Environmental Values, Objectivity, and Advocacy

A Sociological Study of Academic Environmental Scientists

by

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ABSTRACT

Professional environmental scientists are increasingly under pressure to inform and even shape policy. Scientists engage policy effectively when they act within the bounds of objectivity, credibility, and authority, yet significant portions of the scientific community condemn such acts as advocacy. They argue that it is nonobjective, that it risks damaging the credibility of science, and that it is an abuse of authority. This means objectivity, credibility, and authority deserve direct attention before the policy advocacy quagmire can be reasonably understood. I investigate the meaning of objectivity in science and that necessarily brings the roles of values in science into question.

This thesis is a sociological study of the roles environmental values play in the decisions of environmental scientists working in the institution of academia. I argue that the gridlocked nature of the environmental policy advocacy debates can be traced to what seems to be a deep tension and perhaps confusion among these scientists. I provide empirical evidence of this tension and confusion through the use of in depth semi-structured interviews among a sampling of academic environmental scientists (AES). I show that there is a struggle for these AES to reconcile their support for environmentalist values and goals with their commitment to scientific objectivity and their concerns about being credible scientists in the academy. Additionally, I supplemented my data collection with environmental sociology and history, plus philosophy and sociology of science literatures. With this, I developed a system for understanding values in science (of

which environmental values are a subset) with respect to the limits of my sample and study.

This examination of respondent behavior provides support that it is possible for AES to act on their environmental values without compromising their objectivity, credibility, and authority. These scientists were not likely to practice this in conversations with colleagues and policy-makers, but were likely to behave this way with students. The legitimate extension of this behavior is a viable route for continuing to integrate the human and social dimensions of environmental science into its practice, its training, and its relationship with policy.

DEDICATION

This is dedicated to everyone doing good things with what time they have.

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Chapter 1

INTRODUCTION

Do environmental values play roles in the decisions of academic environmental scientists?[1] If they do, what roles do they play? Furthermore, what can be gained by studying how environmental values function in the decisions of academic environmental scientists (AES)? This linked triad of questions motivates and structures this thesis. The benefits of research on this topic are clear given the protracted history of policy advocacy debates in conservation biology, ecology, and other environmental sciences.

In these debates scientists reveal how they understand what science is and what it is supposed to do (Kaiser, 2000; Wallington & Moore, 2005; Pielke, 2007; Neff, 2011) through their use of archetypical arguments for and against policy advocacy (Nelson & Vucetich, 2009). When scientists understand objectivity differently they understand science differently, and consequentially the role of science in society differently. Environmental scientists are subject to semantic confusion (Lackey, 2007) like any other human endeavor, but they are increasingly under pressure to contribute to policy making (Pielke, 2007) at a time thought to be pivotal for the survival of life on Earth (Barry & Oelschlaeger, 1996; Vitousek, A., Lubchenco, & Melillo, 1997; Lubchenco, 1998; Wilson, 2002).

[1] An environmental scientist is difficult to define. Bocking (2006) treats the science itself as "diverse and diffuse... the boundaries of which are always open to negotiation" (p. 15). I construct my working definition on p. 44-45 after introducing my respondents.

This addition of pressure further supports the merit of sociologically investigated how AES perceive, treat, and use values (of which environmental values are a subset) in their professional and personal lives. In this thesis I seek to build an understanding of how AES comprehend the complex relationship among values, scientific objectivity, credibility, authority, and advocacy. It is important to understand how AES think about environmental values and advocacy, including how they determine when it is acceptable (or required) in their work. This inquiry benefits from a sociological approach because its empiricism helps describe and inform the debates over values in science and policy advocacy that often take place at a more conceptual or philosophical level.

The results presented in this thesis are the product of this kind of sociological study of environmental values and their roles in the decisions of a sample of AES. Specifically, I interviewed nineteen professors of science with training or experience in ecology, conservation biology, sustainability, and certain types of engineering. I structured our conversations around research selection motivations, academic employment, objectivity's relationships to credibility and authority, and policy engagement behaviors. This often led to discussing the environmental movement, the importance of mentoring students, and developments in the practice and in the philosophy of science.

Research into the values actually held by scientists seems useful for advancing the debate over advocacy, objectivity, and credibility in the environmental sciences, and for improving the ability of scientists to contribute to

environmental problem solving. Environmental scientists and their science are less able to effectively contribute to policy decision-making and to its politics until open discussions about how values are embedded in science are had in a more explicit and transparent manner. Exploring how values are understood and function in the scientific enterprise can improve the quality of discussion found in the environmental science policy advocacy debates by putting the science in its human and social context (Barry & Oelschlaeger, 1996; Allchin, 1999; Robinson, 2006; Pielke, 2007; Meyer, Frumboff, Hamburg, & de la Rosa, 2010). As Sarewitz (2004) argues, "Bringing the value disputes concealed by—and embodied in—science into the foreground of political process is likely to be a crucial factor in turning such controversies into successful democratic action.... Moreover, the social value of science itself is likely to increase if scientific resources relevant to a particular controversy are allocated after these value disputes have been brought out into the open, their implications for society explored, and suitable goals identified" (p. 399).

I organized this thesis into a series of chapters that 1) provide a historical and intellectual context for how the changing practices of environmentalism and academic science are influencing the worldviews of AES, 2) illustrate how the AES are handling these changes through the examination of two recent policy advocacy debates, 3) develop and describe my sociological methods for studying the views these scientists, and 4) present and discuss the results of interviews conducted with nineteen AES.

Chapter two examines how AES are conflicted and perhaps confused about how to reconcile their support of environmental values with the development and maintenance of scientific credibility in the academy. I provide brief backgrounds of American environmentalism and academic science and show how their practices and conceptual foundations are changing the content of their narratives. To illustrate what these changes are like in practice I review examples of the policy advocacy debates in two top tier environmental science journals. I end the chapter by explaining the framework of values I use to discuss and analyze my results. In chapter three I describe my methodological approach of using grounded theory to gather data by conducting interviews and I introduce the structure of the results that I present and discuss in chapter four.

I conclude my study by suggesting that AES can operate successfully and legitimately with respect to environmentalism and academic science by acting on their environmental values without compromising their objectivity, credibility, and authority. This dual orientation may enhance meaningful and effective policy engagement. Ultimately, I argue that AES can benefit from discussing and interrogating their understanding of environmental values more explicitly and integrate these commitments into their emerging community's scientific work. My sociological study of environmental values held by a sample of AES and an analysis of their attitudes toward policy advocacy also suggests that it is well within the reach of AES to incorporate environmental values more openly in their research and professional activities.

Chapter 2

THE ENVIRONMENT OF VALUES IN ACADEMIC ENVIRONMENTAL SCIENCE

In this chapter I provide a brief overview of environmentalism and academic science in America in order to develop my argument for what the sources of tension and possible confusion are for academic environmental scientists (AES). I review (in summary fashion) their historical development and describe how the practice and philosophical foundations of environmentalism and academic science are changing in response to accusations of inaccurately portraying what it is that they do. Following this, I illustrate these issues by analyzing analyze two policy advocacy debates published in the journals *Conservation Biology* and *Frontiers in Ecology and Environment.* I end this chapter by laying the groundwork for how I handle discussions of value throughout the rest of this thesis.

Changes in Environmentalism

Earth Day, April 22, 1970 represents the moment in time when the American environmental movement became a social force to be reckoned with, and one of increasing interest to policy makers (Nordhaus & Shellenberger, 2007; Stone, 2009; Dunlap, 1992). Nationwide, twenty million people reportedly participated in teach-ins, rallies, and protests (Dunlap, 1992). The key organizer of the event, Denis Hayes, reflected the image of many of the participants with his

youth and his grassroots approach to education. Many of the early movement's participants were inspired by ideas captured in key environmental works such as Rachel Carson's *Silent Spring (*1962), Paul Ehrlich's *Population Bomb* (1968), and Aldo's Leopold's earlier *Sand County Almanac* (1949), a paperback copy of which was released in the late 1960s and which would turn into the "environmentalist's bible" (Duffy, 2004; Stone, 2009). The common thread among these iconic literary works is not only the subject matter—i.e., man's detrimental relationship with nature is in need of a transformation— it is also the manner in which textual authority derives from each author's scientific expertise in the construction of their arguments (Bocking, 2006; Nordhaus & Shellenberger, 2007).

People armed with scientific knowledge stood witness to the polluted Cuyahoga River burning in 1969 and decided something had to be done (Nordhaus & Shellenberger, 2007, p. 21, 27-29). The first image of Earth from space was taken the same year and this reinforced the uptake of new beliefs and environmental values (Stone, 2009; Nordhaus & Shellenberger, 2007, p. 21, 24). Humility mingled with horror and with the first Earth Day came hope: one logical recourse was political change. The passing of the National Environmental Policy Act (NEPA) in 1969 made it the cornerstone of U.S. environmental law and policy. The following decade saw the enactment of thirteen major federal

environmental policies aimed at protecting nature from society's pollution.[2] Grassroots movements and science coalesced, forming and then catapulting environmentalism as a social movement into successful political action with "save the earth" as its motto (Dunlap, 1992; Nordhaus & Shellenberger, 2007; Stone, 2009).

Narratives become easy to grasp as they simplify societal and environmental complexity and reduce these forces into less complicated accounts. In Ted Nordhaus and Michael Shellenberger's *Break Through: From the Death of Environmentalism to the Politics of Possibility,* the environmental movement's "political fable" is deconstructed and reconstructed in attempts to rid society of the "albatross [called] the politics of limits" (Nordhaus & Shellenberger, 2007, p. 22, 17). Nordhaus and Shellenberger recognize that the well-packaged stories of the 1960s and 70s energized people to support environmental policy development; the narrative served its purpose. However, it imprinted within us an incomplete (if not false) story rife with fundamental concepts that, they argue, we must overhaul or jettison if we are to achieve a more progressive and sustainable social and environmental order.

Take, for example, the Cuyahoga River. It caught fire more than a dozen times in the hundred years prior to 1969. Up until this event industrial river fires were somewhat of a socially tolerated annoyance. In fact, the now iconic

[2] The Environmental Protection Agency's history website http://www.epa.gov/history/ (accessed 3/15/2012) and the National Resource Defense Council's legislature website http://www.nrdc.org/reference/laws.asp (accessed 3/15/2012).

newspaper picture of Cuyahoga burning was shot during the fire of 1952 (Nordhaus & Shellenberger, 2007, p. 23). Nordhaus and Shellenberger argue that it was not simply the fire igniting environmentalist concerns, but people using the "visual imagery [as] a kind of nostalgia masquerading as political strategy" to ignite environmentalism and imbue it with political advocacy (p. 24).

Citizens across the nation idealized how nature used to be before man polluted it and grew nostalgic. Seeing Earth from outer space for the first time buttressed this nostalgia of a pristine planet. Such worldviews do not accommodate rivers on fire or springtime without birds or man as part of nature. Rather, the programmed worldview of environmentalism held that people interact with nature largely by contaminating it with pollution, so pollution and people must be regulated in order to protect nature. As Stephen Bocking argues in *Nature's Experts* (2006), "Several of the most serious environmental problems... were only recognized as problems once scientists had described them" (p. 4) which allows scientists "privileged access to the political system, where they shape both policies and their implementation, framing definitions of what is and is not feasible" (p. 22). Scientists as quantifiers of scope and environmental problems theorize the ramifications successful policy change intended to avoid. "Environmentalists have often drawn on scientists authority," (p. 23) in part because defining these decisions as scientific "discourage[s] potential opponents," (p. 22) and because it "implies... regulation of industry activities" (p. 23). But, it is recognized that the science did not dictate the policies, rather, "these policies

were a response to a wave of popular support that reflected evolving aesthetic, ideological, and ethical perspectives about the preservation of nature" (Sarewitz, 2000).

What then of Earth Day? And what does this mean for environmentalism in the 21st century? Given that Earth Day is the milestone linked with the origins of contemporary environmentalism (Dunlap, 1992, p. 2), opening this question up provides some insight into why environmentalism "died" (Nordhaus & Shellenberger, 2007). The common narrative casts Earth Day as the brainchild of the idealistic and environmentally concerned youth. In reality, Senator Gaylord Nelson had the idea to host a teach-in after seeing this method's success with the anti-Vietnam movement (p. 30). With his power came funding for Earth Day and the formation of the National Resource Defense Council (p. 30). In other words, Earth Day's and environmentalism's political entry into American government began within the government in a way not often recognized in light of the perhaps more inspiring story of a spontaneous grassroots social movement.

That said, a social movement did form during this time and it did taper off significantly after the landmark policy reformation of the 1970s. Nordhaus and Shellenberger point to how the institutions of environmentalism codified the traditional worldview of man's separation from nature and are now restricted by it as a result (Nordhaus & Shellenberger, 2007). Complementary to this analysis, environmental sociologist Riley Dunlap evoked Mauss's (1975) "natural decay" of social movements model to describe the way in which the institutionalization

of the environmental movement absorbed perceived social responsibility (Dunlap, 1992, p. 3-4). Where Dunlap sees institutions as siphoning environmentalism from the people (in agreement with the common narrative), Nordhaus and Shellenberger see the common narrative described at the beginning of this section ignorant of its institutionalized inception.

If we recognize institutions are effective tools and we recognize that we must find ways to face the environmental challenge, then institutional creativity holds some promise. The "break through" for Nordhaus and Shellenberger is that "modern environmentalism with all of its unexamined assumptions, outdated concepts and exhausted strategies, must die so that something new can live" (Nordhaus & Shellenberger, 2007, p. 10). This "something new" is "post environmentalism," where the special interests of old environmentalism are analyzed, filtered, and integrated into larger societal needs such as economic development, health care, and social justice.

Although their conclusion seems somewhat overstated it also seems to resonate with many academics and activists within the growing field of sustainability, which uses interdisciplinary skills to address a range of problems emerging from maladaptive human-environment interactions (for the history and organization of the sustainability movement, see Miller, 2011). Even the mainstream motto "go green" shows a significant shift away from environmentalism's "save the earth" because people are empowered to help and improve their livelihoods rather than make the tradeoff at their personal expense.

As William Cronon argued in his plenary speech for the American Society of Environmental History in 2011, we are learning from our mistakes as "negative environmentalists" and applying our experience to make some sense of and do some good with the new concept of positive sustainability (Wheeler, 2011).[3, 4]

Scientific authority is still invoked to justify political action when a group agrees on the scientific and normative framing of policy decision-making. This reduces the diversity of alternative policy options and marginalizes socially held values (Sarewitz, 2004; Bocking, 2006; Nordhaus & Shellenberger, 2007; Pielke, 2007). One prominent group is that of academic experts because academia is seen as a major source of authority.

Changes in Academic Science

Institutions share "understandings and expectations of appropriate organizational form and behavior," and are comprised of individual organizations, which are under pressure to change their methods and behavior to match the appropriate "institutional environment" (Tolbert, 1985, p. 1). This is the case with academia and universities. But what constitutes the institutional environment? Can its organizations or partner institutions affect it? These questions are threaded throughout the rest of this thesis, but for now I turn to the professionalization of

[3] Your author was a member of this audience.

[4] Nordhaus and Shellenberger allude to this point. They state that post environmentalism must be sustainable, but stop short of calling it sustainability.

science in academia to see how it influenced the practice and conceptual foundations of science.

Science is the "systematic pursuit of knowledge" (Pielke, 2007, p. 31). Or put another way, science's "proper concern is the construction of comprehensive accounts of the natural world" and it does this by "testing, retesting, rejecting, and reformulating hypotheses" (Longino, 1990, p. 32, 34). Science is a method and perhaps a worldview strongly guided by epistemic virtues (Longino, 1990; Norton, 1991; Sarewitz, 2004; Pielke, 2007) which are "specific ways of investigating and picturing nature (Daston & Galison, 2007, p. 28). Of these virtues, objectivity is arguably the most common. Indeed, "conceptually, it operates by synecdoche, making this or that aspect of objectivity stand for the whole [of science] on an *ad hoc* basis" (Daston & Galison, 2007, p. 29).

Objectivity has two components. One is its descriptive accuracy of the natural phenomena under scientific interrogation. The other is its freedom from inappropriate values held by the scientific practitioner or imposed by some aspect of society such as moral, economic, propriety, religious, and otherwise cultural or personal values known as non-epistemic values (Longino, 1990, pp. 62-63). This two-part definition is characteristic of the positivist's account of what counts as good scientific knowledge, the production of which depends each individual contributing scientist having the quality of objectivity (p. 66).

