

Strategies for Developing the College Course on Global Climate Change

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This paper suggests an outline for a model text and approach to climate change education through the framework of international cooperation. Educators have not been successful in getting students to apply environmental knowledge to their own lives and cross-curriculum environmental connections have been weak. The administration of the United States has not shown strong environmental leadership but this is partly due to a weak civil society that has failed to put pressure on the government. Media bias on climate change must be countered with scientific knowledge. Higher education holds a key role and responsibility in educating Americans on climate change and should be instrumental in getting American society on an environmentally sustainable path.

As the concerns about global climate change mount, we have to ask whether higher education in the United States is up to the task of enhancing literacy on this subject. In the United States, climate change education is but one of the many smaller fronts in a larger more sophisticated battle over culture, foreign policies, and the environment. At the onset of the 2004-2005 academic year, the author taught a geography course at the University of Maryland, Asian Division, listed as *Causes and Implications of Global Change*. The very idea of teaching a climate change course to undergraduates would have seemed unconventional to him twelve years ago, but times have changed and, not coincidentally, so has the climate. In this paper, the author presents an analysis of his teaching experiences in the classroom and offers practical ways to teach the topic holistically. He suggests an outline of a model text and course and approach to climate change education through the framework of international cooperation.

The Kyoto Accord as Viewed through American Foreign Policies

The world has 6.4 billion people and this demographic phenomenon impacts all aspects of our lives, whether it be environment, disease, war, economy, labor, immigration, or the acquisition of natural resources, among others. An uncomfortable fact for Americans is that of these 6.4 billion people, approximately 5% (the people of the United States) is utilizing 30% of the world's natural resources and producing 30% of the world's waste. (Ranking the rich, 2003; 2004). Clearly, with respect to our greenhouse gases and our resource needs, we should be maintaining some sort of humble dialogue with other nations. But the current nationalistic policies of our government

are hardly effective in solving real world environmental problems mainly because these policies prevent honest discussions from taking place (i.e. family planning, fossil fuel consumption in America, CO₂ as a greenhouse gas, dialogue with environmental groups).

In American society today there is another rift that manifests itself within its citizenry who have scientific knowledge of climate change but lack democratic power to push their elected leaders to act either nationally or internationally. Ehrlich (2002) notes that enlightened political leadership can play a key role in changing a non-sustainable cultural mindset. Nonetheless, Uhl, Kulakowski, Gerwing, Brown, & Cochrane (1996) suggest that governments typically will only act if they are pressured by an educated and responsive civil society.

Environmental leadership (or lack thereof) does not necessarily reflect a shortage of understanding or concern about climate change. In a survey conducted by Chicago Council of Foreign Relations (Gonzalez Gonzalez, 2004, p. 45), 71% of the American public supports the United State's participation in the Kyoto agreement, as do 72% of the leaders. Clearly, American opinion suggests some degree of understanding on the need to mediate man-made impacts on global climate change. The societal disconnect mentioned above, is readily seen with blatant inaction by the federal administration in the face of popular opinion. The United States pulled out of the Kyoto Protocol on Climate Change in 2001. Despite this withdrawal, the Russian Federation ratified the Kyoto Treaty in 2005 and with the 55 other nations ratifying, the treaty has gone into effect.

International cooperation, however excruciating, represents the next step in social evolution for the nation-state, and perhaps the next front with which to focus our intellectual and educational resources. It does come as a surprise, however, to non-foreign policy watchers that the United States fails to sign most international treaties not the least being the Kyoto Accord. In this regard, explaining to students our withdrawal from the Kyoto Accord in the context of the overall American treaty "track record" and foreign policies, may, in fact, be a better way of teaching our recent legacy of international environmental non-cooperation. It has been noted by researchers (Institute for Agriculture and Trade Policy, 2004) that the United States is only interested in treaties that extend its control over the world's resources and less in those that promote the rights of people and protect the planet. Consider our failure to sign the Convention on the Rights of the Child (only the United States and Somalia have failed to sign this treaty). Or note our reversal of support for the Anti-Ballistic Missile Treaty, The Biological and Toxin Weapons Convention, the Non-Proliferation of Nuclear Weapons Treaty and the International Criminal Court. Therefore, in light of the large number

