flawed and unstated assumptions, so widespread that they amount to generalized beliefs: (1) that better information is all it takes for individuals and societies to change behaviour in favour of the environment; (2) that such information mostly involves "hard data" (meaning peer-reviewed), properly communicated; (3) that scientific consensus – even certainty – is indispensable for managerial and political action; and (4) that as scientists we are in a privileged position to provide an unbiased view and to propose 'the best solutions' on issues close to our field of expertise.

I analyse these beliefs and their consequences, the most visible of which seems to be the tendency to accuse politicians and managers of being ignorant and insensitive, while the accuser remains ignorant of their knowledge and unaware of the functioning and constraints of the decision-making processes. We would not respect someone trying to manage ecosystems without a notion of how they operate—but it seems that we are acting in a similar way when we move into the world of environmental management and policy. Moreover, I argue that this attitude is not just wrong but also detrimental, because it makes many researchers with a biological, physical and chemical background (hereafter, "ecologists" for short) act in a provincial and sometimes defensive way, isolating the ecological community

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Table 1
Caricature version of twelve common complaints stemming from oversimplification of (and obstructing feasible solutions to) environmental and other complex context-dependent and value-laden problems. This list can be used as an *aide-mémoire* or as a questionnaire: e.g., Candidly answering 'yes' to most questions from the first column shows a lack of environmental literacy, and is a recipe for irrelevant and even counterproductive advocacy. The answers on the second column are meant for debate and study. Based on Fernández (2014, 2015).

#	Do you often . . . ?	. . . this could be a mistake—so common as to have its own name! *Italicised* terms are search suggestions.
1	. . . wonder why available scientific knowledge does not translate into sounder environmental policies?	You risk being accused of *scientism* and *technocratic* thinking. The environment encompasses complex human-nature systems. Context and values matter to define policies; moreover, they determine what constitutes a problem and (like it or not) it influences research. Look at *constructivist epistemology*.
2	. . . think that most politicians are either ignorant, or corrupt, or lack political will?	The focus should not be on specialized information (Greek *logos*) only. Besides "hard data", required knowledge includes its *co-production* by mutual learning and sharing of tacit assumptions, preferences and beliefs. *Ethos* and *pathos* also matter.
3	. . . demand or expect scientific consensus and certainty as a requirement for action? ...conclude after each project that more research is needed in order to provide more reliable advice?	Science is an endless search, and every answer yields a number of new questions. Thus, incomplete knowledge and uncertainty are inevitable. We have to learn how to live with them, and avoid and detect their *tactical*[a] use as an excuse for inaction.
4	. . . become impatient because even when there seem to be broad scientific and political consensus, action does not occur immediately?	All new knowledge takes a while to permeate through previous notions and competing values in all actors (researchers included). Mutual trust over time *(social capital)* is needed to cooperatively develop viable solutions (but see *rationalized trust* [Berardo, 2009]).
5	. . . accuse adversaries of selective and ideological use of information? ("Notice the speck in your brother's eye . . . ?")	You are acting as a *stealth advocate*[b] in the name of scientific objectivity. As for "ideology", check the dictionary: we all have one. Discuss issues and options, not big words.
6	. . . are tempted to overstate data for the sake of nature's future? (" . . . but do not see the log in your own eye?")	Environmental commitment should not compromise intellectual honesty; it is wrong, and sooner or later it backfires.
7	. . . dismiss information that contradicts your views as "bad science", and refuse to debate with their authors and even to read them?	These are the *ad consequentiam* and *ad hominem* time-tested fallacies routinely used from each side of every dispute. Isolation, in biology and politics, develops incompatibility and lack of dialogue.
8	. . . believe there are intrigues and conspiracies by powerful people?	You have a common case of the *devil shift*[c], i.e. view opponents as more corrupt and powerful than they probably are. Even if this turns out to be true (e.g. Jacques et al., 2008) we can denounce them, but should not use them as excuses (see next point).
9	. . . spread pessimistic and apocalyptic messages regarding the future?	People are sympathetic with short-term catastrophes, but tend to become bored and to screen out repetitive gloomy forecasts. Even if we are right, still need to work around several denial barriers (e.g. Stafford Smith et al., 2011).
10	. . . wonder why societies' behaviour does not conform to what would be expected from conscientious citizens?	Appeal to individual responsibility has been mostly ineffectual. Besides, it is unfair in a planet with huge imbalances in wealth. Shove (2010) argues that this is not an innocent claim, but one that takes responsibility away from governments.
11	. . . think that long-term cultural changes are needed before a more responsible behaviour can take place?	You may have fallen into the *progressist dilemma*[d]: rejecting shorter-term regulatory or technical fixes to tackle problems that have ethical roots.
12	. . . wish there were everlasting solutions to environmental problems?	New circumstances and context, including past solutions, require ongoing work because we are dealing with co-evolving systems.

Terms borrowed from: (a) Shafer (2008); (b) Pielke (2007); (c) Sabatier (2007); (d) Sarewitz (2010).

from many fora and sources of crucial information, and limiting our potential contributions.

This article analyses the four beliefs listed above, summarizing background information from relevant social science studies in the hope of making young ecologists sufficiently curious and motivated to grasp some useful language and explore the literature on their own. My goal is to stimulate a more realistic attitude towards ecological research, more modest regarding its role in decision making, but at the same time bolder in its overall ambitions. Table 1 is meant to serve as a practical synopsis, and to provide a heuristic basis for debate and further study. Since it may appear overly harsh, I point out that the left-hand side column contains mostly prejudices that I have heard myself voicing, and that the answers on the right-hand one have to be taken as tentative, as they are just some out of many possible ones and could be contentious. Thus, the table should not be taken as a do's and don'ts list. On the contrary, my overall point is that there is no recipe for an easy role of scientists in public contexts. In order to be heard, we need to listen and study more, working harder to develop technical options in the understanding that these will then need to be explored through social and political debate until the most appropriate pathway for a given context emerges.

2. The linear model and its progeny

Most of the misguided beliefs listed above are related to what is known as the "linear model" (LM) of research and information flow between scientific and technical producers and lay users formalized during the post-WWII years (e.g. McNie, 2007). Decades of scholarship in the social and behavioural sciences, particularly in Science and Technology Studies (STS), have incontestably shown that the production of knowledge always involves social and cultural factors (Wesselink et al., 2013), and that the relationship between evidence and decision-making is highly politicised, complex and recursive (Ludwig, 2001; Sarewitz, 2004; Juntti et al., 2009). In other words, it is the opposite of the seamless one-directional flow described by the LM.

What we do as researchers, how, and why, is the focus of STS scholars, and is a pity how little we have apparently learnt from what they have to say (Table 1, rows 1–4, 8, 10).What is remarkable is that the field of STS was conceived by some of its founders as "science for public understanding" (Aikenhead, 2003); then, as most academic territories, turned into a specialized field hard to follow for scholars from other disciplines (Becher and Trowler, 1989). What worsens the gap is the generalized attitude of