

Moral approach to climate change

The letters from VH Smith and M Marsh (Write Back, *Front Ecol Environ* 2005; 3(6): 302–03) indicate that I failed to communicate clearly in my letter “The dangers of scientific consensus.” I apologize. Let me try again.

First, Smith and Marsh allege I deny the dangers of anthropogenically induced climate change and am thus complicit in advancing “anti-environmental propaganda”. One benefit of writing a regular column is that my position is clear, consistent, and in the public record. All are accessible on the Foundation for Research on Economics and the Environment (FREE) web site (www.free-eco.org/publications.php).

For example, I’ve written, “Shorter, warmer winters and drier summers are here. Warmer spring temperatures cause our rivers to peak about two weeks earlier than in the past... These changes are consistent with global climate models predicting the greatest warming over the higher latitudes during winter. This warming is likely due to human activity.” (www.free-eco.org/articleDisplay.php?id=397).

Whether climate change is real, human-caused, and potentially dangerous is not the issue I was raising. Rather, the important policy question is: In a world of limited resources, how do we deal responsibly with climate change?

There are many problems in the developing world requiring immediate action. For example, 2 million people die each year from malaria, 90% of whom are children under the age of five. (Climate change, by the way, is not even on the UN’s priority list for its Millennium Development Goals project; see www.un.org/millenniumgoals/.)

Might we increase the well-being of the world’s poorest more by eradicating malaria, providing access to clean drinking water, reducing infant mortality, increasing female literacy, and increasing access to primary education? The only moral approach is to prioritize among competing values. If this line of reasoning is anti-environmental propaganda, I’m in

good company (eg Nordhaus 2001; Schelling 2002; Mendelsohn 2004).

Comparing the costs and benefits of greenhouse gas mitigation is particularly vexing because investments today will pay off over centuries. The Climate Stewardship Act was defeated in the US Senate. Its failure illustrates the political calculus of climate change. Politicians’ time horizons rarely extend beyond the next election cycle. When benefits accrue to future generations but the costs are borne today, politicians avoid tough decisions.

Consider the reaction of former German Chancellor Gerhard Schröder. He recommended that Europe should not rush to reach its greenhouse emissions targets. Why? He estimated the costs to his constituents included increased gasoline and diesel prices, a shrinking GDP, and a reduction in employment of 1 million jobs annually between 2008 and 2012.

All interesting and important policy questions involve choosing how to allocate scarce resources among competing values. However well intended, it is naïve and irresponsible to ignore the unavoidable trade-offs in dealing with climate change. Those who believe it trumps all other problems ignore this reality. They hold a religious position that is not open to reason.

Second, we have known since Thomas Kuhn’s *The Structure of Scientific Revolutions* that at any one time in any scientific discipline there exists a consensus. Kuhn termed it “the paradigm”. That one should exist in a relatively new discipline such as climatology is unsurprising.

But science can only alert us to potential problems and solutions. The political process determines whether action should be taken and to what extent we choose to adopt the recommended solution.

Finally, Marsh insinuates that FREE’s positions are influenced by our corporate donors. This line of attack is often deployed when critics won’t (or can’t) wrestle with the logic of an argument.

Marsh neglects to mention that our website (www.free-eco.org/funding.php) clearly identifies both our corporate funders and the amount they con-



tribute. In 2004, the bulk of FREE’s income (78%) came from foundations and individuals. Just 22% was from corporations.

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Kuhn TS. 1962. *The structure of scientific revolutions*. Chicago, IL: University of Chicago Press.

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Geddes’ second letter, recycled from another of his newspaper columns (Geddes 2004), is once again characterized by red herrings. While acknowledging that global warming may indeed be occurring, he indicates to his column’s readers that we should do nothing about it, arguing that “the best climate-change policy is to emphasize present economic growth, especially in the developing world.” Cynically, he argues that “...there are no solutions, only trade-offs.”

One of Geddes’ biggest red herrings is his dismissive comment that “Climate change. . . is not even on the UN’s priority list for its Millennium Development Goals project.” By implication, naïve readers of Geddes’ letter will almost certainly conclude that the project report’s authors had few concerns about global climate change and its potential effects on business planning. This conclusion would be in error, but I

believe that Geddes' diversion is deliberate and intentional.

