

The Essex Report: Workshop on the Principles of Sustainability in Higher Education

Held under the auspices of:
The President's Council on Sustainable Development
Public Linkage, Dialogue and Education Task Force

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Introduction

On February 24 through 27, 1995 a workshop at the Essex Conference Center in Essex, Massachusetts brought together thirty-two educators and other professionals with environmental expertise to discuss the principles of sustainability, and how best to incorporate them into higher education. The workshop was held under the auspices of the President's Council on Sustainable Development Public Linkage, Dialogue and Education Task Force and was jointly sponsored by Second Nature and the Secretariat of University Presidents for a Sustainable Future. Participants discussed the role of the university in

teaching about sustainability, the relevant pedagogical content, the institutional changes necessary to support this pedagogy, and strategies for implementing these changes. This report represents the majority view of the participants, and includes a series of recommendations which were developed and are offered to the President's Council on Sustainable Development in the hope of facilitating the transformation of higher education and society as a whole in the direction of sustainability. The recommendations build on those contained in the Talloires Declaration of University Presidents for a Sustainable Future, now signed by 230 university presidents from 42 countries, and in the Blueprint for a Green Campus, crafted by the Campus Earth Summit at Yale University in 1994. Funding for the workshop was provided by Pacific Gas and Electric Company; Georgia Pacific Corporation; S.C. Johnson & Son; and the National Environmental Education and Training Foundation.

The Role of Higher Education in Achieving a Sustainable Society

1. Predicament of the University in the Face of Ecological and Social Trends

In the last four decades the population of the world has more than doubled and the world's economic output has increased fivefold. This unprecedented growth is altering the face of the earth and the composition of the atmosphere. Pollution of air and water, accumulation of wastes, destruction of forests, erosion of soils, depletion of fisheries, and damage to the stratospheric ozone layer threaten the survival of humans and thousands of other living species. These changes, a result of unsustainable and inequitable patterns of production and consumption, are likely to accelerate with the addition of 91 million people to the planet each year. In *Changing Course: A Global Business Perspective on Development and the Environment*, the Business Council for Sustainable Development points out that we are a society living off its natural capital, not its income. We are acting like a planet in liquidation.

Current strategies to meet human needs are not sustainable. Eighty percent of the world's resources are being consumed by 20% of the world's population. The world's poorest 20% earn 1.4% of the world's income. For 30% of the world's population, poor sanitation, malnutrition and air pollution are still the major causes of illness and death. By the time population growth stabilizes in the next century, a 5- to 7-fold increase in consumption of energy and goods will be needed just to raise the consumption level in the developing world to that in the industrialized world. Agricultural production must increase 3 fold in the next 40 years for all humans to have adequate nutrition. An 80-90% reduction in the generation of pollution per unit of economic output is necessary just to keep global pollution and waste loadings at their current unhealthy level. In the next 20 to 40 years, society must adopt new strategies that allow the needs of an expanding population to be met in an environmentally sustainable and equitable manner. Higher education will play a critical role in determining whether we succeed or fail.

2. Role of Higher Education

Meeting basic human needs now and in the future requires a major shift in the thinking, values, and actions of all individuals and institutions in their relationship with the natural environment. This shift in mindset must be led by the higher education system because it prepares most of the people who develop and manage society's institutions, and who serve as teachers. It will require comprehensive short- and long-term educational change, necessitating unprecedented leadership and commitment by colleges, universities and professional schools.

Society has conveyed a special charter on institutions of higher learning. Within the United States, they are allowed academic freedom and a tax-free status to receive public and private resources in exchange for their contribution to the health and well-being of society through the creation and dissemination of knowledge and values. Higher education institutions bear a profound moral responsibility to increase the awareness, knowledge, skills and values needed to create a just and sustainable future. These institutions have the mandate and potential to develop the intellectual and conceptual framework for achieving this goal. They must play a strong role in education, research, policy development, information exchange and community outreach and support. The 3500 institutions of higher education in the United States are significant but largely overlooked leverage points in the transition to a sustainable world -- they influence future leaders through their students and current leaders through their alumni. They have the unique freedom to develop new ideas, comment on society, and engage in bold experimentation, as well as contributing to the creation of new knowledge.