The underlying notions of purity in science are reflected in the development of the atomic bomb in World War II and the new science policy

following their uses (Stokes, 1997). President Franklin D. Roosevelt commissioned Vannevar Bush, the Director of the Office of Scientific Research and Development (OSRD), to report on how to transfer America's wartime scientific progress into peacetime in 1944 (Bush, 1945). The OSRD was housed in the Executive Office of the President (Stokes, 1997, p. 47) and this contributed to the impact Bush's report *Science the Endless Frontier* would grow to have following its publication in July of 1945. In the report Bush coined the term "basic science" (research performed without practical ends, in its "purest form") and placed it in opposition to "applied science" (the transformation of basic knowledge to "complete answers" through innovation) (p. 3). He was the first to associate basic science with pure science and his argument for how to attain scientific greatness hinges on it. Bush's argument is now known as the "linear model," and through it Bush explains that scientific greatness comes from heavily investing in basic science that is free of any contaminating thoughts about its application. Such thoughts are the responsibility of technological innovators down the pipeline rather than research scientists. The dichotomy between basic and applied science was thus drawn and codified through the identity of scientists.

The United States dropped both atomic bombs on Japan the month following the publishing of *Science the Endless Frontier* and brought the end of WWII into sight. The method of producing the bombs followed Bush's linear

model,[5] so this guided the new standard practices and philosophies of science institutionalized by the creation of the National Science Foundation (NSF) a few years later. NSF's mission was to primarily pursue "pure research and training" by using publically generated funds to support science in academia and other research institutions (Kevles, 1987, p. 344). As Bush stated in his 1945 report,

> "These institutions are uniquely qualified by tradition and by their special characteristics to carry on basic research. They are charged with the responsibility of conserving the knowledge accumulated by the past, imparting that knowledge to students, and contributing new knowledge of all kinds. It is chiefly in these institutions that scientists may work in an atmosphere which is relatively free from the adverse pressure of convention, prejudice, or commercial necessity."

The practice of academic science as only basic science and training of objective scientists served to mutually ensure freedom from subjective and social non-epistemic values. This recent history supports the belief that objectivity defines science and in "environmental affairs, the postwar authority of science was epitomized by confidence that the same strategies that had won the war could be applied to defeating 'enemies' in nature" (Bocking, 2006, p. 15).

But the history of objectivity is much longer. The oldest records of objectivity date back to the fourteenth century, where the Latin adjectival form *obiective* was (as now) paired with its antithesis, *subiective.* This oldest known casting defined objective reports of events as "things as they are presented to consciousness," and subjective events were the actual "things in themselves"

[5] Einstein's basic research in atomic energy fed into the big-budgeted Manhattan Project which produced the atomic bomb (Kevles, 1987).

(Daston & Galison, 2007, p. 29). These meanings carried on into the dictionaries of the eighteenth century as seen in the definition of objectivity being the descriptive property of a thing "when it exists [as an] Object of the Mind" (Daston & Galison, 2007 p. 29 citing Chambers, 1728). The reversing of meaning familiar today took place only in the mid nineteenth century (Daston & Galison, 2007, p. 31). Clearly, the meaning of objectivity is subject to change.

After objectivity and subjectivity switched meanings, objectivity became one of the guiding epistemic virtues[6] of science along with truth-to-nature (i.e. descriptive accuracy) and trained judgement (i.e. the scientific use of methodological and mental skills) (Daston & Galison, 2007, pp. 19, 33, 39). The relationships between the concepts of objectivity and subjectivity, descriptive acccuracy and freedom from value, and scientific training changed over the centuries. One example is how scientific illustrators went through a transistion in the 1860s from seeking to display idealistically true forms of natural objects to embracing the messiness of details and variation found in nature (Daston & Galison, 2007, p. 35). Both sides believed that their method was more true to nature and the other side was "scandalous [by being] subjective" (p. 35). It should come as no surprise that these concepts central to science are continuing to change. As Richard Rudner concluded in reference to objectivity defining the postivist's account of science (1953, p. 6),

[6] Epistemic virtues then are epistemic values now. They are simply understood are traits that define knowledge or are likley to produce knowledge if followed. See McMullin (1982) and Daston & Galison (2007 p. 39-42) for a more in depth discussion of epistemic values.

> "The slightly juvenile conception of the coldblooded, emotionless, impersonal, passive scientist mirroring the world perfectly in the highly polished lenses of his steel rimmed glasses,—this stereotype—is no longer, if it ever was, adequate."

Many philosophers of science have since showed how central values are in science and are often collectively refered to as "post-positivist" arguments (e.g., McMullin, 1982; Nickel, 1989; Longino, 1990; Rolin, 1998; Machamer & Douglas, 2003). This began with elucidating how evaluating hypotheses and determining the strength of inference were epistemic value judgements, and expanded into discussions about cognitive, social, political, and other values in science. Longino (1990), like many post-positivist scholars, argues we can work with our values and still "our intuition that scientific inquiry at its best is objective is kept intact by appealing to the spirit of criticism that is its traditional hallmark" (p. 82).

Such a view entails a shift away from thinking science as the discovery of nature's universal truths through the toiling efforts of individuals in isolation (positivism) towards science as a social activity with transparent values producing increasingly more helpful and explanatory hypotheses and theories through the public interrogation of ideas, beliefs, and values (post-positivism) (Longino, 1990, p. 66-67). Longino argues that the peer reivew system characteristic of science is one of the main processes that transforms scientific research into knowledge through structured but relatively free social interaction. Longino continues to argue that if scientists can articulate and then subject their values to constructive criticism, then values "can be defended, modified, or abandoned in

response" (p. 74) similar to the way the peer review system treats research. Sarewitz (2004) echoes this point by arguing that to dismantle the scientization of politics process, the open deliberation about norms and values within the scientific community. Without this, science is used as an ill-suited vessel for value based decisions.

Given this shift in practice, objectivity becomes a concept with its degrees "dependent upon the depth and scope of the transformative interrogation that occurs in any given scientific community" (Longino, 1990, p. 79). In other words, being objective is a community practice, not a characteristic of individuals. But "most scientists… are simply unaware of the understandings of the scholarly community who study science in society" (Pielke, 2007, p. 8). By Longino's argument and Pielke's claim, the more ignorant the scientific community is of the critiques of science, the less objective they are and apparently this is the current state.

This review of environmentalism and academic science in America sheds light on why environmental scientists employed by academia publically take a guarded approach to environmentalism due to its inherent normativity but are less wary of research based sustainability. They are unsure how to transition towards a socially relevant science because the history of positivist objectivity has is integral to the employment of scientists in academia and the funding of their basic science through NSF. Furthermore, questions of socially relevant science raise concerns about policy advocacy. As mentioned in chapter one, these debates

illustrate how scientists understand objectivity differently and consequently understand advocacy and the role of science in society differently.

Two Policy Advocacy Debates

The two environmental science advocacy debates I chose to analyze in the AES literature appeared in the journals *Conservation Biology* in 2007, and in *Frontiers in Ecology and the Environment* in 2008–2010. They illustrate how changes in the practices and conceptual foundations of environmentalism and academic science are starting to influence AES.

Conservation biology as a scientific discipline struggles with its stance toward policy advocacy. This tension is not new; on the contrary, the debate over advocacy by biodiversity scientists took root well before the field emerged and the Society of Conservation Biology (SCB) formed in the mid-1980s (Soulé, 1985, Meine, Soulé, & Noss, 2006).[7] With this in mind, SCB decided to hold a symposium in the 2006 annual meeting on the topic of policy advocacy. The five papers presented at the symposium were published in a special edition of its journal *Conservation Biology* in 2007 (Lackey, 2007; Noss, 2007; Brussard & Tull, 2007; Murphy & Noon, 2007; Scott, et al., 2007). Together, these papers provide a revealing glimpse into conservation biologists' views about the role of

[7] Various scientific, social, institutional, and political factors came together in new ways in the 20th century to move scientists to advance a broader conservation agenda for society (Callicott, 1990; Minteer & Manning, 2003; Meine, Soulé, & Noss, 2006).

advocacy in their science, as well as their understanding of the various possible modes of policy advocacy by conservation scientists.

The authors of all five papers agree that environmental scientists are "in the best position to interpret [the] facts [they generated]" (Noss, 2007, p. 19). Additionally, they all agree that scientists should use this knowledge to inform policy. J. Michael Scott and his colleagues surveyed the SCB membership at the SCB meeting in 2006 about the prevalence and promotion of policy advocacy in *Conservation Biology*. They found 89 percent[8] of the survey respondents knew of such prevalence and 72 percent thought the journal should continue to publish papers with this type of language. Hiding within this consensus of SCB membership, however, is disagreement about what advocacy actually is. This disagreement forms the core of the policy advocacy debate in the field.

Robert Lackey defines policy advocacy as the "support of a particular policy or class of policies" and values as "a core belief that tends to determine or shape personal or group policy preferences," to argue that advocacy is inappropriate for scientists (Lackey, 2007, p. 13). Lackey "subscribe[s] to the view that science is not free of values" (p. 13). Despite apparently understanding science from a post-positivist point of view, he still believes that the proper role of the scientist when informing policy is to provide "objective… accurate, relevant, and policy-neutral information" (p. 12). Furthermore, this marks the line between normal and normative (i.e. value-laden) science, the latter of which

[8] I note that the paper reports "more than 70%" yet the data results add up to 89.4% (Scott, et al., 2007, p. 32).

engages in "stealth policy advocacy" due to its implicit or explicit policy preferences as seen in language like "degradation, good, and healthy" (p. 13, 14).

Scientists acting as policy advocates—stealth or otherwise—run the risk of harming their credibility and the credibility of the scientific community according to Lackey (2007) and Scott, et al (2007). Dennis Murphy and Barry Noon's paper echoes Lackey's positions that scientists must provide neutral information when participating in decision-making to maintain credibility and increase the impact of science on policy and management decision-making (Murphy & Noon, 2007).

Reed Noss takes a contrasting position. He sees no contradiction between a conservation biologist being an advocate for biodiversity (and other normative issues) while retaining objectivity (Noss, 2007). Like Lackey, he acknowledges that values are in science, but he carries this further. Noss maintains that how scientists select research, interpret results, and decide what to advocate for are all value-laden choices. This leads to an alternative form of objectivity Longino (1990) argues for, where the "collective, social process of science" is reflected (Noss, p. 19). Included in this social process is discussing "scientific and philosophical ideas with your colleagues and students in the classroom" (p. 19).[9]

Peter Brussard and John Tull introduce four types of advocacy they believe conservation biologists, particularly academics, ought to engage in: professional advocacy, advocacy for science, advocacy for ecosystem services,

[9] This last point will be opened up using respondent data in chapter four.

and advocacy for the natural world (Brussard & Tull, 2007, p. 21-23). Professional advocacy informs policy decision-makers and managers—in addition to the public—of the science with their expertise when issues develop. Essential to this is being explicitly transparent about what is known, what is thought as known, and what is opinion. But the education and experience of the policy decision-maker(s) the scientist is trying to inform limits even the most earnest professional advocate. Brussard and Tull argue academics have a special responsibility to incorporate advocacy for science into their roles as educators (p. 22). By educating students, Brussard and Tull hope to enhance the abilities of future policy-decisions makers and the general public to better inform their choices.

Brussard and Tull (2007) continue by discussing how advocacy for ecosystem services and for the natural world reinforces this point. They believe this helps put citizens in touch with their environing conditions, because "without a first-hand familiarity with nature the conservation ethic wanes" (p. 22, 23). Advocating for science through education and advocating for people to have direct contact with their ecosystem services and the natural world work together. These three forms of advocacy contribute to the effectiveness of professional advocacy by increasing the odds that policy decision-makers and stakeholders are working with a similar foundation of values and understanding of the environment.

The positions taken in this debate indicate that the authority of science is at least uncommon. Through this assumed axiom comes the desire to have works against the grain towards widespread agreement on shunning advocacy (Lackey, 2007; Scott, et al., 2007), the definition of objectivity (Noss, 2007), and society's evaluation of nature (Brussard & Tull, 2007).

The Ecological Society of America (ESA) also has a history of policy advocacy and continues to struggle with finding and following guidelines for this activity (Janzen, 1986; Tjossem, 1994; Bazzaz, et al., 1998; Kinchy, 2006; Chew, 2009). Indeed, current disagreements over advocacy divide environmental scientists just as they did a hundred years ago during the early formation of ESA in 1915.[10] Today, however, ecologists have more scholarly venues in which to disseminate their views on advocacy and related questions of science and society. For example, the ESA started publishing *Frontiers in Ecology and the Environment* in 2003 to go "beyond the recognized boundaries of a traditional scientific journal" (Lymn & Silver, 2010). According to ESA's Director of Public Affairs[11] Nadine Lymn and *Frontiers'* Editor-in-Chief Sue Silver[12], the journal

[10] Victor Shelford was one of the founding members of ESA and became the *de facto* chairman of the Committee on the Preservation of Natural Conditions in 1917. (Tjossem, 1994; Kinchy, 2006; Chew, 2009). From 1917 to 1945, the committee actively used the scientific value of basic research to tactfully advocate for policies. WWII increased tensions about advocacy in ESA and Shelford was bureaucratically stripped of his power before he resigned. Shelford went on to help form the Nature Conservancy in 1950.

[11] This is the case of the writing in July, 2012. (http://www.esa.org/pao/)

[12] This is the case of this writing in July, 2012. (http://www.esa.org/aboutesa/staffDirectory.php)

did this by providing the publication space for ecologists to discuss the implications of their scientific research for policy makers and resource managers (Silver, 2003).

Frontiers is criticized simultaneously for going too far and not going far enough with their mission. This tension is on display in what I'll refer to as the Don Strong[13] debates of 2008–2010 (Strong, 2008a; de la Rosa, 2008; Strong, 2008b; Burke & Lauenroth, 2009; Strong, 2009; Lymn & Silver, 2010; Meyer, Frumboff, Hamburg, & de la Rosa, 2010). Examination of these debates shows how controversial the advocacy question remains among ecologists nearly a century after the formation of the ESA.

At the ESA Annual Meeting in 2008, audience members "were told by a prominent ecologist that we are scientists and therefore should eschew environmentalism" (Strong, 2008a, p. 347). In the audience sat ecologist (and editor of the ESA journal, *Ecology*) Don Strong and he channeled his surprise and frustration regarding this eschewing position into a 2008 *Frontiers* editorial. Strong argued in favor of ecologists' embracing environmentalism because "[ecologists] use science to study the environment, and science provides the rationale and avenue for its preservation" (p. 347). Additionally, Strong argued, "To separate ecological science from environmentalism to avoid potential negative connotations of the latter affords anti-environmentalists the power of

[13] Don Strong became Editor-in-Chief January 1, 2001 (*Ecology's* New Leadership, 2001) and is still in this position of this writing in July, 2012. (http://www.esapubs.org/esapubs/editors_E.htm)

demagoguery; with rhetoric and false claims, they will have achieved prejudice against the subject of our studies" (p. 347). He concluded that "It should be a tenet of our ethics as ecologists to reject and counter the defamation of environmentalism" (p. 347).

Carlos de la Rosa replied to Strong's argument by writing that if ecologists are environmentalists, they run the risk of acquiring the "interest group" label and become an advocacy group (de la Rosa, 2008). For de la Rosa, if scientists lose their special authority, then the already weak channels of communication between ecologists and decision-makers would be further damaged. Ecologists Indy Burke and Bill Lauenroth follow a similar line in their response to Strong's editorial. They argued that they believe ecologists ought not be environmentalists because "individuals and groups allowing their values to creep into their analysis of environmental problems" are by definition not scientifically objective (Burke & Lauenroth, 2009, p. 240). The result is a loss in the credibility for the ecological science community and that could cause decision-makers and policy specialists to purposefully make uninformed decisions because the ecological science is illegitimate.[14] But Burke and Lauenroth contend at the end of their reply "few ESA members… are not environmentalists at heart" (p. 240).

[14] Lauenroth (2003) argues in agreement with this point in the first volume of *Frontiers* published. He believes if ecologists become advocates they will become environmental activists, and the mission of activism—"to preserve some aspect of the earth"—does not commensurate with the goal of science—to generate knowledge (p. 48).

Strong argues that ecologists (as environmentalists) are advocates, but their advocacy is guided by the commitment to "objectivity, rationality, and well-supported evidence" (Strong, 2008b, p. 468). Objectivity does not rule out all values unless one takes a "strictly negative connotation and narrow definition of values" (Strong, 2009, p. 240). Strong discusses the many positive values of science—e.g. "objectivity" and "rigorous empiricism"—and positive values outside of basic science that environmental science labors to understand—e.g. "utilitairian,... intrinsic,... and opportunity values." Furthermore, he argues that reflecting on the ways epistemic and social values function in science can actually make science more thorough and more applicable to environmental decision-making to help achieve, the goal of ecology as publicly useful science. In sum, Strong believes that it is not the case that ecologists working as environmentalists lowers the scientific bar of ecology (as de la Rosa, and Burke and Lauenroth argue); rather, they raise the bar of environmentalism by placing it on solid scientific supports (as Strong argues).

