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"Campus Ecology" Curriculum as a Means to Teach Urban Environmental Literacy

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Knowledge of a place—where you are and where you come from—is intertwined with knowledge of who you are. Landscape, in other words, shapes mindscape.
—David Orr (1999)

We now live in a time of unprecedented ascendancy of the urban ecosystem type. Soon, more than half of the world's human population will live in urban environments. The ecological effects of these three billion urban dwellers extend way beyond the boundaries of the urban core and contribute greatly to ongoing degradation of planetary ecosystem services, geologically unprecedented rates of biological extinction, and global climatic perturbation (Wackernagel and Rees 1996). The global dominance of urban environments extends well beyond their ecosystem effects, however—the history of human culture is dominated by needs and technologies defined and devised in the urban core. The urban cultural/economic/educational footprint on the hinterland is arguably many times larger than its material/energy-based ecological footprint. The next 50 years will be of telling significance to humanity because the present generation of our citizenry must redesign key aspects of our basic cultural, economic, educational, and ecological framework to reduce our impact upon our environment and transform our society into one that is just and sustainable. This is a formidable task and because of the arguments above the success of these efforts depends greatly upon how well we can affect urban ecosystem sustainability.

An international movement is currently emerging to spur political, economic, and educational institutions toward ecological sustainability (Cortese 2000; Second Nature 2000; Filho 1999). The leaders of this movement have built upon the compelling and vivid lessons from the major social change movements of the twentieth century, such as the impact of local organizing, simple direct action, and creative use of the mass media. The take-home message is that large-scale reform begins with small steps at home. As it was succinctly put by David Orr (1995), "seemingly unsolvable global problems are often very solvable if approached at the right scale and

with sufficient commitment." Thus, for me and for many others there is no better place to begin this process of cultural, institutional, and urban ecosystem redesign for sustainability than right here on the campus of higher education where we teach (Mansfield 1998).

Fundamentally the institutions of higher education are as much components of the urban ecosystems as are any other institutions in society. Therefore, the institutions of higher education contain all of the design flaws and unsustainable assumptions of the parental biosocial systems that they were designed to serve; however, higher education is also where visionary thinking and bold experimentation can be encouraged (Orr 1994; Cortese 2000), and is thereby in a unique position to wield tremendous leadership in the effort to educate our future citizenry about sustainability. According to Tom Kelly, former director of the Association of University Leaders for a Sustainable Future, "our campuses are overflowing with examples of ecologically irrational practices that are often economically and socially unsound as well.... This shadow curriculum is a constant, repetitive, and often unconscious educational force ... in many cases working against the very principles of environmental literacy that we seek to engender in our students." (Kelly 1996).

This nexus of intentions and opportunities for innovation, leadership, self-reflection, and enlightened humanitarianism embedded within a structure of deeply unsustainable institutional design and practice creates a point for intervention in the lives of the students, faculty, staff, and community members that enter the sphere of higher education. Tom Kelly (1996) observed "by identifying and analyzing those examples [of unsustainability], formulating responses, and participating in their implementation, students are empowered and emboldened to take on issues of institutional change." Thus, the goal of these efforts is to look to one's home institution not only to affect institutional change locally toward sustainability, but more importantly to teach students how and why to engage in the process of change and thereby affect change toward sustainability at larger scales.

Campus Ecology Curriculum Overview

At Widener University, I teach a course to first-semester freshmen undergraduates entitled "Campus Ecology: Environmental Stewardship for the Twenty-first Century (FRS 101)" (*http://www.science.widener.edu/~grant/courses/campus.html*). This course meets 2 hours per week and is one of about a dozen "Freshman Seminars" at Widener in an innovative program created by Dean Andrew Bushko. My campus ecology curriculum consists of activities, such as demonstrations, discussions, and guided inquiries, which explore and attempt to improve the sustainability of Widener's campus ecosystem. My course goals are to enable students to better understand:

1. The physical, biological, economic, and social processes that determine the structure, function, and ecological design of the campus ecosystem and its interaction with the natural world within which it is embedded, which is "campus ecological literacy."
2. How to use methods of scientific inquiry (observation, literature manipulation, hypothesis formation, experimental design, data collection, modeling, analysis, and presentation) to construct the knowledge of the processes in (1), which is "scientific literacy."
3. Why and how to engage in the process of institutional change to move one's campus toward an ecologically just and sustainable ecosystem design, which is "human environmental literacy."

