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VOLUNTEER URBAN VEGETATION OF RACINE, WISCONSIN

We have only meagre knowledge of the composition and the functions performed by vegetation in Wisconsin cities. The records of the U.S. Government Land Survey conducted in the 1830s provide information on the pre-settlement vegetation. Likewise, the notes and letters of settlers and early residents speak of the plants they found here, or brought with them. We know less about the vegetation now growing in our cities.

Urbanization results in major changes. Hills are lowered, depressions filled and hydrologic regimes altered. Forests are cut and fragmented, wetlands are drained, prairies are plowed and all that remains of the original vegetation is that set aside in parks or forgotten in small patches along railroads, streams and similar "waste spaces." Urbanization may also follow agriculture as the city expands, again with alteration of the land and vegetation. Some parcels may be used for the same purpose over many years, while elsewhere the land and vegetation are continually disturbed by human activity.

This study examined the volunteer, non-native vegetation of urban Racine. Various sites were examined, some stable, others subject to continuous disturbance; plant communities were characterized and compared. The findings permit us to draw conclusions as to the nature, composition and life histories of the invading species.

The Root River floodplain cuts through the heart of Racine, crossing east through the moraine at a low point. Much of the area is covered by lake clay deposited while Lake Michigan was at higher post-glacial levels. The clays are overlain by other deposits of sand and gravel, often mixed with clay and marl. Springs were abundant, particularly along the lakeshore, where they emerge above impervious clay layers.

The pre-settlement vegetation consisted of prairie and oak openings on the low dry ridges, wet prairie and other wetland communities along the drainage ways and in the low depressions (particularly near the lakeshore on the poorly drained soils). On the upland, northward from the river, mesophytic maple forest covered an extensive area.

The first permanent settlement at Racine was established by Captain Gilbert Knapp in 1834 (Stone, 1916). He settled at the mouth of the Root River which he visualized as an important harbor. Racine prospered and grew from a settlement of about 140 acres to a city of 13.3 square miles. The early settlers put the clay to good use by developing a brick-making industry. Limestone found near the mouth of the Root River was utilized to manufacture lime. About 1842, wheat farming expanded in Racine County; J.I. Case put together a threshing machine and began manufacturing it. This was the beginning of Racine industry.

Table 1. Urban habitat types

<i>Type</i>	<i>Habitat description</i>
1.	Stabilized lots and parking strips (grass cover 50% or more)
2.	Fence lines
3.	Lots along railroad tracks—stabilized
4.	Disturbed lots—recent and older (less than 50% grass cover)
5.	Surfaced areas: asphalt, gravel and brick
6.	Sidewalks and walls
7.	Alleys
8.	Filling station areas
9.	(Grassland) remnants
10.	Lake Michigan shoreline

Table 2. Comparison of origin and life span of plant species in urban Racine and Colonial Park and Sanders Park. Colonial Park represents a prairie-grassland type and Sanders Park is a woodland preserve.

	Urban Racine	Colonial Park	Sanders Park
Total species	185	114	85
Native Species	49.7%	68.4%	91.8%
Foreign species	50.3%	31.6%	8.2%
Annuals	35.7%	14.1%	5.9%
Biennials	5.4%	7.0%	1.2%
Perennials	58.9%	78.9%	92.9%
Clone formers ^a	63.3%	46.7%	36.7%

^aPercentages are based on number of perennials

Methods

In 1973 and 1974, 56 sample sites representing ten different urban habitat types were examined (Table 1). Most of the study sites were in the eastern third of Racine, an area bounded by the Chicago Northwestern Railroad on the west and by Lake Michigan on the east. Two city parks, Saunders Park and Colonial Park, were chosen to represent non-urban conditions. Saunders Park includes 80 acres of mesic hardwood forest and Colonial Park is a 27-acre area of grassland and prairie. These parks represent the terrestrial plant communities present at the time of settlement.

A species list was compiled for each of the 56 sites and for the two parks. On 36 of the sites, detailed samples were obtained using 25 or more

rectangular quadrats, each 0.1 m². These plots provided density and frequency information. Species were classed by life span, whether annual, biennial or perennial; by origin, native or foreign; and by their ability to form clones. Ratios between these various characteristics were calculated. Multivariate analysis was employed to examine the significance of 13 variables and cluster analysis was used to determine the interrelationships among the 36 sites. Ordination methods were utilized to select relationships based on composition.

RESULTS

Urban Racine supported at least 185 plant species, Saunders Park 85 and Colonial Park 114, a total of 294 species. The two parks proved to be very different. Of the 185, only 54 urban species were shared with one or both of the parks (8.6% with Saunders and 26% with Colonial Park). When the park vegetation is compared to the urban vegetation it is evident that perennials are more prevalent in park vegetation (86% compared to 59%). The urban vegetation also contained a higher percentage of foreign species than did the vegetation in either park. Likewise, clone-forming perennials are more frequent in the urban sites than in the parks.

Both ordination and cluster analyses indicated that most urban stands would fit into three habitat groups instead of 10. These groups are: 1) stabilized (or low stress) sites 2) highly disturbed (or high stress) sites and 3) transitional sites. In comparing stable with disturbed urban sites, the highly stressed areas show more annuals, 50% compared with 19% for stable sites (Table 3). The increase in proportion of perennials is presumably a result

Table 3. Average species number, density and frequency for perennials and annuals in high stress and low stress urban habitats.

	Perennials	Annuals
No. of species		
High stress	42%	50%
Low stress	70%	19%
Density		
High stress	27%	67%
Low stress	80%	8%
Frequency		
High stress	36%	57%
Low stress	82%	7%

of successional change. Perennials make up 70% of the vegetation in stable urban sites and 42% in heavily disturbed areas. Under the stress caused by frequent disturbance, (including trampling comparable to overgrazing in rural areas) succession may be reversed. Some plants are in fact adapted to high stress areas where trampling is particularly heavy, i.e., in sidewalk cracks, construction sites, etc. Racine shows similar patterns to those Lund (1974) found in Atlanta where he noted that "The continual disturbance of the city generally arrests any succession in urban communities." Results

from Racine also indicate that there are more species of foreign origin in the urbanized habitats than elsewhere and that they appear most abundant within the older urbanized areas. Some plant species show a haphazard occurrence, presumably resulting from random events of establishment and the passage of time. The ten most prevalent species of the urban environment included five perennials, *Taraxacum officinale*, *Plantago major*, *Medicago lupulina*, *Trifolium repens* and *Chicorium intybus*, four annuals, *Polygonum aviculare*, *Chenopodium album*, *Ambrosia artemesifolia* and *Polygonum persicaria*, and one biennial, *Daucus carota*.

Work on Racine volunteer urban vegetation provides a basis for further study of plant species adaptation to the frequent and major disturbance often characteristic of urban habitats. In addition, it should furnish useful information on the effects of urbanization on wildlife habitat and on various aspects of the hydrological and biological features.

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