Supplementary materials

Table S1. Overview of the studied forests in Poznań

Name	Area	Main aim of conservation	Vascular plants species richness[1]	Alien species richness	Number of study plots	References[2]
'Bogdanka' ecological lands	159.1 ha	Riparian forests and fens, oak-hornbeam forests, wet meadows	445 (280)	93	46	Wrońska-Pilarek (2010), Dyderski et al. (2014a; **2014b**; 2015)
'Dębina' ecological lands	84.63 ha	Toposequence of riparian forests, ponds and oak-hornbeam forests	371 (438)	88	27	Wrońska-Pilarek and Stasik (2003), Dyderski and Jagodziński (2014), **Dyderski and Wrońska-Pilarek (2015a)**
'Rusałka' forest	138.9 ha	no conservation	314 (226)	74	63	**Dyderski et al. (2016)**
'Strzeszyn' ecological land	94.48 ha (including 34.9 ha of lake)	Riparian and oak-hornbeam forests, alder carrs, degraded mesotrophic lake, fens	322 (341)	56	18	Wrońska-Pilarek (2008), Dyderski et al. (2015), **Dyderski and Wrońska-Pilarek (2015b)**

[1] – total species richness of studied object and (in parentheses) species richness per 1 km^2; [2] – bolded references indicate source of vegetation plots data

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Table S2. Tree layer species composition in eight vegetation types studied: frequency and median cover of species are listed in the table.

Species	***Carici elongatae-Alnetum***	**meadian cover [%]**	***Carpinion betuli***	**meadian cover [%]**	***Chelidonio-Robinietum***	**meadian cover [%]**	***Fraxino-Alentum***	**meadian cover [%]**	**Pinus monocultures**	**meadian cover [%]**	***Populetum albae***	**meadian cover [%]**	***Salicetum albae***	**meadian cover [%]**
Acer campestre	0.0	0	10.0	3	0.0	0	5.7	8.5	8.3	3.5	16.7	4	16.7	3
Acer negundo	3.2	3	0.0	0	25.0	20.5	2.9	3	4.2	8	33.3	6	83.3	13
Acer platanoides	0.0	0	30.0	18	25.0	13	8.6	8	12.5	26	16.7	4	16.7	13
Acer pseudoplatanus	3.2	8	0.0	0	12.5	38	5.7	5.5	4.2	3	33.3	6	0.0	0
Alnus glutinosa	100.0	88	0.0	0	0.0	0	71.4	88	0.0	0	16.7	3	16.7	3
Alnus incana	3.2	3	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0
Betula pendula	6.5	8	10.0	4	0.0	0	0.0	0	12.5	3	0.0	0	0.0	0
Betula pubescens	6.5	3	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0
Carpinus betulus	0.0	0	30.0	16	0.0	0	11.4	8.5	4.2	4	0.0	0	0.0	0
Cornus sanguinea	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	16.7	3	0.0	0
Crataegus monogyna	0.0	0	0.0	0	0.0	0	2.9	3	0.0	0	0.0	0	0.0	0
Fagus sylvatica	0.0	0	30.0	8	0.0	0	2.9	13	0.0	0	0.0	0	0.0	0
Frangula alnus	0.0	0	0.0	0	0.0	0	2.9	13	0.0	0	0.0	0	0.0	0
Fraxinus excelsior	0.0	0	10.0	8	37.5	4	42.9	38	4.2	8	16.7	4	0.0	0
Fraxinus pensylvanica	0.0	0	0.0	0	0.0	0	8.6	21	0.0	0	0.0	0	0.0	0
Pinus sylvestris	0.0	0	30.0	4	0.0	0	0.0	0	100.0	68	0.0	0	0.0	0
Populus alba	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	100.0	53	0.0	0
Populus tremula	0.0	0	0.0	0	0.0	0	0.0	0	4.2	2	0.0	0	0.0	0
Populus ×canadensis	0.0	0	0.0	0	0.0	0	2.9	38	4.2	3	0.0	0	0.0	0
Populus ×canescens	0.0	0	0.0	0	0.0	0	0.0	0	4.2	4	0.0	0	0.0	0

