Spring 1971

Urban botany - an essay on survival

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THE UNIVERSITY OF WISCONSIN–MILWAUKEE

FIELD STATIONS BULLETIN

Vol. 4, No. 1 Milwaukee, Wisconsin Spring, 1971

URBAN BOTANY–An Essay on Survival

Botany is today's most needed urban science. It deals with life and with objects which man can understand, for which he reaches and with which he feels comfortable. The technological and economic problems of the city are horrendous–transportation, waste disposal, air pollution, and housing to name a few. Yet the technological problems are minor compared to the biological and behavioral problems of *Homo sapiens* as he faces life in the complex and catastrophic aggregations we call the modern city.

Urban Botany–is this not a contradiction in concepts–almost a physical impossibility? In the sense of the old stereotypes of plants, botanists and cities this may be true. The confirmed urbanite may well believe that plants are messy green blobs that one sees only along the freeway, or in plastic facsimile in apartment house foyers.

The urban ecosystem is dominated by populations of one animal, *Homo sapiens;* the sizable populations of other species are classed either as pets or pests. Unfortunately, man cannot be objective about himself. It is easier to be objective about plants. "All flesh is grass"–primitive and modern man share dependence on plants–for food, for protection from the elements, and for cover and concealment from their own species.

In the jargon of the biologist, habitat is a place to live–the den, hunting territory, brood range and mating territory. This living area has many attributes, but essential are availability of water, food, and physical protection from the elements. On inspection one finds that these attributes depend largely on the nature, type and distribution of growing plants. Not so for the urbanite. His guides, the landlord, architect, interior decorator, and sociologist have convinced him that habitat is limited by the walls within which he resides. While walls and roofs may fill certain habitat needs, providing protection and privacy, they do so superficially.

For man, as an animal recently evolved, the house as habitat is an artificial concept and one his subconscious cannot accept—he searches without end for something missing—lost with his separation from constant contact with green and growing plants. The work of painters, poets and plain people, even the pathetic plastic greenery that adorns so many city homes, all these and much more give evidence of the search.

Rene Dubos, in a superb essay "Trend is not Destiny," (which should be required reading for every planner and politician) reminds us of our recent origins; "Modern man still operates with the equipment of genes that governed the paleolithic hunter during the ice age and of the neolithic farmer after the ice had retreated." Man's preferences and requirements reflect his genetic origins in temperature adaptation, responses to crowding and need for sensual perception. Beyond their essentiality for food and cover, plants still serve as the most important source of sensory stimulation and diversity, again to quote Dubos, "Sensory deprivation is incompatible with the maintenance of sanity. . ." and for man, "Diversity is more important than efficiency in the long run. . ."

The botanist—he who observes and works with living plants—can take a unique view of the biology of the city. He may, if he wishes, stand aside from involvement in the immediate problems of human health and human frailty—a position difficult for the animal biologist and impossible for the practitioner of medicine. Thus, the botanist may look at man and habitat objectively, seeing *Homo sapiens* in perspective as a product of animal origins and a transient genetic link between past and future.

Li, in a recent article in BioScience (1969), called for a "new science—urban botany." His argument for the essentiality of botany in the city is well taken. However, no new science is needed, but instead a bolstering and renovation of an old one. Botany has not been misapplied in the past (and here with botany I include both horticulture and forestry), but it has long neglected the specific problems resulting from concentrations of men. Today the botanist must re-enter the city, where human need for plants is paramount.

Until recently, virtually all cities had a large component of neglected land, unpaved and unstructured in which plants prospered; distances between the center city and outskirts were relatively small and contact with plants was frequent and direct for all ages of man. Growth in population and size of urban concentrations, vastly increased efficiency of destructive agents and proliferation of concrete-oriented planners have all served to bring the situation to critical proportions.

Most knowledge of plants has been drawn from their responses under normal or favorable conditions in nature or agriculture. There is, as Li has said, a very limited backlog of information on the roles that plants play in the city and likewise on the effects that the urban environment has on plants. Yet, anyone who has visited older European cities is aware that the practice of urban botany is well established. Botany must now undertake a most difficult and vital mission—that of intergrating plants into the evolving modern urban system—not for the sake of botany, but for the future of urban man.

What is the situation we face? What urban plant communities exist, and what are their present and potential roles? Even now the catalogue of plants found in a modern American city is long and diverse—testifying to the resilience and vigor of vegetation. The data are best presented not as a list of species, but as a sampling of the communities—for within the city, as elsewhere, site and

history result in an ordering of plants into associations and successional patterns. The plant communities fall into several categories, residual, successional, and man-made or man-managed entities.

Residual communities include those left from presettlement vegetation, in this case defined as the vegetation on the land prior to conversion to urban uses. In Wisconsin, these communities may include deciduous and coniferous forest, prairie, marsh, and various seral stages. These communities persist in parks and estates, along rivers, on inaccessible slopes, and even as narrow fringes along railroad rights-of-way.

Exotic and successional communities include the weed patches of dumps and road edges, railroad yards, alleys, neglected lots and garden patches. They may range from a few species of pioneer annuals on new ground through patches of perennial weeds to briars or brush, and finally to multilayered communities including trees, shrubs, and herbs.