3. Problems with Current Education

Despite the efforts of individual programs at a number of universities and colleges, education and research about the interdependence of humans with the environment is not a priority in higher education. For example, no engineering school has yet made design for the environment, industrial ecology, pollution prevention or the relationship of technological development to sustainability the cornerstone for an engineering education. American medical students receive only 6 hours of training in occupational and environmental medicine during 4 years of medical school. Only 100 out of the 700 schools of business and management in the US have courses on business and the environment. All the courses are elective; none of these schools has fully integrated business and environment issues across the curriculum. Only 9% of teachers' colleges require a practicum in environmental education at the elementary level, and only 7% at the secondary level. Education in environmental management, planning or policy is not a required curriculum standard in any of the accredited programs in public affairs and administration.

As a result, the general public has little awareness that a healthy natural environment is essential to our very existence -- not only providing clean air, water, and food, but all the raw materials that feed the economy. We see ourselves as separate from the natural world. Much of the population has little idea about where goods come from and where they go, the destructive impact of pollution on human health, and the importance of maintaining biologically diverse, productive ecosystems. A belief that natural and physical resources are free and inexhaustible and that the environment can assimilate all our pollution and waste has led to unsustainable use of renewable resources such as fisheries, forests, agricultural

land and fresh water, and overuse of non-renewable resources such as minerals and fossil fuels. This belief also results in overuse of the land, atmosphere, and bodies of water as repositories for pollution and waste. A lack of knowledge often results in inappropriate use of technology, as well as inappropriate concern about some environmental hazards while other, more critical ones go unattended. It also supports the erroneous belief that there need be a tradeoff between economic development and environmental protection. And, most importantly, the general public has little idea that it is not just industrial enterprise, but the aggregate of all human activities -- all the individual and the collective daily decisions -- that are irreversibly changing the earth, or that environmental degradation can be both a cause and a consequence of poverty, especially in the poorest countries.

In addition, the current education and training of most environmental professionals who will be employed by government, industry, academia and environmental organizations is narrowly focused and incomplete. Most of these professionals are trained in dealing with a subset of environmental problems such as air pollution, water pollution, or hazardous waste, but are not trained to deal with environmental issues in an integrated and comprehensive fashion. The focus of training is on controlling pollution and waste once created and in remediating environmental damage, rather than reducing or eliminating pollution and waste generation at the source. Pollution specialists are rarely trained in natural resources management, conservation or preservation of biodiversity, and vice versa. This non-systemic orientation reinforces the compartmentalization of environmental issues and programs rather than promoting more effective, integrated approaches to solutions. Moreover, education of environmental professionals about environmentally responsible action usually emphasizes government mandated "command and control" regulation, rather than a broad range of strategies that might include market incentives, technology transfer, technical assistance, information dissemination, public, consumer and investor advocacy, and education and training.

An even more fundamental problem in current environmental education is the underlying assumption that environmental protection should be left to environmental professionals. This results in educational systems treating environmental education as yet another specialty, not unlike sociology or biology. But human impact on the environment is far more dependent on the actions of individuals who are not trained as environmental specialists than those who are. Therefore environmental education must be a pillar of all higher education, rather than restricted to an isolated individual discipline.

Several structural aspects of the educational system contribute to the problem. Interactions between population, human activities and the environment, and strategies, technologies and policies for an environmentally just and sustainable future are amongst the most complex issues with which society must deal. These issues cross disciplinary boundaries, making it very difficult to convene the skills necessary for effective teaching and research in educational institutions that are organized into highly specialized areas of knowledge and traditional disciplines. Specialists are produced with little feeling of connectedness, and little understanding of the workings of natural systems, or even the place of their own discipline in the larger human and non-human world. For example, neoclassical economics views the economic system as separate from the biosphere rather than one of its subsystems. Narrowly focused experts often generate information that is of limited utility

and authored for a minute number of readers. Interconnecting patterns and relationships which govern all natural and most human interactions are largely left to the student to discern on his or her own. In *Earth in the Balance*, Vice President Al Gore argues that "we organize our knowledge of the natural world into smaller and smaller segments and assume that the connections between these separate compartments aren't really important... (On the other hand) the ecological perspective begins with the view of the whole, an understanding of how the various parts of nature (including humans) interact in patterns that tend toward balance and persist over time." Designing a sustainable human future requires a paradigm shift toward a systemic perspective which encompasses the complex interdependence of individual, social, cultural, economic and political activities and the biosphere. This shift emphasizes collaboration and cooperation, while current higher education stresses individual learning and competition, producing managers ill-prepared for cooperative efforts.

