THE ŁÓDŹ ATLAS

Sheet XI: Natural heritage: The Flora

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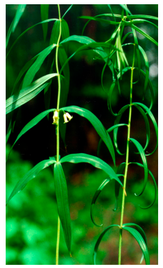


Photo 1. Whorled Solomon's-seal – representative of mountain vegetation in the flora of Łódź

Photo 2. Globe flower – a legally protected species at a site in Łagiewnicki Forest (photo J. K. Kurowski)

Map 1. Herbaceous plants

The flora of Łódź appears to be strongly affected by anthropogenic transformations. It is largely affected by two major factors: the natural ecosystems variability observed in the rural-urban fringe, and the urbanization pressure masking the natural distribution of habitats – found in the urban area.

Łódź is one of the few large Polish cities with a well-studied flora of vascular plants, including the species that occur not only in synanthropic, but also in semi-natural and natural habitats. In Łódź, over 1130 spontaneous vascular plant species are to be found. The flora's contemporary picture results from the spread of geographically alien species (anthropophytes) and the progressing extinction of indigenous species.

In Łódź, there are over 430 anthropophyte plant species, including some that are rare in Poland. The most interesting non-indigenous species include viper grass Dinebra retroflexa, medium-flowered wintercress Barbarea intermedia, narrow-leaved clover Trifolium angustifolium, the medicks Medicago – spotted medick M. arabica and field medick M. rigidula, spiny cocklebur Xanthium spinosum, blue lettuce Lactuca tatarica, Russian mustard Sisymbrium volgense, the amaranths Amaranthus – perennial pigweed A. deflexus, slender amaranth A. gracilis and dioecious amaranth A. palmeri, and the evening primrose Oenothera jueterbogensis. They are mostly ephemerophytes – non-naturalized species and impermanent flora components. Some of them were brought to Łódź in the past, together with natural textile raw materials, and at present they are found less and less frequently or have already disappeared in effect of structural industrial changes.

Out of the number of plants that are recognised as almost extinct or exposed to extinction in Central Poland, 66 species have sustained their natural and semi-natural habitats in the area of Łódź, including 33 legally protected vascular plant species (including 18 under strict protection). Their habitats have been preserved mainly in the rural-urban fringe, where the urbanization pressure is lowest. In Łódź, one can find species such as the bird's-nest orchid Neottia nidus-avis, Cassubian buttercup Ranunculus cassubicus, whorled Solomon's-seal Polygonatum verticillatum, Siberian iris Iris sibirica, white woodrush Luzula luzuloides, martagon lily Lilium martagon, large yellow foxglove Digitalis grandiflora, adder's tongue Ophioglossum vulgatum, globe flower Trollius europaeus, white cinquefoil Potentilla alba, a bur chervil Anthriscus nitida and coralroot orchid Corallorhiza trifida. Their primary habitats are Łagiewnicki Forest and 'Zdrowie' Forest. Some regional species are endangered in their natural and semi-natural habitats, e.g. hawkweed ox-tongue Picris hieracioides, sulphur cinquefoil Potentilla recta, yellow chamomile Anthemis tinctoria, longleaf Falcaria vulgaris and whorled clary Salvia verticillata. In Łódź, they can primarily be found in ruderal plant communities in anthropogenic habitats.

The great richness of the flora of Łódź (about 75% of vascular plant species in Central Poland) results mainly from the diversity of forms, the intensity of human activity and, to a lesser degree, the natural diversity of habitats. The flora of Łódź has a geographical, genetic and ecological structure that is typical of large cities and resembles the floras of Warsaw and Poznań.

Unfortunately, the natural diversity of biocoenosis in the territory of Łódź has become visibly impoverished due to the settlement density. The intensity of urbanisation pressure, increasing towards the city centre, finds its reflection in the spatial structure of the flora. The most impoverished is the city centre (where, in some places, there are only 100 species per square kilometre). The number of species gradually increases towards the outskirts, reaching the highest figure on the border of the urban area and the rural-urban fringe (rising to a maximum of 330 species/ km^2), to decrease again in the rural-urban fringe (where there are no more than 295 species/ km2). As the urbanization pressure increases, so does the proportion of non-indigenous species (from as little as 3% in the urban-rural fringe to over 45% in the city centre). The flora's response to urbanization is well reflected in the increasing proportion of kenophytes, i.e. naturalised anthropophytes which began to appear in Central Europe in the 16thc. (from only 3% in the rural-urban fringe to over 26% in the inner city).

