

6. Diversity of the flora and vegetation of abandoned farmlands

6.1. Diversity of species and habitat groups of the flora

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One hundred and thirty-nine taxa of vascular plants and four taxa of mosses were recorded in the analysed abandoned lands (Tab. 6.1).

In the flora inhabiting abandoned farmlands, there are taxa which prefer various habitat types. The majority of identified species are associated with habitats of dry grasslands or they grow there frequently (24 species). They include *Carlina vulgaris*, *Carex leporina*, *Centaurea scabiosa*, *C. stoebe* and *Thymus pulegioides*. Almost equally numerous were groups of species associated with or preferring farmland habitats (22 species), such as *Apera spica-venti*, *Arnoseris minima*, *Centaurea cyanus*, *Papaver argemone* and species which mostly inhabit ruderal locations, including species of the *Rudero-Secalietea* class (20 species), e.g. *Cirsium arvense*, *Convolvulus arvensis*, *Elymus repens* and *Rumex crispus*. The group associated with meadow habitats of the *Molinio-Arrhenat-*

heretea class (19 species) is also numerously represented. They include: *Achillea millefolium*, *Anthoxanthum odoratum*, *Crepis biennis*, *Galium mollugo*, *Rumex acetosa*, *Stellaria graminea*, *Trifolium repens* and *Vicia cracca*. Fewer species are found in the group of plants which occur predominantly in forest communities (13 species). They mainly include trees: *Pinus sylvestris*, *Betula pendula*, *Quercus robur* and a few species of herbaceous plants, such as *Anthriscus sylvestris* and *Pteridium aquilinum* (Tab. 6.1).

Invasive species of non-native origin should be treated as a separate group. There are 7 of them, which is about 5% of all the identified plant taxa. They include three species of high invasiveness category (Tab. 6.2). The remaining 34 taxa are cosmopolitan plants, which occur in various types of plant communities.

Table 6.2. Invasive alien plant species recorded on abandoned farmlands of the Łódź Voivodeship

Latin name	Life form	Origin	Category of invasiveness
<i>Anthoxanthum aristatum</i> Boiss.	annual plant	South Europe	I
<i>Conyza canadensis</i> (L.) Cronquist	annual plant	North America	I
<i>Galinsoga parviflora</i> Cav.	annual plant	North and Central America	I
<i>Padus serotina</i> (Ehrh.) Borkh.	tree	North and Central America	IV
<i>Quercus rubra</i> L.	tree	North America	IV
<i>Setaria viridis</i> (L.) P. Beauv.	annual plant	South Europe, South-West Asia, North Africa	I
<i>Solidago canadensis</i> L.	perennial	North America	IV

Categories of invasiveness according to Tokarska-Guzik et al. 2012:

Category I – segetal and ruderal weeds that show high relative abundance, or potentially invasive species that currently occupy a small area;

Category II – species that already show invasive behaviour in some regions, and are increasing the occupied area or the number of localities;

Category III – species occurring at a few localities with high relative abundance or found scattered around many localities;

Category IV – species whose occurrence is very important in Poland – a large number of localities and large populations in patches are known.

Source: own elaboration.

Apart from *Helichrysum arenaria*, no protected species or species that are endangered in Poland or the Łódź region were found in the flora of the analysed abandoned lands. Despite that, some of the identified species are not common in the