Other aspects of higher education make it ill-suited for rapid movement in the directions necessitated by the global change that has and is likely to occur over the next several decades. Curriculum and degree requirements are primarily determined by faculty isolated by department and school of study, and/or designed to satisfy accrediting agencies rather than generating students with skills relevant to society's needs. Learning is fragmented, and faculty, responding to long-established incentives and professional practices, are discouraged from extending their work into other disciplines or inviting interdisciplinary collaboration. Tenure and promotion of faculty are largely based on teaching and research, which is most often in a single discipline. Quality scholarship is usually considered as synonymous with originality in a single discipline, and individual contribution is generally encouraged over team efforts. The tenure system, intended to protect risk-taking, more often promotes traditionalism and discourages change. It is extremely difficult to obtain tenure as an interdisciplinary scholar in the overwhelming majority of institutions of higher education. Institutional commitment to build structures that promote interdisciplinary teaching and learning is often lacking. Administrators (presidents, provost and deans) who must lead the effort for change have more limited say in academic direction than is usually assumed. Visionary leaders are rare; financial pressures encourage a short-term survival mentality over long-term planning. Academic programs supporting environmental specialists and research usually must rely on external funding (soft money). Being multidisciplinary and interdisciplinary these programs are often considered to be academically less rigorous and therefore inferior to traditional academic programs, and are often viewed as "temporary" or "faddish." As a result, proponents of multidisciplinary programs are often held in lower esteem by their academic peers.

A number of myths, pervasive throughout current institutions of higher education, interfere with the attainment of their mission. The myth of the value-free university, that knowledge is attained for its own sake, stands in contrast to the reality that special interests always play a greater or lesser role. The myth that higher education is separate from the political, economic and cultural world in which it is embedded, that it is an island unto itself, ignores the reality that higher education is subject to the same natural and societal forces that constrain the activities of all human endeavors; and furthermore, that higher education has an obligation to the well-being of the biosocial community in which it is inextricably embedded.

Many outside the environmental arena agree that there is much wrong with the educational system. Thus, we have an opportunity to solve many problems at the same time with the incorporation into higher education of systems thinking and a pedagogy and practice that supports movement towards sustainability.

4. Understanding the Process of Change

As the world increases in complexity, rate of change, interdependence, and extent of environmental deterioration, institutions of higher education must reorient themselves if they are to contribute positively and avoid becoming irrelevant or even detrimental to a sustainable society. They must be able to balance service and leadership, to be responsive and adaptive on the one hand, and proactive and grounded on the other. In short, they must take their charge and pursue their missions with the full understanding that they are part of an interacting global environment and economy.

Some have suggested that current institutions of higher education are losing their collective learning capacity. Rebuilding collective learning capacity in these institutions will require a shared vision, common mental models, reconnection among individuals and with the biosocial environment, increased diversity, willingness to experiment, and a transition to systems thinking. All of these changes underlie and will support the goal of sustainable development and a sustainable future.

Education for Sustainability: Content and Strategies

Moving society on a sustainable path will require major changes in the process and content of higher education. Leadership must be provided by university presidents, provosts and deans -- i.e., those who are capable of converging all the academic disciplines and professional schools on large, complex issues. They must focus their schools' attention on the critical issues of sustainability by speaking out, mobilizing existing resources and acquiring new ones, creating incentives and programs for faculty development, and encouraging relevant teaching and research in all academic domains.

1. Educational Foundations

The foundation of education and research must be interdisciplinary, systems-oriented thinking that will address environmentally sustainable development on local, regional and global scales over short, medium and inter-generational time periods. Rather than being isolated in its own academic discipline, education about the environment, natural resource management and sustainable development must become an integral part of the normal teaching in all the disciplines. This will avoid adding new requirements to already crowded curricula, give students repeated exposure to environmental concerns, and help them develop the necessary values and skills; it is the most effective way to create the necessary paradigm shift.

Educated graduates must understand:

how the natural world works
the interdependence of humans and the environment
how to assess the effects on humans and on the biosphere of human population dynamics; energy extraction, production and use; and other human activities such as agriculture, manufacturing, transportation, building and recreation
the relationship of population, consumption, culture, social equity and the environment
the interdependence of human health and the environment
how to apply principles of sustainable development in the context of their professional activities
technical, design, scientific and institutional strategies and techniques that foster sustainable development, promote energy and natural resource efficiency and conservation, prevent and control the generation of pollution and waste, remediate environmental problems, and preserve biological diversity
social, cultural, legal and governmental frameworks for guiding environmental management and sustainable development
environmental and health risk assessment, communication, perception and management strategies to motivate environmentally just and sustainable behavior by individuals and institutions

