

FEATURE ARTICLES

Urban Ecology and School Education

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Urban ecology is one area of ecology which has captured the attention of a growing number of ecologists, environmentalists, and educators. It is concerned with the biological, physical, and social interrelationship between plants, animals, and humans in a city environment. Its purpose is to promote an awareness of the ecological systems and processes which they affect and are affected by (e.g., Dawe & Kunz, 1986; Hale, 1987). In short, it deals with the question of how ecosystems maintain their structure and patterns of behavior in the face of disturbance in the urban environment. In this sense, urban ecology does not aim to control systems or reduce their variability, but to understand them in order to bring them in to a state of interdependence. Today, urban ecology has been recognized as a distinct field in higher education, but it still lacks overall theory and standard methodology (Tangley, 1986).

In order to better understand the environment in which we live it is important to understand the urban ecology. For instance, most of the vegetation in a city is mainly decorative or put up as a noise or dust barrier. However, these plants provide an environment for a surprising number of species such as birds, squirrels, and insects. The other city animals (such as rats and mice) and insects (mostly cockroaches, ants and other pests) and pigeons seem to reap their livelihood only from the concrete and human offerings and refuse. In other words, city plants and animals must depend entirely on the man-made environment for their livelihood, while plants and animals living in a natural environment depend on each other.

Like plants and animals, city humans have many sets of survival mechanisms they must employ. The dense population and complexity of the ecosystem tends to produce a competitive environment which promotes stress, anxiety, pressure, and even antagonistic behavior toward other humans that is not evident in a more natural environment. Even our relationship to animals is different in the city. We value most animals in cities as either pests or pets. In more natural environment we have not only work animals and livestock, but a full array of wild animals. There we can see their place in the web of life perhaps more fully and appreciate their intrinsic values such as beauty, song, and their contribution to the maintenance of the ecosystem. Most of those animals would perish quickly in an urban ecosystem.

WHY SHOULD WE STUDY URBAN ECOLOGY

The reasons for studying urban ecology are many, the most obvious being that the majority of people in the world are city dwellers for whom an understanding of the environment in which they live is critical. Thus, for more than half the world the study of urban ecology is vital in the study of ecology.

Studying urban ecology is also important in solving the problems of many city teachers who, finding no natural environments, neglect to teach ecology at all. The misconception that only a "natural" environment is suitable for field work in teaching ecology has been replaced by the realization that the urban environment is more than adequate in the interrelationships between natural systems, including humans. Study in this field has been done by Monica Hale (1985), who outlines eight advantages of studying ecology using the urban environment, all of which are good reasons in themselves for including urban ecology in the study of ecology. These reasons, briefly, are: 1) The obvious savings in costs on transportation, etc. 2) Savings in time. 3) The ability of teachers to be spontaneous or flexible in their research, experimentation, fieldwork, etc. without undue preparation. 4) The opportunity to carry out long-term experiments and monitoring of environmental factors and their effects (such as pollution). 5) The promotion of better structured concept based studies, rather than the habitat type because of the additional time available to explore concepts in the local urban ecosystem. 6) The fact that children can relate to their "own" ecosystem, and can develop a sense of belonging and caring for "their" environment; one of the goals of studying ecology.

As Tangley (1986) explains, city ecosystems "... in addition to hosting an abundance and variety of organisms, are systems where important ecological concepts, including succession, competition, territorially, interrelatedness, niche, carrying capacity, and energy and nutrient flow, can be fruitfully studied" (p. 68). However, in order for teachers to be able to take ecological principles from textbooks to the city, they

should be able to recognize the most distinct features that make the ecological processes in urban areas quite distinct from those in natural systems. According to R.S. Dorney, from the University of Waterloo, Ontario, Canada, those features include:

... heat islands over city centers that force insects upward, providing food for predators such as nighthawks, chimney swifts, and bats; range extensions for many species due to warm microclimates and homogeneous landscaping; toxic air pollutants; variability in both quantity and quality of water, fragmented habitats separated by buildings and roads; and the interaction of native species with alien plants and animals either deliberately or accidentally introduced.

(Cited in Tanglely, 1986, p. 70).

Understanding the urban ecosystem leads to a better understanding and appreciation of natural ecological systems and processes.

WHAT SHOULD BE THE AIMS OF URBAN ECOLOGY

To list, but some, of the aims of teaching urban ecology:

1. Recognition of natural processes in the urban context.
2. Optimizing urban landscape to maintain sensitivity.
3. Maximizing individual participation in the maintenance of the well being of the environment and in turn, human well being.
4. Developing a realistic sense of urban and natural habitats.
5. Developing a realistic sense of human roles in ecological processes in urban and natural ecosystems.
6. Developing awareness, attitude, and appreciation toward the importance of the natural environment.
7. Developing an understanding of interrelationships and interdependence of those living in rural and urban environments.

WHAT SHOULD BE STUDIED UNDER URBAN ECOLOGY?

A good place to start in the study of urban ecology is the understanding of what an urban ecology is and what its main characteristics are. For instance, students should understand that an urban ecosystem requires an enormous output of energy provided mostly by humans, and that it generates an enormous output of waste that depends entirely on human technology to manage. This means that most city plants and animals depend on humans rather than on each other. Students also should understand that we are part of the urban ecosystem regardless of the fact that in cities, we are the dominant urban species and the original creatures of the urban habitats (Tanglely, 1986).

Students should be able to distinguish in detail between natural, changing and urban ecosystems. By calculating for example, the amount of energy, waste, and human effort necessary to maintain different environments such as these, students should be able to make decisions regarding the environment they might choose to live in.

