

Human-Environment Interactions: The Initiation of a New Curriculum

**Arthur B. Sacks
Colorado School of Mines**

“Philosophers since Socrates have insisted that the unexamined life is not worth living; but only more recently have environmental philosophers insisted that life in an unexamined world is not worth living either.”

-Holmes Rolston III¹

“...we must recognize that all education is environmental education, by which I mean that students are taught in various and often unintended ways that they are part of, or apart from, natural systems. Furthermore, we must recognize that the goal of education is not the mastery of knowledge, but the mastery of self through knowledge...In the conduct of teaching, we must also acknowledge that the process of learning is often as important as content, and that institutions teach by what they do as well as by what they say.”

-David W. Orr²

In the years immediately preceding the current design and development phase of a new undergraduate curriculum for the Colorado School of Mines (CSM)-a process which began in 1994-CSM articulated a powerful new vision of itself. While maintaining the strength and character of the Earth science and Earth resource disciplines which established the school's reputation and also acknowledging the rapid expansion of the school's general engineering fields over the past ten years. CSM articulated a new expression of its heritage and would become “an academy for the stewardship of the Earth.”³ This simple statement underscored a profound change in self-concept built upon the recognition that engineering and applied science have a responsibility for responding to the environmental challenges of our age, challenges, ironically, which were created in part by the very intelligence, imagination and ingenuity of engineers and applied scientists. It pointed as well to the responsibility of higher educational institutions for developing new ideas, strategies and technologies to respond to quickly emerging environmental problems that are increasingly transboundary and global in character and which threaten to undermine the fundamental biospheric systems and ecosystem services upon which we depend. This responsibility is all the more significant because of higher education's primary role in preparing new generations of leaders for industry, commerce, science and government.

In defining itself as an institution dedicated to Earth stewardship, CSM has acknowledged that ours is indeed the Age of the Environment, that the 21st century will demand engineers and applied scientists aware of the complexity of environmental problems and how such problems emanate from the interactions of human systems and environmental systems. As I have commented elsewhere,

...it is important to observe that CSM students...will live professional and personal lives

substantially different from those whose careers will end by the turn of the current century. Future CSM graduates will work in a far more crowded world with population rapidly increasing in those developing nations least able to accommodate the physical and social needs of their people, a world in which the competition for the Earth's resources will become increasingly fierce, a world which will see heightened social and political instability driven by complex, dynamic local, regional and global environmental stresses, a world in which national and international affairs will increasingly be dominated by such stress. CSM graduates will work in a world shaped by an integrated global market; by new international alliances and global institutions; by entirely new technologies; and, by new demands to preserve and strengthen the ecosystem and planetary services upon which economy and life depend.⁴

This reality requires talented professionals with disciplinary depth and the most advanced skills in their fields, but also professionals who possess an understanding of the social and cultural basis of contemporary environmental challenges in local, regional and global contexts, and an understanding of their own ethical responsibilities in their professions and in their personal lives.

Such considerations, as well as many others about the evolving nature of engineering and applied science, led CSM to undertake a complete re-examination of its entire undergraduate curriculum and its "Graduate Profile," the description of the attributes of CSM graduates. The "Profile," drafted by the CSM Academic Planning Council over the course of the 1993-94 academic year, was debated and subsequently adopted by the CSM faculty and finally by the Board of Trustees.⁵ Key items in the "Profile" supported the direction which the Division of Liberal Arts and International Studies (LAIS) had already embarked upon in its own curriculum planning activities. Specifically, the preamble of the revised "Profile" states,

CSM is committed to educating students to become good stewards of the Earth and its resources. To do this, CSM must provide students with perspectives informed by the humanities and social sciences, perspectives which also enhance students' understanding of themselves and contemporary society. CSM is committed to the development of processes and approaches to mitigate environmental damage caused in the past by the production and utilization of minerals, energy and materials. It is also committed to minimizing such damage in the future, thus helping to sustain the earth system upon which all life and development depend.⁶

The recognition of the importance of the humanities and social sciences and the integral nature of these fields and perspectives in enabling CSM to meet its fundamental mission affirmed LAIS's interests in focusing its programmatic thrust in the area of human-environment interactions, and gave substantial impetus to the Division for taking leadership in defining the substance of a required LAIS Division and to the humanities and social science curriculum:

- Graduates must have the skills to communicate information, concepts and ideas effectively orally, in writing, and graphically....