2. Pedagogical Approaches

Following is an outline of a framework for pedagogical approaches for sustainability in higher education. Sustainability is best understood by exploring the intersection of a number of different dimensions, such as the biophysical, cultural (including linguistic), economic, social, institutional, aesthetic and spiritual. This framework is not meant to be static; it must evolve as we improve our understanding of what sustainability entails. The real world changes, and our understanding of it is full of uncertainty. Instead of only conveying facts, true education entails a process of iterative questioning and probing.

a. Systems Thinking

Environmental literacy entails understanding how the "households of earth" function and interact with humans. Systems thinking provides a common language for understanding and communication about ecology and living systems, the interaction of social, political, cultural, economic and ecological perspectives in a framework that reflects the complexities of the modern world as well as the actions that need be taken or avoided in order to ensure sustainability. Systems thinking provides a means for exploring the critical complex interrelationship of population, consumption and the environment. Students should learn that systems thinking provides understanding rather than explanation and that it emphasizes:

wholes over parts
relationships over objects
contextual over objective definitions
patterns over contents
quality over quantity
process over structure
dynamic equilibrium over stability

development over growth
inclusiveness over exclusiveness
non-linear dynamics
complex cause-effect relationships

Systems thinking is a mode of cognition that exists in us all, but tends to be de-emphasized and overshadowed by linear thinking within formal education. Failure to apply systems thinking when it is required often results in incomplete or erroneous solutions to problems. Systems thinking can lead to the understanding of the root causes of problems and lead to more lasting, holistic and equitable solutions.

b. How the Biophysical World Works

Because the biophysical world is the basis for life, students must understand the nature of the biophysical world, how it works and why it is sustainable. This understanding includes:

natural laws (e.g., first and second laws of thermodynamics)
ecosystems as communities with hierarchies of relationships
all energy is derived from the sun
tendencies toward dynamic equilibrium
limits and boundaries
material cycles are circular: closed loops and waste as a resource
interdependence and holism: e.g., if part of the system is sick, the whole system is sick
flexibility, adaptation and resilience through feedback
diversity and complexity
development, evolution and self-organization
partnership, cooperation and competition
co-evolution of species including humans
short and long time scales
synergy

c. Sustainability in Human Activity

Human interaction with the biophysical world can either be sustainable or not sustainable. Sustainable development is possible only if system integrity is maintained:

Human population size is maintained within the carrying capacity of natural systems.

Physical and natural resources are used no faster than they can be replenished.

The assimilative capacity of natural systems is not exceeded.

Global life support systems are maintained, including biological diversity, clean air and water, food production capacity, and sufficient open space.

Efficiency and equity characterize use of all natural resources, including exposure to environmental hazards.

Sustainability emerges from the appropriate integration of economic and ecological systems. Students must understand the basic principles that underlie this interaction, and the implications of these principles:

Economic systems are organized around and sustained by the flow of energy and matter.

Economic systems are open subsystems nested within and dependent on a closed global biogeochemical system and its cycles.

Limitations exist in the rate at which economic systems can utilize natural resources and the earth's capacity to assimilate waste or provide other environmental services.

Economic activity should be designed to mimic and live within natural systems.

A sustainable economy should provide for basic material requirements and a healthy quality of life.

A sustainable economy will cause no net loss of social and human capital (our current system does not do this).

Economic "progress" must be encouraged, measured and gauged in terms of quality of life and development of human potential, not solely in quantitative terms.

Economic activity must be subject to a true cost accounting, which will entail new approaches such as exploring economic value as a function of energy flows, ecological processes preserved and maintained, or resilience of systems to collapse.

A sustainable economy, in addition to emphasizing efficiency and adaptability, should provide work that is meaningful, valued and biophysically compatible for every individual.

Economic systems are a subset of the socio-political structure, including its moral structure; people are citizens first and consumers second.

The behavior of economic systems today should not diminish the potential enjoyment of life for future generations.

Appropriate market incentives (e.g., full cost accounting) are essential to achieve biophysical and economic sustainability, and subsidies for unsustainable practices should be eliminated.

Enhancing and sustaining human health is dependent on a healthy, productive and biologically diverse environment. To achieve sustainability, students need to understand:

The productivity and health of the physical and natural environment is one of the most important determinants of human health since the environment provides all the resources that make life possible.

Protection of the environment and preservation of biologically diverse ecosystems are, in public health terms, the most fundamental forms of primary prevention of human illness.