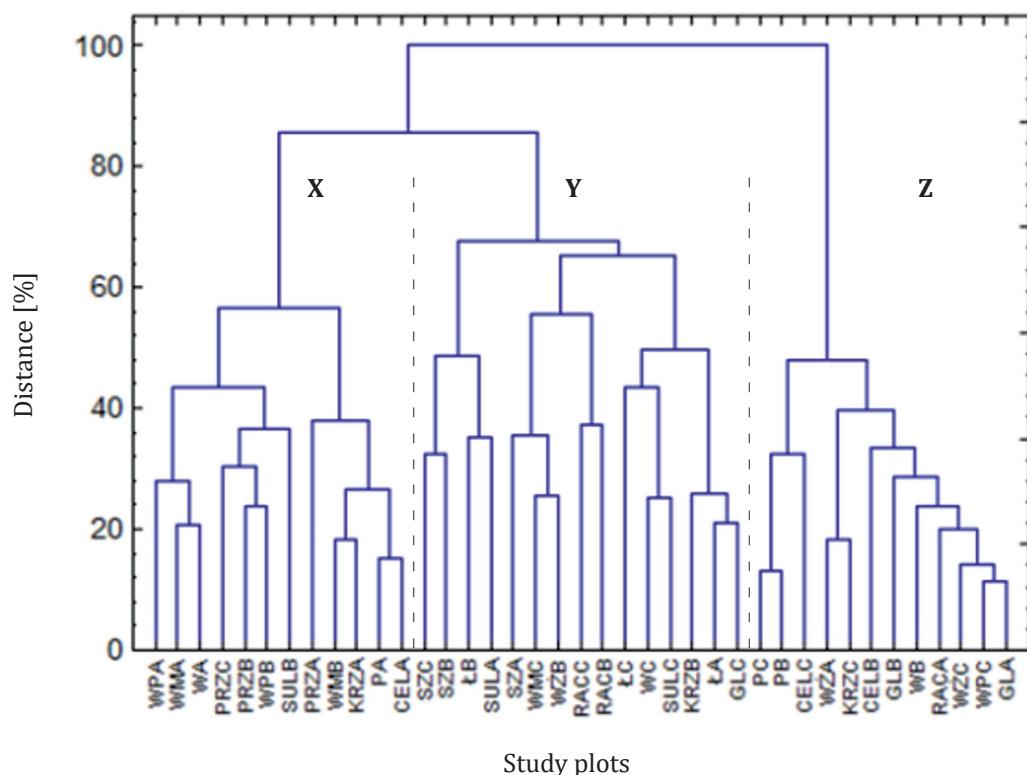
Łódź Voivodeship, due to their occurrence in rare or endangered phytocoenoses. Such species as *Dianthus carthusianorum*, *Knautia arvensis* and *Thymus pulegioides* are worth mentioning here.

6.2. Vegetation structure

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In the analysed abandoned lands, three main structural groups of plant communities (Fig. 6.1) were distinguished using Ward's method of hierarchical cluster analysis. In addition, the use of the IndVal index made it possible to determine the preferences of plant species for individual community group (Tab. 6.3). Each community group represents a particular development sta-

ge but sometimes, in the same cluster, there are communities typical of the given development stage and communities which are a transition to another stage or community with a different structure. The isolated clusters and analysis of similarities between the plots they were assigned, allowed to identify 8 plant communities with different structures.



Abbreviations: **CELA, CELB, CELC** – Celestynów A, Celestynów B, Celestynów C; **GLA, GLB, GLC** – Glinnik A, Glinnik B, Glinnik C; **KRZA, KRZB, KRZC** – Krzętle A, Krzętle B, Krzętle C; **ŁA, ŁB, ŁC** – Łagiewniki A, Łagiewniki B, Łagiewniki C; **PA, PB, PC** – Polesie A, Polesie B, Polesie C; **PRZA, PRZB, PRZC** – Piskorzeniec A, Piskorzeniec B, Piskorzeniec C; **RACA, RACB, RACC** – Raciszyn A, Raciszyn B, Raciszyn C; **SULA, SULB, SULC** – Sulejów A, Sulejów B, Sulejów C; **SZA, SZB, SZC** – Szymaniszki A, Szymaniszki B, Szymaniszki C; **WA, WB, WC** – Weronika A, Weronika B, Weronika C; **WMA, WMB, WMC** – Wola Makowska A, Wola Makowska B, Wola Makowska C; **WPA, WPB, WPC** – Wola Pszczólecka A, Wola Pszczólecka B, Wola Pszczólecka C; **WŻA, WŻB, WŻC** – Wola Życińska A, Wola Życińska B, Wola Życińska C

Fig. 6.1. Classification of study plots (hierarchical cluster analysis, Euclidean distance, Ward's method)

Source: own elaboration

Table 6.1. Percentage share of species of flora and lichens in the abandonment study plots in the Łódź Voivodeship

Table 6.1. Percentage share of species of flora and lichens in the abandonment study plots in the Łódź Voivodeship (continued)

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Source: own elaboration.