"Scientists can be objective and effective advocates, without this being a contradiction in terms" (Meyer, Frumboff, Hamburg, & de la Rosa, 2010, p. 299). It is worth the risk of sounding redundant to point out that de la Rosa, i.e. one of the previous authors who disagreed with Strong (2008a), published this view. This shows a considerable change in his understanding of how values, objectivity, credibility, authority, and advocacy relate in the environmental sciences.[15]

[15] He and his coauthors even cited Noss (2007) for this view.

Seemingly key to de la Rosa's 2010 position of "science-based advocacy" is the rule of "Transparently represent the scientific basis for policy recommendations and *explicitly acknowledge the values that also inform them*" (p. 301, emphasis added). They conclude that "Academic environmental scientists could play a more substantial role in developing sound environmental policies if the criteria for success in academic institutions... recognized the challenges in making science relevant to policy" (p. 305).

Analyzing these two environmental science policy advocacy debates shows there is a sense that these scientist re making appeals to a group beyond conservation biologists and ecologists to "academic environmental scientists" (Meyer, et al, 2010, p. 305). This emerging AES community does acknowledge that environmental values do play roles in their decisions, but rather than addressing what exactly those roles are, the concepts of objectivity, credibility, and authority are often used as ambiguous proxies. Where Lacky (2007) and Burke and Lauenroth (2009) primarily appeal to objectivity to prevent a transparent investigation of how non-epistemic values function in science, Strong (2008a, 2008b, 2009) and Noss (2007) work with a different definition of objectivity to promote such an investigation. Yet, ironically everyone agrees good science is objective science despite defining objectivity differently. Additionally, these scientists agree that environmental policy informed by environmental science is better than the alternative (i.e. policy not informed by science) and an apparent consensus is developing that AES are responsible for ensuring this

benefit. These two cases illustrate how semantically complex and frequently gridlocked the nature of policy advocacy debates are in the AES community.

An Emerging Value Framework

The meaning of value has a rich and complex history.[16] As I explained in the introduction, this thesis takes a more pragmatic approach of working to understand how AES use values to make decisions, with special attention paid towards environmental values. My approach, in other words, is more sociological and functional in nature rather than being a conceptual or philosophical analysis of the content and structure of alternative environmental values.

This section explores one proposed framework of environmental values and a framework for understanding the values of communities, which I define as any collection of people organized around a common goal with centralized interaction to build and enforce a common culture (synthesized from Morris, 1963 & Longino, 1990). This means environmentalists and academic scientists can be treated as belonging to an environmental community and an academic science community, but this community may not be a cohesive entity, or always

[16] Briefly, Aristotle wrote the bedrock of value theory, particularly in *Nicomachean Ethics* where questions of what is good for man, what is virtue, and what is intrinsic value opened up (Aristotle, 335-323BC/1889). The influential reach of his answers carries through the metaethical works of Immanuel Kant (Kant, 1785/1997), the utilitarian codes of John Stuart Mill (Mill, 1907), John Rawls' system of justice (Rawls, 1971), G.E. Moore's axiology (Moore, 1993), and its impact is still recognized in abstract (Justus, et al., 2009a; Sagoff, 2009; Justus, et al., 2009b) and more practical philosophical debates (Daily, 1997; McCauley, 2006) about how society ought to value the environment.

recognizable. I synthesize these frameworks into a larger value mapping framework for understanding how environmental values interact with other values in within and between members of the seemingly emerging AES community.

To begin, I use the follow definition of value: “the motivational factor for an individual or a group’s behavior, overt or mental” (Najder, 1975, p. 67). From this perspective, values are understood as embedded convictions at the junctures of thought where decisions are made. In addition, I borrow the definition of environmental values provided by one of my interview respondents:

> "Environmental values are our beliefs about how nature benefits us, and what that means in return for our responsibilities towards nature."

This is, of course, one respondent’s definition, but it is a fairly representative understanding of environmental value as expressed by the scientists I interviewed for this study.

Along with these ideas, another influential classification system can be used to make sense of environmental values: the Millennium Ecosystem Assessment’s (MA) ecosystem services categories (MA, 2003). Ecosystem services are defined as “the benefits people obtain from ecosystems,” and there are four categories that provide the environing conditions for the well being of people (see table 2-1).

Table 2-1 The Millennium Ecosystem Assessment's Ecosystem Services

Cultural services	are the nonmaterial benefits of ecosystems, such as recreational, educational, inspirational, spiritual, religious, and aesthetic
Provisional services	are the material goods produced or provided by ecosystems, such as food, water, shelter, and genetic resources
Regulating services	are the benefits obtained from the regulation of ecosystem services processes, such as climate, flood, and disease
Supportive services	are necessary for the production of the above described ecosystem services, such as soil formation, primary production, and nutrient cycling

The MA conceptual framework was "established to help provide the knowledge base for improved decisions and to build capacity for analyzing and supplying [the] information" (MA, 2003, p. 27). With this knowledge foundation "[s]ound policy and management interventions" can be made for "[h]uman well-being and progress toward sustainable development" (p. 27). The MA framework does this by situating supportive services beneath provisioning, regulating, and cultural services, which then link to individuals and societies as a whole through use (instrumental value) or supplement human decisions by existing with values independent of human use (intrinsic value) (p. 34).

To give an example, the supportive ecosystem service of primary production of trees provision fuel and shelter materials, regulate water purity and floods, and are culturally significant for recreational and education use (instrumental values) in addition to being places with aesthetics and spirituality

(intrinsic values).[17] Fuel and clean water are fundamental to a good and healthy life as are shelter from and mitigation of natural disasters such as floods. The three categories of security, good life basics, and health are predominately supported by provisioning and regulating ecosystem services, but social relations are entirely supported by cultural ecosystem services (ibid, p. 28). In the example provided, cultural services included recreation and education as instrumental values whereas the aesthetics and spirituality values can be inherent to the place itself as intrinsic values. Although the intrinsic value of nature plays a historic and consistently central role in conservation biology (e.g., Soulé, 1985; Noss, 2007), my analysis here focuses on the largely instrumentalist categories of value provided by the MA, which is familiar to the scientists I interviewed and is also a framework that has considerable currency in the policy and management community.

Combining the aforementioned definitions of value and environmental value transforms the MA conceptual framework of ecosystem services into an evaluative framework of environmental values. By this I mean the MA ecosystem services categories are populated by environmental values and statements about them can be evaluated for the motivational content of individuals' and/or groups'—academic environmental scientists in this thesis—overt or mental

[17] I recognized that some argue aesthetics are instrumental environmental values (Justus, Colyvan, Regan, & Maguire, 2009). This example is worked with the primary guidance of MA (2005).

behaviors—such as devoting their life to studying the environment or choosing how to associate with environmental policy.

With a framework of environmental values asserted, I turn to the second framework for how values (of which environmental values are a subset) function in the decisions of AES. For this process I return to Longino's arguments in *Science as Social Knowledge: Values and Objectivity in Scientific Inquiry* (1990). Longino's work is valuable for this project given that she specifically writes that sociologists can develop her framework to make visible the "institutional features of the practice of science that affects its content" (p. 64). Longino's work also informed similar studies of environmental values, advocacy, and scientific objectivity among environmental scientists, including a sociological study of ecologists (Wallington & Moore, 2005) and a more philosophical consideration of advocacy and credibility in conservation biology (Odenbaugh, 2003).

As touched on earlier in this chapter philosophers, historians, and sociologists of science largely dismantled the traditional positivist account of science in favor of post-positivism. This transition allows for scientific objectivity to be saved if it transforms with post-positivist science (Longino, 1990; Shrader-Frechette, 1996). Longino's reconstruction of objectivity is no longer incompatible with non-epistemic values in science due to the degree of objectivity being a function of how involved the community members are in interrogating the values held by individuals and by the community. Parallel to her distinction

between the individual and social practice of science, Longino draws a distinction between contextual and constitutive value categories.

Table 2-2 Longino's Community Value Categories

Contextual values	"the personal, social, and cultural values, those group or individual preferences about what ought to be, [and they] indicate that they belong to the social and cultural environment in which science is done" (p. 4)
Constitutive values	"the values generated from an understanding of the goals of science [and they] indicate that they are the source of the rules determining what constitutes acceptable scientific practice or scientific method" (p. 4)[18]

I believe Longino's definition of constitutive values has a greater explanatory role in society than she grants. By that I mean if a community is working towards a goal and they develop rules and methods for what counts as acceptable actions to ensure members well reflect the community, then this community has constitutive values even if it is not strictly a scientific community. I'll return to this point briefly, but first I will explain how contextual and constitutive values interact.

Contextual values sometimes transform into constitutive values. Epistemic values illustrate this case well. Features that make hypotheses and theories desirable, such as testability, predictive accuracy, and reproducibility of results, are epistemic values in that they promote the legitimate production of knowledge

[18] Longino specifies that she takes a historically descriptive approach as compared to an idealistically descriptive approach.

(Longino, 1990). Adherence to epistemic values through unbiased and rational behavior (contextual value) is thought to promote the generation of truth-like scientific knowledge (constitutive value) in the scientific community.[19]

Additionally, contextual values may be encoded in how constitutive values are understood to create a reinforcing feedback of values within the community (Longino, 1990). By accepting this and the broader definition of a community, the methods and goals of environmentalists and academic scientists are better understood. First, academic scientists hold objectivity as an epistemic value and therefore it is a necessary contextual value for the constitutive goal of generating science to help accurately describe reality. Secondly, advocacy for environmentalists is the method and therefore the contextual value for their constitutive goal of environmental policy and worldview change.

The emerging AES community can be seen as a blending of two communities with these two sets of contextual and constitutive values. This explains how a significant amount of academic environmental scientists in the policy advocacy debates discussed earlier contextually care about nature, the environment, and/or biodiversity (e.g., Noss, 2007; Brussard & Tull, 2007; Strong 2009; even Burke & Lauenroth 2009) and how all participants constitutively value that AES ought to generate science helpful for informing environmental policy decision-making.

[19] But, we do not have an account to distinguish the legitimate from the illegitimate of contextual influence (Rolin, 1998).

As I will show with my data in chapter four, some of my respondents shared how they have cultural environmental values as contextual values and all of my respondents expressed wanting to use epistemic values as contextual values. Furthermore, most of my respondents wanted to apply their research, often through policy engagement and teaching, to contribute to the continuance of ecological-evolutionary systems. These supporting, provisional, and regulatory environmental values are the constitutive values for the AES interviewed.

Chapter 3

METHODOLOGY

This thesis investigates the roles environmental values play in the decisions of a sample of academic environmental scientists (AES). As discussed earlier, I decided to take a sociological approach to understand how AES perceive, treat, and use their values (of which environmental values are one type) when reflecting on the decisions they made to become and remain a practicing environmental scientist employed by the academy.

Although my interdisciplinary training in conservation biology, philosophy, and ethics helped me select my research project, it did not provide me with all of the skills to necessary to conduct the more empirical aspects of the study. I therefore had to learn how to conduct sociological research by actually doing it, drawing from experience and revising my approach and methods as my project moved forward. I conducted in-depth semi-structured interviews with nineteen AES and I describe those methods in this chapter.

Grounded Theory and Semi-Structured Interviews

I followed the tradition of grounded theory (Glaser & Strauss, 1967; Charmaz, 2006) to design, conduct, and analyze a qualitative sociological study of nineteen scientists from four public universities.[20] Grounded theory's sampling

[20] Arizona State University's Institutional Review Board granted my research exemption status. See Appendix A for documentation. All rules of contact were followed.

method is not aimed at representing a population; rather, it samples individuals to discover some of the relationships in use within a group of people (Charmaz, 2006, p. 6). This approach is not about forming and testing hypotheses. Through the use of the "constant comparison method," I simultaneously collect and analyze my data to root the conceptual growth in my protocol changes and in the decisions made to select the next round of respondents (p. 5). Additionally, to help reduce researcher bias, grounded theory calls for conducting the literature review after developing the analysis.

I began by identifying potential respondents in the fields of conservation biology and ecology, but then decided to expand my selection criteria to include environmental and certain types of civil engineers as I learned more about the history of basic and applied science. Additionally, I decided that diversity between and within fields would expose me to a finer degree of contrast in accordance with the constant comparison method of grounded theory. Interview times ranged from thirty minutes to one hundred and forty minutes, with an approximate average of sixty minutes.

The discovery-based approach of grounded theory aims to uncover bases of comparison to find contrasting positions. Abduction (i.e. inference to the best explanation) is used to systematically identify variations of beliefs, actions, and their relations. To do this, the researcher interviews contrasting respondents in round punctuated with data analysis to more finely tune the differences with successive rounds of interviews. The found patterns drive the direction of the

research itself. This provides the foundation out of which theories are constantly developed and redeveloped. The result is the discovery of new empirically grounded relationships.

A tripartite relationship is used to structure the data into dimensions, attributes, and values (a.k.a. categories, characteristics, and values) (Gerson, 1998). To illustrate, people have hands that have in total ten fingers. The dimension of people having hands has the characteristic of fingers and the value of ten. Some people don't have ten fingers (variation of value), some people don't have hands (variation of attribute), and there are creatures that aren't people (variation of dimension).[21] We often assume things are a certain way and only after being exposed to variation can we appreciate diversity. Additionally, by exploring the interactions within and in between dimensions, attributes, and values, data is analyzed with managed depth.

Four dimensions (categories) developed during my research process. These are not mutually exclusive dimensions; they are centralized, interwoven, and mutually reinforcing. The first dimension, Motivations for Being an Academic Environmental Scientist, explores some of the decisions made for becoming an AES and how certain values influence scientists' decision to remain in this career track. The second dimension, Conditions of Academic Conditioning, focuses on academia as the institution connecting generations of AES through scientific training and practice. In the third dimension, Objectivity, Credibility,

[21] I thank Elihu Gerson for providing this example.

and Authority, the different meanings of these three concepts and their interrelationships are explored. The fourth and final dimension, Engaging Policy, covers the variety of ways respondents understand where and why the line is drawn between appropriate and inappropriate policy engagement behaviors.

I will explain below which types of questions prompted answers that created and fell into the four dimensions. Yet, questions also varied due to the open-ended, semi-structured nature of administering grounded theory-based interviews. I also tried to press respondents for justifications when they used normative language answering questions, so the questions varied somewhat depending upon the answers given and the flow of discussion in a particular interview.

Motivations for Being an Academic Environmental Scientist

The questions for this dimension were mostly asked in the early part of the interview to help prepare the respondent for introspection and also give me some personal background to use throughout the rest of the interview. Respondents shared personal experiences from their childhoods, their reasons for choosing their field(s) of study, and their stories for how they became and why they remain an academic.

Questions on this subject began as "Were there any formative experiences that helped lead you into your profession?" and "What motivated you to invest your time and energy into your studies?" and evolved over the course of the study

to questions such as “Hypothetically, if there were no limits on time, money or who you could talk to, what would you do with the rest of your life?”, “What value do you see in your research?” and “What impact do you want your research to have?”

Conditions of Academic Conditioning

At the outset, I only considered the role of academia as an employer but I quickly expanded this after I realized the diversity of career paths in the environmental sciences. Respondents shared their views on how academia trained and now employs them to train the generation of scientists. Conversations often expanded to reflections on what they can and cannot do as an academic, such as mentoring students, and how time constraints to faculty evaluations limits them from engaging policy. Comparisons between academia and other institutions, e.g. federal agencies, provided additional contrast for why they chose academia.

Every interview contained the question, “What tradeoffs did you consider when deciding to join academia?” but grew to include, “Do you think academic environmental scientists should be promoted or restricted from communicating their findings to policy decision-makers?” and “Do you ever hear your colleagues talk about why they do the work they do?” These alternative phrasings provided a way to address the same content from a different direction.

It appeared that many of my interview respondents were not used to providing deeper normative or personal justifications for their scientific work –

e.g., the response “that’s how I was trained,” was quite common among the scientists I spoke with. I therefore decided to focus this line of questioning on professionalized habits of tradition, e.g. a single disciplinary approach or conducting basic research, and opportunistically asked my respondents about their training. There did not seem to be an appropriate way to create a question for this, as academic training was used as a reason for not having a personal justification.

Objectivity, Authority, and Credibility

The questions for this dimension changed the most as my interviews progressed. I believe this was in part due to my growing appreciation of the depth of these concepts, and in part to how they articulated with some larger themes in the philosophy of science as well as the specific debates over values and advocacy some AES are engaged in. Respondents did vary on the meaning of objectivity, yet did not seem to vary as much on its perceived importance in science. This was appeared important for how they understand the relationships between objectivity, credibility, and authority.

Questions on these interrelated topics included, “How do you understand objectivity?”, “What do you think about the developing argument that science cannot be objective because values are inescapable in science?”, “Do you think your held environmental values have ever positively or negatively impacted your credibility as a scientist?” [if the respondent acknowledged environmental values], “What differences and/or similarities do you see when comparing

ecologists and conservation biologists in relation to objectivity?", "Do you think you think that environmental values have influenced important decisions in your career?", and "Do you think the limits of science are changing? Should they?"