How to assess the impact on human health of economic and other human activities which impact the biophysical environment.

How to design economic activities, food production, transportation, communities and building structures which enhance and sustain human health.

Human activity always takes place in a cultural context. The changes necessary to bring about a sustainable future are intrinsically linked to that cultural context. Students need to understand that:

Human cultures are built around spiritual, social, philosophical and political beliefs that determine societal values.

Values change at certain times, especially when cultural and political systems are in flux; we are now in a constructive period when values can change.

Not all values can be accommodated simultaneously.

There is a biological basis for some values.

Human rationality is bounded.

Beauty and aesthetics as well as immediate self-interest can motivate behavior.

Cultural diversity must be recognized and respected; we need to examine issues from a variety of cultural perspectives.

Sustainable development is not an ideology or religion.

Sustainable development must be inclusive and not alienate.

The question of what is a good life must be considered from a cultural perspective; sustainable development must serve cultural as well as physical needs.

Communities and institutions play a critical role in sustainable development. Students must understand the principles by which communities and institutions operate and can contribute to bringing about a sustainable future. Students should especially be guided to discover and understand the focus and operations of the communities and institutions to which they themselves belong or which impact them significantly, and to participate in these communities and institutions in order to assure their contribution to a sustainable future. Students should be made aware that:

The natural and physical environment is the platform which supports all communities and institutions.

Sustainability depends on ecological design inside and outside communities.

Feedback loops operate in different time frames in intra-person, intra-company, intra-industry and intra-society situations; short feedback loops are key to effective change and must be designed into institutions.

Environmental management must be decompartmentalized -- e.g., it should be a function distributed throughout government, not solely delegated to the EPA; and consideration of environment/sustainability issues should be a normal part of government programs and those of community-based organizations.

Institutions must upgrade their understanding of their relationship to the planet.

Institutions should encourage empowerment through incentives, such as reorganizing for optimal outcomes, increasing access to community resources, and symbiotic local relationship building.

Decentralization and flexibility are generally desirable.

d. Pathways to Justice and Sustainability

A sustainable society is a just society. Many at the workshop felt that this is the overarching principle of environmental justice and sustainable development. In a sense it is redundant to speak about sustainability and justice; the former includes the latter. There may be paths that are not just and fair, but could perhaps be maintained for a limited period of time; but these are not ultimately sustainable paths. Because of the importance of environmental justice and the fact that it is often overlooked in discussions of sustainability, it should be given equal emphasis in education. Environmental justice is broader than environmental equity, the equal protection of all groups under environmental law. All aspects of a sustainable society -- economy, culture, institutions/social structure, the ecosystem -- can be viewed from an environmental justice perspective. For example, students must understand the implications for sustainable development of differences between the northern and southern hemispheres, between the "industrially developed" and "developing" worlds; the consequences of free trade agreements; the relationships among women's rights, access to knowledge and sustainability; issues of disproportionate impact; the connection between peace/security and sustainability, and that all these issues are necessarily interdependent. Students should also explore and debate the relationships between environmental justice and sustainability that are contained in the following proposals:

Sustainable development with environmental justice ensures that no community, group, people or gender is required to accept socially condoned and/or legally sanctioned negative environmental consequences.

Sustainable development with environmental justice redresses past, present, and future maldistribution of resources, privileges and rights of endangered communities, of poor people, and of communities of color.

Sustainable development with environmental justice eliminates the necessity to choose between sources of income versus health and safety, especially for poor people and people of color.

Sustainable development with environmental justice ensures the widest stakeholder participation possible in relevant decision making needed to avert inequitable and unjust environmental conditions.

Fossil fuel energy flows should be not only be decreased, but more equitably distributed among all people regardless of their differences -- sustainable and equitable energy flows foster structural interdependence rather than structural dependence.

Sustainable communities cannot be maintained unless biodiversity and cultural diversity are highly revered.

