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**Human impact on flora and vegetation in prehistoric times:
Neolithic site, Pleszów, and Kraków's Medieval Old Town
(S. Poland)**

Helena TRZCIŃSKA-TACIK and Krystyna WASYLIKOWA

Very little is known about the first disturbances of vegetation caused by hunter-gatherer tribes in the Palaeolithic and Mesolithic periods. Clear evidence is provided only for the periods after the introduction of agriculture, domestic animals and permanent settlements. The studies on archaeological sites in Cracow (Krakow) illustrate two problems: 1) the influence of early farming on vegetation catchment area in site which included the large river valley bottom and the adjacent loess terrace, and 2) the character of synanthropic flora of the Early and Late Medieval settlement complexes, situated on crossroads of important trade routes, in comparison with today's flora of the same area. About 6'000-4'000 years ago, several Neolithic settlements of different cultures occupied the marginal zone of the loess terrace along the Vistula valley east of Cracow (Fig. 1.; WASYLIKOWA et al. 1985, GODŁOWSKA et al. 1987). Sediments of a buried oxbow lake found at the foot of this terrace at Pleszow record the impact of habitation on local environment including changes in vegetation and soil erosion processes. Seven settlement phases distinguished in the pollen and macrofossil diagram (Fig. 2) are characterized by the occurrence of cereals, field weeds, the increased number of riverside meadow and grassland plants, and the changes in tree pollen curves indicating forest clearances. By means of the C-14 data these phases are correlated with settlements evidenced by archaeological data. The activities of the Linear Pottery (phases I, II) and Lengyel culture people (III-1 to V) had the greatest impact on local vegetation. Their agriculture was based on slash-and-burn cultivation, fallows were either grazed or completely abandoned to enable the regeneration of shrubs and trees. Cattle grazing in the valley bottom was confirmed by the

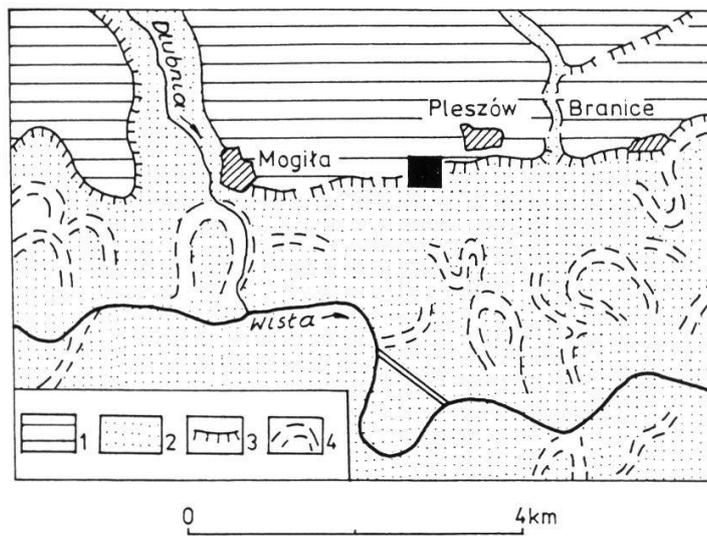


Fig. 1. A geomorphological sketch of the study area at Pleszow.
1 - Pleistocene loess terrace, 2 - Holocene alluvial plain, 3 - Pleistocene terrace edge, 4 - Holocene palaeochannels, black square - study area.

finding of beetles living in cattle manure (PAWŁOWSKI et al.1989). The abundance of weeds points to a prolonged tillage of the same fields (WASYLIKOWA 1986). The disturbance of plant cover by farming and household activities of the inhabitants of the largest settlement at Pleszow (phases III-1 and III-2) caused soil erosion on the loess terrace. Loess deluvia were washed into the oxbow lake and covered organic sediments with a c. 1 m thick layer of highly organic silt (at 2.90-3.90 m depth).

The changes in dominance of plants having different moisture requirements indicate water level oscillations in the valley (WASYLIKOWA 1989). Drier periods were synchronous with the location of settlements near the terrace edge and the cultivation of cereals on the higher places of the valley bottom. Each increase of water table forced people to abandon the low lying fields.

Contemporaneous settlement translocations were observed on the loess terrace. The youngest wet period which allowed alder to spread (phase V) correlates with the shift of the Lengyel culture settlement some 2 km west of Mogila (GLUZA 1984). The coincidence of low water level periods and the settlement periods at Pleszow points to the importance of the habitats on the valley floor for the early farming societies (WASYLIKOWA 1989).

The area of Cracow is characterized by diversified geological structure, topography and groundwater level. The town has been developing continuously from the end of the 9th c. A.D. and is now a fairly large urban area of about

330 km² where industry plays an important role. Medieval flora, known from several sites within the Old Town area, includes 356 taxa (WASYLIKOWA 1978, WIESEROWA 1979, TRZCINSKA-TACIK and WIESEROWA 1976). Out of this number, 326 species occur today in the flora of Cracow or its nearest surroundings or occurred here in the 19th c. The species absent from today's Cracowian flora include, first of all, useful plants, either cultivated locally (e.g. *Cucumis sativus*) or imported (*Ficus carica*). It is interesting to note that in addition to species which occurred persistently there were others which had already in the Medieval times the status of ephemerophytes. *Galium tricornerutum*, *Conringia orientalis* and *Spergula arvensis* var. *maxima* probably belonged to this last group.