Ecological and human environmental literacy are sometimes used interchangeably; however, I prefer to restrict "ecological literacy" to understanding the system of multidisciplinary interactions described in (1). Developing ecological and scientific literacy equips one with the skills to read signposts of unsustainability (climate change, biodiversity loss, and environmental degradation), and identify ecological flaws in the social, economic, and political systems we have devised to interact with the natural world that have created these signposts. "Human environmental literacy" on the other hand, imposes the broader responsibility to use ecological and scientific knowledge wisely in personal decisions about how we interact with our environment, through both our consumer and disposer decisions, and requires our participation in the process that we all must undertake in our transition to a sustainable society. Environmentally literate people accept the realization that as authors of signposts of unsustainability, each of us has a profound moral obligation to act responsibly to correct what we have written. Human environmental literacy is thus synonymous with citizenship in its broadest sense.

Course Introduction

I begin the course by reading David Orr's foreword to Julian Keniry's *Ecodemia* (1995), including:

> creative and ecologically smart management can: reduce institutional operating costs; improve the quality of services ranging from food . . . to lighting; reduce waste and ecological impacts; rejuvenate local economies. . . . The fact that it is also the right thing to do is either an added bonus or the heart of the matter depending on your point of view . . . (Orr 1995).

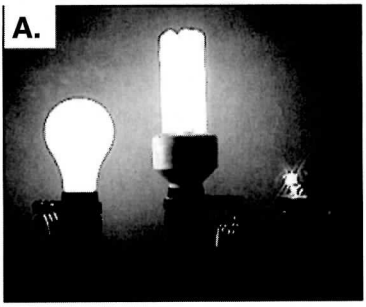
I then lead a discussion of the ecological design of our classroom. Topics span a wide range of issues including lighting efficiency, motion detecting on/off switches, room heating and cooling issues, single pane glass windows, materials recycling versus "trash removal," toxics, and so on. My intention is to use the first class to expose students to the basics of making observa-

tions and asking questions on a very small scale. Then, we close with the message that once these skills are learned, they can be applied to systems of any scale.

Greening Our Lighting

We compare an 18-watt compact fluorescent bulb with 15- and 75-watt incandescent bulbs (see Figure 22.1a).

1. Students learn how each bulb makes light (incandescent lightbulbs produce light by heating a metal filament, whereas the compact fluorescent bulbs excite gasses to glow). I ask students to bring their hands near each lightbulb so they can feel the intense heat from the incandescent bulb, whereas the compact fluorescent bulb wastes very little energy as heat.
2. Students learn how to read an electric utility bill, and by making a few assumptions about lighting use, we calculate and compare the purchase and operations costs of each bulb (see Figure 22.1b). I show that the "payback time" to compensate for the higher purchase cost (about $15) of the compact fluorescent bulb is only a few months (Figure 22.1c). Thus students learn that one can reduce environmental costs and save money at the same time. Most students have never seen this type of demonstration before and are now less prone to the misinformation that environmental protection will always prove financially costly. In fact, many ask why everyone doesn't replace their incandescent bulbs with compact fluorescent bulbs. This leads to a discussion of how to design lighting fixtures and the recognition that most people are simply unaware of how to do these calculations and are wasting money and energy through ignorance. These are powerful lessons.
3. We then sketch out a system diagram of campuswide energy flow, and we discuss what one needs to know and how to pursue this analysis. Students also learn several case histories of energy-efficient lighting systems that have been adopted by campuses elsewhere (Keniry 1995; NWF 2000).
4. We then turn our attention to off-campus and discuss regional energy generation and carbon emissions from fossil fuels, the global carbon cycle, the greenhouse effect, acid rain, and other airshed pollution issues. Also, because about 40 percent of electricity in Pennsylvania is from nuclear power, we also discuss radioactive waste issues and the nuclear energy fuel cycle. We also discuss the science and economics of "alternative" renewable energy sources (hydroelectric, geothermal, solar, and wind power).
5. Last, we address the question of energy supply and demand. Shortages in energy stem from demand in excess of supply—but the question is, How do we respond to this? If one sees the shortage solely as a supply problem, then the solution is to increase supply. Because a sustainable society must rely on a finite base of renewable energy sources, however, our energy shortages must be ultimately solved by engineering finite energy