A sustainable society produces a public policy process which is cyclical rather than linear.

e. Strategies and Techniques for Optimal Learning About Sustainability

Education about sustainability is a necessity, not a luxury. By the time students enter college, they have been exposed to a cumulative total of hundreds of days of advertising urging them to consume the earth's resources. Some have suggested that since the university is part of the problem, it may not be part of the solution. Others are more optimistic, arguing that radical change in the way learning takes place in the universities is possible, and this change can benefit not only learning about sustainability, but all learning. For example, while the lecture format is useful for conveying some types of knowledge, it is clearly not the best way to inculcate values, generate passion, or teach real-world problem solving skills. Experiential education is often preferable, in spite of obstacles like the lack of easy assessment techniques or the ignorance of colleges about their local communities. The process of education should encourage collaborative, active learning in which students work on real problems on their campuses, in surrounding communities, in government, or in industry. This will improve learning, and help develop multidisciplinary and interdisciplinary analytical skills and the ability to solve real-world problems. It enables students to ground theory in application. Experiential education allows students to continually interact with, learn from, and apply knowledge to their own environment: home, workplace, city, rural area, wilderness, or ocean. It helps them develop critical awareness of their impact on the environment and its importance to their health and well-being, as well as to develop competency in nurturing this relationship.

Better learning strategies might include:

- developing new performance indicators

- identifying new tools and mental models

- balancing emphasis of breadth and depth

- developing a sense of place of the campus in the local environment

- diversifying student's learning strategies

Interdisciplinary learning can be encouraged by bridging, uniting, or even "dissolving" currently separate disciplines. Possibilities include:

- starting new schools (and letting old ones die)

- creating special sustainability courses, such as a single basic natural science or basic social science course

- modifying existing courses

- creating a unified, team-taught science course on the biosphere

creating an institute for ecological design arts
funding research on applied sustainability and justice
Students should get outside and do something real. This could be accomplished by:
using the campus as a laboratory for environmental management and sustainability
creating biological reserves on campus
confronting actual, real-world problems
internships in government, industry, communities, K-12 schools and NGOs
capstone courses oriented toward solving environment and development problems of communities, government and industry
finding opportunities and giving credit for off-campus work in communities
encouraging students to work in groups so that they will be able to effectively collaborate as future managers and leaders
Finally, higher education must be open to the lifelong learning necessary to support the continuing evolution of sustainable development.

3. The University as a Role Model

The university is a microcosm of the larger community, and the manner in which it carries out its daily activities is an important demonstration of ways to achieve environmentally responsible living. By focusing on itself, the university can engage students in understanding the "institutional metabolism" of materials and activities. Students can be made aware of their "ecological address" and the impact of their attending school on the natural environment and the community, and they can be actively engaged in the practice of environmentally sustainable living. By using the campus as a laboratory, students learn to analyze complex multidisciplinary problems, develop real solutions and focus on their institution's and their own behavior -- skills that are critical for the realities of the 21st century. By "practicing what it preaches," engaging in environmentally just and sustainable practices in its operations, purchasing and investments, higher education helps reinforce desired values and behaviors in all members of the academic community. Moreover, the annual buying and investment power of the nation's institutions of higher learning (\$120 billion in purchasing; \$75 billion in endowment) make them important players in creating market demand for environmentally just and sustainable goods and services and in supporting the local communities in which these institutions are located.

Institutional Change: Moving Universities to Incorporate Sustainability in Teaching and Practice

Society has a 20 to 40 year window for instituting the changes that will ensure a sustainable future. Higher education must be a leader in this process, in spite of current impediments such as ossified disciplinary boundaries, counterproductive incentive systems, the low status of experiential education, and a lack of appropriate funding. Universities must alter their operations and become models of sustainable communities. Teaching and learning must become more interdisciplinary and multidisciplinary; learning must become more active and experiential, with greater student participation, and more collaborative; critical thinking, and negotiation and mediation skills must be developed. Interdisciplinary research must be encouraged both within and across universities, and in partnership with funders

such as government and industry; centers should be established to house these interdisciplinary research programs. Universities must also reach out at all levels -- local, regional, state, national and global. This outreach must extend to all cultural constituencies, across race, religion, gender and geography. It must include all societal structures that provide education -- other universities; elementary, middle and high schools; continuing education programs, and service learning in industry. Universities must also reach out to leaders outside of the traditional educational system -- to religious leaders, journalists, and those in government, business, and non-governmental organizations. There already exist numerous stories of successful change within the universities in these areas of operations, teaching and learning, research and outreach. One effective way to facilitate further change is to collect and disseminate these individual success stories (as well as examples of what did not work), and to elevate the visibility of the good models that already exist.