We may assume that almost all plant communities present in the Cracow area in the 19th and 20th c. appeared already in the vegetation of the Medieval town because plants of natural habitats and apophytes found in archaeobotanical materials represent nearly all present-day communities (Table 1) (TRZCIN-

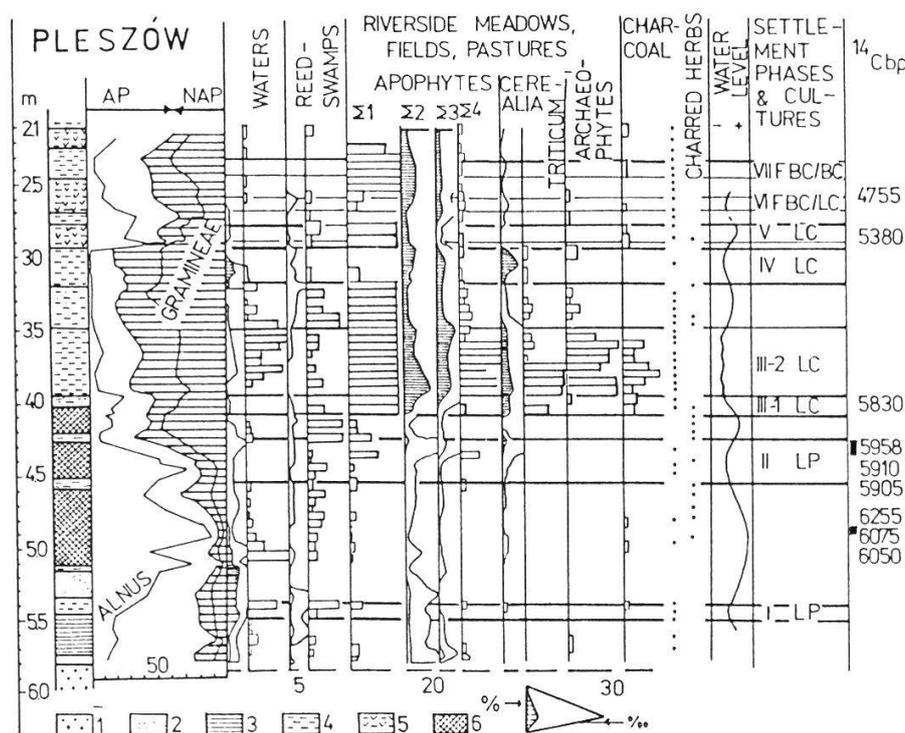


Fig. 2. Pollen and macrofossil summary diagram.

Bars represent number of macrofossils per 40 cc, curves represent pollen.

Sum 1 - riverside meadows, sum 2 - probably apophytes, sum 3 and 4 - apophytes, + indeterminate charcoal dust, LP - Linear Pottery Culture, LC - Lengyel Culture, FBC - Funnel Beaker Culture, BC -Baden Culture, 1 - gravel with sand, 2 - sand, 3 - clayey silt, 4 - sandy silt, 5 - organic silt, 6 - peat and strong organic silt. (From GODŁOWSKA et al. 1988).

SKA-TACIK and WIESEROWA 1976, TRZCINSKA-TACIK 1979).

Today's synanthropic flora of Cracow includes 128 archaeophytes which were recorded in the period 1809-1977. As many as 66 of these species were present in the Middle Ages. It should be stressed that 10 species of archaeophytes known from excavations survived through centuries and disappeared only in the 20th century. This fact demonstrates the impact of the increased intensity of urban and industrial enterprises in 1921-1977 on the changes in

Table 1. Comparison of the archaeobotanical data from Cracow with its present-day synanthropic flora.

- * Apophytes of classes *Nardo-Callunetea*, *Scheuchzerio-Caricetea fuscae* and of the order *Prunetalia*
- ** including 26 species, which disappeared in the 20th century
- *** including 10 species, which disappeared in the 20th century
- **** number of species determined from the archaeological excavations in Cracow and occurring in today's synanthropic flora: 356 species are known from archaeological excavations in Cracow

Kind of data	Synanthropic flora of Cracow in 1809-1977		Data from archaeological excavations till the end of the 15th century		Species confirmed by archaeobotanical data (%)
	Number of species	% 100% = 751	Number of species	% 100% = 222	
Apophytes					
forest	106	14.1	43	19.4	40.6
meadows	84	11.2	37	16.7	44.0
water shores	60	8.0	29	13.0	48.3
xerothermic habitats	57	7.6	15	6.8	26.3
rocks	14	1.9	2	0.9	14.3
sands	22	2.9	5	2.2	22.7
wet sands	13	1.7	3	1.3	23.0
saline habitats	6	0.8	-	-	-
Carpathian gravels	7	0.9	-	-	-
other habitats*	13	1.7	4	1.8	30.8
Total	382	50.9	138	62.1	36.1
Anthropophytes					
Metaphytes					
Archaeophytes	**128	17.1	***66	29.7	51.6
Kenophytes					
Holoagriophytes	3	0.4	-	-	-
Hemiagriophytes	13	1.7	lack from definition	-	-
Epocophytes	46	6.1		-	-
Diaphytes					
Ergasiophygophytes	111	14.8	15	6.8	13.5
Ephemerophytes	68	9.0	3	1.4	4.4
Total	369	49.1	84	37.9	22.8
Total	751	100.0	****222	100.0	29.6

the local flora. Twenty-six species of archaeophytes disappeared from the Cracowian flora in the 20th c. and their number is still decreasing (e.g. *Che-nopodium bonus-henricus* becomes more and more rare).

Other processes related to the strong anthropopression are disappearance of some apophytes (e.g. *Myosurus minimus*), increased number of kenophytes, ergasiophytes and ephemeroxytes, and spread of many epocophytes (e.g. *Galinsoga ciliata*) and hemiagrophytes (e.g. *Rudbeckia laciniata*).

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