What is the current level of public understanding of urban ecosystems?

Francis Pandolfi, National Environmental Education and Training Foundation

For the past seven years, Roper Starch Worldwide and the National Environmental Education & Training Foundation (NEETF) have surveyed adult Americans to gauge their environmental knowledge, attitudes and behaviors. This data is then published at the end of each year in a report called The National Report Card on Environmental Knowledge, Attitudes and Behaviors.

The 1998 Report found that while public support for the environment has continued to grow, the public's understanding of environmental issues lags far behind. While concerned about the quality of their drinking water, most individuals do not know the main source of water pollution. While concerned about air pollution, over 60% of the public thinks that U.S. electricity is generated in a non-air polluting manner.

The result? Many Americans lack the basic understanding to engage in an informed public debate about the nation's environmental policy – and their lack of knowledge can push them to promote environmental policies that may not be the best for the situation at hand.

The 1998 The National Report Card on Environmental Knowledge, Attitudes and Behaviors focuses on these common environmental myths, and looks at what the implications of this lack of environmental knowledge means for America's policy makers, industry leaders, and individuals.

From an urban ecosystems standpoint, it is important to note that 36% of the respondents live in an "urban ecosystem" (classified as people who responded that they live in a large or medium sized city). Among other questions, each respondent is asked to describe the area in which they live as either: a large city, a medium size city, a small city, a suburban town, a small town, or as a rural or farm area. These six categories can be grouped as: 1) urban comprising large and medium sized cities, 2) suburban, comprising small cities and suburban towns, and 3) rural, comprising small towns or rural/farm areas. These groupings can give us an insight into differences in attitudes and knowledge between urban and rural communities and some important distinctions between people living in urban vs. rural ecosystems.

An analysis of the 1998 National Report Card shows that urban respondents were 25% more likely to think that environmental regulation "had not gone far enough" than rural respondents. In other words, people in urban ecosystems are 25% more likely to support increased environmental regulation as compared to their rural counterparts. As a contrast, rural residents were 32% more likely than their urban counterparts to think that environmental regulation "had gone too far".

The 1997 National Report Card focused on the establishment of a baseline of knowledge that the general public has about the environment. To accomplish this task, the National Environmental Education & Training Foundation asked 10 multiple choice questions that were gauged to be

answerable had the respondent paid attention to widely discussed environmental issues in the mainstream media.

Thus, the 1997 National Report Card allows us to gauge the general environmental knowledge of people who live in urban vs. rural ecosystems. The 1997 report also found that the better that someone did on the environmental knowledge quiz, the less likely they were to support environmental regulation. Conversely, the people who scored lowest on the environmental quiz were most likely to support existing environmental regulations, and to support their expansion.

The National Environmental Education & Training Foundation feels that this finding can be attributed to several related factors: 1) people in rural ecosystems are more likely to be directly affected by environmental regulations (farmers, loggers, ranchers), 2) people with a greater knowledge of environmental issues realize that there are often alternative solutions to these problems and that regulation is not a magic bullet, and 3) people in cities are more likely to view the government as their "protector," whereas rural residents are more likely to embrace a culture of "individualism" that doesn't lend itself easily to government solutions.

Why is understanding urban ecosystems important to people concerned about environmental justice?

Bunyan Bryant and **John Callewaert**, School of Natural Resources and Environment, University of Michigan

During the past decade, issues of justice, equity, and racism have become significant developments in the environmental movement, particularly with regard to demographics and environmental burdens. Researchers, scholars, professionals, community activists and members of the general public are beginning to view environmental issues as more than wilderness protection, pollution prevention and resource conservation. Environmental justice is the field of study and the social movement that focuses on these developments. Environmental justice is concerned with the distribution of environmental benefits and harms, and asks whether the procedures and impacts of environmental decision making are fair to the people they affect. This focus on distributional issues adds new layers of analysis to the field of environmental science. Just as environmental scientists examine how human actions can upset local and regional ecological equilibriums, the notion of environmental justice focuses on how the environmental repercussions of human actions can disrupt societal equilibriums. Within the United States, environmental justice is primarily understood as the disproportionate exposure of minority and low-income communities to environmental hazards. This understanding is supported by numerous empirical studies.