Engaging Policy

The direct form of these questions came at the end of the interview due to the controversial and complex nature of the policy advocacy. I decided to structure the protocol this way so I could better understand the respondent's views that contribute to their understanding of policy advocacy in addition giving them the opportunity to trust me. Respondents often shared their positions before getting to the explicit questions in the protocol, which suggests that the advocacy debate concepts are interrelated in many respondents' thinking of their science, their institutional affiliations, and understandings of philosophy of science.

Questions ranged from "How do you draw the line between appropriate and inappropriate ways for environmental scientists to engage in environmental policy decision-making?", to "What do you think about how professional societies are handling discussions about environmental policy advocacy?" and "If policy decision-makers were to use your research, do you think it would have a positive impact?"

Every interview was different not only because of the questions asked and the personalities of the respondents—some were talkative, some were more

reserved or even defensive[22]—but because my approach developed as I went through the interview process. I initially wanted to document what environmental values are held by members of the AES community but realized a more effective approach is to understand how these scientists understand and use environmental values within the larger context of their careers. This lead to my respondents explaining their motivations for choosing their career in academia and their motivations for what they want to do with their career through direct, indirect, or merely suggestive environmental values contributing to this decision process.

[22] This is not surprising. As Longino states, "scientists sometimes become defensive when asked to comment on the relation between science and values because the think their moral integrity is being challenged" (1990, p. 5)

Chapter 4

SOCIOLOGICAL STUDY OF ACADEMIC ENVIRONMENTAL SCIENCE

Introduction to Respondents and Results

This chapter presents and discusses a set of patterns found in the interview data gathered. As explained in chapter three, grounded theory provided the methodology for structuring this exploratory qualitative sociological research. Each of the following sections focuses on one out of the four dimensions but notes are made when one dimension's results connect to another. All conclusions drawn from respondent testimony are contingent on my ability to accurately interpret their words.

There are times when I will provide an exchange between the respondent [R] and myself [C]. Otherwise, I'll embed short quotes and provide block quotes throughout this chapter. All quotations are direct transcriptions save the few exceptions where I add words to clarify the quote, or replace words to ensure the identity of the speaker cannot be deduced. Additionally, all italicized words reflect the respondent's tone and bolded words are used when dealing with longer quotes to help highlight the ideas I analyze.

This chapter is organized around the four dimensions discussed in chapter three. The first dimension, Motivations for Being an Academic Environmental Scientist explores some of the decisions made for becoming and remaining a AES. Conditions of Academic Conditioning looks at the effects of academia as an institution connecting generations of these scientists through scientific training

and practice with a notable degree of insulation. The third dimension, Objectivity, Credibility, and Authority, opens up the different usages of these terms and their relationships. The last dimension is Engaging Policy and it considers a variety of ways these scientists understand where the line is drawn between appropriate and inappropriate policy engagement behaviors. I will describe and discuss the patterns found within each dimensions below.

I interviewed respondents from four public universities in the Southwestern United States. The nineteen scientists interviewed all agreed to varying degrees that they are members of the AES community by virtue of being employed by the academy to practice environmental science. (Indeed, a few potential respondents chose to not participate because they did not believe they were "environmental" scientists.) In order to better understand what an environmental scientist in academia is I began all except the first interview by asking the respondent to describe how they identify themselves as a scientific researcher. The diversity of these answers (see Table 4-1) does more than display the range of respondents interviewed; it introduces the diverse ways my respondents conceptualize their approach to their careers and helps lay the foundation for the rest of this chapter.

Table 4-1 Respondents' Self-Description

Number	Respondent's self-description of identity as a scientist
1	Bioeconomist or natural resource economist. Avoids "ecological economist" due to its "unfortunate history."
2	Generalist, behavioral ecologist, "but at the root of all of it," a conservation biologist
3	Evolutionary ecologist
4	Environmental economist
5	Studies coupled social-ecological systems. Currently studies ecosystem services, but changes fields regularly.
6	Ecosystem ecologist and an environmental educator
7	Industrial ecologist, sustainability engineer, emerging technology ethicist
8	Trained as stream ecologist, says aquatic ecologist to most people, but finds these terms increasingly inaccurate. More of an ecological educator.
9	Environmental justice scholar
10	Plant ecologist
11	Evolutionary biologist, with a specialization in conservation genetics
12	Civil and environmental engineer
13	Ecosystem ecologist turned systems scientist
14	Ecosystem ecologist
15	Ecologist. Trained as an ecologist and does grassland ecology specifically, but believes "work is relevant to ecology in general."
16	Biogeochemist when talking with members of the scientific community. Climate scientist "when talking with more lay audience."
17	Botanist "for the most general audiences." But a geographer, landscape ecologist, environmental scientist for other audiences.
18	Computational social scientist, but "for the lay person [they] typical say [they] study the relationships between people and the environment."
19	Climate adaptation scientist

Many respondents appealed to their training in providing their self-descriptions as environmental scientists, but interesting differences emerged regarding how they each related to their disciplinary training. For example, a few

respondents flatly answered that they were trained with a certain set of skills and they are therefore a certain type of scientist. Their interests fit their training in such a way that it gives them the primary framework through which they structure their career. Their identity doesn't change; instead, their research does.

For example:

[R] "**Well, I'm an evolutionary biologist**."

[C] "**Just straight forward?**"

[R] "**Yeah, that's my training**. I was trained as evolutionary biologist and I use fish as a model organism. Maybe the historical context—I've been doing this since before there really was a lot of conservation biology. Being 'old school,'[23] I basically have approached it that conservation biology should be approached by getting the best biological information as possible to better inform management decisions. So **my original training is in terms of evolutionary biology, population genetics, and population biology**."

[C] "And now a good amount of your work is with isolated population genetics management, and **online you describe your work as conservation genetics**."

[R] "**That's where my research program has evolved to because of where we live**…. **When I moved to the Southwest, I became a conservation biologist**. Anyone working on native fishes in the Southwestern US is a conservation biologist. You have to be…. a conservation geneticist is by definition an evolutionary geneticist…. I did not actively search out a conservation biology research program; I evolved into it. And I think that's true of a lot of people of my age."

For the respondent quoted above, training in a certain field did not dictate their research program entirely. The context of working in the Southwest transformed their research program into applied conservation. Another respondent took a completely different approach to their identity in relation to their disciplinary training:

[23] Received PhD in 1984.

[C] "You were trained as a civil and environmental engineer. I would like to know if you think that still accurately describes who you are a researcher."

[R] "Sure, **I define what civil and environmental is; it doesn't define *me***. So, sure, it describes me because I self identify as a civil and environmental engineer."

[C] "That's interesting because there's this notion that the way people are trained can constrict how they see themselves going through their careers."

[R] "Yeah, that may be true, but I'm a PhD. **My job is to *re*define things, create *new* knowledge**. I mean, it may be true at other levels, but I have the liberty of being more thoughtful than that. And I have tenure. **I'm *supposed* to decide what civil and environmental engineering is so I can train people to do it. I don't get trained and then locked into some sort of status quo."**

The two respondents quoted above treat their disciplinary training-identity relationship differently, perhaps because the evolutionary biologist spoke from the perspective of career researcher, where the civil and environmental engineer approached the relationship from the perspective of career educator. All respondents play both roles of researcher and educator and this is opened up more in Conditions of Academic Conditioning. Another respondent commented that,

> "There's an **unfortunate component of this career track** that tends to make it more about your ego than it should be… maybe because it's so competitive. I have this constant battle with myself. It's not about you, it's not about your ego. **It's about producing something that's of value that other people can use**."

It appears common for core differences and even tensions to develop due to the dual nature of academic employment, career, and identity.

Respondents identified themselves with multiple professional roles. In addition to disciplinary training and research interests the role of audiences appears to be crucial for some of my respondents. For example, even though the following respondent does not hold a degree in botany (the respondent's degrees

are in environmental biology and geography), they changed their answer when I asked about the role of audiences.

[R] "I'd say I'm a botanist."

[C] "Would you use that for all audiences?"

[R] "No, **I'd probably say different things for different audiences**. For the most general audience I'd say I'm a botanist because most people know what that is. For some audiences I'd say I'm a geographer and for some I'd say I'm a landscape ecologist. **For some I might say I'm an environmental scientist, because it's sort of general**, and for some I'd say I'm a botanist because it's tangible."

Like the respondent quoted above, many of these scientists were trained in an inter- and/or trans-disciplinary manner. Being able to see things from a more "general" environmental perspective also offered them a way to synchronize personal interests with training and thus identity with academic work. For example,

> "**In terms of my subject area, I've been trained interdisciplinarily**…. **[But] how do I think of myself as a researcher? I think of myself as someone who has always been interested in coupled social-ecological systems**, as someone who has wanted to move on to different fields every 5-7 years with the touchstone of ecology, but I like to be doing something new. So I haven't seen my career trajectory as building towards being the leading expert in something so much as an opportunity to keep learning about new things."

Such remarks raise an interesting question: What makes an academic scientist an academic "environmental" scientist? I grappled with the concept "environmental scientist" for most of my research (it can seem too broad a classification, yet narrower terms such as "ecologist" may exclude others – e.g., environmental engineers – that should be included in this grouping). Upon

analyzing my results I developed a working definition with three criteria: AES 1) work beyond the limits of disciplinary visions, 2) turn environmental issues into a research agenda, and 3) seek to connect knowledge generation to a societal problem or use.

Motivations for Being an Academic Environmental Scientist

This dimension explores the personal motivations AES have for choosing and remaining in their career as an environmental scientist with their academic institutional affiliation.

> "One thing that always surprises me is when you look at standard basic science approaches, they spend *all this time* talking about their methods, right? Just to make sure that it's very clear why they chose their methods, and talk about their data sources, and so forth. **But *rarely* do they talk about their personal motivations for doing it. Which can be *just as important* as in defining those methods and data sources** that they choose, but it's often something that is excluded… **people just don't dare to go to there**."

The quote above came from an interdisciplinary program administrated focused on the beneficial integration of science and society. Scientists "don't dare to go there" because talking about how values influence their decisions is seen as not appropriately scientifically objective. The respondent was careful to explain that,

> "**objectivity is an absolutism**, and I'm always suspicious of absolute arguments of any kind. And, I think that we recognize that **as human beings we can't take on any kind of objective stance and really be true to ourselves**."

Respondents commented on how because science is a "human endeavor" scientists need to at least give some serious consideration to the human dimensions of their work throughout the research process. One respondent trained in and now teaching ecology suggested that,

> "Most of the people I see going into ecology had some sort of experience as a young person. Because why would you go into a field that isn't going to pay you very much? [chuckles] *We know this.* If you are lucky you can get a job at an agency or something, but those jobs are competitive and hard to come by. So, **you have to *really feel* something in order to go into it**.... **And most of the people I know have some sort of environmental value set behind them**, is my guess, to choose this field of study."

I asked this respondent to elaborate on the suggestion that prospective ecologists are motivated to choose their field of study because of their environmental values.

> "…to me, education is going to play a very big role in establishing someone's value systems…. [but I] didn't want to influence my students. If they had different values than me doesn't mean they can't learn science from me."

Environmental values, like any other component of our worldviews, develop through interacting with other people (Norton, 1991). The classroom provides educational material and intellectual challenges for subjecting our beliefs, values, and ideas to passive improvement and active scrutiny. The subject matter itself is sufficient for this; the academic environmental scientist does not necessarily need to share their own values in the classroom. But there is a difference between overt efforts to do so, transmitting values by example, conscious and subconscious small nudged, etc. Regardless, professors usually

want to avoid unduly influencing their students' values. As seen in the quote above, this is of high concern because such influence could keep the students from learning the subject matter in the first place. Many respondents gave teaching the public to be "ecologically literate" as a motivating reason for joining academia.

When I asked my respondents why they decided to spend their time and energy in pursuing their degrees and getting into their field of study many spoke of curiosity as their motivator. For example, one remarked, "I was always interested in the question of why there are so many species." Another indicated that "a love of the ocean" moved them toward their work. For these scientists, and for many others, studying the environment was the "natural transition."

It often took respondents some time to openly discuss that they were motivated by their environmental values, perhaps because of how they understand objectivity in relation to scientific credibility, or perhaps because of how they understand the roles of environmental values in scientific work. But, some recognized environmental values motivating their students. Furthermore, respondents who reported that their students' are motivated by environmental values were also likely to find validity in applied science such as the respondent quoted below.

> "**I think the attraction for most of the people that are coming into this field (ecology) are coming in with some desire to fix something or change something or be an environmentalist.** I think the subset that is purely curiosity driven is probably a smaller subset…. **[It's important for students to] see how they fit in on that continuum: purely curiosity driven to doing something**

> **that is a combination of curiosity with results that can be more immediately used**."

For this respondent, who received their PhD in 1988, students of ecology have traditionally been driven by curiosity but they have seen a shift to greater emphasis on practical application. However, another respondent's choice to pursue a BS in ecology in the second half the 1990s still pivoted on curiosity as expressed by the respondent below.

> "I went to summer camps like most kids and **I got involved in nature [through 4H], and then it was time to go to college**. I was 18 and idealistic, and I thought 'do I want to do engineering or ecology?' Engineering is too practical, so **I went with being idealistic and studied ecology**."

As shown in Table 4-1, the respondents included environmental scientists other than self identified ecologists. Scientists who came from the more applied sciences like engineering, geography, and justice studies were more likely to connect their curiosity to application and other non-academic institutions.

> "**I was always interested in unevenness… and in understanding the processes behind those patterns**… [I became] interested in the differentials in terms of people having access to power and opportunity… and the justice implications of it. But one of things I have realized [while at a particular [non-profit organization] annual award ceremony], I turned to one of the people and said, 'It seems like my work is so irrelevant compared to what these people are doing. They are actually out there and they are making a difference in the local communities and so forth,' and he said, 'No, you guys need to do exactly what you are doing, keep on doing that, because it makes a difference when City Hall or the city planners start think of ways to modify what they are doing to the city, they are going to listen to you. And leave it to me to translate that information and actually work with people on the ground through this organization.' So, in some senses, it's a bit of a cop-out, but on the other hand, it's a division of labor that might actually be an appropriate way of doing things. Nevertheless, that hasn't stopped

> me, **I've always been thinking about ways I can actually take what I'm doing and think about it can be applied, actually intervene in the cities and ameliorate some of these injustices**."

Sometimes pure curiosity can act as the sole motivator (nurtured through academic development) and other factors are recognized only upon reflection well after the fact. As one respondent put it,

> "**I just became much more interested in ecological issues in graduate school** as a result of the papers we were reading in courses, books that I was reading. **It just drew my attention** towards evolutionary ecology…. It was my exposure within an academic environment that showed me that this was a very interesting research area. **But it also played to the whole set of unexpressed, deeper interests that I had going back to being a kid and even in college**."

The respondent above explained that those deeper interests were "learning and teaching about the biology of critters." A career in academia as an environmental scientist offers a way to align personal interests with research agendas and daily activities for many of the scientists interviewed. As another respondent shared,

> "**If you are in an office all the time and you are a natural scientist then you are losing touch with the systems you are trying to study.** You are becoming an administrator, not a researcher, and *yuck.* A lot of the work I do is administration, but **that's not going to get in way of me putting this on the door before I leave tonight (holds up note that reads, 'OUT IN THE FIELD, BACK MONDAY')**."

Allocating time to get outdoors into the systems the scientists are studying is part of being a natural scientist for this respondent and many others volunteered complementary sentiments. Some spoke of how they enjoy the traveling, hiking, and camping of fieldwork, and of bringing students into the field to help them

better understand not only their subject of study, but what a career in environmental science might hold for them.

The different but patterned positions for enjoying nature suggests the question of how the environmental values within the category of the Millennium Ecosystem Assessment's (MA) cultural ecosystem services (educational, intellectual, inspiration, recreational, aesthetic, and spiritual) influences decisions about joining the academic science and environmental communities. In keeping with grounded theory, I researched the MA later in the interview process and consequentially could ask direct questions about the MA framework late in the interview process. But, I was able to analyze the older interviews again and discovered the presence of MA environmental values I had not previously recognized.

For example, the respondent who enjoys "teaching and learning about the biology of critters" was one of my first interviews. I listened to the interview and recoded to discover that they expressed the educational and inspirational cultural values. In contrast I interviewed the field biologist later in the process and was able to directly ask about the MA ecosystem services acting as categories of environmental values. I did so, however, after the field biologist explained they enjoy fieldwork because of its recreational, aesthetic, and spiritual cultural values.

Decisions about higher education and career track development were made during the height of the environmental movement for some of the scientists I interviewed. Younger respondents made those decisions in the wake of the

environmentalism. It is out of necessity that AES address how they orient themselves and their work to environmentalism because society often perceives the association as strong and also as a point of attack on the validity of the science (as we saw in the policy advocacy debates discussed in chapter two).

