

## **TALK TO INTEGRATE AUDIENCE – GEOSCIENCES**

Many of you are engaged with linking the geosciences to the set of problems that deeply concern all of us: energy and finding a balance with serious gains for renewables; toxification of the environment; climate change and its threats to civilization; our chronic overdependence on fossil fuels; and our abusive and unsustainable over-harvesting of resources ranging from fish to forests. I begin with the premise that education of our students is probably the best way of turning things around.

What do they bring to us and what do we expect of them? They are curious as well as energetic, bright, and hopeful. They look over our academic catalogues, and wonder what courses, if any, are going to help them prepare to solve the world's challenges. They all already know the problem list, and are choosing to take courses and major in something -- often in fields that combine work in many different departmental disciplines. Those who integrate scientific training in their work must recognize a central challenge -- that we aren't doing so well in reaching the public. The scientific consensus on climate change, for example, couldn't be stronger. You know the data: it is already here, with an increase in average global temperature

approaching 1 degree Celsius, and it clearly is a result of human activity in pursuing our economic ends. The future promises even more increase in carbon dioxide and other greenhouse gases even if new emissions were to be stopped right now, because stored CO<sub>2</sub> and its equivalents would still be released from the oceans and other labile sources. But without strong actions to change the production and use of energy —the ‘business as usual’ world —the climate regime will continue to drive the temperature up. This consensus is believed by upwards of 95% of the scientists who have worked seriously on this problem and published their research results in the peer-reviewed literature.

Yet a few well-supported denialists have tipped the polls upside down in their favor, so that more than 60% of the American public are persuaded that somehow the science is not quite clear, and doubt that the results call for action in the policy sector. Now, our students know that’s crazy.

They themselves are already well attuned to the difficulty of the large, interdisciplinary challenges we face – and they believe in data and in hard, peer-reviewed science. Unfortunately the challenges in this area have made it harder for scientists and an evidence-based analysis of the natural world to get serious attention from the rest of us.

Thus we may need to give our students new kinds of help with this reality, getting some serious attention from social scientists and humanists who understand human behavior and some of the historical and cultural changes that have shaped it. Interestingly, this is not the first time this kind of thing has happened. We recently heard a seminar by Naomi Oreskes, Professor of the History of Science at UC San Diego, who has received well-deserved attention for a book she has written with Eric Conway entitled “Merchants of Doubt”. As the title suggests, when scientific discoveries promise trouble for major players in the economy, those who fear government regulation or product liability lawsuits may well dispute the science. That certainly is the case with respect to climate change.

The other piece of the story is that this is nothing new. Naomi has pursued an earlier cause célèbre, the scientific finding now accepted everywhere that smoking cigarettes significantly raises the risk of lung cancer in those who use them. The tobacco industry in the United States rose up in arms, and their strategy was to get a few leading scientists to raise questions about the validity of the scientific rationale. These included one noted physicist at Princeton and another who had been president of the US National Academy

of Sciences. But the stunning surprise in this history was the overlap among the participants. Many of the same scientists who doubted that smoking causes cancer were the same individuals who now are denying the scientific consensus on climate change.

It will be some time, I guess, before we figure out the motivational structures that give rise to this result. For some it may be an iconoclastic leftover from a time at which much innovation was irresponsibly advertised as “scientific” when in fact it was not. It could be, as many believe, that the promise of handsome remuneration for sowing the doubts could reward the sowers. But the reality is difficult to escape: that whenever scientific results indicate a prospect for social action, attacks are likely to come again from the merchants of doubt. I see this as another indication of our need to know about how human behavior is contributing to our problems and to our capacity to resolve them.

In that connection, my colleague Paul Ehrlich and I wrote a Policy Forum piece in *Science* in 2006 proposing that there should be a Millennium Assessment of Human Behavior, which we abbreviated MAHB. It recognized the need to understand not only what is happening to our

environment, but how our own cultural and behavioral tendencies have participated in shaping those events.

Now retitled as the Millennium Alliance for Humanity and Biosphere, this project is attracting groups of faculty and students here and in other universities. I hope this continues, because after all the epoch in which we are all living is the Anthropocene. One of the ways in which our education should change – and of course it is now reformulating itself in all sorts of different ways – is to make it interdisciplinary even beyond science, by incorporating the humanities and social sciences. I think the students who have already signed on for this venture may be among the first cohort to move education in this direction. I hope they will.