An incident in 1982, in Warren County, North Carolina, is often cited as the event that propelled environmental justice into public awareness. In Warren County, a community mobilized in opposition to a state proposed landfill for polychlorinated biphenyl (PCB) contaminated soil in a predominantly African American community. Grassroots opposition followed the siting decision and grew into a movement that took on the atmosphere of a civil rights campaign. During acts of nonviolent civil disobedience related to the landfill, over 400 people were arrested. Outcomes related to this event include numerous research initiatives, a national conference of academic and civil rights communities in 1990 at the University of Michigan which helped to set the policy and research agendas for environmental justice, the First National People of Color Leadership Summit in 1991, and Executive Order 12898 (signed by President Clinton in 1994) requiring federal agencies to focus attention on environmental justice issues. Important recent developments with respect to environmental justice policy and research include the Environmental Protection Agency's 1998 interim guidelines for investigating permitting complaints filed under Title VI of the Civil Rights Act of 1964, and the newly published report *Toward Environmental Justice* by the National Academy of Sciences, Institute of Medicine, Committee on Environmental Justice.

At first glance, it may seem odd to link efforts to close hazardous waste management facilities or polluting industries with efforts to improve the understanding of urban ecosystems. Given that many of the major U.S. environmental organizations have ignored the environmental health and survival needs of communities of color and low-income communities, the environmental justice movement has been very critical of conventional environmental initiatives. However, making the connections between environmental justice and understanding urban ecosystems goes straight to the heart of resolving many of the conditions that lead to a wide array of environmental injustices. When production cycles fail to function in balance with ecosystems the result is greater amounts of, and often more toxic, pollution. Data from numerous studies show that communities of color and

the poor bear a disproportionate exposure to this pollution. Our lack of a "sustainable knowledge" to promote "sustainable production" often results in environmental injustice.

Those gathered at the First National People of Color Leadership Summit understood this when they established the 17 Principles of Environmental Justice and acknowledged that environmental justice affirms the ecological unity and interdependence of all species, and that environmental justice affirms the need for urban ecological policies to clean up and rebuild cities in balance with nature. Another example of the link between understanding ecosystems and environmental justice can be found in quality of lay observation in what is known as "popular epidemiology." In numerous cases local residents have been able to identify the connections between their own health problems and the contamination of the ecosystem. Finally, Walsh, Warland and Smith (1997), note that community challenges to incinerators are more successful when they develop a regional rather than local focus and build coalitions with other groups. Such evidence emphasizes the link between environmental justice and understanding the ecosystem.

In order to strengthen the connections between environmental justice and understanding ecosystems, we offer the following three strategies. First, there must be a vigorous effort to promote community involvement in designing initiatives promoting the importance of understanding urban ecosystems and environmental justice. This emphasis on participatory research is highlighted in the recent NAS report and has been supported by other leading research institutions. Second, although people concerned about environmental justice often place health and survival issues as top community priorities, they must place these priorities in the context of the failure of urban ecosystems; they must make the connection between healthy ecosystems and healthy social systems. Geographic Information System applications have been an important tool for those concerned about environmental justice and also for those concerned about urban ecosystems. Combining economic, social, and ecosystem data will support better-coordinated efforts by all involved parties. Finally, a new type professional must be trained for this work. Such professionals need to accept the challenges of working directly with communities and should be able to use participatory research methods to involve community members in the design, implementation, data collection and analysis of initiatives connecting environmental justice with better understandings of urban ecosystems.

The results of such efforts would hopefully be better community-based initiatives that are aware of economic, social, and ecosystem realities. There would also be stronger, more successful coalitions working on environmental justice and understanding ecosystems.

Walsh, Edward J., Rex Warland, and D. C. Smith. 1997. *Don't Burn It Here: Grassroots Challenges to Trash Incinerators*. University Park, PA: The Pennsylvania State University Press.

