PENN STATE INDICATORS REPORT -2000-

Steps Toward A Sustainable University

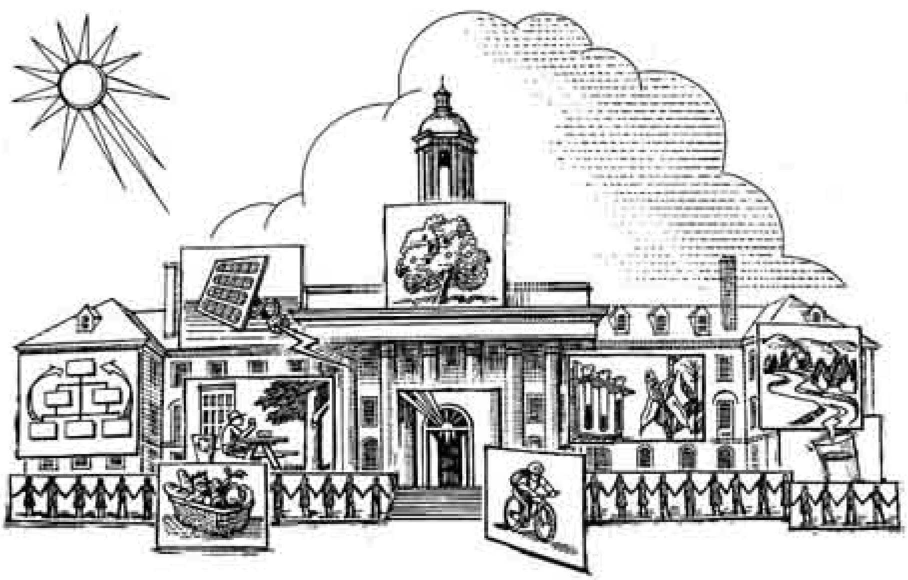
Penn State Green Destiny Council

sus·tain *vt.* 1. to keep in existence; keep up 2. to maintain; specif. to provide sustenance or nourishment for --*SYN*. support—sustain'a/ble *adj*.--sus.tain'/er *n*.

sus·tain·able uni·ver·si·ty *adj., n.* 1. university whose long term prospect for continuing to exist is good; specif. such a university behaves in ways that sustains the integrity and biodiversity of the local and planetary ecosystems upon which all life depends 2. a university whose core values include: respect for the biota and natural processes, mindfulness of place, living within planetary limits, accounting for full costs, and civic responsibility 3. The kind of university that PENN STATE is striving to become.

The paper used in this report was made using 100% post-consumer recycled paper and is chlorine-free.

Whatever you can do, or dream you can,
begin it.
Boldness has genius, power and magic in it.
J. Goethe



An Invitation to the Penn State Community

This report is intended for a wide range of readers--students, staff, faculty, administrators, and members of the community at large. It reflects the University's growing commitment to environmental stewardship and builds on the literally hundreds of initiatives undertaken by University staff to promote sustainable practices.

We hope that those who read it will consider how they might contribute to making Penn State more sustainable. We invite faculty to use this report in the classroom. Indeed, the content has relevance to almost every discipline offered at Penn State from engineering and architecture through business, philosophy and ethics to the natural and social sciences.

We especially invite students to use the ideas contained herein as a starting point for new research projects or as jump-off points for concrete actions to promote sustainability at Penn State. For assistance, contact Matt McLaughlin (Student Coordinator for Indicators Project) at mxm495@psu.edu or Christopher Uhl (Faculty Coordinator) at cfu1@psu.edu. We also invite you to visit the Green Destiny website at: www.bio.psu.edu/greendestiny

TABLE OF CONTENTS

EXECUTIVE SUMMARY

We live in an extraordinary moment in history—a period flush with opportunity but fraught with uncertainty. Age-old values and traditions are being pushed aside as a cacophony of new ideas competes for our attention. In such times universities can play a special role. We rely on them to serve as anchors—places of reflection and moral integrity, as well as loci of questioning and innovation.

As we look at the world, we see a finite planet being overwhelmed by humans. Our numbers have doubled in the last 40 years and will increase by several more billion before there is any hope of stabilization. As population mushrooms, the seemingly insatiable human drive to consume has accelerated rather than abated. Human activities have degraded many of earth's life support systems: soils are thinner, ground water increasingly polluted and scarce, the atmosphere tainted, and many plant and animal species endangered. This is not alarmism; it is a cool-headed summary of what our best scientists have been telling us for two decades.

A while back, humans imagined that they could take from the earth forever. Now we know that earth's bounty is limited and cannot be taken for granted. The solution to our problems is not continual growth, as we once thought, but sustainable living—an approach to life that is mindful of limits and that emphasizes quality rather than quantity. The concept of sustainability—meeting present needs without compromising the ability of future generations to meet their needs—challenges us to pay attention to the myriad ways in which we depend on the earth.

This report examines sustainability at Penn State using 33 different indicators distributed among 10 University "systems." These systems include, among others, energy, water, food, transportation, and decision-making. For each indicator we present data that attempt to gauge if Penn State is moving toward sustainability. For example, Penn State has taken many steps to encourage and facilitate recycling on campus, an indication that the University is moving toward sustainability for this indicator.

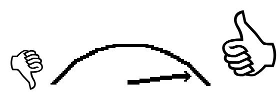
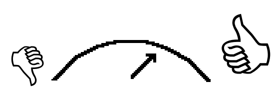
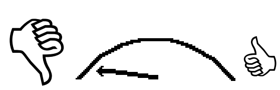
Examining an institution through the lens of sustainability invites us to think about values. The values associated with sustainability are age-old precepts that are both sensible and uplifting. They include a respect for the biota and natural processes, the exercise of mindfulness of place, a commitment to live within limits and to consider full costs, and the assumption of civic responsibility.

A team of 30 students (both graduate and undergraduate) and several faculty mentors and young professionals conducted the research presented here. The members of the research team displayed great tenacity and creativity in collecting the data for the various indicators. They visited the Somerset County landfill that receives Penn State's trash, journeyed to the open pit mines near Dubois that provide PSU's coal, and walked through the local well fields that supply the University with water. And this was just a start. They went on to look into campus dumpsters to see what was being thrown away, to examine the food offerings in the dining halls, to study land transactions at the County deeds office, to calculate the loss of campus green space using maps in Pattee Library, to determine the numbers of exotic vs. native plants on campus through botanical surveys, to characterize the ecological literacy of graduating PSU seniors by administering questionnaires, and much more. These researchers conducted not an abstract educational exercise, but rather engaged in face-to-face interactions with Penn State's complex and often invisible support systems and the people responsible for running them.

The intent of this report is not simply to supply answers but to raise questions. The questions center on ecological responsibility, research ethics, the wisdom of continual growth, the openness of decision making, the uncritical acceptance of technology, and the moral responsibilities of the University—in short, questions that are worthy of the attention of all vital institutions.

Overall, the Report depicts an institution whose performance on sustainability indicators is not exemplary, but mediocre (and quite typical of other large universities) (Table 1). Ample evidence exists, however, that Penn State is becoming aware of what needs to be done. The report describes many examples of measures that Penn State has taken to become more sustainable. While reassuring, these steps still fall short of the bold and far-reaching initiatives that will be required to address the sustainability deficit at Penn State.

Table 1. Summary of Results from the PSU Indicators Report 2000.

Rating Criteria	Grade Scale	Number of Indicators
• The University has a comprehensive strategy to adopt sustainable practices; high profile issue with strong leadership.		0
• The University has taken many significant measures to adopt sustainable practices but still lacks a comprehensive strategy.		16
• The University has taken only limited measures to adopt sustainable practices.		13
• The University has taken no significant measures to adopt sustainable practices.		4

The Report details thirty concrete steps that Penn State should consider in its quest for truly sustainable practices and concludes by laying out the elements of a comprehensive ecological mission for Penn State.

THE PENN STATE INDICATORS REPORT
2000

The first edition of the Penn State Indicators Report (1998) attracted national attention. Never had a university sought to forthrightly examine itself through the lens of sustainability. This 2000 edition of the Report offers: updates on all the indicators; eleven new micro analyses (presented as boxes); a new, more didactic system for evaluating the indicators; and a concrete set of proposals aimed at defining Penn State's emerging ecological mission.

Introduction

Over the past fifty years, humans have slowly awakened to three sobering problems:

- The first is the problem of rapid growth, most stunningly illustrated by the explosion of the human population, but exhibited just as dramatically in scores of production, consumption and waste trends.
- The second problem is that the earth is essentially a closed system--a blue planet, with an atmospheric blanket, orbiting a star; planetary resources are finite and there are incontrovertible limits to growth.
- The third problem is that the large and growing human population is profoundly disrupting planetary dynamics. We have already experienced these disruptions in the form of wide-scale acid rain, ozone layer thinning, and extinction of species.

These problems—rapid growth in consumption and waste as human numbers increase, the earth as a closed system with finite resources, and humanity's growing, planetary-scale disruptions of earth processes—are sensitizing us to the fragility of our home planet, but human alteration of the Earth continues (See Box).

Human Domination of the Earth's Ecosystems

The lead article in a recent issue of Science Magazine described the magnitude of human alteration of the Earth as follows:
"Between one-third and one-half of the land surface [of the Earth] has been transformed by human action; the carbon dioxide concentration in the atmosphere has increased by nearly 30% since the beginning of the Industrial Revolution; more atmospheric nitrogen is now fixed by humanity than by all natural terrestrial sources combined; more than half of all accessible surface fresh water is put to use by humanity; and about one-quarter of the bird species on earth have been driven to extinction…All of these seemingly disparate phenomena trace to a single cause—the growing scale of the human enterprise. The rates, scales, kinds, and combinations of changes occurring now are fundamentally different from those at any other time in history; we are changing Earth more rapidly than we are understanding it…In a very real sense, the world is in our hands—and how we handle it will determine its composition and dynamics, and our fate" Vitousek et al., 1997.

Vitousek and his Stanford colleagues are not alone. Indeed, there is a growing consensus among intellectual leaders throughout the world that all is not well. Recently, 102 Nobel Laureates in Science and 1600 other distinguished scientists from 70 countries issued this statement:

> *"Human beings and the natural world are on a COLLISION COURSE…If not checked, many of our current practices put at serious risk the future that we wish for human society community…A great change in the stewardship of the earth and the life*

on it is required, if vast human misery is to be avoided and our global home on this planet is not to be irretrievably mutilated." World Scientists' Warning to Humanity, 1992 and 1997

The research coming out of our universities confirms the seriousness of our planetary situation. Atmospheric chemists report steady rises in greenhouse gases; soil scientists report that our farm soils are eroding in many places more rapidly than they are forming; human physiologists tell us of increases in foreign, perhaps disease-causing and reproduction-impairing, chemicals in our bodies; ecologists register the impoverishment of ecosystems and the extinction of species; sociologists report the breakdown of families and the deterioration of communities; and philosophers and theologians observe the erosion of moral principles and the alienation of humans from the natural world.

This report is concerned with the opportunities and responsibilities that Penn State has in these troubled times to serve as an anchor of wisdom and moral integrity and a locus of creativity and innovation.[1]

Goals and Definitions

"Sustainability means living, working and behaving in a way that will sustain the integrity and biodiversity of the local, regional and planetary ecosystem upon which all life depends." Guy Dauncey

Sustainability needs to become a central organizing idea for higher education—a whole-systems framework within which a broad range of environmental, technological, and cultural problems can be discussed and addressed. The sustainable practices necessary to move off our "collision course" require our civilization's major institutions, including universities, to adhere to five principles (See Box).

Principles of Sustainability

- *Respect Life*
  Avoid actions that harm the integrity, stability, and beauty of the biotic community upon which we all depend.
- *Live within Limits*
  Recognize that our natural resources are finite endowments to be used with care and prudence at a rate consonant with their capacity for regeneration.
- *Value the Local*
  Help to create strong local and regional economies that respect the natural and cultural components of our neighborhoods, communities, and watersheds.
- *Account for Full Costs*
  Recognize that product prices should reflect "full costs" and confine purchases, to the extent possible, to enterprises and products that embody sustainable practices and full-cost accounting.
- *Share Power*
  Realize that people, biota, and the physical world are interconnected, and that problems are best solved through processes where all voices are heard and civil exchange is nurtured.

---

[1] Since 1980, university presidents, historians, philosophers, and teachers have written a series of remarkable books, analyzing the rapidly changing university environment. For those wishing to dig deeper, we recommend: Bok (1982), Wilshire (1990), Smith (1990), Getman (1992), Pelikan (1992), Solomon and Solomon (1993), Tierney (1993), and Orr (1992, 1994).

Though the concept of sustainability is relatively new, the substance of its five principles is already embedded in societal values. What is "respect for life," but appreciation of life's magnificence and mystery? "Living within limits" embodies the traditional values of frugality and thrift. "Full-cost accounting" emphasizes the value of honesty and complete disclosure. "Respect for what is local" honors history and traditions, and "sharing power" is, of course what democracy is all about.

A bit of reflection reveals, however, that many aspects of modern consumer-based culture violate these sustainability principles (Table 1). This culture fails to deeply *respect life*, often regarding the natural world as raw material for human ends. It fails to *live within limits*, emphasizing ever-increasing consumption and often viewing natural resource supplies as infinite. It generally neglects to *account for full costs*—selling goods at prices that often fail to reflect their environmental and social costs. It frequently damages *local* economies, traditions, and cultures in a rush for global competitiveness and short-term profits. And, finally, it fails to *share power* in any meaningful way—regarding citizens as mere "consumers" while increasing the centralization of capital. Our universities, Penn State included, mirror the nation; thus, they are failing to lead the nation to a sustainable future.

Table 1. Sustainability principles in consumption-based cultures.

PRINCIPLE	SUSTAINABILITY-BASED CULTURE	CONSUMPTION-BASED CULTURE
Respect Life	Humans understand themselves as embedded in and interconnected with the Earth's ecosystems.	Humans understand themselves as manipulators of life; the earth is generally regarded as a resource pool to be exploited.
Live within Limits	There ARE limits to growth and consumption; resource supplies are finite.	There are NO limits to growth and consumption; resource supplies are infinite.
Value the Local	Emphasis on the local economy, face-to-face interaction, and community identity.	Emphasis on the global economy and mass culture.
Account for Full Costs	Decisions are based on full-cost accounting; concern for future generations.	Decisions based primarily on narrow economic concerns; focus on present generation only.
Share Power	Power and wealth are shared; Citizenry empowered and influential.	Power and wealth are concentrated; citizenry passive and without significant influence.

The solution to the ecological crisis the Nobel scientists have alerted us to rests on moving from unsustainable to sustainable practices. As a highly influential educational institution, strategically placed and visible, Penn State can contribute significantly by example, to creating a sustainable world.[2]

Tracking Sustainability at Penn State

As a society we measure what we value. So it is that Penn State has traditionally put effort into tracking academic, research, and economic performance. Things look pretty good at University Park based on these traditional measures of University performance. Penn State scores reasonably high in peer reputation, SAT scores of incoming freshmen, size of

[2] Fortunately, university leaders are beginning to recognize the importance of promoting sustainable practices. A recent report by the Association of Governing Boards of Universities and Colleges listed "creating sustainable society and future" among the top policy issues for higher education.

endowments, number of government research contracts, percentage of Ph.D.s on the faculty, and winning football seasons. But these traditional measures are not telling the full story, for they fail to recognize the University's strong dependence on the physical and biological world and to consider PSU's performance in this broader context. What is needed is a measurement system for Penn State and other universities in which sustainable practices are highlighted (See Box).

A New Ranking System for Colleges and Universities

In a recent article, David Orr (1999), proposes to rank colleges and universities based on whether they move the world in more sustainable directions. He employs five criteria as follows:

1. *What quantity of material goods does the university consume on a per capita basis?* (e.g., How much paper and water is used per student? How much CO_2 is released per student for electricity and heating needs?)

2. *What are the university/college management policies for materials, waste, recycling, purchasing, landscaping, energy use, and building?* (e.g., Is there a priority to use recycled materials? Is the use of toxic chemicals kept to a minimum?)

3. *Does the curriculum engender ecological literacy?* (e.g., Do graduates know the "stories" behind their food, water, and discarded materials? Are there opportunities to restore local rivers and degraded lands?

4. *Do university/college finances help build sustainable regional economies?* (e.g., Do food purchases come from regional farms? Are endowment funds invested in enterprises that employ sustainable practices and produce goods that truly benefit society?

5. *What do the graduates do in the world?* (e.g., Does the work they do contribute to a sustainable culture?)

This report lays the foundation for a new measurement system by examining Penn State's performance and well-being through the lens of sustainability. We track energy consumed and waste discarded per person. We examine Penn State's policies and performance in water conservation, recycling, purchasing, landscaping, energy use, building design, and research ethics. We take a hard look at Penn State's food and transportation systems and ask if they are moving the University in a sustainable direction. We check to see if Penn State's institutional power is being used to strengthen regional economies and promote corporate responsibility, and much more.

In organizing the information contained in this report, we have divided the functioning of PSU into ten categories. Each of these categories (e.g., Water, Food, Transportation, etc.) comprises a chapter of the Report. For each category (chapter) we examine several indicators (Table 2) that have clearly traceable links to sustainability. Several criteria were helpful in choosing and developing indicators. Good indicators: 1) address what is fundamental to the long-term educational, economic, environmental and/or social health of a community; 2) are understood by the community and accepted as valid signs of well-being or symptoms of distress; and 3) are easily measured (Sustainable Seattle, 1995).

Table 2. Penn State in ten categories and the Indicators of Sustainability for each category.

PSU CATEGORIES	INDICATORS OF SUSTAINABILITY
Energy	-Total and per capita energy consumption -Consumption of natural gas vs. coal on campus -Carbon dioxide emissions
Water	-Total and per capita water consumption -Ground water quality -Waste water disposal
Material Resources and Waste Disposal	-Total waste production -Recycled solid waste -Paper consumption
Food	-Dining hall diet -Dining hall waste -Food purchasing policies
Land	-Land accumulation and policies -Impervious surfaces -Native vs. exotic plants on campus -Pesticide use in land care
Transportation	-Car dependence -Green space converted to parking space -Transport-related safety
Built Environment	-Building decision process -Building priorities -Ecological design in buildings
Community	-Ecological literacy of graduating seniors -Technology: Enhancing vs. undermining community vitality -Student crime -Student alcohol consumption -Student depression
Research	-Ethical treatment of research subjects -Disposal of laboratory wastes -Research on sustainability -Research priorities
Decision Making	-Core values guiding decisions -Openness

Often, the data for the indicators can be plotted, and depending on the trends over time, “indicate” a movement toward or away from sustainability. For example, we will show that the percentage of solid waste recycled at Penn State has increased since 1992—a trend toward sustainability.[3]

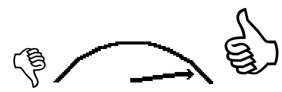
---

3 Some of our indicators are quantitative while others are qualitative (e.g. they focus on policies, values, priorities, attitudes, and university culture). A few reviewers encouraged us to limit our analysis to the strictly numerical indicators, but in the course of this study we came to see that sustainability is much more than millions of BTUs saved or tons of paper recycled. Indeed, it is a whole way of looking at the world which

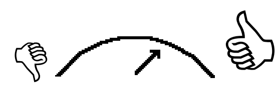
When viewed together, the various indicators provide a kind of status report for the University. They are analogous to the vital signs a doctor uses to assess the overall well-being of a patient. Like a patient's vital signs, an understanding of these measures of institutional well-being can serve as a starting point for constructive change.

We begin each of the Reports' ten categories (chapters) with a few paragraphs explaining why the category is important to the sustainability of Penn State. Next, we introduce the indicators for that category, explain their link to sustainability, and summarize the findings for each indicator. Based on these findings we offer a sustainability assessment for each indicator as follows:

- The University has a comprehensive strategy to adopt sustainable practices; high profile issue with strong leadership.

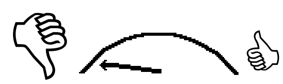


- The University has taken many significant measures to adopt sustainable practices but still lacks a comprehensive strategy.



- The University has taken only limited measures to adopt sustainable practices.

- The University had taken no significant measures to adopt sustainable practices.



After assessing each of the indicators for a given category, we describe both short- and long-term steps necessary to achieve truly sustainable practices at Penn State.

The ultimate goal of this presentation is to build a more sustainable and vital Penn State. This will be achieved only if we develop new ways of understanding PSU as an institution of higher learning, of evaluating Penn State's mission, and of formulating Penn State's relationship to our region and the world.

Brief History of the Project

In 1995, Dr. Christopher Uhl, of the Penn State Biology Department, read about a citizens' initiative in Seattle to evaluate the well-being of that city based on "sustainability indicators" (Sustainable Seattle, 1995). Intrigued, he wondered if it might be possible to do something similar at Penn State. Meanwhile, Dr. Barbara Anderson, of the Science,

---

encompasses mindfulness of place, respect for natural processes, discernment of true needs, civic responsibility, and full-cost accounting. In this vein, the use of non-numerical indicators reminds us that some of what is important and worthy of our attention cannot be expressed in numbers.

Technology and Society Program, was in the process of establishing Penn State's Center for Sustainability. These two streams of activity eventually gave rise to a small working group which began making plans for research on Penn State.

Project participants read the "Campus Ecology" literature (e.g., Eagan and Orr, 1992; Smith, 1993; Keniry, 1995) and in the process, they learned that many universities were engaged in campus audits (e.g., measuring trends in energy use, waste generation, water use). Early on, the research team decided to merge the idea of the campus audit with the more holistic concept of sustainability. In so doing, they hoped to ground their analysis in a set of values (See Box, pg.2) that are necessary for both planetary and university well-being. They presented the conceptual framework of their approach in a paper entitled, "Sustainability: a Touchstone Concept for University Operations, Education, and Research" (Uhl et al., 1996).

In Spring 1996, the team was ready to begin measuring sustainability at Penn State using 33 indicators. Dominik Kulakowski, a MS Degree candidate in the Intercollege Ecology Program, together with Uhl and a group of ten upper-level undergraduates, set to work. In January 1997, ten new undergraduates were invited to join the team, together with a second graduate student. Each student was assigned an indicator to work on. In all, twenty-seven undergraduates from five different Penn State colleges worked on the First Edition, as well as three graduate students and two research assistants. In addition, scores of University staff helped by providing information and guidance through reviewing the report (See Box).

The Review Process

Once the research team had produced an acceptable draft of the report, members of the university community were invited to review it. This resulted in hundreds of suggestions and ideas from more than seventy reviewers. In aggregate, the reviewer's criticisms and suggestions led to dramatic changes in the First Edition of the report: several indicators were completely thrown out, four new indicators were created, and whole chapters were thoroughly reworked.

Even after extensive revision and refinement, some reviewers were still dismayed by what they perceived as a negative tone in this Report. Perhaps this is inevitable, given that the overarching goal of the Report is to promote a fundamental shift from Penn State's current—often unsustainable—practices to practices which are truly sustainable, over the long haul. Thus, pointing out what Penn State is doing that is sustainable is important, but we believe that it is even more important to forthrightly acknowledge Penn State's sustainability deficit, and then to articulate a comprehensive ecological mission for our University, as we have endeavored to do in these pages.

This is the Second Edition of the Indicators Report. In the process of updating the report we again solicited information from scores of Penn State staff and, again, received a high degree of cooperation. In addition to the updated information, this edition differs in significant ways from the original report. For example, for this edition we developed a new system for evaluating the indicators, extensively revised the text, inserted new information (e.g., boxes) in many of the chapters, and unified the presentation by proposing a ten-fold ecological mission for Penn State.

Recognizing that much more needs to be done, a group of faculty, staff, and students have recently formed Penn State's Green Destiny Council, an association committed to promoting ecological responsibility at Penn State. The Council believes that institutions of higher education can be leverage points in the transition to a sustainable society in so far as they model sustainable practices and foster ecological literacy. Penn State, because of its reputation for excellence, is in a unique position to lead other universities in demonstrating how U.S. society can adopt truly sustainable practices.

For further information on the Indicators Report and the Green Destiny Council, contact Dr. Christopher Uhl (Faculty Coordinator at 208 Mueller Lab, University Park, PA 16802; 814-863-3893; cfu1@psu.edu) or Matt McLaughlin (Student Coordinator at mxm495@psu.edu). The web site for the Green Destiny Council (and for this report) is www.bio.psu.edu/greendestiny/.

Participants

Coordinators: Christopher Uhl, Garrett Fitzgerald, and Amy Anderson
Research and Editing for Second Edition: Autumn Hanna and Katherine Zimmerman
Graphics: Holly Marzec, Jeff Mathison and Bill Moyer
Graduate Researchers: Dominik Kulakowski, Sharmila Chaudhuri, Renee Sharp
Undergraduate Researchers: Amy Balog, Mark Chilton, Patricia Cole, Ai Yan Deng, Rajika Dravviam, Denise Ecker, Jason Ezratty, Christie Fallat, Garrett Fitzgerald, Danielle Free, Gina Giazzoni, Anne Hermes, Nate Hersh, John Kepner, Brian Kloepfer, Elizabeth Kozak, Amy Marino, Matt McLaughlin, Tim Murrell, Kelly Orr, Debby Peterman, Jennifer Petullo, Joanna Phillips, Tim Powderly, Erin Questad, David Sandy, Tammy Sanner, Henry Sauer, Megan Schuster, Eric Sheffer, Jan Snyder, Erica Syvertsen, and Seth Wilberding
Non-University Researchers: Amy Anderson and Jennifer Gorospe
Advisory Committee: Robert Brooks, Robert Burkholder, Robert Carline, James Eisenstein, Caren Glotfelty and Paul Ruskin.

Acknowledgements

We are grateful to the following for their generous financial support:

Penn State STIR Program of the Pennsylvania Space Grant Consortium
Penn State Center for Sustainability
FELT (Fund for Excellence in Learning and Teaching)
STS (Science Technology and Society Program)
PSU Intercollege Program in Ecology
PSU Biology Department

We would like to thank the following people for providing information about Penn State operations: Deborah Blythe, Eric Boeldt, Dave Branigan, Charles Brueggebors, Maureen Claver, Teresa Davis, Doug Donovan, Ron Eckenroth, John Gaudlip, Tom Gesell, Tom Gibson, Doug Holmes, Tom Houck, John Joseph, Robert Killoren, Peg Kimble, Matt Lapinsky, Kate Lumley-Sapanski, Al Matyasovsky, Betty Moore, Michelle Newhard, Bonnie Ortiz, Sue Rankin, Paul Ruskin, Dwight Smith, Curtis Speaker, Kevin Stahl, Wilbur Wadlington, Lisa Wandel and Ruth Ann Witmer.

Of course, we take full responsibility for the accuracy of the presentation.

References

Bok, D. 1982. Beyond the Ivory Tower. Harvard University Press, Cambridge, MA.

Eagan, D. and D. Orr. 1992. The Campus and Environmental Responsibility. Jossey-Bass, San Francisco, CA.

Getman, J. 1992. In the Company of Scholars. University of Texas Press, Austin, TX.

Keniry, J. 1995. Ecodemia. National Wildlife Federation, Washington D.C.

Orr, D. 1992. Ecological Literacy. State University of New York Press, Albany, NY.

Orr, D. 1994. Earth in Mind. Island Press, Washington D.C.

Orr, D. 1999. Rating colleges. Conservation Biology

Pelikan, Y. 1992. The Idea of the University. Yale University Press, New Haven, CT.

Smith, A. 1993. Campus Ecology. Living Planet Press, Los Angeles, CA.

Smith, P. 1990. Killing the Spirit. Viking Press, New York, NY.

Solomon R. and J. Solomon. 1993. Up the University. Addison-Wesley Publishing Company, New York, NY.

Sustainable Seattle. 1995. Sustainable Seattle: Indicators of Sustainable Community. Sustainable Seattle Metrocenter, Seattle, WA.

Tierney, W.G. 1993. Building Communities of Difference. Bergin & Garvey, Westport, CT.

Uhl, C., D. Kulakowski, J. Gerwing, M. Brown, and M. Cochrane. 1996. Sustainability: a touchstone concept for university operations, education, and research. Conservation Biology 10: 1308-1311.

Vitousek, P. M., H. A. Mooney, J. Lubchenco, and J. M. Melillo. 1997. Human domination of earth's ecosystems. Science, July 25, pp. 494-497.

Wilshire, B. 1990. The Moral Collapse of the University. State University of New York Press, Albany, NY.

World Scientist's Warning to Humanity. 1997. Union of Concerned Scientists, Boston, MA.

ENERGY

"State government must lead by example. We cannot expect more from Pennsylvania residents than we are willing to do ourselves. If we expect Pennsylvanians to shift their environmental expectations beyond compliance, then we must shift ours toward sustainability, including a goal of zero emissions achieved through pollution prevention and energy efficiency."

Tom Ridge, Governor of Pennsylvania

Introduction

This century has been characterized by worldwide fossil fuel dependency. At Penn State, the expansion of building space, the increased use of electronic devices, and a growing university population have led to a significant increase in the use of fossil fuels over the last two decades. However, during this same period there have been many technological breakthroughs in the realm of energy-use efficiency and conservation (McKinney and Schoch, 1997; Hawken et. al., 1999). Hence, it is now possible for a university like Penn State to expand its infrastructure and services while significantly reducing its total energy consumption. As a research institution, especially one with a strong engineering program, Penn State has a wonderful opportunity to be a leader in the design and implementation of highly efficient and environmentally benign energy systems.

A sustainable energy system has the following characteristics:

- **Conserving.** Every effort is made to increase energy-use efficiency and to use energy mindfully.
- **Generated from renewable resources.** A sustainable energy system runs, as much as possible, on energy income (e.g. solar, wind, biofuels), not on energy capital (i.e., fossil fuels).
- **Non-polluting.** Care is taken to minimize pollution associated with energy consumption.

An institution which seeks to use energy efficiently and prioritizes sources of energy that are renewable and non-polluting is moving towards sustainability. With this in mind, we considered the following three indicators:

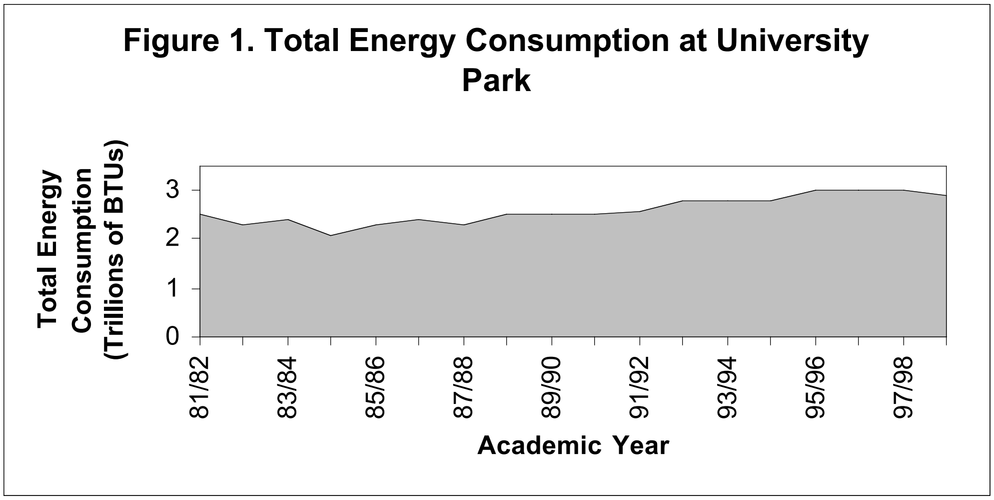
1. Total and Per Capita Energy Consumption
2. Consumption of Natural Gas vs. Coal on Campus
3. CO_2 Emissions

Indicator 1. Total and Per Capita Energy Consumption

At present rates of consumption, global supplies of fossil fuel energy will be exhausted, for all practical purposes, within the next few centuries (Miller, 1997). Of even greater concern is the environmental degradation (e.g., air pollution, acid precipitation, global warming) associated with fossil fuel use.

Findings

Penn State's energy is generated at two locations. Steam produced on campus is used to heat buildings, while PSU's electrical energy is purchased from Allegheny Power.[1] Virtually all of the energy consumed at University Park is derived from fossil fuels. During the period from 1981 to 1999, total energy consumption, while fluctuating somewhat from year to year, increased from 2.34 trillion BTUs to 2.87 trillion BTUs (Figure 1).[2,3]



On a per capita basis,[4] energy consumption at University Park has fluctuated between 54.9 million BTUs per person in 1984/85 and 68.0 million BTUs per person in 1995/96. In 1998/99 61 million BTUs were consumed per person.

An important reason for the continued high energy consumption at University Park is the construction of new buildings and the addition of air-conditioning to existing facilities. Building area increased by 3 million square feet between 1981/82 and 1997/98 (See Chapter on Built Environment for more information on buildings). Annual energy consumption fluctuated at around 200,000 BTUs per square foot of building area over this period.

Another factor contributing to high energy use at PSU is the growing use of electrically-powered devices in classrooms, offices, laboratories, and dormitories. For example, in the early 1970s, a typical Penn State dorm room was equipped with very little electronic equipment or appliances, but by 1992, all dorm rooms on campus were equipped with microwave/refrigerator units and television cable hook ups. Add to this personal

---

1 Allegheny Power is a member of the Global Climate Coalition, a consortium of business interests, which systematically downplays the seriousness of global warming.