A consistent pattern emerged among the AES I interviewed. There was often talk of environmentalist values providing an initial motivation for becoming an AES followed by a disassociation from environmentalism. This was especially true among the respondents who spoke about how attending college during the 1960s and 1970s affected their decisions to pursue a life in the environmental sciences. The two following quotes came from the same respondent at different parts of the interview.

> "**I grew up in the era of the environmental movement of the 70s**, and Earth Day was happening, environmental laws were being passed; I knew I wanted to do *something*. I saw areas that were sprayed with insecticide and the birds weren't there anymore. **I was very much an environmentalist and wanted to do something to contribute**…. [After taking a few undergraduate classes] I realized, oh, this what I really enjoy. It's scientific. As a young adult, I would look at a plant and think, 'Why is this plant growing here? How? *Why?*'"

> "I suppose the only real tradeoff [of being in academia] is perhaps **suppression of** my inherent—the emotional side of **joy of working with plants and being outside. I sort of feel like it's sort of inappropriate to express that as a serious scientist**. I love my garden and my plants at home, so I still very much enjoy interacting with the natural world, but I guess I put a more serious hat on when I'm being a scientist [laughs]. I think this is a good fit for me."

Environmentalism motivated this respondent to become an AES but then they apparently decided to trade in environmentalism for professionalism at the

price of openly expressing joy. I thought it might be worthwhile to know what they have grown to think of environmentalism, now decades later. Their answer:

> "If someone called me an environmentalist, that I would not like, because I think there are many environmentalists who are too hair trigger quick to act and motivate, and they aren't basing their actions on fact."

As established and respected scientists, it is common for AES to not want to be associated with actions that are perceived as not based on fact. As discussed in chapter two, acting on something other than facts implicates non-epistemic values, which is a flag for compromised objectivity and therefore impaired credibility and authority for scientists in general and for AES in particular. But this is changing for the current generation of students studying sustainability. As one respondent remarked,

> "A student today could go off in a direction of conservation biology or environmental science and still be successful. Sustainability science, right? Sustainability science; they can't get away from an advocacy position…. It's a mix that, for all practical purposes, didn't exist at all when I was in college."

Others indicated that, although the environmental movement partially motivated their decisions to go into the environmental sciences in college, they did not self identify as an environmentalist primarily because of its association with advocacy. One scientist with a distinguished career in research and administration shared that the decision to study ecology in college was motivated by what was the "vernacular of the time, [to] save the world," but later explained,

> "**Early on in my career in graduate school**, which was the late 60s and early 70s, **the environmental movement was alive and well. And then there was the more 'dispassionate scientific**

> **approach'**… it was clear that if I wanted to be a successful scientist within the Department of Zoology and the Museum of Natural History, **I was off on the dispassionate side**. If I wanted [environmentalism], it was over at the School of Natural Resources…. **It served my career**. It was what I was really interested in at the time and **I reasoned I could be more successful going down that route**. The environmental movement at that time [was] a lot of advocacy, and the science, a lot of it, had to be worked out."

For most respondents coming out of the environmental movement the desire to contribute scientifically gave way to believing the movement was not scientifically grounded. This view emerged in step with becoming an academic ES. For others, the perception of the movement was that of advocacy without science from the onset. The decision to separate success and enjoying nature from the "unscientific" environmental movement was the solution of choice for the many of these respondents trained in the 1960s and 1970s.

Younger AES varied, but continued this pattern of motivation followed by disassociation. One respondent went through a life stage of civil disobedience and avid Edward Abbey reading—"as a young person should!"—with their cohort around the turn of the millennium before shedding the environmentalist label. It is noteworthy to point out that this particular respondent expressed the highest degree of caution out of all the respondents when deciding whether or not to participate in this research. This scientist is an accomplished and respected AES, but with a higher level of scientific credibility came an increased level of concern that was only handled through granting anonymity. This AES was not alone in showing fear and exercising caution in the interviews I conducted. Another

Skype-based interview showed a similar degree of concern. The respondent was in their office on campus and they would periodically look over their shoulder while remarking that though they do not have these kinds of conversations with colleagues, they enjoy thinking about these ideas.

Environmentalism as a movement aimed to cultivate environmental values into a social movement. The collective purpose of environmentalists in the 1960s and 70s was to impact policy and management practices, which in turn would transform lifestyles and worldviews. In a limited sense, it accomplished its short-term goal of generating a wide assortment of new environmental laws and regulations to protect endangered species, environmental quality, and human welfare. But in another sense, it failed to be a strong cultivator of environmental values into society seen in the policy reformation of the 1970s aftermath, including the disassociation indicated by my respondents. As discussed in chapter two, this is at least partly because of the dominant philosophy of human separation from nature. One respondent recalled how when they took an undergraduate class in environmental science with a fieldwork assignment, they started to think about these things.

> "The thing that struck me, then I didn't know that but I remember it and know that now it affected me, was one of the conditions was we needed to find a place without evidence that humans had been there…. Nothing visible. That struck me as odd… [T]his was **back in the mid 70s when the environment was that which humans had nothing to do with, humans were not embedded in the environment.** That was the origin I think, the seed, of thinking about what, at that time we didn't even use the word sustainability, but **what is now termed sustainability by putting humans back**

> **in the environment** and recognizing that we have impact by how we behave….
>
> If we are going to truly understand how to make sure that we don't completely destroy this place, then we take that approach [i.e. sustainability], rather than one where the environment is pristine if it weren't for humans. **The framing of that time, and frankly for that time for better or for worse, probably was what was necessary, but it didn't get us as far as it could because it polarized communities between those who were hugging the trees and those that wanted to cut it down**."

The environmental movement lost, or possibly never gained, a significant amount of its academic scientific constituency. The respondents whom I interviewed found other ways to express their environmental values outside of environmentalism by connecting their personal interests with research agendas and with their personal lives.

Some use their skills in systems-level thinking to study environmental issues by addressing global relationships, sustainability, regional management issues, and climate adaptation science. Or they facilitate other scientists, for example, by acting as academic administrators. They also spoke of how they enjoy camping, hiking, traveling, and other outdoor activities in their spare time. These scientists often commented on how they spend a significant—if not majority—of their time on a computer writing papers and grant proposals, and responding to emails.

The other group made their research careers a way to "get paid to do [their] hobby," which is spending time outdoors doing field research and having their science "move ahead the understanding in the field." It is worth pointing out

that not every administrator I interviewed found that such activities detract from enjoying their career. One respondent with extensive administrative experience thought about whether they would change anything about their career and stated,

> "No, I wouldn't. I feel pretty good—I feel *very* good about the career track that I've had. I think I've had a good ride. I'm comfortable to the commitment to the administration as well as the straight research."

As mentioned earlier, I offered a thought experiment to my research respondents by asking what they would do with their lives if they had unlimited resources of time, money, and ability to work with anyone. For most of the respondents, within the first few seconds of answering this question they placed themselves into one of two categories, and these categories correlate with the two approaches outlined above. Those that described spending too much time working on a computer wanted to change what they were doing. Examples were putting research aside and get involved in community development through local organic farming, teaching capacity building in Africa, marriage equality rights, or getting back into the field to conduct their research. I believe these types of answers are exemplified by wanting to find ways to "make a big difference [such that] you could point to it and say 'look what difference I made'," and academia does not always offer that kind of personal satisfaction.

But the majority of those whose research interests, agenda, and activities matched wanted to keep doing exactly what they were doing. A few said they "wouldn't change a thing." Why stop when your life's activities are your hobbies? As one respondent expressed it, "I feel privileged to do what I love." This

statement captures the essence of the responses given by respondents in this group.

Both sets of respondents wanted to connect their daily activities to contributing to good, which was predominantly an environmental good, but also social good.[24] Some were able to do that through their research in a satisfactory way and others imagined alternative routes to achieving that end. The MA supporting, provisional, and regulatory environmental values are constitutive goals in the AES community. One respondent quoted below summarized this well.

> "I think you need to recognize that scientists are people, too, and that they have values, and it's probably going to direct where they conduct their research and the kinds of questions that they ask, but in the end, they are doing things that can make a real difference in terms of things we rely on for our survival, livelihoods, wellbeing and so forth."

After inviting the respondents to reflect upon what they truly value by thinking about what they would ideally do with their life, I thought it would be revealing to ask what actual value they see coming out of their professional lives as a researcher and an educator. Besides "want[ing] the classic academic accomplishments," the majority of respondents were also solaced by the belief that their research fits into a system of effecting social change. They described this in two ways: managers and other decision-makers use their research, and

[24] Working from the perspective that man is part of nature, solving social problems can often help solve environmental problems in the process. One respondent discussed how higher education rates among women decrease birth rates, which contributes towards a reduction in environmental resource extraction.

students are engaged through education and mentorship. This will be developed in more depth in Conditions of Academic Conditioning and Engaging Policy.

This dimension suggests the generational differences found between the younger and older respondents in addition to how these current AES community members think about future members. Environmentalism played a significant role in motivating people to become environmental scientists, but its associated emotions are sometimes suppressed as a part of being a professional scientist in academia. The changes in academic science are offering new ways for current and incoming scientists to act on their values by contributing to environmental and social goods with their science. In the process, this is changing the acceptability of advocacy in the process, which is especially salient in sustainability science.

Conditions of Academic Conditioning

Academia is the institution where the cycle of training and employing academic environmental scientists can be, and not uncommonly is, continuous. It employs AES to be researchers, educators, and administrators, and as a result these scientists train the next generation of members in addition to other scientists, professionals, and citizens in general. But, as mentioned in Introduction to Respondents and Results, there are some contentious issues.

> "**I'm not really interested in sitting in the ivory tower**… my whole life I've done what interesting to scientists, because what's interesting to scientists is solving problems, and solving puzzles. **We create fancy puzzles and try to come up with solutions.** It's all a Rubik's Cube™. For science to be valuable, for us to justify public funding for science, for all these policy related things, we

> need to figure out ways to connect this stuff back to things that matter…. [The trouble is] **the unresolved issues in the policy sphere aren't resolved by academics because they aren't academic questions**."

The respondent quoted above is one of the younger generation AES and has a training background in applied ecology. Other respondents shared the belief that academic scholars and their work have a history of social and political irrelevance due to how academia is structured. The respondent from the quote above offered their opinion for what is wrong.

> "We're used to applying science to solving problems, right, which requires things other than science…. At the very least, it requires a normative framework for evaluating objectives…. One framework is not sufficient, but it is necessary…. You need a way to make tradeoffs…. **We train really great scientist at doing really great positive science. We spend very little time training those same people in thinking what is a normative problem**. Most of them don't even know what the word means. And, almost no time in how to make tradeoffs."

In a different part of the interview, this respondent expressed further frustration because "universities are sold as education, and us as teachers: we are not. We are here to generate knowledge." This statement seems to conflicts with the history of how American academia was set up to bridge teaching academies with research universities (Rosenberg, 1961). Additionally, it was not clear whose responsibility it is to teach normativity to students given the respondent's position that academics are not teachers.

My respondents felt frustrated about this, but no one expressed feelings of disempowerment when interacting with students. Indeed, respondents who perceived the gap between knowledge and action often treated it as one that can

be overcome by explicitly talking about values and tradeoffs in the classroom and when mentoring students. One respondent particularly interested in how academia and other institutions can contribute to social and environmental problem solving stated:

> "**One of the first things I have students do is write their worldview and talk about how it affects the kinds of questions that they ask and the kinds of priorities they have for sustainability**. And I do that deliberately so that they know when they are coming in, that their worldview is going to make a difference for how they view the world—not to be redundant—but it's going to make a different how they interact with other studies, what articles and books they tend to key in on, and what they tend to ignore. **I want them to be totally aware of that**."

Many respondents mentioned value considerations in the context of making their own career path choice to work in academia compared to federal agencies and private industry. The respondent below worked at a federal agency for a few years before deciding they wanted to conduct independent research and eventually become an academic. But there are tradeoffs in academia, too.

> "**The only real negative tradeoff of going into academia**—and this maybe real or perceived—**there are other opportunities if you want to live a higher economic caliber of life**. Basically, there are other ways to go with your degree to make more money, and I have friends who do that [with environmental consulting]…. **They make a lot of money, they drive fast cars, they have big, crazy houses, but, you know, I don't see them as being happy [laughs]**…. That's the only real tradeoff. **And what none of those folks will ever have is the opportunity to mentor students, and that's hugely important to me**. I don't have kids of my own, so my legacy is going to be the legacy I leave behind with my

> students. So I take it very seriously. You can't do that at the [a federal agency], you can't do that at CH2M HILL."[25]

Many respondents believed that though they could have a better salary if employed by a different institution, teaching and mentoring is "where the rewards are coming from." For some, working closely with students was their way of leaving a legacy, whether it is because they don't have children of their own, or to inspire the next generation of AES practitioners.

> "Frankly, **one of the biggest values we contribute is training the next generation of people to get frustrated about all of this** [laughs] and then it just repeats. Or not. I'm not convinced all scientists are as frustrated as I am."

Others expressed taking pride in helping young scientists go on to accomplish great things, challenging students to think through their implicit value positions, to become "ecologically literate citizens", act as a fair mediator of normative perspectives for policy, and problem-solve with systems of complexity and uncertainty. One respondent with administrative responsibilities connected generational change with more positive contingencies.

> "**Unfortunately, we always try to put our hope on the next generation**. It's like, 'oh, we wrecked it, so let's leave it to the next generation to figure it out.' But, that's what I am trying to do in this school, is try to communicate these ideas to students from the very beginning. You might work with people that are stuck in the lab all day long, but **you might be the person that can bridge those multiple constituencies of knowledge and use it as a way to actually move policy toward the normative dimension of**

[25] CH2M HILL is an environmental management and planning firm. http://www.ch2m.com/corporate/services/environmental_management_and_planning/default.asp

> **what we want our future to look like.** How many it will stick with and how many will be effective at doing that, I hope a lot."

Some respondents were concerned that currently too much hope is placed on the next generation rather than investing enough time and energy on improving the conditions for the actually practicing scientists. One respondent from an interdisciplinary and solution-oriented school expressed particular dissatisfaction.

> "There was some talk [in this school] about how we evaluate our tenure and promotion decisions. The academic stool has three legs; the big fat one is research, and the two skinny ones are teaching and service. Service does not very effectively fit. **One of things we tell our students, and preach to our students and teach to our students [here] is that the work we do needs to be societally relevant and it should be solutions oriented to the extent that it can be, and it should be actionable. As faculty, we should be expected to do these things**….
>
> **[T]here were discussions of adding a fourth leg to our academic 'stool': of action**. Faculty would be judged… on the extent to which their research especially, but also their teaching and service, are spinning into things they can demonstrate are actionable…. **If a faculty member can demonstrate that their involvement in x solution based project or organization or movement actually facilitated a solution being generated or sped something up, that would count as action**. I can't imagine that any traditional disciplinary departments would ever consider that fourth leg. Here, where we are supposed to be [interdisciplinary and solution-oriented], that fourth leg is still being debated."

Partly, the reason for this is the incentive structures in place within academia. A transition is taking place as identified by the fact that adding this "fourth leg" of action is even being discussed at all. One respondent who has a history of being an "institutional architect," commented that,

> "I recognize, and I still do, that universities are really bad at managing. Faculty are horrible at managing things, particularly this

> new kind of institution that is a boundary spanning organization between academia and practical use."

Every respondent agreed on the importance of finding ways to use the knowledge generated in academia to directly cause beneficial action. They looked for it inside academia through the increasingly prevalent science of sustainability. Some used their credibility and authority to plug their research into non-profit organizations, management, and policy spheres through conference attendance (and a couple mentioned sometimes getting a beer afterwards, too), participation in stakeholder meetings and even collaboration. Others use their specific topical expertise to inform management policy. Of these different approaches, respondents were either highly or hardly active, but both types of respondents frequently expressed they were not able to do as much as they would like. One respondent took a particular approach to time commitments.

> "I think I was more ambitious when I was young. I think I thought we could save the world…. I don't think there's a single event that changed my views. It may just be a way of allowing myself to not work insane hours. If you think you have it within your reach to save the world and you don't try, what does that say about you as a person? **So it might just be a really convenient excuse to say, 'well, I can't *really* save the world,' and now I get to live a balanced life. I'm serious about that; a lot of my colleagues don't have a balanced life at all**. I fell in love relatively late in life and turned around and thought that **there's importance in being a good [spouse], a good [child], a good [sibling], and a good friend. And maybe that's as important as anything I could accomplish with my science**. So again, it may just be a convenience because I absolved myself from having to try too hard…. **But that's the personal side**. The professional agenda is still motivated by global environmental challenges. I just don't think it should take over my life."