Unfortunately, higher education is not likely to change its direction far enough or fast enough without strong outside influence. Historically, this is due to the isolation of higher education from many of society's problems, the overwhelming dominance of the disciplinary approach in learning and research and the tendency to be "producer" driven rather than "customer" driven. In *Universities and the Future of America*, former Harvard president Derek Bok opines "When society recognizes a need that can be satisfied through advanced education or research and when sufficient funds are available to pay the cost, American universities respond in exemplary fashion... On the other hand, when social needs are not clearly recognized and backed by adequate financial support, higher education has often failed to respond as effectively as it might, even to some of the most important challenges facing America... After a major social problem has been recognized, universities will usually continue to respond weakly unless outside support is available and the subjects involved command prestige in academic circles."

Strong, rapid and largely unprecedented efforts by all of higher education's stakeholders are necessary to motivate the system on a path to sustainability.

Students, parents, alumnae, prospective employers, organizations funding research and education (government, industry and foundations) and the public are all consumers, clients or supporters of higher education's services. Individually they have varying degrees of influence on academic direction and programs, but collectively they have great potential to encourage innovation in education. To date, these stakeholders have exerted modest influence on higher education concerning education for sustainability; they must exercise more leverage.

If we are to encourage the educational system to produce the environmentally aware professionals and specialists needed to lead us on a sustainable path, the stakeholders must work with the higher education system in creative ways to encourage environmental education and research. For example, there is a growing student demand at colleges and universities in the US and internationally for environmental education and for the institutions to reduce the environmental impact of their own operations. This effort must be encouraged and expanded. The federal government, which provides over 90% of the funding for academic research, could gradually move this research budget over the next two decades toward activities which are environmentally, economically and socially just and

sustainable. The federal support for education through agencies like the Department of Education, NSF and the Department of Energy could emphasize the critical human interdependence with the environment and the principles of sustainability as a foundation for teaching math, science, engineering and social studies. Both directly and through their hiring practices, prospective employers could expand efforts to communicate with higher education about the need for both environmental specialists and environmentally literate and responsible graduates in all fields. Environmental education could be encouraged or required at the state and local level. These steps would encourage faculty to make environmental concerns central to their teaching.

Strategies for Change: Recommendations

1. Actions by Institutions of Higher Education

All college and university presidents and deans of professional schools should sign and implement the 1990 Talloires Declaration of University Presidents for a Sustainable Future which has been signed by 215 university presidents from 42 countries and on which many of the following recommendations are based.

All institutions of higher education should follow the recommendations contained in the Blueprint for a Green Campus, crafted by the Campus Earth Summit at Yale University in 1994.

All higher education institutions should develop a 10-20 year plan to make environmentally just and sustainable action a goal and a central thrust of their education, research, operations, investment, recruiting and community outreach activities.

Higher education must rapidly engage in education, research, policy formation, and information exchange on population, environment, and development to move toward a sustainable future. These efforts should encourage the development of lifelong learning programs and strategies for the existing and future workforce.

Leaders of higher education should use every opportunity to raise public, government, foundation, and university awareness by publicly speaking out on the importance of moving society on a just and sustainable path. They should encourage the involvement of government, foundations, donors, alumni and industry in supporting university research, education, outreach, policy formation and information exchange programs in environmentally sustainable development.

Higher education leaders should advocate for a shift in research funding priorities toward interdisciplinary, population, environment and development research. Research funds earmarked for traditional disciplines often encourage the continuing compartmentalization of problems and solutions.

Higher education leaders must create institutional infrastructure for education about sustainability, such as:

Creating programs that develop the capability of faculty to engage in education, research, outreach, and policy formation, and information exchange programs that empower students to pursue sustainable living. These programs should result in knowledge and values about the environment, natural resource management, and development becoming an integral part of the normal teaching within all academic disciplines.

Changing tenure and promotion requirements so that they reward and encourage interdisciplinary work on environment, population, and sustainable development; faculty

must not be penalized for multidisciplinary initiatives. For example, innovation and creativity might be encouraged by instituting campus-wide tenure hearings.

Creating and funding positions for interdepartmental and interschool faculty who will research and teach population, environment, and sustainable development topics. This might include establishing multidisciplinary and interdisciplinary structures within the university, such as "centers of excellence" for research, education, and policy development. Existing faculty could be encouraged to participate in these centers by giving them release-of-time from narrow department-restricted activities. New faculty hires for positions within traditional departments should be based not only on a candidate's ability to meet crucial department needs, but also on his/her potential contribution to interdisciplinary programs. "University" professors could be hired; not beholden to any individual discipline, they could act as the interface between disciplines.

Developing an institutional role or structure -- a provost, a dean, or teams of administrators, faculty, and/or students -- to promote and continually focus the institution on sustainability. Encouraging multidisciplinary thinking and action with the use of internships, Capstone courses and integrative seminars, work study, case studies and community service.

