

On Advocacy by Environmental Scientists: What, Whether, Why, and How

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Abstract: *Debate about the nature and appropriateness of advocacy by environmental scientists is important—it represents understanding the role of these citizens in our society. Much has been written about advocacy by scientists, and that literature describes substantial diversity in reasons why advocacy by scientists is or is not appropriate. Despite the nature of this literature there has been no comprehensive, systematic review of why some favor and others oppose advocacy by environmental scientists. Through a literature review we catalogued, categorized, and critiqued the arguments used for and against the appropriateness of advocacy by environmental scientists. Most arguments, whether for or against advocacy, are characterized by some significant deficiency. From our analysis of the literature an argument emerges that to date has never been fully articulated: that advocacy is nearly unavoidable, and that scientists, by virtue of being citizens first and scientists second, have a responsibility to advocate to the best of their abilities, to improve their advocacy abilities, and to advocate in a justified and transparent manner. We also discuss the meaning and relevance of advocacy being justified and transparent. We suggest scientists expend their efforts to better understand what constitutes appropriate advocacy and spend less effort pondering whether they should advocate.*

Keywords: advocacy, citizenship, credibility, environmental ethics, policy, science, scientists

Sobre la Abogacía por Científicos Ambientales: Qué, Sí, Porque y Cómo

Resumen: *El debate acerca de la naturaleza y la relevancia de la abogacía de científicos ambientales es importante—representa el entendimiento del papel de estos ciudadanos en nuestra sociedad. Se ha escrito mucho sobre la abogacía de los científicos, y esa literatura describe una sustancial diversidad en las razones por las que la abogacía de científicos es apropiada o no. No obstante la naturaleza de esta literatura, no ha habido una revisión integral, sistemática de porque algunos favorecen a esta abogacía de científicos ambientales y otros la rechazan. Mediante una revisión de literatura, catalogamos, clasificamos y criticamos los argumentos utilizados a favor y en contra de la abogacía de científicos ambientales. La mayoría de los argumentos, a favor o en contra, se caracterizan por alguna deficiencia significativa. De nuestro análisis de la literatura emerge un argumento que hasta la fecha ha sido articulado en su totalidad: la abogacía es casi inevitable, y los científicos, en virtud de que primero son ciudadanos y después científicos, tienen la responsabilidad de abogar al máximo de sus habilidades, mejorar sus habilidades de abogacía y abogar de manera justificada y transparente. También discutimos el significado y la relevancia de la abogacía justificada y transparente. Sugerimos que los científicos hagan esfuerzos para mejorar su entendimiento de la abogacía apropiada y que hagan menos esfuerzo en ponderar si deben abogar.*

Palabras Clave: abogacía, ciencia, científicos, ciudadanía, credibilidad, ética ambiental, política

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Introduction

In 1914 zoologist and author William Temple Hornaday complained, "90 percent of the zoologists of American stick closely to their desk-work. . . never lifting an active finger on the firing line in defense of wild life." In 1920 biologist Francis Sumner claimed, "the fact that neither [botanists] nor the zoologists are making themselves heard from at all audibly in this matter, seems evidence of the comparative indifference of both groups of biologists to the worldwide assault upon living nature." Debate over the prudence, and even morality, of advocacy by environmental scientists has persisted for a century. Today the literature on scientist advocacy is extensive and reveals a wide range of attitudes (many incommensurable) about what counts as advocacy and whether it is appropriate. Many argue advocacy is problematic and should be avoided. Others suggest scientist advocacy is innocuous because ecologists essentially share the values of mainstream society (e.g., Lautensach 2005). Still others argue that most environmental scientist advocacy is engaged by those aiming to harm nature (Wright 1997).

In a surprising number of papers it is unclear whether authors are in favor of or against scientist advocacy (e.g., McCoy 1996; DeStefano & Steidl 2001). Many papers contain internal inconsistencies (i.e., they argue both for and against scientist advocacy). For example, Robinson (2006) warns that "if values define the scientific questions we ask and scientific data are used to defend value-defined conclusions, then [conservation biology] runs the danger of slipping down the slope into . . . advocacy," but he ultimately argues that conservation biologists "need to apply . . . science to problems and in contexts that seemingly contradict the objectivity and rigor of the biological sciences from whence we came: to address problems where scientific knowledge is limited . . ." Likewise, Mulvey and Lydeard (2000) scold colleagues who "appear to be arguing from a position of advocacy," yet seemingly endorse advocacy when they suggest "credible and convincing advocacy. . . can be best achieved by adhering to this process [i.e., peer review and falsification]." Sparrowe (1995) simultaneously criticizes those who advocate when he asserts, "We cannot simultaneously be objective voices on behalf of science and strident lobbyists for our views," yet advocates himself when he concludes, "Hop on the train and let's pass the Fish and Wildlife Diversity Funding Initiative. Take the biggest step forward for wildlife in more than 50 years!" Most authors who support advocacy in any form also suggest that advocacy should be done carefully, but do not indicate what constitutes care.

Much of what has been written about advocacy assesses its appropriateness without adequately assessing its nature. This is problematic because advocacy is defined in profoundly different ways. Advocacy has been portrayed as the interpretation of facts for managers,

working closely with managers, or even making policy decisions (Lach et al. 2003). Others suggest four roles for scientists "in policy and politics" (pure scientist, science arbiter, issue advocate, and honest broker) and argue for the necessity of each (Pielke 2007).