- Graduates should have the flexibility to adjust to the ever-changing professional environment and appreciate diverse approaches to understanding and solving society's problems. They should have the creativity, resourcefulness, receptivity and breadth of interests to think critically about a wide range of cross-disciplinary issues....
- Graduates should be capable of working effectively in an international environment, and be able to succeed in an increasingly interdependent world where borders between cultures and economies are becoming less distinct. They should appreciate the traditions and languages of other cultures, and value diversity in their own society.
- Graduates should exhibit ethical behavior and integrity. . . .They should assume responsibility to enhance their professions through service and leadership and should be responsible citizens who serve society, particularly through stewardship of the environment.⁷

With the CSM mission and the “Graduate Profile” in mind, the Humanities and Social Science (HSS) Curriculum Reform Subcommittee, established to consider the HSS curriculum, developed a set of objectives and a coherent theme for a three-course, ten-credit required core curriculum:

The objectives of the HSS core curriculum are to offer a coherent sequence in the humanities and social sciences appropriate to a Mines education and to develop writing proficiency throughout the CSM curriculum. The focus of the core is human-environment interactions, including knowledge of how engineering responsibilities extend to consequences for human society and the rest of life on earth.⁸

Two new core courses would be developed by LAIS: “Nature and Human Values”- a writing-intensive four-credit freshman course, and “Human Systems”-a three-credit sophomore course. An existing three-credit freshman course, “Principles of Economics” offered by the Division of Economics and Business, would be modified to include more ecological and natural-resource economics and for most students would be shifted to the sophomore year. Building upon this ten-credit core, students would be required to select nine credits from “thematic clusters” designed to present depth through structured breadth. With the clusters, the total required HSS curriculum is 19 credits.

The core curriculum's focus matched the new human-environment interactions orientation of the LAIS Division, a direction which I established when I who came to CSM in summer 1993 from the University of Wisconsin-Madison where I served as Director of the Institute for Environmental Studies. This overall direction of LAIS, I argued, better fit the role, scope and mission of CSM. As such, it would enable the Division to better attract and retain faculty with

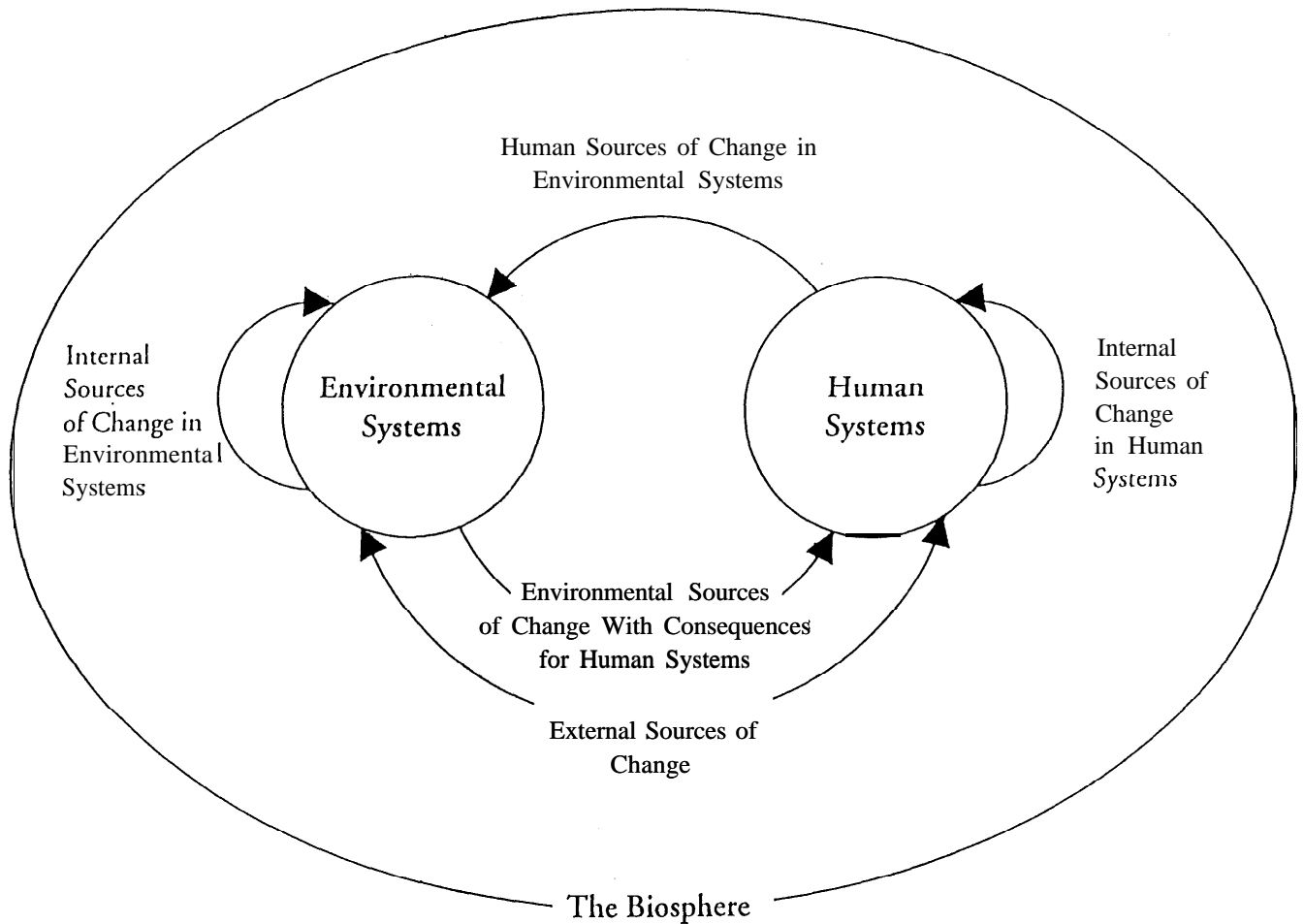
interests that complemented the School, and would allow LAIS eventually to develop an appropriate interdisciplinary graduate degree program in international natural resource management in addition to its current undergraduate minor programs. In so doing, LAIS would be better integrated into the mainstream of traditional instruction, research and service.