Prunus padus	0.0	0	0.0	0	0.0	0	5.7	3	0.0	0	16.7	4	0.0	0
Prunus serotina	0.0	0	20.0	10.5	12.5	8	2.9	13	45.8	18	0.0	0	0.0	0
Quercus petraea	0.0	0	0.0	0	12.5	7	0.0	0	8.3	3.5	0.0	0	0.0	0
Quercus robur	0.0	0	90.0	38	0.0	0	8.6	13	29.2	38	66.7	23	0.0	0
Rhamnus catharticus	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	16.7	13
Robinia pseudacacia	0.0	0	0.0	0	100.0	83.5	0.0	0	8.3	3	0.0	0	0.0	0
Salix alba	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	83.3	38
Salix fragilis	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	66.7	8.5
Sorbus aucuparia	3.2	3	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0
Tilia cordata	0.0	0	60.0	53	12.5	4	14.3	4	8.3	11	0.0	0	0.0	0
Ulmus glabra	0.0	0	0.0	0	12.5	3	0.0	0	0.0	0	0.0	0	0.0	0
Ulmus laevis	0.0	0	0.0	0	0.0	0	2.9	3	0.0	0	0.0	0	0.0	0
Ulmus minor	0.0	0	0.0	0	0.0	0	5.7	8	4.2	8	33.3	38	0.0	0

Table S3. Shrub layer species composition in eight vegetation types studied: frequency and median cover of species are listed in the table.

Species	*Carici elongatae-Alnetum*	meadian cover [%]	*Carpinion betuli*	meadian cover [%]	*Chelidonio-Robinietum*	meadian cover [%]	*Fraxino-Alentum*	meadian cover [%]	Pinus monocultures	meadian cover [%]	*Populetum albae*	meadian cover [%]	*Salicetum albae*	meadian cover [%]
Acer campestre	3.2	3	10.0	13	12.5	13	14.3	3	16.7	2.5	33.3	2.5	16.7	3
Acer negundo	6.5	8	20.0	10.5	37.5	3	14.3	3	20.8	4	50.0	3	83.3	4
Acer platanoides	0.0	0	10.0	3	37.5	3	11.4	2.5	16.7	3.5	50.0	13	16.7	13
Acer pseudoplatanus	32.3	3	40.0	3	62.5	3	25.7	3	8.3	3	16.7	38	0.0	0
Aesculus hippocastanum	0.0	0	0.0	0	0.0	0	0.0	0	4.2	2	0.0	0	0.0	0
Alnus glutinosa	19.4	2.5	0.0	0	0.0	0	2.9	3	0.0	0	0.0	0	0.0	0
Betula pendula	0.0	0	0.0	0	0.0	0	0.0	0	4.2	3	0.0	0	0.0	0
Carpinus betulus	3.2	1	20.0	3	12.5	13	2.9	2	4.2	3	0.0	0	16.7	3
Cornus alba	3.2	3	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0
Cornus sanguinea	9.7	3	0.0	0	0.0	0	14.3	4	0.0	0	50.0	4	16.7	38
Cornus sericea	6.5	6	0.0	0	0.0	0	5.7	68	0.0	0	0.0	0	0.0	0
Corylus avellana	3.2	2	10.0	18	12.5	3	5.7	2	4.2	3	0.0	0	0.0	0
Crataegus monogyna	22.6	2	10.0	3	37.5	3	11.4	2	12.5	4	16.7	3	16.7	13
Crataegus rhipidophyla	0.0	0	0.0	0	12.5	3	0.0	0	0.0	0	0.0	0	0.0	0
Euonymus europaeus	3.2	3	0.0	0	0.0	0	5.7	2.5	0.0	0	33.3	3	0.0	0
Fagus sylvatica	3.2	1	0.0	0	0.0	0	2.9	3	0.0	0	0.0	0	0.0	0
Frangula alnus	22.6	2	0.0	0	12.5	3	11.4	3	16.7	2	0.0	0	0.0	0
Fraxinus excelsior	12.9	2.5	10.0	2	0.0	0	5.7	8	4.2	3	16.7	1	16.7	3
Fraxinus pensylvanica	0.0	0	0.0	0	0.0	0	2.9	3	0.0	0	0.0	0	0.0	0
Juglans regia	3.2	2	0.0	0	0.0	0	2.9	1	0.0	0	0.0	0	0.0	0