Goal number 7 in the Millennium Development Goals web page (www.un.org/millenniumgoals/) is in fact titled "Ensure environmental sustainability"! Are we therefore to conclude that the authors of the Millennium Development Goals report believed that there is no link between environmental sustainability and climate change? Geddes is once again being disingenuous. The newly published Millennium Ecosystem Assessment Report (www.millenniumassessment.org/en/index.aspx) highlights ways in which businesses are dependent upon services that are provided by Earth's ecosystems; how those ecosystem services are changing over time; and how there could be important ramifications of these changes for business and industry in the future. Clearly, the effects of major global climate change on these ecosystem services could interfere dramatically with even the most strenuous of efforts to meet the UN's Millennium Development Goals.

Unfortunately, I'm afraid Geddes' contempt for science, and for those of us who practice it, is all too clear. I suspect that many readers of *Frontiers* will be offended by Geddes' insinuation that adhering to, and making decisions based upon, the objective principles of science is somehow akin to holding a religious (faith-based) position that is not open to reason. Science by definition is based upon reason! In contrast, politics are based upon opinions (and in some cases by the age-old problem of "who can be bought by whom"). I suggest that readers of *Frontiers* refer to RealClimate (www.realclimate.org), a climate science commentary site offered by working climate scientists for journalists and the interested public, and a welcome counterpoint to the rhetoric of anti-science skeptics. Also of likely interest are the recent publications by Keller (2003) and by Hogan (2005).

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Possible cryptic invasion through "back introduction"?

Intercontinental species exchanges are likely to increase with growing trade and travel. In response, many countries, including China and the United States, are now developing early warning detection systems, such as the generation of "black lists" of invasive species. However, such efforts are often extremely difficult due to accidental introductions and the unknown invasive potential of species involved. A number of recent articles have addressed cryptic invasions (Taylor and Hebert 1993; Gaskin and Schaal 2002; Saltonstall 2002; Cox 2004). Here, I add another form of invasion, highly possible or already occurring, that has been largely neglected; the cryptic "back-introduction". This is the re-introduction of exotic populations (including biocontrol agents or genetic control transgenes; Li *et al.* 2004) from introduced ranges back to native ranges.

It is highly possible that the invasives may be back-introduced to their native range via the same or additional pathways as they were introduced to non-native ranges (eg ships). Unlike other introductions, back-introduced populations are almost certain to succeed because they are in "home" environments. They may also become invasive and harmful in native ranges, especially if they "hybridize" (or backcross) with native populations. For example, if populations of *Spartina alterniflora* were being introduced from China,

an introduced range, back to Florida, the species' native range, they may no longer be genetically the same as native populations (Cox 2004). In such cases, the original limiting factors such as natural enemies or chemicals may no longer function (Guo 2002). In addition, such back-introduction from exotic to native ranges would be difficult to detect because these back-introduced populations would appear very similar to native populations.

Although there are no specific efforts to detect back-introductions, pathways for such invasions are in place, as are factors that result in genetic variation. Hence, back-introduction should be considered as a possible cause where native species become invasive. Given the potential for back-introduction, government agencies and the public should take appropriate actions to prevent such cryptic invasions. For example, the development of the "black lists" should take this factor into account. Otherwise, it may be too late and difficult to detect once a back-introduction has occurred. Extensive DNA sequencing for both native and introduced populations can help identify such "hidden" invasions and even the source populations, invasion history, and pathways. Given the same efforts made by each party, intercontinental cooperation would be much more effective in monitoring the two-way traffic.

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Vernal pools: critical habitat

Vernal pools have become the focus of increasing research and conservation attention during recent decades (Colburn 2004). The June “Websight” (*Front Ecol Environ* 2005; **3**(5): 286) covered basic ecology as it is presented to laypeople in a number of vernal pool-related websites. However, the increase in vernal pool research provides ample information for a more substantial review, which would be timely and very useful given the current relevance of vernal pools to wetland policy in urbanizing areas. US states are now considering, or have implemented, legislation to protect these important ecosystems. Central to vernal pool conservation is the 2001 US Supreme Court ruling (*SWANCC vs US Army Corps of Engineers*) concerning the regulation of “isolated” wetlands.

