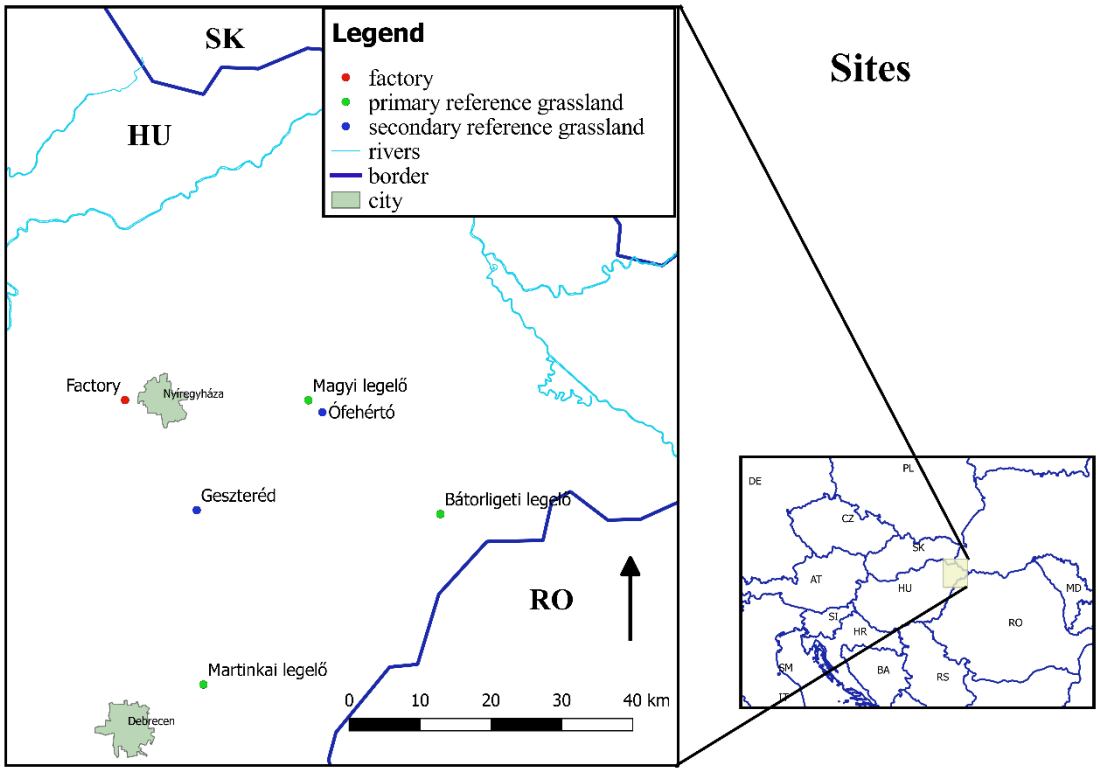
Supporting Information to paper:

Kövendi et al. Three years of vegetation development worth 30 years of secondary succession in urban-industrial grassland restoration *Applied Vegetation Science*

Appendix S1. Map of study sites. Restoration area around the factory in Nyíregyháza; primary reference sites as semi-natural sandy grasslands; secondary reference grasslands as old-fields are presented on this map.



Appendix S2. Basic soil properties of the restoration and reference sites (the former: before the restoration treatments). All measurements were made according to the Hungarian Standards. $K_{(A)}$ is the amount of water that 100 g dried soil is capable of holding (values 25-30 are characteristic for sandy soils). H marks the humus content of studied soil. Missing data are due to insufficient amount of soil samples. Abbreviations: primary closed reference (PCR), primary open reference (POR), secondary closed reference (SCR), secondary open reference (SOR), commercial seed mixture (COM), seeds of a single dominant species (DOM), hay transfer (HAY).

