Outdoor Museums and Laboratories: Needs, Uses and Values

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The welfare and future of the human species present compelling demands for answers about the organization of the ecosphere and about man's interactions with all other components (1). Detailed knowledge of ecosystem function is imperative if man is to maintain a quality living experience in the face of the growing dilemmas of population increase, environmental attrition and energy misuse.

The environmental sciences, whose truths arise from the study of nature, hold the key to human survival. In the final analysis, the same laws and relationships that govern populations of wild species govern us. Man's ability to study and understand these natural relationships and to implement his findings through wise management of the natural landscape is his hope for survival.

In the introduction of his stimulating book, *Design with Nature*, Ian McHarg revives our hope for a better world when he states that "man is that uniquely conscious creature who can perceive and express. He must become the steward of the biosphere. To do this, he must design with nature." (5).

Obviously, the trial and error land-use policy of the past has not worked, and represents everything but a 'design with nature,' but where do environmentalists turn for information to design a better system? A growing body of scientists believe that the answers lie in natural ecosystems wherein live species that have collectively achieved a near-perfect design through the processes of organic evolution, natural selection and ecological adjustment over enormous periods of time. Some of the most valuable information is stored in the developmental histories of these biotic communities and in the DNA templates of their component species. The richness of the information source is a function of the species diversity and the time span during which the organisms have been interacting with, and adjusting to, their physical environment.

To destroy habitats and the species they support is to destroy an equal number of volumes in nature's library. Past land-use changes have nearly obliterated many natural communities and have fragmented the rest, forcing ecologists, in the process, to translate most of nature's books without access to many key pages. In Indiana, the story is still there for the perceptive to read, but time is short and we continue to destroy our environmental library, page by page, volume by volume. For example, at this writing, a portion of the last tract of Vigo County prairie, that once covered over ⅕ of the county, is for sale for real estate development, and one of the finest remaining

oak-hickory forests left in the state, the James Bird Woods in Harrison County (6), will doubtless be leveled by the chain saw before this appears in print. Closer to home, the white oak woodland next to my home that yesterday was a forest with the golden glimmer of autumn is today a pile of pulpwood.

There is no point in lamenting the loss of the wilderness that was Indiana. Instead, we must address ourselves to saving the remnants of primaeval Indiana as nature preserves. The destruction of the natural environment is appalling and everywhere evident; land prices rise daily and land-use patterns are crystallizing so rapidly that what we save in the next 10-20 years is all that ever will be preserved.

As the intellectual excitement and the practical significance of ecology attracts more scientists, the need for natural areas representing the whole range of natural ecosystems will grow. A nation-wide or preferably a world-wide system of nature preserves is needed in which all major ecosystem types are represented. Although the United States has led the world in national park establishment, the federal government has lagged behind several other nations, such as Great Britain, Finland, Romania and the Soviet Union, in natural area preservation. For example, in 1968, only 31 of the 85 types of eastern deciduous forest recognized by the Society of American Foresters' classification were represented in federally-owned nature preserves. Grassland and savanna types were even more poorly represented with only 15 of 57 recognized types included in federal ownership (2). This presents a challenge to state and private agencies in the east and midwest to acquire and protect areas in the presently non-represented types. Moreover, most local natural areas are too small to attract national concern and preservation efforts. Far too often we discover a highly desirable natural area, quickly do an ecological inventory to add its description to the literature, then find the aftermath of the chain saw or bulldozer when we return to preserve the tract. Redoubled efforts in natural area preservation would go a long way to avoid this kind of 'epitaph ecology.'

Indiana is one of nine states having legal provisions for establishing and protecting nature preserves, but acquisition has not been as rapid as desired. Official endorsement has little value unless backed by public and private acceptance and action. Several Indiana community types are not well represented and most of the best natural areas remain vulnerable in private ownership. Funding continues to be exceedingly difficult. Unfortunately those who best understand natural area values are not financially well-endowed. As a result, ecologists 'bite their lip' and watch two or three of the finest remaining outdoor laboratories in Indiana be destroyed each year.

