

# Is Science Biased Toward Natural?

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## Abstract

*A bias toward “natural” or “pristine” ecosystems (i.e., those ecosystems unaltered by humans) is a common misuse of science in environmental policy and politics. Such a bias in science is often subtle and frequently goes undetected, but its presence reduces confidence in the impartiality of science and scientists. Public confidence that scientific information is technically accurate, policy relevant, and politically unbiased is central to informed resolution of environmental policy and regulatory issues that are often contentious, divisive, and litigious. Scientists should watch for the often subtle creep of normative science (i.e., information that appears to be policy neutral, but contains an embedded preference for a particular policy or class of policies). Failing to do so risks marginalizing the essential role that science and scientists ought to play in informing decisions on important public policy questions.*

**Audio Recording:** [https://media.oregonstate.edu/media/t/0\\_1fkr1udp](https://media.oregonstate.edu/media/t/0_1fkr1udp)

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## Introduction

Thanks so much. I really appreciate the opportunity to attend another SETAC annual meeting and especially the chance to reconnect with colleagues. I've had a good time.

But mostly, I want to thank the organizing committee for thinking of me as they considered possible keynote speakers. From personal experience, I know that assembling an appealing set of speakers is tricky business and it needs to be done with meticulous sensitivity.

First, full disclosure, let me start by sharing some inside information about how my participation actually came to be. How a hard-core scientist like me ended up standing here in front of you, mostly other hard-core scientists. Here's the telephone pitch from a representative of this year's program committee:

*"We've pretty much already lined up a trio of really good keynote speakers; ones who will be both entertaining and informative, but we are looking for a fourth speaker to round out the lineup, ideally a scientist to talk about the use and misuse of science in environmental policy. Your name came up as person who worked as a scientist and also held senior management jobs in a regulatory agency. Now we're not expecting you to be entertaining, but maybe you could be controversial, or perhaps say something that we don't hear every day, possibly even challenge a sacred cow or two, but nothing over the top!"*

OK, I get it. No expectation of being entertaining. Good, check that one. Not much potential for saying something new. Fair enough, probably unrealistic to expect from a scientist. But controversial, challenge some sacred cows, but nothing over the top; perhaps that charge is worth exploring, something that an entertainment-challenged scientist might be able to pull off!

Say no more; sign me up!

My topic? I want to publicly answer a question that has bugged me for more than two decades. It was asked by a high school student at the end of a routine "science day" tour, one of many show-and-tell tours of EPA's National Research Laboratory in Corvallis. Now these tours are not memorable events in the life of a Deputy Director. With a staff of several hundred independent-minded scientists, there are many things competing for your attention, but this tour turned out to be very different.

After the tour, as we were waiting for their bus to return, one student pulled me aside and asked a question in a quiet, intense, and worried voice:

*“Nearly everyone in my family makes a living off the land, mostly as farmers and loggers. Nowadays, every one of them thinks that scientists are biased against their activities and even biased against most anything that humans might do to change the natural environment. Are they correct? Are your scientists [by that she meant EPA scientists] biased?”*

Clearly she was not your typical 16 year old. Regardless, my answer was instant and unequivocal:

*“Science by definition is policy neutral. Thus, the science we produce neither favors, nor opposes, natural conditions. Your family is incorrect.”*

Great answer. Confident, clear, comforting. Indeed, I immediately liked my quick response. And, even better, she seemed relieved. But more than two decades later, her question still gnaws at me. It was like having a bad case of Poison Ivy. Scratch it and it feels better, for 30 seconds or so, and then itches worse than ever. My simple textbook answer never made the itch go away. Worse, the more I thought about her question, the less I liked my answer. She was on to something. The scientific enterprise has changed.

Here’s how.

These days, for what is popularly called “science”, there is increasing tolerance, even encouragement of *scientists* who intentionally, or unintentionally, push science beyond its proper and appropriate boundaries. Such behavior has consequences for all of us.

One unfortunate consequence, the low esteem with which much of the public now hold scientists. The result? The all-too-common view is that everyone: no matter how poorly informed, no matter how dubious the source of the quoted information, everyone has the right to his or her own scientific facts. Junk science is everywhere!

Even worse, some of us, yes, professional scientists, scientists like us who believe we are objective and unbiased, have contributed to this erosion of trust. Whether it is the policy debate over banning GMOs, whether to add fluoride to drinking water, what, if anything, to do about greenhouse gas emissions, pick your favorite example, the distrust of scientists and by extension, science, is rampant.

This situation is especially unfortunate because many public policy issues cry out for high quality science that is policy relevant and policy neutral — and beyond reproach. But, search the internet and you will find web sites that offer a self-defined scientific rationale for any conceivable political or policy position you can possibly imagine. Truly, the so-called democratization of science has fully arrived. Everyone’s scientific opinion seems to be equal!

