Is Science Becoming Policy-Biased Toward Pristine?

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Abstract

In disciplines such as fisheries, wildlife, forestry, conservation, water resources, and environmental science, I am concerned that peer-reviewed scientific publications are often implicitly shaped by an overarching and value-driven policy worldview: the pristine, natural, and unaltered state or trajectory of ecosystems is presumed to be the ideal or benchmark *policy* goal. This assumed *desirability* of pristine (natural) ecosystems often creates biased science. Worse, this implied assumption that natural conditions are inherently preferable to human-altered ones frequently exists unrecognized by many consumers of scientific information, even by some scientists. The result is often a subtle, but tangible policy bias in scientific analysis and reporting. Trust in the impartiality of science is the cornerstone of the scientific enterprise. Personal (or employer) bias for particular policy choices (embedded in purportedly policy-neutral scientific information) compromises scientific integrity. Educators, mentors, and supervisors have a vital obligation to sustain the important role that aspiring and current scientists have in providing relevant, credible, and policy-neutral information.

1. Introduction

Policy *advocacy*, policy *making*, and natural resource *management*, by definition, are biased toward a preferred outcome, as is appropriate. Conversely, *science*, the fact-based foundation of policy and management, should not be slanted to promote a preferred policy outcome (Lackey 2007, 2026).

In disciplines such as water resources management, fisheries, wildlife, forestry, conservation, and environmental science, I am concerned that peer-reviewed scientific publications, the foremost sources of credible scientific knowledge, are often implicitly shaped by an overarching and value-driven *policy* worldview: the pristine, natural, and unaltered state or trajectory of ecosystems is presumed to be the ideal policy goal. This goal may not be attainable due to society's competing, mutually exclusive policy priorities, but it is the assumed *desirability* of pristine (natural) ecosystems that creates biased science. Worse, the implied assumption that natural conditions are inherently preferable to human-altered ones often exists unrecognized by many consumers of scientific information, even by some scientists. The result is often a subtle, but tangible policy bias in scientific analysis and reporting.

I am not referencing *organizational* and *personal* policy bias (Pyron and Mooers 2022). For example, government and private organizations are often established to achieve specific normative policy goals. These goals and objectives are inherently policy-biased, and that is appropriate. All individuals, including scientists, possess personal policy preferences. I will focus on the knowledge generated by individual scientists who implicitly claim to follow the basic notion of the classic Baconian Scientific Method and its many derivatives. This approach to knowledge generation was developed and popularized by Francis Bacon (1561-1626) and emphasizes systematic analysis, empirical research, and inductive reasoning (Szabla and Gaffney 2023). This type of knowledge is *science*, but not all knowledge *labeled* as science is actually knowledge generated following the Scientific Method, nor is it policy neutral.

Most scientists are rigorously trained in technical disciplines. They are frequently not alert to policy bias embedded in information that reads (or sounds) like conventional science, addresses what appear to be purely scientific questions, and is presented by individuals who seem to be operating as legitimate and policy-neutral scientists (i.e., honest brokers) (Pielke 2007). For non-scientists, it is even more challenging to recognize when science is being corrupted in policy debates. Non-scientists routinely struggle to distinguish between policy-*neutral* science and policy-*biased* science (Herrick 2021). When non-scientists *do* find instances of policy-bias, they may regard *all* scientists and science as untrustworthy.

In highly contentious areas (i.e., climate change, water resources management, species conservation, ecological restoration, biological resource management, and environmental protection), the credibility of the scientists *themselves* often becomes part of the political argument (Horton, Peterson, Banerjee, and Peterson 2016; Finnerty and Levine 2024). *Dueling scientists* is a recurring feature of natural resource and environmental policy disputes, further undermining trust in scientists (King 2016).

Science should be fundamental to management and policy debates, but it is increasingly misapplied — even by scientists (Cardou and Vellend 2023). Unless scientists themselves are vigilant in maintaining the boundary between science and policy advocacy, they risk diminishing the role science can play in resolving divisive natural resource issues. According to Pew, YouGov, and other polling, many people do not trust scientists to present policy-neutral information (Kennedy and Tyson 2023).

To delineate the boundary between scientific information and other types of information, I define science as information gathered in a rational, systematic, testable, and reproducible manner (i.e., following the initial Baconian formulation or its subsequent variants). A scientist, then, is someone who gathers or interprets such information using understandable and repeatable methods. Not all individuals with scientific credentials are working or acting as scientists in this sense. In fact, my unscientific assessment is that probably most individuals holding science-based academic degrees are *not* working as scientists using the Baconian definition of science.