The ecology of vernal pools is considerably more complex than indicated in the “Websight”, and this complexity is the underlying cause of many of the misconceptions about vernal pools that confuse the policy debate. For example, the concept of obligate vernal pool species is less clear than indicated: “The spotted salamander (*Ambystoma maculatum*) is an obligate species of vernal pool habitats”. It is true that vernal pool-breeding amphibians breed primarily in ephemeral wetland habitats, but spotted salamanders frequently breed in margins of rivers, fishless ponds, and other aquatic habitats that may be considered “waters of the United States” in a policy context. Likewise, not all ephemeral wetlands are equally suitable as breeding habitat for all amphibian species. Differing pool hydroperiods, egg and larval developmental periods, aquatic community dynamics, water quality, and condition of surrounding landscapes

result in a complex conservation problem which the general public needs to be “vernal pool literate” to tackle. And finally, vernal pools help maintain other biodiversity; moose, deer, flycatchers, turtles and snakes frequently forage in vernal pools, and wetland plants, invertebrates, and microbial communities exist in many upland-dominated landscapes because of vernal pools.

From a conservation perspective, it is imperative for the general public to understand that vernal pool-breeding amphibians have complex life cycles, and that road mortality during spring migrations are often the cause of local amphibian declines. While elimination of breeding pools due to poor regulation is an enormous problem, fragmentation of upland habitat is an equal, less monitored problem (Semlitsch 2000). The review does mention the use of road crossing signs, but these will do little to halt the declines in the absence of policy limiting new construction near wetland habitats.

These points illustrate the complexity of vernal pool ecosystems. Given the importance of scientific literacy in the wetland policy debate, a thorough review of the vernal pool literature provided by a communication-oriented journal like *Frontiers* would be a service. I suggest that the community of researchers collaborate on a joint review in *Frontiers*, covering aspects of their ecology, to clarify the policy debate.

If vernal pool conservation is to be effective, the public needs to be more aware of the subtleties of vernal pool ecology, and websites such as these are good outreach tools. Because urbanization is the cause of much loss of vernal pool habitat, it is local citizens and community groups that, collectively, can conserve vernal pool landscapes. The cumulative impact of local conservation actions in urbanizing areas can protect habitat for organisms operating at this scale.

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Environmentally “taken” by the Supreme Court

In “Environmental ‘takings’” (*Laws of Nature, Front Ecol Environ* 2005; **3**(6): 340), Douglass Rohrman explored some of the ramifications of the US Supreme Court’s ruling in *Kelo v New London*. In *Kelo*, the Court ruled that a city could take private property for the public purpose of economic growth. Rohrman wondered if the ruling could be turned into a good precedent and used by local governments to pursue the public purpose of conservation instead. Theoretically, anything is possible, but the real precedent from *Kelo* is not the use of eminent domain for just any public purpose, but the formal acknowledgement at the highest level of the judiciary that economic growth is indeed a public purpose and may be used as rationale for eminent domain.

We now have an American government in which economic growth is the highest priority in the domestic policy arenas of Capitol Hill and the White House, and is sanctioned by the Supreme Court as a public purpose. When we think about who appoints and confirms our federal judges, it should tell us something about the likelihood of the federal courts ruling for conservation instead of economic growth via *Kelo*. *Kelo*’s dangerous precedent is not the weighing of public purpose versus private property rights, but the weighing of more economic growth against less!

For the Ecological Society of America (ESA), *Kelo* should be a wake-up call about the need to educate the public and polity on the fundamental conflict between economic growth and environmental protection, including biodiversity conservation and ecological integrity. Common sense (eg “money talks”)

explains how the legislative and executive branches of government become so pro-growth, but for the Supreme Court to deliberate on what will produce more economic growth, deeming the “winner” most in the public interest, should sound an alarm bell for ecologists with a sense of civic duty. Professional ecological societies such as ESA need to take a position on economic growth, if only for the purpose of providing a foundation from which non-governmental organizations and civil servants may speak the truth to those in power about the threat of economic growth to environmental protection and national security.