In the areas of the scientific enterprise where I spend my time, usually environmental, natural resource, and ecological policy disputes, many of the policy players take it as a given that scientists have often been corrupted. Corrupted, not by sleazy financial shenanigans, but rather by something less obvious and perhaps more insidious.

Let me be specific. When I travel outside the confines of my cloistered scientific world, I run into many people who are highly skeptical of what scientists say or write. And the skepticism comes from both the political right — and left. Oh, they still value scientific information, but increasingly they have lost faith in the policy neutrality of scientists themselves.

Now, there are many causes for this unfortunate state of affairs and the professional literature is full of speculation as to why it has developed. Today, I want to focus on one really important cause: the pervasive misuse of science as a weapon in policy advocacy. Specifically, I am referring to the increasing prevalence, and acceptance, of normative science. In the scientific world it has become one of the great afflictions of our time.

Just to refresh your memory, normative science is a type of science that is *developed, presented, or interpreted based on an assumed, usually unstated, preference for a particular policy or class of policy choices*. I'll give examples in a minute.

Of course, there are many reasons why people have lost faith in the policy neutrality of the scientific enterprise, but normative science is a big one, and it is one that we scientists can do something about.

Now none of us would slip into normative science, right? I admit that I have. Worse, I didn't even realize it. Not concerned? You should be, even if you are vigilant in avoiding normative science in your own work. Its rampant prevalence threatens to marginalize the essential and legitimate role that science should play in public policy.

Still skeptical? For many years I have taught a graduate class in ecological policy at Oregon State University. Most of my students have one or more science degrees. In class, I do my best to encourage students to watch out for normative science. And I talk a lot about how they, as scientists-in-training, ought to follow good practices and remain policy relevant, but policy neutral, in their scientific endeavors. If they want to become policy advocates, fine, but keep their advocacy out of their science.

A couple of definitions to remember:

First, what we loosely call “regular” or “traditional” science is simply information, but *information gathered in a rational, systematic, testable, and reproducible manner*. Science contains no good or bad policy judgment, no implied policy preference, and it is only one type of information in environmental policy debates.

The key point: “regular” science *becomes* “normative” science when a policy preference gets embedded in the research design or interpretation of the data, and often this transgression passes unnoticed.

The second definition, I am using the term “scientist” to describe *a person who generates or interprets information by applying the scientific method, the same method you learned way back in your first high school science course.*

Yes, I know that loads of people have science degrees and are all commonly called “scientists”, but many science degree holders are employed as environmental risk decision-makers, natural resource managers, pollution regulators, or environmental advocates, roles where using scientific information may be hugely important, but it is only one of many factors. Therefore, they are not working solely as scientists according to my definition.

Back to my graduate class full of young, aspiring scientists. After discussing this topic in class and mostly being met with skepticism, one student finally raised his hand, but his body language had an aura of futility. He was one of the more reflective students and, once I saw his hand go up, I instinctively knew that he would be supportive of my idealized vision of the proper role of science. And, even better, he was someone who hadn’t yet been immersed in the “less pure” aspects of the scientific enterprise and, perhaps, become jaded.

Yes, as only an idealistic and passionate young scientist might say:

*“Dr. Lackey, things have changed since you were a graduate student. You are living in a dream world. Most of the public just assumes we are policy advocates. These days, the only people who really trust scientists to be policy neutral are scientists themselves. You need to get real!”*

Wow. Is this the breed of scientist our universities are now producing? Scientists who see themselves as members of a policy advocacy group? Is this what scientists have become?

I would normally dismiss such a judgment, especially one coming from a naive graduate student, but I well remember a scolding that I received from a very experienced career Government lawyer. And, it is not a pleasant recollection, even after many years. We were relaxing in a pub after spending a long, long day listening to dueling scientists testifying in an Endangered Species Act hearing. I was trying to convince him, a lawyer, from my perspective, as a scientist, that it seemed reasonable to presume that the opposing sides should be able to agree on the basic science relevant to this particular case or simply reach consensus on the so-called “scientific facts”.

After all, the legal debate should be over interpretations of law, not science, right? My argument seemed pretty self-evident to me, perhaps even a platitude. In retrospect, perhaps I was badgering him a bit too much, but his response still stuns me all these years later:

*“Bob, you guys [by that he meant you scientists] have no credibility. All of you spin your science to lend support to whatever policy outcome you or your employer favors. I’m not sure science was ever a beacon of truth, but it sure isn’t now, at least not in the legal arena. I watch scientists routinely misuse science in case after case.”*

I didn’t buy it at the time, but my thinking has changed. Pick any of today’s policy issues, climate change, fluoridation of drinking water, GMOs, endangered species, childhood vaccinations, oil and gas pipelines, fracking, much of the public no longer trusts scientists to present “just the facts.” A deplorable state of affairs for sure!

