



Introduction

For most of the century, research on environmental quality has been separated from the study of human health. Health is normally studied in parts of universities other than those that study the environment, and even primary and secondary curricula demonstrate this distinction.

The field of environmental health has emerged gradually over the past two decades recognizing the environmental basis of some diseases or health threats. Malaria - a parasitic infection - provides one important example. Nearly 250 million people have died of malaria during the 20th century, and 80% of these have been children beneath the age of 5. Malaria is transmitted by mosquitoes that carry a parasite among humans, especially in tropical and semi-tropical parts of the world. Malaria incidence is surging today, especially in Africa, Latin America and Southeast Asia. Any land use practice that increases surface water in malarious parts of the world will promote incidence of the disease, simply by providing suitable habitat for mosquitoes to breed. Thus agriculture, irrigation, deforestation, dams, sewage, and storm water may all contribute to its incidence. Lyme disease in the U.S. provides another example of the relation between deer habitat, the deer tick which carries the virus, and patterns of disease incidence.

Asthma incidence and air contamination provides another example of the relation between human health and the environment. Asthma is a complex disease that may have many causes: genetic, viral, behavioral and air pollution. The EPA believes that asthma incidence is epidemic among poor urban children. Incidence formerly estimated to be 7-9%--averaged nationally-is instead 17-25% in some urban school districts. Emergency hospital admissions for asthma attacks increase on high air pollution days, as does mortality from pulmonary distress. For children, asthma is debilitating in many ways beyond the physical distress associated with difficulty in breathing. It may prevent participation in sports, an important source of self-esteem among elementary and secondary school children; and it clearly leads to increased school absenteeism, with mounting evidence of poorer academic performance, and associated depression.

A third example is that of pesticide mismanagement. In 1962 Rachel Carson sounded the warning bell in her book *Silent Spring*, by stating her belief that the risks from pesticides exceeded the threat of radioactive fallout from atomic weapons testing. During the 20th century, pesticide management has dominated other pollution issues within government and the media, simply because of the scale of their use. Nearly 250 billion pounds of pesticides have been released to the world during the 20th century. We learned that nearly 75,000 pesticide products are marketed in the world, and that many have not been tested for their adverse health effects before reaching the market. The intensity of current use in the U.S. - several billion pounds per year-lead to patterns of exposure that especially threaten children. Poorer children are more exposed than

wealthier, again raising questions of environmental justice.

The curriculum units presented in the pages that follow reflect on similar issues. The units are each unique, ambitious, and well-conceived. They demonstrate the potential to integrate across disciplines, and the need to think historically, spatially, and ethically about environmental management. Here is a quick summary of the work that follows.

Stephen Broker designed a unit that explores human-environment relations in the Do'ana National Park in Andalusia, Spain. The park includes what many experts believe to be the most important wetland in Europe. In 1998, a billion gallons of heavy metals and other contaminants spilled into the system. Stephen is using the case to explore the interplay among cultural, ecological, environmental and human health issues. Land use, contamination, and human error combined to threaten biological diversity at a scale of global significance. Students will be exposed to relevant concepts in ecology, human health risk, law, biogeography and economics in this unique and intellectually stimulating unit. Stephen's students will be exposed to interdisciplinary thinking at a very sophisticated level. Given his teaching capacity, the lessons they learn about environmental mismanagement in Spain will seem immediately relevant to New Haven.

Maureen Taylor-French designed a unit that examines how plants respond to pollutants that also affect human health. Students will create and conduct an experiment to learn how heat, water, air, nutrients, light and space affect plant growth and health. Students will also explore how land pollution, soil degradation, and air pollution influence plant growth and biological diversity. A case study on radioactive fallout that eventually circled the globe following the Chernobyl nuclear reactor explosion will clearly demonstrate how vulnerable we are to environmental mismanagement by others - even those residing on the other side of the world. Maureen's reliance on plants to teach us principles of ecology and human health is exceptional and innovative.

Richard MacMahon recognized that asthma is taking an increasing toll on the health, academic performance and social life of his students. He decided to explore the relations between asthma incidence and environmental quality in his own school, by designing a survey he administered to the students. This is an extraordinary unit that will teach students the meaning of "research." Asthma incidence has increased dramatically in the U.S. during the past several decades with little expert explanation for the rise. Genetic, viral, environmental and behavior factors contribute to asthma, and understanding their relative influence has confounded research scientists. It is known that certain airborne pollutants such as ozone can trigger attacks or exacerbate their severity. Richard's contribution is not only his finding that incidence in his school may be as high as 25%, it is also the sensitivity of his research methods, and the policy implications of his findings. This is an exceptional unit, one that will engage students directly in scientific research on a topic that is of crucial significance.

Creola Smith will integrate science and mathematics to interpret effects of air pollution on human health. Creola's students will study the Clean Air Act and associated regulations to understand what level of contamination is permitted in New Haven. Her students will also analyze data on air pollution emissions available from the EPA and Connecticut DEP. Students will learn to summarize statistics, to graph information, and will interpret information on the proximity of releases to schools. Students will explore mathematical associations among land use, air pollution, and human health. This is an excellent method to teach students to judge the importance of air quality in their own environments, and to teach them mathematics in a manner that will be of obvious relevance to their lives and health.

Mary Stewart chose a park near her school - Edgewood Park - as the foundation of her unit designed to

address the question: What is an honorable relation with nature? By tracing the history of park ecology, use and management, Mary will explore how and why the park was created, and key management problems associated with its use. She will have her students create a time line that reveals important turning points in the Park's history, using primary documents available at the New Haven historical society. Her students will also study a law suit brought by residents of New haven to prevent the river from being straightened to facilitate international rowing tournaments. Finally, they will study the geology, hydrology and ecology of the river that runs through the heart of the park. This is an exceptionally thoughtful and original piece of work, combining archival with field research.

Yolanda Trapp created a curriculum unit to help students in K-4th grade understand basic concepts of ecology. Yolanda's unit is interdisciplinary and problem-directed. It is based on the concept of balance ... between humans and the environment we all depend upon for survival. Yolanda has created lesson plans on problems of reforestation, organic farming, wildlife and recycling of solid wastes. Her passion for understanding and protecting the environment will energize her students, as will her obvious joy in discovery.

Connie Florio Welton prepared a very thoughtful and innovative unit to examine vector borne disease- especially the transmission of parasites from other species to humans. She will especially focus on the role that water and sewage management has played in the disease transfer and its control. Tens of millions of children die in the world each year from preventable parasitic infections. By examining the causes behind these figures, Connie will teach students that poverty, waste and water management are intricately associated with disease. Students play the role of health managers within the World Health Organization, and face the problem of eradicating malaria in the world. To tackle the problem, students will analyze data in poverty, health, environmental quality, health infrastructure and other characteristics of those nations where malaria is now present. Students will undoubtedly gain an appreciation for the relations between improved economic conditions, sustainable development, and capacity to manage malaria.

This course was a delight for me to teach. Each week, as we met through the spring and early summer, I was continually struck by the creativity they all were bringing to their charge. They were thinking "out of the box", so to speak, crossing disciplinary boundaries, focusing on problems that they deeply care about. We all share the same sense that curriculum reform is desperately needed to create a new level of environmental literacy. I think we all left the course with a sense of urgency; belief in the need to reconstruct the way that "environment" is conceived and taught in current educational practice. The next generation of environmental stewards is now in our classrooms, and these units will help them to more accurately comprehend human-environmental relations, and perhaps to better manage environmental quality and human health.

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