B.

incandescent bulb (75W)

$$\frac{75\,W}{1} * \frac{10\,hr}{day} * \frac{30\,days}{month} * \frac{\$0.13}{kWhr} * \frac{1\,kW}{1000\,W} = \frac{\$2.93}{month}$$

compact fluorescent bulb (18W)

$$\frac{18\,W}{1} * \frac{10\,hr}{day} * \frac{30\,days}{month} * \frac{\$0.13}{kWhr} * \frac{1\,kW}{1000\,W} = \frac{\$0.70}{month}$$

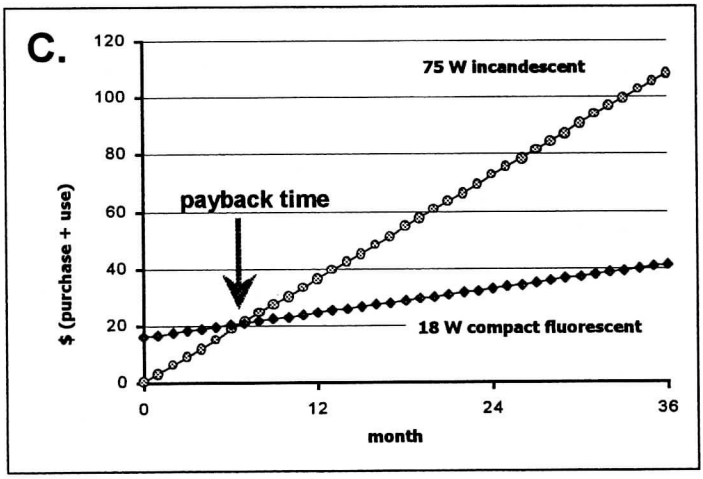


FIGURE 22.1. Greening our lighting. (A) Comparing a 15-watt compact fluorescent bulb to 15- and 75-watt incandescent bulbs. (B) Calculation of operations costs for ten hours/day, and (C) monthly sum of purchase plus use costs show that only a few months are required to "payback" the initially higher purchase cost of the compact fluorescent bulb.

demand, not by perpetual increases in supply. From this example, students glimpse the changes that are needed in world view to devote our efforts and technologies to a strategy of sustainability.

Greening the Paper Trail

We compare new paper from pine tree pulp with several grades of recycled paper and paper from alternative pulp sources.

1. Students compare the appearance, uses, and prices of various types of recycled paper, and we compare these to paper from several alternative paper sources (hemp and kenaf).

2. Students learn how much of what type of paper is used on campus per year for various purposes (of the 20 million sheets of white office paper Widener purchases every year, less than 1 percent contain any recycled fibers), where we obtain our paper, and where our paper goes once used. Students also learn several case histories of recycling and "closed-loop paper flow" that have been adopted by campuses elsewhere (Keniry 1995; NWF 2000).