2 The BTU (British Thermal Unit) is commonly used to compare the amount of heat energy stored within each kind of fuel (e.g., coal, natural gas, gasoline, wood). Think of 1 BTU as the amount of heat produced from the burning of one match; and 100,000 BTUs as the amount of energy contained in 80 peanut butter and jelly sandwiches (Hubbard and Fong, 1995).

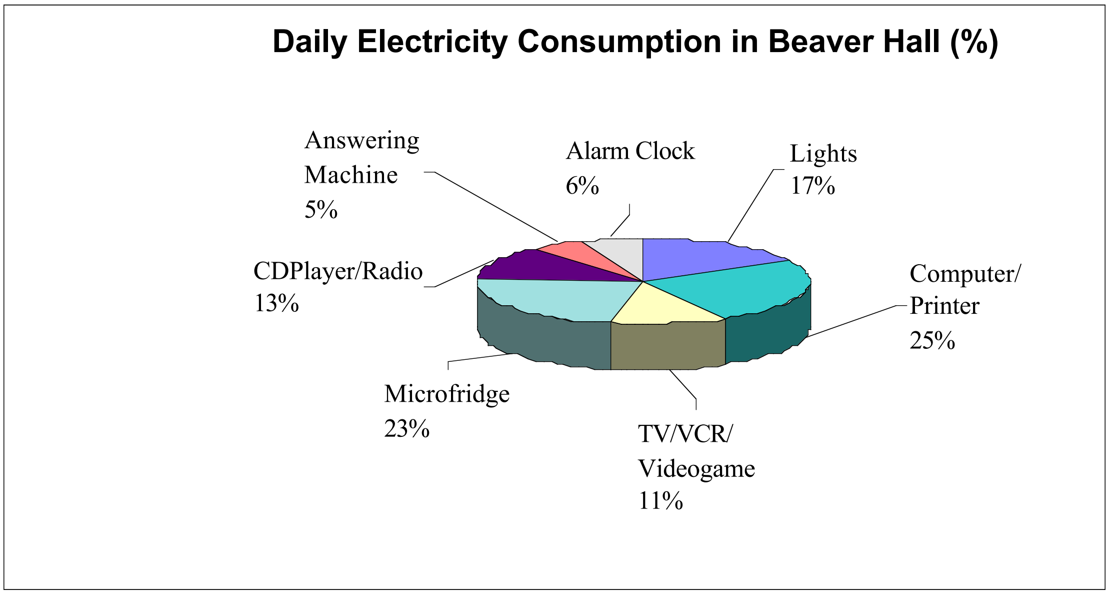
3 The data for this section are based on electricity purchases from Allegheny Power and coal, gas and oil consumption at University Park. These records are maintained by the Penn State Office of the Physical Plant.

4 We considered the University Park population as the sum of full-time faculty, staff, and students. This population increased by 7,748 people between 1981-82 (39,236) and 1998-99 (46,984). Population data from Office of Budget and Resource Analysis.

computers and music systems and the amount of energy consumed in dorm rooms is considerable (See Box).

How Much Energy is Consumed in a Typical PSU Dorm Room?

When energy is expressed in BTUs and kWh it is hard to visualize what and how much we are consuming. Amy Balog, a Penn State junior, decided to make her reliance on energy more palpable. She started by conducting an inventory of all the plug-ins in ten double rooms in Beaver Hall. Amy found that a typical dorm room has 12 plug-in devices—micro-fridge, television, VCR, computer, printer, alarm clock, CD player/radio, answering machine, video game unit, and several lamps/lights; and some rooms have as many as 19 plug-ins. The largest energy consumers are micro-fridges, computers, and lights. Amy determined that a little more than one ton of coal is required to supply Beaver Hall's total electricity needs each day, or roughly eight pounds per dorm room (includes energy consumed in all parts of the building). The burning of the coal necessary to "power" Beaver Halls each day releases about 3 tons of the greenhouse gas, carbon dioxide, to the atmosphere. To make the connection between electricity and fossil fuels more vivid Penn State might do well to place an eight pound chunk of coal on all dorm room desks.



Inefficient building design characteristics, physical expansion, and increased use of air conditioning and electrical devices all contribute to high energy use at University Park. However significant steps have been taken to promote energy conservation and efficiency. Here are some examples:

- Temperature Reductions During Winter Break Period. In 1973 a policy was adopted to reduce temperatures to 55ºF during winter break in certain campus buildings.

- Lighting Retrofit. In 1992, the Office of Physical Plant began the replacement of T-12 fluorescents with the more efficient T-8 variety. Each 2' by 4' upgraded fixture yields an energy savings of 26 percent.

- Continuous Commissioning Process. In 1998, the Office of Physical Plant began a detailed inspection and evaluation of several campus buildings to improve comfort, then increase energy-use efficiency. Changes made to the Materials Research Institute building, as part of this Commissioning Process cut electricity use by 12% and natural gas consumption by 41% the first year, saving almost $84,000. More information on this program can be found at http://energy.opp.psu.edu/engy.

- The Office of the Physical Plant is able to assess energy use in new campus buildings through a network of building sensors hooked to a Central Computer System. This sophisticated system allows OPP personnel to monitor building energy use minute-by-minute and to detect zones of energy waste. OPP is also installing electrical meters that can be read over the "backbone," with trend data collected for analysis of usage amounts and patterns.

A variety of measures have been undertaken over the years to reduce energy consumption at Penn State; and improvements in energy efficiency in the late 90's allowed Penn State to grow without increasing energy consumption. However, there is much more that PSU could be doing. Penn State still lacks a comprehensive, long-term commitment to creating the cleanest, most efficient, and sustainable energy system possible.

Indicator 2. Consumption of Natural Gas vs. Coal on Campus

As residents of Pennsylvania, we appreciate the tremendous benefits our coal endowments have provided. At the same time, we know, first hand, the environmental and social costs of coal extraction and combustion: fatal accidents and disease, landscape destruction, land subsidence, acid mine drainage, and acid rain (Miller, 1997).

Natural gas and coal are both non-renewable fossil fuels and their extraction, transport, and combustion have negative environmental impacts. But compared with coal, natural gas burns cleanly, emits only about half as much CO_2 per BTU generated, and usually produces little or no CO, SO_x, or particulate emissions (Sears, 1997 and Wilson and Morill, 1998). Therefore, it is sensible to utilize this fuel as a transitional resource as we move toward truly sustainable energy sources.

Findings

Between 1981/82 and 1998/99, energy consumed from the burning of natural gas at University Park decreased from 0.9 trillion BTUs to 0.25 trillion BTUs. This decrease occurred because Penn State instituted new particulate emissions control measures at its steam plant in the mid-1980's which reduced the demand for natural gas as a means of meeting air-quality standards.

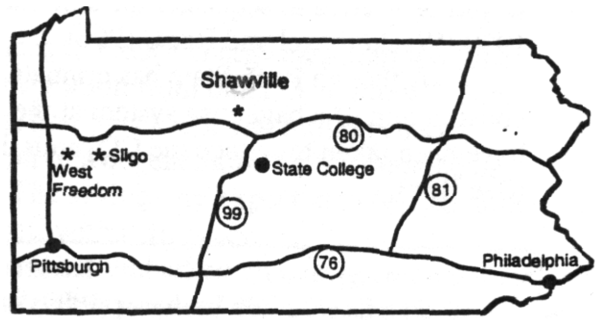
While natural gas consumption declined from the 80s to the 90s, the burning of coal increased from 1.6 trillion BTUs in 1981/82 to 2.6 trillion BTUs in 1998/99 (R. Watt, pers. comm., Allegheny Power; and PSU Office of the Physical Plant). Expressed as tonnage, Penn State's total coal consumption increased steadily from about 87,000 tons in 1981/82 to 157,400 tons in 1998/99. This translates to a per-capita increase of about 2,300 pounds (from about 4,400 pounds per person/year in 1981/82 to about 6,700 pounds/person in 1998/99).[5] All this coal is supplied from Pennsylvania coal fields (See Box).

---

[5] Total coal consumption includes coal burned off-campus to provide electricity for University Park. This off-campus coal consumption is estimated from data on University Park energy consumption (OPP) and assumes that Allegheny Power burns 0.8 pounds of coal to produce 1kWh of electricity (R. Watt, Energy Specialist, Allegheny Power).

From Coal Mines to Warm Buildings: Penn State's Energy Pathway

The fossil fuels that we use in our cars, offices and dorm rooms are derived from plants that grew on the earth long ago. Three hundred million years ago, the vegetation in large areas of Pennsylvania was swamp forest composed of giar ferns and other primitive plants. As these plants grew and died, over tens of millions of years, they formed deep organic matter deposits. Burial led to increased pressure and temperature and gradual the dead plant material was transformed into coal When the temperature and pressure were very hig oil or gas were formed.



Thanks to these processes, Penn State has access to nearby coal. Currently our coal is extracted at an open-pit mine 110 miles from campus in West Freedom, Pennsylvania, by the K&C Coal Mining Company. After extraction, the coal is transported ten miles to the town of Sligo where it is cleaned and sorted before being trucked to PSU's main steam plant at the corner of College Avenue and Burrowes Street. In the course of a year, Penn State buys about 70,000 tons of coal or 2,800 truck loads for heating purposes. The purchase price is $40.00 a ton. A large part of the remaining energy Penn State receives originates 45 miles from campus at a coal-burning, electricity generation plant in Shawville.

In sum, Penn State has come to rely increasingly on one of the more polluting forms of energy—coal (Indicator 2).

Indicator 3. Carbon Dioxide Emissions Associated with PSU Energy Use

Coal is primarily composed of carbon and its combustion in the presence of oxygen results in the emission of carbon dioxide. Penn State's high energy consumption contributes to the rising pool of atmospheric CO_2.[6] There is strong scientific consensus that increased CO_2 concentrations in the atmosphere are leading to climate change. The earth has already heated up by a degree since the beginning of the Industrial Revolution; and the water level in oceans that cover most of the planet's surface are clearly rising, both because of melting glaciers and because water expands as it warms (McKibben, 1998).

Findings

The emissions of carbon dioxide from the University Park, West Campus, Steam Plant increased from about 118,000 tons in 1981/82 to about 178,000 tons in 1998/99. This comes to just under four tons of CO_2 emissions per person per year just for heating. Adding the significant amount of energy (electricity) purchased from Allegheny Power and energy produced from the combustion of natural gas, it turns out that in the 1990s, Penn State was

---

6 In addition to CO_2 the PSU steam plant emits particulates, as well as nitrogen and sulfur oxides, and carbon monoxide:

- Particulates. University Park particulate emissions were 14.4 tons in 1998. The inhalation of particulate matter can contribute to pulmonary distress and disease (Hall et. al.,1986).
- Nitrogen and sulfur oxides. University Park 1998 emissions of nitrogen oxides and sulfur oxide measured 309 tons and 1,679 tons respectively. These oxides are the primary contributors to acid rain which plagues our region (McKinney and Schoch, 1997).
- Carbon monoxide (CO). In 1998, 201 tons of CO were released from the University Park steam plant. CO in high concentrations has immediate health effects on humans and other mammals and can cause respiratory complications.

emitting 465,000 tons of carbon dioxide annually to supply its total energy needs.[7] This amounted to approximately 10 tons per capita per year. A 1.6-acre patch of temperate forest would be needed to sequester the amount of carbon dioxide emitted by each Penn Stater in 1999 (Wackernagel and Rees, 1996).

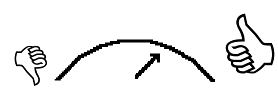
Although Penn State has dramatically reduced emissions of particulates through the construction of a baghouse system at the West Campus Steam Plant, no significant measures have been taken to reduce the CO_2 emissions. However, there are initiatives that can be taken (See Box).

Reducing CO_2 Emissions

In a recent study Lachman (1999) showed how CO_2 and other greenhouse gas emissions could be halved at Penn State if certain measures are adopted; these include using natural gas for all energy needs and improving building energy efficiency by 20%.

One institution already working towards reducing its carbon dioxide emissions is the World Resources Institution (WRI). WRI is committed to reducing its CO_2 emissions to zero by 2005. Steps WRI is taking include turning off office equipment at night (expected to prevent 2.5 tons of CO_2 emissions annually), reducing paper use (a 10% reduction would reduce CO_2 emissions by 4 tons), and videoconferencing instead of travelling (saving 88 pounds of CO_2 per 100 miles traveled by air). By taking these initiatives, WRI hopes to demonstrate that individual institutions can lead the way towards more sustainable practices.

Summary of Energy Indicators

Total and per Capita Energy Consumption	From the early 1980s to the mid-1990s, energy consumption per capita at University Park remained high, but in the late 1990s measures taken to increase energy-use efficiency and thereby bring energy consumption down appeared to be yielding results; a comprehensive strategy aimed at reducing our dependence on fossil fuels is still lacking.	
Consumption of Natural Gas vs. Coal on Campus	Between 1981 and 1999, coal consumption at University Park increased by 1 trillion BTUs while natural gas consumption decreased by 0.65 trillion BTUs with no significant measures taken to move towards renewable energy resources.	
CO_2 Emissions Associated with PSU Energy Use	Although the world's scientists concur that global warming is a serious problem, Penn State persists in releasing huge amounts of CO_2—about ten tons/person/year—into the atmosphere each year.	

Although significant energy conservation measures have been undertaken at Penn State in recent years, continued energy waste, increasing reliance on coal, and high emissions of carbon dioxide all indicate that we need to do much more if we are to achieve sustainability in the energy realm.

---

7 Calculations are based on 2.86 lbs. CO_2/kwh for electricity purchased from Allegheny Power and 124.6 lbs. CO_2/million cubic feet for natural gas combustion (Hubbard and Fong, 1995).

Moving Toward Sustainability

Other Institutions on the Path

While Penn State has taken significant steps to reduce energy consumption (See Indicator 1 for examples), we might also draw inspiration from other institutions.[8] For example, Carleton University in Ottawa, Canada, has launched a $20 million energy conservation program that includes the installation of a cogeneration facility and the use of geothermal systems to heat buildings in winter. The savings are expected to be two million dollars a year allowing the program to pay for itself within 10 years.

Closer to home, the University of Rochester has embarked on a program to reduce energy consumption by more than half without affecting program delivery. So far Rochester has been successful in reducing energy consumption despite the addition of two new buildings and more intensive use of existing facilities. Although this has resulted in a reduction of 1.5 million dollars in electricity costs, the gains have not just been financial. M. A. Pierce, describing Rochester's program, wrote: "…the greatest enhancement to the program has been the inclusion of the academic and environmental community into the energy management process…Whatever fields students choose after graduation, an intensive exposure to the realities of energy and environmental issues will make them not only better educated but also better citizens of the global community" (Pierce, 1992).

Another college in New York, the University of Buffalo, initiated energy conservation practices in the early 1970s and it is estimated that they have saved a cumulative $60 million since then. On Buffalo's North Campus, electrical energy use in 1998-99 was almost 20,000,000 kilowatt hours less than it was in 1982-83, even though eight buildings had been constructed since the early 1980s. These savings were obtained by retrofitting lights, building shell insulation and window improvements, and upgrading heating and cooling systems along with the computer controls that regulate that equipment. In addition to these larger projects, many smaller, everyday practices have been encouraged at Buffalo (e.g., dressing according to the season, using natural lighting instead of electrical lighting, and keeping rooms closed that are heated and air conditioned) to help conserve energy. For more information visit their website at http://wings.buffula.edu/ubgreen.

Short-Term Goals

Reduce Energy Consumption. Penn State should make it a goal to reduce total University energy consumption by 10% by 2010. In conjunction with this, the University should consider the installation of highly visible energy meters in all new buildings (and where possible in existing buildings) with rebates given to departments/dorms that hold energy consumption below projected demands.

Reduce Emissions from Coal Combustion. Large amounts of sulfuric oxides are emitted during coal combustion each year at University Park (See Footnote 6). The consequence—acid rain—is well known to university scientists. Penn State should set an

---

[8] W. Simpson's 1990 book, Recipe for an Effective Campus Energy Conservation Program, provides a good introduction to this topic. Also, the National Wildlife Federation's book, Ecodemia, offers many examples of how different universities are addressing energy problems (Keniry, 1995).

example by installing sulfur 'scrubbers' at our West Campus Steam Plant to reduce sulfur emissions.[9]

Switch to Natural Gas as Short-Term Transition Fuel. Natural gas burns clean and releases only about one-half as much CO_2/BTU as coal. Moving from coal to natural gas would cost the University an additional four million dollars per year according to an OPP estimate—a significant outlay, yes, but still only a few tenths of one percent of the University's annual budget. Penn State should begin its transition to a fossil fuel-free, renewable energy future by substituting, to the extent possible, natural gas for coal at its West Campus Steam Plant. It is the ecologically responsible thing to do.

Long-Term Goal: Move Toward Fossil Fuel Independence

Penn State continues to rely completely on non-renewable sources of energy with no sign of shifting to renewable sources. The University needs to formulate a comprehensive plan to guide it toward fossil-fuel independence over the next century. A way to begin is by pledging to increase the sustainable (renewable) portion of the University's energy mix by 10% of total consumption by 2010. How? Penn State now has the freedom to choose its own energy provider. Rather than relying on a provider that depends almost exclusively on coal for electricity production, PSU could begin to purchase a portion of its energy from a "green" supplier.[10] Opportunities also exist for sustainable approaches to the heating and cooling of PSU's buildings. For example, the use of geothermal heat pumps can lead to significant energy and cost savings.

In general, renewable energy alternatives are becoming increasingly competitive with conventional fossil-fuel technologies,[11] and with research, interdisciplinary cooperation, and an engineering college as impressive as our own, Penn State could surely develop an energy system that made significant use of the renewable resources available in our area.

Imagine a Penn State that runs entirely on energy 'income' instead of entirely on energy 'capital.' Picture carefully designed buildings that use only one-tenth of the energy

---

9 Plans are underway to increase efficiency and reduce emissions of the West Campus Steam Plant by shifting to a harder coal and making modifications on the boilers (e.g., modifying the 'economizers' so that less heat goes out the stacks). Although this will help somewhat, it falls short of what is needed.

10 Public Institutions and businesses have an important role to play in ushering in a future based on sustainable energy. In California, government agencies are now the largest buyers of energy from renewable energy suppliers (www.eren.doe.gov/); and in Pennsylvania, Kinkos, the photocopying and print services company, has 15 of its stores using green (i.e., geothermal, hydro, wind, and solar) sources of electricity (www.green@work.com.). According to a March, 2000, OPP document, Penn State is also now considering the possibility of purchasing a portion of its electricity from a "green" energy supplier.

11 Usually unfairly dismissed as too costly to implement, major strides are now being made in the solar energy industry to increase the efficiency and durability of solar technologies while simultaneously decreasing their cost (Walter et al., 1992). Although Pennsylvania's northerly latitude and cloudy climate places limits on the potential harvest of solar energy, modifications in the ways that we think about and design buildings would allow us to take advantage of the solar energy which is available. At present, not a single one of the almost 700 buildings at University Park is designed or sited to take advantage of solar energy. Geothermal also offers potential for our region. Local homeowners have already begun to adopt geothermal technologies for household heating and cooling (Boyd, 1998); Penn State Office of the Physical Plant is interested in exploring geothermal energy opportunities (P. Ruskin, pers. comm.)

that our present buildings require for heating, cooling, and lighting.[12] Envision transparent south-facing walls designed to maximize solar gain in the winter and visualize rooftops constructed for the utilization of photovoltaic panels, solar heated water or wind turbines where appropriate.[13] Finally, imagine Penn State taking a pioneering role in the development of sustainable geothermal technologies for the temperature regulation of buildings.

Sustainable energy use at Penn State should be characterized by energy conservation and the gradual transition to renewable and non-polluting energy sources. By becoming more sustainable we would not only create a cleaner environment, but we would also be creating unique educational opportunities for students and faculty, and set an example for the Commonwealth.

References

Boyd, R. S. 1998. Global Warming Pact May Inspire New Energy Research. Pg. 38, Centre Daily Times, January 8.

Hall, C., J. Cutler, Cleveland, and R. Kaufmann. 1986. Energy and Resource Quality. John Wiley & Sons, Inc. New York.

Hawken, P., A. Lovins, Hunter L. Lovins. 1999. Natural Capitalism. Little, Brown and Co. Boston, MA.

Hubbard, A. and C. Fong. 1995. Community Energy Workbook: A Guide to Building a Sustainable Economy. Rocky Mountain Institute. Snowmass, CO.

Keniry, J. 1995. Ecodemia. National Wildlife Federation, Washington, D.C.

Lachman, S. 1999. A Greenhouse Gas Inventory of the Pennsylvania State University Park Campus. MS Thesis in Geography. Penn State University, University Park, PA.

McKibben, W. 1998. A special moment in history. Atlantic Monthly. Pages 55-60, 62-65, 68-73, 76.

McKinney, M. L. and R. M. Schoch. 1997. Environmental Science: Systems and Solutions. West Publ. Co. New York, NY.

Miller, G.T. 1997. Environmental Science. Wadsworth, New York.

Pierce, M. 1992. Campus Energy Management Programs. In Eagan, D. J., and Orr, D. W. (eds.), The Campus and Environmental Responsibility. Jossey-Bass Publishers, San Francisco, CA.

Sears, P. 1997. Greenhouse Gas Reduction: Calculating Emissions Underscores Important Role of District Energy. District Energy, Fourth Quarter. Pages 8-10.

Simpson, W. 1990. Recipe for an Effective Campus Energy Conservation Program. Union of Concerned Scientists, Cambridge, MA.

Wackernagel, M, and W. Rees. 1996. Our Ecological Footprint. New Society Publishers, Gabriola Island, BC, Canada.

---

12 Such buildings are possible. They require that we implement conservation measures to reduce energy consumption and adopt available technologies that dramatically increase energy-use efficiency (Hawken, et al., 1999).

13 Penn State will consider passive solar designs for new buildings and is presently evaluating a proposal to use photovoltaic power to supply a small portion of the Abington campus' electricity needs.

Walter, B., L. Arkin, and R. Crenshaw. 1992. Sustainable Cities. Eco-Home Media, Los Angeles, CA.

Wilson, A. and J. Morill. 1998. Consumer Guide to Home Energy Savings. Amercian Council for an Energy-Efficient Economy. Washingtion, D.C.

WATER

"And how about water? Holy, Holy water. If you want to know how sacred water is, then do as Native American Bill Wahpapah advised—go without it for four days. One's gratitude for the gift of water returns with that first sip."

Matthew Fox

Introduction

When we spoke the word "water" to Penn State students, the words that frequently came to their minds were "bottled", "tap" and "polluted." This is not surprising; we no longer nurture our bodies with water; most of what we drink comes in cans and bottles. How we, as a university and as a culture, regard water says a lot about our prospects for creating a sustainable world.

Although the United States is endowed with abundant surface and ground water, our clean water supply is far from unlimited; careless water use and neglectful stewardship can lead to water contamination or even exhaustion.

Rapid growth is stressing the Spring Creek Watershed within which Penn State is located. Citizens were first alerted to this in the 1970s when two highly toxic chemicals, kepone and mirex, manufactured at Nease Chemical (today known as Rutgers Organics) on Benner Pike, leaked from storage drums into the ground water and eventually into Spring Creek. To this day, Spring Creek's fish populations carry mirex in their tissues. More recently, activities associated with Penn State's airport expansion project resulted in sinkhole formation and rapid discharge of sediment-laden waters into Spring Creek. Another area of concern is PSU's Big Hollow well field. Land adjacent to the well field has been contaminated with: 1) chemical residues from fire fighter training activities and 2) leakage from Penn State gas tanks (Cheng, 1999; Pomponio, 1999; CDT staff, 1999).

Our porous limestone geology is delicate. On the one hand, it ensures us large stores of water, but on the other, it leaves our water open to contamination.

Sustainable water use has the following characteristics:

- **Conserving**. Water is used carefully when needed, not wastefully.
- **Non-polluting**. Surface and ground water are protected from contamination ensuring high quality drinking water and demonstrating a respect for the biota and natural processes.
- **Cyclical**. Water is captured and returned to the environment close to its point of use; the biota cycle and clean "used" water.

If water consumption and disposal were steadily rising and our ground water was showing signs of pollution, we would have cause to be concerned about the long-term sustainability of our community. Based on this premise, we considered the following indicators:

1. Total and Per Capita Water Consumption
2. Ground Water Quality
3. Waste Water Disposal

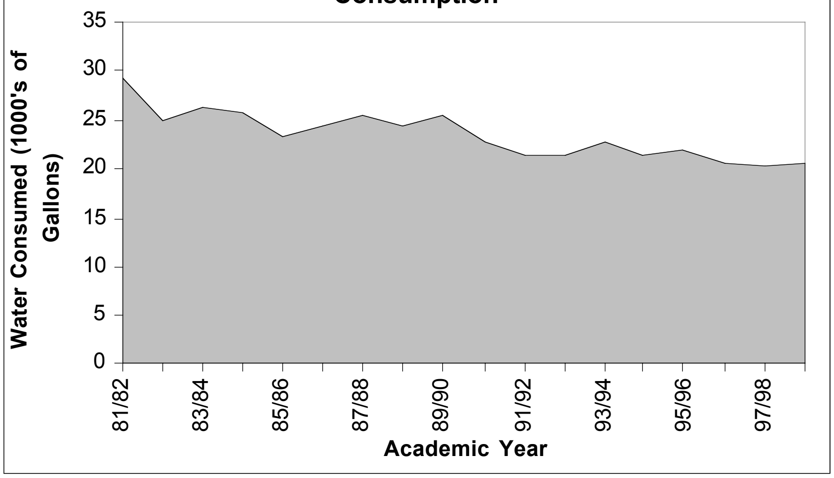
Indicator 1. Total and per Capita Water Consumption

Penn State is located on top of a very large aquifer. The University's easy access to a seemingly endless supply of water may make us indifferent to water conservation.

Findings

Annual water consumption at University Park ranged from 906 to 1,146 million gallons between 1981-82 and 1998-99.[1] In the 1980s consumption exceeded 1000 million gallons during four years. From 1990-91 through 1998-99 consumption was slightly less than 1000 million gallons/year with total consumption figures at 961 million gallons in 1998-99.

Figure 1. University Park Per Capita Water Consumption



Expressed per person,[2] water consumption was between 23,000 and 29,000 gallons/person/year during the 1980s and ranged from 20,000 to 23,000 gallons/person/year from 1990-91 through 1998-99 (Figure 1). The 16-year average was 24,800 gallons/person/year. This translates to approximately 68 gallons of water/person/day (See Box for a close-up of water consumption).

1 The data for this section are based on records of water use maintained by the Penn State Office of the Physical Plant (OPP).

2 As noted in the previous section on energy, the University Park population is considered to be the sum of full-time faculty, staff, administration and students. This population increased by 7,748 people between 1981-82 (39,236) and 1998-99 (46,984). Population data from Office of Budget and Resource Analysis.

Water Use in Penn State Dorms

We can appreciate the magnitude of water use at Penn State by examining the habits of individual users. Take students living in Leete Hall, as an example. How do they use water?

First, there are showers. The Leete Hall shower heads were installed in 1957 and have a flow of 4-5 gallons of water per minute. There are a total of 40 shower stalls in the building. According to the results of a survey of Leete Hall residents, 85% of the students polled said that they showered once a day, and 75% of the respondents said that their shower time is between 10 and 20 minutes. With a shower flow of 4 gallons per minute, one student would use an estimated 40 gallons of water in a single 10-minute daily shower!

Another site of water use in Leete is the 48 flush toilets which were also installed in 1957; they use 3.5 gallons of water per flush. Assuming that a student uses a flush toilet two to five times per day, this adds 7-17 gallons of water consumption per day (not including urinal-related water use).

A third site for water use is bathroom faucets. The 1950s faucets in Leete have a flow rate of about 2.5 gallons per minute; this adds a couple more gallons to the tally.

The last major site for water use is the washing machines located in the basement of Leete. Leete has 6 Maytag washers which use approximately 35 gallons of water per load. Assuming students do one load of wash per week adds another 5 gallons to daily water consumption. A summary of these various uses reveals that a typical Leete Hall resident consumes about 60 gallons of water per day just in bathroom and clothes-washing related activities [40 gallons (shower) + 10 gallons (toilet) + 2 gallons (sink) + 5 gallons (clothes washing)].

The lower per capita water consumption in the 1990s vs. the 1980s is strongly suggestive of a trend toward sustainability. The construction of a water cooling tower at the West Campus Steam Plant to reduce water throughput, as well as efforts to remove once-through cooling for equipment in existing and new buildings are, in part, responsible for declining water consumption.[3]

The University's comprehensive water-leak detection and repair protocols are also contributing to water conservation. Finally, water conservation has been accomplished by the gradual shift to low-flow showerheads on campus: six hundred low-flow shower heads were installed in residence halls during the summer of 1999 and water-conserving showerheads and toilets are now standard equipment in all new campus construction.

In sum, water use is declining at University Park and this is commendable.

Indicator 2. Ground Water Quality

Penn State's water is vulnerable to several sources of contamination. In particular, volatile organic compounds (VOCs) and nitrates can pose significant threats.[4] VOCs include tetrachloroethylene (PCE), trichloroethylene, vinylchloride, as well as many other compounds. PCE (used as a solvent in the dry cleaning industry) is a common contaminant of drinking water in Central Pennsylvania. This compound is toxic to aquatic animals,

---

[3] It is important to note that OPP's "Design and Construction Standards Manual" specifies water conservation measures (e.g., low volume flush valves and low flow shower heads) but there is sometimes a lengthy lag time before such recommendations are implemented.

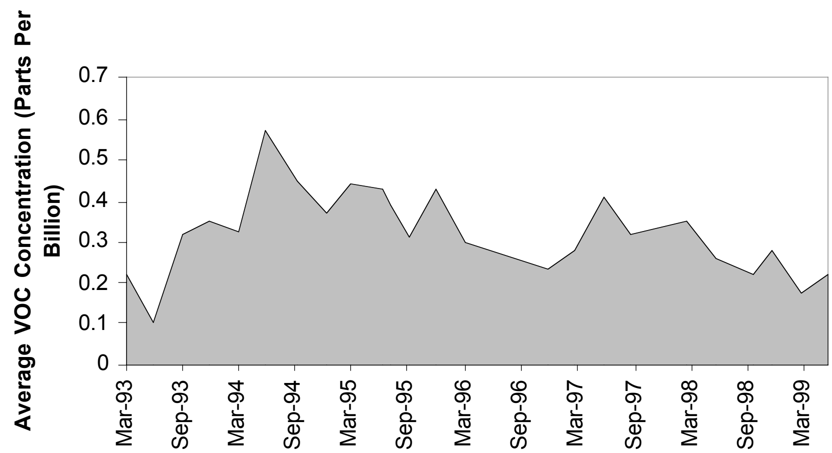
[4] The U.S. Environmental Protection Agency monitors about 70 water parameters.

carcinogenic to mice, and possibly carcinogenic to humans (Sitting, 1980). Nitrates, the principle other threat to the quality of Penn State's water, occur naturally at low levels in underground water supplies, but their levels can increase due to leaching of chemical fertilizers and/or organic wastes. High nitrate levels in drinking water have been linked to methemoglobinemia in infant mammals.

Findings

Average VOC concentrations in water drawn from PSU wells between 1988 and the first half of 1999 ranged from 0 to 0.6 ppb (Figure 2).[5] While these averages are within public health legal limits, water from some University wells was contaminated with VOCs in the late 1980s. In 1987, three wells were closed due to high PCE concentrations (e.g., as high as 7 parts per billion). The "maximum allowable contaminant level" for PCE is 5 parts per billion (Pennsylvania, DER).

Figure 2. Average VOC Concentration in University Park Well Water

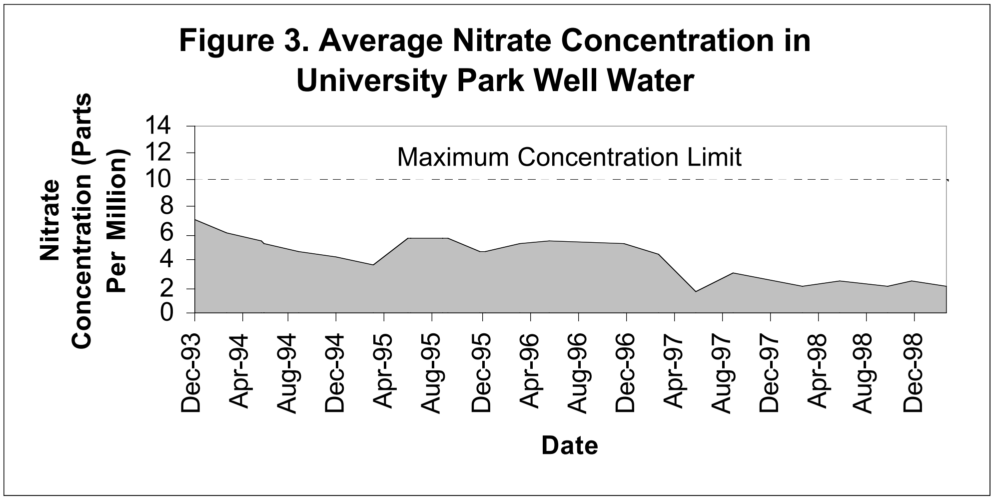


PCE water contamination has become a concern in recent years. In August of 1997, high levels of PCE were discovered in a Penn State test well at Big Hollow Road. Three monitoring holes were dug to check the groundwater; one tested 56 parts per billion of PCE, over 11 times the state regulation of 5 parts per billion. TCE, the cancer-causing chemical found in the drinking water in the feature film, *A Civil Action*, was also found at unsafe levels at the site. Officials are uncertain of the source of PCE and other chemicals found in the groundwater at Big Hollow (Cheng, 1999).