The most uniform was cluster Z, which grouped study plots representing the same community type, with *Agrostis capillaris*, *Hieracium pilosella* and *Achillea millefolium*. Less uniform is cluster X, which groups patches of a poor community with *Anthoxanthum aristatum* and *Corynephorus canescens* and patches similar to the more diverse community with *Agrostis capillaris*, *Hieracium pilosella* and *Achillea millefolium*.

The most heterogeneous is cluster Y. It groups patches of the floristically poor community with *Calamagrostis epigejos*; patches of a community rich in plant species, with *Cirsium arvense*, *Galium mollugo* and *Gnaphalium sylvaticum*; the few patches of phytocoenoses with *Cirsium arvense* and *Solidago canadensis*; a community of grasses and perennial plants with *Betula pendula* and a community with lichens of the *Cladonia* genus.

Table 6.3. Relative cover (P), relative frequency (F) and IndVal indicator value (I) (all in %) in individual clusters (for species associated with any cluster at $p < 0.1$).

The significantly (at $p \leq 0.05$) highest IndVals are in bold

Cluster		<i>Ahtoxanthum aristatum</i>	<i>Corynephorus canescens</i>	<i>Bryum sp.</i>	<i>Gnaphalium sylvaticum</i>	<i>Cirsium arvense</i>	<i>Galium mollugo</i>	<i>Carex leporina</i>	<i>Betula pendula</i>	<i>Poa pratensis</i>	<i>Senecio jacobaea</i>	<i>Solidago canadensis</i>	<i>Hieracium pilosella</i>	<i>Agrostis capillaris</i>	<i>Achillea millefolium</i>	<i>Festuca rubra</i>	<i>Jasione montana</i>
	p	0.0028	0.0055	0.0482	0.0008	0.0094	0.0104	0.0166	0.0334	0.0896	0.0945	0.0964	0.0011	0.0046	0.0268	0.0869	0.0982
X	P	100	87	100	0	0	0	0	0	0	0	1	31	0	7	4	20
	F	42	58	25	0	0	0	0	0	0	0	8	75	17	25	8	50
	I	42	51	25	0	0	0	0	0	0	0	0	23	0	2	0	10
Y	P	0	0	0	100	100	85	100	94	85	77	96	7	42	44	28	29
	F	0	0	0	33	40	40	40	47	47	47	33	60	60	40	20	20
	I	0	0	0	33	40	34	40	44	40	36	32	4	25	17	6	6
Z	P	0	13	0	0	0	15	0	6	15	23	3	61	57	49	68	50
	F	0	42	0	0	0	8	8	25	42	50	17	100	100	92	42	83
	I	0	5	0	0	0	1	0	2	6	11	0	61	57	45	28	42

Source: own elaboration.

Community with *Anthoxanthum aristatum* and *Corynephorus canescens*

It is a floristically poor community of grasses. The highest IndVal value was obtained by two species here: *Anthoxanthum aristatum* and *Corynephorus canescens* (cluster X). Some study plots were overgrown only with *Corynephorus canescens* (e.g. Celestynów A). The two species dominate as regards land cover and shape the physiognomy of this community. The share of other species is in-

significant (Tab. 6.1). The most typical patches include: Celestynów A, Krzętle A (Photo 6.4), Wola Makowska A, Wola Makowska B, Polesie C. The physiognomically similar patches of study plots Polesie B and Polesie C, which are very poor floristically, and their dominating species are grasses *Anthoxanthum aristatum* or *Poa compressa*, can also be included in this community.

Community with *Agrostis capillaris*, *Hieracium pilosella* and *Achillea millefolium*

These are floristically poor phytocoenoses, in which the species with significant values of IndVal were: *Agrostis capillaris*, *Hieracium pilosella* and *Achillea millefolium* (cluster Z). All patches of phytocoenoses that are included in cluster Z constitute the typical form of this community (Fig. 6.1). Only study plots Piskorzeniec C and Wola Życińska A are characterised by a high share of *Holcus mollis*, higher than that of *Hieracium pilosella*. In some plots, there are small numbers of tree saplings (*Betula pendula*, *Pinus sylvestris*).