Much of the advocacy literature presumes too much too quickly and conflates three fundamentally separate questions: (1) "Should scientists, as a matter of principle, advocate on policy-related matters?" (2) "If scientists should be advocates, what general qualities should characterize their advocacy?" (3) "How, more specifically, should scientists manifest their advocacy?" Most of the literature treats the last question without giving due consideration to the first two. Here we made only two assumptions about the nature of advocacy. First, it entails more than merely conducting research and communicating results through primarily scientific venues—even if the nature of the research is inspired by or relevant to a policy matter. Second, advocacy entails promoting, developing, or assessing policy positions. We also considered the assessment of policy a form of advocacy because policy assessment routinely entails important yet obfuscated promotion or refutation of a policy, even when the assessor is unaware of such affects (see "Nature of Science Arguments"). In this sense our definition of advocacy is similar to Lackey's (2007), which suggests advocacy is the "active, covert, or inadvertent support of a particular policy or class of policies." Prompted by this notion of advocacy we catalogued, categorized, and critiqued arguments used for and against the appropriateness of advocacy by environmental scientists.

Given the interdisciplinary nature of our analysis, we evoked a variety of concepts considered elementary in some disciplines, but that may be largely unfamiliar to those in other disciplines. For this reason an on-line Appendix (see Supporting Information) provides a fuller list of sources discussing such concepts.

Arguments against Advocacy

Scholars assert that various aspects of science conflict with advocacy to varying degrees. These varying aspects include scientific credibility, the ability to conduct science (operational conflicts such as time conflicts), and the fundamental nature of science itself (e.g., science is objective and advocacy is subjective). The supposed degree of conflict ranges from relatively mild to fundamental and severe. Some assert that although scientists may be justified to advocate on some occasions, there is no general moral obligation to advocate, whereas others assert no scientist should ever advocate.

All arguments against advocacy that we found can be represented as a formal argument with the following general form (P, premise; C, conclusion):

- P1. A scientist has some obligation to serve society as a scientist.
- P2. Advocacy conflicts in some way with some aspect of science.
- C1. Therefore scientists, as individuals, or science, as a whole, should not advocate.

Various arguments against advocacy can be expressed by replacing P2 with a more precise expression of the supposed conflict. Premise P1 is not typically stated when scientists speak about obligations to avoid advocacy. Nevertheless, P1 seems uncontroversial because most scientists, whether for or against advocacy, accept P1 as true, and P1 seems necessary for arriving at C1.

Credibility Arguments

Several arguments against advocacy depend on a conflict between advocacy and scientific credibility. They are represented by the following expressions of premise P2:

- P2(1). Because some scientists advocate in dubious ways (e.g., rely too much on authority to promulgate a policy position), one should refrain from advocacy.
- P2(2a). Advocacy is unavoidably detrimental to science's credibility.
- P2(2b). Advocacy is unavoidably detrimental to a scientist's credibility.
- P2(3a). Advocacy entails a significant risk of being detrimental to a scientist's credibility.
- P2(3b). Advocacy entails a significant risk of being detrimental to science's credibility.

Several authors believe advocacy should be avoided because it threatens scientific credibility (e.g., Wiens 1996; Mills & Clark 2001; Nielsen 2001; Rykiel 2001; Tomasso 2007). Lackey's (2007) attitude is "Once policy preferences are rooted in the core of the scientific enterprise, it is not clear. . . how scientific independence and credibility can survive over the long term." Kaiser (2000) reminds us of Wooster's letter to *Science* that said, "When an ecologist makes an apocalyptic statement about the death of one or another ecosystem, he trades his credibility for his passion as an advocate."

Other authors, contrarily, believe these attitudes are inappropriate (e.g., Lovejoy 1989; Czech 2007; Noss 2007). Still others (Gitzen 2007) simply conflate advocacy with making "overly inflated claims" and other bad manifestations of science. Despite assertions about scientific credibility we are unaware of any detailed assessment of the logic supporting or refuting premise P2.

Each of the credibility premises result in an inadequate or unjustified argument against advocacy. Premise P2(1) results in an argument perfectly analogous to concluding that one should not conduct science because some do so dishonestly. Premise P2(2a) and P2(2b) are very

similar and differ only in that P2(2a) implies no scientist should advocate because it is detrimental to the credibility of the entire scientific community. Premise P2(2b) is less extreme and implies one is justified in refraining from advocacy and in being neutral about advocacy by other scientists because, although their personal scientific credibility is at stake, one's own credibility is not.

Premises P2(2a) and P2(2b), and the argument each supports, are false because there are counter examples of scientists advocating without any detriment to their credibility, for example, E. O. Wilson, Stuart Pimm, and Jane Lubchenco. These and others have been effective advocates, and there is no reason to think their scientific credibility is suspect.

Premises P2(3a) and P2(3b) are less extreme versions of P2(2). Among the credibility arguments, premises P2(3) seem most persuasive and less obviously false because they only require that advocacy *might* be detrimental to scientific credibility. Nevertheless, these premises are false as well. Consider the nature of scientific credibility. What is it, what affects it, and who are the arbiters of it? Credibility—of any kind—is an "ability to inspire trust" and thus a relationship in which two parties share a responsibility. For example, if I always act in a transparently trustworthy manner, yet someone refuses to trust me, then I have lost credibility. However, the distrustful person is to blame, and I remain obligated to be trustworthy.