OK, what can scientists themselves do to help clean up this mess? Let me offer two common-sense policy tenets that every newly minted scientist, and every practicing scientist, should uphold. Only two tenets, but whether you work for a government agency, a consulting firm, a policy advocacy organization, a business enterprise, or a university, these two tenets should be posted prominently on your office wall.

## **Tenet 1**

The first tenet to post is a simple one, one that should be printed in a bright and bold font:

*“Science is rarely the key to resolving policy disputes.”*

Important in policy disputes, for sure, but rarely is science the key. Every year, I am taken aback by the reaction of my graduate students when they first hear this tenet. Most go into visceral shock. Their response is reminiscent of my feelings when I first learned the truth about Santa Claus.

OK, their reaction shouldn’t surprise me because they are just learning about the reality of the world beyond what they heard in Political Science 101. But I am surprised when I hear experienced colleagues tacitly ignore this tenet. For example, how often have you heard this lament from a scientist?

*“If we just had better science, or at least more science, more data, the best policy choice would be obvious and we could move on. It is a lack of science that is the main obstacle to deciding what to do.”*

This lament is often followed by a proposed course of action:

*“Provide us with more funding and we’ll provide you with the necessary scientific information to make for an easy decision!”*

And if that doesn't clinch the deal, there is always:

*"More and better science will lead to good public policy. Our proposal will do just that."*

I know. I've followed this script many times in the never-ending search for research funding. My guess is that you are now saying to yourself: *"Been there, done that"*.

Here's another confession: when I was working as a research scientist at the Environmental Protection Agency, part of my job was to convince the EPA regulatory people that their main problem, their core decision-making problem, was really a lack of scientific information.

To prosper these days, a government research scientist must play this game and play it well. More money means you can hire additional staff, buy the latest technology, publish more papers, and ascend the scientific pecking order. But the fact is that science is rarely the key to resolving policy debates, at least not policy debates that people care much about. And, however necessary, however essential, science should not be the key, at least not in a democracy.

## Tenet 2

A second tenet to post on your office wall . . . and tape to the front of your smart phone:

*"The values, that is, the policy preferences, of scientists are no more important than those of anyone else."*

Let me slightly rephrase this tenet:

*"The values, that is, the policy preferences, of scientists are not, in any way, special."*

They are not. When scientists step outside the bounds of science, in reality our only area of special expertise, we should remember the blunt admonition of Nobel Prize winner Richard Feynman who cautioned us:

*"I believe that a scientist looking at nonscientific problems is just as dumb as the next guy."*

And policy making is certainly a nonscientific problem. Looking for a great example? Think about the unrelenting policy debate over what should be done, or can be done, about an apparently warming climate.

Nearly everyone is aware that climate changes over centuries and millennia. Changing climate is the norm, not an aberration. Most people know this. For example, there is little question that today's temperatures are higher than they were 150 years ago. After all, the planet 150 years ago was emerging from the Little Ice Age, a relatively cool period from around 1400 to 1800. And before the Little Ice Age was the Medieval Warm Period from around 900 to 1300. Old news for sure.

But the policy relevant scientific debate is over how much of the current warming is due to human actions. This is where the political dynamics of the scientific debate get interesting. But *which* of the many scientists who offer opinions on climate change will the public trust? Those employed by the Sierra Club? The Canadian Petroleum Institute? Greenpeace? The Farm Bureau Federation? The U.S. Wind Energy Association? A United Nations Commission?

Not likely.

But presumably the public can safely trust scientists employed by U.S and Canadian government agencies and ministries, right? Well, let's consider this question.

I was a government scientist for a long time, but before you so quickly place us among the angels, imagine that you are the ordinary Joe or Jane Citizen. Now, how should Joe or Jane decide which scientist to believe about the degree to which humans have caused the recent global warming? My political science colleagues love to deconstruct these kinds of superficially simple questions! I'll try.

Scientists, like everyone else, have political leanings. Let's not be naïve here. We also know that as a demographic group, scientists these days tend to reside on one end of the political spectrum. For example, a recent national opinion survey of U.S. scientists revealed that they were 9 times more likely to be aligned with one political party than with the other major political party. A 9 to 1 ratio favoring one political party!

A little audience participation here: your challenge is to guess whether the 9 to 1 ratio favored Democrats or Republicans. I'll make a wild guess and presume that you came up with the correct answer. What a shock! Unless someone still believes in the tooth fairy, it is not surprising that a reasonable person might well be suspicious of such a skewed political inclination and how it might affect Joe or Jane's trust in science, even for government science.

Furthermore, tell me, what would Joe and Jane think when they hear the following statement from a senior leader in an organization that funds a lot of climate change research?



