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Indices of synanthropization of flora in Polish cities

Abstract. The paper summarises several years investigation of the responses of the flora to different levels of anthropic infuence in large cities. The floristic parameters which are the most sensitive to human impact were selected and assessed.

The aim was to study the possibility of assessing the degree of synanthropization of the flora using selected floristic parameters. Different aspects of the problem have been discussed by many authors (FALIŃSKI 1971, KORNAŚ 1977, KOWARIK 1988 (and references cited in this work), KOWARIK 1990, PYŠEK 1989a, PYŠEK 1990, JACKOWIAK 1990).

Two complex indices of flora synanthropization in 7 out of 11 of the largest cities in Poland have been proposed (SUDNIK-WÓJCIKOWSKA 1992). Each of the complex indices consists of six floristic parameters which take into account the proportion or the reciprocal ratios of specific groups of species. Most of them were distinguished in the historical-geographical classification put forward by KORNAŚ (1982) and are associated particularly with man's activity. The indices were proposed in an earlier work based on studies conducted in four anthropopressure zones in Warsaw (SUDNIK-WÓJCIKOWSKA 1988, 1991) and are shown in Table 1.

In each of the seven cities (Fig. 1) the flora was investigated in selected areas of 1 km^2 each within one of two zones differing in anthropopressure intensity. The cities are situated within the Central European climatic range and the maximum distance between them does not exceed 900 km.

In total 96 sample areas have been analyzed (among them 18 by B. JACKOWIAK, P. WITOSŁAWSKI, unpublished data) including 50 in the zone of strongest anthropopressure (zone A – typical downtown area) and 46 in zone B, where anthropic pressures are weaker and usually shorter lasting and the diversity of habitats is much wider, with suburban vegetation occurring in relatively dispersed settlements, gardens and fields dominating.

Table 1. Indices of synantropization of flora, G – the total number of species, Ap – the number of euapophytes, Ae – apophytes not established permanently in anthropogenic habitats, Ar – archaeophytes, Ep – epoecophytes, Ag – agriophytes, Ef – ephemerophytes, Eg – ergasiophygophytes, T – therophytes, Ta – alien therophytes, Tn – therophytes–newcomers.

I	II
$P_1=\frac{Ar+Ep+Ag}{Ap}$	$P_7=\frac{Ar+Ep+Ag+Ef+Eg}{Ap+Ae}$
$P_2=\frac{Ta}{G}\times 100\%$	$P_8=\frac{T}{G}\times 100\%$
$P_3=\frac{Ta}{T}\times 100\%$	$P_3=\frac{Ta}{T}\times 100\%$
$P_4=\frac{Ep+Ag+Ef+Eg}{G}\times 100\%$	$P_9=\frac{Ep+Ag}{G}\times 100\%$
$P_5=\frac{Tn}{G}\times 100\%$	$P_{10}=\frac{Tn}{T}\times 100\%$
$P_6=\frac{Ap+Ar+Ep+Ag}{G}\times 100\%$	$P_{11}=\frac{Ap+Ae+Ar+Ep+Ag+Ef+Eg}{G}\times 100\%$

The application of the method of property lines (Fig. 2) where floristic parameters in each of the complex indices were the properties, enables the reduction of floristic information and selection of the best (three out of six) parameters. They are as follows:

I': P_1, P_4, P_5; and II': P_7, P_9, P_{11}.

Minimum spanning trees (Fig. 3) calculated for three-component indices show resemblances between study areas. Additional information on the degree to which study areas were confined in each city to one anthropopressure zone reveals that the indices differentiate the anthropopressure zones relatively well.

CONCLUSIONS

The intentional reduction of information (instead of complete floristic lists, six-component complex indices and then three-component complex indices) allows selection of those parameters which are most sensitive to human impact. These parameters include the proportion of such groups of species as synanthropic newcomers and permanently established alien species. The parameters which included different groups of life forms (except for therophytes-newcomers) are of lesser importance.