of treaties the United States has not signed related to human rights or the environment, not endorsing the Kyoto Protocol is completely within the character for the United States government. In fact, of the 549 treaties reviewed by the 2004 report (Institute for Agriculture and Trade Policy, 2004) the United States signed only 29%.

The U.N. Law of the Sea and the Convention on Biodiversity are two more treaties that we have not ratified because of the restrictions they would place on the United States on the acquisition of and responsibility for natural resources. Maintaining national sovereignty has always been the key position in Congress. Ironically, the United States has been aggressive in signing numerous international trade agreements that have clearly violated its own national sovereignty. In the context of America's environmental and sustainability treaty record, and our voracious appetite for commerce and consumer goods, we appear to be setting ourselves up as a classic natural resources raiding society of the future.

Our history for funding sustainable development worldwide (such as clean energy and carbon sequestration) is likewise subject to scrutiny. Currently our official development assistance stands around .2% of GNP and we are nowhere close to reaching the .7% of GNP for official development assistance as signatories to the United Nations millennium development goals (Sachs 2005). The 2002 Environmental Sustainability Index ranked the United States 45th out of 142 nations based on 20 indicators that measure progress towards environmental sustainability (World Economic Forum, 2002). In another study, the annual Center for Global Development and Foreign Policy magazine (CGD/FP) Commitment to Development Index (CDI) ranked the United States last in the environmental category, when compared with the 21 other nations of the Organisation for Economic Co-operation and Development (OECD). In the environmental category the CGD score is based on a consideration of each nation's depletion of the shared commons (greenhouse gases emissions per capita, consumption of ozone depleting substances per capita, fishing subsidies per dollar of GDP). Also considered in the environmental score were ratification of major treaties and protocols, contributions to environmental funds, and government support for clean energy technologies.

Americans can mitigate such bad government policies by being a more approachable and educated people; by acting locally, reducing consumption, and pushing state governments for climate change action. As VanDeveer (2003) has warned: "If citizens do not demand strong environmental policy from their governments, no number of treaties and summits will 'save the earth'" (p. 59).

The divergent views on climate change are no better expressed than those between the European and American governments. Europeans maintain a pro-active stance and seek to invoke preventative strategies such as the Kyoto Protocol regulation of greenhouse gases. The U.S. government is still debating the causes of climate change (anthropocentric or natural) and is more inclined to take action later, or through free market initiatives.

The Need for yet Another Interdisciplinary Course?

Increasingly, colleges are realizing that many of their graduates are ecologically deficient when it comes to having a holistic understanding of the environmental crisis affecting the world today (Orr, 1991; Uhl et al., 1996). While environmental studies may be among the fastest growing majors in American colleges, the majority of other non-environmental science majors receive, at best, a piecemeal understanding of the environmental concerns at hand (Strauss, 1995). The frustration expressed by some educators in the environmental science education literature is that there appears to be few students who take their environmental knowledge and apply it to their own lives (Orr, 1991; Uhl et al., 1996). Orr implies that all disciplines, whether they are economics, history, or psychology, should include environmental education. It is only when students are able to make connections across their coursework, by grasping the larger picture that they will be cognizant of the problems and how to develop solutions for these problems holistically.