Scientific credibility is a special kind of credibility and is necessarily arbitrated between a scientist and a scientific community. This is necessarily so because scientific credibility depends on judgments that only other scientists are trained to make (e.g., is a scientific claim adequately supported given the sample size of the study?). Although scientific credibility is complex and nuanced, the salient point is that so long as a scientist's work is transparently honest, the scientific community is obligated to, and almost always does, confer scientific credibility. Scientific credibility is not the same as effectiveness. One may have scientific credibility and be effective or ineffective at advocacy. Conversely, one may be an effective advocate but have no scientific credibility.

Indeed scientific credibility is greater, *ceteris paribus*, for scientists producing more valuable science or demonstrating greater scientific insight. Moreover, greater scientific credibility is valuable to the scientific community and for effective advocacy. These aspects of scientific credibility, however, are beside the point of whether scientists ought to be advocates. In addition, a scientist opposed to advocacy might doubt the wisdom of another scientist's decision to be an advocate. Such a doubt among scientific peers has little to do, however, with scientific credibility, and scientists in practice tend not to confuse advocacy with scientific credibility. For example, we doubt that our scientific colleagues question the scientific credibility of Vucetich et al. (2002), which is a technical description

of wolf predation, on the grounds that Vucetich et al. (2006) advocate a certain reading of the U.S. Endangered Species Act.

Undoubtedly scientific credibility is critical to the work of a scientist and can be easily lost but not easily regained. Consider for example Herbert Spencer's social Darwinism, Linus Pauling's unwarranted advocacy of vitamin C as a cure-all, and the advocacy by apologists for special interest groups (sometimes dubbed "biostitutes"). These scientists did not lose scientific credibility merely because they advocated. They lost credibility for doing bad science, advocating ridiculous positions, or advocating in ridiculous ways.

Although scientist advocacy sometimes results in non-scientists (e.g., members of a special interest group) publicly and vociferously challenging the scientific credibility of a scientist advocate, such challenges are not (and should not be) taken seriously by the scientific community. Although such challenges risk reducing a scientist's effectiveness as an advocate, it is inappropriate to argue that advocacy—while a good thing—should be avoided because it might fail or be less effective than desired or because doing so would require developing a thoughtful strategy.

Nonscientists can, and sometimes do, slander and even threaten scientist advocates. Most often the slander amounts to little more than being called bad names in the newspaper—which hardly seems a reason to avoid advocacy. Much less frequent, although much more serious, scientist advocates are sometimes seriously slandered (e.g., Rachel Carson), blacklisted (e.g., Sagan 1993; Wilson 1993), or receive death threats (e.g., over topics such as preservation of old-growth forests, reintroduction of wolves, and killing of feral cats).

A general principle of ethics suggests one is not, in general, excused from doing the right thing because there is a risk of incurring an unjustified cost. Overriding this principle requires articulating how the virtue associated with scientist advocacy is outweighed by the magnitude and risk of the potential cost. Other kinds of publicly engaged citizens (especially politicians) apparently believe that the value of policy development outweighs the moderate risk of being slandered or the marginal risk of being threatened. People against scientist advocates have an unmet burden to indicate how or why a scientist's responsibility to society differs from the obligations of other publicly engaged citizens and how that obligation overrides the obligation of citizenship.

Finally arguments against advocacy based on advocacy's detriment to a scientist's public reputation represent a misperception. That is, sociological surveys indicate (Lach et al. 2003) that most of the attentive public either agree or strongly agree that scientists should "work closely with managers to integrate scientific results into management decisions," and many representatives of special interests and the interested public are neutral or fa-

vorable about the idea. There is some reason to think that the reputation of scientists among the public is enhanced (or at least not harmed) when scientists advocate (Steel et al. 2004).

Arguments against Advocacy, Revised

Now consider a revised, general argument against advocacy, entailing additional, necessary premises.

- P1. A scientist trained by or supported by public funds has some obligation to serve society as a scientist.
- P2. Advocacy conflicts in some way with some aspect of science.
- P3. Advocacy (i.e., assessing, promoting, or developing policy positions) is a valuable and intellectually challenging societal activity.
- P4. In general a scientist's skills (knowledge of facts and logic and communication skills) are distinctive among various kinds of citizens in our society.
- P5. The application of these distinctive skills would be extremely valuable for assessing, formulating, and promoting policy positions.
- P6. The value represented in P4 and P5 is overridden by the cost represented in P2.
- C1. Therefore scientists, as individuals, or science, as a whole, should not advocate.

These new premises (P3 to P6) are implied by the critiques we presented above. Premises P3, P4, and P5 are uncontroversial unless P4 is read to mean that scientists are the only citizens with skills and knowledge relevant to policy assessment or scientists (simply by virtue of being scientists) have all the skills and knowledge necessary for policy assessment. The appropriateness of this revised argument against advocacy depends only on judging the truth of P6. To the extent P6 is dubious or false (discussed in "Analysis of Arguments for Advocacy") the argument against advocacy is substantially weakened, if not collapsed.