The role of understanding urban ecosystems in community development

Jack K. Shu, Office of Community Involvement, California State Parks

Opening:

Human communities and urban ecosystems have only recently become major components of environmental education. Most people still have in their minds something close to natural history or natural science education when they think of environmental education. An article in the Viewpoint section of The Journal of Environmental Education a few years ago entitled *Whose Voice Sets the Agenda for Environmental Education? Misconceptions Inhibiting Racial and Cultural Diversity,* raised the question of whether the selection of topics or issues for environmental education is inclusive of all people. The study of urban ecosystems provides an opportunity for environmental education to be more relevant to diverse communities. Additionally, with what we now know and teach about whole ecosystems, urban systems must become the mainstay of the discipline. It seems that a paradigm change is needed in the field of environmental education, a shift from the study of natural systems to the study of sustainable living systems for human communities. With a systems approach, this change would involve more social science, use of public health models, economic feasibility studies, and factoring in of political realities and cultural differences. Together with more human emotions, the complexity of urban ecosystems would shadow that of life webs for forests with a handful of different human perspectives. We are at the beginning of a major challenge.

Why is it important for people to understand urban ecosystems?

For many years environmental educators have been teaching the point that we live in one ecosystem, that we should think "globally." This may have helped us move towards working as one community and realize that what happens at one location has an effect on a system that is thousands of miles away. However, it has done little to help people focus on major environmental problems in their own communities such as staggering high consumption of resources, leaping urban sprawl and recycling with little effort to reduce or reuse. The environmental justice movement has helped to point out where some major problems are. However, problems are complex and so far actions seem to be only directed at symptoms, not long term solutions to the entire ecosystem of the affected communities. Understanding urban ecosystems, which would include cultural, political, demographic and economic issues, will allow communities to focus on holistic solutions. Communities may then seek sustainable systems.

How can people use an understanding of urban ecosystems?

Too often students study distant ecosystems which, if they are lucky, they may only visit. Since most of the population in developed countries lives in urban communities, a better understanding of urban ecosystems would provide curriculum that involves students with their home community. From the primary grades, students can follow the standard environmental education model of awareness to action. Almost all of their learning will take place with real projects within their neighborhood. Students and their families would be involved from the selection of projects to evaluating results. Best of all, they would not only see the benefits of their actions but have a better quality of life as a result.

We do not know all the skills that the students and community leaders will need to achieve this yet. However, we can guess that it will involve more group learning and problem solving than individual science work. Our understanding of the chemistry of pollution or cause and effect of poor control and disposal of toxic waste, for example, is proceeding ahead of how to implement solutions. Thus, the need for greater understanding is probably more on the social science side than on the natural science side of the equation. If the understanding is holistic and the necessary skills provided, then with relatively little effort, effective solutions would come about.

What practical improvements can we expect if such understandings are developed broadly?

An increase in the use of the urban ecosystem as a topic for student action projects would be the initial goal. With better understanding of urban ecosystems, such lessons would be more successful and effective at reducing some of the most threatening problems in urban communities. More importantly, it can stimulate students' pride in their own communities, reversing the tendency to idealize natural systems and see only the despair of older cities. This would also lead to an increased involvement and support by much of the community's population. Helping the environment would not be seen as an enemy to business or progress. The cumulative long-range goal would be the empowerment of whole communities to develop a new vision. Each community's vision of the future would no longer emphasize more shopping malls or better freeway systems. Rather it would be a vision of an improved urban ecosystem complete with economic success and progress towards sustainable use of resources. Only if we understand urban ecosystems in a comprehensive manor, will such a vision be formulated with confidence and realism.

How can teaching about urban ecosystems be a vehicle for education reform?

Celeste Pea, Education Reform Division, National Science Foundation.

Since 1991, the National Science Foundation's (NSF) Education and Human Resource (EHR) Directorate, has served as a focal point for **systemic reform** efforts designed to strengthen the science, mathematics and technology education infrastructure of states, urban centers, and rural areas. Systemic reform of education is increasingly recognized as a necessary strategy to provide sustainable improvements in the nation's educational enterprise.

EHR's urban program was first established in 1993 as the Urban Systemic Initiative (USI). It constituted a partnership between the Foundation and large urban school systems to effect sustained school reform for all of their K-12 mathematics and science students, The importance of which is made manifest by the fact that urban school systems enroll more than half of all public school students in the United States. However, beginning FY 1999 and beyond, the Urban Systemic Program (USP), derived from the merger of two existing efforts, the USI and the Comprehensive Partnerships for Science and Mathematics Achievement (CPMSA), is EHR's new K-12 based effort. It targets urban districts with at least 25,000 students where mathematics and science reform are significantly underway.