Similarly the communities created and managed by man show much variety. They range from the subgroup "house plant" through various categories of lawns (weedy to manicured), decorative flower gardens, potted trees on downtown plazas, vegetable gardens, and finally parks, large and small. The park often represents a fusion of residual and man managed communities.

Drainage ways have, in the past, been an important setting for plant development. Increasingly, however, the engineer, in attempting a short run solution to runoff problems, is replacing—with unseemly haste—these high quality sites with concrete lined channels.

Clearly the plant communities listed and a variety of others not mentioned have different roles in the eyes of both botanist and urbanite. They do however, share a number of vital functions. What then are the roles of plants in the physical environment of the city?

Lanphear, speaking at a AAAS symposium on urban ecology (1970) summarized present knowledge of plants relative to air pollution and noise reduction. Vegetation is useful in reducing air pollution in several ways: by absorption of gases, carbon dioxide (CO_2), sulphur dioxide (SO_2) and others into the leaves and by trapping dust and particulate material on leaves and stems. At moderate concentrations, the amount of SO_2 absorbed is much larger than might be anticipated. A mature street tree may absorb from 10 to 50 pounds of SO_2 per year. It would obviously require a great many trees to remove the 188,000 tons of SO_2 released into the air in Milwaukee County each year—yet local removal of gases is both considerable and beneficial. Plant utilization of CO_2 and concurrent release of oxygen represent an appreciable contribution to air quality.

The effect of vegetation in reducing wind is well known although little considered in the city. Reduction in air speed results in a lessened ability to carry dust, dirt, and pollen and these materials drop out. Added to this cleaning process is the filtering effect of vegetation in trapping particulate material on leaves and stem surfaces.

Vegetation presents a major barrier to sound waves. Appreciable abatement of highway noise, perhaps 50%, has been demonstrated to result from windbreak plantings. Even a narrow shrub planting will serve to reduce certain common noises such as the tire-pavement noise of passenger vehicles. Work on the effects of surfaces has shown that smooth-mowed grass lawns propagate

noise less well than do paved surfaces. The roughness and interference inherent in shrubs and trees greatly reduce the carrying ability of sound.

Vegetation has a major effect on air and ground temperature. In Saint Louis, Lanphear noted differences of 10°F. between a city park and adjoining business district. Even in residential suburbs, the proportion of land covered by pavement or roofs may exceed 50%. Rapid runoff of water from impervious surfaces, with the resultant retention of energy which might otherwise be lost in evaporation, plus the heat absorbing qualities of asphalt, concrete, brick and stone all contribute to higher temperatures in the city. Where vegetation is present, much energy is utilized in the essential process of evapotranspiration thus alleviating human discomfort. Likewise, energy is reflected by trees which shade both man and structures from the heat loads which would accrue from direct insolation.

Soil erosion can be a serious problem in the city, more so than on agricultural land. Vegetation can alleviate this impact by cushioning the soil from rainfall impact and slowing water flow. Strategically placed vegetation not only holds the soil in place, but also may trap and retain particulate fallout and dust in the runoff—with its subsequent incorporation in the soil rather than loss to sewer and lake or stream.

Having looked at the effects of plants on the city, the urban botanist must consider the impact of the city on plants. The city influences plants through atmosphere, soil, water, and physical affronts of man. Insects and fungus disease are ever present, but save for certain conspicuous cases, probably no more important in the city than in wild nature. Where disease or insects have caused catastrophic effects it has been a direct result of man's manipulation of the plant population. For example, in Dutch elm disease neither the bark beetle nor the fungus disease the beetle carried could have made such rapid headway had man planted a mixture of tree species along city streets.

Air pollution is a serious problem in all cities, not only in the city core, but as far out as the heat dome circulation extends and a long distance downwind from major sources. Of the pollutants, SO_2, PAN (peroxyacetylnitrates), ozone, and less common gases such as fluorides are all destructive to plants, both those that will grow vigorously in the city and others to serve as indicators of the condition of the city atmosphere. Progress is beginning in those areas but will be slow. White pines have been found, for example, that are susceptible in different degrees to three gaseous pollutants.

Soil conditions often restrict urban plants. Urban soils are compacted mixtures of exotic materials lacking in organic matter. Water is frequently limiting, the function of gutters is to take water away not to infiltrate it into the soil. Finally, urban soils receive inordinate amounts of potentially toxic chemicals, from road salt to copper, arsenic, hydrocarbons and lead.

Drains at the footing of deep foundations put stress on the soil water which does manage to infiltrate, and the success of street trees under city conditions can only be considered as amazing.

Urban vegetation can be worn out—physically eliminated by human pressures just as readily as if it were overgrazed and trampled by cattle, elk or buffalo. Every lawn shows the evidence in paths and bare patches. Vandalism is a major problem in the establishment of new street trees, and the direct impact of the automobile is often evident. Today, the bulldozer rampant is probably the most destructive single force. Such subtle effects as the influence of shading by buildings have hardly been noticed or considered.