Conflicting Moral Obligations

It is widely appreciated that one is not excused from an obligation merely because fulfilling that obligation would entail a cost. To believe one is so excused may itself come at a cost—the cost of being unethical. Life routinely involves navigating between two or more conflicting, moral obligations. This does not mean we are not obligated to both; rather, it means only one can be manifest at a given time. One may have a moral obligation to not steal, but may choose to steal in order to satisfy the moral obligation to feed one's family in a time of crisis. Likewise, scientists may have a moral obligation to avoid conflicts with their

scientific work *and* engage in activism that risks conflict with that work, and they may opt for one over the other, while neither obligation is diminished. But this is to acknowledge that, at least in principle, scientists have an obligation to advocate. Scientists know that other obligations (e.g., an obligation to be a good spouse or parent) regularly override their obligation as a scientist. It is eminently plausible that an obligation to advocate overrides, at least on some occasions, an obligation to risk-free or frustration-free science.

The assessment of credibility arguments depends importantly on distinguishing scientific credibility from reputation with nonscientists and distinguishing trivial instances of slander from serious threats to well-being. With these distinctions in mind it is not obvious that the (societal) value of advocacy by a scientist, when justified and transparent, is outweighed by costs that are either trivial or substantial, but of relatively low risk. Although credibility arguments could, in theory, be reasonable arguments against scientist advocacy, their reasonableness depends on what seems an unmet burden to explain how the possible costs of advocacy justify overriding what others argue is an important moral obligation (see "The Citizenship Argument").

Nature-of-Science Arguments

Several arguments against advocacy presume a conflict between advocacy and the fundamental nature of science. These arguments can be represented in a revision of the general argument against advocacy, in which premise P2 is replaced with a more precise expression:

- P2(4). Advocacy conflicts with science because the purpose of science is to assess fundamentally objective phenomena, whereas policy assessment also requires the assessment of values and other subjective elements.
- P2(5). Advocacy conflicts with science because the purpose of science is to remain neutral and impartial, whereas policies manifest bias of one kind or another.
- P2(6). Advocacy conflicts with science because the purpose of science is to provide facts or information, not policy advice.
- P2(7). Advocacy conflicts with science because, although the nature of science is to draw conclusions only when it can be done with a relatively high degree of certainty, conclusions about the appropriateness of policy do not typically entail certainty. (The participation of science in making uncertain conclusions risks science's reputation and may implicate science in harming society).
- P2(8). Advocacy conflicts with science because scientists are not adequately versed in the breadth of issues

associated with a given policy, only policy makers are.

Such arguments are supported by Rosenzweig (2001) ("The words 'good' and 'bad' constitute value judgments and so lie beyond the bounds of science. . . . Were exotic species to reduce diversity by 30%, no ecologists could test whether that loss of species would be a bad thing.") and Jack W. Thomas (quoted in Kaiser 2000) ("Researchers present results as if they were handed down from the heavens on inscribed tablets. . . . It's up to the politicians and decision-makers to weigh the costs and benefits."). McCoy (1996) represents a dramatic version of this argument: "In a perfect world, advocates would be those who spoke or wrote in support of something and scientists would be those who spoke or wrote in support of nothing. Advocates would care deeply about what they advocated. . . . [s]cientists, on the other hand, would not care deeply about what they hypothesized. . . ." Many objecting to advocacy use these kinds of arguments (e.g., Tracy & Brussard 1996; Weins 1996; Nielsen 2001; McCoy & Atwood 2005; Martin 2006). Interestingly some appeal to the nature of science to defend science advocacy (Safina 1999).

Premise P2(4) misrepresents science as focused on the assessment of objective phenomena and advocacy as focused on the assessment of phenomena entailing objective and subjective elements. To correct this misrepresentation consider a precise expression of the relevant concepts.

First, objective observations are independent of the observer making them, whereas subjective observations vary with the observer's perspective. Second, rational claims are those based on sound and valid reasons, whereas irrational claims are not. That is, rational claims are based on arguments composed of only true premises and all the relevant premises and use only inferences consistent with the rules of formal and informal logic. By these definitions objectivity is not equated with rationality and subjectivity is not equated with irrationality. The challenge of evaluating subjective claims is to determine whether they are rational. Evaluation of rational claims can be an objective activity (as illustrated by the academic disciplines of ethics, political science, and history). Additionally the subjective and objective elements of policy are often inextricably linked. For example, some environmental policies entail the notion of "natural regulation" (e.g., Huff & Varley 1999). Natural regulation entails a complicated scientific element (i.e., "regulation") that ecologists are best equipped to handle and a complicated subjective element (i.e., "natural") that philosophers are best equipped to handle. Even the most knowledgeable scientists wrestle with the concept of regulation (e.g., Berryman 2004), and the most knowledgeable philosophers struggle with the concept of naturalness. Such complexity is commonplace (e.g., What

constitutes an endangered species, a sustainable harvest, and ecological restoration?). Because these policy issues entail critical dimensions that are fundamentally normative, subjective, and objective, the wise handling of such topics requires scientists to participate in their development.