Average nitrate concentrations in PSU well water remained below 7 mg/l (7 parts per million) between 1993 and early 1999 (Figure 3), although some individual wells had values as high as 8.8 parts per million. All values were below the EPA maximum allowable contaminant limit of 10 parts per million.

In sum, although PSU's water generally tests out as safe, there is growing concern about long-term groundwater quality at Penn State.

[5] Water in PSU wells/chlorine houses is tested every three months in accordance with Pennsylvania Department of Environmental Protection regulations.



Indicator 3. Wastewater Disposal

The manner in which a community disposes of its "waste" water can affect the health and long-term sustainability of the community. For example, shunting wastewater directly to local streams without any treatment pollutes waterways while increasing the probability of disease outbreaks. Fortunately, municipalities are no longer permitted to pipe raw sewage into streams; water must be treated to remove organic debris, contaminants, and disease-causing organisms.

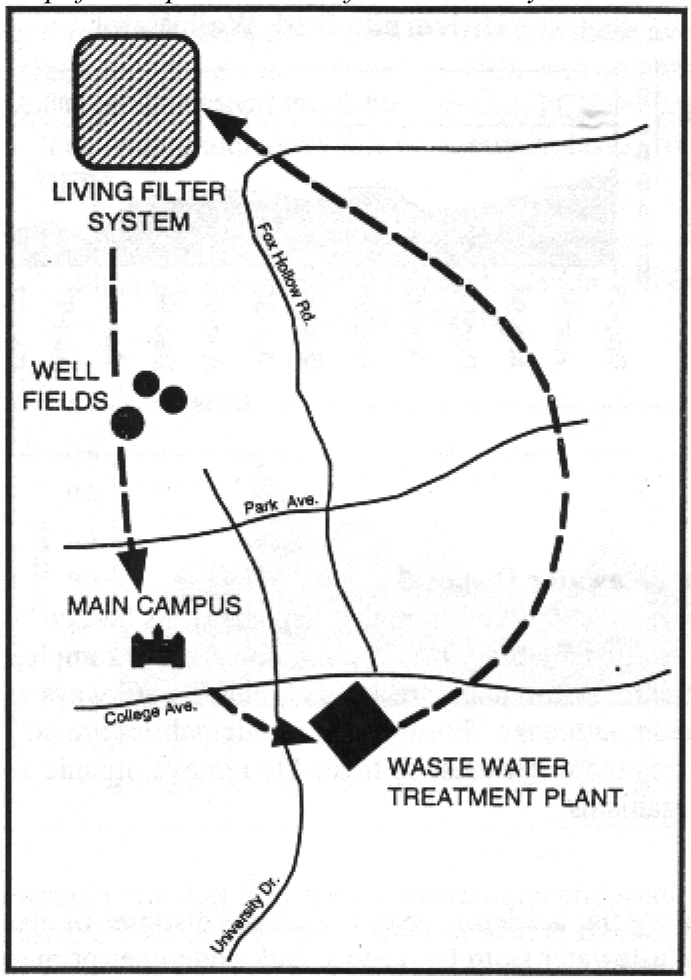
Findings

During the regular academic year, Penn State disposes of about 2.6 million gallons of water each day. Wastewater from University Park undergoes primary and secondary treatment (and tertiary treatment to reduce nitrogen) at the University Wastewater Plant located on University Drive, just south of campus.[6] There wastewater is settled and broken down biologically (aerobic bacteria are the key breakdown agents). The treatment plant removes a minimum of 90% of the waste solids and BOD (Biological Oxygen Demand) contained in the sewage influent. However, even after treatment, the water is still rich in nutrients, such as nitrogen and phosphorous. In the 1960s this posed a problem for Penn State because the University was under orders from the State to reduce the phosphorus concentrations in its wastewater discharged to the stream.

Scientists and engineers at Penn State developed an interesting solution to this problem. Rather than discharging its treated, phosphorus-rich effluent to Spring Creek, PSU now sprays its effluent onto fields and woods just north of campus (Fig. 4). This effluent-spray system covers 516 acres of land and contains approximately 60 miles of pipe with over 3,000 spray heads. The trees and crops in the spray area are, in effect, fertilized with the effluent. When functioning properly, this system strips the nutrients from the effluent while maintaining ground water quality.

[6] A portion of Penn State's waste water (about 0.5 million gallons a day) is shunted to the University Area Joint Authority. This water is released to Spring Creek after treatment; "treatment" includes measures to significantly reduce phosphorus concentrations.

Figure 4. A Highly Simplified Representation of the "Water Cycle" at Penn State.



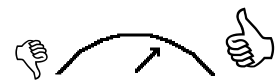
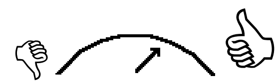
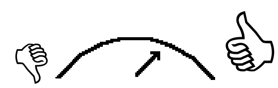
Penn State's Water-Land Treatment System is innovative and approximates a natural cycle,[7] but considerable amounts of energy are required to pump and distribute the wastewater and there is a substantial opportunity cost associated with using a large tract of land close to campus to receive the University's wastewater. In addition, forested areas receiving the spray have suffered severe winter ice damage, invasion of weedy edge species, and, in some cases, a general deterioration of forest structure. Finally there are concerns in some quarters that the present system is too small to continue to effectively cleanse the large amounts of effluent being applied;[8] however, the system is designed to receive a maximum of 4 million gallons/day and current applications are only 2.7 million gallons/day (J. Gaudlip, pers. comm.).

---

7 Penn State's Water-Land Treatment System has served as an important site for graduate training. Dozens of PSU students in fields as diverse as Agronomy, Civil Engineering, Ecology, Geology, and Forestry, have conducted Ph.D. and MS-level research at the site.

8 Several Penn State researchers expressed concerns about the long-term stability of the system (e.g., Tamminga, 1995). One commented as follows: "I agree that the "living filter" (i.e., Water-Land Treatment System) is innovative, but the University's system is not working properly and the University needs to fix it. The problem is that the system is undersized. The wastewater needs to be applied to a larger area of land. Forested areas should not be irrigated on a continuous basis. Dormant season storage should be added to the system. The University will need to spend money on the system. They know this but they are reluctant to bite the bullet."

Summary of Water Indicators

Total and per Capita Water Consumption	Per capita water consumption at University Park has declined in recent years; however the University still lacks a comprehensive strategy aimed at water conservation.	
Ground Water Quality	The University is in compliance with water regulations but it needs to take comprehensive measures to ensure the long-term protection of its drinking water. The past closing of several PSU wells and the recent pollution of monitoring wells reveal the potential for contamination of PSU's water.	
Waste Water Disposal	Penn State's Water-Land Treatment System is a bold approach to creating a sustainable wastewater treatment system, but because the system is energy intensive and has a high opportunity cost, it falls short of a truly sustainable solution.	

Moving Toward Sustainability

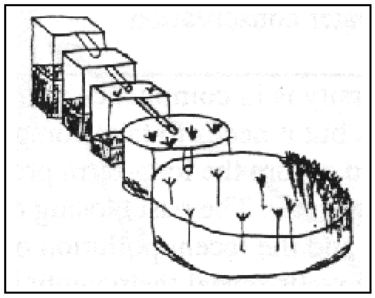
Institutions on the Path

Some universities are making efforts to increase the sustainability of their water systems by decreasing water consumption. California State University/Northridge has adopted a combination of measures aimed at reducing water consumption by 25% including: retrofitting all showers, flush valves, and faucets on campus with water-saving devices; posting water-conservation information throughout campus; and using reclaimed water for landscaping purposes (Smith, 1993).

The way that "waste" water is treated also affects sustainability. In Frederick, Maryland, a "living machine" designed by John Todd of Ocean Arks International (Todd and Todd, 1993) is purifying wastewater (See Box). Closer to home, the Julian Woods Community, located less than 20 miles from the University Park campus, cleans its waste water using a series of marshes and treatment tanks located in a community greenhouse.

Living Machines

Humans employ machines to accomplish specific tasks but typically these machines are not alive. John Todd and Associates have been pioneers in the development of an entirely different type of machine—one with parts that are alive. Todd's "living machines" contain symphonies of organisms working together in concert to accomplish a big task—cleaning wastewater. These living machines are also different than conventional machines in that they are powered by the sun and eliminate all the chemicals used in conventional treatment plants. Wastewater is moved through a series of open tanks, with each tank populated by an increasingly complex series of organisms ranging from bacteria and algae through marsh grasses and snails to fish. The organisms treat the nutrients and organic materials in the wastewater as food, riding the water of harmful bacteria and pathogens and creating potable water and useful fertilizers. These systems look like water gardens and are free of unpleasant odors.



The construction of a living machine wastewater treatment facility costs the same or less than a conventional treatment plant and can be built to serve from one household to ten thousand (Hawken et al., 1999). PSU's Center for Sustainability has recently constructed a living machine prototype; and the Class of 2000 has voted to give a fully functional living machine to Penn State.

Short-Term Goals for PSU

Further Reduce per Capita Water Consumption by 25% Over the Next Ten Years. Many communities have been able to significantly reduce water consumption. For example, in Goleta, CA (pop. 74,000), a combination of technical improvements, leak reduction, and rate restructuring have cut annual water consumption by 30% and sewage flow by 40% (Hawken et. al., 1999). Using these and similar measures Penn State could significantly reduce its water consumption.

Increase Visibility of Water System. Members of the Penn State community need to make connections between their water consumption and the local environment. To this end, the University should post signs explaining the source and fate of University water by faucets, toilets, and showers.[9]

Develop Proactive Strategy to Protect Groundwater. Penn State should develop a comprehensive strategy that goes beyond State and Federal standards to protect the water in

9 The University does publish a "Consumer Confidence Report" on the web that explains the sources of University water.

its aquifers.[10] The plan should include "best management practices" for stormwater management.

Long-Term Goal: End Water Waste

> *We envision a day in the near future when Penn State students, faculty and staff, will be fully cognizant that water is a wellspring for life. In this more enlightened Penn State, freshman orientation will include an initiation ceremony—newcomers will be welcomed to the Spring Creek watershed and be taken out to the mountains and valleys to walk the headwater streams, search under rocks for aquatic insect larvae, visit wells, and enter caves that reveal this region's limestone geology. At the end of the day, our newcomers will take showers recognizing that water doesn't simply come from a tap. Indeed, they will see the entire watershed when they reach for the faucet.*

With state-of-the art engineering and mindfulness, Penn State could reduce its water consumption by 4-fold. Here are some ideas for how this might be done: First, rather than taking two perfectly good resources—pure water and human manure—and then ruining them both through mixing to form wastewater, the University might keep them separate from the start. There is a way to do this—the composting toilet. Second, rather than using 40 gallons of water to bathe each day, University members could still have enjoyable showers, while using just 10 gallons of water. The answer: installation of more low-flow shower nozzles on campus. Third, the amount of water used in the washing of dishes and clothes could be more than halved using water saving technologies (Barnett and Browning, 1995). Fourth, there is no need to pump shower and washing water from wells and then shunt it to distant wastewater processing facilities. Provided the materials are safe, the University can capture significant amounts of rainwater from its roof surfaces to use for washing purposes. Fifth, significant water savings could be achieved by reusing graywater (i.e. water that has been used for washing)[11] rather than shunting it directly to wastewater treatment plants. Finally, the use of "living machines" to process building wastewater on site offers a cost-competitive technological alternative to conventional wastewater treatment facilities with remarkable educational benefits. In sum, Penn State needs to shorten and tighten the water loop and in so doing render wastewater a thing of the past.

References

Barnett, D.C. and W.D. Browning. 1995. A Primer on Sustainable Building. Green Development Series. Rocky Mountain Institute, Snowmass, CO.

CDT staff. 1999. Contaminated soil dig gets under way. Centre Daily Times, February. 10.

Cheng, Vicki. 1999. "DEP says drinking water is safe." Centre Daily Times, January 10.

---

10 As an important step in this direction, the University has already delineated and mapped well head production areas for all well fields. All potential contamination sources (e.g., storage tanks, chemical storage areas, pesticide mixing facilities, and past contamination sites) are mapped within these protection areas.

11 A graywater recovery system at the Roseland III office park (360,000 square feet) in Essex County, New Jersey, cut water use by 62% (Hawken et. al., 1999).

Hawken, P., A. Lovins and Hunter L. Lovins. 1999. Natural Capitalism. Little, Brown and Company, Boston.

Keniry, J. 1995. Ecodemia. National Wildlife Federation, Washington, D.C.

Pomponio, A. 1999. DEP: PSU waited to report gas leak. Centre Daily Times, October 6.

Sitting, M. 1980. Priority Toxic Pollutants: Health Impacts and Allowable Limits. Noyes Data Corporation, Park Ridge, NJ.

Smith, A. 1993. Campus Ecology. Living Planet Press, Los Angeles, CA.

Tamminga, K. 1995. Is the "living filter" sustainable? Assessing the land application of municipal effluent. The Environmental Professional. 17: 290-300.

Todd, J. and M. Todd. 1993. From Ecocities to Living Machines. North Atlantic Books, Berkeley CA.

MATERIAL RESOURCES AND WASTE DISPOSAL

"The wildfire spread of the consumer life-style around the world marks the most rapid and fundamental change in day-to-day existence the human species has ever experienced. Over a few short generations, we have become car drivers, television watchers, mall shoppers, and throwaway buyers."

Alan Durning

Introduction

Measured in constant dollars, the world's people have consumed as many goods and services since 1950 as all previous generations combined. Nowhere is consumerism more rampant than in the United States. On an average daily basis, each U.S. citizen now consumes (directly or indirectly) 115 pounds of basic materials—40 pounds of petroleum and coal, 29 pounds of minerals, 26 pounds of agricultural products and 20 pounds of forest products (Durning, 1992).

In terms of the consumption of materials, PSU shows no signs of straying from the national pattern. A consequence of using such large amounts of materials is the generation of immense quantities of waste.

Sustainable materials use has the following characteristics:

- **Conserving.** Products are carefully maintained and repaired; they are designed intelligently with reuse in mind; and the use of virgin materials is kept to a minimum.
- **Non-polluting**. Goods are manufactured in ways that minimize pollution.
- **Minimum waste**. Material goods are always recycled thereby reducing the need for virgin materials and lowering environmental costs associated with waste disposal.

When we treat our resources respectfully, reduce our reliance on superfluous goods, conserve and repair our possessions, and recycle our "wastes," we minimize damage to the environment and grow in self-reliance. We use three indicators to gauge the sustainability of resource consumption and waste disposal at Penn State:

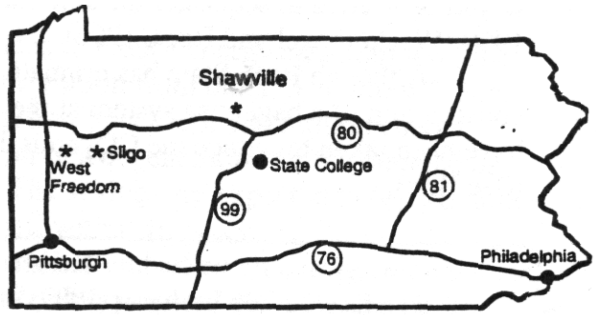
1. Total Waste Production
2. Recycled Waste
3. Paper Consumption

Indicator 1. Total Waste Production

Solid waste is a by-product of consumption. This waste has to go somewhere, and in the case of Penn State, it is either recycled or shipped to a landfill (See Box).

Where is "Away?" The Story of PSU's Trash

What happens when we toss something ir the trash? First, our trash is transferred from PSU buildings to the "dumpsters" outside. Then, large trucks owned and operated by Penn State collect the trash and take it to the Centre County Trans: Center, just past the Nittany Mall. The Universi pays the Transfer Center $48 per ton to take the trash. At PSU's current rate of waste production this comes to about $300,000 per year. Next the trash takes a long trip from "our backyard." It is trucked over 100 miles to a landfill in Central City, located in Somerset County (See Map). At the landfill, the trash is dumped into an immense depression that is sealed at the bottom.

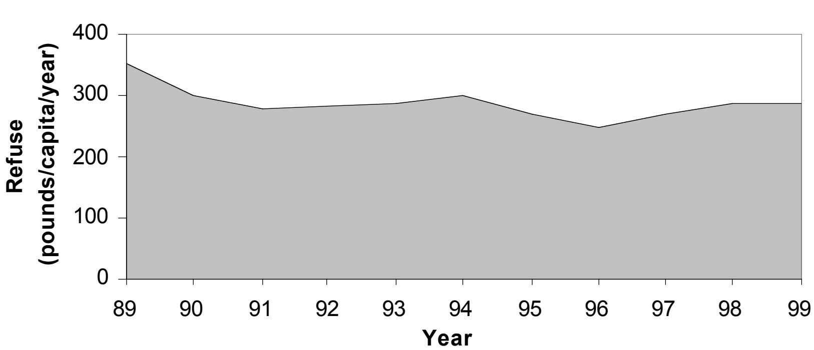


There is a final twist to this story. Much of the "trash" that is hauled to Central City and buried in the ground could be recycled! It doesn't need to make that long trip. For example, a recent excavation of a campus dumpster at Pollock Halls revealed that 46% (almost half) of the dumpster content by weight was composed of materials that are currently recycled at Penn State. When we recycle our trash we still pay to have it hauled away but the cost is only $5.00--$7.50/ton (vs. $48.00/ton when it goes to a landfill). Just by carefully separating recyclable materials from trash Penn State could save more than $100,000 per year.

Findings

The total amount of solid waste produced by Penn State was 7,420 tons in 1989. Although oscillating somewhat, refuse had increased to 9,180 tons by 1999 (Office of the Physical Plant). It is important to note, however, that there was a 1.5 % decrease in total waste from 1998 to 1999. On a per capita basis, refuse production has been steady at about 300 pounds per year (Figure 1).

Figure 1. University Park Annual per Capita Refuse Production



Indicator 2. Recycled Waste

One characteristic of a sustainable system is the cycling of materials. In the U.S. attention to recycling has increased significantly over the last two decades. What about Penn State?

Findings

Recycling of solid waste has increased at Penn State from 20 tons in 1989 to 2490 tons in 1999 (Figure 2).[1] Indeed, in 1999 PSU was recycling 27% of the total waste produced on campus**.** Roughly 50% of this recycled waste is comprised of paper and corrugated cardboard, with the remainder composed mainly of scrap metal and glass (Al Matyasovsky, Supervisor, Central Support Services, OPP, pers. comm.).[2]

Figure 2. Proportion of University Park Waste which is Recycled

Some Penn State recycling efforts have begun as bottom-up initiatives. For example, PSU's garage staff has taken the initiative to recycle tires, car batteries, and antifreeze;[3] meanwhile, concern is mounting over the growing problem of computer waste (See Box).

Computing Computer Waste

Computer waste is one of the least talked about but most serious waste problems at universities like Penn State. Computers and monitors contain toxic materials, such as lead and mercury. It is estimated that one billion pounds of lead from computers will enter the U.S. waste stream over the coming decade (Salkever, 1999). At Penn State there are probably well more than 50,000 computers on campus, and the average computer lifetime is only a few years. Penn State's Salvage Department does a heroic job of gathering unwanted computers and recycling monitors, drives, keyboards and cables, but eventually most of the components of Penn State's computers—perhaps as many as 15,000 per year—find their way to landfills. With the passage of time, hazardous materials in these land-filled computers will be leached into soil and water compromising the long-term health and sustainability of the Commonwealth. One company working to prevent useful computers going to the landfill is Keystone State Auctioneers. They collect both complete and incomplete computers from Penn State. The complete computers are sold to subsequent stores and users. The components are sold separately or rebuilt to create a complete computer. The majority of the leftover waste is recycled as scrap metal or crushed glass.

---

1 This analysis considers the recycling of consumer goods; it does not include leaf and yard waste.

2 The University Park recycling program was created to be in compliance with Pennsylvania's Municipal Waste Planning, Recycling, and Waste Reduction Act 101. This Act imposed a mandate on educational institutions to collect high-grade paper, corrugated cardboard, aluminum cans, and leaf waste for recycling. PSU had a modest recycling program in effect prior to the enactment of Act 101.

3 Recycling efforts have also begun for four other non-traditional items: motor oil from university vehicles is collected and recycled; old pallets are resold to industry; used toner cartridges are collected, sent to a toner

In the past five years, Penn State has expanded its recycling efforts to include Beaver Stadium football games. More than 165 tons of recyclable material have been saved from the landfill as a result. Of course recycling helps but if consumption remains unchecked, sustainability will remain an illusive goal (See Box).

The Four "R's"

When it comes to addressing the problem of high resource consumption, there are four things that Penn State might do. These have been called "The four R's": Refuse, Reuse, Repair, and Recycle. The four R's are listed in the order of their importance in contributing to sustainability:

1. Refuse. Begin by asking, "Does this product meet a true need?" By refusing to buy a product, we eliminate any impact and create no further demand for its production.
2. Reuse. If a product is necessary, it should be sturdy and capable of repeated use.
3. Repair. The product should be easy to fix, thereby maximizing its useful life.
4. Recycle. The product should be capable of being recycled when its useful life is over.

At Penn State, we frequently prioritize the Four R's in reverse order (Recycling to Refuse). Sustainability is better served if we question the necessity of additional purchases and rely on recycling only as a last resort.

Indicator 3. Paper Consumption

The use of paper worldwide has grown more than six-fold since 1950; and one-fifth of all harvested wood goes to produce paper (www.greenatwork.com). At Penn State there are many ways in which paper is used, from campus phone directories and course bulletins to newspapers and notebooks. This should not be surprising. We are, afterall, a university and paper is a wonderful medium for exchanging and storing information.

The paper that Penn State consumes is produced from trees—often natural forests in Canada or plantations in the southern United States. The forest trees that Penn State depends on are renewable resources: Cut them down and new ones grow back, provided that tree harvesting is done with care.

For this indicator we limit our focus to how carefully and conservatively Penn State uses paper resources. Profligate and wasteful use of paper will not be sustainable over the long-term.

Findings

Because of the myriad ways in which paper is used at Penn State, a measure of the total amount of paper consumed is hard to obtain. But by examining PSU's more paper-intensive activities we can gain an appreciation for the sheer volume of paper which the University consumes.

General Stores purchases more than 100 different types of paper, accounting for close to half of Penn State's total paper consumption. About one fifth of the University's paper-use is associated with the Daily Collegian. The Collegian is responsible for using about 719,000 pounds of paper a year. Other major paper users include university publications such as Intercom, The Penn Stater, and Research Penn State. The combined use of paper by these three publications is approximately 300,000 pounds a year. Also, on a regular basis, each of Penn State's 10 colleges puts out its own publication. For example, the College of Engineering uses approximately 27,000 pounds for Engineering Penn State. Add to this the

---

cartridge refurbishing plant, and resold to General Stores at a reduced cost; and scrap metals from various campus locations are collected and marketed to off-campus vendors.

paper used for recruitment brochures, student notebooks, course catalogues, and directories and total paper use at Penn State adds up (Table 1).[4]

Table 1. Estimates for the amounts of paper consumed in 1999 by Penn State's more paper-intensive activities.

Paper Use Category	Pounds of Paper
General Stores Purchases	1,900,700
Collegian	719,000
Student Notebooks	580,000
Intercom/Penn Stater/Research Penn State	300,000
College Publications and Recruitment Brochures	250,000
Graduate/Undergraduate/Associate Catalogues	70,000
Student and Faculty Directories	47,000
Schedule of Courses: Fall/Spring/Summer	36,000
TOTAL	3,902,700

Considering the full-time student, faculty and staff population in 1998/99 (46,984), the total paper consumption from the above uses comes to approximately 83 lbs./person/year or 8700 standard 8.5" x 11" sheets.[5] A large area of forestland is necessary to grow the trees used to supply Penn State's paper needs (See Box).

How Much Forest Land is Required to Supply PSU's Paper Needs?

Based on the above figures, Penn State consumes, approximately, 4,000,000 pounds, or 2,000 tons of paper a year. If we assume that 70.6 cubic feet of wood are required to produce one ton of paper (Wackernagel, 1994), then 141,160 cubic feet of wood would be necessary to supply PSU's annual paper consumption of 2,000 tons. The forest area needed to produce this much paper is approximately 3,200 acres—141,160 cubic feet of wood divided by 44 cubic feet (typical annual wood productivity per acre for native forests in the Temperate Zone). On a per capita basis, this comes out to about 3,100 square feet per person in the PSU population (47,000 people). Think of this as a continuously productive plot of forest measuring about 55 feet on a side for each of us.[6] This is our "paper footprint"—the amount of forest land that each of us needs working for us day after day to satisfy our paper needs.

Some measures are being taken to reduce paper consumption at Penn State including the use of electronic forms (IBIS system) for General Stores requisition and purchase orders and the switch from fold-type hand towels to roll towels in bathrooms (R. A. Witmer, General Stores). In addition to paper saving initiatives, the amount of recycled paper

---

4 Estimates are based on data from: University Stores (K. Stahl and R.A. Witmer, pers. comm.; The Lewistown Sentinel (L. Cavanaugh, pers. comm.); Centre Daily Times (Mike Donley, pers. comm.); and the offices of various university publications. We assume that students use, on average, 150 pages of paper/course for note taking.

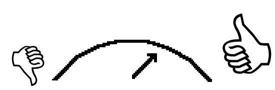
5 Often we throw away paper that has only been half-used. For example, we conducted a survey of paper recycling bins in ten campus buildings and estimated that only 15% of the paper had been fully used (i.e. both sides) before being discarded.

6 If we rely on southern pine plantations (instead of native temperate forests) to supply our paper needs, the forest area necessary per capita would be considerably less (i.e., about 400 square feet, or a plot 20 feet on a side), but plantations are disease-prone and replace biologically diverse natural ecosystems.

purchased by General Stores increased from 11,250 pounds in 1995 to 363,800 pounds in 1999.[7] Paper with some recycled content was almost 20% of General Stores total paper purchases in 1999. Since 1996, Copy Center Services has begun using a recycled stock as its default paper. This means about 40 million additional sheets of 8.5” x 11” white paper, or about 200 tons, are now recycled stock, as compared with four years ago.

While Penn State is conserving paper in some areas, paper consumption is rising in others. For example, many of Penn State’s college and departmental publications were smaller, or in some cases didn’t even exist a decade ago.[8] Overall, there is no clear indication of declining paper consumption at PSU, although there appears to be a growing commitment throughout the university community to seek ways to lower paper consumption.

Summary of Material Resources and Waste Disposal Indicators

Total Waste Production	Total waste (sum of refuse + recycled waste) increased by over 20% at University Park between 1989 (7,420 tons) and 1999 (9,180 tons); this is more than two times the increase in the PSU population for the same time period. High waste is a reflection of high consumption; few measures taken to curb consumption.	
Recycled Waste	Recycled waste has increased markedly with many significant recycling measures. A comprehensive strategy aimed at minimizing waste by restricting purchases (whenever possible) to environmentally benign products and shunting all waste into recycling pathways is still lacking.	
Paper Consumption	Paper consumption/capita at University Park is around 9,000 sheets/year. There have been reductions in paper consumption in some areas and increases in other areas. Overall, paper waste is large and a comprehensive paper conservation strategy is lacking.	

Moving Toward Sustainability

Other Institutions on the Path

Innovative businesses are discovering ways to dramatically reduce waste. The textile giant, Milliken, has developed a new technology to completely renew used carpet tile. The carpet is super-cleaned, retextured and redesigned to give it a second life at approximately half of the cost of new material (Hoffman, 1997). Recently, Colorado State paid Milliken to revitalize used carpet it had received as a “gift” from Amoco Corporation. This partnering of

---

7 A ton of paper produced from recycled paper saves approximately 4,000 kWh of energy, 7,000 gallons of water, 60 pounds of air emissions, and three cubic yards of landfill space (www.GreenWorksChannel.org).

8 Both students and faculty generally acknowledge that their increasing reliance on computers for writing and tabulation tasks has not led to personal reductions in paper consumption.

Amoco, Colorado State, and Milliken created a win-win-win scenario: Amoco avoided paying the "tipping fees" to dispose of materials that would have taken centuries to breakdown, Colorado State received support in its efforts to lower costs and act in an environmentally responsible manner, and Milliken received some business.

Universities can also use their considerable purchasing power to persuade product supplies to cut down on waste. For example, Kevin Lyons, senior buyer at Rutgers, has taken a multi-faceted approach to reduce waste that involves announcing to suppliers Rutgers' interest in reducing packaging, creating new product specifications that are environmentally sensitive, and returning packaging material to suppliers for reuse (Keniry, 1995). As a result Rutgers has saved tens of thousands of dollars, as well as setting a standard for environmental purchasing policies for universities.

Short-Term Goals for PSU

Reduce Solid Waste. Policy makers know that behaviors can be encouraged by offering "carrots" (i.e., incentives) and discouraged by presenting "sticks" (disincentives). Penn State might create disincentives for waste production by charging departments and dorm residents for garbage disposal on a weight or volume basis (Walters, 1997). At the same time, the University might use incentive-based strategies to more effectively recycle such things as transparencies, electronic equipment, and batteries.[9]

Reduce Paper Consumption by Setting an Example. Penn State continues to waste enormous amounts of paper, but with care and attention, paper consumption might be reduced by as much as 4-fold. We don't need a "program" to achieve such a remarkable reduction; we, instead, need a change in how we view paper—it is the life of trees rendered smooth. Seen as such, members of the university community will come to naturally share newspapers, post announcements once in community gathering places for all to see, and make use of electronic alternatives to paper.

Create Purchasing Policies to Reduce the Ecological Impacts of Materials Consumption. It is timely for Penn State to incorporate policies that promote sustainable product production into its purchasing decisions. Policies might include requirements to purchase products that: 1) have high recycled content, 2) are produced in an environmentally sustainable manner, 3) demonstrate maximum durability and reparability, and 4) are energy efficient, non-toxic, and recyclable (Keniry, 1995).[10] Other Universities provide models for how this might be done (See Box).

---

9 For example, Penn State purchases approximately 10,000 pounds of transparencies each year (General Stores). At present, these transparencies are buried in a land fill after use, but PSU could recycle them. The 3M corporation operates a transparency recycling center in Exeter, PA.

10 Currently Penn State makes most (although not all) purchases based on the economic criterion of "lowest cost," ignoring the sustainability precept, *account for full costs*. A product that costs a bit more because it is produced in an environmentally responsible manner will be rejected if the sole criterion is "lowest cost." This, in turn, has the effect of contributing to a vicious cycle (e.g., because the market for the environmentally responsible product is small, the costs of providing it are high; and because the costs are high, buyers avoid it and thereby fail to expand demand). Breaking the cycle requires introducing full-cost accounting into purchasing decisions.

Buffalo's Procurement Policy

The University of Buffalo has formally adopted thirteen environmental policies aimed at "promoting environmental responsibility within the University community." Buffalo's campus purchasing policy reads:

"SUNY Buffalo, through its strong commitment to environmental protection, will seek to utilize to the fullest extent possible, "environmentally friendly" products which, to whatever extent possible, have the following attributes or qualities:

--Durable, as opposed to single-use or disposable items
--Made of recycled materials with high post-consumer content
--Non-toxic or minimally toxic
--Highly energy efficient in production and use
--Manufactured in an environmentally sound, sustainable manner by companies with good environmental track records
--Causing minimal or no environmental damage during normal use or maintenance
--Shipped with minimal packaging (consistent with care of the product), preferably made of recycled and/or recyclable materials
--Produced locally or regionally (to minimize the environmental costs associated with shipping)" (http://wings.buffalo.edu/ubgreen).

Long-Term Goal: Become a Minimum-Waste University

"Nature's ecosystems have 3.8 billion years of experience in evolving efficient, complex, adaptive, resilient systems. Why should [institutions] reinvent the wheel, when the R & D has already been done?" G. Friend

Fifty years hence, it may well be that Penn State students and administrators will look back at our current resource-intensive consumption model in astonishment, unable to comprehend how an institution could consume so much and generate so much waste. If we achieve sustainability in the future, we will be relying only on a small fraction of the inputs that we now require, and the wastes that we generate will be minuscule compared to today's amounts. We will have evolved from dependence on a wasteful "throughput" system to a sustainable cyclic system.

Many business people and engineers are now working to create industrial processes that eliminate waste altogether. These are referred to as "intelligent product systems" (Hawken, 1993). One strategy is to make products that are wholly biodegradable, (e.g., capable of being transformed into food for another organism). In the case of durables which cannot easily decompose (e.g., toasters, televisions, cars), an *intelligent products* approach would entail leasing products to consumers. Products would be designed for easy disassembly and re-use. Already, car manufacturers are embracing this *intelligent product* approach in Germany: Newer models are designed to be disassembled and parts are bar-coded to identify materials and facilitate re-use.