In dealing with human needs, it is often more informative to watch people than it is to listen to them. Man's inner needs for contact with vegetation are not voiced and cannot be measured in dollars, but rather appear in small increments of comfort, in fewer sneezes, in air with less dirt and more oxygen, in a feeling of relief from stress or surveillance and in stimulation of intellect, youthful and mature.

In an indirect way, one can approach unspoken needs by determining the cost which man is willing to incur in retaining plants in an urban environment. The ledger may open with a listing of the funds spent by governments in planting, trimming, spraying and, when necessary, removing street trees, and in maintaining parks, gardens, and conservatories. Next, one may add the costs to industry of landscaping and, upon occasion, of simulating nature with plastic replicas of plants. The growing and widespread use of plastic vegetation is a useful commentary on the inner needs of man, his lack of understanding of himself, and the development and state of urban botany.

Vegetation costs must also include the money and energy invested by individual property owners to plant, fertilize, trim, manicure, weed and decorate their immediate surroundings. Each spring, seeds are used as promotional giveaways. Houseplants are available virtually everywhere, from department store to supermarket, and sell for a profit. Add also the concomitant expense of sprays and "garden soil" available by the pound. The marketplace clearly gives good evidence of the tie between plant and man. From the long stemmed roses at the bedside of the new mother, to the potted geranium held in first grade hands, the orchid in the hair of the bride and the lilies on the casket, plants are a vital part of man's being. And, lest this seem to be the local florist talking, be reminded that the apartment dweller must eat plants to survive.

Yet vital relationships resist measurement. Man evolved with plants. They form his basic scale and frame of reference as buildings cannot. Form, color, odor, and texture are components of all images we perceive. Those of vegetation are familiar, soothing and diverse. Perception is heightened by contrasts between vegetation and structural materials—brick, wood, steel and concrete as between vegetation and native rock. Structures in the polluted urban atmosphere soon smudge to drab greys and blacks, materials rot and weather, flake and crack, but vegetation is renewed each season. Thus vegetation may help to ameliorate the processes of time to the advantage of both owner and passerby. Contrast, diversity, and beauty, changing with the season enhance the mental impact and stimulate the imagination, but they are not recorded in grams, meters, seconds, or dollars.

Vegetation may serve to reduce visual contact between animals, an attribute familiar to any hunter, farmer, birdwatcher, or school child. Within the city, this effect may often be beneficial in reducing the contact overload between members of the species *Homo sapiens*. Similarly, shrubs and vines clothe the harsh lines and obvious meaning of fences and may likewise serve to delimit territory without the need for manmade structures.

Much more could be said of the aesthetic virtures of urban vegetation and its functions, not only in the service of man but in the service of other animals and birds—in whose presence too, man may obtain relief from stress.

One final area deserves consideration, this is the area of human learning—related to aesthetics, yet distinct. Plants in the city provide children with the essential opportunity to see, smell and feel life different from themselves. Appreciation for diversity and for green plants must come early. Growing plants

must be at hand if the lesson is to be repeated often enough to be absorbed. Nature centers and field stations serve a vital purpose in education of man for his place as the major animal of the natural world. Yet, at best, such facilities can only supplement and illuminate that evidence which child or man find in their everyday environment. Without question, urban botany has been neglected. This neglect must cease if man and city are to survive.

Plants are as essential to city living as they are to the family isolated on the back forty. The responsibility of the professional botanist is clear. No longer is it enough that he serve merely as a source of information on poison ivy, sick trees and deadly berries. He must function actively in the city to encourage the use of plants to ameliorate the urban environment for man and thus to make possible realization of man's full potential.

The botanist will not make the grade alone. The herb grower, the landscaper, the amateur gardener and the teacher, especially at the elementary level, must join with him to improve the urban environment and to give its inhabitants opportunity to develop skills and understanding of the uses and needs of plants, and thus of the basis for life on earth.

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POPULATION DYNAMICS OF THE BLACK-CAPPED CHICKADEE

SCOPE OF STUDY

The Black-capped Chickadee is an abundant, familiar bird in Wisconsin, known to almost everyone. In summer it is widespread in nearly all kinds of woods, although it is more numerous in younger second-growth forests, swamp forests or along forest-edges than in mature climax types. In winter, it becomes more restricted to dense thickets, bogs or swamps, especially where conifers like cedars or hemlocks occur; however, it also congregates in large numbers in towns or suburban areas wherever it can find artificially provided food at bird-feeding tables.

I and a number of UWM students have been investigating the Chickadee at the UWM Field Station since 1965. At first, we were mainly interested in the annual fat and weight cycle but as time went on, it became apparent that this species provided an ideal opportunity for investigating some of the major unsolved problems of population ecology. Since 1968 we have been concentrating our efforts more and more on a year-round study of Chickadee population dynamics.

Among the ultimate questions we are trying to answer are these:

1. Is the Chickadee population regulated, in the sense that mechanisms come into play which tend to keep the populations at a constant level, preventing extremely high or low levels from developing? Or does the population simply fluctuate at random, with no regulation?