Type	name	date	soil depth cm	pH-H_2O	K_A	EC µS/cm	salt m/m %	H m/m %	$CaCO_3$ m/m %	AL - K_2O mg/kg	AL - P_2O_5 mg/kg	NH_4-N mg/kg	NO_3-N mg/kg
Restoration sites	COM	2013	0-20	7	28	97.83	< 0.02	0.17	0.36	48.48	46.85	3.73	1.62
	COM	2013	20-40	6.97	28.67	86.33	< 0.02	0.04	0.38	46.8	51.08	3.74	0.92
	DOM	2014	0-20	6.48	27.2	108	< 0.02	0.71	.	99.35	78.19	5.40	3.15
	DOM	2014	20-40	6.64	27.6	158	< 0.02	0.65	.	103.43	60.92	5.09	6.02
	HAY1	2014	0-20	7.55	27.2	132	< 0.02	0.39	0.24	34.75	31.03	3.70	0.93
	HAY1	2014	20-40	7.51	27	145	< 0.02	0.52	0.22	40.05	41.16	4.17	1.39
	HAY2	2014	0-20	7.12	27	119.5	<0.02	0.42	0.06	46.32	67.56	3.88	1.14
	HAY2	2014	20-40	7.15	26.8	123.5	<0.02	0.38	0.06	54.53	74.05	4.95	1.58
Primary reference sites	PCR	2015, 2016	0-20	6.83	31	.	.	1.84	4.03	76.97	40.59	12.59	2.37
	PCR	2015, 2016	20-40	7.1	28	.	.	1.02	3.01	59.28	32.43	11.76	1.52
	POR	2015, 2016	0-20	5.84	31	.	.	0.87	0	68.81	40.56	15.10	0.90
	POR	2015, 2016	20-40	5.94	26.5	.	.	0.49	0	54.32	48.21	11.79	0.74
Secondary reference sites	SCR	2017	0-20	6.21	35	.	< 0.02	1.02	0.06	120.16	38.18	8.02	0.95
	SCR	2017	20-40	6.27	32	.	< 0.02	0.69	0.04	101.51	42.65	7.1	0.72
	SOR	2017	0-20	6.29	31.5	.	< 0.02	0.57	0.08	71.50	44.96	7.68	0.47
	SOR	2017	20-40	6.33	30.5	.	< 0.02	0.39	0.06	67.75	46.90	5.28	0.69

Appendix S3. List of plant species, their life form and sociability of species. Social behaviour types (Borhidi 1995) were merged to three categories of sociability of species: 1) natural constituents NC (combined from specialists - S, competitors - C, generalists - G and natural pioneers - NP); 2) disturbance tolerant species DT; and 3) weeds W (including weeds - W, introduced cultivated plants – I, ruderal competitors - RC and adventive competitors - AC). Species missing from the database were classified by the authors, marked by *. Some species could be identified only to higher taxonomic level, these taxa (15) were excluded from the analysis.

	Species	Life form	Borhidi category	Merged categories of sociability of species
1	*Achillea collina*	forb	DT	DT
2	*Achillea pannonica*	forb	DT	DT
3	*Achillea setacea*	forb	G	NC
4	*Achillea sp.*	forb	.	.
5	*Agrostis capillaris*	graminoid	C	NC
6	*Agrostis stolonifera*	graminoid	C	NC
7	*Allium vineale*	forb	W	W
8	*Ambrosia artemisiifolia*	forb	AC	W
9	*Anchusa officinalis*	forb	DT	DT
10	*Anthemis ruthenica*	forb	NP	NC
11	*Anthoxanthum odoratum*	graminoid	C	NC
12	*Apera spica venti*	graminoid	W	W
13	*Arabis glabra*	forb	G	NC
14	*Arenaria serpyllifolia*	forb	NP	NC
15	*Aristolochia clematitis*	forb	W	W
16	*Arrhenatherum elatius*	graminoid	DT	DT
17	*Artemisia vulgaris*	forb	W	W
18	*Asclepias syriaca*	forb	AC	W
19	*Asparagus officinalis*	forb	G	NC
20	*Asperula cynanchica*	forb	G	NC
21	*Berteroa incana*	forb	W	W
22	*Bromus arvensis*	graminoid	W	W
23	*Bromus erectus*	graminoid	C	NC
24	*Bromus hordeaceus*	graminoid	DT	DT
25	*Bromus inermis*	graminoid	C	NC
26	*Bromus tectorum*	graminoid	DT	DT

27	*Buglossoides arvensis*	forb	NP	NC
28	*Calamagrostis epigeios*	graminoid	RC	W
29	*Capsella bursa-pastoris*	forb	W	W
30	*Carex flacca*	graminoid	G	NC
31	*Carex hirta*	graminoid	DT	DT
32	*Carex humilis*	graminoid	C	NC
33	*Carex liparicarpos*	graminoid	G	NC
34	*Carex stenophylla*	graminoid	G	NC
35	*Carex supina*	graminoid	G	NC
36	*Carlina vulgaris*	forb	DT	DT
37	*Centaurea arenaria*	forb	G	NC
38	*Centaurea cyanus*	forb	W	W
39	*Centaurea jacea*	forb	G	NC
40	*Centaurea stoebe subsp. micranthos*	forb	.	DT*
41	*Cerastium semidecandrum*	forb	NP	NC
42	*Chondrilla juncea*	forb	DT	DT
43	*Cichorium intybus*	forb	W	W
44	*Cirsium vulgare*	forb	W	W
45	*Consolida regalis*	forb	W	W
46	*Convolvulus arvensis*	forb	RC	W
47	*Conyza canadensis*	forb	AC	W
48	*Corynephorus canescens*	graminoid	C	NC
49	*Crataegus monogyna*	forb	G	NC
50	*Crataegus sp.*	forb	.	.
51	*Crepis rhoeadifolia*	forb	W	W
52	*Crepis tectorum*	forb	W	W
53	*Cruciata pedemontana*	forb	G	NC
54	*Cynodon dactylon*	graminoid	RC	W
55	*Cynoglossum officinale*	forb	W	W
56	*Dactylis glomerata*	graminoid	DT	DT
57	*Daucus carota*	forb	DT	DT
58	*Dianthus pontederae*	forb	G	NC
59	*Draba nemorosa*	forb	NP	NC
60	*Echium vulgare*	forb	W	W
61	*Elymus hispidus*	graminoid	DT	DT
62	*Elymus repens*	graminoid	RC	W
63	*Elymus sp.*	graminoid	.	.
64	*Equisetum arvense*	horsetail	DT	DT
65	*Equisetum ramosissimum*	horsetail	S	NC
66	*Erophila verna*	forb	NP	NC
67	*Eryngium campestre*	forb	DT	DT
68	*Erysimum diffusum*	forb	NP	NC
69	*Euphorbia cyparissias*	forb	DT	DT
70	*Euphorbia seguierana*	forb	S	NC
71	*Falcaria vulgaris*	forb	W	W