Justified Advocacy

Ultimately P2(4) does not imply scientists ought to refrain from advocacy; rather, it suggests how scientists ought to advocate. That is, P2(4) suggests what would constitute justified advocacy, the critical elements of which may be appreciating that (1) policy assessments can and should be represented as formal arguments composed of premises and conclusions; (2) justification of a policy can be judged by the validity and soundness of its supporting argument; (3) some premises in such arguments will be subjective and others objective (i.e., some will look like facts and some will look like values); (4) the boundary between objectivity and subjectivity will not be distinct; (5) scientists will sometimes be the best arbiters of whether a premise is objective and true and sometimes they will not; (6) given their high level of skill and training in rational thought, scientists are better prepared than many citizens to construct and assess arguments representing policy; (7) by partaking in such a process, the primary risks for scientists are inappropriately declaring some premise as objective or broadly agreed to, when in fact it is not, or neglecting to clearly articulate the necessary value premises; (8) by laying the argument out clearly, scientists may be mistaken, but the mistake will be transparent; and (9) this process protects scientists' scientific credibility and serves society.

These points outline the nature of what might be considered justified advocacy, not policy determination. In democratic societies policy is determined by citizens, their elected representatives, or technocrats responsible to elected representatives. This process does not value the exclusion of scientists or nonscientists. The process is virtuous because all are invited to construct and defend arguments for all to assess.

The Nature of Neutrality

Premise P2(5) is not a justified reason to oppose advocacy by scientists, in part, because it misrepresents the nature of neutrality. In the context of contested policy with significant consequences neutrality often represents an incoherent and unethical position—even for a scientist. In these cases neutrality is unethical for the same reason that it is incoherent and unethical for a scientist to be neutral, for example, about child abuse.

Neutrality is appropriate only under particular, although not uncommon, circumstances. Neutrality is sen-

sible for positions without a moral dimension (e.g., I am neutral about your preference for strawberry ice cream) and is sometimes allowable, even demanded, given certain kinds of uncertainty. I may be neutral about your expectation that the next president of the United States will be a woman. It is unethical, however, to be neutral about whether a woman is capable of being president.

Assessing the appropriateness of neutrality involves critical nuance and requires great care (Coady 1993). Careful assessment of neutrality is required, in part, because others sometimes selfishly misrepresent the nature of neutrality. For example, former U.S. President G. W. Bush claimed other government leaders were either with the U.S. government or with the terrorists. The aphorism “you are either for us or against us” is sometimes appropriate, but not when a third, coherent position exists: one can be against terrorists and also against America's global hegemony. Premise P2(5) is generally false because the appropriateness of a neutral position depends on the nature of the issue, not on the nature of the person (i.e., whether one is a scientist).

Quite apart from whether neutrality is an appropriate position, refraining from advocacy is unlikely to represent a neutral position. Rather, such a refrain is typically implicit, but powerful, support for the policy backed by those with the most political power. Conservation scientist Bern Shanks wrote: “. . . professionals are advocates, even when they remain silent” (Fraidenburg 2007). For example, biodiversity loss, climate change, human population growth, and pollution on the whole are so favored by the dominant culture, institutions, and policies that abstaining from advocacy against such processes is a de facto support for these processes. Just as being neutral toward child abuse guarantees children will be abused, neutrality about environmental abuse guarantees environmental abuse. Arguably, many current policy issues are like this. They are clearly bad, and scientists are responsible for knowing that they are clearly bad, but they delude themselves into believing that they can remain neutral about them. Perhaps this view is too extreme, and the inappropriateness of many policy issues is not so clear. If so, the possibility that a policy is grossly inappropriate dictates the need for scientists to actively discuss the status of such policies. Such a discussion would constitute advocacy, as we have characterized it.

Impartiality and Bias

Premise P2(5) is not a justified reason to oppose advocacy by scientists, in part, because it misrepresents the nature of impartiality and bias. Like neutrality, these concepts are nuanced and easily mishandled. Medical doctors should be impartial to (i.e., without bias toward) the financial fortunes of a particular pharmaceutical company but not impartial about their patients' health. Likewise, judges should be impartial about specific rulings but not

impartial to justice. Judges' partiality to justice would determine their position on specific rulings. Moreover, judges would change their positions on a ruling if shown that they had mishandled some concept of justice—this is precisely how they would be impartial to the ruling. Being impartial about the process of making a ruling should not, and does not, prevent a judge from ruling.

The scientist's circumstance is, in this sense, analogous to that of the doctor and the judge: the scientist is obligated to objective analysis and clear, rational thought. Such obligations will necessarily result in positions on some policy matters. Scientists ought to be impartial to a policy position in the sense that they would change their positions if it were shown that they had mishandled objective analysis *or* clear, rational thought.

Premise P2(8) is inappropriate because it is not even possible to be impartial; it is only possible to be impartial about something in particular. Moreover, it is arguably unethical to be impartial about values universally agreed upon or agreed upon by the members of one's community. Ultimately impartiality is not universally good, and bias is not universally bad.

The Fact–Knowledge Distinction

Premise P2(6) is not a reason to disallow advocacy for reasons expressed in the discussion of neutrality and impartiality and because P2(6) is an inaccurate portrayal of science. Specifically the purpose of science is not to merely provide facts or information. Its purpose is to interpret, filter, and synthesize facts, thereby generating knowledge. Even to merely provide policy-relevant information unavoidably involves interpreting, filtering, and synthesizing facts. Although this processing of facts falls within the purview of scientists, it is not a purely objective activity as implied when scientists say they are merely providing facts. Inasmuch as interpreting, filtering, and synthesizing facts is a normative activity, providing facts routinely represents advocacy for some position. Consequently policy assessment and the provision of policy-related facts would seem to be kinds of advocacy, as we proposed in the "Introduction." If so, advocacy by scientists would seem nearly unavoidable, and scientists might be wiser to better understand what constitutes appropriate advocacy and expend less effort pondering whether they should advocate. Nevertheless, many still argue that merely providing facts is not advocacy (e.g., Hixon 2000; Scott and Rachlow 2006; Lackey 2007; Pielke 2007; Scott et al. 2007). Perhaps scientists are unqualified to recognize the value-ladenness of merely providing facts.