Those working in water or natural resource *management,* or any other type of "decision-making" job, possess personal values. For *scientists*, many of us often choose these fields because we care deeply about ecosystems and species. Surrounded by like-minded colleagues, it is easy to assume that these shared values of such scientists are universal. For example, I have observed many times that, among my colleagues, the belief that restoring wild salmon runs is fundamentally more important than maximizing hydropower or minimizing flood risk is self-evident, but it is a policy preference, not a scientific fact.

Science should inform the "fact" side of policy debates, not dictate preferred policy outcomes. Values and trade-offs are inevitably at the core of policy decisions. Although science provides vital input, it is but one of many inputs (Kloor 2015). In rigorous graduate academic programs, scientists are usually taught to separate their scientific findings from their personal (or employer's) policy preferences; however, I have observed, increasingly, that this distinction is either ignored or unrecognized.

Science is not value-free as a way of knowing, but it should be policy-neutral (Lackey 2001). However, as I read some of the current *scientific* literature in natural resource and environmental disciplines, a frequent policy bias is a veiled preference for "naturalness" (i.e., an ecological condition akin to "pristine") (Figure 1). In the scientific enterprise (and in policy advocacy communication), the naturalness bias manifests in subtle terminology or framing and is often difficult to detect (Duda 2022). Here are three examples that illustrate my concern.

2. Ecological Integrity

Much of the conflict in natural resource management concerns what constitutes a *desirable* state or *preferred* condition of the ecological resource of concern (i.e., a lake, river, watershed, ocean, forest, alpine environment, species complex, etc.). One popular descriptor in the scientific literature of a desirable state is one with ecological *integrity*, but what does this presumed management goal imply policy-wise? Does it have embedded policy assumptions?

There are many formulations of ecological integrity in natural resources policy and science (Angermeier et al 2026). Typically, these concepts are described in terms of native species and undisturbed (i.e., unaltered by humans), but in some formulations, ecosystem alterations caused by pre-1492 human populations (in North America) are considered natural. For example, even though many North American landscapes were highly altered ecologically before 1492, that year is often implicitly considered a natural baseline for assessing ecological integrity.

The language associated with ecological integrity may appear objective, masking the ingrained policy bias. In policy debates, however, the word integrity carries advocacy heft because it suggests goodness or desirability. After all, if a particular ecosystem lacks integrity or has low integrity, it must be in an undesirable condition, right?

Despite the precise definitions often used in scientific reports, in policy discussions, integrity is a subjective word (Figure 2). To most people, it implies that human-altered ecosystems are innately degraded and thus less desirable than their unaltered or pristine counterparts. This framing risks conflating a purportedly scientific description with subtle or stealth policy advocacy. In contrast to management or policy activities, science should inform, fairly and impartially, what is possible scientifically and what the likely consequences are, not tip the scales stealthily toward which option is preferable.

Nothing in science will reveal the *desired condition* of an ecosystem unless a decision maker (perhaps an elected or appointed official) or a law delineates the characteristics of the desired condition. As enticing as it may be for scientists to promote their (or their employer's) favored policy choice, they should remain fair and impartial. In short, they should operate as honest brokers of scientific information.

3. Ecosystem Management

A century ago, goals in natural resource management were typically measured in pounds or numbers of fish caught, numbers of deer harvested, or board feet of timber provided on a sustainable basis (i.e., maximum sustainable yield, MSY). By the mid-20th century, population dynamics models were almost all driven by MSY. Later management goal variants included notions of economic maximization, sustainability, and optimality (Larkin 1977). In the 1990s, the notion of ecosystem management emerged as a prominent and official approach in the government-owned forests of the U.S. Pacific Northwest and elsewhere. In the early 2000s, some fisheries agencies adopted the general approach, particularly those agencies tasked with managing marine fisheries (Link 2026). Now there are permutations of ecosystem management used in many areas of water and natural resource management.

The associated scientific literature regarding ecosystem management frequently includes terms like *degradation*, *health*, and *impoverishment* (Lackey 2001). These three words (and others) imply that human disturbance leads to particular policy outcomes, but precisely what do the words mean? Such language blurs the line between empirical (scientific) observation and value (policy) judgment and creates *normative* science (Lackey 2007).