3. We discuss the environmental costs of paper production processes. For new paper, we discuss forestry management issues of pulp production (biodiversity loss, habitat and watershed degradation, economic subsidies to the forest industry, etc.). Waste production for all paper also stems from the bleaching process (chlorine versus nonchlorine methods), and for recycled paper bleaching depends on the inks used and consumer demand for whiteness (e.g., soy-based inks, etc.). Students also learn about the economics of pricing of new versus recycled paper and learn that not all environmental costs have been adequately included in the consumer price of new paper. Most students have never heard of the difference between "internalized" costs and costs of market "externalities." This is a fundamental issue to the pursuit of sustainability, in which all prices of goods and services should reflect their true environmental costs. Students also learn that the external environmental costs of pulp production and paper bleaching are disproportionately borne by those living immediately downstream or downwind of these activities. This becomes an important opportunity to include issues of environmental justice. The lesson is that in a just and sustainable society, all people have equitable access to resources and no groups are disproportionately exposed to risks from waste.

4. We discuss the environmental costs of paper recycling versus disposal processes. Students generate a mass-flow system diagram to account for the 20 million sheets of white paper we purchase per year. Most of this paper ends up in a nearby incinerator in the Chester, Pennsylvania area, which is not known for its environmental sensitivity to its neighboring residents. This becomes another important opportunity to engage students in issues of environmental justice, especially since many of the recyclables that our campus does *not* recycle on a large scale (including paper, glass, metals, etc.) end up in the Chester incinerator and subsequently may contribute to reduced air quality and other toxicological concerns in our region.

5. We discuss the economics of paper recycling (and other materials) by comparing prices per ton of white, mixed, newspaper, and so on, and students learn some of the challenges to implementing recycling programs on our campus. In fact, this year several pilot programs are presently being developed at Widener to increase the flow of materials to local recycling centers. Students in my class are excited to learn of the immediacy and fledgling nature of these programs.

Brief Listing of Additional Green Topics

1. Greening the Grounds: I take the class on a campus grounds tour, and we examine issues in landscape design and management for sustainability.

Our campus lawns are dominated by a nonnative grass, have highly compacted soils, and are depauperate in invertebrates. We discuss the resulting effects on decomposition, soil nutrient cycling, runoff, and aquatic ecosystem stress and human health concerns downstream (another environmental justice issue). Students examine several model projects at other campuses.

2. Green Food: We examine campus food services in the main dining hall and in the numerous campus vending machines.

Students learn from where we get our food, and several key issues in agricultural practice (organic vs. nonorganic food, biotechnological foods, etc.). Students also learn key issues in food transport, food preparation and processing costs, and ecological footprint analysis (Wackernagel and Rees 1996). We also study the fates of waste food and the interconnections between food and nonfood solid and liquid waste streams.

3. Greening Transportation: We discuss how students get to school and from where they come.

We examine the economics of alternative modes of travel and the environmental issues surrounding transportation, including personal lifestyle choices about car size and patterns of use and larger-scale issues of urban sprawl.

4. Green Building Design: In this activity, we examine several web sites dedicated to sustainable buildings and the notion of "architecture as pedagogy" (Orr 1993).

According to David Orr, the intention of a new environmental studies building at Oberlin was to "create not just a place for classes but rather a building that would help to redefine the relationship between humankind and the environment—one that would expand our sense of ecological possibilities" (Orr 1998).

5. Hazardous Waste Issues:

The activity is for students to perform an "environmental audit" of the hazardous waste stream by documenting sources and sinks, exposures, and human health risks; and to analyze the efficacy of reduction initiatives. This is a problematic facet of this curriculum and should be approached with great care. The principal challenge is in gathering accurate data. Although I have had success with simple toxics issues (e.g., battery recycling), detailed toxicological studies require equipment and training beyond my reach. In addition, there is the possibility that students might uncover serious potential risks to toxic exposures, especially in older campus buildings. Without proper methods, however, the realities of these concerns are difficult to determine. I do not mean to argue that one is better off not knowing about

these exposure risks; my point is that unless the data are really good, such a program is neither effective nor likely to engender administrative support. This last point is extremely important to devising a strategy of change, and I will return to this issue of operational ethics shortly.