Establishing programs to produce experts in environmental management, sustainable economic development, population and related fields.

Reshaping university career services so that they facilitate the placement of environmentally and sustainability literate graduates.

Higher education leaders should establish institutional policies and programs to guide faculty, staff, administration, and students in implementing environmentally sustainable practices in the daily operations of the institutions. Examples might include:

Conducting a campus resource and environmental audit with public disclosure. This should include full student participation.

Encouraging programs in energy and water conservation, waste reduction and recycling.

Creating a 10-20 year plan to reshape the physical plant, bringing it into conformance with requirements for sustainability (and simultaneously lessening the physical barriers that help maintain isolation between disciplines).

Harnessing the institutions' buying power and investment to support a just and sustainable society, such as investing endowments in local community energy efficiency. Universities should shift a minimum of 1-5% of their purchasing each year toward products from environmentally sustainable enterprises, such as sustainable agriculture. This gradual shift is reasonable, practical and would help create a market that encourages sustainable practices.

Offering retirement programs for faculty and staff that include environmentally sustainable and just investment vehicles.

Higher education institutions should orient education and research toward environmental, economic and social sustainability in the communities and regions in which these institutions are situated.

Higher education institutions in the US should develop cooperative programs with universities and professional schools in other countries to promote faculty and student exchanges, collaborative research, and educational programs that develop international understanding and action toward sustainability.

Universities should establish partnerships with primary and secondary schools to enhance the latter's capability to teach about population, environment, and sustainable development issues.

Higher education should work with employers to encourage placement of graduates in organizations working toward or practicing environmentally just and sustainable action.

Higher education should work with the UN Commission for Sustainable Development, the UN Environment Programme, the Secretariat of the University Presidents for a Sustainable Future, Second Nature, the Management Institute for Environment and Business and other national and international organizations to promote a worldwide higher education effort toward a sustainable future.

2. Actions by the Stakeholders

Tuition payers (parents and students) should encourage higher education institutions to provide students with the knowledge, skills and values needed to carry out their lives in an environmentally just and sustainable manner. For example, student environmental organizations should be encouraged to pressure the universities to institute change.

Communities in which higher education institutions are located should request active administration, faculty and student assistance in making their communities sustainable, and in ensuring that the university itself has only a positive environmental impact on the community.

Funders of education and research (governments, industry and foundations) should gradually shift their support over the next decade to educational efforts and research that promote environmentally just and sustainable action.

Future employers of graduates of higher education (industry, government, environmental organizations) should communicate with the leaders of these institutions about their desire to hire graduates who have the knowledge, skills and values to help move their organizations on an environmentally just and sustainable path. Future employers should immediately establish and utilize recruiting criteria and strategies that support this desire.

Professional associations should insist that environmental literacy and an understanding of sustainability be a core component of professional training, and accreditation boards should establish the ability to demonstrate and apply this knowledge as a requirement for certification.

Faculty at higher education institutions should individually and collectively work with the leaders of the institutions to create the incentives and programs that would encourage and reward faculty for research and teaching that promotes environmentally just and sustainable action. Faculty should also insist on the option of investing their retirement funds in investment vehicles that promote environmentally just and sustainable action.

Alumni and others who donate time and money to higher education should use this leverage to make environmentally just and sustainable action a goal and a central thrust of their institution's education, research, operations, investments, recruiting and community outreach. One effective way to do this is to make donations contingent on the development and implementation of an appropriate 10-20 year plan. Another is to create endowments for "systems" professorships.

All levels of government which provide subsidies to higher education (e.g., tax free status, land, equipment) should develop strategies to communicate with and influence higher education to produce a workforce that has the knowledge, skills and values to help move society on an environmentally just and sustainable path. Included must be the development of lifelong learning programs to help the workforce adapt to change.

The President's Council on Sustainable Development should initiate an effort to develop a sustained long-term partnership among all major stakeholders to help the higher education system make this transition to sustainable development in its teaching and practice. This could be initiated by a 12-18 month project in which participants from all the stakeholder groups explore the intellectual, institutional and operational changes that are necessary to make the shift, and examine cost effective, high leverage options for instituting these changes. The project could culminate in a conference of the most influential leaders in each of the stakeholder groups (e.g., university presidents, corporate CEOs, government agency heads, faculty and student leaders) to consider strategic options and recommend actions stakeholders can take to help make sustainable development a foundation of higher education.