This community is represented by study plots Wola Pszczołecka A, Weronika A and Piskorzeniec

C, included in cluster X. These patches are richer in plant species, with a large share of *Hieracium pilosella*. They probably constitute a transitory link from poor communities of grasses with a small share of perennial plants, to the floristically richer phytocoenoses of meadow character. Study plots Glinnik C, Celestynów C and Krzętle B, included in cluster Y, are also physiognomically similar to this community, because their dominating species is *Agrostis capillaris*, accompanied by a significant share of *Hieracium pilosella* or *Elymus repens*.

Community with *Calamagrostis epigejos*

The physiognomy of this community is shaped by dense occurrence of *Calamagrostis epigejos*, assisted by a small addition of *Agrostis capillaris*, *Hieracium pilosella*, *Eupatorium cannabinum*, *Cirsium arvense* and *Equisetum arvense*. Among the analysed abandoned lands, only three patches dominated by *Calamagrostis epigejos* were found. They were: Wola Życińska B, Wola Makowska C and

Szymaniszki A (Tab. 6.1). The study plots were included in cluster Y (Fig. 6.3). The least typical is plot Szymaniszki A, which differs from the others by the much greater number of species (17), a smaller share of *Calamagrostis epigejos* and a high share of perennial plants, such as *Hieracium umbellatum*.

Community with *Cladonia*

Patches of this phytocoenosis are characterised by a very small share of vascular plants, mainly: *Corynephorus canescens* and *Arnoseris minima*. The plants cover an insignificant percentage of the plot. The patches are dominated by lichens of the *Cladonia* genus, mostly *Cladonia arbuscula*

and *Cl. rangiferina*. They are accompanied by *Cladonia strepsilis f. coralloides* (Photo 7.6), *Cl. uncialis* and *Cl. furcata*. Patches of this community were recorded at study plots: Piskorzeniec A, Polesie A and Wola Pszczołecka B, included in cluster X.

Community with *Cirsium arvense*, *Galium mollugo* and *Gnaphalium sylvaticum*

It is a floristically rich community, with multi-species flora (Tab. 6.1). A significant value of IndVal was reached by 5 species: *Cirsium arvense*, *Galium mollugo*, *Gnaphalium sylvaticum* and *Betula pendula*. This phytocoenosis is represented by two study plots: Raciszyn C and Weronika C (cluster Y). Seve-

ral meadow species were identified here, such as *Galium mollugo*, *Stellaria graminea*, *Vicia cracca*, *Trifolium repens*; species of xerothermic grasslands, e.g. *Dianthus carthusiana*, and a few forest species, e.g. *Gnaphalium sylvaticum*.

Community with *Elymus repens* or *Poa pratensis*

This phytocoenosis is dominated by grasses – *Elymus repens* or *Poa pratensis*. In patches of this community, a high share of *Senecio jacobaea* or *Rumex acetosa* is also noticeable. The community is very abundant floristically (Tab. 6.1). Fo-

rest species, meadow species, and species of dry grasslands occur here. Typical patches of this community – Sulejów A and Sulejów C were included in cluster Y.

Community with *Cirsium arvense* and *Solidago canadensis*

The phytocoenosis is represented in the analysed area by only one study plot – Szymaniszki B, included in cluster Y. Floristically, it is a very poor

community. Two species dominate here: *Cirsium arvense* and *Solidago canadensis*. The share of three other species is insignificant (Tab. 6.1).

Community with *Betula pendula*

This type of community was identified at two study plots only: Łagiewniki B and Łagiewniki C, included in cluster Y. The physiognomy of this phytocoenosis is shaped by a considerable share of *Betula pendula*. There are not many herba-

ceous plants there (8–12). The dominating ones are: *Elymus repens*, *Conyza canadensis*, *Senecio jacobaea*, *Jasione montana* and *Rumex acetosa* (Tab. 6.1).



Photo 6.1. *Solidago canadensis* in Sulejów A (S. Krysiak)



Photo 6.2. *Padus serotina* in Wola Życińska A (S. Krysiak)



Photo 6.3. *Helichrysum arenaria* in Weronika A (E. Papińska)



Photo 6.4. *Corynephorus canescens* in Krzętle A (E. Papińska)



Photo 6.5. *Senecio jacobaea* in Raciszyn A (E. Papińska)



Photo 6.6. *Viola tricolor* in Raciszyn C (E. Papińska)