Green Initiative Projects

These are original research projects in campus ecosystem design that students create and conduct.

1. Students learn the methods of science to pose questions, collect and analyze data (collaborating with campus operations officers), and draw conclusions. At the end of the semester, students present their results to their peers in an in-class symposium.
2. Students also learn how to devise and generate policy recommendations based on scientific data to submit to campus administrators, faculty, and other students with the aim of implementing their green initiatives. Through this process, they also learn that the viability of any particular recommendation, regardless of its environmental merit, is often deeply constrained by "economic and social reality" as defined by others. This provides powerful lessons about the process of institutional change and the diversity of individual stakeholder perspectives.

Related to this, I advise that great care must be taken to manage interactions between students and stakeholders (especially campus administrators). I advise setting clear ground rules to all contacts, and using role-playing activities in class. Students also should be made aware of the importance of following chains of command and of carefully noting what and when requests were made of the different stakeholders involved. Lastly, the instructor must follow up outside of the course to make sure that summary reports of students' projects are delivered to the appropriate people.

The projects in my freshmen course differ in two ways from projects in most other courses that I have examined (Second Nature, 2000, posted more than 500 course syllabi on campus ecology and sustainability. First, the goals of the projects in my course are (1) for students to understand the campus human ecosystem, (2) to understand the inquiry process of designing and conducting a project to improve campus sustainability, and (3) to understand why this is an important thing to do. The success or failure of any particular student in the class cannot be rigidly linked to their project's implementation because follow-up is a separate issue beyond the scope of this course. In fact, most of the other comparable courses are designed either for upper division undergraduates with declared majors (e.g., environmental science, studies, or environmental engineering) or for graduate students, whereas my students are freshmen from diverse programs and many are still undeclared. The fact that many of my students' projects are

often continued by another student in a subsequent year or by students in Widener's student Environmental Club, or contribute to pilot programs by the university, is an added bonus (my students' projects are listed on the course web site at *www.science.widener.edu/~grant/courses/campus.html*). For my freshman course this cannot be a reasonable goal, however, and the students need to be made aware of that. I will return to this critical issue of "course outcomes" later.

The second way in which my course differs from many others is that I require students to select projects that serve the dual purpose of reducing campus environmental costs and campus operations costs. Admittedly, this can greatly constrain steps toward sustainability, but this becomes an important opportunity to show that green investment pays (Creighton 1998; Eagan and Keniry 1998) as well as to promote strategic thinking to build coalitions among diverse stakeholders to create change. I will return to this important ethical issue shortly.

Connection to Urban Environmental Literacy

Campus ecology curriculum teaches urban ecosystem ecology in microcosm and thereby enables students to attain urban environmental literacy. I have grouped the basic components of urban environmental literacy into four categories. Each of these components is either directly (**) or indirectly (*) educed in students through studies of campus ecology such as in my course.

Urban environmental literacy is:

1. Urban Ecosystem Science:
   People need to understand:
   - ** how materials flow to, cycle throughout, and are exported from the urban ecosystem (such as water, nutrients, wastes, toxins, etc., moving through and transforming in air, water, soil, and living organisms), and how these flows change along the urban-rural gradient (McDonnell, et al. 1993);
   - ** how energy flows to, throughout, and from an urban ecosystem;
   - ** how different types of materials and energy interact as they move through the urban ecosystem, and how to engineer ecosystem mass and energy flow to serve human needs and prevent human distress;
   - ** urban wildlife ecology (individual, population, evolutionary, and community), urban forestry science, urban biological conservation and management, and so on (Nilon and Pais 1997);
   - ** agriculture in urban environments (Smit, et al. 1996);
   - ** ecology of disturbance, fragmentation, and the roles of exotic species (Foresman, et al. 1997);
   - * urban disease epidemiology (brownfields and public health connections, urban ecotoxicology, and the dynamics of human pathogenic epidemics);

** systems thinking necessary to understand how ecological systems are modeled; and
* the importance of temporal and spatial scales in modeling ecosystem processes (Grove and Burch 1997).