Some scientists, however, recognize how failure to distinguish facts from knowledge and the fallaciousness of the fact–value dichotomy represent an obstacle for understanding the appropriateness of advocacy. For example, Kaiser (2000) quotes two ecologists: "There's so much managers could gain from what researchers have learned,

if only we could synthesize the information for them" and "[d]umping information from the ivory tower down clearly isn't working." However, even well-known scientist advocates reinforce the false dichotomy between facts and values. For example, Kaiser (2000) quotes Jerry Franklin as saying, "Scientists should be providing information rather than advocating any particular solution."

Uncertainty and Neutrality

The question implied by premise P2(7) is, does uncertainty justify neutrality and preclude advocacy? A hallmark of science is the removal of epistemological uncertainty for the purpose of making robust inferences. Moreover, science is a conservative institution tending not to change its position until justified by a relatively high burden of proof. This conservativeness is one of science's virtues. This virtue is also associated with scientists' considering falsification of hypotheses of high value and verification of hypotheses of low value.

If this were an adequate portrayal of science, then advocacy by scientists might be shunned. However, science is not like this. Increasingly scientists focus more on how to make inferences in the presence of uncertainty, rather than merely reducing uncertainty. This is reflected by an increasing knowledge of model selection techniques and formal risk analysis, which is designed to facilitate rational decision making in the presence of uncertainty.

Although many scientists are not adequately knowledgeable about formal risk analysis, such knowledge could be readily developed. To be clear we strongly oppose policy making by technocratic use of formulaic methods. These methods too easily disguise contestable, subjective claims as indisputable, objective claims. Our point is that because scientists, among all citizens, are well able to understand principles of decision making in the face of uncertainty, they should not be disallowed or discouraged from the assessment of specific policies—quite the opposite (Hixon et al. 2001; Harwood & Stokes 2003).

To successfully argue against advocacy arguments rooted in P2(7) one would also need to distinguish between uncertainty about the truth of some scientific claim and uncertainty about the value of a specific policy. The first kind of uncertainty does not necessarily imply the second. For example, although there are important uncertain aspects of future climate change, the value of policies encouraging wealthy people and countries to emit less carbon is not uncertain. In this case there seems little reason for scientists not to advocate such policies. Valuable advocacy by scientists may include rejecting policies of uncertain value (e.g., reject policies that promote unlimited economic growth), even though policy makers tend to assess specific policies rather than kinds of policy.

Sometimes premise P2(7) is associated with an explicit concern that advocacy by scientists could implicate scientists in harming society should their advocacy be mistaken (see “The Social Harm Argument”). Equally of concern, scientists can be (and we suspect will be by future generations) implicated for harming society to the extent that they categorically refrain from advocacy.

Premise P2(7) is an unjustified reason to oppose advocacy by scientists because it misrepresents the role of scientists in an interdisciplinary process such as policy assessment and underestimates scientists’ knowledge of issues beyond their given scientific specialty. Policy making appears by its very nature relational, interdisciplinary, and inclusive. It seems unfair or inappropriate to expect a group of people who participate intimately in the formation of the premises used in arguments for policies to then recuse themselves, or allow themselves to be recused, from participating in the policy development process, especially because no other citizen has more or less stake in a public policy than a scientist. Ultimately neither uncertainty nor limited personal expertise is a justified reason to be critical of scientist advocacy.

Operational Arguments

One might oppose scientist advocacy because it conflicts with one’s ability to effectively operate as a scientist. These arguments may be represented by the revised form of the general argument against advocacy, in which premise P2 is replaced with one or more of the following more precise expressions:

- P2(9). Advocacy puts scientists at risk of losing favor with a policy-making agency that is also the primary source of funding for their basic research, research they need to conduct.
- P2(10). Advocacy takes away from time spent doing basic research.
- P2(11). Advocacy would require developing new skills and gaining such skills would take time away from basic research.

Although the literature on scientist advocacy offers little explicit expression of, or reflection on, these kinds of arguments, they seem like real, but understated, reasons for opposing or being apprehensive about scientist advocacy.

Premise P2(9) might justify a scientist’s aversion to specific instances of advocacy (e.g., advocating a policy unpopular with a critical source of funding). Although P2(9) seems to justify caution with respect to the research topics for which one chooses to pursue funding, P2(9) does not generally excuse scientists from advocacy. To justify P2(10) and P2(11) one must argue that the costs to a scientist of advocating outweigh the benefits to the scientist

and society; otherwise, a scientist could neglect nearly any obligation that conflicted with research (e.g., being an attentive parent or spouse and eating and exercising properly).