Table 1. Łódź's greenery

No.	Types	Proportions	
		hectares	%
1	Forest:	2 378.00	41.10
	– municipal, including two nature reserves (79.65 ha)	1 673.00	70.35
	– State-owned	233.00	9.80
2	Parks:	681.65	11.78
	– municipal (33, including 11 listed)	512.24	75.10
	– sports and leisure centres	86.09	12.63
3	Squares, pocket parks in housing estates and in the vicinity	approx.1 813.50	31.35
4	Allotment gardens	711.40	12.30
5	Cemeteries	201.00	3.47
	In total	5 785.55	100.00

City area 29 439 ha, including about 5 786 ha (19.7%) of green spaces, population 793 217, population density 2 689 people/ km^2
According to G. O j r z y ń s ka, 1991, *Miejsce Lasu Łagiewnickiego w systemie zieleni Łodzi* [in:] *Szata roślinna Lasu Łagiewnickiego w Łodzi* , ed. J . K . K u r o w s k i. Łódź, pp. 9–13 (revised and supplemented).

The flora's habitat requirements change with the growing urbanization pressure. The inner city has a larger percentage of, e.g. thermophilous species and species growing in semi-dark, dry, or alkaline habitats than the suburban zone.

The varied urbanization pressure finds its reflection in the spatial structure of sites inhabited by the vascular plant species. The species present in the rural-urban fringe and only found at single locations in the urban zone form a group of the so called urbanophobes. These include wood anemone Anemone nemorosa, bilberry Vaccinium myrtillus, lesser spearwort Ranunculus flammula, hairy wood-rush Luzula pilosa, common sedge Carex nigra, and May lily Maianthemum bifolium. The species that grow in the city's urbanized area belong in the group of urbanophiles. These include little love-grass Eragrostis minor, wall barley Hordeum murinum, narrow-leaved pepperwort Lepidium ruderale, intermediate cinquefoil Potentilla intermedia, tall rocket Sisymbrium altissimum, common amaranth Amaranthus retroflexus and petty spurge Euphorbia peplus.

Map 2. Woods

The diverse wood stand of these parks includes over 40 primeval forest oaks with the maximum chest height circumferences of 499, 498, 451, 435, 411 cm, and (as of 2002) the age of 323, 301–238 years (according to P a c y n i a k, 1992, *Najstarsze drzewa w Polsce – przewodnik PTTK* 'Kraj', Warsaw, p. 87)*, as well as 2 multi-trunk yew trees with the maximum age of 151 years, with the following chest height circumferences (as of 2002): 1. – [(218 + 58) + 81 + 65 + 55] cm and 2. – 223 cm. The second yew is split into three trunks at a height of 0.5 m, with the following circumferences at the height of 135 cm: [106 + 100 + 89] cm.The most notable species of non-indigenous origin include: maidenhair tree 1. with the circumference of 307 cm, and 2. – 226 cm; Japanese fir – 226 cm, sessile oak (stalkless variety) – 193 cm, beech (round-leaved variety) – 143 and 110 cm, and also the jagged-leaf variety.

Table 2. Origins of the arboreal flora in Łódź in breakdown into coniferous and broad-leaved trees

No.	Geographical taxonomic groups	Coniferous		Broad-leaved		Total			Proportion in %
		species	varieties and cultivars	species	varieties and cultivars	species	varieties and cultivars	together	
1	Indigenous	9	8	62	52	71	60	131	30.8
2	Asian	8	6	71	23	79	29	108	25.4
3	North American	13	13	54	24	67	37	104	24.4
4	European	2	1	37	7	39	8	47	11.0
5	Persisting hybrids	-	1	29	6	29	7	36	8.4
	Total	32	29	253	112	285	141	426	100

Table 3. Natural monuments in Łódź – isolated trees as per the data of the Department of Environmental