Being an academic requires significant time commitments and adding things to the list of academic expectations seems to be seen as directly taking time away from the other activities, especially research efforts. At least some respondents reconsider this tradeoff as seen in how and why they approach teaching different research objectives to their students. But what are the personal motivations of doing environmental science and being an environmental scientist?

> "**Once in a while you hear people talk about how much they enjoy x part of what they are doing. And for natural scientists, most of the time you hear people talking about that, it when you are out in the field with them**, right? Because when you get out from under the fluorescent lights and into the systems we are studying, x. And they'll be like, 'wow, this is why we do this!'… **But usually there's so much else to talk about, that waxing philosophical about why we are doing what we are doing doesn't usually come up. [laughs]**"

More than one respondent opined how incentive structures are keeping them from pursuing socially relevant applications of their research and yet went on to downplay their motivations for making fundamental life decisions like choosing a career. I asked the respondent quoted above why those introspective conversations weren't happening.

> "I don't think the conversation doesn't happen because anybody is inhibited or doesn't want to talk about it. I think that—you know perfectly well that we are all completely strapped for time…. **The time you get with colleagues very rarely involves sitting around, relaxing with a glass of wine, talking about things that aren't directly related to something you need from them or they need from you or you both need from someone else**."

Some respondents voiced this sentiment. As one put it, "It's not that it is actively being suppressed, but you aren't rewarded for it. So it gets suppressed

because you are only rewarded for publishing papers." They saw that the structure of incentives in academia limits investing time in applying their research, but did not see this same system restricting their time for thinking about how environmental values motivated their environmental science career decisions. As long as these academics get what they think they need from the academic colleagues then there isn't a recognized concern to motivate change.

Another respondent's views summarize these ideas of teaching current students to be applied from the beginning while the current AES generation is making this transition in their own research perspective without fully understanding why.

[R] "There needs to be a balance between providing students with foundational knowledge, earth systems, and social systems. But they really need to understand how they interrelate, how they interact, the feedback relationships between them. And in addition to that, **the students need to be able to understand how to use that knowledge to focus on creating solutions**…. **Most of the people in [interdisciplinary and solution-oriented school] were trained just like me. They are trained to basically answer science questions of why and not really care about what happens after that**."

[C] "**They are academics**."

[R] "**Yeah**."

[C] "**So do you ever hear your colleagues talk about why they do the work that they do**?"

[R] "**Not very often… not very often… not very often…(thinking hard) I don't know why that's the case. It could be that it's obvious** why they do their research. They do their research because they enjoy it; **they are curious people**. They do their research because they like being able to ask their own questions rather than having someone else ask them what to do to. I think that's a huge motivator of people in academia."

[C] "**But they are applied. There is more than just curiosity**."

[R] "Absolutely. So, I mean there are people—there's a spectrum. There are some people that are wary of doing anything that hints of advocacy, for instance. They think that might sully their results. Those people are increasingly in the minority.

I think the majority of people now recognize that fundamental social questions are just as relevant a beginning point as so called 'blind science'…. I think people are doing their research to make a difference. But it's not always expressed as much as it should be."

Respondents who reflected on why such conversations with their colleagues are uncommon fit with the suggestion provided above, i.e. they don't perceive much of a reason to. One AES stated, "No, we don't ever talk about why because most of us do it without thinking about why," and another said, "It's just understood. We don't have conversations about that."

Two respondents specifically associated imbibing alcohol with the thought of questioning personal motivations, implying that such thoughts are reserved for leisure time. Which, as discussed above, can be difficult to acquire for academics who are "strapped for time." Put another way, the demands academia places on time limit both opportunities for applying research and contemplating the foundational motivations for doing their work. Arguably, if individual AES are not familiar with probing their own motivations, then it is difficult for them to share their thoughts about their motivations.

That said, recreational, aesthetic, spiritual, inspirational and other cultural values came up often when I asked respondents about how personal experiences influenced their worldview. These environmental values are the cultural ecosystem services in the MA framework seem to be the accepted context for wanted to be a "natural scientist," yet these cultural environmental values are also treated at the unacceptable non-epistemic values that detract from the credibility of science.

[C] Do you hold environmental values?

[R] "I think a lot about of my values because they come from my experiences…. Growing up, I spent hours wandering through the forest and through the creek behind my parents' house… over the course of growing up I watched beavers come in and completely change the system…. It was neat, it was formative. **A lot of the values that I think I hold about natural systems and why I'm so interested in studying them have to come from those formative years when I was out watching things happen and thinking 'Wow! It'd be really to cool to understand what this means** and how this whole system is different now'…. But I'm not sure I answered your question."

[C] "Let me make sure I understand. **You've identified recreational values**—you like to go out and hike around and so forth since you were young. Earlier you talked about the fallacy of preservation, so the preservationist value is not something you ascribe to."

[R] "Yeah, it's just absurd."

[C] "**But you are interested in this cultural-environmental relationship. And you talked about ecosystem services earlier and that means you might hold certain instrumental values from supportive to provisional to regulatory to spiritual—**"

[R] "**Absolutely, and aesthetic**."

[C] "**And you described that when you are out in the field that is when you and your colleagues are happiest, that there is some kind of value experience happening there that makes [you and your colleagues] happy**."

[R] (respondent is hemming and hawing) "**Absolutely.**"

[C] "So you've covered it all."

[R] "Yeah!"

[C] "It's just one of those things you may not have realized."

[R] "Okay, okay, yeah, cool!" (we both share a laugh)

[C] "I just said everything back to you that you told me."

[R] "Yeah, right, *good*, okay. This is fun stuff!"

The ecosystem ecology respondents all identified or agreed with the four types of MA ecosystem services categories of cultural, provisional, regulatory, and supportive services discussed in chapter two as reasons for doing their research. Understanding and working to ensure the continuation of these

ecosystems services seem to be the goals of doing environmental science, making them constitutive values. Additionally, provisional services (e.g. food, water, shelter) emerged as the highest perceived priority in greater society.

> "**Until everyone is wealthy enough and feels like they have the healthcare that they need, the food that they need, I just don't see people caring about the environment in the way they should.** They should for the future of the human race. But if you're really constrained with problems that are more important, like feeding your family, then you're never going to get there."

So then, what are environmental values? One respondent was able to phrase their response concisely and eloquently.

> "Environmental values are our beliefs about how nature benefits us, and what that means in return for our responsibilities towards nature."

Others were unsure how to make sense of the term "environmental values." One respondent explained they always had these thoughts but didn't know to call them "environmental values" until a departmental colleague versed in environmental ethics explained the terminology. When I asked another respondent (in the same department as the previous respondent) what environmental values are, they said,

[R] "I don't know. I'm not familiar with that term."

[C] "So, then what do you think values are?"

[R] "**Values are the importance different stakeholders give to different things**."

[C] "**Okay. With that, environmental values would be the result of how stakeholders give different weights of importance to environmental things**."

[R] "Versus cultural or other things. Material things. Sure. "

Though this respondent could define "value" they were not familiar with a definition of "environmental value." Even though the respondent had no such conception of "environmental value" to articulate, the respondent still revealed their preconceptions about it referring to material things and not cultural things. This supports the pattern that AES interviewed permit the material categories of ecosystem services (supportive, regulatory, and provisional) as constitutive environmental values. At the same time, they are mixed on whether and how to treat the nonmaterial ecosystem service of cultural benefits as contextual environmental values. This raises the question of how safeguarded the epistemic value of science is when such values are not transparently discussed and honestly scrutinized. This will be discussed more in the next section due to how the "excess of objectivity" (Sarewitz, 2004) grips AES, or as one respondent described it,

> "Perhaps it is a way in our community to perpetuate the values that we say are really important in our culture. If you can say, hey look, you can be attacked from outside and then oh boy, we are being attacked from the outside so we better be even more value neutral or better at being objective. Somehow it might be a mechanism we employ ourselves perhaps without even realizing."

As Longino (1990) explains, the objectivity of a community requires public interrogation of values, beliefs, and ideas. The method of scrutiny is similar to the peer-review system currently in place for transforming scientific data into fact through socialized critics, but of course requires more. This discussion is beyond the scope of this thesis, but is an essential issue to address for the future development of post-positivism. For now, I point out that such

scrutiny necessitates a high degree of transparency but this would appear to be rebuffed by the defense mechanisms of many AES.

The AES interviewed are becoming more socially relevant, more aware of environmental values, and more are training the next generation differently than how they were trained by emphasizing exactly these ideas. But this is not ubiquitous. Some AES still "train [their] students the way [they were] trained," following in the tradition of scientific inquiry solely for inquiry's sake.

Objectivity, Credibility, and Authority

[C] "How do you understand objectivity?"

[R] "**People that are objective are generating hypotheses and testing them and then interpreting the data and then using the data to inform the decision-making**."

[C] "That's a very textbook answer. Do you think that is actually attainable?"

[R] "Yes!"

[C] "Yes?! And do you think you are being objective in your research?"

[R] "Yes!"

[C] "Yes!?"

[R] "Absolutely! **As a matter of fact, I think every scientist should *strive* to be objective**…. As scientists it is our responsibility to maintain objectivity. **It can be difficult sometimes, don't get me wrong, *but that is our responsibility*. We are only supposed to generate the data.** We like to say the data are what they data are. That's it. Then you generate other experiments to test things and gain other information.

[C] **[briefly explained the post-positivist critique of how values function in science, particularly the judgment of hypotheses] What do you think about this?**

[R] **I guess I really haven't thought about it that much. I mean, my training as a scientist has always been one to be hypothesis driven**. We generate descriptive data to formulate hypotheses, but the whole goal is to hypothesis driven…. Thinking about [the Darwinian Revolution] in terms of a Kuhnian paradigm, you have to think about everything being aligned just right and then

you have this huge shift. I think that clearly occurs, so **I do realize that there is some level of objectivity relative to how one sets up and picks the experiments one does.**

To summarize previous statements, objectivity is complex and is predominately understood as essential for doing good science with its two components: descriptive accuracy and value neutrality (a.k.a. freedom from values). When asked to share their thoughts about what objectivity means to them, many respondents provided a somewhat textbook positivist answer like the one above. Of those, some believed this and most used it as a foil to emphasize the differences between positivist objectivity and their own interpretation. As one put it, "scientists that claim they are absolutely 100% objective in everything they do—they are either completely emotionless robots, or they are deluding themselves." A few others expressed skepticism because objectivity is an absolutist notion and/or found the whole concept to be dishonest. The usage of candid and colorful language to express this point implies that at least some respondents found the concept of objectivity so implausible that poking fun at it is acceptable. The normative and descriptive meanings of objectivity were often grouped together such that objectivity became a transition term for connecting normative and descriptive issues within science.

One respondent described what they termed the "boardwalk phenomenon" based on their experiences with objectivity when studying wetlands and interacting with policy-makers. The discussion seems particularly interesting and revealing, and so it is worth considering their remarks at length:

"[I'm involved in] the **coproduction of knowledge with the people that can actually use that knowledge to make better informed decisions**. Philosophically, it's a sort 'sticky wicket,'[26] I think, for a lot of scientists in general. First of all, **the normative 'we should do this, we should do that' thing in a lot of people's minds steps over the line into advocacy**—or even worse, activism, right? **Most scientists view that as something that's bad, because as soon become an advocate, whether you think so or not, you are perceived as losing your objectivity**, or at least as less objective. And as soon as you become an activist, you now are actually lobbying for, or actively promoting, a particular sometimes normative view of the world. **It's very hard to defend that kind of thing with purely objective data**. **It's not impossible. There's a line there, and I call it the boardwalk phenomenon.**

… **[A] lot of Birkenstock wearing ecologists think there are pristine places away from human impact** (I'll argue those don't exist)… but there are Birkenstock wearing ecologists that think they are working in one of those places. **The first thing you do when you get to one of those places is build a boardwalk because you don't want your footprints or your presence to in any way to alter the system that you are studying**, otherwise it's not the pristine system you are supposed to be studying, right?

When you take your science to policy-makers and let them decide what it means, you are still following the boardwalk analogy. When you become actively involved in that policy-making, or you *allow* those policy-makers to be involved in your objective scientific knowledge generation, **people perceive that as doing work without building a boardwalk first. How can you study a [system]—objectively—if part of what you are doing is actually modifying [it]?**

I think we can work in cities and in places like the Everglades without boardwalks, and I think we need to accept that we can do that. **Fundamentally, there's an illusion that by building those boardwalks**, and you can view those as physical structures or metaphorical analogies, … **that we studying those systems**

[26] A helpful review explained that this is a metaphorical term for a difficult situation. It originates from the game of cricket: a sticky wicket happens when the playing field is compromised by rain and sun causing the ball to bounce unpredictably.

> **without in any way, shape, or form impacting it. That's ridiculous**. I think it's ridiculous. Get over yourselves and acknowledge that you need to be part of the system. Things aren't going to change in the right direction or change quickly enough if we don't involve ourselves in that process."

Both boardwalks are intended to prevent contamination. When studying wetlands a boardwalk is a physical structure and its use will prevent the activity of humans from tainting pristine natural sites. With similar naïveté, believing all interactions with policy-makers that step outside the pristine realm of objectivity slip into the subjective quagmire of acting as an advocate or activist is overly simplistic and inhibits effective science-policy communication.[27] This respondent believes the very idea that such interactions can be prevented—a.k.a. the interactions are objective—is a "ridiculous" "illusion".

Another respondent offered a completely different view on objectivity.

> "I think there are **degrees of objectivity**. **My values may dictate what questions I ask, but I could still bring a fair amount of objectivity to answering that question**. The value of science is that it is internally self-consistent, it is replicable, and there is a set of rules saying when we can or cannot add to the body of knowledge. And I think that has value even if some subjectivity creeps in. **Can science be wholly objective? No. Does that mean it's wholly subjective? No.** Understanding what we are and are not most objective about and most subjective about would be extremely *useful*."

Table 4-2 below summarizes the respondents' views of positivist objectivity.

[27] It is interesting to note the wetland boardwalk "protects" nature from the scientists where the policy boardwalk "protects" the scientists from politics. One is a good swamp, the other, a bad swamp.

Table 4-2 Respondents' Views of Objectivity

Objectivity is value neutrality and descriptive accuracy as practiced by individuals. (positivism)	Why?
It's "real and necessary"	To protect science's credibility and authority
It's "ridiculous"	"Science is a human endeavor"
It's "suspicious"	
Not quite, because it's a "matter of degree"	

The conversation developed differently with another respondent by discussing the post-positivist critique of science and its dismantling effect of objectivity, traditionally understood. I asked if this means values are inescapable in science, to which the respondent replied, "I think it's probably true, but it's something we are going to have to live with."

Three significant ideas developed throughout my interview with this respondent and they merged at the culmination of the interview. First, we opened up the relationship between emotions and values, realizing that one can describe values without necessarily being emotional.

[C] "You had said earlier in the work place it's not appropriate to show emotions. But emotions are different from values. Emotions are how you sometimes act out the values you that you hold**. You could be perfectly stoic when describing the certain values you may have or the values others may have**—"
[R] "**—That's true—**"
[C] "—You need not necessarily be emotional about."
[R] "**Yes. I think I was implying that a sort of passion is in there and that would be inappropriate to show in the work place.**"

Second, they posited that some sort of guidelines could be put in place to help scientists handle their values' roles in their research. Furthermore, the respondent thought one "could also argue that that is the role of the universities" in addition to professional societies.

> "Objectivity is a constant challenge, and we constantly need to be reminded of that. Take more ethics classes, or take *any* ethics class periodically. **For the professors, maybe**—we have to get our driver's license renewed and you have to do a series of tests, maybe **there should be a periodic 7 year test... about how you teach. You know, [take] a teaching class about ethics**."

Third, they reflected on how an early career experience with the peer-review process taught them "some lessons."

> I can remember a few early papers—or reports—that I wrote… and the review comments came back saying 'this shows bias.' At that point I hadn't realized I was carrying bias. **Let's protect this river versus let's *understand* this river** and understand the factors that influence the river so I can hand that information over to someone to use it. I learned some lessons early in my career. **I didn't realized I had this bias, but it was pointed out to me through peer-review**."

This led the conversation into a discussion about peer-review. The respondent explained that the purpose of it is to function as a large-scale method of not only "checking for errors" in the experimental set up or data analysis, but "exposing personal values implicit in the science" by giving people with different worldviews the opportunity to review and provide constructive feedback. Later in the interview I asked about how objectivity can handle the post-positivism critiques and the respondent returned to peer-review.

[R] "**Having a more robust peer-review system might help**, giving more value to the peer-review process. I mean, I have this boiler plate paragraph that I use [when] people make these same sort of errors, same sort of [problematic] value-judgments…."

[C] "**Can we ever actually be wholly objective**?"

[R] "**No, but I think that if we can get enough multiple view points in there**, rather than be reviewed by the same small group that may have the same worldview that you have and are just reinforcing that, by bringing in larger perspectives to the review process [we can be more objective]."