Teachers should look at urban ecology as an area of study in which students are able to apply and evaluate all their previous learning, ecological knowledge, and experiences. They might also view the urban environment as an area in which students would practice debating issues, making decisions, investigating and solving problems, etc.

WHAT KIND OF LEARNING ACTIVITIES SHOULD BE TAUGHT?

There are many activities teachers can teach under urban ecology especially when they consider their cities as a "city ecosystem". Teachers must select those activities which are important, organized around specific concepts, grounded in real life experience, and provide students with challenge and rich meaning of the environment. One of these activities is called "input and output of the city". Teachers will first give a historical background of how cities are usually formed and then describe the typical modern city ecosystem. Then they will divide their students into two groups, one responsible for the city's input, the other for the city's output. The input group will gather information on input from sources such as the library, and then conduct a practical survey of input from the city itself. For example, they will ask the grocers where the milk comes from, where the bananas, juice, canned goods, etc., come from. They will ask the electric companies, the apparel stores, the gas stations, etc., where their products come from and list them. They

will then analyze their information and information sources for clarity and validity and illustrate this input information in a drawing of their city (say Vancouver B.C.). Data will then be interpreted and a written report will be prepared for future purposes.

The second group, the output group, will also gather information first from the library and then in the field (the city) and will likewise analyze their information and illustrate their findings in a drawing of their city. Written reports will be prepared for classroom discussion. Examples of output would be sewage, chemical air pollutants, toxic industrial wastes, garbage, goods manufactured in the city, etc. Since children in general like to frequent fast-food places, students could start there in determining the use of packaging containers (renewable versus non-renewable), or service stations with respect to their disposal of used motor oil.

The two groups will then present and discuss their findings to each other in the classroom. At this time, "instruction must be provided on generating logical conclusions and inferences, and on making appropriate recommendations based on the data, rather than on emotion" (Volk, 1987, p. 121). The characteristics of the modern urban environment described at the beginning of the class will then be modified by their findings.

The next step is to compare the urban ecosystem to a rural environment and to a natural ecosystem. A mural of the city ecosystem could then be contracted as material for a debate between both groups, each supporting the input or output of the city. In this case, guest speakers might be invited from the city planning and development department to participate in the debate or to comment on it. Finally, teachers should ask their students 'value judgment questions' such as "in which city would you like to live in and why?"

From activities such as these where students work on separate but interrelated tasks, they learn many things such as (1) how to look for and gather information from both literature and the field, (2) how to classify, compare and analyze information and information sources for clarity, bias and validity, (3) how to interpret data and generate logical conclusions and inferences, (4) how to make appropriate recommendations and decisions, and most of all (5) how to become involved and practice involvement in situations that as future voting citizens, they will have to face and make decisions about.

For a homework assignment, teachers can use, for example, the Water Use - Water Waste activity. This activity can be carried out by students at home or at school. It's based on the following ideas:

- 1) While 75% of the earth's surface is covered with water, fresh water is scarce in some parts of the world, and where water is adequate, pollution is increasing at an alarming rate.
- 2) There will never be any "artificial" or synthetic water.
- 3) The flush toilet system in our homes, considered one of the critical problems of modern civilization, uses about 40% of all water piped into a home. The average person contaminates 13,000 gallons of fresh water a year to wash away only 165 gallons of sewage.

First, get the students to measure the size and volume of their kitchen sink, bathroom sink, bathtub, and the toilet tank (water receptacles). Second, get the students to draw up a chart for a week-long period listing the four water receptacles, and providing an area to check each time each one is used. This chart can be just for the students, or for all members of the family. Students can keep track of how many times and how much water each individual (and then the whole family) uses with the four water receptacles (kitchen sink, bathroom sink, bathtub, and the toilet tank) per day and per week. Students can then relate the amount of water used to the activities surrounding water use, such as cooking, washing, brushing teeth, taking a bath or shower, or flushing the toilet.

Finally, ask the students to think of places that do not have an adequate supply of fresh water (a place where water is scarce and has to come from under the ground). Help them to choose a city or village in a desert or semidesert region. Ask them to imagine that they live there. However, they live in the same house and with the same lifestyle as they do here and use the same amount of water. Discuss the use of water; access to an adequate water supply; how this affects our lifestyle, alternatives; solutions to the shortage of water in desert and semidesert regions, and recycling water on both large (city or regional) and small (house or building) scales.

Teachers can also ask students to go to the library and study the pioneers in urban ecology (such as R.S. Dorney from the University of Waterloo, Ontario, and Forest Stearns from the University of Wisconsin, U.S.A.)

and write a report. Then ask them to interview urban ecologists and/or biologists in the university or another institute in their area about their role in lobbying people in other professions about the importance of plants and animals in the cities and about the value of using ecological principles to solve urban ecology.

Teachers in urban areas can also use domestic pest species as experimental animals for some ecological studies such as population dynamics, ecophysiology, limiting factors, surveys, measurement methods, pest control methods, bacterial transmission by insects, etc., (Turner, 1988). Studying the park's animals such as the population of grey squirrels can be a worthwhile urban ecological experience (Tangley, 1986). Teachers can think of so many other ideas and ways of how to utilize the urban ecosystem to enhance ecological understanding and a realistic sense of urban and natural habitats.

Urban ecology can be a very exciting subject for city kids who may not even realize that they are part of an ecosystem. It is an opportunity to involve children in social and environmental issues and the relevance of science and technology in their daily lives. Students can apply all their previous ecological knowledge and understanding to their urban and rural environment. They will evaluate, not only their previous ecological understanding, but also their ecological relationships in an urban environment and their own role and behavior within those systems. Teachers who are interested in urban ecology should consider looking at the references listed in this article.

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