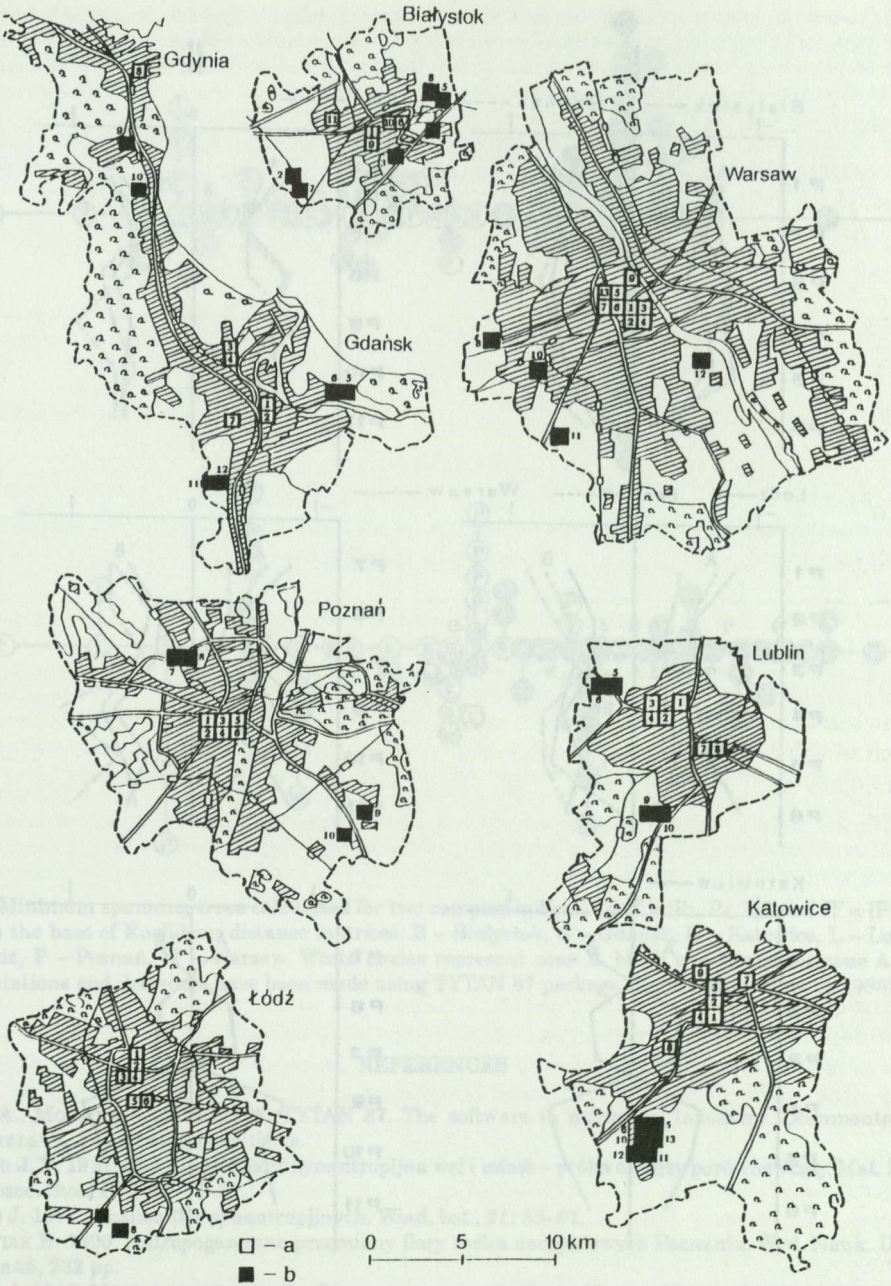

Fig. 1. Location of the areas studied in the seven chosen cities: a – in zone A, b – in zone B.