I proposed a synthesis of these ideas to the respondent.

[C] "Returning to our conversation about communication of our values amongst colleagues, if this conversation were able to take place at a large enough scale, could you have that same system of checks that peer-review currently uses such that we have a more open peer-review system of how our social, political, and especially our environmental values, and so forth influence our science?"

[R] "That would fantastic!"

In keeping with grounded theory, I read Longino's (1990) argument for how peer-review can expand to include the interrogation of values after this interview. Finding out after the fact that this is essentially Longino's suggestion for legitimately integrating values into the social practice of science corroborates the viability of this idea.

Regardless of the respondents' views of what objectivity is, most respondents expressed similar opinions about how objectivity relates to credibility and authority in the scientific community.

> "Well if you haven't ever done anything that has been documented—I hate to say it—documented objectively by your peers, then you don't have any authoritative ground to stand on. A [young scientist] that hasn't gotten any paper published, or grants funded, or really made a name for him or herself, is not going to be

> able to be an expert in a court case that involves scientific credibility and from that, authority."

In other words, one must build credibility out of objectivity and authority out of credibility. Credibility was often talked about in tangible terms of having a track record of peer-reviewed publications and getting grants funded. But, scientific authority and credibility can be lost or compromised if objectivity is not strictly adhered to.

> "Any time a scientist says 'we should do x, y, and z' they are **stepping out of the objective and into the normative, and they lose their credibility and their authority.** I don't think that's the case, but when you are in an adversarial position, you have to be prepared for the fact that's going to be one of the arguments probably used."

But another form of credibility kept coming up, and it could be gained or lost in its own way.

> "In terms of the colleagues that I have, a lot of whom are also friends, I think **the assumption is that those values and that caring about the environment is there… and if in the process of working with someone you found out that it isn't, then… I think a lot of us would be dealing with negative credibility on their part.** I think where we get positive credibility is from much more tangible things, like the impact of a journal article or getting a $5 million NSF grant funded. But I know from personal experience that the values part can generate positive credibility spin outside of the comfort zone of your colleagues."

Some respondents associated their positive environmental values—their shared "caring about the environment"—with the foundation of their environmental credibility and this is different from the "tangible things" that build scientific credibility.

For scientists to have scientific authority they must have scientific credibility, which comes from at least some form of objectivity. As a result of this relationship, when objectivity is perceived as compromised scientific credibility is lost and authority along with it. In parallel, certain positive environmental values are required to build environmental credibility. And if someone with this environmental credibility is found to not have certain positive environmental values, then that credibility is lost.

This sets up a paradox: if AES must be value neutral (with respect to non-epistemic values) in order to be objective and build their scientific credibility and authority, and if AES must hold certain positive environmental values in order to be environmentally credible, then how can these scientists be both objective and act on environmental values? One well established AES proved that it is possible and suggested a way to rationally solve the paradox.

> "I work most commonly **[in] the environmental community, it's inevitable that you're seen as somewhat of a fellow traveler at least in holding values** relative as seeing the world ... you gain certain credibility.... **[A]nother part of my credibility comes from the capacity to be a fair arbiter**.... I think that **combination** has been very important and influential in this whole area of [normative environmental issues] where I can publish a paper [and people know] it'll be nuanced and intellectually rigorous position… and honest."

This introduces an additional component to authority that was not previously addressed: fair arbitration. I asked this respondent to elaborate on their understanding of their environmental and scientific credibility with respect to authority.

> "Folks are quite willing to regard judges as authority figures in society and their job is to interpret the fact relative to the law as law is understood at that time, law can change just like science. In that sense, **scientists are some combination of that authority that comes along with being a judge but also contributes to what is being interpreted**…. When they do these public opinion polls, scientists come out very high, much higher than political individuals or business leaders. Scientists really are seen as individuals as people we can look to for an **honest opinion**."

Other respondents also referred to the ranking of scientists in public opinion polls. But it seems this respondent cited this as a consequence of scientific credibility (i.e. honestly interpreting and producing science) balanced with environmental credibility (i.e. legitimately contributing to normative environmental issues) to create this particular type of authority that affords them the opportunity to express their "opinion" as long as it is "honest." I continued to ask this respondent how they were able to develop this skill.

> "I haven't had [any] training in mediation, but **I have had training in how to reason as a scientist**, and therefore be able to represent all sides—or at least explore myself mentally—all sides of an issue before going forward on one particular view."

The ability to a good mediator is not only taught indirectly through scientific training, but also potentially exercised in the classroom when it comes to values in addition to the science. The respondent continued,

> "**If you are going to be a good mediator, then you are going to get all sides equally represented on the table**. And the students can then weigh the positions…. **In a classroom environment, that's often how I see my role when it gets to these value issues**. Not to buy in to any one of the value systems, but be willing to raise a counter argument to whatever the issue is in order to explore why you are taking that position."

This respondent has international authority with respect to science, science policy, and policy. Additionally, this respondent is expanding their career into more explicitly normative issues and is able to do so successfully because of their mediation skills. These value mediation skills are not so different from the science mediation skills required to build scientific credibility (i.e. evaluating hypotheses, accounting for variables, etc.). Though it is normal for scientists to use their science mediation skills in the classroom, it not as common for scientists to address the normative aspects of their science in the policy arena for fear of being labeled an advocate. But AES can act with environmental and scientific authority by developing their environmental and scientific credibility in the classroom meditating (and arbitrating) issues of science and values.

This brings us back to the paradox. If objectivity is understood in the positivist sense, then the relationship between environmental values and environmental credibility is opposed to the integrity of science perceived by the larger society. To be clear, sharing common positive environmental values builds environmental credibility and the environmental authority that follows. Not sharing these values undermines this type of credibility. Additionally, acting on environmental values in a way that appears to be "advocacy, or worse, activism" (as shared in the boardwalk quote) can quickly destroy scientific credibility and the scientific authority that follows. Given the literature reviewed in chapter two, how my respondents handled their career decisions with respect to environmentalism indicates that adopting a unidimensional approach (i.e. either

producing science or advocating policy) is inadequate on its own. But the method of using both invites conflict, and thus attention is necessitated. As one respondent explained,

> "I think a lot of scientists don't even recognize when they are crossing the line [between scientist and citizen advocate]. They think that they are advocating something that is purely informed by their objective position as a scientist, when in fact it is being informed by their values. So we come back to the point of your research; we all need to be more self aware about what those distinctions are so we can more clearly and accurately state when we are behaving as scientists versus as citizens."

In the quote above environmentalism is an advocacy activity that individuals acting only citizens can engage in, but individuals acting as scientific experts cannot. If the communities are blending, that means drawing the line between appropriate and inappropriate advocacy activities is more difficult because it is now often drawn within rather than between persons. Another respondent offered a completely different view on what advocacy is and what it means for us as humans.

> "I think someone who is not an advocate for something, whatever it is, is going to be a pretty boring person. **The trick is do you advocate or are you an activist about something that is directly associated with what you do every day for your job?** … I think that if you sat down and talked with somebody but couldn't find *something* they feel strongly enough about to be an activist given the opportunity, that person is going to be boring because that means they don't have strong values or feelings about anything…. I think, fundamentally, **if people tell you they are not activist in any way, shape or form, they either lying to you or they are really boring people**…. Or they could be lying to themselves, which makes them doubly boring [laughs]."

My respondents evidenced a variety of views regarding the meanings of and relationships between advocacy and objectivity. Positivist objectivity appears to be common among my respondents. Some think it is real; other think it is ridiculous, worthy of suspicion, or not quite accurate because objectivity is a matter of degree. Regardless of whether they accept objectivity in this form, they do (reluctantly at times) accept that it is necessary for building scientific credibility. Scientific authority then rests on top of this credibility with the judicious use of arbitration on scientific matters.

AES who attempt to use their authority on matters outside of their scientific expertise, as mentioned above, aren't being objective because they are using their environmental credibility in place of or mixed with their scientific credibility. By acting outside the perceived appropriate limits of their expertise, the scientist risks being branded as not objective, and is reprimanded by tarnishing or losing their scientific credibility along with their authority. For some, there is a fear of the collateral damage of reducing the credibility of the environmental science community. As illustrated in chapter two, this is the fear voiced by at least some AES against advocacy, many of which are well published if not leaders. The typical response given by at least some respondents is to not give into the rigid positivist view; instead they argue AES should change the meaning of science to make objectivity useful but not unduly constraining.

These complex relationships between fluctuating and loosely defined concepts are being strained by increased pressure on AES to inform and

sometimes shape environmental policy. Clearly these kinds of conversations need to take place in a more transparent and constructive manner, but as one respondent warned,

> "When we start to question the legitimacy of science, which… comes up when we start to talk about how scientists actually have values and those values influence the kind of questions she's asking, this can be used as the thin edge of the wedge for the anti-science group to come in and say, 'see what I mean, this is all just *bunk*, this is just another *liberal person* with their *liberal questions* to come up with their *science* with an answer in order to take away our liberties.'"

Many Postmodern arguments call the legitimacy of science into question by arguing that the knowledge generated through science is compromised because the standard of value-neutrality was breached. This is an illustrative example of how the problematic definition of positivist objectivity with its two meanings is used to make the "thin edge of the wedge" syllogism.

> P1: Traditional scientific objectivity requires both descriptive accuracy and value neutrality with respect to non-epistemic values
>
> P2: Scientific objectivity is required for building scientific credibility
>
> P3: Scientific credibility is required for building scientific authority
>
> C1: Therefore, if descriptive accuracy or value neutrality with respect to non-epistemic values is compromised, then scientific objectivity is compromised
>
> C2: Therefore, if scientific objectivity is compromised, then scientific credibility and scientific authority are compromised
>
> P4: Advocacy is value-laden work at least partially of the non-epistemic kind
>
> C3: Therefore, engaging in advocacy results in C1 and C2

But if P1 is changed to "Scientific objectivity is a community practice where values, beliefs, and ideas are interrogated and reformed," then C1, C2, and C3 are all neutralized and advocacy is no longer necessarily a harmful activity.

Academia is one of, if not *the* primary institution for the production and housing of traditional science. Yet, due to the high degree to which academia is unregulated in the United States compared to other developed nations, it can perhaps change more rapidly (Crow, 2008). Many respondents expressed this view, but one gave it particular emphasis by evoking the vision of a president from a previous university.

> "Academia needs to take 'ownership over the environmental challenge.' As President [edit] once said, 'We as universities like to stand back and point fingers at the woes of this world. Business did it. Government did it. Why do we as universities not take responsibility? Where did they get educated? Who taught them? Who is the them we are blaming?'"

Engaging Policy

> "No policy decision can be made in the absence of understanding what we value, why we value it, why we value some things more than others. But scientists aren't empowered to be the one who say what society should value."

Responses such as this invited the question of what AES are empowered to do in policy decision-making. My respondents believed that they should "inform" and "advise" policy-makers, not "advocate" or "tell people what they should value." Many respondents expressed some version of the view that my first respondent predicted, "everyone is going to say that [is what] they do,

approximately, but I don't think that's necessarily right." Another respondent echoed this point by explaining how there are actually different roles for different scientists.

> "**I think there are multiple points of entry for environmental scientist to be associated with environmental policy and policy making.** For some, which is the easiest, it's what some people call **the UPS model** of science. Which is where you do your science, bundle it up, put it in a box, leave it on the loading dock, someone backs in, grabs it and takes it away. This has always been the hope of science. **That the science would be packaged up by an objective scientist and the policy-makers would unpack it and decide what they can actually use to influence policy**. For a lot of people, that's the best they can do and the best they can hope for.
>
> **But for other people, they are scientists that can get in from the beginnings of discussions of policy formation**. So they can actually talk to the policy makers about what are the potential levers, what are the things that can actually be done, where is the bureaucracy just so fixed nothing is ever going to happen. So understanding the mechanisms of how policy is made in different kinds of milieu. There are some scientists that are good at doing that. I would say that they are in the vast minority probably."

This appears consistent with the findings of the three other dimensions. Science is a human endeavor and each person can only contribute within the limits of their abilities; there is no single way for environmental scientists to inform policy because there is no single type of environmental scientist. But some respondents on the frontiers of understanding environmental challenges offered views that well represent the changing pulse of their community.

> "**Anything that isn't fairly nimble and flexible is not going to succeed ultimately. I think science is pretty nimble and flexible, but it might need to [improve] in its interaction with social decision-making**…. [Science] should inform the process. It has to and I think it always has. One of the problems in the past is there

> was an overreliance on the presumption of accurate interpretation by nonscientists of that knowledge. What needs to become more prevalent in that informing process is the people who at least know the knowledge better, and preferably the people who generated that knowledge, need to be a part of that informing process.

The practice of science is one of continuous change as discussed in chapter two. This quality makes science resilient, but also difficult to navigate because there aren't any hardened rules for conduct. Rather, the guidelines are flexible to keep the practice nimble. So how can these scientists inform policy if there is an absence of clear and solid guidelines? Some respondents reported that doing more social and policy relevant research in addition to working directly with the decision-makers is an effective way to inform the policy decision-making process. For example,

> "With [large, career defining project], **a big part of what we are moving towards is making the work more applied**. And when I say 'more applied,' that doesn't mean that we are necessarily the ones making the decisions—we're not—but **figuring out ways of studying the urban systems we are studying in a way that includes parameters that are more directly relevant to policy-makers and to decisions-makers**. And to the extent we can, involve them in the science we are doing. The coproduction of knowledge with the people that can actually use that knowledge to make better informed decisions."

Doing research to fill in the lacunas policy makers need to have addressed is a productive method of informing their decisions. The respondent in the quote above specifically includes the parameters that are relevant in an effort to do this. Another respondent elaborated a similar point,

> "If there is an actual management decision to be made, working with the people who are going to make the management decision is *probably a good idea....*

> [Because] **getting an approximation to the right problem is probably better than getting an exact answer to an approximate problem**. Spending time with people on the front lines dealing with the policy questions, you are much more likely to try to solve the right problem with an approximate solution than coming up with a solution to an approximate problem."

Further respondents focused on ways to help evaluate the science if given a defined set of values. For example, one respondent with federal policy experience stated, "I think scientists *can* play a role [by saying] 'here is what you have said your values are, and here is, in fact, the reality'." Pointing out inconsistencies was a valid and helpful way to informing policy for some respondents.

> "I do 'positive analysis' rather than 'policy analysis'…. give me the objective and I'm not going to make statements about whether it's right or wrong, but how to get there…. if you say 'prioritize this way,' I can give you an analysis. If you don't like the analysis findings, you really weren't prioritizing that way."

The respondent with federal policy experience commented on a different kind of inconsistency. Science has limits and although they are changing, policy-makers ought not use the authority of science to make nonscientific decisions.

> "[Telling policy decision-makers] you can choose that because in this particular instance, the politics is way more important than the amount of carbon sequestered we are going to get, and you want to do it [for a particular reason], which is fine. But, don't say you are doing it based on the fact that this is the biggest bang for our buck in terms of sequestering carbon. **Science doesn't defend you on that. You are making this assertion for nonscientific reasons**. I felt like that was advice, not advocacy."

Many respondents voiced concerns that policy could not be changed as quickly as they deemed necessary. One respondent emphasized this point throughout our interview, but did offer some semblance of hope.

> "It's going to require—**you hate to say that things are going to require generational changes because to some extent, there are storms looming on the horizon that suggest we may not have generations of time** to make some truly transformative changes of how we do things on this planet. But this is a case where **I think some generational change is already happening**. Old gray hairs like me are going to be less willing to get out of their comfort zone and become part of this informing voice than **young folks who have grown up learning science in the world of broader impacts**, that they need to get out of the lab."

If time is indeed running out, then playing it safe inside one's "comfort zones" isn't safe. Many respondents spoke about how "one of the hallmarks of science is the continuation of change," so what kind of change *is* happening in the current generation of these scientists?

> "I mean look at the prominent presidents of ESA. They are all about earth stewardship…. **A lot of prominent scientists are there are saying that we need to be better stewards of the planet**. Doing it later in their career, which I think is it safe for them. Because they establish themselves as strong scientists, just like pure scientists who do something more applied later in their career, and **I think that's a safe position because they are working within the system to become credible and then using the credibility for something else, later**."

The structural relationship and possible tensions between objectivity, environmental values, credibility, and authority in the decisions of AES are discussed throughout this thesis. The respondent in the quote above, who is a younger AES, is working with an understanding of these relationships and sees

how they constrain what career moves are safe for these scientists. But is this enough? Two specifically think it isn't. One stated,

> "Terry Chapin, and now Stuart [sic] Pickett,[28] is leading the charge on it [ESA], they've spun into this **big initiative on environmental stewardship**. I think that's just another 's-word' because **they don't want to say the real 's-word' that is sustainability.**"

These two respondents expressed that because time is of the essence, the practice of AES must make "truly transformative changes," and environmental stewardship is not transformative enough. Alternatively, sustainability science is for some seen as more promising here because of its problem solving orientation, its socio-ecological intergration, and its encouragement of scientists to actively address the normative human and social dimensions of their research. Such changes appear to be taking hold among some members of the community.