Lonicera tatarica	0.0	0	0.0	0	12.5	38	0.0	0	0.0	0	0.0	0	0.0	0
Lonicera xylosteum	3.2	3	0.0	0	0.0	0	0.0	0	4.2	3	0.0	0	0.0	0
Malus domestica	0.0	0	0.0	0	12.5	2	0.0	0	0.0	0	0.0	0	0.0	0
Populus alba	0.0	0	0.0	0	0.0	0	2.9	3	0.0	0	16.7	13	16.7	3
Populus tremula	3.2	1	0.0	0	0.0	0	2.9	2	4.2	2	0.0	0	0.0	0
Prunus avium	0.0	0	10.0	13	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0
Prunus insititia	0.0	0	10.0	2	25.0	2.5	2.9	2	4.2	2	16.7	3	16.7	13
Prunus mahaleb	3.2	2	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0
Prunus padus	71.0	8	0.0	0	25.0	3	57.1	8	4.2	4	50.0	2	0.0	0
Prunus serotina	32.3	8	50.0	8	75.0	15.5	28.6	4	91.7	8	0.0	0	0.0	0
Pyrus communis	0.0	0	0.0	0	12.5	2	0.0	0	4.2	2	0.0	0	0.0	0
Quercus petraea	0.0	0	0.0	0	0.0	0	0.0	0	4.2	2	0.0	0	0.0	0
Quercus robur	0.0	0	0.0	0	0.0	0	0.0	0	4.2	3	0.0	0	0.0	0
Rhamnus catharticus	0.0	0	0.0	0	0.0	0	0.0	0	4.2	3	16.7	3	16.7	3
Ribes alpinum	0.0	0	20.0	3	37.5	8	0.0	0	16.7	8	16.7	4	0.0	0
Ribes nigrum	6.5	3	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0
Ribes rubrum	3.2	3	0.0	0	0.0	0	20.0	3	0.0	0	16.7	4	16.7	13
Ribes spicatum	9.7	3	10.0	3	0.0	0	17.1	2	0.0	0	0.0	0	0.0	0
Ribes uva-crispa	0.0	0	0.0	0	0.0	0	2.9	4	0.0	0	0.0	0	16.7	3
Robinia pseudacacia	0.0	0	10.0	2	50.0	3	0.0	0	12.5	4	0.0	0	0.0	0
Salix alba	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	33.3	8
Salix fragilis	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	16.7	2
Salix triandra	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	16.7	13
Salix viminalis	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	16.7	13	16.7	13
Sambucus nigra	12.9	3	30.0	2	25.0	3	57.1	10.5	4.2	2	16.7	2	16.7	13
Sorbus aucuparia	19.4	3	10.0	3	0.0	0	5.7	2.5	29.2	3	0.0	0	0.0	0
Sorbus intermedia	0.0	0	0.0	0	0.0	0	0.0	0	4.2	2	0.0	0	0.0	0
Tilia cordata	0.0	0	40.0	3.5	12.5	1	20.0	2	16.7	2.5	0.0	0	16.7	13
Ulmus laevis	0.0	0	0.0	0	0.0	0	0.0	0	4.2	2	0.0	0	0.0	0
Ulmus minor	12.9	2	0.0	0	25.0	2.5	8.6	3	0.0	0	0.0	0	0.0	0
Viburnum opulus	0.0	0	0.0	0	0.0	0	2.9	4	4.2	2	0.0	0	0.0	0

Table S4. Functional traits used for functional diversity components, their ecological significance and completeness