No.	Species name and origin	Circumference of trunk at the height of 130 cm									
		<200	201–	251–	301–	351–	401–	451–	501–	551<	Total
1	Pedunculate oak		4	13	21	11	6	4		580	60
2	Small-leaved lime		1	10	4	7	1	1	2		26
3	Beech, including its varieties:	3	6	7	6	3	1				26
4	Silver maple (North America)	1	2	3	7	5	4			570	23
5	Horse chestnut (Southern Europe)	2	6	5	8	1					22
6	Common maple		3	12	4	2					21
7	Fluttering elm		2	5	1	1					9
8	Ash		2	4		2					8
9	London plane (hybrid)		1	3	3		1				8
10	Red oak (North America)		2	3	3						8
11	Berlin poplar (hybrid)					1	2	3	1		7
12	Sycamore	1	2	3							6
13	Swedish whitebeam	3	1		2						6
14	Large-leaved lime		2	1				1		630	5
15	Silver lime (South-East Europe)		1		1	1		1			4
16	White willow		1			2					3
17	Black alder	3									3
18	Black poplar				1			1	1		3
19	Aspen				2						2
20	Norway spruce		1	1							2
21	Silver birch		2								2
22	Caucasian wingnut (Asia)		1	1							2
23	Turkey oak (south-east Europe)				1						1
24	White poplar			1							1
25	Canadian poplar (hybrid)									710	1
26	Japanese pagoda tree (Asia)			1							1
27	Sessile oak				1						1
28	Crimean lime (hybrid)					1					1
	Total	13	40	73	65	37	15	11	4	4	262

Map 3: Present vegetation

The natural diversity of the plant cover in the region of Łódź is connected with its geographical and ecological heterogeneity. The richness of the geomorphologic forms, types of soils, and habitat conditions (trophic level, humidity, acidity, etc.) in the border zone of the Łódź Heights Landscape Park has resulted in a multitude of plant communities: forest, marsh, meadow, peat-based, spring, aquatic and others. Human activity has triggered a process of intensifying anthropopressure that has greatly affected the plant cover. The period of dynamic industrial development of Łódź was characterized by the destruction of numerous original habitats, drastic deforestation, drainage of damp areas, and rivers contamination, etc. The present condition of the flora is dependent on the changing natural factors as well as on the effects of human activity. The plant communities in Łódź and its environs are different from each other in terms of their naturalness and spatial distribution. Most plant communities are neither fully developed nor transformed, i.e. degenerated.

1. Natural and semi-natural forests. Forest complexes comprising natural and semi-natural plant communities are of the highest biological value. In the mosaic of the present vegetation, special significance is attached to forest communities that can be combined into three habitat groups.

Hygrophilous deciduous forests with prevalent common alder Alnus glutinosa. Their existence in the city, within the depression cone area, deserves special attention and protection. Swampy alder forests that belong in the forest community Ribeso nigri-Alnetum can sporadically be found in endorheic areas which are filled with water for a considerable part of the year. These 'clustered forests' usually grow on raised areas among osier shrubs Salicetum pentandro-cinereae, e.g. in Łagiewnicki Forest (Śmolarnia and Arturówek) and in Lublinek. By the riversides, in places with varied preserved natural fragments on the valley floors, alder-ash forests Fraxino-Alnetum can be found. The most valuable plant communities have been found recorded by the River Młynówka near Dobieszków, the River Wrząca in Chełmy Forest, the River Bzura, and the River Ner (Gadka, Konstantynów). In some places, mainly in Łagiewnicki Forest, there are also small stands of fertile oak-hornbeam forest Tilio-Carpinetum stachyetosum.

The second habitat group consists of mesophilous deciduous forests with the prevalence of oaks, both pedunculate Quercus robur and sessile Q. petraea. These usually occupy fresh and fertile habitats. The mesophilous deciduous forests group comprises oak-hornbeam-lime forests (with a mixture of other tree species, e.g. fir, sycamore, and beech) which have played a major role in shaping the forest landscape of the contemporary Łódź. Quite well developed oak-hornbeam forest communities, especially the typical Tilio-Carpinetum typicum with their lush early-spring flora, have survived in all major forest areas. An open oak forest community Potentillo albae-Quercetum, abounding in rich thermophilous flora, has only been identified in Łagiewnicki Forest, mainly in its northern part. Łagiewnicki Forest, the largest forest complex in the region of Łódź (1205 ha), is also a habitat of acid oak forests Calamagrostio-Quercetum petraeae. This floristically impoverished sub-Atlantic plant community can be found on dried-out boulder clays.