The idea of almost totally eliminating waste may sound radical but it isn't; rather it is a sensible and necessary pre-requisite to true sustainability. Here, as in other areas, Penn State could, if it chooses, be among those leading the way. We could make it our mission to become a "minimum-waste" university. We could do this through a series of well-conceived steps designed to minimize waste on campus, while simultaneously coaxing our suppliers toward "zero waste" production technologies.[11] Because of its size and prestige, Penn State alone, is capable of sending strong signals to its suppliers and the collective power of all of America's 3,800 colleges and universities (combined annual buying power of $185 billion)—together with their role as molders of vision and character—puts them in a unique position to promote zero-waste production systems throughout the nation (Cortese, 1999).

References

Cortese, A. 1999. The university as a model of sustainability. www.2nature.org

Durning, A. 1992. How Much is Enough? Worldwatch Environmental Alert Series. W. W. Norton, New York, NY.

Hawkin, P. 1993. The Ecology of Commerce. Harper Collins, New York, NY.

Hoffman, S. 1997. Eco-partners in education: a unique environmental initiative that bridges the gap between corporate America and the college campus. Pages 144-149 In: R. J. Koester (ed.), Conference Proceedings: Greening of the Campus II: The Next Step. Ball State University, Muncie, IN.

Keniry, J. 1995. Ecodemia. National Wildlife Federation, Washington D.C.

Slakever, A. 1999. Information Age byproduct: a growing trail of toxic trash. Christian Science Monitor.

Thorpe, B. 1999. Citizens Guide to Clean Production. Clean Production Network, The University of Massachusetts, Lowell.

Wackernagel, M. 1994. Biological Footprint and Appropriate Carrying Capacity: A Tool for Planning Toward Sustainability. UMI Dissertation Services, Ann Arbor, MI.

Walters, Laurel S. 1997. Coming soon to curbside: George Jetson gets your trash. The Christian Science Monitor, May 14.

11 How might Penn State exert its buying-power to encourage businesses to pursue zero-waste technologies? Two examples: 1) Penn State might announce independently, or in concert with other universities, that it will only purchase products from companies that endorse the Valdez Principles (i.e., those that publicly commit to waste reduction, wise use of energy, and sustainable use of natural resources) (Thorpe, 1999). 2) Penn State might endorse the concept of Extended Producer Responsibility (EPR) by announcing that it will give special preference to companies that assume responsibility for taking back their products (e.g. computers, appliances, vehicles) at the end of their useful life. EPR has been enacted or is under serious consideration in Austria, Germany, Belgium, France, Japan, and the UK, as well as in numerous local jurisdictions (Thorpe, 1999).

FOOD

"How we eat determines how the earth is used." **Wendell Berry**

Introduction

Food: There is nothing more central to our existence! Throughout history humans have sought it out in myriad forms, both animal and vegetable; they have celebrated its planting and its harvest; they have written poetry about it and fought wars over it.

Penn State is surrounded by farmland. Crop fields line many of our valley roads. It comes as a surprise to many that most of our local crop land is dedicated to growing food for animals (e.g., roughly 99% of the corn produced in Centre County goes to feed animals; National Agricultural Statistical Summary) (See Box).

Our "Local" Food System

Only a small fraction of the food consumed at Penn State comes from local sources, but our region could theoretically supply a significant portion of our dietary needs. Eric Sheffer (Penn State graduate student) has recently determined that each of us would require 0.6 acres of Centre County cropland to provide our annual food needs (i.e., our grain, vegetable, fruit, dairy, and meat requirements), assuming a balanced (USDA-approved) diet. This means that the existing cropland in Centre County (approximately 90,000 acres) could theoretically meet the dietary needs of the county's entire population (158,000 people). Of course, such a diet would not provide the variety of foods that we now enjoy year round, but Sheffer's analysis does raise an important question: Might there be some happy medium between the impractical notion of 100% local-food consumption and our present system of low local food consumption?

For Penn State students, a simple swipe of a card at one of the campus dining commons provides access to fresh vegetables, fruits, hot entrees, sandwiches, soups, and desserts. But don't be fooled: The PSU food system is complex. It includes farm field activities, as well as the processing, packaging, transport and retailing of the food we eat. At each step, the choices that are made have the potential to promote or undermine sustainability.

A sustainable food system has the following characteristics:

- **Healthy diet.** Food is wholesome; diet is balanced.
- **Low waste.** Strong emphasis on waste elimination and recycling; food waste is composted; packaging is minimized; disposable eating/drinking implements are rejected in favor of durable tableware.
- **Regional orientation.** Explicit linkages are made between a region's land and its food producing potential; government policies (both at federal and regional levels) foster farmland preservation, caps on farm size, crop and animal diversification, and regional (as opposed to predominantly global) alternatives to food production.
- **Sound farming practices.** Food is produced using non-damaging, ecologically sustainable methods: Soils are carefully managed, becoming more fertile with time; pests are controlled, to the extent possible, using biological and cultural techniques (as opposed to pesticides); and the amount of fossil fuel energy used to produce food is always less

than the energy contained in the food itself (i.e., the food system has a positive energy balance).[1]

A diet that is sustainable must foster both the health of the individual and the health of the environment. With this in mind we have selected three indicators of a sustainable food system:

1. Dining Commons Diet
2. Dining Commons Waste
3. Food Purchasing Policies

Indicator 1. Dining Commons Diet

With thousands of students being served every day in the Penn State dining halls, there is tremendous potential for launching life-long healthy and responsible eating patterns by serving healthful food, educating students about nutrition, and demystifying our food system.

Findings

Menu planning: Food Services at Penn State is a business that is primarily concerned with satisfying the customer. Thus, the highest priority in menu planning at PSU is given to student preferences. “Acceptability ratings” are given to all entrees by calculating the average number of servings taken by students at each meal. Decisions as to which foods to continue serving and the quantities to prepare are primarily based on these "student ratings" which tend to be relatively high for things such as french fries, while low for others such as vegetables. However, Food Services is committed to providing healthy options to students. For example, at least one of the entrees served at each meal is *nutritionally dense* and one is vegetarian (Lisa Wandel, Associate Director of Food Services, pers. comm.; Michele Newhard, Program Specialist, Food Services, pers. comm.).

Dining Commons education: Surrounded by an astounding array of foods at each meal, students may find it somewhat overwhelming to eat healthfully. For many years, Food Services has provided labels with information on the fat and calorie content of the foods being served. More recently it implemented the "Five Star System" which provides further nutritional information. Foods which are good sources of protein, for instance, have a protein star on the label. Information on such things as sensible eating, vitamins, and eating disorders is also made available through peer educators as part of PSU’s Health Works Program administered jointly by the Nutrition Department and the Office of Health Promotion and Education. A few attempts have even been made to elucidate the ecological and social dimensions of our food system, including an advertising campaign, “Eat What You Take for Earth’s Sake.”

Student diet: We analyzed the food consumed during a typical Spring, 1998, week at Redifer, one of the Dining Commons at Penn State, to determine how closely student eating patterns match the healthful diet outlined in FDA’s Food Pyramid guide to healthy eating.[2]

---

[1] The success of modern agriculture is due in large part to the availability of inexpensive fossil fuels. Indeed, we invest about ten times more energy (as fossil-fuel) to produce our food (includes energy used in food processing, packaging, and transportation) than the food that we consume actually contains. Given the finiteness of fossil fuel resources, this is not sustainable.

[2] Our figures are based on total amounts of food consumed in the dining hall. The typical student diet will vary in so far as some students might eat more, some less, of the various food categories.

Overall, the student diet, in aggregate, compared favorably with the food pyramid diet—the number of servings per food group usually falling within, though sometimes exceeding, the recommended ranges (Table 1).[3]

Table 1. Comparison of the average Penn State student diet and the USDA Recommended Diet.

FOOD GROUP	STUDENT DIET (number of servings/day)	USDA RECOMMENDED (number of servings/day)
Grain Group (bread, rice, pasta, cereal)	**9.0**	**6-11**
Vegetable Group	**5.4**	**3-5**
Fruit Group	**4.0**	**2-4**
Meat & Beans Group	**4.9**	**2-3**
Milk Group (milk, cheese, yogurt)	**3.2**	**2-3**
Fats, Oils & Sweets[a]	**>3**[b]	**Use sparingly**

[a] During the one-week period of this study an estimated 2.5 gallons of vegetable shortening, 10.5 gallons of cooking oil, 70 pounds of butter, and 112 pounds of margarine were used at Redifer Dining Commons. Butter and margarine consumption came to about 1.25 "sticks"/person/week.

[b] Includes sweet breads, cake, pie, pudding, ice cream, etc.

The most obvious departure from USDA recommendations was students consuming much more protein than they need; 4.9 servings of meat, eggs and beans per person per day compared to the recommended 2-3 servings. Almost three-quarters of these servings (3.6) were coming from meat, while only 1.0 and 0.3 came from eggs, and nuts/legumes, respectively. This level of meat consumption worked out to 0.56 pounds of meat consumed per person/per day or 204 pounds per person/per year. Red meat and pork consumption was relatively low (0.6 servings/day for each), while poultry was high (2.2 servings/day).

The "bottom line" is that Penn State Food Services offers a diet which is relatively healthful. Given a wide array of food choices, students stray from the ideal in ways that are typical of the American diet: overconsumption of meat, refined sugar and, possibly, fat.

Indicator 2. Dining Commons Waste

Waste in the dining halls occurs when food is not fully utilized and thrown away or when the tableware used to serve food (cups, flatware, etc.) is discarded after eating.

Findings

None of the approximately 1.5 pounds of food discarded per student per week in the dining commons is recycled.[4] The total of this food waste for all dining commons combined was estimated at 294 tons[5] in 1997. It isn't just the food that is being wasted; all the labor

---

[3] The number of servings consumed may be somewhat overestimated in some cases because there was no attempt to correct for waste (e.g., vegetable peels, food served but not consumed by students).

[4] The amount of food discarded per week by students is based on a study of Simmons Dining Commons.

[5] [1.5 lbs. x 10,670 (average number of students with meal plans) x 36 (weeks of food service during Fall and Spring semesters)] + [1.5 lbs x 460 (average number of students with Summer meal plans) x 16 (weeks of food service during Summer)] = 294 tons.

and energy associated with the production, processing, transport, refrigeration, and preparation of the discarded food is also wasted. On top of this, the University is obliged to pay the tipping fees ($48.00/ton) to dispose of food "waste" (See Chapter on Material Resources and Waste Disposal).

Efforts are underway to reduce food-related waste in the dining commons. In Fall of 1996 several dedicated staff and faculty helped launch Project Earth Grow, a pilot program to compost some of the waste produced in the dining commons. As of Fall 1999, 100% of the pre-consumer green waste[6] and post-consumer paper napkins from seven PSU dining halls was being composted.[7] Although "throw-away" containers are still used for single servings of items like jelly, sugar and crackers, the tableware used to serve food is durable: plates and cups are porcelain, beverage containers are glass, and flatware is metal.[8]

In sum, although food continues to be wasted in Penn State's dining halls, the use of durable tableware and the initiation of a strong food waste composting program are significant steps toward sustainability.

Indicator 3. Food Purchasing Policies

Penn State has the potential to exert great leverage through its food purchasing decisions. Each dollar spent, in effect, is a vote for a certain way of doing things. Thus, through its food purchasing decisions, the University has the opportunity to pro-actively support a sustainable and just food system, if it so chooses.

Findings

It is not easy to buy food for Penn State's myriad dining halls and food outlets. Thus, it is natural that our food buyers seek dependable suppliers who offer a variety of food products at reasonable prices (Lisa Wandel, Associate Director of Food Services, pers. comm.). While this certainly makes economic sense in the short term, it often does not promote long-term food system sustainability.

Penn State Food Services has exclusive rights to provide all food on campus. This means that campus food can only be supplied by specific certified food suppliers and vendors. This policy restricts access to certain highly desirable food types. For example, none of Penn State's certified suppliers and vendors offer pesticide-free, organic foods.

In addition to price and convenience, an institution with a solid commitment to promoting a sustainable food system would consider the following:

- Practices involved in food production. In many cases the farming practices employed to produce our food are not sustainable (Crews et al., 1991; Lacy, 1993) because they deplete natural capital—namely water and soil resources—upon which long-term food production depends. Penn State doesn't consider the sustainability of the practices involved in the

---

6 "Pre-consumer green waste" refers to plant wastes generated in meal preparation by the kitchen staff.

7 There are plans for a one-month pilot program to begin in Spring, 2000, to compost post-consumer green waste. The projected amount to be collected is close to 200 tons, which would bring the total for both pre- and post-consumer composted waste to 500 tons. Composting this waste could result in projected savings of $24,000 (Al Matyasovsky, Supervisor, Central Support Services, OPP, pers. comm.).

8 However, paper, styrofoam and plastic containers are still the norm for serving food in the campus eateries (e.g., Ottos in Kern, The Cellar in the HUB).

production of the food it purchases. Consequently, it inevitably supports ecologically irresponsible farming, at least to some degree.

- Practices involved in packaging. Much of the food that we purchase, even that purchased in dining halls, is excessively and wastefully packaged. Penn State has no policy which might steer it away from the purchase of excessively packaged foods, so the University misses an opportunity to use its buying power and prestige to signal producers regarding packaging preferences.

- Treatment of animals. The treatment of poultry, swine and livestock raised in confinement for human consumption is an issue of significant ethical concern in many quarters, but not one which enters into meat purchasing decisions at Penn State.

- Labor practices. The fact that U.S. food is relatively inexpensive often means that consumers are not paying the full costs involved in its production. Sometimes we fail to pay environmental costs and pass on ecological debts to future generations. In other cases, we may fail to pay social costs as when the production of food involves the unjust treatment of farm laborers. These concerns do not enter into Penn State's food purchasing decisions.

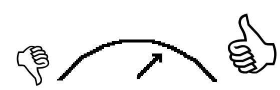
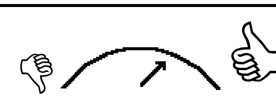
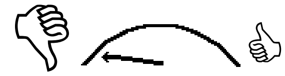
- Distances involved in food transport. Most of the food Penn State purchases comes from far away (See Box). Some of these foods (e.g., coffee, tea, oranges, etc.) cannot be grown in Pennsylvania and the fruits, vegetables and grains that can be grown here are only available during certain times of the year. Nevertheless, with the right policies and incentives, Penn State could be consuming significant amounts of food from the Mid-Atlantic Region, thereby contributing to a healthy regional farm economy and significantly reducing the energy expenditures involved in long-distance food transport. Penn State, however, does not consider "distance" in its food purchasing decisions.

So Where Did that Lunch Come from?

To gain a notion of the magnitude of our reliance on food produced in distant places, we examined the dining hall lunch menu for one day (See Figure Below). We began by determining the ingredients of each menu item. Then we determined the distance each ingredient traveled from its last distribution point to Penn State. For example, the origins of the ingredients for the first item on the menu, New England Clam Chowder, were: clams from Seawatch International in Milford, Delaware; dried onions from Basic Vegetable Products in King City, California; frozen potatoes from J.P. Simplot in Boise, Idaho; margarine from Dean Foods in Richmond, Virginia; flour from Pillsbury in Minneapolis, Minnesota; and white pepper from Atlantic Spices in Avenel, New Jersey. By de-constructing the entire menu in this way, we determined that the average distance traveled per menu ingredient was 873 miles. This was just the distance from the last distribution point to Penn State. The entire menu, summed over all ingredients, traveled over 50,000 miles to reach Penn State.

In sum, Penn State, like almost every other large university, buys its food in bulk at the best price. The University shies away from considerations such as those listed above because of the complexity of the issues involved. Food Services staff, wedged between a mandate to minimize costs at one end and satisfy the customer at the other, needs to be encouraged both from below (strong student demand) and from above (strong administrative mandate) before being able to apply their considerable expertise and problem-solving capabilities to promote a truly sustainable food system at PSU.

Summary of Food Indicators

Dining Hall Diet	Diverse food offerings in dining halls that form basis for healthy diet; significant efforts to provide students with nutritional information; but continued dependence on an industrial food system that often relies on hormones, antibiotics, pesticides, food additives and excessive food processing—all of which compromise food quality.	
Dining Hall Waste	Significant measures implemented, such as Food Composting Program, but composting good food rather than consuming it directly is still wasteful.	
Food Purchasing Policies	Food purchasing based on least cost and convenience criteria; reluctance to use food buying power to address such things as: distances involved in food transport, unsustainable farming practices, excessive food packaging, unethical treatment of farm animals, and unjust labor practices—all of which must be considered in the promotion of a sustainable food system.	

Moving Toward Sustainability

Other Institutions on the Path

Although it is difficult to change deeply embedded food tastes and purchasing patterns, several colleges have begun the exciting process of reinventing their food systems. For example, Hendrix College in Arkansas requires that food served in its cafeterias: 1) be local when possible; 2) be grown using sustainable farming methods; 3) use minimal energy; 4) leave marginal land out of production; and 5) involve the humane treatment of animals. When Hendrix initiated its program, less than 10% of the food served on campus came from Arkansas. Today, 30% comes from Arkansas and the college aims to reach 50%. Following the lead of Hendrix, both Carleton and Saint Olaf Colleges in Minnesota are also redesigning their food systems. Even at their more northerly latitudes, close to half of their food purchases could be local (Bakko and Woodwell, 1992). Closer to home, the Food Project at Wilson College in Chambersburg, PA, is working to re-direct 30% of Wilson's food budget to local growers.

These initiatives are not limited to small colleges. Both the University of Wisconsin and Cornell are altering their food buying practices. For example, at Cornell a student organization (The Cornell Food Project) works with Dining Services to increase the amount of locally produced foods served on campus. The Cornell Project also educates students through workshops held in dormitories and events such as "New York Harvest Week" (a week in September when Cornell obtains all of its produce from local sources).

Short-Term Goals for PSU

Purchase Food from Central Pennsylvania. Penn State should formulate a clear policy to promote the purchase of regionally-grown (e.g., from a radius of 50 miles of University Park) food for its dining halls and public eating places. Specifically, Penn State should commit to purchase at least 10% of all its non-dairy food needs from regional growers by 2010.[9] A good place for PSU to start would be with crops such as onions, potatoes, winter squash, beets, and carrots (i.e., crops that grow well in Central Pennsylvania and that could be purchased in large quantities at the end of the growing season and then stored in underground "root cellars"). If Penn State sent a signal to local growers clearly indicating that it was ready to buy significant quantities of these crops at prices that justly compensated farmers for their efforts, there is little doubt that farmers would respond.

Offer Organic Food in Dining Halls and Eateries. There is a growing demand for food which is free of antibiotics, additives, and pesticide residues and which has not been genetically modified—in short, certified organic food. Penn State should respond to this demand by offering organic food selections on campus.

Make the Food System Visible. Penn State needs to tell a more complete story about the food it serves. For example, serving line labels in the dining commons could explain where each food offering comes from (Centre County, PA or Orange County, CA?) and who prepared it (PSU or Nabisco?). Table "tents" could connect students with their food by educating them about agriculture. On the whole, a more sustainable food system at Penn

---

[9] At present, PSU spends about 13% of its food budget on PA-grown foods; most of this is dairy products with small amounts of fruits and vegetables added in (Tom Gibson, pers. comm.).

State would be proactive rather than passive, recognizing that food is a great teacher (See Box) and taking advantage of this opportunity.

Union Street: Is PSU Traveling Down the Wrong Road?

When Housing and Food Services began to plan for a redesigned food area named Union Street in the expanded HUB/Robeson Center, they surveyed students and other universities to gauge student preferences and trends in campus eateries. The surveys showed that PSU students were asking for national chains and that other universities were bringing "chains" on campus. Food Services decided that they would rename many of the restaurants from the old HUB, but also develop new eateries around brand names such as Ortega, and recruit several national food chains, such as Chick-Fil-A. Union Street was thus designed to create a "marketplace atmosphere" that emphasizes "faster, more convenient service."[10]

Most would agree that we need more space for social interaction on campus and, thus, the HUB expansion was greeted with considerable anticipation. However, Penn State may have gone astray by creating a space which: promotes national chains rather than local enterprises; encourages speed and convenience rather than mindful eating; and does all this in a "marketplace," rather than a "gathering place," atmosphere. To some extent, Union Street reflects student preferences, but have we considered what it teaches?

Long-Term Goal: Purchase, to the Fullest Extent Possible, Foods Produced Using Sustainable Practices

> *"Eating is a profoundly social and ecological event that connects us in the most intimate and primary way to others, to our land, water, and soil, to the future, and to other species. As eaters, we not only consume agricultural products, we also shape the relationship between agriculture and nature by our food choices."*
>
> Dorothy Blair, Penn State Professor of Nutrition

Penn State should use its research and extension expertise to actively guide the Commonwealth toward a food system which respects life, family farms, healthy soil, regional economies and wholesome food (instead of one increasingly centered on genetically engineered crops, industrial farming and excessively processed food).

If we are to create a truly sustainable food system, we will need to draw in our supply lines. A more regionally-oriented food system would not only ease our reliance on fossil fuels for food delivery and processing (Valen, 1992), but help foster connections between urban residents, the land, and the farmers who work the land.

Penn State has power and prestige. Rather than settling for our current unsustainable food system, the University could use its power and influence to promote a more sustainable food system. If this occurs, it would create a "win-win" situation that meets the needs of the campus population and earns the support of the people who live in our region. Following Penn State's leadership, other institutions such as hospitals, corporations, and government agencies could become markets for regional food producers who use healthy and environmentally sensitive production methods.

---

10 David Gingher, Assistant Director of Food Services for Union Street, in the July 17, 1998, Intercom.

References

Bakko, E.B. and J.C. Woodwell. 1992. The Campus and the Biosphere Initiative at Carleton and Saint Olaf Colleges. In Eagan, D.J. and Orr, D.W. (eds.), The Campus and Environmental Responsibility. Jossey-Bass Publishers, San Francisco, CA.

Crews, T.E., C.L. Mohler, and A.G. Power. 1991. Energetics and ecosystem integrity:The defining principles of sustainable agriculture. American Journal of Alternative Agriculture 6(3): 146-149.

Lacy, W.B. 1993. Can agricultural colleges meet the needs of sustainable agriculture? American Journal of Alternative Agriculture 8(1): 40-45.

Pimentel, D., L. E. Armstrong, C. A. Flass, F. W. Hopf, R. B. Landy and M. H. Pimentel. 1989. Interdependence of food and natural resources. In D. Pimentel and C. W. Hall (eds.) Food and Natural Resources. Academic Press, Sand Diego, pp. 32-48.

Strange, M. 1988. Family Farming: A New Economic Vision. University of Nebraska Press, Lincoln, NB.

LAND

"All ethics so far evolved rest upon a single premise: that the individual is a member of a community of interdependent parts...The land ethic simply enlarges the boundaries of the community to include soils, waters, plants, and animals, or collectively: the land."

Aldo Leopold

Introduction

Land in the U.S. and throughout the world is increasingly seen as a commodity—something to profit from in the short term with little thought for the future. So it is that farmlands in Central Pennsylvania are sold off to developers. Land that grew corn for generations now spawns housing tracts, four-lane highways, malls, and parking lots.

In the past, land carried deep meaning—tribal homeland, holy mountain, ancestral birthplace, mother earth (See Box); but as we become more disconnected from our home place, land loses its deeper significance, often becoming a mere bargaining chip—a commodity—to be bought and sold at strategic moments.

> **Sustainability Begins with Respect for the Land's History**
>
> Several Native American archeological sites exist on Penn State property. One such site encompasses the land around the Orchard Road/Park Avenue intersection (just beyond Beaver Stadium). This site was a Native American "quarry" used for several thousand years starting about 8,000 years ago. Jasper, an iron-rich, flinty stone, occurs as scattered surface nodules in this area. The remains of several jasper "chipping stations" can still be found below the "quarry" (J. Hatch, PSU Professor of Archeology, pers. comm.). When archeological sites are altered, such as by development, they lose their scientific value and can no longer instruct us on the past.

Sustainable land stewardship has the following characteristics:

- **Values the native biota.** Supporting and protecting the life that is native to a region strengthens the community's identity and ensures that the region's unique natural ecosystems remain healthy.
- **Respects natural processes.** Allowing natural cycles and processes (e.g., birth/death, growth/decomposition) to operate reduces the cost of land maintenance and provides opportunities to promote ecological literacy.
- **Conserves green space.** Providing special protection to natural areas, open spaces, and fertile farmland helps ensure that poorly planned "development" does not sprawl across the landscape.

In a sustainable landscape, land ownership should be guided by adherence to a well-thought-out land ethic; vegetation should be primarily composed of native species that have played an important role in local history; impervious surfaces should be kept to a minimum; and campus grounds should be self-maintaining and pesticide free to the extent possible. With this in mind, we selected the following indicators:

1. Land Accumulation and Policies
2. Percent of Campus Land Covered by Impervious Surfaces
3. Native vs. Exotic Plants on Campus
4. Pesticide Use in Land Care

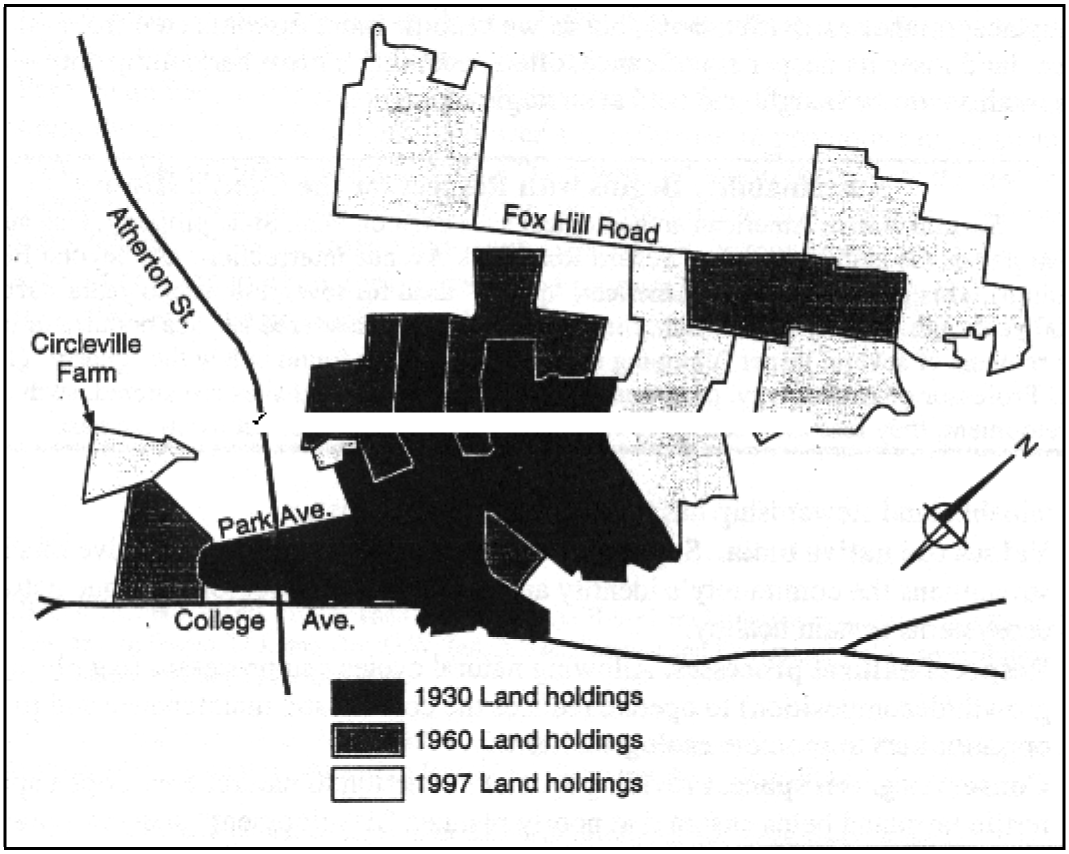
Indicator 1. Land Accumulation and Policies

An ethic based on sustainability principles calls the University to be a wise steward of its lands. Hence, we begin by examining Penn State's land holdings, paying particular attention to policies which might promote responsible land stewardship.

Findings

Between 1926 and 1999, Penn State/University Park increased its land holdings in the immediate vicinity of campus from 1,708 acres to 6,164 acres (Figure 1). Overall holdings at University Park (e.g., including Stone Valley recreation area and experimental forests) sum to 18,512 acres (www.psu.edu/academic/bluebook/).

Figure 1. Expansion of University Park Lands in the Immediate Vicinity of Campus in the 20th Century.



With a few small exceptions, Penn State has not engaged, to date, in the selling of its holdings. A notable exception now on the horizon is the University's disposition to sell Circleville Farm (See Box).

Circleville Farm: An Opportunity for Penn State To Act as a Catalyst for Ecologically Responsible Land Stewardship

The Circleville Farm is a 176-acre Penn State land holding adjacent to Circleville Road about one mile from the Main Campus (See Figure 1). Seventy-five percent of the land surrounding the farm has been transformed into housing developments, 15% of the perimeter land is now zoned industrial, and the remaining 10% is bordered by the Penn State golf course.

Although Penn State intends to sell Circleville, it could stipulate that the buyer create a forward-looking, ecologically responsible village there. The “village” might embody many of the principles of sustainability that are highlighted in this Report such as:

--highly efficient, state-of-the-art energy systems (Energy Chapter)
--zero-waste discharge water system (Water Chapter)
--significant amounts of food grown on community land using sustainable farming techniques (Food Chapter)
--cluster housing with 75-80% of the site left in natural state (This Chapter)
--structures designed and constructed using "green design principles" (Built Environment Chapter).
--car-free, bicycle/minibus transportation system (Transportation Chapter)
--co-housing living arrangements centered on civic responsibility and democratic arts (Community Chapter)

Many Penn State professors and students, as well as citizens of Centre County, are actively involved in the conceptualization and planning of this project.

Clearly land stewardship is a concern at Penn State.[1] Increasingly, words such as "green space," "sustainability," and "preservation" appear in Penn State’s planning documents.[2] However, the University still has no policy that specifies principles of responsible land stewardship.[3]

Indicator 2. Percent of Campus Land Covered by Impervious Surfaces

Impervious surfaces, such as pavement and rooftops, are impenetrable to water. Because water cannot penetrate the ground, it runs instead into stormwater drains, carrying pollutants (such as those associated with motor vehicles) into local streams.

Findings

As University Park enrollment and programs have grown, the University has constructed additional buildings and parking lots. In this process, green space has been lost. The percentage of the University Park campus covered by impervious surfaces increased from 3.3 million square feet, or 29.9%, in the 1960s to about 4.9 million square feet, or 44.9%, in the 1990s (Kulakowski, 1997).

---

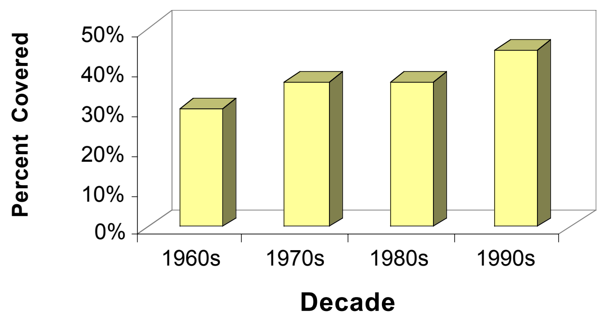
1 For example, Penn State's Shaver's Creek complex provides environmental education opportunities for students and citizens; and the newly created Millbrook Marsh Nature Center (created in partnership with local government and conservation groups) emphasizes environmental education and land stewardship.

2 For example, the Penn State Master Plan shows sensitivity to land stewardship as evidenced in the Plan’s commitment to:

--*Protect and preserve the integrity of the open land and agricultural fields surrounding the core campus.*
--*Demonstrate environmental stewardship by respecting sensitive natural and cultural areas and promoting environmentally responsible practices.*
--*Base future land-use decisions on environmental impact considerations and evaluation* (University Park Campus Master Plan/www.opp.psu.edu/upmp/upmp.htm).

3 Penn State does have a standard forest management plan for its experimental forest holdings located near Stone Valley (R. Brooks, Professor of Wildlife Science, pers. comm.).

Figure 2. Proportion of University Park Campus Covered by Impervious Surfaces



This increase of approximately 50% over the past three decades is due in part to the increased number of buildings on campus. For example, the Wartik Building sits on the former site of the Beal Botanical Garden; Thomas Building has taken the place of playing fields; and Pattee Library has now expanded into a grassy area that once contained scattered oak trees.

Although new buildings usurp green space, they generally enrich the academic life of the University. The University Master Planning Process is a welcome attempt to reconcile university growth with the need for green space.

Indicator 3. Native vs. Exotic Plants on Campus

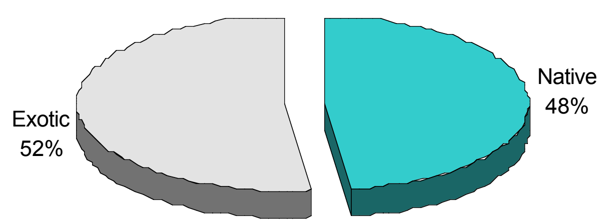
By maintaining campus grounds rich in native species, Penn State respects the life and evolutionary processes native to this place.

Findings

Many of the plants on the University Park campus are native, existing in this region prior to European settlement. In contrast to these "natives," are exotic species. Some of these exotics have been purposefully introduced to provide live examples for teaching purposes, while others have simply spread into the region (e.g., many lawn "weeds" are exotics).