Trait	Ecological significance	Trait type	Values	Completeness (%)	Source
Light	Response to light availability	ordinal	1-9	92.8	Ellenberg and Leuschner (2010)
Moisture	Response to groundwater table level	ordinal	1-12	84.4	Ellenberg and Leuschner (2010)
Soil reaction	Response to soil pH	ordinal	1-9	58.0	Ellenberg and Leuschner (2010)
Soil fertility	Response to soil nitrogen content	ordinal	1-10	73.2	Ellenberg and Leuschner (2010)
Temperature	Response to temperature	ordinal	1-11	69.6	Ellenberg and Leuschner (2010)
Continentality	Response to climate continentality	ordinal	1-12	76.3	Ellenberg and Leuschner (2010)
Canopy height	Competitive ability	numeric	m	86.6	Kleyer et al. (2008)
Leaf dry mass content	Competitive ability, growth rate, stress tolerance	numeric	mg g^{-1}	78.1	Kleyer et al. (2008)
Leaf mass	Competitive ability, growth rate, stress tolerance	numeric	mg	71.0	Kleyer et al. (2008)
Leaf size	Competitive ability, growth rate, stress tolerance	numeric	mm^2	78.6	Kleyer et al. (2008)
Specific leaf area	Competitive ability, growth rate, stress tolerance	numeric	mm^2 mg^{-1}	81.7	Kleyer et al. (2008)
Seed mass	Dispersal, establishment	numeric	mg	82.1	Kleyer et al. (2008)
Seed number per shoot	Response to disturbance, establishment, dispersal	numeric	number of seeds	76.3	Kleyer et al. (2008)
Growth form	Competitive ability, growth rate, stress tolerance	categorical	8 categories	88.9	Kleyer et al. (2008)
Life strategy (Grime 2001)	Competitive ability, stress tolerance, response to disturbance	categorical	7 categories	90.2	Klotz et al. (2002)

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Table S5. Result of Poisson GLM of alien species richness, estimated using *stats::glm()* function. AIC_0 refers to AIC of intercept-only model (null model).

Term	Estimate	SE	z	Pr(>|z|)
(Intercept)	0.2549	0.1581	1.612	0.1069
Vegetation type=*Carpinion*	0.6614	0.2550	2.594	0.0095
Vegetation type=*Chelidonio-Robinietum*	1.0330	0.2439	4.235	<0.0001
Vegetation type=*Fraxino-Alnetum*	0.5205	0.1953	2.665	0.0077
Vegetation type=*Pinus* monocultures	0.5744	0.2078	2.764	0.0057
Vegetation type=*Populetum albae*	0.6614	0.3028	2.185	0.0289
Vegetation type=*Salicetum albae*	0.7866	0.2895	2.717	0.0066
Df	**Residual df**	**Deviance**	**AIC**	**AIC_0**
6	113	56.146	371.4	380.8

Table S6. Result of zero-inflated beta regression of alien species cover, estimated using *gamlss::gamlss()* function. AIC_0 refers to AIC of intercept-only model (null model).

Term	Estimate	SE	t	P(>|t|)
μ estimnation, link function: logit				
(Intercept)	-2.2628	0.1618	-13.984	<0.0001
Vegetation type=*Carpinion*	0.1499	0.2883	0.520	0.6042
Vegetation type=*Chelidonio-Robinietum*	0.5794	0.2910	1.991	0.0489
Vegetation type=*Fraxino-Alnetum*	0.3158	0.1998	1.581	0.1168
Vegetation type=*Pinus* monocultures	0.1068	0.2220	0.481	0.6313
Vegetation type=*Populetum albae*	0.1703	0.3486	0.489	0.6260
Vegetation type=*Salicetum albae*	1.5264	0.2833	5.387	<0.0001
σ estimnation, link function: logit				
(Intercept)	2.5267	0.1349	18.73	<0.0001
ν estimnation, link function: log				
(Intercept)	-3.1355	0.4568	-6.864	<0.0001
Df	**Residual df**	**Deviance**	**AIC**	**AIC_0**
6	111	-239.036	-221.0	-210.0