2. Urban Social Ecology:
People need to understand:
** how people form and prioritize their resource and service needs, and then act upon them through patterns of consumption, investment, resource use, waste production, and disposal decisions—which in turn affect ecosystem energy and mass flow to, through, and from urban ecosystems and the biophysical component of the urban ecosystem (Grove and Burch 1997; Pacala 1993);
** the diversity of stakeholder perspectives and abilities to control access and affect the decisions above (Grove and Burch 1997);
** the effects of local and global economics (especially pricing and marketing), public policy, and law upon the above, and the transformation of materials through industry into goods and services (complexly linking energy and labor with mass flows, as well as complexly linking local and distant markets) (Mander and Goldsmith 1996);
* human demography (including occupational and epidemiological effects) and the consequences of demography on resource use needs and decisions;
* the causes and consequences of the spatial distribution of domestic, service, and industrial development, and the resulting challenges to personal and commercial transportation, utility infrastructure, and residual "greenspace" management (Grove and Burch 1997);
** the causes and consequences of social inequity (e.g., inequitable investment in ecological quality and unjust occupational and domestic exposure to human health risks) (Dorman 1996; Grove and Burch 1997); and
** the operative social constraints on the process of inter- and cross-disciplinary problem solving in improving human ecosystem design. How to build consensus and devise a viable "pedagogy for change"?

3. Science Educational Literacy:
People need to understand:
** how to use the methods of scientific inquiry (observation, literature manipulation, hypothesis formation, experimental design, and data collection, analysis, and presentation) to construct an understanding of urban ecosystems (i.e., understand what scientists do) (Hogan 1994); and
** how to use the urban environment to teach about ecology (immersion experiences in city parks and preserves, wildlife observations [e.g., bird feeders], stream studies, urban gardening, etc.) and engen-

der in urban dwellers a sense of place in the natural world beyond the myopia of the built world (Orr 1994).

4. Urban "Land Ethic":
   People need to understand:
   ** that "a thing is right when it tends to preserve the integrity, stability, and beauty of the biotic [i.e., urban biosocial] community. It is wrong when it tends otherwise" (after Leopold, (1949, "biosocial" from Grove and Burch 1997, see also Callicott 1992);
   ** that at present we live in an ecologically unsustainable society based upon deeply flawed ecological assumptions, and we have a seriously degrading global environment as a result—especially in urban areas;
   ** that each of us has a profound moral and ethical obligation to act responsibly to rewrite our legacy, redesign the principal human ecosystem networks through which we interact with each other and with the natural world, and reduce our ecological "bootprint" and increase global social and environmental justice; and
   ** that transforming our urban environments into sustainable, safe, just, and desirable places to live is key to the flourishing of humanity in the new millennium.

Conclusion

My campus ecology course is one of hundreds that are intended to teach human environmental sustainability, which for me at Widener is synonymous with urban sustainability. My principal hope is that readers will be inspired either to adopt this course model, or find some other way to contribute to sustainability curriculum. In closing, I wish to discuss what I feel are the principal challenges to implementing any kind of "green campus" curriculum.

The Goal

If the overarching goal is to move us all toward human environmental sustainability (urban included), what steps do we take next? Campus ecology curriculum reveals a deep ethical conflict embedded in our society—the tension between actions based on rights/duties versus actions based on consequences/economic utility. Many "green initiatives" offer little help in navigating this maelstrom. For example, in our efforts to wean ourselves off of fossil fuels, certain economies of scale might suggest that it would be financially expedient to create centralized alternative energy sources (administered by the existing utility infrastructure); however, this may also maintain the socioeconomic sacrifice zone approach to resource access and risk management that have created widespread and often tragic examples of envi-