It is prudent and practical to fully understand the costs associated with different kinds of advocacy. Constraints in time and skill may justifiably influence how a scientist advocates (e.g., how much time is devoted to advocacy and what issues to advocate) and ultimately the effectiveness of one’s advocacy. For over 2500 years, however, ethicists have shown that pragmatic concerns do not (except in special circumstances requiring explication) trump ethical obligations.

Arguments for Advocacy

Arguments against advocacy seem poor reasons for scientists to refrain from advocacy. Rather analysis of these arguments seems to imply *how* one may be an effective and just advocate (Chan 2008). Nevertheless, refuting arguments against advocacy does not, by itself, represent an argument *for* scientist advocacy. Next we analyze arguments scientists’ use for the appropriateness of advocacy.

Science-and-Advocacy-Are-Alike Arguments

One argument for scientist advocacy is rooted in an assertion that because the dichotomy between facts and values is false, advocacy is unavoidable and therefore justified. Examples of those making this argument include Decker et al. (1991); Rutburg (2001); Freyfogle and Newton (2002); Barry and Oelschlaeger (1996); and Ehrlich (2000). Kaiser (2000) discusses this argument when she quotes Alison Power: “the idea that we can draw a line down the center of ourselves and say, ‘This is purely our science and this side is purely our values’ is ridiculous.” Similarly, Paul Ehrlich implies this argument when he writes: “the idea that science should (or can) be value-free is wrong. Scientists must make value judgments all the time—at the very least in the choice of projects, in the choice of methods, and in the interpretation of results. Scientists cannot avoid such judgments: being steeped in values is part of being human” (Kaiser 2000).

A precise expression of this argument is

- P1(a). Science, as an activity, is inherently value laden.
- P2(a). Advocacy is a value-laden work.
- C1(a). Therefore science represents a kind of unavoidable advocacy.
- P3(a). It is acceptable to engage in activities that are unavoidable.
- C2(a). Therefore advocacy by the scientific community is acceptable.

A distinct, but closely related and parallel, version of this argument is

- P1(b). A scientist cannot clearly distinguish the objective and subjective aspects of their science or between their science and their values.
- C1(b). Therefore scientists inevitably produce value-laden work.
- P2(b). To produce value-laden work is to advocate.
- C2(b). Therefore scientists cannot avoid advocacy.
- C3(b). By virtue of C1(b) and C2(b) scientists cannot avoid advocating policies.
- P3(b). It is not inappropriate to engage in activities that are unavoidable.
- C4(b). Therefore a scientist is justified (perhaps not required) to advocate policy.

The conclusion of the first argument—that is, C2(a) depends on C1(a)—is false because it commits the fallacy of composition. A simple example of this kind of fallacy is

- P1. Birds lay eggs.
- P2. Bats and birds are members of the same group (animals that fly).
- C1. Therefore bats lay eggs.

More generally, although premises P1(a) and P2(a) seem correct, these premises do not support C1(a). Although it might be said that science is certainly a kind of advocacy (e.g., advocacy for objective analysis where appropriate and for clear, rational thought), this is a different kind of advocacy than advocacy for policy.

Social Harm Argument

Another argument in favor of advocacy suggests advocacy is appropriate when failure to advocate could be harmful to society. Sherwood Rowland, who actively advocated against chlorofluorocarbons emissions prior to knowing for certain the consequences of ozone depletion, commented, “I thought that the possible consequences were severe enough that one should not sit back and watch this for a while to see what happens” (Kaiser 2000).

The formal argument underlying this kind of reasoning is

- P1. Failure to advocate could result in great social harm.
- P2. All citizens have an obligation to advocate, to the best of their ability, against great social harm.
- P3. Scientists are citizens.
- C1. Therefore scientists have an obligation to advocate against great social harm.

According to this argument scientists’ obligation to advocate is likely greater than most citizens’ obligation, given scientists’ deeper understanding of relevant facts. Although this argument is largely appropriate, it limits the role of science advocacy to situations in which the

scientist is impressed by the apparent social harm of a situation. It is not clear, however, that scientist advocacy should be limited only to policy issues the scientist believes may cause great social harm.

This argument is ironic because here uncertainty plays a role in suggesting why one should be an advocate, yet others think uncertainty gives occasion to avoid advocacy. Although the social harm argument has merit, substantial revision results in what we think is a sound argument for advocacy.

The Citizenship Argument

The Citizenship Argument for advocacy is

- P1. A scientist has some obligation to serve society as a scientist.
- P2. Advocacy *conflicts in some way* with *some aspect of science*.
- P3. Advocacy (i.e., the assessment, formulation, and promotion of policy positions) is a valuable and intellectually challenging societal activity.
- P4. Scientists have a moral obligation to be good citizens.
- P5. Good citizens have a moral obligation to advocate (by virtue of its value) to the best of their ability.
- C1. Therefore citizen scientists have an obligation to advocate.
- P6. In practice there are only a few occasions when P1 and P2 overrides C1.
- C2. Therefore scientists, as individuals, and science, as a whole, should advocate.

This argument seems to underlie numerous scientists’ defense of advocacy (e.g., Noss 1992; Meine & Meffe 1996; Lubchenco 1998; Lee 1993) and Stuart Pimm’s comment (Kaiser 2000): “I have a moral responsibility as a citizen to make people aware of what the science means.” Hixon (2000) also supports this argument:

... academic scientists [should] realize that they are citizens like everyone else, and as citizens, they have a responsibility to engage in public debate and politics... By abdicating their role as citizens engaged in public debate during the development and implementation of environment policy, university scientists leave the job to others who have relatively limited technical knowledge, and often, less objective motives.