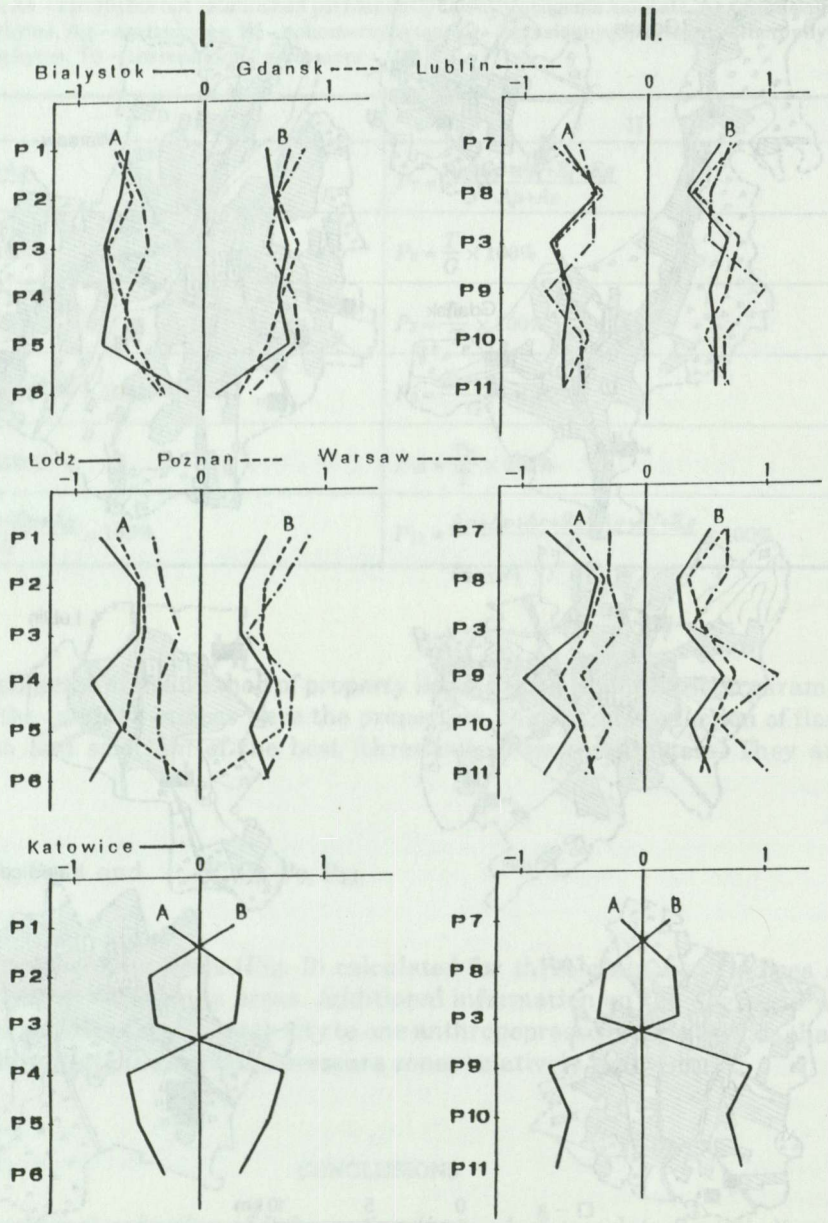

Fig. 2. Property lines of the two complex indices of the flora synanthropization (I and II) enabling comparison of the two anthropopressure zones (A and B) in each of the seven cities studied.

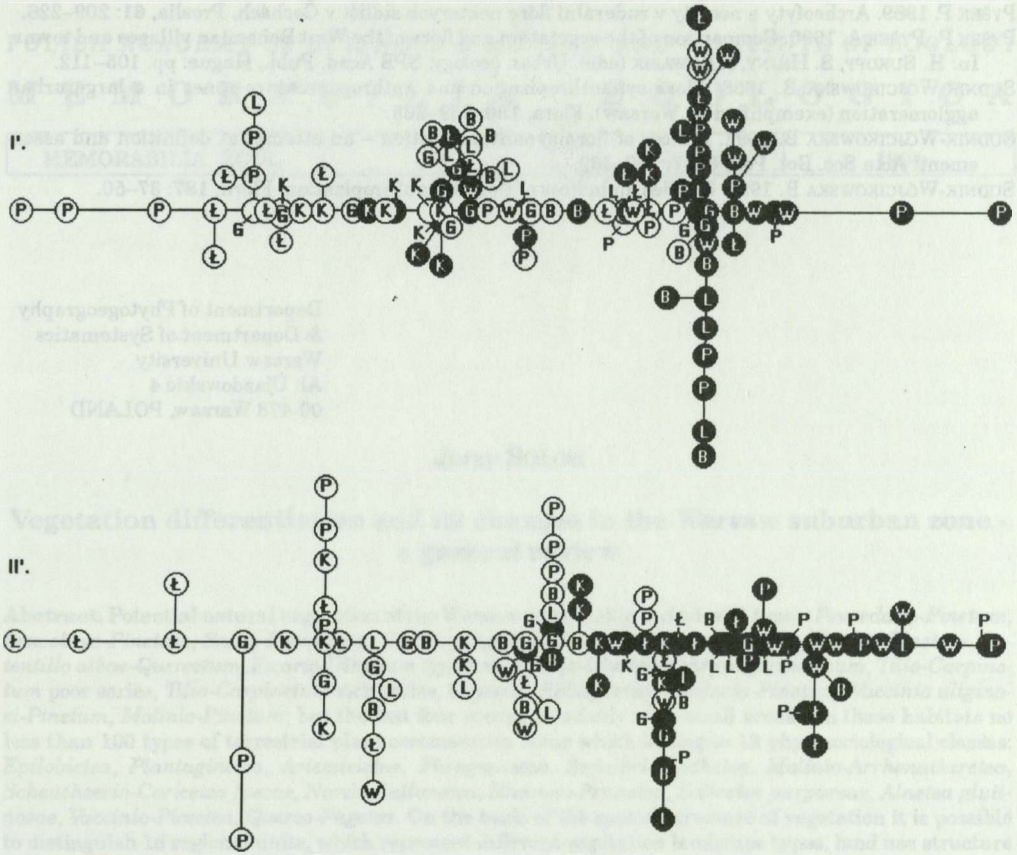

Fig. 3. Minimum spanning trees calculated for two complex indices, i.e. I' = {P_1, P_4, P_5} and II' = {P_7, P_9, P_{11}}, on the base of Euclidean distance matrices. B – Białystok, G – Gdańsk, K – Katowice, L – Lublin, Ł – Łódź, P – Poznań, W – Warsaw. White circles represent zone B, black ones stand for zone A. All calculations and drawings have been made using TYTAN 87 package (BATKO, MORACZEWSKI 1988).

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