In Wiączyński Forest, just outside the boundaries of the city, one may find interesting plant communities belonging in the lowland acid beech forest Luzulo pilosae-Fagetum, a complex which is typical of the Łódź Uplands.

The third habitat group, mixed and pine communities, has never been widespread due to the absence of sandy formations. Frequently found stands of pines are mostly those that were plantem in non-coniferous forest habitats. Plant communities of the continental mixed forest Querco roboris-Pinetum occur in the mesotrophic habitats of Łagiewnicki Forest (Arturówek, Marianka), in the forests of Dobieszków and, less frequently, in other forest complexes. Partially developed plant communities of the oligotrophic damp moor grass-pine woods Molinio-Pinetum and bilberry-pine woods Vaccinio uliginosi-Pinetum have been identified in Arturówek and Lublinek. These are the relicts of larger complexes of pine woods and raised peat bogs.

2. Degenerate forests and non-natural tree stands in degraded habitats. Most forest areas are occupied by significantly degenerated plant communities and tree stands, often monocultural, of unspecified phytosociological associations. These are anthropogenic forests. The most frequently found tree stands include pine (with a mixture of larch and spruce), birch, oak (indigenous species), poplar and beech. In the region of Łódź, there is also a number of non-indigenous species such as red oak, black locust (false acacia), or even horse chestnut. Juniper, birch and aspen communities, followed by young and open birch-pine, birch-pine-aspen, pine-oak tree stands develop spontaneously on abandoned soils.

3. Non-forest flora in semi-natural damp habitats. In the river valleys and constantly damp depressions, there are still patches of semi-natural reed (Phragmitetea), meadow (Molinio-Arrhenatheretea), peat-based (Scheuchzerio-Caricetea, Oxycocco-Sphagnetea) and aquatic (Potametea) plants. The most valuable complexes exist in the Bzura River valley (between Łagiewniki and Zgierz) and in the Ner River valley (in the vicinity of Stefanów, Gadka Stara, and Konstantynów), where it is possible to find reeds, bulrushes and, less frequently, large areas of sedge. These communities are highly peat-forming and water protective. They are accompanied by plant communities of low peat bogs, i.e. swampy 'acid meadows' dominated by sedges Carici-Agrostietum.

Peat has been excavated in these areas for centuries, while the peat pits have usually been filled with waste. Small fragments of primary high-peat mosses, with the protected common sundew Drosera rotundifolia have been preserved near Wiśniowa Góra and Imielnik. In the river valleys, especially on the outskirts of the city, there were once vast meadows and pastures. Today, they are mostly uncultivated, gradually overgrown with spontaneous vegetation such as willow scrub, clusters of alder trees and other plants. In some localities, the natural mosaic of hygrophilous communities is being restored

4. Segetal flora. The flora of the Łódź region has been in a state of transformation for centuries. This has led to the development of new, anthropogenic habitats with synanthropic flora, associated with segetal plant communities. On the outskirts of the city, different plant communities develop among cultivated cereal plants, depending on the kind and type of soil. Fertile brown earths that used to be the habitat of multi-species oak-hornbeam forests, is the dominant type of soil in this area. Presently, brown earths are the habitat of the smooth tare Vicietum tetraspermae. On the few remaining gravel hills, formerly covered with open oak forests, the prickly poppy community Papaveretum argemones is expanding, mainly in the rye fields. Other plant communities develop among root crops, e.g. communities of millets Echinochloo-Setarietum, and of shaggy soldier and foxtail, Galinsogo-Setarietum, which typically live in fertile and moist habitats. Communities of wild radish and sheep's sorrel Raphano-Rumicetum and of black bindweed and deadnettles Bilderdykio-Lamietum can be found among plants cultivated on lighter soils. On brownfield lands weed communities undergo a transformation, as different species of perennial plants (such as the golden rods Solidago – Canadian golden rod S. canadensis and giant golden rod S. gigantea) begin to grow among them, accompanied by the appearance of light-seeded trees, especially the birch.