A system of nature preserves is needed in Indiana to serve at least four major purposes. The first is reference ecosystems that are at or approaching the end point in biotic succession. The information storage is highest in climax types and they are fewest in number;

therefore, they should be assigned the highest priority for acquisition (4). Since these communities are in equilibrium with the physical environment, they provide a base datum of normality or an example of how a healthy landscape maintains itself as a living system. As such, they serve as the environmental equivalent of laboratory controls. Man's modification of the landscape can then be compared to nature's model to determine the wisdom of his management decisions.

Since climax habitats retain high species diversity at relatively low density they also serve as living museums in which wildlife, wildflowers, ferns and other species sensitive to environmental disturbance may be preserved. These wild populations represent the genetic raw materials for improving our complement of domestic plants and animals. All of our present domestic species came from wild ancestors and those of the future will most likely have been tested and approved in natural systems. Lest the rarer species become endangered and their gene pools further depleted and fragmented, collecting should be held to the bare minimum of voucher specimens taken to complete faunal and floral inventories at reasonable time intervals. These areas are too rare, too valuable and too small to be used as private collecting grounds.

If possible, all physiographic areas, vegetation types and special habitats, such as bogs, marshes, swamps and rock outcrops, of the state should be represented in this system of little-disturbed tracts. Buffer areas around the tracts should be acquired to reduce the danger of disturbance; whenever possible, entire watersheds should be preserved as a unit. Aquatic communities are often most vulnerable because of active and frequently unjustified drainage and flooding programs and high levels of watershed mismanagement. Some community types, such as tall grass prairie, are essentially gone from Indiana as a climax type, and need to be artificially reconstituted and maintained.

A second category of natural areas is those specifically designed for environmental research and usually manipulated by cultivation, controlled burning, pesticide application, selective cutting or reduction of wildlife populations to maintain a given successional stage or to determine the effects of specific management practices on community dynamics. Ultimately, entire seres leading to most climax types should be acquired and maintained.

It is recognized that even climax communities undergo some change, but seral communities are very unstable because the forces of succession cause shifts in population density and species composition. Frequently, it is desirable to manipulate community dynamism so that several successional stages are present for research and college instruction in ecosystem development. Management of succession in natural areas is useful in determining the nature, rate and sequence of nature's attempt to repair landscape damage due to human use. Knowledge of community recovery mechanisms is important in main-

taining landscape health because land abuse leaves ecological scars just as surely as organismal wounds leave anatomical scars.

Natural areas maintained primarily for scientific investigation should not be open to general public use because fragile communities or species may be endangered or field research may be disrupted. The public need not resent this restriction, even if these outdoor laboratories are state owned. After all laboratory scientists at our state universities do not permit the public to browse at will in their experimental areas.

Field instruction in taxonomy, ecology, conservation, geology, soils, and nature study is the third major justification for nature preserves. Representative natural areas are needed close to schools for frequent visits and class projects during brief laboratories. As the Environmental Education Quality Act is implemented more areas will be needed near elementary and high schools as well as near colleges and universities. High school relocation, due to consolidation, and the construction of regional college campuses present unusual opportunities to acquire suitable natural areas near new schools. Frequently, a farm woodlot, which would serve a high school's needs very adequately, could be purchased for a few thousand dollars. Natural areas at some distance from a school are also valuable for extended field trips. Dr. Robert Petty, Chairman of the Scientific Areas Preservation Committee of the Indiana Academy of Science, found that the average high school teacher would take classes 45 miles to a natural area (4).

All colleges and universities should have at least one fairly large natural area. Over-use of small tracts of 15-25 acres frequently results in serious disturbance. Little is gained by preserving 20 acres of something irreplaceable if its preservation means that the increased publicity and use will ruin it.

Most colleges and universities can afford a sizable tract of 100 to 200 acres. Even if they must pay $500 or more per acre, the cash outlay would hardly exceed that for a major instrument, such as an electron microscope, its space and accoutrements. Furthermore, with real estate values steadily climbing, and the short half-life of scientific instruments, the land is likely a far better investment.

Ecologists should lead any natural area preservation efforts conducted by their employing institution. Since nature preserves are of utmost importance to field scientists, "What justifies the assumption that laymen should be laboriously pulling our chestnuts from the fire for us?" as Dr. Alton Lindsey phrased it (3).