Thus, as the first course in the HSS core, “Nature and Human Values” (NHV) was designed as the cornerstone of the new core HSS curriculum, but it also served as a “statement” of the new direction and the new focus and coherence of the LAIS Division. The fundamental premise of NHV is that human systems are inherently embedded in the biosphere, that humans are dependent upon the Earth’s bio-geo-chemical systems (i.e., environmental systems) and ecosystems “services” (e.g., the moderation of temperature and climate), and perforce interact with these systems and services. (Figure 1 depicts this relationship.) Inherently, a healthy economy and a healthy society can be achieved and sustained *only* in concert with a healthy and sustainable environment. As articulated in virtually all of the codes of ethics of professional engineering and applied science societies, the primary goal of such professionals is the protection of the safety, health and welfare of the public. NHV argues that such protection intrinsically requires the protection of Nature, and thus the ethical responsibilities of engineering and applied science professionals include the need to consider the requirements of environmental systems and the potential negative impacts of decisions on them in professional practice.

Most freshman introductions to the humanities-at either liberal arts or technical institutions-focus on human systems solely, ignoring the biosphere (Nature) except as it has been viewed in purely cultural contexts. As the first humanities course for prospective engineers, applied scientists and economists-professions which are engaged in transforming the face of the Earth-the LAIS faculty deemed it especially important that NHV be consciously organized to focus on human interactions with environmental systems, to explore the ways the natural environment influences and shapes human society, the impacts humans have upon the environment, and the feedback of these human-induced impacts on society. In this, we concur with our Colorado State University colleague, environmental philosopher Holmes Rolston III, that life in an unexamined world is indeed not worth living.’ We likewise agree with David W. Orr’s sentiments that “all education is environmental education” in that all education teaches students “in various and often unintended ways that they are part of, or apart from, natural systems.”” We wanted a Mines education to help students see that they are indeed very much a part of natural systems, that cultures which intentionally or unintentionally help divorce humans from natural systems yield pernicious effects on both natural and human systems. We determined that it would not be sufficient for CSM to simply pronounce the importance of Earth stewardship and the sustainability of the Earth system in its mission statement alone. CSM needed to devote real time in the curriculum and substantial faculty resources to exploring the meaning and the implications of these complex and sometimes controversial concepts. We thus decided that right in the freshman year-through NHV-LAIS would initiate the critical evaluation of these concepts which are central to a Mines education.

Human - Environment Interactions

Figure 1



After, William C. Clark, et al. *Toward an Understanding of Global Change*, National Academy Press, 1988.

To do this, we organized our introductory humanities course around four broad sets of questions concerning the historical development of human systems and their interactions with environmental systems starting with the assumption that the Earth-and what we humans do to and with it-really matters:

- Where are we now? What is the current state of human-environment interactions? What value systems underlie this current state? Thinking in global terms, are we on a sustainable path?
- How did we get here? What historical events and beliefs have shaped our current path?
- What alternative perspectives on human-environment interaction- beyond the currently dominant one-have existed in the past or currently exist?
- Where do we go from here? Can we develop a pathway for sustainability? What key elements are required for a sustainable world?