Premises P4 and P5 represent essential and uncontroversial aspects of citizenship. All citizens have a moral obligation to actively promote in their society that which they are justified in thinking is right or good and to actively oppose that which they are justified in thinking is wrong or bad. Consequently every scientist has an obligation to be a just and transparently honest advocate. Societies behave unethically when they expect or encourage their citizens to abdicate their privileges and responsibilities as citizens without adequate justification. When

scientists reject advocacy as a principle, they reject a fundamental aspect of their citizenship. Rejecting one's responsibility as a citizen is unethical.

Are scientists perhaps exceptions? Exceptions certainly exist. For example, felons and the insane are excused and excluded from some privileges and responsibilities of citizenship. Special circumstances justify exceptions, but not every circumstance is special. Lawyers, teachers, and religious leaders are all special kinds of citizens, yet we do not consider these kinds of citizens excluded from their moral obligation to be advocates to the best of their ability, even though advocacy by such citizens may create some ethical conflict.

Is there something particular about a scientist's nature that would justify an excuse from advocacy? One would need an argument explaining *how* a scientist's special status excuses or disallows them from advocacy. Three considerations suggest that there are no such explanations.

1. Scientists are distinctive among citizens because they possess a distinctively valuable understanding of objective analysis and descriptive facts about the world. Inasmuch as policy assessment requires nuanced knowledge of objective analysis and descriptive facts, scientists make a distinctive contribution to policy assessment. The value and distinctiveness of their skills does not merely allow citizen scientists to advocate, it represents a strong obligation to do so (P5).

2. Defeating an argument for advocacy premised on a strong obligation to citizenship requires establishing that scientists' obligation to science conflicts with and outweighs their obligation to being a good citizen. Arguably the cost of advocacy to science or scientists does not outweigh the benefits, and science's fundamental nature does not preclude scientists from being just and effective advocates. Given the priority of citizenship over science the tie breaker (should the two conflict) should not be judged by the question, What does science need most? but by the question, What does society need most?—another peer-reviewed paper published in a technical journal or the contributions of scientists to justified and transparent advocacy.

3. Perhaps allowing and encouraging scientists to be justified advocates gives scientists a political advantage over other citizens? It may. Some assert that although scientists are obligated to advocate, they should self-impose handicaps, removing advantages they might have over other kinds of citizens. For example, Nielsen (2001) writes, "Scientists and professionals do have a responsibility to advocate. . . as plain citizens. . . but we need to leave our special access and influence as professionals at home when we do so."

This is like advising philanthropists to advocate their cause, but to do so without the advantage of their financial resources because their cause has controversial political implications and their financial advantage is unfair.

The financial advantage of a philanthropist is no more unfair than the intellectual advantage of a scholar, and obligations of the philanthropists and the scientists are alike: promote what they are justified to think is right to the extent of their abilities. That scientists would suggest to themselves that they should promote policy, but do so without relying on their intellectual resources is pathologically disempowering.

Ultimately it is a perversion of democracy to muffle the voice of the most knowledgeable among us, and consequently amplify the voice of those with the greatest ignorance. Silencing scientists who wish to be just and transparent advocates promotes mob rule or despotic rule by special interests.

Importantly the citizenship argument does not adequately address *how* a scientist should advocate. The primary basis for judging how to ethically manifest advocacy is transparency and justification. Justified advocacy is a policy position whose argument is clearly and thoroughly presented. Transparent advocacy occurs when advocates advance arguments they believe are sound and valid. That is, they do not use arguments they believe may affect policy at the expense of arguments they believe to be sound and valid. Transparency separates good community leaders from sophists.

Conclusion

Reasons to oppose advocacy by environmental scientists have been made on the grounds that doing so compromises scientific credibility, conflicts with the essential nature of science, and conflicts with the practical requirements of being a productive scientist. Reasons to favor scientist advocacy have been based on the fundamentally similar nature of science and advocacy, concern for the social harm that might arise from not advocating, and the dual nature of a scientist citizen. When examining these positions as formal arguments composed of premises and conclusions, all but two arguments (social harm and citizenship) collapse. Moreover, only one argument seems robustly sound and valid. According to this argument scientists, by virtue of being citizens first and scientists second, have a responsibility to advocate to the best of their abilities and in a justified and transparent manner. Importantly arguments against science advocacy are valuable for offering insight about how one should or should not be an advocate, not whether one should advocate. If these conclusions are accurate, then Hardin (1998) is correct: "[O]ne of today's cardinal tasks is to marry the philosopher's literate ethics with the scientist's commitment to numerate analysis."

Our assessment calls for more active participation by scientists in matters of policy. Nevertheless, each scientist is called according to his or her abilities. Broad

participation, however, will undoubtedly result in disagreement among good scientists and in some scientists advocating in an unjustified and dishonest manner. Thus broad participation will substantially complicate the policy-making process. Although this might seem undesirable, our goal here should not be simplicity but rather the betterment of society.

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Supporting Information

A more complete list of sources is available as part of the on-line article (Appendix S1). The author is responsible for the content and functionality of these materials. Queries (other than absence of the material) should be directed to the corresponding author.

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