The intent of the USP is to enable these urban school districts to continue to foster experimentation, accelerate the rate of change, and increase implementation of system-wide improvement in **teaching and learning** for grades K- 12 in mathematics, science, and technology. The intent also is to offer urban school districts the opportunity to partner with local two-year and four-year institutions to produce an educational system for the production and maintenance of a high quality science and mathematics instructional and technological workforce. The USP has the potential of reaching over five million students and more than 200,000 teachers of mathematics and science. It is NSF's expectation that urban districts that elect to participate in this effort have an infrastructure for broad-based improvement in mathematics and science learning—leading to lasting changes in the lives of all students. It is through this reform effort of K-12 urban education that an attempt will be made to establish a context from which all students will learn and thereby become more appreciative of and amendable to the environment in which they live.

Thus, your attention is referred to an article by J. Myron Atkins and Paul Black, entitled *Policy Perils of International Comparisons: The TIMSS Case*, PHI Delta Kappan, September 1997, pages 22-28. The authors served as co-chairs for a large scale study conducted by the Organization for Economic Cooperation and Development (OECD) that included a component relative to how various countries select topics for inclusion in their course of study. Atkins and Black state that virtually everywhere, the curriculum is becoming more practical and that topics are chosen that have an impact on the daily lives of the students and on the community in which they live. Therefore, increasingly, the accepted rationale for including any topic in a new curriculum is that it has real life application. The investigators further state that an emphasis on practical work and applications has led several countries to pursue innovations that accent a cross-disciplinary approach, often called integrated science. For example, when studying the environmental effects of acid rain, no one discipline is considered to be adequate. That is to say, chemistry helps students understand the effect of pH levels on the composition of substances in the environment, while physics explains the effects of acid rain on the strength of structures. Biology helps students understand how life is

affected in an acid environment and the earth sciences help to explain how weather patterns produce differential effects of acid rain in different locations.

A question raised from this study was, "How do communities react to the challenge of reducing pollution?" The partnership that exists between the Detroit USI and the Center for Learning Technology in Urban Schools at the University of Michigan will be used to illustrate how having a high-quality mathematics and science core curriculum is allowing students to address that question. The multi-year research venture involves the school system working in collaboration with key professors from the University of Michigan's School of Education to develop a 10-12 week project-based science unit for seventh grade students entitled "What Affects the Quality of Air in My Community?" The unit engages students in real world experiences that anchor events to contextualized science concepts. Moreover, the students' lessons are technology-based, investigative in nature, simulate real-world experiences, and increase in complexity with each level of understanding. This partnership allows both parties to learn from a research experience intrinsically linked to the world in which they live. From the university's perspective, it represents research in practice; from the district's standpoint, it represents practice based on research.

Correspondingly, students at Detroit's Lessenger Middle School participate in a program called *Model-It* that allows them to conduct investigations on the nearby River Rouge to gauge the health of the waterway that winds through the city. Through this unit based on water quality, students can easily point to broken bottles and litter of all dimensions that line the banks of the eroded river and floats alongside logs and other debris to determine the current state of water pollution in the river. Again, in collaboration with the University of Michigan, science teachers at Lessenger use the familiar scene as a prime opportunity to get students to see beyond obvious conditions that impact life in and around the water and to apply what they are learning in class to real-life problems.

Because of the close proximity of the river to the school, students cross a vacant and overgrown field to observe water pollution at its worst. Modeling the work of scientists, they document their observations of various aspects of nature through hands on activities that offer a powerful entree into lessons learned about water quality and the environment. They also follow the advice of many educators who call for more real world, or authentic, learning activities to engage students in complicated subject matter. More information about this program can be found in the February 13, 1999 copy of the SCB Math and Science magazine, article entitled *Making Learning Authentic: Lessons From a Dirty River* pages 37-38 or at the following website: ***hi-ce.eecs.umich.edu***. Thus, it appears that in both instances cited for the Detroit's USI, a coincident or parallel conclusion about what constitutes good teaching and learning could be drawn that maps with NSF's expectations for USI and perhaps with OECD findings in the U. S. and other countries.

How can increased public understanding help urban planning?