For example, within most formulations of ecosystem management, the emphasis on native species over non-native reflects an implicit policy preference. Nonnative species are often excluded from biodiversity or ecosystem health metrics. Sometimes, intentional species introductions are treated differently from accidental ones. These distinctions are not scientifically determined, but reflect personal or organizational choices disguised as science-derived decisions (Lackey 2007). There is nothing in science that arbitrarily categorizes a species as desirable (or not) unless a value-based judgment is invoked, and such value-based judgments come from policy-based decisions, informed by scientific information and many other inputs. Scientists sometimes fail to appreciate the legitimacy of other policy inputs.

4. Ecological Restoration

Ecological restoration presents another challenge to avoiding policy bias in scientific information (Baker and Eckerberg 2016). Should society aim to recreate conditions from the early Holocene, pre-1492, or last year, or someone's idealized state of the ecosystem in question? (Figure 3) The answer depends on societal values, not scientific facts (Lancaster 2000). Scientists can assess the feasibility and consequences of different restoration targets (frequently called the "if-then" approach to providing policy-neutral information), but selecting from among them is a political or values-based decision. Preferences for certain species or ecosystem states are societal judgments. Scientists may be able to clarify the policy options and their likely consequences, but should not presume they possess a decision-making mandate (Wilhere 2024).

Ecological restoration is fraught with a confusing blend of science and policy choices. For scientists, it is easy to stray from science, and stray they often do. One reason why the public is increasingly skeptical of the impartiality of scientists is that some scientists fail to maintain a clear boundary between objective scientific analysis and personal or organizational advocacy.

When the policy debate is about ecological restoration or a similar endeavor, scientists are often perceived as members of an advocacy group, albeit one whose advocacy is masked behind a veneer of science. Their work may resemble sound science and be presented by credentialed experts, but if it embeds policy preferences, it ceases to be policy-neutral science.

5. A Path Forward

For sound water, natural resource, and environmental policy and management, substantial, credible, and trusted scientific input is needed. Misusing science by embedding personal or employer policy preferences has sometimes undermined its credibility (Alabrese et al 2024). When conducted impartially and transparently, science can be useful to society, water and natural resource managers, and policy makers. Impartial and rigorous "scientific assessment" using a broad cross-section of the peer-reviewed scientific literature will help minimize policy bias.

Educators, mentors, and supervisors have a vital obligation to sustain the important role that aspiring and current scientists have in providing relevant, credible, and policy-neutral information in water resources, fisheries, wildlife, forestry, conservation, and environmental management. Personal (or employer) bias for particular policy choices (embedded in purportedly policy-neutral scientific information) compromises scientific integrity. Maintaining trust in the impartiality of science is the cornerstone of the scientific enterprise.

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Disclaimer:

The opinions and views expressed in this paper are those of the author and do not necessarily reflect those of his current or past employers or any other organization.

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Figure 1. Is this a desirable fishing experience? There is no a priori scientific reason for assuming that this environment provides a particular quality of fishing. People decide using their values and personal priorities. For scientists, stealthily embedding the policy assumption that natural or pristine ecosystems (and their associated fishing opportunities) are inherently superior (policy-wise) to altered conditions assumes a policy preference and thus creates policy bias in scientific analysis and reporting. (Photo courtesy U.S. Fish and Wildlife Service)

Figure 2. Should this "natural" ecosystem be considered the "pristine" benchmark for the southeastern United States? Determining the prevailing ecological conditions at any prior time is difficult, but it is especially so for the pre-Columbian era (pre-1492) of the ~20,000-year human occupation of the Americas (Denevan 2010). First, climatic conditions shifted over century-to-millennial time frames, and this factor would greatly affect ecological conditions. Second, in pre-Columbian times, the human population was substantial, and its overall ecological impact would be significant. For example, the southeastern United States is often assumed to have been covered with a dense forest pre-1492. However, because of deliberate burning to boost agricultural productivity and enhance the abundance of grazing mammals, the Southeast was a diverse mosaic of forests and grasslands of various types. Overall, such intensive land management was necessary to support the substantial human population. So, which state is natural or pristine? (Photo courtesy U.S. Natural Resources and Conservation Service)

Figure 3. This remote mountain lake his minimally affected by human activities, but is it a healthy, degraded, or impoverished ecosystem? It depends on which of many possible policy goals is assumed. The language used in science often blurs the line between empirical, scientific, and policy-neutral information and value (policy) judgment. Even in the peer-reviewed scientific literature, a policy bias toward pristine ecosystems is often implicit. For example, words like degradation, health, and impoverishment often appear. These three words imply that human alternation creates a specific (i.e., worse) policy outcome. (Photo courtesy U.S. National Park Service)