Based of a study by Kulakowski (1997) 48% of the woody plants on campus are native and 52% are exotic (Figure 3).[4]

Figure 3. Native vs. Exotic Woody Vegetation at University Park



[4] The exotic species found on campus have been introduced from all over the world. Several academic departments request that exotic plants be cultivated for educational purposes. This creates a troubling dilemma. On the one hand, ecological research over the last century reveals that the mixing of biotas can lead to disruptions in local ecosystem processes (Ruesink et al., 1995). On the other hand, exotic species can have significant educational value in a university setting.

Because few historical records are available at Penn State regarding campus vegetation, no well-documented trend is evident with regard to native vs. exotic vegetation. However, before the founding of Penn State, the region was covered, for the most part, by native vegetation. Since that time, exotic species have gradually increased, indicating a long-term trend away from native vegetation on campus. At present, Penn State has no policy designed to give preference to native plants in its landscaping decisions and therefore has taken few significant steps to promote a more natural and sustainable landscape.

Indicator 4: Pesticide Use in Land Care

By definition, pesticides are poisonous, at least to some life forms. Often, they affect organisms other than those for which they are intended, and they can persist in the environment long after their time of application.

Pesticides are generally associated with outdoor activities, like farming and lawn care, but pesticides are also used indoors (Morris, 1998) (See Box).

Pesticides Indoors Too at PSU

At Penn State, Ehrlich Company is contracted to control pests in campus buildings. Of the 392 "major" buildings on campus, Ehrlich checks 53 for pests on a regular basis. The pests of most concern are ants, roaches, millipedes, silverfish, and mice. Roughly 15 different types of baiting powders and sprays are used to control these pests. Pollock Commons is an example of a building that is checked monthly for pests: food storage areas are treated with baits; sprays are applied to cracks where flooring meets the walls and to underground crawl spaces. In recent years, Ehrlich has been moving to less toxic, more controlled applications of pesticides in buildings (Keith Hamilton, Ehrlich District Manager, State College, pers. comm.). Nonetheless, pesticides continue to be applied regularly to many campus buildings.

Findings

Pesticide use has declined at University Park in recent years (Kulakowski, 1997) and the University is developing an effective Integrated Pest Management Program (IPM) on campus; nevertheless, approximately forty different pesticides—spread among fungicides, herbicides, insecticides, and rodenticides—are still used on the Penn State campus (includes playing fields and golf courses) each year (Saari, 1999). In 1999, approximately 10,300 liters of pesticides were applied at University Park.[5] Many of these pesticides are known to have adverse health affects: 33% are known to be irritants; 25% are either known or suspected to cause cancer; 7% are known or suspected to be mutagens or teratogens; 2% can cause sterility; and 2% can cause permanent sensory damage (Chemical and Pharmaceutical Press, 1999; Saari, 1999).

While many of these pesticides are applied to the ground, some are applied to trees (See Box).

Keeping the PSU Elm Trees Alive

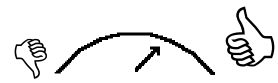
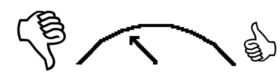
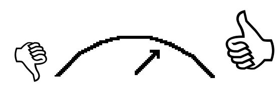
Elm trees have become a symbol of the Penn State campus, adding graceful definition to campus walkways and roads, but for many years now North American elm trees have been under attack from an exotic European fungus. The fungus clogs the elm's water conducting tubes, eventually causing its death. The sickness (called Dutch Elm Disease) is spread by a wood-boring beetle which makes its home in elm wood and inadvertently spreads the lethal fungus from elm tree to elm tree.

The University Park campus is home to 300 elm trees. About three of Penn State's three hundred elm trees die each year from Dutch Elm Disease. Through extensive research on the disease-carrying beetle, university arborists have developed several methods for combating the

5 This number refers to the amount of pesticide product applied. In some cases, pesticides are mixed with carriers (e.g., oil) prior to application.

disease. At the first hint of a problem, arborists prune the branches manifesting the disease (i.e., those with drooping leaves) and inject a fungicide into the tree. If this approach is unsuccessful, the pesticide Mavrick, is applied at a time in the beetle's life cycle when the pesticide will have maximum effect. Finally, in instances when elm trees die and have to be replaced, care is taken to plant hardy elm tree stock that is resistant to Dutch Elm Disease.

Summary of Land Indicators

Land Accumulation and Policies	Steady growth in land acquisition in recent years; absence of a clearly formulated land ethic, but a growing sensitivity to the need to pay close attention to this issue, as evidenced in the Circleville Farm initiative.	
Percent of Land Covered by Impervious Surfaces	Significant increase in impervious surfaces on main campus in recent years; but growing commitment (e.g., Master Plan) to reverse this process; significant shift anticipated in near future.	
Planting of Native vs. Exotic Plants on Campus	Exotic woody plants as abundant as natives on campus; exotics do serve a teaching function but can also wreak havoc; no university-wide policy exists governing introduction of exotic plants.	
Pesticide Use in Land Care	The University's commitment to Integrated Pest Management on campus is a significant step toward sustainability, but pesticides known to have possible adverse health effects are still in use.	

Moving Toward Sustainability

Other Institutions on the Path

In addition to Penn State, a number of other universities have begun the process of harmonizing their human-constructed landscapes with nature, and their initiatives can further inspire Penn State to rethink the way it manages its land. For example, Connecticut College has committed one-third of its property to serve as an arboretum devoted to the propagation of native plants. The arboretum's collection contains 288 taxa of trees, shrubs, and woody vines, all of which are indigenous to Eastern North America. Besides providing a source of native seeds and plants for regional restoration projects, the arboretum is devoted to developing a regional identity.

Nebraska Wesleyan University (NWU) has also recognized the value of native vegetation. Twyla Hansen, NWU's grounds manager, noted the high fertilizer, pesticide, water, and labor input necessary to maintain the campuses prevailing non-native landscape. Consequently, Hansen began replanting campus zones which had been disturbed by construction or other activities with low maintenance, native grasses and wildflowers.

These universities demonstrate that it is possible for institutions of higher learning to respect natural processes, value the native biota and conserve green space. With its abundant land and faculty expertise, Penn State is well positioned to become a leader among institutions in furthering this movement.[6]

Short-Term Goals for PSU

Solidify Commitment to Creating an Arboretum at Penn State. Representatives from several colleges and the Office of the Physical Plant, in collaboration with Sasaaki Associates, have prepared a detailed proposal to establish Penn State's arboretum in the Big Hollow area just north of Park Avenue. The site is highly varied in slope, aspect, geology and rich in plant and animal species. This could be an arboretum for the 21st Century—an environmental classroom, a meeting place, and a center for interdisciplinary research.

Provide Examples of Sustainable Lawnscaping at Spruce/Birch/Pine Cottages on Campus. One of the loveliest parts of the Penn State Campus is around Spruce, Birch, and Pine cottages. This frequently visited area has the quaintness of a neighborhood in a Pennsylvania town. It is a perfect area to showcase exciting alternatives to the traditional American lawnscape (See Box).

Why an Alternative to the American Lawnscape?

The contemporary American lawn requires large amounts of energy, chemicals and money. Consider:

--An area about the size of Pennsylvania is covered by turf grass in the U.S. (This is more land area than is devoted to any single crop).

---

6 Penn State is already taking a leading role in campus composting: The amount of leaves and brush which have been collected, composted, and returned to shrub beds on campus has increased from zero tons in 1992, to 166 tons in 1998. These nutrient-rich resources were previously discarded (R. Eckenroth, Grounds Maintenance Supervisor, OPP, pers. comm.).

--Americans spend more per acre, on average, to maintain their lawns than farmers spend per acre on crops[7]; and they use up to ten times more chemical pesticides per acre on their lawns than farmers use on their fields (Bormann et. al., 1993).
The sum total of the materials, energy and effort that we direct to our lawns is substantial. With this is mind, it is worthwhile to, at least, contemplate alternatives.

The land surrounding the three Penn State cottages could be used to showcase three distinct approaches to household landscaping: 1) historical—plantings and grounds-care reflecting a turn-of-the-century house; 2) contemporary—high input/high maintenance landscape characteristic of the contemporary yard; and 3) futuristic—low input/low maintenance, diverse naturescape with strong reliance on natural processes.[8] A demonstration of this sort would afford campus visitors with the opportunity to see the lawn in a historical and ecological context and, in the process, might inspire them to experiment with alternatives to high input/high maintenance contemporary lawns at home.

Reduce Pesticide Use. As part of a land ethic Penn State should refrain from the use of pesticides on campus. Indeed, scientists now know enough about the potential dangers of synthetic chemicals (Colburn et. al., 1996; Mitchell, 1997) that it behooves the University to eliminate their use in realms where they are not absolutely necessary**.**

Long-Term Goal: Create and Abide by a Land Ethic

> *"Over the past century, the earth was re-designed in the industrial image…Over the next century, the mind of nature will redesign the earth."*
> John Tillman Lyle

Penn State is a Land Grant institution without a clearly articulated land ethic! This should change. The University could begin by simply drafting a statement of its land ethic. Aldo Leopold's (1949) often-quoted remark might serve as a starting point: "A thing is right when it tends to preserve the integrity, stability, and beauty of the biotic community. It is wrong when it tends otherwise."

Sustainable land-use requires viewing the land on which we spend our daily lives in a new way; it requires us to adopt a new aesthetic. Instead of valuing monoculture, uniformity, and linearity, a sustainable land aesthetic would cultivate diversity, complexity, and variation. Guided by this new aesthetic, we might try to imagine a Penn State landscape rich in natural habitats.

Consider the Old Main lawn as an example. Its pleasing expanse of grass, symbolizes, according to the Victorian aesthetic, the values of success and plenty (Bormann et al., 1993), but it comes at a price in terms of fossil fuels, pesticides, and health. Imagine, for fun, the same area, embodying a natural aesthetic: the Old Main meadow, a natural mixture of native grasses, clovers and wild flowers, a symbol of our area's natural vitality and plenitude.[9]

---

7 Penn State spends $3.5 million per year maintaining the University Park campus grounds. This comes to about $4,000 per acre—about twenty times more than what farmers spend per acre (Saari, 1999).

8 This is a project that offers exciting opportunities for learning across disciplines. Students from several different departments (e.g., Turfgrass Management, Horticulture, Landscape Architecture) could work together on the design, creation and maintenance of these yardscapes.

9 Efforts are now underway to convert some corporate office parks in the Midwest to meadows. The maintenance costs of these meadows are estimated to be one-tenth the costs for a conventional lawn (Malin, 1995).

Finally, imagine a campus landscape that is not only pleasant but one that has ecological lessons to teach. For example, West Campus might contain a student run CSA (Community Supported Agriculture) for the production of a small portion of the University's food, a constructed wetland for processing a small portion of the University's waste water (See Water Chapter), or a regenerating forest to sequester carbon dioxide thereby counteracting, to a degree, the large amounts of carbon dioxide released at University Park (See Energy Chapter). Saari (1999) goes further and provides examples of how individual departments could design and maintain a landscape that reflects their academic viewpoint. For example, the Penn State Geology Department could create a rock garden where it also teaches; the Music Department could care for an outdoor amphitheater where it gives public concerts; and the Geography Department could tend a living map of the vegetation zones of the United States. In the process, the students and faculty of these Departments would have the opportunity to use their hands and appreciate natural processes.[10] By becoming responsible stewards of the land that has been entrusted to our care, we can all become healthy in body and in spirit, while promoting a vital, stable, and diverse landscape.

References

Affolter, James, C. Mihalko, and J. R. Stepp. 1999. The University of Georgia Latin American ethnobotanical garden. Pages 150-153 *in* R.J. Koester (ed.) Greening the Campus III: Theory and Reality. Ball State University, Muncie, IN

Bormann, F.H., D. Balmori, and G.T. Geballe, 1993. Redesigning the American Lawn. Yale University Press, New Haven, CT.

Chemical and Pharmaceutical Press, Inc. 1999. Turf and Ornamental Reference for Plant Protection Products. Chemical and Pharmaceutical Press, Inc. New York, NY.

Colburn, T., D. Dumanoski, and J.P. Meyers. 1996. Our Stolen Future. Sutton, New York.

Kulakowski, D. 1997. Sustainability and the Pennsylvania State University: A Case Study in Urban Ecology. Master of Science Thesis, Penn State University.

Leopold, A. 1949. A Sand County Almanac. Ballantine Books, New York.

Malin, N. 1995. Restoring the Tall-Grass Prairie. Environmental Building News 4 (4): 9-11.

Melnick, P.R. 1997. Act 101 Annual Recycling Report for Municipalities. Office of Physical Plant. Pennsylvania State University, University Park, PA.

Mitchell, J. 1997. Nowhere to hide. Worldwatch. pgs. 26-36, Worldwatch Institute, Washington, D.C.

Morris, S. 1998. Safer homes and gardens. Yes Magazine, Summer.

Penn State Blue Book. http://www.cac.psu.edu/academic/bluebook/ge.html.

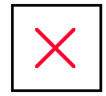
Ruesink, J.L., I.M. Parker, M.J. Groom, and P.M. Kareiva. 1995. Reducing the risks of nonindigenous species introductions. BioScience 45:465-477.

Saari, S. 1999. Paradise Lost? An Examination of the Ecological, Economic and Educational Impacts of the Suburban and University Landscape. Thesis in Ecology. Penn State University, University Park, PA.

---

10 The University of Georgia has recently built an ethnobotanical garden that brings together academic departments, physical plant managers and the University's botanical garden to be used for research, teaching and public outreach (Affolter et.al., 1999).

TRANSPORTATION



“The car's appetite can never be satisfied."

Dr. Peter Everett, Penn State Transportation Specialist

Introduction

Americans are often said to have a love affair with the automobile. We own 23 million more cars than the number of licensed drivers; each year, we drive 2 trillion miles; we have covered significant expanses of our arable land with roads; and one job in six in our country is linked to the car industry (Engwicht, 1993; Ohringer, 1992). Car-based transportation, although wonderful in many respects, has many hidden costs:

- It is expensive. A recent study by economists at the World Resources Institute, USA, entitled "The Going Rate: What it Really Costs to Drive," concluded that if the many hidden costs of car-based transport (e.g., highway and parking area construction and maintenance, police protection, chronic health problems caused by car-generated pollution, loss of productive land to roads, etc.) were passed on to the public at the gas pump, it would raise the price of gasoline to about $6 dollars a gallon in the U.S.

- Car-based transport is inefficient. As any student knows: SPEED = DISTANCE/TIME. If we were to divide our total annual car mileage (DISTANCE) by the sum total of all the TIME we spend earning the money to pay for our car, its maintenance, and its insurance plus all the time we spend stalled in traffic, looking for parking spaces, and caring for our cars, and so forth, our average car SPEED would be only about 10 mph (about the speed of biking).

- Car-based travel is a major contributor to global warming. Cars consume one-third of the world's oil production and account for about one-fifth of human-related global carbon dioxide releases.

- Car use is unsafe. In the U.S. 42,000 people are killed by cars each year. If jets were killing this many people, one would be falling from the sky every day in the U.S.

In many ways, the transport system utilized by Penn State is indistinguishable from the U.S. transport system at large. Penn State’s ‘vision’ apparently includes new highways, loops, and extensions, as well as a strong commitment to airport expansion.[1]

A sustainable transportation system has the following characteristics:

- **Clustered.** Communities are densely settled and designed (i.e., careful land-use planning) so that the places people routinely visit—schools, shops, churches, parks—are close by (i.e., within easy walking or biking distance). Clustered development (as opposed to sprawl-type development) enhances human interaction while also maximizing green space on a regional level.
- **Efficient public transportation.** Reliable, clean, convenient public transportation alternatives are readily available: mini-buses for the elderly and young within town; light rail, running at frequent intervals along main transportation corridors for longer trips.
- **Traffic calming.** The disruptive effects of cars (e.g., accidents, noise, air pollution) on community life are acknowledged. Measures to "calm" traffic (e.g., narrowing rather than widening of roads, enforcing 15 mph speed limits in town, offering right-of-way to

---

[1] Since 1963, Penn State has acquired 26 properties, covering 1201 acres, at a cost of $4,925,808 in the immediate vicinity of the University Park airport (data from Bellefonte Court House). Land acquisition accelerated after 1985 in preparation for the airport expansion: 24 of the 26 acquisitions since 1963 and 99% of the land purchase expenditures have occurred since 1985.

pedestrians and bicyclists[2]) are recognized as essential to restoring the people-centered vitality of the town/campus environment.

In short, the design of sustainable university transportation systems requires that we begin by viewing campuses, towns, and cities as an interactive people's places. The vitality of communities comes form the rich diversity and concentration of culture, information, businesses, public places, and most of all people. Transport decisions which rob communities of their vitality (e.g., continually accommodating the automobile by widening roads and building new roads) lead away from, rather than toward, sustainability (Engwicht, 1993).

Progress toward a sustainable transport system would be based (among other things) on developing and promoting alternatives to single-occupancy cars, preserving green space, and creating a safer environment. With this in mind, we used three indicators to examine Penn State's transportation system:

1. Car Dependence
2. Green Space Converted to Parking Space
3. Transport-Related Safety

Indicator 1. Car Dependence

Only about 20% of those who study and/or work at Penn State actually live on campus. The rest of the population—approximately 40,000 faculty, staff, and students—either walk, bike, bus or drive to campus each day. The distance that these commuters travel, as well as their mode of travel, bears directly on the sustainability of PSU's transportation system.

Findings

An estimated 90% of Penn State's faculty and staff drive by car to University Park on a daily basis. Very few ride the bus (4%), walk (5%) or bike (<1%). Seventy-three percent of those driving drive alone, and 27% carpool with at least one other person.[3]

In 1997, the average distance of a one-way commute to University Park was estimated to be 10.6 miles, or 15% further than in 1988.[4] Using these data, we estimate that the total work-related car miles driven by Penn State employees is approximately 108,000 miles. The gasoline consumed in this daily routine amounts to some 5,375 gallons per work day (assuming 20 mpg). This magnitude of gasoline consumption generates, on a daily basis, approximately 113,480 pounds of emissions—106,400 pounds of the greenhouse gas, carbon dioxide; 5,900 pounds of carbon monoxide, 800 pounds of hydrocarbons, and 380 pounds of nitrogen oxides.[5] In contrast to faculty and staff, walking is the primary form of commuting for most students, although many students bring cars to college (See Box).

---

[2] It seems fair to start from the principle that all travelers, whether on foot, bike or in a car, have equal rights regardless of the transport mode they have chosen. But car travelers are better armed and better protected than pedestrians and cyclists and thus a policy is needed to correct this bias. A logical policy might be to simply give pedestrians and bicyclists right-of-way over cars in all circumstances, as is now the law in some European cities. Some argue that we should even go further and subsidize pedestrians and cyclists because they are much cheaper to accommodate than cars and do little environmental harm (Engwicht, 1993).

[3] These figures are based on the results of a phone survey of 116 randomly selected faculty and staff conducted in April, 1997. Results from our sample indicate that approximately 65% of those interviewed would have needed parking permits (corrected for car pooling) in 1997. This is in line with data on faculty and staff parking permits issued for that year: sixty-four percent of Penn State's 15,607 full and part-time employees had parking permits in 1997 (D. Holmes, Transportation Facilities Coordinator, pers. comm.).

[4] This was determined by selecting 960 names at random from Penn State's Faculty and Staff Directory for the years of 1988 and 1997 and estimating the distance between the person's home address and University Park. The distance traveled for those living in State College was assumed to be 2 miles.

[5] The combustion of one gallon of gas results in the release of 19.8 lbs. CO_2, 1.1 lbs. CO, 0.15 lbs. HC, and 0.07 lbs. NO_x (Hubbard and Fong, 1995).

Students: What Does it Cost to Own a Car?

There are many benefits to owning a car but there is also a downside—expense. Take the case of Maria who grew up in Pittsburgh and is now a sophomore at Penn State. Maria commutes four miles back and forth to campus each day from her apartment on North Atherton. This ends up costing her about $4.25 per day in commuting expenses when all the hidden costs of insurance, financing, depreciation, repairs, and registration are added to the obvious cost of gasoline. Maria uses her car for other things and ends up driving 8,000 miles a year. The annual cost of operating her car (a 1994 Plymouth compact) comes to about $4,500. This is about three-quarters of what Maria paid for tuition last year! Conclusion: Penn State students can significantly reduce the cost of their college education if they are able to satisfy their transportation needs through walking, biking, and public transportation (Poinsatte and Toor, 1999).

Penn State has taken some measures to promote more sustainable transportation options. For example, the recently announced Transportation Demand Management Plan contains incentives to encourage car pooling and also includes provisions for "no fare" bus rides on campus (implemented in Fall 1999) and the creation of new bicycle paths (Intercom, 1999).[6]

Overall, faculty and staff car dependence appears to be increasing at Penn State; and although most students live within walking distance of campus, this is changing as new housing options are located further from campus (See Built Environment Chapter, Footnote 2). In sum, Penn State now recognizes many of the problems associated with heavy car dependence but the University has stopped short of adopting comprehensive measures to "calm" traffic and de-emphasize car-based travel (in favor of walking, biking, and public transportation).

Indicator 2. Green Space Converted to Parking Space

Cars require much more storage space than do most alternatives (e.g., 20 times more space is needed to park 100 cars than 100 bikes). In fact, the family car consumes an estimated three times more space than the average family home, when all aspects of space-use (e.g., roads, parking lots) are combined (Engwicht, 1993). The land area consumed by cars is even greater when we consider the energy and raw materials necessary for car transportation (See Box).

---

[6] The Penn State Master Plan is also sensitive to transportation issues within the campus community as evidenced in the Plan's commitment to create "a well-defined and pleasant pedestrian circulation system that encourages foot rather than vehicular travel within campus, thus reducing parking demand and traffic" (www.opp.psu.edu/upmp/upmp.htm).

Land Requirements for Car vs. Bus vs. Bike Commuting

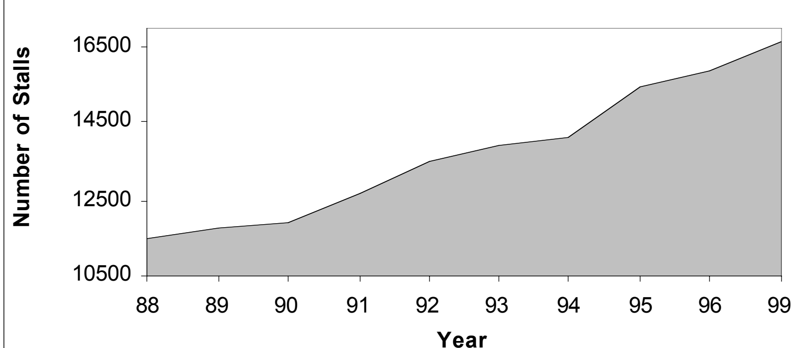
The "ecological footprint" concept developed by Wackernagel and Rees (1996), can be used to calculate the amount of land necessary to support different modes of travel. For a person who commutes 3 miles back and forth to work each day by bicycle, the land "footprint" is 133 square yards. This is the estimated amount of land that would need to be permanently set aside to: 1) grow the food necessary to "fuel" the biker's body on his daily commute; 2) provide the raw materials and energy to construct and maintain the bike; and 3) provide the space (bike paths) necessary for bike commuting. If this same person were to commute by bus, 328 square yards would have to be set aside on a permanent basis. Finally, if our commuter chose to travel in a single-occupancy car, the land area necessary would be 1,673 square yards or 13 times more than the amount needed for commuting by bike (Wackernagel and Rees, 1996).

Paving open space to supply cars with roads and parking lots results in the elimination of native species' habitat, impairs the ability of our aquifers to recharge, sends polluted stormwater into our streams, and encourages urban sprawl with its attendant farmland loss.[7]

Findings

Penn State constructed 3,143 surface and 2,114 multi-story parking stalls at University Park between 1988 and 1999 (Department of University Safety, 1995/96; D. Holmes, Transportation Facilities Coordinator, pers.comm.). If the area of an average-sized stall is taken as 15 x 8.5 feet and we include an area measuring 10 x 8.5 feet for a feeder lane for each space, then an estimated 15 acres of university land were converted to parking spaces from 1988 to 1999.[8]

Figure 1. Number of Parking Stalls at University Park



While multiple-story parking facilities are more desirable in terms of reducing the land area devoted to parking, the cost of building these structures far exceeds the price of merely paving over a field.[9] Therefore, building surface parking lots has been the quickest and most

---

7 The land that we park our cars on is also worth money. For example, there may be a significant opportunity cost associated with putting a parking lot on a one acre land parcel instead of a new research facility. In contrast to the parking lot, the research facility could bring in research grant revenues while enhancing educational opportunities for students.

8 3,143 stalls x 212.5 sq. ft. per stall/43,560 sq. ft. per acre = 15.3 acres.

9 The average price of building a single parking stall in a surface lot is between $2,000 and $3,000, while a single stall in a multiple story lot is about $10,000 (D. Holmes, Transportation Facilities Coordinator, pers. comm.).

economically desirable short-term solution for satisfying parking needs at University Park. Of the 16,629 available parking stalls in 1998/99, 13,982 were in surface lots, while only 2,647 were contained in multiple-story decks.

Parking Services continues to expand the parking resources on campus in response to the increase in the number of registered employee vehicles (registration increased by 2,126 vehicles or 22% between 1988 and 1999). Approximately 700 new surface stalls were added in 1998. Starting in May 2000, the Nittany Parking deck will be expanded to include 533 stalls. There will also be parking spaces constructed in conjunction with Penn State's new Visitor Center, but in this case, an ecologically sensitive "permeable pavement" material will be used to significantly reduce surface runoff.

In sum, this indicator reveals the steady transformation of green space into parking space at University Park, although the University Master Plan aims to reduce both traffic and parking in certain campus areas.

Indicator 3. Transportation-Related Safety

Each day people at Penn State travel from their residences to classes, offices, and events. If a day's movements for the entire Penn State community was mapped, it would reveal tens of thousands of intersecting lines—a dense web of human movement. In a sustainable community, travel entails much more than simply moving bodies from place to place; it is an opportunity to forge connections among people and between people and their surroundings. Central to such sustainable travel is the assurance that people can move about without the risk of accidents.

Findings

The total number of accidents over the eleven-year period (1988-1999) was 2,455. Of these, 1,899 (77%) were motor-vehicle related. One hundred and fifty-two accidents involved bicyclists and 82 involved a pedestrian; at least 261 accidents resulted in personal injury or severe damage to a vehicle (Police Services Department, 1988-1998).[10]

Expressed on a yearly basis, the number of reported transportation-related accidents at University Park between 1988 and 1999 fluctuated between 203 in 1999 and 262 in 1994. The annual total of accidents has been declining steadily since 1994. Expressed per capita (based on the population of full-time faculty, staff and students), there was roughly 1 accident per 230 people in 1999.

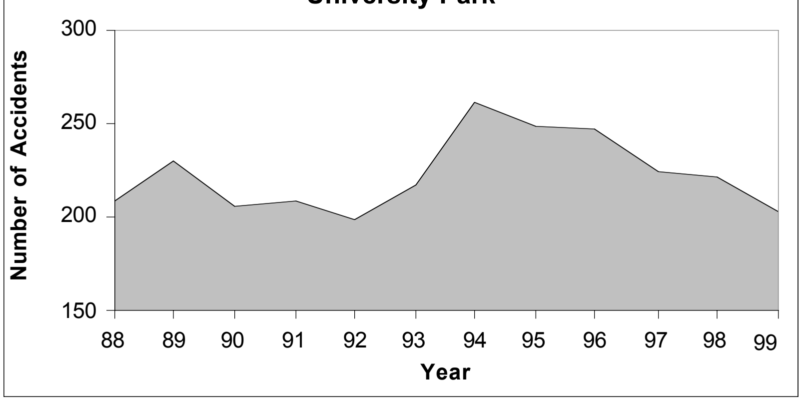
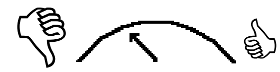
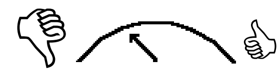
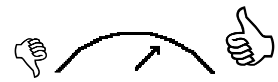


Figure 2. Number of Accidents Occuring at University Park

---

10 Starting in 1999, statistics on specific types of accidents were no longer tracked by Police Services (Bruce Klein, Assistant Director Police Services, pers.comm.)

Summary of Transportation Indicators

Car Dependence	High car dependency among faculty and staff; increasing car dependency among students; significant effort on part of University to encourage bus transit, but lack of comprehensive strategy to reduce car dependence.	
Green Space Converted to Parking Space	A steady increase in paved parking space; growing concern about this issue as reflected in University Master Plan's intent to increase green space in the center of campus.	
Transport-Related Safety	Accident rate has declined in recent years, but the University still lacks comprehensive vision for sustainable transportation system.	

Overall, Penn State's transportation system appears to be headed toward increased dependence on car travel with its associated requirements for more roads and parking facilities. There is much more that PSU could do to move toward sustainability in the realm of transport.

Moving Toward Sustainability

Other Institutions on the Path

It has taken the U.S. more than half a century to begin to question the wisdom of a strongly car-dependent transportation system. Now, with the aid of full-cost accounting, the impacts of car-dependency on our health, the environment, and our social well-being are becoming apparent. Building new roads (e.g., inner loops and interstates) is often not an effective long-term solution to transportation needs. Rather, road expansion often leads to a cycle of more sprawl and consequently more traffic.[11] Traffic planners have acknowledged this since the 1950s.

In addition to Penn State, some other major universities are beginning to pursue sustainable solutions to transportation problems. For example, a parking dilemma at the University of Wisconsin, Madison, prompted that university to intensively promote the bicycle as a commuting alternative (Keniry, 1995). And Cornell University, when faced with a 2,500 parking space shortfall in the early 1990s, decided not to build but instead to figure out other ways to get the university's faculty and staff to and from work spaces (and thereby preserve campus green space). They created a package of alternatives to single-occupancy commuter vehicles and in the process have saved about three million dollars a year, not to mention the beneficial environmental effects of 10 million fewer car miles travelled to and from Cornell each year (National Wildlife Federation, 1998).

These are not the only examples. At the University of Illinois at Urbana-Champaign, a combined initiative involving students, Parking Services, and the local transit authority has resulted in more frequent bus runs and modifications in bus routes to service high-density off-

---

[11] A remarkable document entitled "Redefining Progress: Recommendations from the 21st Century Environmental Commission to Governor Tom Ridge" spotlights sprawl: *"Sprawl is a problem and it is important that Pennnsylvania recognizes it as such. We are using land inefficiently and unsustainably. The rate at which land is developed in Pennsylvania far outpaces the growth of its population. Sprawl harms the environment, increases the cost of infrastructure, and results in the abandonment of existing communities. The Governor and elected leaders, who have the benefit of a broader perspective, need to articulate this problem to Pennsylvanians"* (http://www.21stcentury.state.pa.us).

campus student housing. As a result, city bus use by students has increased 10-fold (Smith, 1993). Finally, Northland College has introduced a "community share" bike program to its campus in which old bikes are donated to the college and students and community members paint and repair them. New bike racks specifically for community bikes have also been built around campus (Cahalan and Cornett, 1997).

Short-Term Goals for PSU

Reduce Number of Cars. The number of student, staff, and faculty cars has increased significantly in recent years and is leading to intolerable levels of congestion and local pollution. Penn State should develop a plan to reduce car use by 25% over the next 10 years through a package of incentives (and disincentives) that discourages members of the Penn State community from bringing cars to campus.

Promote Traffic Calming. Traffic congestion, unheard of only a decade ago, is now a problem in State College. More cars usually means more accidents, more noise, more exhaust emissions, and more loss of public space to roads and parking. Penn State should work with the State College Borough to promote traffic calming measures such as the narrowing of existing roads, lowering and enforcing of speed limits, and preferentially granting right-of-way to pedestrians and bicyclists. These and like measures are necessary to maintain the people-centered vitality of the campus–town environment.

Expand Innovative Public Transportation Options. To be effective, public transportation must be convenient (i.e., run at frequent intervals along common transportation corridors). In some communities these prerequisites are now being satisfied with light rail service along major thoroughfares and minivans along secondary travel corridors. These and other innovative options merit investigation and final determinations should not be based solely on short-term financial considerations. Penn State, with its technical expertise and state and national connections, should be a catalyst in the development of a forward-looking, sustainable transport system for Central Pennsylvania.[12]

Long-Term Goal: Create Alternatives to Car Transit

> *"People move well on their feet. People solely dependent on their feet are more or less equal, move on the spur of the moment, at three to four miles per hour, in any direction and to any place from which they are not legally or physically barred. An improvement on this native degree of mobility should be expected to safeguard these values and to add some new ones..."*
>
> Ivan Illich, Penn State Visiting Professor

At present, Penn State exerts a huge impact on the Centre Region catalyzing, in concert with other forces, haphazard growth. Instead of sprawling, inefficient, car-dependent land settlement, Penn State should do what it can to create tight, compact patterns of land settlement and attractive alternatives to car transit. Indeed, Penn State, as the region's largest employer, has the opportunity and the responsibility to encourage and model our most sustainable transportation options—walking, bicycling, and clean, efficient public transportation, with car travel as the option of last resort.[13]

---

12 As a step in this direction, Penn State's Office of the Physical Plant is beginning to change over to compressed natural gas vehicles (P. Ruskin, pers. comm.).