It does not make sense to recommend another required course for college environmental literacy when present courses might well do the job. There may be a need, however, for a general climate change course that, done right, can prepare college graduates for the shifting ecological and socially dynamic world they will inherit. Such a general course would, of course, be interdisciplinary and include: geography (earth sciences), environmental science, political science (treaties, United Nations and foreign policy), economics (sustainable economies), sociology, agronomy (cropping system change and research), and biology (ecosystem change and disease). A general environmental science course fills the same niche but with one big exception; absent is the large amount of earth science, mostly climatology, which is the core of a climate change course. It is clear that students need a course on global climate change to be able to interpret scientific data but can such a general course really do service to the complexities of climate change? A global circulation model, after all, encompasses trillions of bits of data. Geography, due to its expansive focus, seems to be the most logical choice for housing a general global climate change course, although it could be taught in an environmental science department.

Defining the Boundaries of the Course

Given the politically enhanced atmosphere in the United States over the Kyoto Accord, the author had doubts as to whether the students were going to focus on the scientific data. Because of this doubt, he left the political, economics and sustainability lectures and discussions to the later part of the course. What he eventually found out was that many students were not even aware of the Kyoto Accord in the first place! Therefore, in a global climate change course, professors should be specific in their goals and objectives. As an example, one specific objective in his syllabus was for students to understand the processes and variables that create our climate (see Table 1). This one objective in itself would constitute several lectures but the course was interdisciplinary and limited in time. The author asked himself what material should be included in the course, particularly in light of the fact that most of the students were non-science majors. There were no requirements for the course, but after teaching this course for the first time, the author feels a general introduction to geography course should be a necessary pre-requisite.

Table 1
Select Examples of Lesson Goals and Objectives

Book Chapters and Goals	Objective	Attribute
Climate	Introduce the facts about climate change.	Temperature, ocean rise, greenhouse gas statistics
	Grasp the systems and variables that influence climate	Feedback systems Ocean currents Orbits Thermohaline circulation
Modeling Climate	Understand the basic components of a global circulation model	Clouds Land surfaces Other greenhouse gases
Measuring Climate	Comprehend the different types of measurements	Instruments Satellites Historical records Proxy data
Physical Geography	Understand tectonic	Plate boundaries

	forces	Volcano formation Isostasy
Climate Change	Understand some principal causes of climate change	Atmosphere-ocean interactions Human activities Orbital variations ENSO
Impacts of Climate Change	Discuss the consequences of climate change	Sea level rise statistics Temperature statistics Flora and fauna Agriculture Disease CO ₂ in ppm
Environmental History	Describe the various social, historical, and lawful aspects of environmental issues in the United States since the Industrial Revolution	Western societal values Frontier mentality Common law torts Consumption
Sustainability	Comprehend sustainable growth and how it is attained	Green technologies Alternative economic indexes
Environmental Economics	Understand the importance of true environmental costs	Externalities Sustainable growth
Agronomy/Biology	Understand the biological impacts of global warming	Crop research Ecosystem damage Spread of disease
Beyond Nationalism: International Cooperation	America's treaty record. Kyoto Accord.	Carbon emission cuts Kyoto Accord Earth Summit agreements Sustainable solutions

From the beginning, most students did not have a firm understanding of weather and climatic processes. Students were also lacking in basic earth science knowledge including tectonic forces. After a week of instruction, it was apparent that without teaching some basic climatology and geology, students were not going to understand the more advanced concepts. Humbled, the author began teaching the basics of climatology followed by a review of basic earth science. This longer approach proved to be satisfactory and allowed for a more natural progression to the advanced concepts of global circulation models, radiation laws, atmospheric-ocean interactions, orbital variations, sunspots, proxy data, and others. Finally, climate change both politically and within the context of sustainability principles was presented at a later part of the course.

The main goal for the course was to have students learn the hard science first, and later on they learn about social and national policies that caused and could better address climate change. Climate change solutions must include environmental, social and economical sustainability. Environmental sustainability is defined here as holding the waste emissions within the assimilative capacity of the environment without impairing it. It also means keeping harvest rates of renewables equal to regeneration rates. Environmental sustainability is not achieved among humans without social and economic sustainability however. Social sustainability requires systematic community participation and a strong civil society (Goodland & Daly, 1996) while economic sustainability is defined as the maintenance of capital.