How would an ESA position on economic growth have helped in the case of *Kelo*? ESA could have underwritten an amicus brief submitted to the Supreme Court by the likes of the Environmental Defense Fund (EDF) or the Natural Resources Defense Council (NRDC). The brief would have been greatly strengthened by additional positions taken by professional natural resources societies. As it was, only positions by The Wildlife Society (TWS), the United States Society for Ecological Economics, and the North America Section of the Society for Conservation Biology were available. In our opinion, what we need to be effective with an amicus brief are positions by TWS, ESA, the American Fisheries Society, and the Society for Conservation Biology as cornerstones of a foundation that includes several other professional societies and conservation organizations. We suspect the EDF and the NRDC would have similar sentiments.

Although we missed the boat on *Kelo*, it is not too late to obviate a rambunctious application of *Kelo* throughout the federal courts. We will need environmental lawyers such as Mr Rohrman to keep us apprised of court petitions and dockets for cases in which *Kelo* may serve as precedent. By weighing in on the perils of economic growth to the public good, acting as *amicus curiae* to the courts, as well as in other venues, professional societies such as the ESA can help to ensure that the precedent of *Kelo* is tightly

constricted. At the very least, the courts will be forced to acknowledge explicitly the negative environmental effects of economic growth, resulting in court reports and news coverage that will educate citizens far and wide.

But we are getting a bit ahead of ourselves. First, we need an ESA position on economic growth, and the sooner the better.

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The end of reductionism?

I read with keen interest Keay David-Davidson's (2005) New York Times Book Review of Robert B Laughlin's brilliant book *A Different Universe*, which points out that Laughlin, a physicist, claims that “emergent” principles must play a role in understanding how the physical universe operates. The long-dominant “reductionists”, who claim that the physical universe can be explained by breaking things into ever smaller parts (atoms, quarks, leptons, strings) and then putting them back together, are in fact missing something fundamental, mysterious, and quite wonderful. The whole is not a sum of its component parts, according to Laughlin. Instead the whole is *greater* than the sum of its parts.

This is a concept that my colleagues in the ecological community grasped long ago, when we wrestled with understanding how forested ecosystems function. Forty-three years ago, I participated in the founding of the Hubbard Brook Ecosystem Study at a 7600-acre experimental forest in New Hampshire. In our study of nutrient cycling, water flows, and other ecological phenomena at a closely monitored watershed in the White Mountain National Forest, we recognized that understanding the individual parts of an ecosystem wasn't enough; measuring responses of the whole system (emergent properties)

were necessary to make progress.

In our ecological studies we also came to recognize that humankind is a part of nature. We are living, breathing organisms, subject to gravity, chemical bonds, energy flows, and nutrient cycling, and like other organisms, we depend on natural processes to maintain life. Human beings are a part of nature and subject to her rules. And a key rule, as evidenced in the workings of the forested ecosystem at Hubbard Brook, is that nature is much more than simply equal to the sum of its parts. There are mysteries at work here, and we are a part of them.

I find it a comforting concept that we are so inextricably connected to natural phenomena, and I'm heartened that my physicist colleagues (thanks to people like Laughlin) are finally catching on. Is this truly the end of the age of reductionism? I hope so. Our goal should be to understand how nature works and how human enterprise affects the workings of the natural world. Only then can we develop human enterprise designed to work with nature and not against it.

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Davidson K. 2005 “A different universe”: you are more important than a quark. New York Times. June 19: Books Review.

Erratum

Front Ecol Environ 2005; 3(8): 409. Ecological forecasts validated. Robert Twilley is Director of the Wetland Biogeo-chemistry Institute at Louisiana State University, not the University of Louisiana.

Intrigued, encouraged, aggravated, or amused by something in *Frontiers* or the world at large? Contribute to *Write Back* by sending your thoughts and opinions to Frontiers@esa.org