13 Perhaps because it is equated with poverty, or perhaps because our nation's transportation system has virtually eliminated it as a clear or feasible choice, walking is often overlooked as a transportation option. With proper design of community spaces, however, walking can be a viable transportation mode. Biking is a second

Over the long term, Penn State should use its expertise and vision to create a Central Pennsylvania with fewer rather than more roads, better public transportation, enforcement of urban growth boundaries, protection of open spaces in sacred trust for future generations, and vibrant, people-centered town centers.

References

Cahalan, G. and R. Cornett. 1997. Campus transportation systems: The community bike program. Pages 190-195 *in* R.J. Koester (ed.) Greening the Campus II: The Next Step. Ball State University, Muncie, IN.

Department of University Safety. 1995/96. Annual Report. Penn State University.

Engwicht, D. 1993. Reclaiming Our Cities and Towns. New Society Publishers, Philadelphia, PA.

Hubbard, A. and C. Fong. 1995. Community Energy Workbook: A Guide to Building a Sustainable Economy. Rocky Mountain Institute. Snowmass, CO.

Intercom. 1999. New transportation plan for University Park encourages carpooling, eases traffic flow. Pg. 3 April 28.

Keniry, J. 1995. Ecodemia. National Wildlife Federation, Washington, D.C.

Klingenberg, H. 1996. Automobile Exhaust Emission Testing. Springer, New York, NY.

National Wildlife Federation. 1998. Green Investment, Green Return: How Practical Conservation Projects Save Millions on America's Campuses. National Wildlife Federation, Washington, D.C.

Ohringer, J. 1992. Our beloved cars: what a price we pay. In Context 33, 8-9.

Penn State University. 1988. Faculty and Staff Directory.

Penn State University. 1997. Faculty and Staff Directory.

Poinsatte, F. and W. Toor. 1999. Finding A New Way: Campus Transportation for the Twenty/First Century. University of Colorado Environmental Center and Office of Energy Conservation, Boulder, CO.

Police Services Dept. 1988 through 1997. A Vehicle Code Accidents/Incidents, Penn State University.

Smith, A. 1993. Campus Ecology. Living Planet Press, Los Angeles, CA.

Wackernagel, M. and W. Rees. 1996. Our Ecological Footprint. New Society Publishers, Philadelphia, PA.

---

sustainable form of transportation. Bicyclists, like walkers, cause little negative environmental impact and, as with walking, bicycling empowers people by building strength, stimulating the senses, and connecting them with their neighbors and neighborhoods.

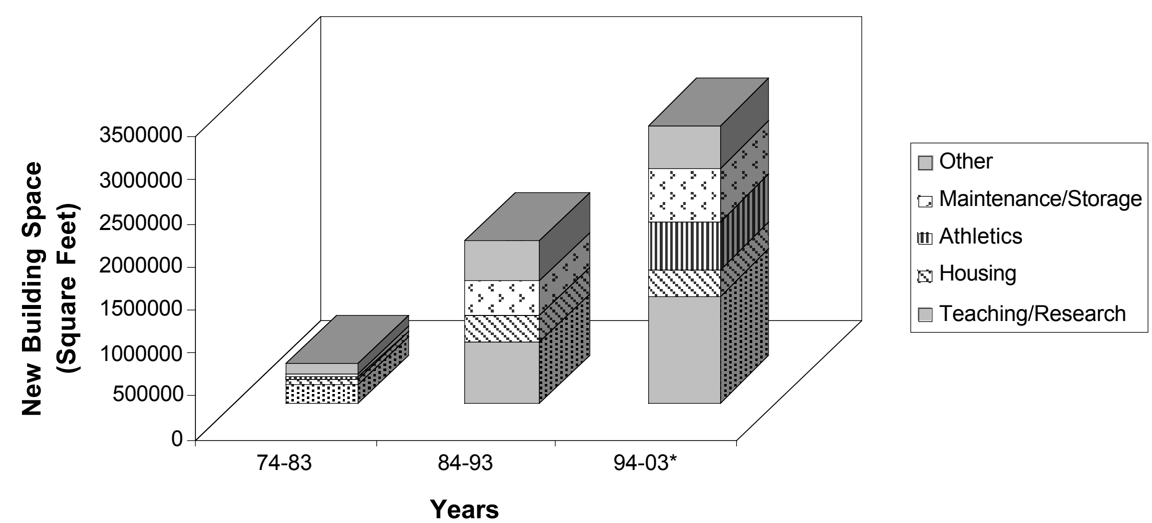
THE BUILT ENVIRONMENT

"A building constructed today will last well into the next millennium. In making these buildings, we make the mold within which much of the future will have to fit and function." **Sean Wellesley-Miller**

Introduction

Our university contains hundreds of buildings--many more than most of us realize (Fig. 1). We have departmental buildings, classroom buildings, research buildings, but also barns, airplane hangers, warehouses, greenhouses, garages, cold storage buildings, power plants, pump houses, and more. In all, there are more than 600 structures on campus (392 "major" and 260 "minor" buildings).

Figure 1. New Building Space by Type Since 1974 at University Park



Because we spend much of our time at Penn State living and working indoors, it is sensible to consider the sustainability of our built environment. Buildings can educate: the materials used in their construction, their design, how they fit their location, and how they operate, all combine to produce a "hidden" curriculum that teaches, for better or worse, through example.

Buildings on the Penn State campus—even those recently constructed—exhibit worrisome inefficiencies in material and energy use, stemming, primarily, from design shortcomings. Indeed, building design is the ultimate determinate of building life-cycle cost. By the time only 1-2% of a building's life-cycle costs have been spent (for design), 70-80% of the structures total life-cycle costs have been committed (Romm and Browning, 1994). The technology and expertise now exist to create buildings which are many times more efficient than those of the past (Hawken et al., 1999). Because Penn State is currently in the midst of a major building campaign, the University has a remarkable opportunity to dramatically improve how it plans, designs, and constructs buildings.

A sustainable built environment has the following characteristics:

- **Conserving.** Sustainable buildings utilize materials produced in environmentally-sound ways; they are energy efficient; and they minimize the loss of green space.
- **Respectful of place.** The design, placement, and function of sustainable buildings is in tune with their locale; heating and cooling systems are designed with local geography and climate in mind.
- **Democratic.** Sustainable structures are designed with the whole community in mind; they are built as a response to a true need in the community; all stakeholders have a voice in the design and planning process.

Developing a sustainable built environment at University Park requires the full participation of the Penn State community. When building priorities are carefully considered and agreed upon, the University becomes more purposeful. Furthermore, when university buildings are designed to be in sync with their surroundings and to embody ecological design principles, environmental impacts are minimized. With this in mind, we selected three indicators to assess the sustainability of Penn State's built environment:

1. Building Decision Process
2. Building Priorities
3. Ecological Design in Buildings

Indicator 1. Building Decision Process

Though we may not realize it, we are affected emotionally and physically by the buildings we inhabit (Barnett and Browning, 1996). Hence, it is desirable that all university stakeholders have the opportunity to participate meaningfully in decisions about the types of buildings that are needed on campus and the planning, design, and construction of these buildings.

Findings

Decisions concerning the creation of new buildings at Penn State are reached, in large part, through the workings of three processes:

- The Master Planning Process: Several different committees and groups develop long-range plans for university development.
- The Strategic Planning Process. The University Planning Council (UPC) calls on university leaders (e.g., academic deans at University Park and Branch Campuses) to submit proposals for new buildings and/or expansions; this call goes out every two to three years.
- Facilities Resources Process. The Facilities Resources Committee (FRC), headed by the Provost, evaluates proposals in view of Strategic Plan priorities, genuine need, and fiscal limitations. Each year the FRC submits a Capital Plan to the President for approval; the Plan specifies how available funds will be allocated for Penn State building projects (D. Blythe, pers. comm).

The most recent Master Planning process occurred from 1996-1999 and attempted to involve all stakeholders in Penn State's long-range planning process. For example, the Master Plan Advisory Committee was composed of students, faculty, staff, and university administrators. In addition, scores of university and community professionals were involved in "focus group" sessions to examine the consequences of various Master Plan recommendations on such things as transportation, housing, utilities, and the environment. Finally, there were periodic open meetings to seek reactions from all stakeholders (e.g., government leaders, local planning commissioners, environmental groups, business leaders) regarding Master Plan recommendations.

In sum, sincere efforts are being made to seek input from a broad range of stakeholders concerning Penn State's building and expansion decisions. However, certain crucial questions do not appear to be open to discussion (e.g., Should Penn State continue to grow?). Also, major decisions are sometimes made quickly from the top. Of course, decisive top-down decisions may be appropriate under certain circumstances, but it is important to acknowledge that such decisions largely bypass the slower, more inclusive process described above. Recent examples of fast-tracked, top-down Penn State "growth" decisions which did not benefit from substantive community discussion include: the creation of University Park's new Innovation Boulevard, the establishment of a College of Information Science and Technology, the University Park Airport Expansion, and the construction of a University Retirement Center.

Indicator 2. Building Priorities

While we at Penn State have been busy erecting a multi-million dollar sports arena (See Box),

> **Building Priorities**
>
> Many are reluctant to speak critically of some of Penn State's new buildings, such as the Bryce Jordan Center, but we would be a much healthier community of learning if we actively discussed the merits of such structures? For example, we might begin by considering the costs and benefits of the Bryce Jordan Center. What is its true cost? How much fossil fuel is consumed with each event? How many tons of greenhouse gases are generated? In sum, what does the Bryce Jordan Center 'teach'? We don't have answers to these questions, but wouldn't it be enriching to have lively, open discussions in which we wrestle with such issues from philosophical, economic, ethical, ecological, and other perspectives?

attracting business enterprises to our new Innovation Boulevard, and leasing land for a retirement village (all are expected to generate good long-term economic returns), have we overlooked a central function of our university buildings—to provide a dwelling place for our students? Indeed, ecological impacts could be reduced and sustainability served by offering students attractive, ecologically sound living space on campus (i.e., within walking and biking distance of classes and downtown).

Findings

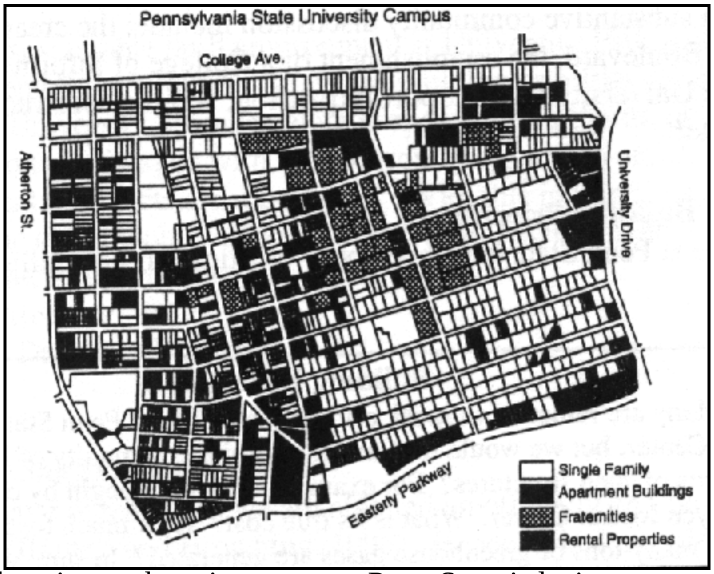
Prior to the 1960s, the majority of Penn State students lived on-campus, but as enrollments have increased, no new undergraduate dormitories have been built. Presently, just under one-third of the total student population (graduate + undergraduate) lives on-campus; the other two-thirds must live off-campus.

Predictably, the decision to increase enrollments but to cease building undergraduate dorms transformed downtown State College into a "dormitory park." Penn State has benefited in that it has been able to increase enrollments without worrying about providing student housing, and developers have profited from the new construction and subsequent rent collection.[1] But, it appears that the spill-over of Penn State's expanding student population has contributed significantly to the fragmentation of the Highlands Neighborhood (located just to the South of Beaver Avenue; Figure 2). Indeed, on some streets, the family neighborhood character has ceased to exist, a result of Penn State literally swelling out of its boundaries. Approximately 45% of all the residential space in the Highlands neighborhood is now occupied by apartment buildings/townhouses or fraternities and one-third of all homes are now rental properties.

---

1 As space for high-rise apartments becomes limiting in downtown State College, developers are erecting large apartment complexes on the outskirts of town. For example, the 216-unit University Commons (built by Capstone Development Corp. of Birmingham, AL) and 204-unit Jefferson Commons (built by Dallas-based JPI) are located on Vairo Boulevard. These two are being joined with the 294-unit The Pointe (built by Integroup Inc. of Jacksonville, FL) which will start housing students in August, 2000. Many of these developers are from other regions with no long-standing interest in our community beyond its profit potential.

Figure 2. Fragmentation of the Highlands Neighborhood (located adjacent to the Penn State campus).



By leaving housing to the private sector, Penn State is losing an opportunity to take a proactive role in helping students examine important life-style issues relating to consumption, health, community, civic responsibility, and sustainability particularly during their second and third years at the University. Even more important, are we failing to offer students the chance to live in accord with sustainable practices (See Northland College example, pg. 71).[2]

Indicator 3. Ecological Design in Buildings

The overall intent of ecological or "green" building design is simple: Create buildings that take less from the earth and give more to people. The goal is to produce energetically efficient, aesthetically pleasing buildings which cause no harm in their construction and use. “Green buildings" are healthy, safe, and a pleasure to work in, in addition to being considerably less expensive to operate.

Findings

Although there are many examples of buildings which reflect "green design" principles throughout the United States (National Audubon Society and Croxton Collaborative, Architects, 1994; Romm and Browning, 1994; Barnett and Browning, 1995; Natural Resource Defense Council, 1997), there are no buildings on the Penn State campus that embody these principles (See Box).[3]

A Closer Look at the HUB Renovations

Because of its recent renovation, the Hetzel Union Building (HUB) was chosen as a logical choice for examining the application of ecological design principles in Penn State buildings. Using the U.S. Green Building Council’s Leadership in Energy and Environmental Design (LEED) building rating system (a program that establishes a standard for green buildings), the HUB was evaluated in five categories including building setting, energy efficiency, materials

---

[2] Plans have been put forth to house 220 undergraduate students in McKee Hall (once the graduate students now living there are relocated to new housing on West Campus). Also, the University intends to replace the graduate units at East View Terrace (near Pollock Commons) with undergraduate dormitories (Tom Gibson, pers. comm.). The University should seize this opportunity and offer ecologically enlightened, state-of-the-art housing to its students (again, refer to Northland College example, pg. 71).

[3] Our buildings are designed by specialists, usually working independently from one another, and sometimes employed by firms unfamiliar with our local landscape and community. This fragmentation of responsibility means that designers seldom see the entire picture.

sustainability, indoor environmental quality, and water conservation. Based on the number of points received (out of a total of 50), a building is certified as a Platinum, Gold, Silver, or Bronze building. The HUB renovation had a very low rating (15 points out of 50) which fell short of even the minimum 22 points necessary to be classified as a Bronze-certified building. The HUB received kudos for rehabilitating an existing building and using 20% its of materials from within three hundred miles of the construction site but lost points for such things as not supplying any building needs with renewable energy resources and not taking measures to ensure that building materials came from non-virgin sources (LEED audit conducted by Danelle Ardell, Elwood Tower Corp.).

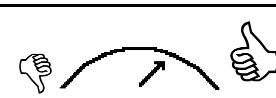
The Penn State Design and Construction Standards Manual, distributed to the architects and contractors working on each new campus building, provides specific standards for materials and efficiency. Of the sustainable building material characteristics listed in Table 1 (below), only three of seven (durability of materials, non-toxic materials, and concern for energy efficiency) are effectively addressed in Penn State's manual and builders don't necessarily adhere to these guidelines.[4] Furthermore, Penn State's design and construction standards do not establish overall building efficiency thresholds; nor do they consider such basic green design elements as passive solar heating, the insulation value of building materials, and building orientation (Lachman, 1999).

Table 1. Characteristics of Sustainable ("Green") Building Materials (Green Seal, 1996)

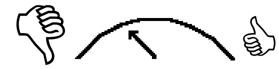
- Manufactured/harvested close to point of final use
- Made from renewable and sustainably harvested materials
- Energy- and water-efficient to produce and use
- Minimally air or water polluting to manufacture
- Non-toxic
- Durable
- Recycled and recyclable wherever possible

The Penn State Master Plan is attuned to the need to build in ecologically responsible ways as suggested in the plan's commitment to "design, renovate and/or construct all new buildings in an environmentally sensitive manner" (University Park Campus Master Plan; www.opp.psu.edu/upmp/upmp.htm); but, the University's achievements to date have been very modest. On a positive note, the Office of the Physical Plant (OPP) has a goal of developing design guidelines that will require sustainable features in every new building; and ensure that all new buildings are EPA "Energy Star Buildings" (P. Ruskin, pers.comm.).

Summary of Building Indicators

Building Decision Process	Efforts being made to involve the larger community in decisions surrounding University planning; but some major decisions (e.g., whether to grow or not) are not open to substantive discussion.	
Building Priorities	Large increase in student population in recent decades but no significant measures taken to increase undergraduate student housing on campus; but there are hopeful signs that this might be changing.	

[4] Several buildings on campus have small features which do embody ecological design. For example, Chambers building, built in 1960, utilizes a large skylight, reducing the need for fossil fuel-dependent lighting.

Ecological Design in Buildings	Very limited application of green-design principles in campus buildings to date; but the University is demonstrating a growing interest in creating ecologically “smart” buildings.	

In sum, building decisions at PSU, as at most other universities, are generally governed by short-term, least-cost considerations. In some cases we are failing to build enough of the right kind of buildings (e.g., living spaces for students); in almost all cases we are failing to build in the right way. We can and must do better.

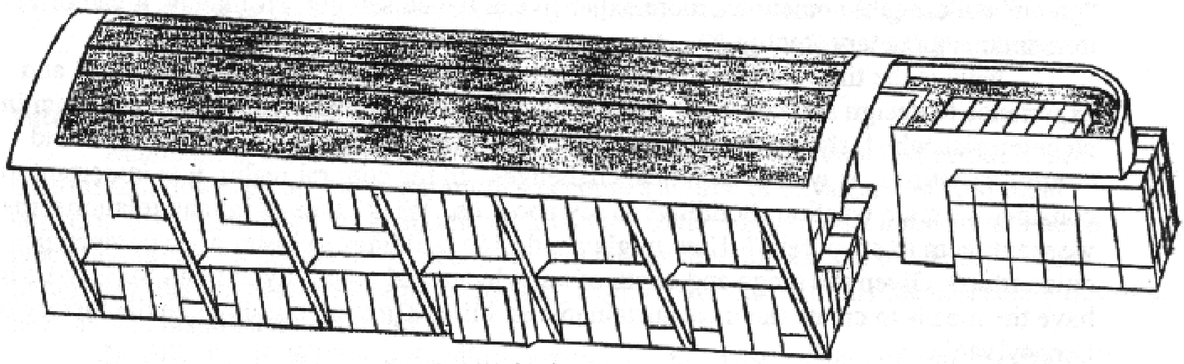
Moving Toward Sustainability

Other Institutions on the Path

The decision to construct new buildings on campus offers many opportunities for the application of ecological design principles. As an example, consider the building and design process at Northland College in Wisconsin. Northland spent two years planning a new residence hall which would meet the needs and interests of students, showcase its environmental mission, and offer a living/learning laboratory for environmental studies (Koziol et al., 1997). Students worked closely with the Master Planning Committee, local architects, engineers and consultants in the conceptualization of the building. Efforts were made to choose the most environment-friendly building materials; these included cedar shakes from Michigan (to reduce the impact from transportation from western states), organic based linoleum flooring (to avoid using petroleum-based products), and cellulose (recycled paper) for attic insulation (www.northland.edu//studentlife/ELLC/index.html). The building, completed in 1998, houses 114 students and contains community and classroom space, passive solar design, supplemental photovoltaic and wind generators for electricity, two greenhouses, two composting toilets, low volume showers, and energy-efficient appliances and lighting. Estimates indicate that the construction cost per bed will be comparable to buildings other colleges have built recently, but the operational costs should be significantly lower than average (Koziol et al., 1997).

Academic buildings can also embody "green design" principles. Oberlin College in Ohio is constructing a "green" environmental science building that will be a net producer of energy (Figure 3). In addition, the Oberlin building has been designed to: discharge wastewater at least as clean as the water which enters the building, incorporate sustainable materials, and meet the rigorous requirements of full-cost accounting (Orr, 1997). Similarly, the Department of Natural Resources at Rutgers University is moving forward with a plan to design and construct a new building for its labs and offices that will embody sustainable building principles (D. Ehrenfeld, Rutgers Professor, pers. comm.); and Yale University’s new Forestry building will be a “flagship of environmentally sensitive architecture” according to Yale President, Richard Levin.

Figure 3. Sketch of Oberlin’s New “Green” Academic Building.



Short-Term Goals for PSU

Initiate Campus-Wide Discussion on Merits of Continued Growth at University Park. Rather than assuming that growth is inevitable, we should openly and thoughtfully evaluate the advantages and costs of continued growth at Penn State. We might begin by asking: Do we really know where growth is leading us? Where do we wish it to lead us? "Progress" is meaningless without this knowledge.

Provide Housing for Undergraduates on Campus. By failing to provide sufficient campus housing for undergraduates, Penn State is losing an opportunity to educate the whole person. President Spanier is right when he says: "We're catching most of our students at a time in their lives when they're in transition from adolescence to adulthood; citizenship, social responsibility, conscience, and civility are a very important part of their human development." These qualities and values may be best cultivated in the day-to-day rhythms of campus life where students live together in community (with mentors) and take responsibility for their surroundings.

Construct a "Green" Building at University Park. It is time for Penn State to combine its intelligence, experience, and enthusiasm to design and construct a campus building that utilizes sustainable materials, recycles its organic wastes, and heats and cools itself using, to the extent possible, renewable energy and natural air flows. The design and construction of such a building offers great potential for learning and, once completed, such a building could serve as a remarkable tool for education.[5]

Long-Term Goal: Make all Campus Buildings Green

In a world of growing environmental hazards and resource limits, it is short-sighted to continue to construct buildings that are inefficient, damaging to the environment, and insensitive to our sensibilities, culture, and values. In a very real sense, the way PSU constructs its buildings will either ensure or undermine long-term sustainability. Designing "green" buildings is sometimes more expensive at the outset, but, ultimately, it can offer tremendous monetary savings.[6]

---

5 A new building is planned for Penn State's Architecture and Landscape Architecture Departments and the possibility of making this Penn State's first green building is under discussion.

6 For example, by taking simple energy conservation steps, such as the installation of highly efficient lighting, low-emissivity glass, and well-planned heating and cooling systems, the PA Department of Environmental Protection lowered energy cost in its new Harrisburg building from an estimated $1.54 to $0.74 per square foot (Pennsylvania's First Green Building, 1998). And green design innovations need not be confined to new buildings. Citing one example among many: In 1996 the city of San Diego retrofitted its

Now is the time for Penn State to challenge itself to combine its intelligence and experience to design and construct sustainable campus buildings. Green building planning is an enterprise which should involve the entire PSU community. There are aesthetic and cultural questions, as well as technical challenges. In the cultural realm, it is important to consider what we want our buildings to say about us. What kinds of human relationships do we want them to encourage? How might we design buildings to foster civic competence and citizenship? Given the range and depth of knowledge and creativity at Penn State, we surely have the means to create the most sustainable and life-affirming buildings in the history of Pennsylvania.

References

Barnett, D. L. and W. D. Browning. 1996. A Primer on Sustainable Building. Green Development Series. Rocky Mountain Institute, Snowmass, CO.

Green Seal. 1996. Choose Green Report. Green Seal, Washington, D.C., December.

Hawken, P., A. Lovins, L. Hunter Lovins. 1999. Natural Capitalism. Little, Brown and Company, Boston.

Koziol, L, B. Pasko, and T. Wojciechowski. 1997. A Residence Hall for the 21st Century. Pages 208-214 In: R. J. Koester (ed.), Conference Proceedings: Greening of the Campus II: The Next Step. Ball State University, Muncie, IN.

Lachman, S. 1999. A Greenhouse Gas Inventory of the Pennsylvania State University Park Campus. MS Thesis in Geography. Penn State University, University Park, PA.

Lyle, J.T. 1994. Regenerative Design For Sustainable Development. John Wiley and Sons, New York, NY.

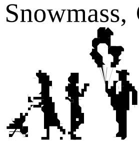
National Audubon Society and Croxton Collaborative, Architects. 1994. Audubon House: Building the Environmentally Responsible, Energy-Efficient Office. John Wiley and Sons, New York, NY.

Natural Resources Defense Council. 1997. The NRDC Webpage at http://www.nrdc.org.

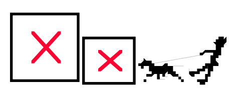
Orr, D. 1997. Architecture as pedagogy II. Conservation Biology 11: 597-600.

Pennsylvania's First Green Building. 1998. Video. Resource Communications Group.

Romm, J. J. and W. D. Browning. 1994. Greening the Building and the Bottom Line. Rocky Mountain Institute, Snowmass, CO.



COMMUNITY



"All stakeholders in the University—students, faculty, staff, administrators, trustees, parents, and the public—have a right to expect that the University will strive to be a civil community of learning; all have an obligation to make it happen." **Dr. Fern Willits, PSU Professor**

Introduction

Maintaining a healthy community requires a common and constant effort. Once established, however, strong communities become a source of physical and emotional support, protection, belonging, and happiness. One of the roles of education should be to teach and prepare students for a successful and responsible life as part of society. What better way than

73,000 square-foot municipal office building and in the process reduced building energy costs by 60%; the payback period was four years (Hawken et al., 1999).

to teach by example, creating a university that exhibits the characteristics of a healthy and responsible community.

In 1996 Dr. F. Willits and colleagues conducted an assessment of community well being at Penn State. The investigators discovered that many Penn State students and faculty did not feel that they were members of a purposeful, caring, and just community. Indeed, an estimated 33% of Penn State students felt that they were just a "number" at Penn State (Willits et al., 1996).[1]

A sustainable community displays the following characteristics:

- **Ecologically literate.** Members of sustainable communities have the capacity to see themselves as part of, rather than separate from, the environment in which they dwell (e.g., they understand where their water comes from and where their waste goes).
- **Safe.** Sustainable communities are safe; community members share mutual respect and this in turn fosters trust and social interaction.
- **Healthy.** Sustainable communities are open and vital. Community members share core values; they are emotionally and physically healthy; addictions are rare.

Social interaction and participation in community decisions are critical to social well-being and to sustainability. Ideally, we would like to have data on the frequency, nature, and quality of interactions among students, faculty, staff, administrators and townspeople but such data are not generally available. Nonetheless, there are some data and approaches that may provide a useful overview of community well-being at Penn State.

We use information in five areas to examine community sustainability.

1. Ecological Literacy of Graduating Seniors
2. Technology: Enhancing vs. Undermining Community Vitality
3. Student Crime
4. Student Alcohol Consumption
5. Student Depression

Indicator 1. Ecological Literacy of Graduating Seniors

Literacy is a central goal of the education enterprise. The university years provide an opportunity to expand and deepen one's understanding of the world. A quality education should, among other things, guarantee that students are helped to develop an abiding respect for the biota and natural processes as well as a comprehensive understanding of their own ecological dependencies. This type of literacy, known as "ecological literacy", is just as fundamental (some would argue even more fundamental) to living fully and wisely as the capacity to read and write.

Findings

Since students spend much of their time at Penn State taking tests in specific subjects, we wondered how well they would fare if they were given a test of a different nature—one that focused on their ecological literacy. In a survey of 150 graduating seniors (names chosen randomly from a complete list of graduating seniors obtained from the Registrar's Office), we found that:

--40% did not know the size of the world's population to the nearest billion;
--63% were unable to name one federal or state law that protects the environment;
--43% were not aware that acid rain is a common phenomenon in Pennsylvania;
--72% had no idea that they were living within the Susquehanna River Basin; and

1 In addition to the Willits et al. study, PSU conducted a faculty and staff survey in 1996. This survey (based on 5,000 responses and commissioned by the Office of the President) revealed that more than a quarter of the respondents would leave Penn State if another job with equal pay, benefits and working conditions were available. In addition, roughly 40% of the respondents felt that PSU was a worse place to work in 1996 as compared to three years before. While this level of disaffection is certainly not unique to Penn State, it does point to the need to pay careful attention to the changing quality of community life at PSU.

--40% were unable to name even two tree types on campus.

Unfortunately, our universities, Penn State included, often seem to cultivate ecological indifference rather than ecological literacy. For example, the prolific consumption of materials at Penn State teaches (indirectly) that the Earth can supply personal needs, no matter how grand they may be. Dining Hall food, arriving from all over the world, reinforces the mistaken notion that Penn Staters need not concern themselves with how or where their food is produced or with the loss of farmland close to home. And dumpsters bulging with refuse throughout campus delude students into believing that there is always an "away" for trash (Orr, 1994). In sum, Penn State students and U.S. college students, in general, are not learning nearly enough about how to live, day-to-day, in a sustainable fashion.

There are small signs, though, that Penn State is recognizing the need to educate for sustainability. For example, the University's recent decision to offer an undergraduate minor in environmental studies is a step towards promoting ecological literacy. Also, PSU's recently established Center for Sustainability has courses designed to offer students hands-on experience in sustainable living. Finally, in recent years many PSU professors have begun to incorporate environmental issues and concerns into their course materials.

Indicator 2. Technology: Enhancing vs. Undermining Community

We are often dazzled by new technologies and adopt them without considering their overall impacts—particularly their effects on the quality of human interactions. At a sustainable institution, technology is not permitted to undermine the quality of human interactions.

Findings

A quick reflection on our history reminds us that Penn State is becoming increasingly dependent on technologies of all sorts. For many years after Penn State's founding in 1855, there were no automobiles or telephones on campus. There were no synthetic pesticides or herbicides, leaf blowers, motorized leaf sweepers, weed whackers, wood chippers, power trimmers, chain saws, power mowers, or snow blowers. There was no fluorescent lighting and no air conditioning. There was no education by television or by computer. Classrooms were not equipped with microphones, television sets, VCRs, slide projectors, film projectors, or over-heads. In the residence halls, there were no cable TV hook-ups, microwave/refrigerator units, washing machines, or clothes dryers. Neither were there any electronic copy machines, vending machines, or parking meters on campus. There was no nuclear reactor and no airport.

Only 20 years ago at Penn State there was no automated registration.[2] There were no computer labs, fax machines, cellular phones, answering machines, pagers or e-mail accounts.

Some of the technologies adopted by Penn State over the years have brought immense benefits and contributed to the sense of community, but some technologies might undermine community (See Box).

Can Some Technologies Undermine Community?

The choice to adopt a technology to do something that we previously did on our own is not always trivial. Consider the University's decision to replace the hand rake with the leaf blower. The leaf blower technology has certain characteristics and affirms certain values. When we use it, we are opting for fast (machine) pace rather than natural pace, noise rather than quiet, polluted air rather than clean air, and so forth. Of course, these things—fast pace, polluted air and noise—can negatively affect the frequency and quality of our social interactions (i.e., the quality of community life). Leaf blowers are an obvious case—but if we think about it—almost all of the technologies (answering machines, computers, motor vehicles, televisions, etc.) that we

[2] For an example of how new technologies can reduce human interaction, consider the following: Before the computerization of registration, students were required to take a pre-registration form to their faculty advisor for a signature. This produced thousands of faculty/student interactions every semester and provided an opportunity for students to seek out faculty for advice not only about requirements, but good courses, career plans, and study habits, among other things.

have adopted at PSU in recent decades have the potential to affect the quality of our community life for better or worse.

Generally, decisions to adopt new technologies at Penn State fail to consider overall impacts. The most ill-advised way to respond to new technologies is to simply embrace all that is offered without considering negative consequences; this is "technological sleep walking" (Franklin, 1990). In a community of learning it is essential to question the benefits and costs of each new technology that presents itself. Indeed, some technologies may free us from misery, but others might addict us to imagined needs. Some might enhance the quality of education, but others might subvert critical thinking and creative expression. Some technologies might foster community; others might undermine it. So far we at Penn State have been disinclined to critically examine the possible negative effects of our myriad technologies on the quality of community life.

Indicator 3. Student Crime

Crimes against individuals and property generate fear and show a lack of respect for fellow community members; their prevalence suggests a lack in community strength and undermines sustainability.

Findings

Crime creates fear. A 1994 survey of 1,261 students, faculty, and staff conducted by PSU's Department of University Safety, showed that reasons for fear on campus were overwhelmingly from the possibility of human attacks of some kind. Forty-five percent of respondents reported never experiencing fear, while 55% experienced fear at least "occasionally," and 6% "always" or "most of the time." A possible solution to this problem is to install more lighting on campus, but there is a "downside" to this "solution" (See Box).