A discussion of the specific course content is not appropriate here. Suffice it to say, the nature and scope of these questions require NHV instructors to take an interdisciplinary approach and provide room to investigate both traditional humanities as well as social science fields and use the materials and methods of both as well. And they provide fruitful areas for discussion and debate among students.

In addition, because one of the important goals of the CSM curriculum (and thus the HSS curriculum) is to develop and strengthen students' written and oral (as well as graphic) skills, NHV has been designed to focus on written communication and integrate both written and oral expression in the course. Indeed, fully two of NHV's four credit-hours are devoted to writing instruction, and writing becomes a primary vehicle through which students articulate their own views and develop their analytical and critical thinking skills.

In NHV students find a lot to write about, to discuss and argue over. Some of the concepts (and related questions) raise serious concerns in freshman students about the way the world operates:

- the limits of growth and economic development;
- the possibilities of sustainability;
- the role people play in transforming the Earth for good and for ill;
- the difficulties surrounding the growing number of humans who inhabit the Earth;
- the consumption patterns of humans driven by needs and by wants, many of which represent excess and selfishness;
- matters of intra- and inter-generational equity;
- "the good, the bad and the ugly" aspects of technology;
- the tug of ethical responsibility in one's profession and personal life; and,

- the need to make difficult professional and personal decisions in the face of scientific uncertainty.

NHV is intended to have students investigate some of the challenges that confront the contemporary world. Its questions all too often lead to more questions, too infrequently, for many students, to answers and solutions. Answers and solutions, when they are developed in students' own minds through private contemplation or arrived at through peer discussion, at times conflict with the way they see have seen the world or the way they think they want the world to be.

All this can be unsettling to young people, most of whom are just beginning to explore the meaning and implications of their own values and the values of the society in which they hope to be leaders. NHV has been designed to be constructive in this process of self discovery. It has been developed to further CSM students' pursuit of excellence in their professions, to be able to set their professions and their roles in them in a social and environmental context, to enable them eventually to assume the leadership positions that many of them so actively seek. Such leadership requires acting responsibly to protect and promote the health, safety and welfare of society and the public they serve.

If we are successful, NHV will help set the wheels of bright minds spinning, to investigate how their ideas, their energy and their commitment can contribute through their professions and their lives to re-integrating people with the world, human systems with environmental systems. If we are successful, we will assist students in seeing more clearly our very complex, dynamic interactions with the Biosphere. If we are successful, we will assist future engineers, applied scientists and economists to assume their places as "responsible citizens" in a world whose past, present and alternatives for the future they will better understand, a world which they will be better able to serve, "particularly through stewardship of the environment." In doing so, NHV will assume its place in helping students achieve the purpose of a Mines education.

1. HOLMES ROLSTON III. "Foreword," in *Environmental Ethics*, edited by Louis P. Pojman
Boston: Jones and Bartlett Publishers, 1994, p. xvi.
2. DAVID W. ORR. "Educating for the Environment: Higher Education's Challenge of the
Next Century," *Change*, volume 27, number 3, May/June 1995, p. 45.
3. FRANKLIN D. SCHOWENGERDT, CSM Vice President for Academic Affairs, 20 January 1993,
"State of the Academy Address," Golden, Colorado.
4. ARTHUR B. SACKS, "Toward Earth Stewardship and Sustainability: Liberal Arts and
International Studies at CSM," *Colorado School of Mines Quarterly Review of
Engineering, Science, Education and Research*, in press.
5. The "Graduate Profile" was adopted by the CSM Board of Trustees in November 1994. The author was an
active member of the Academic Planning Council which drafted the revised "Profile."

6. The Colorado School of Mines Graduate Profile, November 1994.
7. The Colorado School of Mines Graduate Profile, November 1994.
8. "Final Report of the Humanities and Social Sciences Curriculum Reform Subcommittee," Colorado School of Mines, 6 June 1997, p. 4.
9. ROLSTON III, *op. cit.*, p. xvi.
10. ORR, *op. cit.*, p. 45.

ARTHUR B. SACKS is Professor and Director of the Division of Liberal Arts and International Studies, Colorado School of Mines, Golden, Colorado USA. He specializes in international environmental education and the human dimensions of global change.