5. Ruderal flora. Urbanized areas, roadside verges, railway areas, and all geomechanically altered places (e.g. gravel pits) are occupied by ruderal vegetation. These create specific communities of indigenous (spontaneous) and non-indigenous species (anthropophytes). On the basis of a pioneering study of ruderal vegetation that was conducted some years ago, it is possible to distinguish nine such plant communities in the region of Łódź, which probably does not fully reflect the diversity of the contemporary vegetation in these habitats. On slightly transformed land surfaces, especially those enriched with calcium carbonate (e.g. construction sites), there appears a community with prevalent coltsfoot Senecioni-Tussilaginetum. Communities of nettles and mallow Urtico-Malvetum neglectae develop in fertile, nitrophilous habitats, primarily in the rural-urban fringe. Impressive weeds, mainly perennials that usually form communities of motherwort-burdock Leonuro-Arctietum and tansy-mugwort Tanaceto-Artemisietum occupy the neglected quarters and brownfields, even those in the city centre. In the urbanized areas of the city, mostly in those occupied by apartment blocks, a Hordeetum murini community develops with widespread presence of wall barley (Hordeum murianum). Communities of flixweed Sisymbrietum sophiae and false London rocket Sisymbrietum loeselii are typical of highly urbanized areas, and include groups of annual thermophytes and biennial anthropophytes .

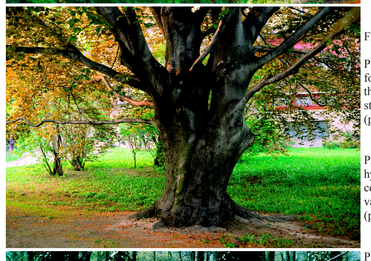
6. Impoverished ruderal vegetation with enclaves of cultivated plants. The congested housing area in the city centre is dominated by habitats that are not accessible to plants. Over 90% of the area is covered by impermeable materials (asphalt, concrete). Vegetation develops only locally and is strongly fragmented. The prevailing form is grass maintained at a low, even height, accompanied by fragmentarily developed communities and groups of plants from such plant associations as love grass Eragrostion, mustards Sisymbrion and knotweed Polygonion avicularis .

7. Cultivated plant life. Organised and cultivated vegetation in the area of Łódź can be fund in all major complexes of allotment gardens, city parks (e.g. parks of the residences of former factory owners) and rural gardens, botanical gardens, cemeteries, green areas in housing estates, as well as squares and lawns. These areas are dominated by vegetation that has been developed by human activity, however, some remnants of preserved old forest communities can be found, especially in parks that were established in forested areas in and outside Łódź. Some synanthropic species, which sometimes form incomplete ruderal communities, can also be encountered there .

Map 4. Actual potential climax natural flora in Łódź

The potential vegetation is defined as plant communities that would develop under natural conditions without the human factor impact, making it possible for ecological succession to reach the ultimate climax stage. The actual environmental conditions are understood as those that have already been changed by humans. This vegetation is therefore referred to as the actual vegetation, in contrast to the primary vegetation that could have existed before the appearance of humans. In the climate and soil conditions of the region of Łódź, only forest communities can be classified as potential plant communities. The vegetation map was constructed on the basis of the remnants of natural forest communities which perform the function of benchmarks, and anthropogenic vegetation as a substitute for natural communities. The map is more accurate for areas containing the largest amounts of natura vegetation. Of course, in urbanized areas, there are few of these 'benchmarks', therefore a large part of the map is basically hypothetical.

The region of Łódź is located in the border area of the range of certain forest-forming trees (among others beech and fir) and upland and lowland geobotanical regions. Hence there can coexist heterogeneous forest communities, whose boundaries take the form of wide transitional zones, while communities with similar trophic levels can overlap due to negligible habitat differences. This region is mostly occupied by eutrophic and mesotrophic deciduous and mixed forests with fir, oak and beech trees as the main component of the tree stands. Plant units specified in the map legend are fully reliable and well-documented, whereas the boundaries between them are, to a considerable extent, hypothetical



From the top:

Photo 3. Oak-hornbeam forest with abundant ivy in the reserve in Polesie Konstantynowskie
(photo H. Andrzejewski)

Photo 4. The mosaic of marshy, meadow and rush plant communities in the Ner River valley near Gadka Stara
(photo H. Andrzejewski)

Photo 5. 'Educational' garden of the Department of Geobotany and Plant Ecology of the University of Łódź – an example of cultivated vegetation
(photo J. K. Kurowski)

Photo 6. A shapely beech tree in the Bishop Klepacz Park
(photo J. Hereźniak, 1996)

Photo 7. Ivy on alder trees in Polesie Konstantynowskie reserve
(photo J. Hereźniak, 1995)