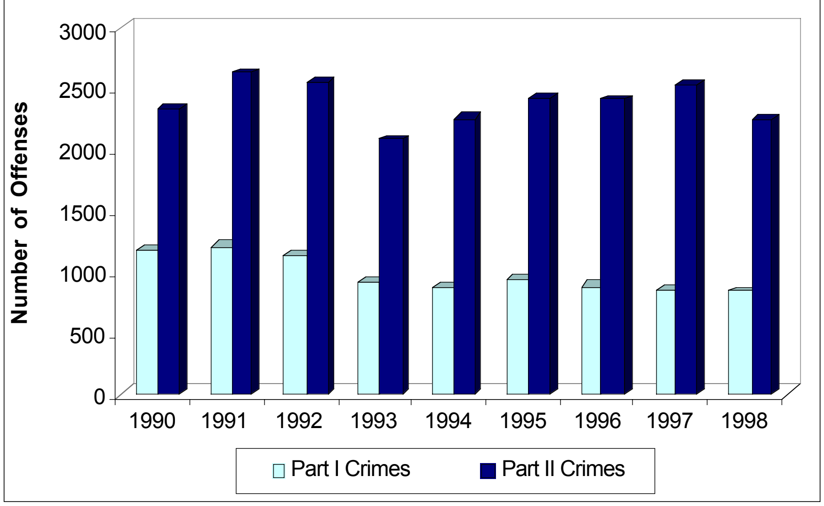
A Trade-Off: Dimming the Stars for Safety

Strolling outdoors on a clear night and gazing at the moon and stars is one of life's pleasures. But the installation of strong outdoor lighting for safety purposes makes it hard to view even the brightest constellations from our cities, neighborhoods and campuses.

Between 1995 and 2000, Penn State's Department of Health and Safety spent approximately $500,000 on outdoor lighting improvements in an effort to solve campus safety issues. The lighting was installed in places on campus where people complained of feeling unsafe or where site assessors determine there to be dark spots. The cost of each new light fixture was approximately $1,000. Installation raised the total cost to over $2,000 per lamp (M. Claver, Director of Environmental Health and Safety, pers. comm.). The lights operate from dusk until dawn, 365 days a year. As we increase outdoor lighting on campus, our experience of night-time is diminished—and so it is that we may gradually come to lose sight of the fact that we live in a vast and mysterious universe.

On average, 8.5 crimes were committed per day by PSU students on and off campus in 1998. Considering that the Department of University Safety (1994) has estimated that only 39% of all crimes committed against university students and faculty are actually reported, the actual number of crimes per day in 1998 may be as high as 22. For the entire year of 1998, a total of 845 reported instances of serious Part I crimes (i.e., rape, assault, larceny) and 2,242 reported instances of less serious Part II crimes (i.e., sex offenses other than rape, crimes against property) were committed (data from University Police Services and State College Bureau Police records).
Overall, the number of student Part 1 crimes per year has decreased in recent years while Part 2 crimes have been fluctuating (Figure 1).

Figure 1. Student Crime at University Park



In response to safety concerns, Penn State has created and expanded a paid escort service. In 1999, the 24-hour, 365-day service provided an average of 250 free escorts per month. Additionally, a “Take Back the Night” March is held on campus each year.

Indicator 4. Student Alcohol Consumption

Student drinking probably originated centuries ago in Greece where “apprentices (students) gathered with their masters (teachers) for spirits and discussed great issues” (Goodale, 1986). However, alcohol consumption can be not only unhealthy, but often academically damaging (Harris, 1997).

Findings

Alcohol consumption at Penn State remains high as evidenced by the following statistics from the Student Affairs Research and Assessment Office (1998, 1999).

- In 1999, 84% of the students at University Park report that they consume alcoholic drinks.
- 91% of seniors, as compared to juniors (87%), sophomores (81%), and freshman (66%) said they drank.
- Those who drank in 1999 did so an average of 7.2 times in the last 30 days (vs. 5.9 times in 30 days in 1996) and consumed an average 5.3 drinks each time out (vs. 4.6 drinks in 1996).
- Significantly more males (61%) met the criteria for “binge drinking” (5 or more drinks at a time) in 1999 than in 1998 (36%); the percent of female students who met this criteria (4 or more drinks at one time) in 1999 was 59%, over a ten percent increase from 1998 (48%).

Penn State has forthrightly acknowledged the high incidence of drinking among students and taken measures to combat this problem (e.g., HUB Late Night activities that offer students alternatives to drinking;[3] the Alcohol Intervention Program to educate and treat those with liquor law violations; and Life Houses for students committed to substance-free living). Although these programs are commendable, student drinking continues at a high level.[4]

---

3 According to the Student Affairs Research and Assessment Office (1999), students who don’t drink attended an average of 3.3 HUB Late Night events, while those who drink attended an average of 1.5 events.

4 Perhaps Penn State’s efforts to curb drinking have been unsuccessful because the University has not addressed the root causes of the problem. In a recent editorial Suzanne Wills, past Penn State professor and

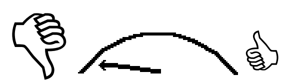
Indicator 5. Student Depression

Depression is a psychological disorder which has been linked to the absence of a strong social support network (Koeske, 1991). A prevalence of depression in our community could indicate a lack of mutual caring and support among community members.

Findings

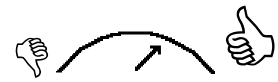
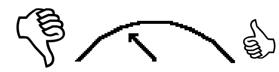
During 1998/99, 2031 students sought treatment from the University's Counseling and Psychological Services (CAPS). Out of this number, 32% (641 students) were diagnosed with depression-related disorders—up from 18% in 1991, making depression the most frequently diagnosed disorder group.[5] Major depression, a specific type of depression, saw a 31% increase in the two year period from 1996/97 to 1998/99. CAPS is working hard on this problem and the increased incidence of depression is probably due to better diagnostic efforts by the CAPS staff and also to an increasing public awareness and publicity given to this disorder which may be causing once-reluctant students to seek treatment (W. Wadlington, Associate Director for Clinical Services, pers. comm.).

Summary of Community Indicators

Ecological Literacy of Graduating Seniors	Graduating seniors appear to have a low level of ecological literacy; the University has taken some steps to begin to address this problem.	
Technology: Enhancing vs. Undermining Community Vitality	Disinclination to assess how the introduction of new technologies to campus might negatively affect the quality of community life and long-term sustainability.	
Student Crime	Decline in incidence of serious crimes (e.g., rape, violent assault); but steady and high level of more common crimes (e.g., abuse of property). Some measures taken to reduce crime, but a comprehensive analysis of crime causes and solutions still lacking.	

psychologist at CAPS (Counseling and Psychological Services) wrote: *A sizable portion of my (CAPS) clientele were drinking heavily, sometimes several times a week. It was clear that the beer and the bourbon were medications against the symptoms of mental disorders that had frequently gone undiagnosed and untreated for months—sometimes for years. They were drinking to stop their pain…I have since been convinced that many binge-drinking students at Penn State are actually self-medicating for a variety of untreated mental disorders, personal issues and family problems. Tragically, their disorders remain largely undiagnosed and untreated…If the university administrators are sincere about significantly reducing excessive drinking by students, they need to rethink completely their approach to the problem (Wills, 1999).*

5 Using these data, the estimated rate of depression in the total student population was 1.3% during 1998/99. However, this figure may be an underestimation because it accounts for only those students who sought treatment at CAPS. A survey of 525 students conducted by Student Affairs Research and Assessment (1997) indicated that 72% of students surveyed wished to discuss "dealing with depression."

Student Alcohol Consumption	The University has taken significant efforts to curb drinking, but still lacks a comprehensive strategy for how to address underlying causes for frequent drinking (admittedly a daunting challenge).	
Student Depression	Depression fairly common among students; some measures taken to diagnose and provide assistance to students suffering from depression-related disorders, but comprehensive analysis of problem and possible solutions still lacking.	

Moving Toward Sustainability

Other Institutions on the Path

Many organizations are endeavoring to facilitate the creation of more wholesome, open, and just interactions while, at the same time, promoting ecological literacy. For example, the World Resources Institute is working with over 100 business schools to integrate ecological literacy into business curricula (www.wri.org/wri/meb/); and the Consortium for Environmental Education in Medicine is working with medical schools to elucidate the relationship between human health and environmental health (www.ceem.org).

Universities are also taking initiative. Tufts recently created an Environmental Literacy Institute and made ecological literacy a goal for all students. Allegheny College is working with students to create environmental and economic improvements in biologically diverse but economically impoverished Northwest Pennsylvanian communities. Some schools have even incorporated a commitment to ecological literacy into their mission statements. For example, Middlebury College…"is committed to environmental mindfulness and stewardship in all its activities. This commitment arises from a sense of concerned citizenship and…a desire to teach and lead by example. The College gives high priority to…respect and care for the environment, sustainable living, and intergenerational responsibility" (quoted from Middlebury College Mission Statement).

Short-Term Goals for PSU

Critically Evaluate New Technologies before Accepting them. Major new technologies should not be introduced into Penn State until the University has carefully considered their costs as well as their benefits. The University needs a policy that outlines the criteria by which it might judge the "appropriateness" of technological innovations. J. Robertson (1985) provides a good guide when he writes: "A useful criterion [in examining a proposed technology] is to ask whether the new material, or equipment, or process, or system is likely to enlarge the range of competence, control, and initiative of the people who will be affected by it; or whether it is more likely to subordinate them to more powerful people and organizations, and make them dependent on bureaucracies and machines which they cannot themselves control."

Initiate Pledge of "Social and Environmental Responsibility" at Graduation. Graduating seniors at dozens of universities are now signing a statement which says: "I pledge to investigate and take into account the social and environmental consequences of any job opportunity I consider." This pledge is printed on commencement programs and students signing the pledge wear green ribbons at graduation (www.machester.edu). Offering Penn State graduates the opportunity to sign a wallet-size card containing this pledge would foster ecological responsibility.

Create a Constellation of Communities to Nurture Civic Responsibility. To create a stronger sense of interconnection at Penn State, instead of assigning most students to residence halls at random, Interest Houses (dorm floors to which students with common interests are assigned) could become the norm, allowing smaller, more intimate communities to emerge. Members of an Interest House might also be assigned specific responsibilities. Areas of responsibility could include landscape maintenance, food preparation, building and equipment care, and so forth. Allowing students to participate meaningfully in university life would generate feelings of connection, trust, and empowerment.

Long-Term Goal: Promote Ecological Literacy of PSU Community

> *Does the graduate know that "he is only a cog in an ecological mechanism? That if he will work with that mechanism his mental wealth and his material wealth can expand indefinitely? But that if he refuses to work with it, it will ultimately grind him to dust…If education does not teach us these things, then what is education for?"* Aldo Le

Our universities are educating the people who will eventually run society's institutions. It is time for Penn State—through well-designed courses, labs, workshops and internships—but most of all through example—to ensure that all its graduates achieve ecological literacy. Specifically, Penn State should work, step-by-step, to ensure that its graduating seniors are:

- Aware of their ecological dependencies: PSU graduates should learn how to identify, wherever they live, the sources of their food, water, and energy, as well as the destiny of their waste.
- Grounded in the natural world: Graduates should be able to walk through Pennsylvania's fields and forests and along streams and recognize the commonly occurring organisms (biodiversity); and they should be attuned to fundamental ecological processes (e.g., energy flow, nutrient cycling, species interactions).
- Skilled at making ecological connections: Graduates should be able to take any ordinary man-made object (e.g., a magic marker, three-ring binder, pair of sneakers) and elucidate, in a general way, the "upstream" and "downstream" ecological connections associated with the product's manufacture, use, and disposal.
- Mindful of their "ecological footprints": Graduates should be able to calculate the size of their ecological footprint and be knowledgeable of measures they might take to minimize "footprint" size (Wackernagel and Rees, 1996).

References

Department of University Safety. 1994. Victimization/Campus Safety Survey. Pennsylvania State University, University Park, PA.

Franklin, V. 1990. The real world of technology. CBC Massey Lectures, Toronto, ON: CBC Enterprises.

Goodale, T. G. 1986. Alcohol and the College Student. Jossey-Bass Inc., San Francisco, CA.

Harris, A. 1997. Binge drinkers risk serious health problems. Centre Daily Times, Page A1, Oct. 10.

Koeske, G.F. 1991. Underestimation of social support buffering. Journal of Applied Behavioral Science. 27(4): 475-489.

Orr, D. 1994. Earth in Mind. Island Press. Washington, D.C.

Roberston, J. 1985. Future Work: Jobs, Self-Employment, and Leisure After the Industrial Age. Universe Books, New York, NY.

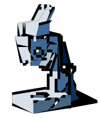
Student Affairs Research and Assessment Office. 1998, 1999. Penn State Pulse: Student Drinking. The Pennsylvania State University, University Park, PA.

Wackernagel, M, and W. Rees. 1996. Our ecological footprint. New Society Publishers, Gabriola Island, BC, Canada.

Willits, F.K., J.O. Janota, B.L. Moore, and D.M. Enerson. 1996. Penn State as a Community of Learning: Faculty and Student Views. The Pennsylvania State University, University Park, PA.

Wills, S. 1999. The right to party may be excuse for escape. Centre Daily Times. Page 12a. Oct. 24.

RESEARCH



"…Although the scientific enterprise in the US and abroad has been phenomenally successful in producing a wealth of knowledge which in turn has brought untold benefits to humanity, the scientific enterprise is not sufficiently forward-looking and is not fully prepared to face the formidable challenges ahead…I suggest that part of our collective responsibility to society should include a community-wide reexamination of our goals and an alteration of our course…" **Dr. Jane Lubchenco, Presidential Address to American Association for the Advancement of Science, February, 1997**

Introduction

Penn State is recognized globally for the quantity and quality of its research. Across the sciences and humanities the University has scores of world-renowned scholars. The contributions of Penn State faculty appear regularly in the world's most prestigious journals; PSU researchers have received almost every imaginable award. Moreover, the importance of Penn State research increases with each passing year as reflected by the steady rises in the number of grants and in the size of the research budget (e.g., increasing from about 100 million dollars in 1980 to over 390 million dollars today). Of particular note in recent years is the rapid increase in funding from industry and other private sources (up 16% in 1999 from 1996).

Of course, there is more to understanding university research than tallying prizes, grants and patents. For example, a Pennsylvania citizen or a Penn State Trustee or a student might wonder: Do the scientific discoveries and technological innovations coming out of Penn State contribute measurably to health, harmony, and wholeness? Does PSU research contribute to local and global sustainability?

Research in a society which is committed to sustainability is characterized by the following:

- **Research uses sustainable means.** Research activities endeavor to minimize harm to the environment and to other beings. Strict ethical guidelines govern the treatment of research subjects; research-related waste is kept to a minimum and disposed of carefully.
- **Research seeks to promote sustainability.** Creating a sustainable society requires that we conduct both basic and applied research with an emphasis on: deepening our understanding of natural processes; the efficient and wise use of materials; the intricacies of full-cost accounting; and the social dimensions of democracy and civic responsibility.[1]
- **Researchers are mindful of the values underlying their investigations.** Researchers should acknowledge forthrightly that research is not "value-free"--that it always serves some value.[2]

---

1 Of course, this is not an exhaustive list. Basic research in such fields as medicine, physics, chemistry, astronomy, climatology, among many others, is also fundamental to contributing to a sustainable world.

2 Upon reading this statement, one reviewer wrote: *"Strong objection! Research is or can be value-free. To "acknowledge" this [that research is value-laden] is to give legitimacy to the deliberate prostitution of science for idealogical purposes."*

It is not our intention to suggest that the objectivity of our research enterprise is compromised by value-orientation. Rather, we simply wish to point out that values of some sort undergird all of our research undertakings. Indeed, the questions that we ask are a reflection of our values. We believe that it is both worthwhile and important for those engaged in research to examine the ways in which their work may serve the values of major societal institutions (particularly those institutions providing the money for their research).

Sustainability in the area of research is difficult to gauge. Therefore what follows is only a first step in considering how research might be conducted with sustainability principles in mind (Indicators 1 and 2); how it might produce knowledge that leads toward a more sustainable world (Indicator 3); and how research priorities could promote or undermine sustainability (Indicator 4).

1. Treatment of Research Subjects
2. Disposal of Laboratory Wastes
3. Research on Sustainability
4. Research Priorities

Indicator 1. Treatment of Research Subjects

In disciplines such as psychology, physiology, sociology and nutrition, humans are often used as research subjects. Moreover, because humans share anatomical, physiological, and genetic similarities with other animals, especially vertebrates, our understanding of human biology and psychology has been aided by laboratory investigations of animals. A university that is respectful of the biota and natural processes will endeavor to treat research subjects—both human and non-human—in an ethical manner.

Findings

Human subjects. In 1999, Penn State's Office for Regulatory Compliance (ORC) coordinated the review and approval for 2,001 research protocols involving human subjects. Protocols are assigned to one of the three review levels (i.e., exempted review, expedited review, or full review). The level of review is determined by the potential risk to the participant(s). During the review process, the Institutional Review Board (IRB) may require modification and/or clarification to the submitted protocol before approval can be considered. An estimated 6% of the 1999 protocols required "full review" by the IRB. The IRB and ORC are committed to working closely with researchers in obtaining approval while maintaining compliance with governmental regulations. This commitment is evident in that fact that only three protocols have been denied full approval by the IRB since 1991. (K. English, Research Compliance Coordinator and C. Yekel, Director of Regulatory Affairs).

Non-human subjects. Information revealing the frequency of research projects that may be potentially stressful to animal subjects is not generally released by ORC (C. Yekel, Director of Regulatory Affairs).[3] However, a review of PSU laboratory animal stress data received from the USDA through “Right to Know” channels revealed no reported incidences of animals subjected to severe pain or distress in PSU research labs in recent years.

Overall, the ORC and IRB appear to do an exemplary job of ensuring that research is conducted in accordance with federal regulations. But, in the interest of sustainability, PSU should consider exceeding these regulations. For example, regulations on “non-human subjects” (see above), only apply to vertebrates, but vertebrates are not the only organisms that experience pain. Penn State might extend these regulations to all creatures with the capacity to experience pain.

Indicator 2. Disposal of Laboratory Wastes

Waste is a byproduct of scientific research. Research-related wastes at University Park take three principle forms: hazardous, infectious, and radioactive.

---

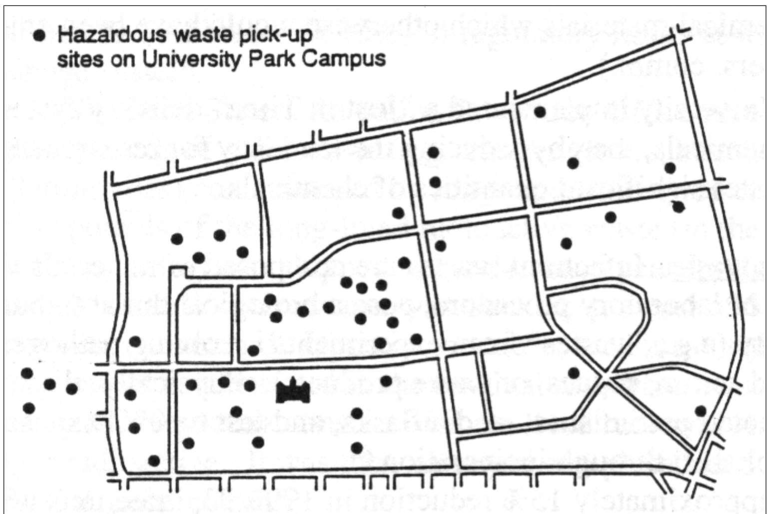
[3] The Institutional Animal Care and Use Committee (IACUC) compile these data. The Penn State IACUC uses the following three USDA categories of animal treatment:

- The use of animals in teaching, testing, or experimental procedures that would be expected to cause slight or momentary pain or distress or no pain or distress.
- The use of animals in procedures that would cause pain or distress appropriately relieved by analgesia, tranquilization or anesthesia.
- The use of animals in procedures that involve unrelieved pain or distress.

Findings

Hazardous wastes. Approximately three-quarters of the hazardous waste generated at Penn State comes from research laboratories (M. Claver, Director of Office of Environmental Health and Safety, pers. comm.).[4] A wide array of chemical substances are used in the research and teaching of Chemistry, Biology, Physics, Materials and Polymer Science, Nutrition, and Earth and Mineral Sciences. Spent chemicals (i.e., unwanted end products of research activity), old chemicals (chemical activity no longer considered reliable), and certain other research materials are disposed of as hazardous waste. Hazardous waste is generated at many sites on the main campus (Figure 1).

Figure 1. Hazardous Waste Pick-up Sites on University Park Campus. (Not all buildings that generate hazardous waste are included.)



Hazardous waste production at University Park has been in the vicinity of 100,000 to 150,000 lbs/year with the exception of 1996/97 when it increased sharply to 231,000 lbs (Department of University Health and Safety Annual Report, 1996/97).[5] The disposal of hazardous waste presents special challenges for a university striving to be ecologically responsible (See Box).

Where Do Penn State's Hazardous Wastes Go?

Safety-Kleen (formerly Laidlaw Environmental Services), an international company with headquarters in Columbia, South Carolina, collects and disposes of PSU's hazardous waste. Safety-Kleen transports much of this waste either to Bridgeport or Deepwater, New Jersey, for incineration or treatment to Pinewood, South Carolina for landfilling. Poor rural communities with cash-flow problems are often, though not always, targets for hazardous waste disposal. This raises knotty ethical questions for an institution like Penn State which seeks to promote equality and justice. If Penn State was required to dispose of all its hazardous wastes right here in Pennsylvania there would be a powerful incentive to completely eliminate highly toxic waste from campus (i.e., waste that we would refuse to bury in our own "back yard").

---

4 "Hazardous wastes", as defined by the U.S. Resource Conservation and Recovery Act, are solids, liquids and gases which may: 1) cause or be a significant contributor to mortality or illness within an individual or population; or 2) pose a hazard to the health of humans or the environment when managed improperly.

5 According to the Department of University Health and Safety's 1996/97 Annual Report, this increase is attributable, at least in part, to two factors: 1) the disposal of gas cylinders (in the past, General Stores was able to return most cylinders to the original manufacturer, but now manufacturers are no longer willing to provide disposal services); and 2) the disposal of a higher-than-normal number of lithium boilers.

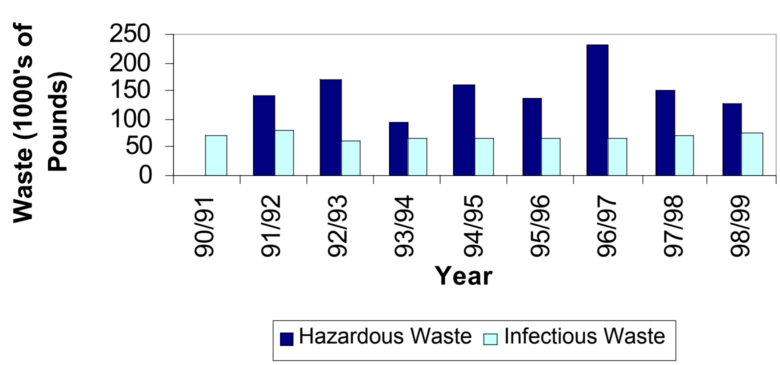
Penn State has taken many significant steps to reduce hazardous waste. Here are three examples:

- Since the early 1990's the University been using micro-techniques in its introductory chemistry lab courses. The concept of "micro-technique" is simple—when chemical reagents used in laboratory exercises are measured precisely, the amount of reagent necessary can be greatly reduced.
- PSU's Office of Environment Health and Safety has established a pathbreaking chemical redistribution program that takes chemicals that are no longer needed in one lab or division and matches them with university personnel in other units who have a use for those particular chemicals. This program has resulted in the redistribution of 10,000 pounds of chemical materials which otherwise would have been entered the waste stream (M. Claver, pers. comm.).
- In 1996 the University implemented a "Just in Time" delivery system that ensures quick delivery of chemicals, thereby reducing the tendency for researchers to stock (and inevitably waste) significant quantities of chemicals.

Infectious waste. Infectious wastes are composed of materials which, after being used in an experiment or laboratory procedure, pose a biological threat to humans due to potential pathogenic activity (e.g., "wastes" from experiments involving pathogenic bacteria, mammalian blood serum, tissues, or waste products). Physically, these wastes often take the form of contaminated petri dishes, media flasks, and test tubes. Disposal of these materials is generally accomplished through incineration.[6]

After an approximately 15% reduction in 1992/93, infectious waste disposal remained relatively constant at about 60,000 pounds per year until 1998/99 when infectious wastes rose to approximately 75,000 pounds, the highest it had been since 1991/92. (Figure 2). The quantity of infectious waste is related to the amount of biomedical science research conducted at the University (M. Claver, pers. comm.).

Figure 2. Hazardous and Infectious Waste Produced Annually at University Park



Radioactive waste. Approximately one hundred and fifty Penn State faculty—predominantly in the Colleges of Science, Agriculture and Health and Human

---

6 Penn State has its own incinerator at the Animal Diagnostic Laboratory (ADL) on Orchard Road. One of the biggest environmental concerns surrounding the disposal of infectious waste is the production of dioxins as a by-product of incineration (Russell, 1999). Dioxins are among the most carcinogenic compounds known to science. Dioxin is released from Penn State's ADL incinerator; but the levels are well within EPA's acceptable limits.

Development—conduct research using radioisotopes. Penn State has a well-developed protocol for receiving, tracking, and disposing of radioactive materials.

Most (about three-quarters) of Penn State's radioactive waste is short lived. For example, the University generates anywhere from 400-1500 gallons of short-lived, liquid radioactive waste each year. This material is stored in the Academic Projects Building until its activity has declined to well below (< 10%) of regulatory limits at which time it is released to the drainage system.

During the 1990s, Penn State's Radiation Protection Office received, annually, approximately 12,000 pounds of solid waste (e.g., rubber gloves, bench paper, petri dishes, pipette tips, scintillation viles) contaminated by long- and short-lived radioisotopes. Approximately 4,000 pounds of the long-lived radioactive waste (in the form of tritium-contaminated scintillation viles) was shipped to Florida each year for disposal. Another 2,000 pounds of long-lived radioactive waste was trucked, at a cost of $7-10/pound, to Washington where it was incinerated. Upon incineration, the long-lived isotopes were either diluted in the atmosphere or concentrated in the residual ash, which was placed in drums and buried. The remaining 6,000 pounds consists of short-lived radioactive waste that was stored until it was no longer radioactive. It was then surveyed and placed into the normal trash waste stream (E. Boeldt, pers. comm.).

In sum, Penn State produced, on average, about 250,000 pounds of hazardous, infectious, and radioactive waste per year in the 1990s. This amounts to about six pounds per year for each full-time student at University Park. It is to Penn State's credit that it has a highly effective system for monitoring and transferring research-related waste. Nevertheless, with large amounts of research-related waste generated by Penn State, the situation cannot be said to be sustainable.

Indicator 3. Research on Sustainability

Research that improves our understanding of ecology, seeks to discover ways to harness renewable sources of energy, or increases the health of our soils, often contributes directly to sustainability. But the impact of many types of research on sustainability is, admittedly, difficult to discern. Indeed, Penn State has little knowledge of how its myriad research initiatives are linked to sustainability. Here we consider the research in Penn State's College of Agriculture in the context of sustainability. Agriculture is an appropriate example because of Penn State's status as a Land Grant Institution.

Many attributes of the current U.S. food system are unsustainable (Lacy, 1993). For example, the system depends on unsustainable supplies of fossil fuels, often promotes the erosion of biological diversity and soils, depletes freshwater aquifers, and might even compromise human health with it heavy use of pesticides, antibiotics, and hormones. In response to these problems, there is an increasing emphasis on sustainable agriculture in our Land-Grant universities (Francis et. al., 1995)

Findings

At Penn State a growing amount of research attention is being directed to biotechnology and "industrial" approaches to agriculture. This hi-tech emphasis can solve short-term problems of food production and distribution, but may have deleterious long-term consequences (See Box).

PSU and Biotechnology: Promise and Peril

Biotechnology now gives humans the ability to take a gene from a trout and stick in into a tomato. Why do this? To give the tomato some desirable trait that previously only the trout possessed. Life forms created in this way are referred to as "transgenic species."

At Penn State there are over one-hundred scientists working in the realm of biotechnology. The promises of biotechnology research (e.g., cloning to mass-produce animals that could be used as chemical factories to produce chemicals and drugs for human use) are exciting.

Humans have been quick to seize on the promises of biotechnology but slow to acknowledge the perils. Jeremy Rifkin (1999) raises five questions that prompt us to consider the peril behind the promise:

--In reprogramming the genetic codes of life, do we risk fatal interruption of millions of years of evolutionary development?

--Will the creation, mass production, and wholesale release of thousands of genetically engineered life forms into the environment cause irreversible damage to the biosphere, making genetic pollution an even greater threat to the planet than nuclear and petrochemical pollution?

--What are the consequences for the global economy and society of reducing the world's gene pool to patented intellectual property controlled exclusively by a handful of multinational corporations?

--How will the patenting of life affect our deepest convictions about the sacred nature and intrinsic value of life?

--What is the educational and intellectual impact of growing up in a world where all of life is treated as "invention" and "commercial property"?

It is remarkable that a technology which could substantially reconfigure, in unknown ways, what it has meant to be human is not under discussion in every hallway, dorm suite, classroom, and street corner of our University. As Bill McKibben points out, "To ignore this issue is to duck history."

While it is true that Penn State lacks a well-coordinated research emphasis on sustainable agriculture, individual researchers and labs have made some significant contributions to sustainable farming practices, most notably in the areas of soil fertility and pest management. Outlined below are examples of a few Penn State research and extension projects related to sustainable agriculture:

- Nutrient management to increase fertilizer-use efficiency and decrease pollution caused by excess fertilizer runoff.
- Intensive pasture grazing systems to reduce costs and soil erosion as well as decrease energy, pesticide and herbicide use, while increasing herd health.
- Integrated Pest Management to control pests and reduce reliance on pesticides.
- Pesticide education program aimed at the safe and proper use of pesticides, the fate of pesticides in the environment, and the effects of pesticide exposure on human health.
- Agricultural Extension Agent training to incorporate sustainable agricultural principles and approaches into extension work through SARE (Sustainable Agriculture Research and Education Task Force).

Although PSU's College of Agriculture has some initiatives underway that explicitly aim at promoting long-term ecological sustainability, there is much more that could be done (especially considering the size of the College of Agriculture's annual State/Federal research appropriation--approximately $28 million in 1998/99). Penn State still lacks, for example, a strong and comprehensive commitment to promoting sustainable vs. conventional (often unsustainable) farming practices. In general, there is an over-emphasis on large-scale, high-tech, high-input, corporate solutions to the agricultural challenges before us. Needed is a proactive, forward-looking agenda that promotes sustainable farming practices and healthful eating and that leads to the creation of a tapestry of public policies that can nourish family farming, care for natural resources, and guarantee food security (See Box).

Using Sustainability Principles to Shape Penn State's Ag Research Mission

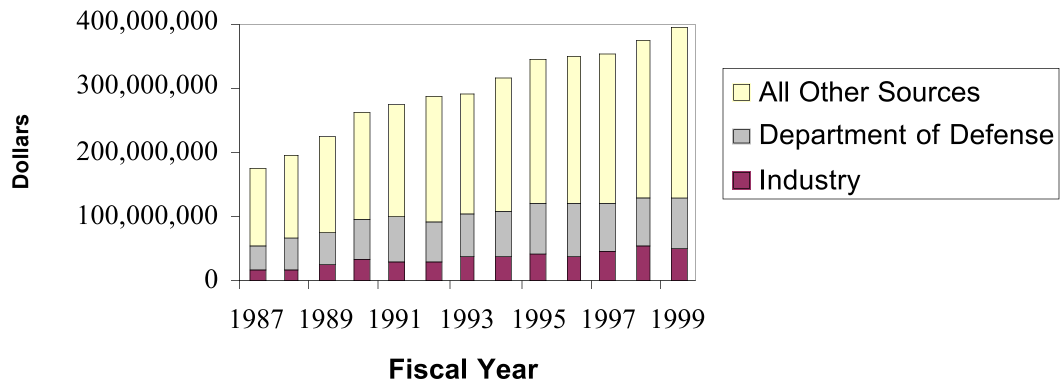
A sustainable agriculture respects the biota and natural processes, eliminating those practices and substances that might compromise the well-being of present and future generations of all species (not just humans). It embodies a commitment to live within limits, minimizing the inputs of non-renewable resources and carefully managing those inputs which are renewable. A sustainable agriculture also accounts for the environmental and social costs involved in food production and these costs are reflected in food prices. Furthermore, a sustainable agriculture is intensely democratic and mindful of place, seeking to promote a diversified, healthy regional farm economy that links communities, to the degree possible, to the food they consume and the people who produce it. The transition to a sustainable agricultural system will require more than just substitution or increases in efficiency; rather, like many other systems within society, the agricultural system will require innovative redesign (Hill and MacRae, 1995).

Overall, Penn State is increasingly aware of both the importance of promoting sustainable agriculture and the research needs in this realm. However, PSU research continues to focus strongly on conventional agriculture with its heavy emphasis on short-term productivity and efficiency, often at the expense of long-term ecosystem health and sustainability.

Indicator 4. Research Priorities

Penn State research activity, as measured in total research expenditures, has increased considerably in the last twelve years (Fig. 3). Measured in constant dollars, the increase was 44% between 1987 and 1999.