Anne Whiston Spirn, Department of Landscape Architecture and Regional Planning, University of Pennsylvania

The realization that nature is ubiquitous, a whole that embraces the city, has powerful implications for how the city is built and maintained and for the health, safety, and welfare of every resident. Unfortunately, the belief that the city is an entity apart from nature and even antithetical to it has dominated the way in which the city is perceived and continues to affect how it is built. This attitude has aggravated and even created many of the city's environmental problems: poisoned air and water; depleted or irretrievable resources; more frequent and more destructive floods; increased energy demands and higher construction and maintenance costs than existed prior to urbanization; and, in many cities, a pervasive ugliness.

The ecosystem concept provides a powerful tool for understanding the urban environment: it furnishes a framework for perceiving the effect of human activities and their interrelationships; it facilitates weighing the relative costs and benefits of alternative actions; it encompasses all urban organisms, the city's physical structure, and the processes which flow within it; and it is appropriate in examining all levels of life, from an urban pond to a metropolitan region. Regarding the city as an ecosystem permits every individual to perceive his or her cumulative impact on the city, and the designer of every building and park to perceive its place within the whole. It also permits the planner of a transportation network or regional park system to trace the effect of comprehensive change on smaller parts of the system. A knowledge of the system's dynamics yields a different appreciation for boundaries in space and time than is normally permitted in day-to-day pursuits and highlights the shortcomings of designing solely within political boundaries and time spans of less than several human generations (Spirn 1984).

Environmental problems felt in one place may be caused by activities that take place elsewhere. Solving an environmental problem may require taking action in a different location than where the problem is felt. Without broad understanding of urban ecosystems, among both planners and the public, it is difficult to take the measures required.

The problems facing contemporary cities loom large and seem to dwarf the resources available to address them effectively. Social and economic issues, on the one hand, and environmental and aesthetic issues, on the other, compete for attention and scarce funds. The quality of urban life depends upon opportunities for education and employment, the availability of affordable housing and transportation, an environment that supports and sustains human life, and an urban landscape that nurtures the body, mind, and spirit. Successful resolution to urban problems must integrate all these dimensions: social, economic, environmental, and aesthetic. Cities can no longer afford single-purpose solutions to narrowly-defined problems. Such an approach is wasteful of resources and causes unanticipated consequences. We must seek integrated solutions to social, economic, cultural, and environmental problems. Without broad understanding of urban ecosystems, among both planners and the public, it will be impossible to implement such solutions.

Anne Whiston Spirn. 1984. The Granite Garden: Urban Nature and Human Design, Basic Books.

Why is public understanding of urban ecosystems important to science and scientists?

Steward T.A. Pickett, Institute of Ecosystem Studies

Questions to be posed by the talk:

I. Why is understanding by the public of any science good for the science and its practitioners?
II Are there characteristics of urban ecological systems that make them particularly useful subjects for enhancing public understanding of science?
III. Does the public understanding of urban ecosystems have an unusually high potential to benefit science and scientists?

Ideas that might be discussed in relation to each question.

1. Why is understanding by the public of any science good for the science and its practitioners?
    A. Scope: Who is the public (*sensu latu*)?
        1. Individuals
        2. Institutions - formal and informal; public and private.
    B. Public pays.
    C. Public allows access.
    D. Public supplies recruits to science.
    E. Public the user scientific knowledge.
    F. Public enjoys intellectual stimulation.
    G. Public often misapprehends scientific issues or is troubled by science.
        1. Theory versus fact.
        2. Evolution.
        3. Nature of causality.
        4. Linear vs systems thinking.
        5. Probability.
        6. Consensus and peer review.

II Are there characteristics of urban ecological systems that make them particularly useful subjects for enhancing public understanding of science?
    A. Scope: What is urban (*sensu latu*)?
    B. Accessible and familiar.
    C. Relevance.
    D. Dynamism.
        1. Spread.
        2. Internal mosaic shifts.
    E. Embodies all important ecological phenomena.
    F. Emphasizes the contemporary ecological paradigm.

II Does the public understanding of urban ecosystems have an unusually high potential to benefit science and scientists?
    A. Visibility of scientific research.
    B. Opportunity for interdisciplinary integration.

C. Advances dialog about human-nature relationship.
    1. Important for ecological applications.
    2. Deep and often unexamined assumptions.
D. Access to new audiences and constituencies.
    1. Science in a diverse society.
    2. Diversification of science.