*“We’ve got to ride the global warming issue. Even if the theory of global warming is wrong, we will be doing the right thing in terms of economic policy and environmental policy.”*

Nothing unusual. From the President of the Sierra Club, right? Or perhaps the CEO of Greenpeace? Reasonable guesses, but not correct. It is a quote from a former senior official in the U.S. Government.

Or, what about this statement from a former Canadian Minister of the Environment?

*“No matter if the science is all phony, there are collateral environmental benefits . . . Climate change provides the greatest chance to bring about justice and equality in the world.”*

What conclusion would Joe or Jane draw about the policy neutrality of science funded by government when they hear these kinds of statements from senior political leaders?

## **Corollary 1**

OK, those are the two tenets that should be prominently taped to every scientist’s computer monitor. Remember, however, that question from the high school student? It still remains dangling out there annoying me:

*“Is Science Biased Toward Natural?”*

A simple question, but I’m working in academia these days so a straightforward yes or no will not suffice. To start, I’ll offer a corollary to the two tenets:

*“Scientifically, pristine ecosystems are neither superior, nor inferior, to human altered ones.”*

By “pristine” I mean those ecosystems unaffected, or minimally affected by humans. Many graduate students choke when they first hear this corollary. Are not pristine ecosystems self-evidently in better shape than human altered ones? Is not an old growth forest obviously superior to a tree farm? Better than a corn field? And surely, vastly better than the same land covered by another Costco parking lot? But who says that natural ecosystems are superior to human altered ones? Certainly not scientists, right?

All those years ago, the high school student was correct. My new answer:

*“Science is often biased toward natural.”*

Just one example, in science why is it that native species are almost always considered preferable to nonnative species? Nothing in science says one species is innately better than another, that one species is inherently preferred, or that one species should be protected and another species should be eradicated.

To illustrate, why do most people lament the apparent sorry state of honeybees in North America, a nonnative species from Europe that has become much more abundant than North American native bee species? Yes, what we call honeybees are in reality nonnative, what many people would label as an invasive species, but people value their agricultural role.

Conversely, zebra mussels, another common, and nonnative species, are nearly universally regarded as a scourge. Where are the advocates for this species? Even with increased water clarity in lakes where they are abundant, there are never cheerleaders for zebra mussels.

Or, what about North American feral horses, wild horses, mustangs, another nonnative species, but one that enjoys an exalted status by many. Pity the unfortunate BLM employee tasked with culling the ever-expanding population of this invasive, nonnative species. One vocal group regards wild horses as pests that are overgrazing the open range and they should be eradicated. But, another group, equally vocal and committed, regards mustangs as sacred icons of the Wild West that ought to be protected even at great cost.

Values drive these policy preferences, not science.

## Conclusion

OK, those are my two tenets and one corollary.

Let me wrap up by recalling Charles Darwin's advice to scientists. Remember that he was under a lot of pressure to make his science conform to the dominant policy views of the time. His pithy guidance to scientists:

*"A scientific man ought to have no wishes, no affections, a mere heart of stone."*

Strict, uncompromising, and unequivocal advice, but spot-on for scientists both then and now.

Or, consider more recent advice often attributed to the late New York Senator Daniel Moynihan:

*"Everyone is entitled to his own opinion, but he is not entitled to his own facts."*

And facts, including probabilities, uncertainties, and unknowns are what the public and decision-makers need from scientists. They do not need scientists pushing their personal opinions about which policy option should be chosen, nor stealthily advocating in favor of their employer's policy preferences by slipping into normative science.

My message to those of you who see yourself as a practicing scientist: follow both tenets. Be fully engaged, but stick to science, tell the truth, tell the whole truth. It may be uncomfortable, it may be unpleasant, and it may be unappreciated, but scientists should be unimpeachable providers of facts and probabilities, nothing more, and certainly nothing less.

Finally, as an individual scientist, if you want to advocate your personal, or your employer's policy preferences, so be it, just don't call it science.

Thank you.

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### About the Speaker:

*Dr. Bob Lackey is professor of fisheries science at Oregon State University. In 2008 he retired after 27 years with the Environmental Protection Agency's national research laboratory in Corvallis where he served as Deputy Director, among other senior science and management jobs. Since his very first fisheries job mucking out raceways in a California trout hatchery, he has worked on an assortment of natural resource issues from various positions in government, academia, and the private sector. His professional assignments involved diverse aspects of natural resource management, but mostly he has operated at the interface between science and policy. He has published over 100 articles in scientific journals. Dr. Lackey has long been an educator, having taught at five North American universities and currently teaches a graduate course in ecological policy. Canadian by birth, he is now a U.S.-Canadian dual-citizen living in Corvallis, Oregon.*

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