Figure 3. Research Funding at Penn State, University Park



Penn State receives research funding from hundreds of different sources spread among federal and state agencies, industry, and private foundations. In characterizing research priorities, it is instructive to examine the largest sources of research funding, as well as funding sources that are increasing. With this in mind, we focus on military research (largest segment of research expenditures) and corporate funding (a growing source of research funds).

Findings

Military Research. Penn State has been active in military research for the past 50 years and is particularly well known for its investigation of torpedo and submarine propulsion and silencing, as well as navigation and guidance control systems. Roughly one-fifth of all research funds coming into Penn State go to the Applied Research Lab (ARL) where most of PSUs military research is conducted. Most of ARL's support comes from the Navy. ARL has approximately 680 full-time employees. About 280 of these are full-time researchers with Ph.D.s.[7] In 1999, the Department of Defense (DOD) provided approximately $77 million to Penn State for research. According to Penn State President Graham Spanier, our faculty are

7 In recent years, ARL has been diverting some of its research focus away from exclusively military projects. For example, ARL now has research projects devoted to increasing manufacturing efficiency, assessing the ecological risks associated with molluscicides applied to ship hulls, and using electronic signaling to transmit "vital signs" from ambulances to hospitals.

involved in more than 200 DOD research projects. Nationally, Penn State is number one among public universities in Department of Defense (DOD) funded research.[8]

From a short-term perspective, military research is desirable at Penn State: It provides jobs, helps ensure national defense, and leads to non-military technological spin-offs that benefit the economy. However, there is concern in some quarters that a university emphasis on military research will not lead toward an open, just, purposeful and peaceful society.

Taking a long-term perspective, it is indeed possible that our military research could undermine sustainability for the simple reason that it generally perpetuates a way of thinking that implicitly condones the use of violent means to resolve conflict (as opposed to peaceful means). This, however, is by no means an easy determination to make. Penn State's strong emphasis on military research presents us with an important moral question: In what ways, if any, should military research be restricted on our campus?[9]

<u>Corporate Funding</u>. Penn State ranks first nationally among public universities in industrially sponsored research (Industrial Research Office). In the twelve-year period between 1987-1999, Penn State's corporate research funds increased from $16.2 million to $50.9 million. Expressed in standardized (1983) dollars, total corporate funding during this period more than doubled from $14.2 million to $30.4 million. In 1987, 387 different companies provided 839 grants/contracts to 291 faculty members at Penn State. By 1999, these numbers had roughly doubled: 535 faculty members received 1,682 grants/contracts from 900 companies.[10]

University corporate contracts have the potential to either contribute to or undermine long-term societal sustainability. In building an ever-more open, just and morally responsible university, it is important to ask:

--Does Penn State consider the social responsibility of the companies which it accepts contracts from?
--Are there certain types of corporate-sponsored research which Penn State will not permit on campus?[11]

It is perhaps timely to incorporate these and related questions into a code that governs the types of corporate contracts that Penn State accepts and the ways in which the University executes these contracts.

In sum, Penn State has made many significant contributions in military research, and our research linkages with industry are growing ever stronger. Penn State is in an excellent position, because of its high profile, to lead the way in establishing a code of ethics which provides guidelines for military and corporate research on campuses.

---

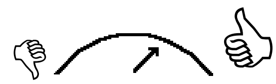
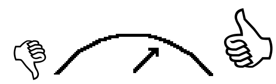
8 It is important to note that some DOD research at Penn State is only remotely linked to warfare and defense (e.g., DOD has supported PSU research on wetland restoration and the soaring behavior of birds).

9 On this question, Matthew Fox (1988) writes: "*Native people teach that the ultimate norm for morality is the impact our choices have on persons living seven generations from now: If the results appear good for them, then our choices are moral ones; if not, they are immoral. What would have to change in our civilization today if we agreed on this criterion? Would we not find something else to do with the 1.8 million dollars per minute we currently spend on weapons, for example*."

10 Often, the support coming from corporations is not part of competitive grants programs. Typically, a corporation contracts a particular faculty member or department in the hopes of getting help on a basic or applied problem.

11 Universities have been reluctant to address these kinds of questions on the grounds that restricting research in any way is an infringement on academic freedom. This is tantamount to declaring that academic freedom should supercede all other values. But surely we cannot justify every conceivable research endeavor on the grounds that to raise ethical questions about its purposes or methods violates academic freedom.

Summary of Research Indicators

Ethical Treatment of Research Subjects	PSU follows all national, state, and local guidelines regarding the ethical treatment of research subjects; however sustainability calls for even higher ethical standards.	
Disposal of Laboratory Wastes	The University's Office of Environmental Health and Safety has taken significant steps to reduce laboratory-related waste, but the University continues to produce approximately 250,000 pounds of hazardous, infectious, and radioactive waste each year; still needed is a comprehensive plan for dramatically reducing research-related waste.	
Research on Sustainability	The College of Agriculture has research initiatives that focus on sustainability but still lacks a comprehensive commitment to sustainable agriculture.	
Research Priorities	Few significant measures taken at PSU to promote research explicitly designed to promote sustainable practices. At the same time there has been a disinclination to define categories of research that, for ethical reasons, the University might choose not to engage in.	

Penn State has a strong commitment to research, but to date we have not fully considered the ways in which our research directly contributes to or undermines sustainability.

Moving Toward Sustainability

Other Institutions on the Path

Some forward-looking universities, including Penn State, are now developing training and research programs that focus on sustainable practices. For example, the Georgia Institute of Technology has made sustainable technology a core mission that permeates all university endeavors from teaching through research to operations (Cortese, 1999). Also, the Center for Energy and Environmental Studies at Boston University offers graduate training and research opportunities in ecological economics, energy analysis and environmental modeling; the University of Maryland provides graduate training and research in sustainability practices through its program in Sustainable Development and Conservation Biology; and the University of Virginia School of Architecture has a strong emphasis on ecological principles and "green" design (Student Conservation Association, 1997).

Other universities, in addition to Penn State, are working on reducing the volume of hazardous waste. For example, the University of Washington Environmental Health and Safety Office has adopted a policy to "minimize the amount of chemical waste that is going into the environment whether it enters through incineration, landfill, or discharge into the water system." Through a chemical distillation redistribution program, UW—like PSU—is able to reduce both disposal costs and the need to purchase new chemicals (Keniry, 1995).

Short-Term Goals for PSU

Establish an Ethical Code for Research Activities. Penn State needs an ethical code which clearly delineates the types of research which it might, in good conscience, choose not to conduct. The recently established student Pugwash Chapter at Penn State could help develop such a code.[12]

Be an Advocate for Research that Focuses on Sustainable Practices. Research advances are determined, in large part, by funding priorities: Provide money for "Starwars" and the work gets done; prioritize research on AIDS and the pages of Science magazine are filled with AIDS research. By the same token, provide funding for innovative technical and social solutions to over population, over consumption, environmental deterioration, and injustice and great things might be accomplished, as well! PSU's leaders should make this point to those with money in the federal government and the private sector. They will need to educate, coax and cajole until support for research that promotes sustainability in concrete ways (e.g., sustainable food production systems, ecological building design, efficient energy systems, sustainable forestry and on and on) is forthcoming.

Appoint an Ombudsman for the Environment. Environmental issues generally don't fit within traditional jurisdictions and management units. Hamburg and Ask (1992) resolved this problem at the University of Kansas by convincing their university to appoint an Ombudsman for the Environment. An "ombudsman" is someone who intercedes on behalf of someone else; an Environmental Ombudsman intervenes on behalf of the environment. The job of the Ombudsman at Kansas is to work with faculty, staff and students to identify and initiate research projects that seek to reduce environmental impacts. Projects are wide ranging (e.g., solvent recycling, improvement of energy efficiency in lighting). The cost of running the Ombudsman Office at Kansas is more than covered by the savings attributable to the projects that have been undertaken (Hamburg and Ask, 1992). Penn State needs an Environmental Ombudsman (together with a small technical staff) to begin the process of institutionalizing sustainability at University Park and the branch campuses.

Long-Term Goal: Prioritize Research for a Sustainable World

> *"The unprecedented powers that science now makes available must be accompanied by unprecedented levels of ethical focus and concern by the scientific community as well as the most broadly based public education into the importance of science and democracy."* Carl Sagan

If our civilization is to reverse the negative trends we see all about us, its leading centers of research will need to play a critical role. Penn State must begin to consider sustainability as a legitimate theme for research across the disciplines (See Box).

Expanded Research Agenda for Penn State Based on Five Sustainability Precepts

12 Pugwash began in 1957 (in response to nuclear proliferation) at the urgings of such famous scientists as Linus Pauling and Albert Einstein. Pugwash maintains that citizens have an obligation to ensure that science is used responsibly; the organization works to examine the ethical, social, and global implications of science and technology.

Penn State could augment its powerful existing research enterprise with a new research emphasis centered around the five sustainability precepts outlined in the introduction of this document.

1. Promote a respect for the biota and natural processes: We must challenge our natural scientists, philosophers, writers, and educators to seek a fuller understanding of global biodiversity and earth processes and, in so doing, to lead us to revitalize and restore the health of the planet.

2. Live within limits: We must employ our engineering, scientific, and social science expertise to achieve a transition to a "factor-ten economy"--a 10-fold decrease in material use as we dramatically increase energy efficiency and completely eliminate waste.

3. Show mindfulness of place: We must call on our historians, geographers, agronomists, architects, natural scientists, and artists to help us celebrate the uniqueness and richness of the places wherein we dwell and to build thriving local economies.

4. Create full-cost analyses of policy options: It is time for our business planners, economists, political scientists, and ecologists to take a leadership role in examining commerce in holistic ways so that product pricing is in accord with the true ecological and social cost of production.

5. Promote civic responsibility: We must call on all those in our academic community to join together to pioneer in the development of more democratic forms of planning, decision making, and conflict resolution.

It is also time for Penn State to consider "sustainability" as a critical theme for graduate training. The University must marshal the creativity and brain power to train graduate students to address key social, economic, technical, and environmental challenges, such as promoting energy-use efficiency and conservation, designing and implementing sustainable farming systems, developing policies to ensure the inclusion of "externalities" in product pricing, creating "green" buildings, and many more. As we do this, we will surely discover that it is possible to move purposefully toward the creation of a more healthy, just and sustainable society.

Finally, it behooves us to use our research prowess to institutionalize sustainable practices right on campus. This report offers thirty short-term steps (three in each chapter) which Penn State might take to move forthrightly toward sustainable practices.

References

Cortese, A. 1999. The university as a model of sustainability. www.2nature.org

Fox, M. 1988. The Coming of the Cosmic Christ. Harper, San Francisco, CA.

Frances, C., C. Edwards, J. Gerber, R. Harwood, D. Keeney, W. Liebhardt and M. Liebman. 1995. Impact of sustainable agriculture programs on U.S. landgrant universities. Journal of Sustainable Agriculture 5: 19-33.

Hale, B. 1997. Research Up. Intercom. November 20.

Hamburg, S. and S. Ask. 1992. The Environmental Ombudsman at the University of Kansas *in* D. J. Eagan and D. W. Orr (eds.), The Campus and Environmental Responsibility. Jossey-Bass Publishers, San Francisco, CA.

Hill, S. B. and R. J. MacRae. 1995. Conceptual framework for the transition from conventional to sustainable Agriculture. Journal of Sustainable Agriculture 7: 81-87.

Keniry, J. 1995. Ecodemia. National Wildlife Federation, Washington, D.C.

Lacy, W. B. 1993. Can agricultural colleges meet the needs of sustainable agriculture? American Journal of Alternative Agriculture 8: 40-45.

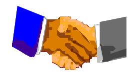
Penn State Department of University Health and Safety. 1996/97. Annual Report.

Rifkin, J. 1999. The Biotech Century. Penguin Putnam, Inc., New York, NY.

Russell, D. 2000. Health problems at the health-care industry. Amicus Journal. Pages 34-39. Winter.

Student Conservation Association. 1997. The Guide to Graduate Environmental Programs. Island Press, Washington, D.C.

U.S. Department of Agriculture and the U.S. Department of Health and Human Services. 1990. Nutrition and your health: Dietary guidelines for Americans. Home and Garden Bulletin 232. Washington D.C., GPO, 27 pp.

Decision Making 

"May no act of ours bring shame…May our lives but swell thy fame."
Fred Lewis Pattee

Introduction

University administrators throughout the U.S. generally rely on economic criteria in decision making. Increasingly wedded to "bottom line" thinking, university officials often use the language of business (e.g., deliverables, competitiveness, cost effectiveness, accountability, customer focus) to describe their goals.

At Penn State rarely a month passes without a major news story about a new initiative—a new building, a new land acquisition, a new corporate alliance, a new college, a new merger. Indeed, the University is making big decisions. But is it making wise decisions?

A decision-making structure that promotes sustainability has the following characteristics:

- **Decisions based on deep-seated values.** Sustainable institutions recognize that economic considerations alone are not adequate bases for wise decision making; deep-seated values and ethics are central to sound decisions.
- **Decision-making process is open.** In a sustainable institution, information affecting community members is shared unconditionally. On major issues, every effort is made to reach consensus; questioning and debate are encouraged.

Long-term societal sustainability is nurtured when narrow economistic thinking and opacity do not cripple organizational decisions. With this in mind, we examined two aspects of decision making at Penn State:

1. Core Values Guiding Decisions
2. Openness

In neither case are we able to offer a definitive assessment. What follows is simply a first attempt at thinking about some characteristics of decision making at Penn State that affect sustainability.

Indicator 1. Core Values Guiding Decisions

The structure and function of American universities has become decidedly more business-oriented over the course of the past several decades. Along with an increasing emphasis on "bottom line" thinking, there has also been an increase in the number and types of business arrangements with outside businesses. Indeed, a kind of "mutualism" has developed in many instances where both universities and business seem to benefit.[1]

Business acumen and attention to fiduciary responsibility, of course, are essential to the successful operation of any university. But to the extent that a university's decision making is governed predominately by monetary considerations, the institution falls into an entirely modern and, ultimately, non-sustainable way of functioning known as "economism" (See Box).

The Ascendancy of *Economism* in America

Just as racism and sexism are forms of discrimination based on race and gender, "economism" is a form of discrimination stemming from the idea that the ECONOMY is separate from, and superior to, the rest of life.

---

[1] At Penn State the composition of the Board of Trustees reflects this marriage of business and academic interests: 14 Board of Trustee members (i.e., more than 40%) are CEOs/Corporate Professionals; 6 members are Government Appointees; 5 members are agriculturists; 7 members represent the Law/Education/Medicine/Communication professions; and 1 member is a Penn State student.

As Barbara Brandt (1995) points out: "Economism equates the goals and well-being of businesses with the well-being of society as a whole. Thus, in our modern economistic system:

--the purpose of the natural environment is to provide resources that can be turned into more products to be sold by businesses.
--the purpose of government is to promote policies that will help business.
--the purpose of home and family is to consume the products of business.
--the purpose of creative arts is to help sell business products.
--the purpose of our schools is to teach students the skills they will need at work so that our businesses can remain competitive in the new global economy."

Modern economistic thinking is largely devoid of moral precepts. "Whatever generates the greatest profit" has become the criterion for a false morality. The criterion is no longer "Is this right or wrong?" but "Will this make money?" "Will it bring the highest return on my investment?" Under economism the needs and values of business have come to overwhelm the rest of society.

Findings

Penn State is not immune, nor could it be, to a growing nation-wide emphasis on economism. However, PSU's strong service mission can act as a counter-balance to narrow, economistic decision making.

This balance, though, is difficult to maintain. Perhaps nowhere is this more evident than in the realm of university investments. Prompted by student activism, Penn State has wrestled with difficult ethical considerations regarding investments on a few occasions (e.g., South Africa). However, in general, PSU has preferred to allow economic concerns alone to dictate its investment decisions. In July, 1996, PSU's Board of Trustees updated the Endowment Spending and Investment Policy with a resolution which reads:

> *(5) In performing its duties delegated under this resolution, the Investment Committee shall be guided solely by fiduciary principles. The committee shall consider only financial criteria in formulating investment policies…*

Penn State administrators acknowledge that economic considerations have not always been such an important force at Penn State, but instead, have developed slowly over several decades and today are often taken for granted. Faculty and staff, for their part, have learned to frame discussions and proposals in economic terms—asserting that the proposed change will either make or save money for the University.

But universities are not simply businesses; all evidence to the contrary. They have a huge advantage over businesses. They can, if they choose, act on a vision that is not excessively hobbled by bottom-line thinking and in so doing leverage society toward a sustainable future. After all, the true bottom line at a university is represented by the accumulated knowledge, moral fortitude and social responsibility of its graduates.

Indicator 2. Openness

Penn State is a huge enterprise and, by global standards, a wealthy university (1.38 billion dollar budget in 1998-1999). Publicly accountable and open decision making processes engender a sense of interconnectedness, trust, and cooperation.

Findings

The research conducted by the numerous participants in this project involved gathering information from many university sectors (e.g., Office of the Physical Plant, Housing and Food Services, Police Services). In almost all instances, the investigators were very well received; they had no difficulty in acquiring the information that they sought.

The Indicators team did, however, encounter cases where information existed but was off-limits. For example, Old Main officials were unwilling to provide details on Penn State's contracts with corporations such as AT&T, Nike, Pepsi and Cellular One. Information on University investments was also off limits when the first edition of the Indiactors Report was released but that changed in March, 2000 (See Box).

Penn State takes a Leading Role in Investment Openness

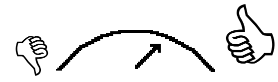
In February, 2000, sixty student government members called on Penn State to reveal the names of the companies in which the University invests (Wengerd, 2000a). After deliberating on this matter, the University decided to release the list of the money managers who handle its $730 million endowment; the University also agreed to provide an annual snapshot of its specific investments (Wengerd, 2000b).

A logical next step, in the interest of sustainability, is to "screen" University investments. Many investment companies (e.g., Calvert) now offer the option of screened investments. There is even a precedent for this at Penn State: Faculty and staff are given the choice of investing their retirement funds in socially-screened stocks. Aside from the satisfaction that comes from acting on moral principles, there is strong evidence that, over the long term, social investors can expect to do as well as other investors. For example, the Domini Social Index-400, a socially-screened stock index of 400 companies, has generally performed similar to or even better than the Standard and Poor's Index (the standard by which most stocks are judged) (Melton, 1995).[2] PSU money managers should be instructed to place screens on investments to ensure that PSU does not contribute to injustice or environmental harm.

PSU has taken other steps in recent years to become more open and responsive. For example, Penn State President Graham Spanier has initiated a monthly call-in radio show ("To the Best of My Knowledge") in which community members are given a forum to discuss issues of local and national concern. In addition, the minutes of the Board of Trustees meetings are open to public scrutiny (available upon request in the Penn State Room at Pattee Library) and the Penn State Budget is on the Worldwide Web. Finally, the University's Continuous Quality Improvement Program has empowered staff to take greater control of their work environment and resulted in improvements in both efficiency and morale (P. Ruskin, Communications Coordinator, OPP, pers. comm.)

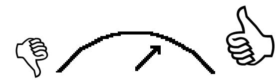
Although each of these examples is a step in the right direction, there have been no comprehensive measures to promote openness in decision making. Of great concern is the fact that Penn State administrators and Trustees are now making far-reaching decisions about the future structure and operations of the University without the substantive participation of the academic community itself.

Summary of Decision-Making Indicators

Core Values Guiding Decisions	Penn State struggling to maintain a balance in decision making between economic concerns vs. ecological and social responsibility.	

---

2 At the conclusion of the second quarter of 1999, two highly respected financial analysis teams—Morningstar and Lipper—gave top ratings to three out of the four large (funds with assets greater than $100 million) socially screened funds (www.coopamerica.org).

Openness	PSU has made significant efforts to make some categories of information more available, but still falls short of a truly open decision-making process.	

Moving Toward Sustainability

Other Institutions on the Path

Sustainability is becoming a criterion in decision making at some colleges and universities. These schools are finding that the use of sustainability "filters" in decision making can actually save them money. A recent report, "Green Investment, Green Return," demonstrated that 23 sustainability initiatives at 15 U.S. colleges and universities are saving $17 million each year (National Wildlife Federation, 1998).

Some colleges and universities are also beginning to introduce ethical (rather than purely monetary) concerns into contracting and investment decisions. For example, Duke University has recently passed a "code of conduct" for all companies that manufacture products emblazoned with the Duke name and/or logo. The code requires companies, such as Nike (which currently manufactures both PSU's and Duke's athletic apparel), to disclose the location of all factories and permits Duke to examine working conditions and labor practices at these factories. If contractors are found to be in persistent violation of the code, Duke will terminate the contract.

This issue is also a concern at Penn State. PSU has recently joined more than 100 other universities in signing the Fair Labor Association (FLA) Agreement. This agreement requires Nike and other university licensees to disclose factory locations (www.nikebiz.com/labor/index/html) and bans child and forced labor within factories (Pomponio, 1999).[3] Penn State President Graham Spanier is also developing a relationship with the Global Alliance for Workers and Communities that represents a partnership between private, public, and nonprofit institutions committed to improving the work and life opportunities for factory workers (www.theglobalalliance.org/) (Spanier, 2000).

On the investment front, some universities now pass investment decisions through a "screen" to eliminate companies that treat employees unjustly, produce dangerous products, or pollute the environment. For example, Harvard, Johns Hopkins, Tufts, and Northwestern do not invest in companies that manufacture tobacco products. Tufts includes manufacturers of alcoholic beverages in its "screen." Such a screen might be a forthright way for Penn State to globally manifest its concern with campus drinking.[4]

---

3 Recent protests at the Universities of Michigan, Wisconsin, and Pennsylvania, however, have raised questions about the credibility of the FLA's efforts (Associated Press, 2000). Students at the University of Wisconsin have urged their president to withdraw from the FLA and instead join the Worker Rights Consortium (www.nlcnet.org/elsalvador/wrcandes.html), an organization with a commitment to opening up factory conditions to public scrutiny and responding to workers complaints. As this report goes to press, Penn State students are calling on President Spanier to take a similar action.

4 Universities also have the leverage to promote corporate responsibility by voting on shareholder resolutions. Many schools have committees composed of students, faculty and administrators that review and vote on shareholder resolutions (PSU has no such committee; it delegates this responsibility to investment managers). Some universities have gone even further by filing resolutions to be voted on by stockholders. For example, a few years back, the University of Washington filed a resolution calling on Unocal, an oil company with operations in Burma, to include "clear human rights criteria" in its code of conduct (Mercer, 1996).

Short-Term Goals for PSU

Make Alterations to Mission Statement. Penn State could demonstrate a fundamental commitment to sustainability by making several small, but significant, changes to its mission statement (See Box).

> **Proposed Amendments to Penn State's Mission Statement**
>
> Here we quote Penn State's mission statement. Proposed new text is presented in CAPITAL LETTERS.
>
> Education. Penn State strives to create new dimensions in the lives of its students by introducing them to the collective knowledge, wisdom, and experience of human society AND THE NATURAL WORLD by encouraging them to acquire the skills and intellectual discipline to comprehend the complexities of our times...
>
> Research. Penn State strives to broaden human horizons by promoting scholarship, creativity and the advancement of knowledge, thus enhancing our understanding of ourselves AND OUR PLACE in the many worlds around us.
>
> Service. Penn State strives to contribute to ECOLOGICAL, economic and societal vitality by offering informed views on critical and recurring issues, by providing opportunities for cultural and intellectual enrichment, and by contributing new ideas and new techniques...
>
> Finally, Penn State's ultimate purpose is to:
>
> ...enhance the well-being of THE COMMUNITY OF LIFE LOCALLY, NATIONALLY AND GLOBALLY.

Hold University-Wide Referenda for Major Decisions. Although they might be consulted from time to time, faculty, staff, and students do no have a final say in the substantative issues that are shaping Penn State's future (e.g., decisions about expansions, mergers, and policy). The University should develop mechanisms, such as university-wide referenda, which permit the voices of all members of the PSU community to be heard.

Develop New Ways of Rewarding Administrative Excellence. In the past, most of the significant year-to-year decisions at Penn State were in the academic realm and faculty had the authority to make many of those decisions (as they still do today). At present, however, the big decisions shaping the character and culture of Penn State are centered increasingly in the business realm. Thus, our administrators are judged, to a significant degree, by their capacity to create new things (i.e., to promote growth in its various guises). We should consider revising the incentive system for administrators to one which rewards efforts to make things philosophically better or to achieve better balance or to enhance quality while reducing material throughput.[5]

Long-Term Goal: Ground Decisions in Sustainability Principles

> *"The university is an investment in a culture, in continuity and intelligence. It is not primarily a financial investment, and the rewards are not necessarily financial either. There is more than one way for a community to become rich."*
> Robert Solomon

If sustainability is to permeate university culture, Penn State will need to develop a protocol to ensure that important decisions are passed through a "sustainability filter." That filter might include such questions as: Does this decision lead to a deepening of our respect for life? Does it account for full social and environmental costs? Does the decision recognize and respect natural limits to growth? Does it respect local economies and local cultures? Have all voices been considered in arriving at the decision? The use of such filters would help Penn State and other universities address the ethics of, heretofore, often ignored issues such as the

5 This recommendation emerged from conversations with PSU administrators.

appropriateness of military research on campus or the investment of university monies in corporations with a history of environmental and/or human exploitation.

This last challenge—a challenge to base university decisions in profound ethical truths—is the most daunting of all. It calls us to take great risks. Not many universities have the courage to contemplate such a challenge.

References

Associated Press. 2000. Michigan students occupy dean’s office. Centre Daily Times, February 18.

Brandt, B. 1995. Whole Life Economics. New Society Publishers, Philadelphia, PA.

Melton, J. 1995. Can you really do well by doing good? Co-op America Quarterly, 36:13-15.

Mercer, J. 1996. Morality in investing. The Chronicle of Higher Education. March 29. A49-50.

National Wildlife Federation. 1998. Green Investment, Green Return: How Practical Conservation Projects Save Millions on America's Campuses. National Wildlife Federation, Washington, D.C.

Pomponio, A. 1999. PSU seeks information on Nike labor practices. Centre Daily Times, October 17.

Spanier, G.B. 2000. PSU works hard to avoid dealing with sweatshops. Centre Daily Times, February 23.

Wengerd, E. 2000a. No secrets in PSU's portfolio, Spanier says. Centre Daily Times, February 9.

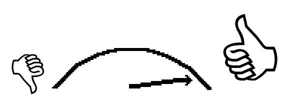
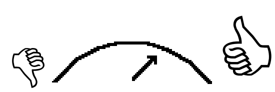
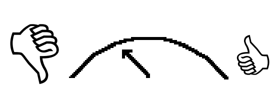
Wengerd, E. 2000b. Penn State’s investment practices debated. Centre Daily Times, March 12.

CONCLUSION

"There must be new contact between men and earth; the earth must be newly seen and heard and felt and smelled and tasted; there must be a renewal of the wisdom that comes with knowing clearly the pain and pleasure and the risk and the responsibility of being alive in this world."
Wendell Berry

Based on the analysis in the foregoing pages, Penn State's performance on sustainability (Table 1) mirrors that of the nation at large. For category after category—energy, food, materials, transportation, buildings, decision making—PSU practices depart little from the status quo. Indeed, a clear comprehensive strategy to adopt sustainable practices, strong leadership and deep commitment is still lacking for each of the 33 indicators. However, for sixteen indicators significant measures have been taken to adopt sustainable practices although a comprehensive strategy is still lacking. Meanwhile, for thirteen indicators only limited measures have been taken to encourage sustainable practices. As for the remaining four indicators, we were unable to detect notable efforts aimed at promoting sustainable practices.

Table 1. Summary of Results.

Rating Criteria	Grade Scale	Number of Indicators
• The University has a comprehensive strategy to adopt sustainable practices; high profile issue with strong leadership.		0
• The University has taken many significant measures to adopt sustainable practices but still lacks a comprehensive strategy.		16
• The University has taken only limited measures to adopt sustainable practices.		13
• The University has taken no significant measures to adopt sustainable practices.		4

It is time to embrace a new way of living—a new way of thinking. Our university needs a comprehensive and deep-reaching mission aimed at achieving sustainability in all facets of campus life. Penn State has certainly begun to respond to this challenge. For each of the ten categories examined in this report, there are things the University can be proud of:

- Energy—Penn State's Continuous Commissioning Process has been increasing energy-use efficiency in campus buildings through detailed evaluations and systems upgrades.

- Water—Penn State's Water-Land Treatment System protects the integrity of Spring Creek by spraying treated wastewater on land rather than discharging it into Spring Creek.

- Material Resources and Waste Disposal—The tonnage of recycled solid waste at Penn State has increased significantly over the last ten years.

- Food—The healthfulness and diversity of food offered at PSU's dining facilities is extraordinary.

- Land—Penn State's commitment to create a blueprint for ecologically sound land settlement at its Circleville farm is visionary.

- Transportation—The expansion of university bus routes and the use of natural gas-fueled buses are significant measures aimed at reducing our dependence on cars.

- Built Environment—The planned restoration of the Old Botany Greenhouse (year 2000 Senior class gift), complete with a "living machine" to process the building's wastewater is an outstanding green design project.

- Community—PSU's newly instituted Environmental Studies minor should significantly enhance ecological literacy.

- Research—Penn State's newly created Environmental Consortium is well positioned to make major research and education contributions in the realm of sustainable practices.

- Decision Making—The University has made sincere and comprehensive efforts to involve many different constituencies in the Master Planning process.

These measures, and others like them, are noteworthy. Now, the time has come for Penn State to reach even higher by joining its various environmental efforts into a comprehensive Ecological Mission (Table 2).

Table 2. Leading the Way Toward Sustainability: PSU's Emerging Ecological Mission.

ELEMENT	GOAL	SPECIFIC SHORT-TERM GOAL

ENERGY	Significantly Reduce Fossil Fuel Dependence	Reduce Total Energy Use by 10% while Increasing the Renewable Portion of Energy by 10% by 2010
WATER	Dramatically Reduce Water Waste	Reduce Water Use by 25% by 2010
MATERIALS	Become a Minimum-Waste University	Substitute Environmentally Sound Products for Harmful Ones
FOOD	Purchase, to the Fullest Extent Possible, Foods Produced Using Sustainable Practices	Supply 10% of Non-Dairy Food from Regional Sources by 2010
LAND	Create and Abide by a Land Ethic	Formally Incorporate Environmental Stewardship into PSU Mission
TRANSPORT	Promote Compelling Alternatives to Car-Based Transit	Reduce Number of Campus Cars by 25% by 2010
BUILDINGS	Create "Green" Buildings	Make all New Buildings "Green"
COMMUNITY	Promote Ecological Literacy	Model Sustainable Practices
RESEARCH	Prioritize Research for a Sustainable World	Actively Support Research on Sustainable Practices
DECISION MAKING	Ground Decisions in Sustainability Principles	Develop Protocol for Systematically Considering Sustainability Consequences of all Decisions

It is certainly true that there will be up-front costs involved in reducing waste in the realms of energy, water, and materials; and there will be expenses involved in constructing green buildings and promoting alternatives to the automobile. But businesses and universities are discovering that waste is also expensive and that up-front investments in sustainable practices often pay off handsomely over the long-term, especially when environmental and social costs are calculated and educational benefits are tallied.

There is a growing consensus among PSU leaders that the goals summarized in the above Table should form a basis for PSU's Ecological Mission (See Box).

An Emerging Consensus on Penn State's Ecological Mission

In February, 2000, the Green Destiny Council invited all Penn State deans, department heads, and operations and facilities managers to participate in a process aimed at reaching consensus on Penn State's emerging Ecological Mission. Sixty-nine leaders responded to this invitation. This group of leaders reached broad, although not complete, agreement on the following long-terms goals for our university:

--Energy: Significantly Reduce Fossil Fuel Dependence
--Water: Dramatically Reduce Water Waste
--Materials: Minimize Solid, Liquid, and Hazardous Waste
--Food: Purchase, to the Extent Possible, Food Produced Using Sustainable Practices
--Land: Create and Abide by a Land Ethic
--Transportation: Promote Compelling Alternatives to Car-Based Transit
--Buildings: Create Green Buildings on Campus
--Community: Promote Ecological Literacy by Modeling Sustainable Practices

On Tuesday March 21st, 2000, Penn State Student Government voted unanimously to endorse these long-term goals. And as our report goes to press, Penn State's Faculty Senate is preparing to consider a resolution urging the University to incorporate this Ecological Mission into its Strategic Plan.

Penn State is now on the eve of revising its Strategic Plan and thus has a remarkable opportunity to incorporate a forward-looking ecological mission (Table 2)—with appropriate performance indicators—into its long-term vision. By pursuing a comprehensive ecological mission Penn State can create a new model for living—one which is highly energy efficient, produces little or no waste, supports the regional economy, engenders an abiding respect for life, and fosters bonds between all community members.

The work necessary to achieve the ecological mission and thereby transform Penn State into a sustainable university will require specific strategies and actions. Penn State needs to, in effect, institutionalize sustainability. This will entail, among other things, adopting policies and regulations that point the University forthrightly toward sustainable practices.

An organization, such as Penn State's Environmental Consortium, could play a central role in spearheading PSU's ecological mission. Such an organization could develop and then implement cost-effective programs aimed at moving Penn State resolutely, step-by-step, from non-sustainable to sustainable practices. This is a process that will not be completed in a day, year or even a decade, but it can be done and it should begin.