The fourth category of natural areas has perceptive-recreation, aesthetic appreciation and isolation in nature for central values. Since recreation is valuable in proportion to the intensity of its experiences, and to the degree to which it differs from and contrasts with workaday life, people need 'vest pocket' wildernesses where they can experience a complete change from their tedious daily routine. Most thoughtful people concur that some contact with wild nature is

essential to human health. Perhaps it was best summed up by one of my students, Priscilla Gustafson, when she wrote in her term paper: "When all natural wilderness is gone, will the frontiers of man's mind be enough?"

Some may protest that natural area values serve only a minority of the population. They should be reminded that we are talking about only an infinitesimal portion of the land. All of the natural areas listed in *Natural Areas in Indiana and their Preservation* (4) total less than 0.06% of Indiana. Natural areas are priceless beyond all proportion to their size because of their increasing rarity.

De facto land saving is insufficient to maintain available nature preserves in the four major use categories outlined above. Perpetual maintenance and management are needed to prevent attrition and over-use, particularly near the central features. Perpetuity is a rather long time so ownership and protection should rest with a state or permanent public agency rather than private landholders. Larger natural areas can meet several needs if zoning, protection and management are skillfully employed. Part of an area could be held inviolate, another section used for experimentation under quasi-natural conditions, and a third portion used for supervised field class instruction or aesthetic pursuits.

Classification of and priority for saving natural areas should be based primarily on their ecological and aesthetic attributes, but economic values should not be discounted. Although difficult to assign its dollar value, a major benefit is the dissipation and neutralization of pollutants. Examples are oxygen production and CO_2 use in photosynthesis. Pollution is an increasingly serious problem because landscape modification has reduced the natural or 'undeveloped' portion of the biosphere to an area that can no longer absorb, disperse and counteract the effects of increasing quantities of environmental additives. As the natural environment is destroyed (currently 4,000 acres are placed in housing developments daily), the current imbalance of natural versus 'developed' landscapes shifts ever more rapidly toward pollution-producing tracts, further endangering a deteriorating human environment. How far can the ecospheric equivalent of the Tower of Pisa lean before completely collapsing?

Other economic benefits derive from virgin soils as models for buildup and maintenance of fertility, and as sources of fungi for antibiotic manufacture. Drugs are frequently extracted from wild plants and natural insecticides may be developed from ferns, horsetails or bryophytes. Insect-plant-biochemical co-evolution has been going on in natural communities for millenia and chemical defenses against insects are nearly perfect in some native plant species. Our food plants have energy storage as the major essence and cannot afford the luxury of producing defensive chemicals.

A classic illustration of the economic benefits of natural areas was provided by Dr. Charles W. Wharton, Georgia State University,

Atlanta. He cited the Alcovy River Project in which a cost analysis by the Soil Conservation Service showed that the annual benefits from agricultural acreage would be $105,000, providing that it was fully used. However, this was speculative, since much of the area was already in soil bank.

In a carefully documented study, Dr. Wharton showed that the multiple-use value of the swamp has an annual value to the taxpayer of more than $7,000,000. Southern river swamps, in Dr. Wharton's words, are described as "examples of green belts, as oxygen machines, as sponges for regulation of the vital water cycle, as giant kidneys for waste purification, as natural convalescent wards for the aesthetically ill, and as outdoor classrooms and laboratories for the public school system." (7).

This is not to imply that preservation for its own sake is not important. Even though many species have little or no current economic value other than to contribute to the integrity and diversity of biotic communities, they are entitled to continuance because they add enrichment to our living experience and help avoid the dreary commonality of modern life. Man will be less human in a world without brown pelicans, bald eagles, black-footed ferrets and wild orchids even if the Gross National Product increasingly elevates.

Perhaps the case for natural areas can be best summarized by paraphrasing a passage from one of Aldo Leopold's perceptive essays: "Worth in dollars is only an exchange value, like the sale value of a painting or the copyright of a poem. What about replacement value? Supposing there were no longer any paintings or poetry or natural areas? It is a bleak thought to dwell on, but it must be answered. In dire necessity somebody might write another *Iliad* or paint another Mona Lisa, but fashion a natural area?" Hardly!

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