A good interdisciplinary climate change textbook is important. The author eventually settled on Burroughs' *Climate Change: A Multidisciplinary Approach*, which was adequate only in conjunction with other supplemental readings. The ideal textbook for this class would include those chapters, goals, and objectives presented in Table 1. In particular, an enterprising textbook author should adequately describe and graphically portray some rather difficult astronomy concepts for students. Furthermore, there is a need to condense the huge amount of climatic data into a manageable form for students.

Countering Media Bias with Majority Scientific Opinion

Scientific evidence supporting climate change in the classroom may not sway many students who have grown up on a diet of conservative news media networks. In fact, media reporting should be of no concern to scientists and science teachers who have taught the scientific method well and base their careers on empirical testing. Teachers must be partly aware of the student

bias they are facing so that they can counter such dogma with facts based on the majority of scientific opinion. To many students who get their science through media, the element of balanced reporting on climate change seems plausible and, in fact, necessary, as it is a part of the American psyche of balanced reporting. (Note: there is a parallel concept of "balance" now being used by some to contest the teaching of evolution in the classroom, suggesting a lack of balance by not teaching creationism in schools). As such, this balanced reporting must logically, in the student's mind, translate into equally balanced scientific opinion both for and against climate change.

This is a dangerous logical progression as nothing could be further from the truth when it comes to the vast majority of scientists who have thrown their opinion on the climate change side. The large body of international scientific opinion decidedly supports the idea that climate change is happening with a great number of supporting anthropogenic causes. Among the high quality research institutions who back climate change are: the Intergovernmental Panel on Climate Change (<http://www.ipcc.ch/>), National Oceanic and Atmospheric Association (<http://www.noaa.gov/climate.html>), American Association for the Advancement of Science (<http://www.aaas.org/news/releases/2004/0616climate.shtml>), Environmental Protection Agency (<http://yosemite.epa.gov/oar/globalwarming.nsf/content/climate.html>), National Aeronautic and Space Association (<http://www.giss.nasa.gov/>), American Geophysical Union (http://www.agu.org/sci_soc/everyonecl.html), Earth Observatory of NASA (<http://earthobservatory.nasa.gov/>), and the Pew Center on Climate Change (<http://www.pewclimate.org/>). All of these organizations have their scientific opinions posted online. Numerous scientific bodies in other countries have reached the same conclusions as American scientists.

In the non-science press even the foreign policy experts are taking notice; in July of 2004 the widely held *Foreign Affairs* journal published an article on global warming (Browne, 2004). In September the largest geography monthly in the United States, *National Geographic*, committed 74 pages to global warming (Allen, 2004). Among the mainstream book press, Leblanc and Register (2004) and Diamond (2005) both present convincing theories on the collapse of civilization, including climate change scenarios based on archaeological evidence.

Conclusion

As this paper has mentioned, only an educated and alert society can pressure governments to act responsibly. If American society has somehow become passive about climate change and environmental issues, then a

great deal of the blame should be placed on higher education. Higher education will play a monumental role in the next 40 years in getting society on an environmentally sustainable path through interdisciplinary teaching, sustainability-oriented research, and sustainable campus operations (Calder & Clugston, 2001).

This paper has presented practical classroom instruction points that may help educators and department heads in their planning of climate change courses. Deceptive in their title, climate change courses can be difficult interdisciplinary courses to teach. Teaching about international cooperation through foreign policy is a good way to see the real face of American treaty records. In the course planning, the educator must ultimately try to find a balance between the science of climate change and the other key interdisciplinary goals of such a course for non-science major students. Teachers must counter media propaganda with scientific data. In the end, teaching the scientific method well is the best tool to enhance critical thinking on climate change. Solutions to climate change must be given to encourage students and to challenge them to find answers to this huge quandary facing our planet and civilization.

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