ronmental injustice. Thus, utilitarian ethical constructs alone would provide no guarantee that switching from fossil fuels to alternative renewable sources is going to move us any closer to a just and sustainable society, depending critically upon how costs and benefits are calculated. The point is that little will have been accomplished if human suffering and inequity are hardwired into the new and more "efficient" biosocial ecosystem diagram. Clearly, this argues that issues of social justice, rights, and duties to others should be incorporated into our conception of any "green initiative" and form a basis of our intention with any "green action" (i.e., included in the calculation of utilitarian cost and benefit). Yet this is exactly the complaint of many who dismiss sustainability for being "a Trojan horse admitting radical environmental values" into economics and policy (Owens 1994; Burgess, et al. 1998) and marginalize issues of equity and environment while focusing on sustaining business growth (Eden 1994).

I raise this concern in my campus ecology class with the requirement that all of my students' projects must meet the dual goals of reducing campus environmental costs and reducing operations costs. I tell my students that we first need to build a track record of financial success to engender administrative support, and that by saving tuition we will attract student support. Many other campus ecology courses implicitly advocate the same ethic, and indeed a great deal of money has been saved. This bizarre ethical argument (based on a teleological suspension of belief), however, subtly teaches students that if justice is to be served, it must follow the saving of monies. Similar to Tom Kelly's shadow curriculum, this is a "shadow ethic"—we profess intentions of sustainability, but our actions speak to economic utilitarian efficiency without necessarily any real confrontation of the inequitable and unsustainable underlying assumptions. The shadow curriculum is the result of an unsustainable ethical model; are we responding to this challenge with an ethic that in fact casts a deeper shadow? As Einstein said, "We can't solve problems by using the same kind of thinking we used when we created them" (quote brought to my attention by Tony Cortese). In sum, the pedagogical challenge here is to engineer a curriculum (a path) that strategically builds a coalition to effect campus reform toward sustainability while illuminating the right reasons why. Intentions matter.

How Do I Know That My Students Are Attaining My Course Goals?

Unfortunately, the answer to the above question is that I do not know. My ignorance, however, is not unique among faculty whose campus ecology courses I have examined on the Second Nature web site. Too often, successes are measured in anecdotes or in terms of financial savings (see above). I think there are three categories of needs to address this question.

First, a clear set of learning outcomes and standards for campus ecology should be developed, which must map throughout the loop of goals → outcomes → activities → assessments → and back to goals. These outcomes and standards should also be aligned with urban environmental literacy components, such as the list I presented earlier. Second, many more research models specific to green campus initiatives must be published, with tools for assessment and course evaluation, that would enable faculty to pick up and use educational research methods to learn what worked and why in their classes. Last, whatever standards, assessments, and evaluations are developed must encompass courses designed to span a wider range of students. According to the Second Nature web site, my course is only one of five course syllabi (out of more than 500) that specifically target freshmen undergraduates, and mine is the only course designed for freshmen of any major. This discrepancy suggests that we need to think much more broadly, and strategically, about whom we want to attain human environmental literacy, and pool efforts accordingly.

Building Links to Urban Ecological Science, Urban Environmental Education, Social Justice Movements, and "Citizenship"

Despite the daunting challenges posed above, there are several promising directions for solving these challenges. First, there are many excellent service learning course models (e.g., at Brown University, the University of Pennsylvania, Middlebury College, Allegheny College, Antioch College, and others) that engage students in projects in the local community of their campuses. I look forward to research into student learning outcomes carried across these types of projects and in comparison to more campus-based ones.

Second, and perhaps more important, to be alive now is to participate in the period of the most rapid social, cultural, economic, and ecological change in all of human history. As we begin the third millennium of our calendar, we are witnessing monumental and long-awaited movements toward unity—such as the globalization of the economy (and the concerned dissention from the unified voice of major environmental and labor movements). A similarly monumental act of coalescence is occurring among the fields of ecological science, environmental education, and social justice—under the banner of sustainability. I enjoin that the urban environment shall be the proving ground of our understanding of sustainability—and, given the dominance of the urban ecosystem type in our world, this must be so.

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