[R] "I've seen some sea changes, at least with urban ecologists, when I first starting working… there were some ecologists that said "we can't get into any kind of advocacy work, we can't let policy need dictate what we are going to for research, we need to be objective."

[C] "What year was this?"

[R] "About 2002, 2003. But since then… I've seen [how] this last round of [NSF] renewal grants include sustainability, doing scenarios, and talking about normative values. … This was a huge surprise; this was a fundamental shift in the ways that ecologists were thinking."

What caused this shift? Early in the interview process an older and well established respondent offered their explanation of the changes for when, why,

[28] Former and current ESA presidents as of this writing in June, 2012. (http://www.esa.org/history/officers.php)

and how ecology developed through the institutional leadership of ESA. They provided a short story to cover this development.

> "The ESA was formed and for many decades functioned as a society focused on doing the science of ecology. Victor Shelford got crossed when he wanted to take it in what we would now regard as sort of an environmental or conservation direction. If memory serves me correctly, there's even a connection with the Nature Conservancy. **So, you get those as very different traditions, of value systems really, in terms of 'were you being a scientist, doing the science, or were you being and advocate**.'[29]
>
> Shelford felt that ESA had to be more of an advocate for the natural places than it was being in the 40s and 50s. There was a division within the community. **Those two strands, those two ways of thinking, come back together in the 90s. I would look to the Lubchenco report as a place where that group gets together those two traditions by making the case the ESA, what ecologists were doing, had to also play a role in policy.**
>
> [They argued] that these were not contrarian views, but that they could be complementary. **Yes, you can be a scientist, but you can still have your opinions as far as how environmental things handled—environmentalism, conservation, preservation—you just need to make it clear when you are talking as the scientist or the advocate**.
>
> …. **[T]he Lubchenco report—it really was the major shot across the bow for the ecologists to step up**. The Washington Office of Public Policy emerges from that report, which signaled a willingness on the part of the Society to take positions on these kinds of issues…. I do think it anchors this kind of reason that shows how the ESA shifted from its historical position of 'we're independent, we're outside the system, we provide advice,' to one that where 'we can provide advice, and in fact, we are in the very best position to provide this advice.'"

[29] See footnote #10 for a more detailed account of this history. See (Tjossem, 1994) for a more thorough account.

This respondent has witnessed four decades of ecological science, but has not actively participated in ESA affairs. Another respondent interviewed is an ESA insider and has been since before the Lubchenco Report of 1991, more formally the Sustainable Biosphere Initiative or SBI (Lubchenco, et al., 1991). When I began eliciting this respondent's insider opinions, they prefaced their responses with, "Since all my answers are anonymous…" This indicated again that, although some AES support increased demands for transparency of values, beliefs, and opinions, these are not yet full fledged (or not yet) consensus constitutive values among all AES.

[C] "When do you think ESA made the transition from putting so much distance between ESA and advocacy, as seen when Victor Shelford was essentially forced to leave, to ESA has a fundamental responsibility to address policy questions?"

[R] "**I can tell you *exactly* when that happened**."

[C] "When's that?"

[R] "It's going to sound like a crazy answer. **It was in 1991 when they published the Sustainable Biosphere Initiative…. That paper laid it right out there**. You read that paper and it's relevant today, it's incredible. It's an incredible document. **And it was written by a team of sort of mid-career super luminary that has all the street cred necessary to write such a thing**. It was an amazing thing to write and publishing it in *Ecology* and not as a white paper made a statement: this is important, we need to set priorities, we to think about relevancy, and we need to think about how to handle environmental challenges. That was a turning point for me, and for ESA…. It got a huge splash. I'm sure there were a lot of ecologists who got freaked out by it…. **It actually had an amplifying affect across societies by changing the way people thought to make it relevant.**"

According to some of the AES I interviewed, Terry Chapin and Stewart Pickett waited until they were late in the career and in secure positions of authority as president of ESA to strongly support environmental stewardship. Jane Lubchenco and her "super luminary" team were mid-career, but still had enough

credibility to publish one of the most important documents in AES, one that appears to have had ramifications for the AES research agenda as well as the funding priorities for scientific research. Indeed, one respondent with insider information about why The National Science Foundation decided to change one of its research grant evaluative criteria to "Broader Impacts" in 1997[30] cited SBI as a main motivator. The SBI report encouraged AES to realize their work needed to be socially relevant and applied to find solutions. One of the ways this could be done was through a research emphasis on sustainability. Going back to chapter two's discussion of institutional and organization environments and the question of how institutional environments change, I believe this example of SBI influencing some of evaluative criteria of publicly funded science in America is an example of how institutions can cause significant lateral change.

So what is advocacy? The profile of Engaging Policy in chapter three explained that this question is threaded through the other three profiles of Motivations for Being an Academic Environmental Scientist, The Conditions of Academic Conditioning, and Objectivity, Credibility, and Authority. The simple answer provided by many of the respondents is summed up as "advocates are… those who are driven by claims that are not transparent and/or not backed up by a set of facts." This implies that values are contributing to decisions elusively and therefore scientists as advocates are behaving inappropriately due to the now well-established problematic and entrenched positivist objectivity.

[30] http://www.nature.com/news/2010/100526/full/465416a.html

> "**Advocacy is the movement away from objectivity**, because … [a]dvocacy is a missionary effort of convincing others that the values you hold should be of value to them. I don't think it's an inherently bad thing, but because of what I said before, that it moves away from objectivity and we hold objectivity of such high value, then **we're saying that person is an advocate therefore their science is not objective, pure, this or that. I think that's really goofy, because are all advocates**."

The post-positivist meaning of objectivity seems to resonate with a portion of respondents as indicated by the different views of objectivity in my respondents. This is happening as advocacy is also becoming more acceptable. One respondent who is an active educator, researcher, and administrator commented,

> "I think there has been a shift in the degree to which people are willing to engage in policy and advocacy than there were before. How many people are doing that, I don't know."

As discussed above, the Sustainable Biosphere Initiative appears to have had a ripple effect through out AES. But we may still ask what are the specific responsibilities of scientists? In 1997, Lubchenco became the president of the American Association for the Advancement of Science (AAAS), the world's largest scientific organization (Lubchenco, 1998). Her presidential address "Entering the Century of the Environment: A New Social Contract for Science" was an attempt to further incite social responsibility within professional science. The ESA insider respondent and I talked about how well Lubchenco's speech and her following publication were received.

[C] "**What about Jane Lunchenco's 1998 paper "A New Social Contract for Science**," did that have the same impact [as SBI]?

[R] "No, **I don't think it had the same impact at all…. People read it and thought, 'Oh, that's nice, but I don't have a social contract, I am free to do whatever I want. I'm an academic.**' I think today more and more people are turning back and referring to that and saying that in fact we do have a social contract; we have an *obligation to the public. They are paying our way, right?* How many of us work for public universities? Where does that money come from? **I think more people realize this now and see that we do have a social contract**…. People were afraid. They thought if priorities were set, what they do wouldn't be relevant…. I don't think a lot of people want to admit that."

In summary, respondents reported various definitions of and positions toward policy advocacy. Objectivity, Credibility, and Authority showed how these respondents also do not have a common definition of or attitude toward objectivity. These data help explain why advocacy is treated as tantamount to being a subjective science by many AES interviewed, but seen as a necessarily human thing by other AES who seemed to take a more post-positivist position on the question. The latter appear to agree that academic environmental scientists have the capacity to inform policy. What's more, they also seem to agree that they ought to do so, and there are many ways to for scientists to tailor their approach. Lastly, I believe that my respondents' views that policy engagement among AES is increasingly prevalent in academia are partly explained by ESA's SBI. It seems this is the case because of the asserted influence of SBI on NSF's funding decisions directed what research is done in academia towards social and policy relevancy. Although I am not claiming that other factors did not play a role in NSF's adoption of the "Broader Impacts" criterion in evaluating research proposals, ESA's pivot toward sustainability and social engagement—marked by

the SBI in the early 1990s—appears to have had some influence on research policy, at least according to some of the well-positioned AES I spoke with.

Chapter 5

CONCLUSION

Simple as it may sound, change takes time. Environmentalism has a longer history than discussed in this thesis, but the brief history presented here illustrates fundamental changes in perspectives underpinning changes in practices and philosophical foundations. This is especially salient with respect to sustainability because it is seen by many of the AES interviewed here as transforming the more or less exhausted practice of social environmental advocacy and activism through the professionalization of policy-relevant environmental science.

The practice and conceptual foundations of science changed slowly over time, too. This is seen in the complete reversion of objectivity since the fourteenth century, how it now dominates the epistemic values of science, and how it relates to credibility and authority. These shifts in conceptual understanding are reflections of the larger shifts in science, notably from positivism to post-positivism (see table 5-1) and address the influence of non-epistemic values, particularly environmental values, to help embed science into its human and social context. But the time between such shifts is often characterized by conflict and confusion. The AES I interviewed (as well as those participating in the policy advocacy debates in the literature discussed earlier) illustrate this conflicted position toward advocacy. When people hold different ideas of what objectivity is, a different view of what advocacy is and its permissibility follows. The diversity of positions towards policy engagement and the meaning of advocacy

found in my sociological study of nineteen AES provide empirical grounding for these tensions and confusions.

Table 5-1 Respondents' Views of Objectivity Expanded

Objectivity is value neutrality and descriptive accuracy as practiced by individuals. (positivism)	Why?	Objectivity is a community practice where values, beliefs, and ideas are interrogated and reformed (post-positivism)	Why?
It's real and necessary	To protect science's credibility and authority	It's real, necessary, and comes in degrees	Keeping the normative variables unaddressed results in inaccurate science.
It's ridiculous	Science is a human endeavor		
It's suspicious			
Not quite, it comes in degrees			

AES' public funding constraints and society's environmental constraints have motivated more scientists to act in accordance with a social contract within the last decade. Academia's constraints include attempting to adapt to these lateral influences. With the institutional change of academia comes the organizational change of each university, which is one of the most central places for exchanging ideas for these scientists. But again, change takes time. And such transitions bring diversity of opinions and even confusion along with them. One respondent gave a response that embodies the kind of thoughtful relationships that this thesis explores.

> "I do think we have a fundamental responsibility to be active members of society. Not just in terms of being citizens… but in

> terms of engaging society with our knowledge and our science—where it is applicable—and to the extent we are comfortable. And that last term is so incredibly squishy, that it allows pretty much anything."

This thesis's intention is empirical discovery. I believe one pattern found in my respondent data (see table 5-2) indicates a potential method for dealing with some of the issues raised. It seems to be the case that the AES I interviewed treat students and policy decision-makers in parallel. Consequentially, AES can practice their ability to mediate environmental issues with normative and scientific dimensions by building their environmental and scientific credibility. This in combination with a post-positivist understanding of objectivity offers one way to break out of the paradox discussed in chapter four. One respondent was able to integrate the two forms of credibility and use the resultant new form of authority without conflict.

Table 5-2 AES' Parallel Treatment of Students and Policy Decision-Makers

Should scientists…	Subject x →	Students	Policy decision-makers
…inform x of science?		Yes	Yes
…decide x's values?		No	No
…evaluate science with x to match given social values?		Only if mediation skills are strong, which isn't for everyone. Science needs more this type of scientist.	

Respondents expressed desire to more actively and effectively engage in environmental policy decision-making but were reluctant to compromise their scientific credibility and some were additionally unsure how to find the time to invest in the personal changes seen as necessary for policy engagement. This

thesis indicates that AES are able to work towards meeting their desires and building their tool set of working with values by utilizing the social learning environment of the classroom. An additional benefit of discussing the normative dimensions of environmental science cited by respondents is this helps train the next generation of AES practitioners, policy-makers, and citizens in general to better appreciate the roles of value in science and the role of science in society.

A second pattern is that the recent and ongoing changes in the practices and conceptual foundations of environmentalism and academic science could potentially help ameliorate some of the tensions and confusion AES face, such as the meaning and use of environmental values, objectivity, and policy advocacy. They have the potential to successfully integrate their two sets of contextual (environmental advocacy and scientific behavior guided by epistemic values) and constitutive values (change policy and contribute to science). Yet, this is clearly not the case as seen in the policy advocacy debates. The two sets of contextual and constitutive values initially invite conflict—as explained by advocacy's relationship to objectivity—but diffusing this tension is possible as shown by analyzing my respondent data. This is possible because the changes in the practice and philosophy of science in AES offer a stimulus for constructively integrating the disparate value sets for AES.

This is seen in the differences of social and policy relevant science across generations of AES practitioners. AES I interviewed who were trained in the 1960s and 1970s shied away from societal application because of its association

with environmental advocacy, but are engaging policy in alternative ways (or at least desiring to) now later in the careers. The younger generation was more likely to be originally trained this way, and the next generation is more likely to be exposed to societal application, sustainability, and the questions of informing policy. This also seems to be linked to the pattern of how colleagues rarely talk about their personal motivations for their research, yet these scientists are increasingly having these conversations with students in the classroom.

Even though some accounts of advocacy are thought of as permissible and even unavoidable, the move from "advocacy" to "informing" seems to help preserve the entrenched relationships between objectivity, credibility, and authority. This is understandable given the transition academic science is going through and the concern that these changes could jeopardize the credibility and authority of science if not handled with caution. Matching this caution is the urgency demanded of political action and the need for scientists to be transparent about their values. My interviews with AES in this study suggest that cultural environmental values are for them contextual values, and that ensuring the continuance of supportive, regulatory, and provisional environmental values through the informing of policy and citizenry are held as constitutive values. The constitutive values are recognized by the AES I spoke with as more acceptable than the contextual values, perhaps because cultural environmental values are non-epistemic and therefore perceived to conflict with certain notions of objectivity.

But post-positivist objectivity seems to be able to account for the contextual cultural environmental values if subject to a sort of value peer review system discussed in chapter two and in Objectivity, Credibility, and Authority. The scientific mediation skills of scientists can expand to include value mediation skills. And if practiced, scientific and environmental credibility can integrate and build authority beyond the limited scientific authority. AES already have the ability to do this (i.e. they were trained to have scientific mediation skills) plus the space and time to practice (i.e. in the classroom and eventually with policy decision-makers).

AES are in transition between recognizing the human and social dimensions of science and integrating them into their institutions. I conclude that it is helpful to understand how environmental values function in the motives and decisions of AES given that these scientists are realizing through their roles as educators, scientists, administrators, and policy informers that the normative dimensions of science must be actively handled. Furthermore, this is within reasonable reach. The submission to positivist objectivity trained into the currently practicing AES is weakening with the rising critiques of post-positivism, but the benefits of objectivity are kept intact so far as these scientists can transparently discuss and reform their values. The interrogation of the contextual and constitutive values must be handled as actively as possible to integrate the roles of environmental values in the human and social dimension of AES.

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APPENDIX A

IRB APPROVAL DOCUMENTATION

ASU Knowledge Enterprise Development

Office of Research Integrity and Assurance

To:	Ben Minteer LSA
From:	Mark Roosa, Chair Soc Beh IRB
Date:	10/10/2011
Committee Action:	**Exemption Granted**
IRB Action Date:	10/10/2011
IRB Protocol #:	1110006942
Study Title:	Environmental Value-Science Relationships in Academia

The above-referenced protocol is considered exempt after review by the Institutional Review Board pursuant to Federal regulations, 45 CFR Part 46.101(b)(2) .

This part of the federal regulations requires that the information be recorded by investigators in such a manner that subjects cannot be identified, directly or through identifiers linked to the subjects. It is necessary that the information obtained not be such that if disclosed outside the research, it could reasonably place the subjects at risk of criminal or civil liability, or be damaging to the subjects' financial standing, employability, or reputation.

APPENDIX B

RECOGNITION OF TOPICS NOT EXPLORED

1) The role of metaphors in the AES community.
2) Assessing the role of nostalgia in the contextual and constitutive environmental values of the AES community.
3) The intrinsic versus instrumental environmental value debate, and, how this is perhaps reflected in the value systems of conservation biology and ecology.
4) How degrees of uncertainty affect degrees of objectivity.
5) The basic versus applied false dichotomy (i.e. Stokes, 1997).
6) The finer differences between politics and policy, and their implications for advocacy in the AES community.
7) The scientization of politics and the politicization of science.
8) Technocracy of scientific rationalism and its authority in politics.
9) Pielke's (2007) "science arbiter" is his "honest broker" if the arbiter effectively uses mediation skills for values in policy decision-making.
10) The role of funding in relation to social responsibility in science.
11) Division of labor between and within institutions.
12) Maslov's hierarchy in relation to the MA framework