72	*Fallopia convolvulus*	forb	W	W
73	*Festuca pratensis*	graminoid	C	NC
74	*Festuca spp.*	graminoid	C	NC
75	*Festuca vaginata*	graminoid	C	NC
76	*Filago minima*	forb	NP	NC
77	*Filago sp.*	forb	.	.
75	*Fragaria viridis*	forb	G	NC
76	*Galium verum*	forb	DT	DT
77	*Geranium pusillum*	forb	DT	DT
78	*Hieracium pilosella*	forb	DT	DT
79	*Holosteum umbellatum*	forb	W	W
80	*Hypericum perforatum*	forb	DT	DT
81	*Hypochoeris radicata*	forb	G	NC
82	*Jasione montana*	forb	S	NC
83	*Knautia arvensis*	forb	DT	DT
84	*Kochia laniflora*	forb	NP	NC
85	*Koeleria cristata*	graminoid	G	NC
86	*Koeleria grandis*	graminoid	.	NC*
87	*Koeleria sp.*	graminoid	.	.
88	*Lamium amplexicaule*	forb	W	W
89	*Leontodon hispidus*	forb	DT	DT
90	*Leucanthemum vulgare*	forb	G	NC
91	*Linum perenne*	forb	DT	DT
92	*Luzula campestris*	graminoid	DT	DT
93	*Luzula sp.*	graminoid	.	.
94	*Medicago falcata*	forb	DT	DT
95	*Medicago lupulina*	forb	DT	DT
96	*Medicago minima*	forb	G	NC
97	*Medicago sativa*	forb	I	W
98	*Melica transylvanica*	graminoid	G	NC
99	*Mentha sp.*	forb	.	.
100	*Muscari comosum*	forb	DT	DT
101	*Myosotis arvensis*	forb	DT	DT
102	*Myosotis ramosissima*	forb	NP	NC
103	*Myosotis stricta*	forb	NP	NC
104	*Mysotis sp.*	forb	.	.
105	*Ononis spinosa*	forb	DT	DT
106	*Petrorhagia prolifera*	forb	G	NC
107	*Peucedanum oreoselinum*	forb	G	NC
108	*Plantago indica*	forb	NP	NC
109	*Plantago lanceolata*	forb	DT	DT
110	*Poa angustifolia*	graminoid	DT	DT
111	*Poa bulbosa*	graminoid	NP	NC
112	*Polygonum arenarium*	forb	NP	NC
113	*Potentilla arenaria*	forb	G	NC
114	*Potentilla argentea*	forb	DT	DT

115	*Pseudolysimachion spicatum*	forb	G	NC
116	*Rhinanthus serotinus*	forb	.	NC*
117	*Rhinanthus sp.*	forb	.	.
118	*Rumex acetosa*	forb	DT	DT
119	*Rumex acetosella*	forb	NP	NC
120	*Rumex crispus*	forb	W	W
121	*Salsola kali*	forb	DT	DT
122	*Salvia nemorosa*	forb	DT	DT
123	*Salvia sp.*	forb	.	.
124	*Scleranthus annuus*	forb	W	W
125	*Scleranthus polycarpos*	forb	NP	NC
126	*Secale cereale*	graminoid	.	W*
127	*Securigera varia*	forb	DT	DT
128	*Seseli osseum*	forb	G	NC
129	*Setaria sp.*	graminoid	.	.
130	*Silene alba*	forb	W	W
131	*Silene borysthenica*	forb	G	NC
132	*Silene conica*	forb	NP	NC
133	*Silene vulgaris*	forb	DT	DT
134	*Sisymbrium altissimum*	forb	W	W
135	*Spergula pentandra*	forb	NP	NC
136	*Taraxacum officinale (agg.)*	forb	RC	W
137	*Taraxacum sp.*	forb	.	.
138	*Tetragonolobus maritimus subsp. siliquosus*	forb	DT	DT
139	*Teucrium chamaedrys*	forb	G	NC
140	*Thlaspi arvense*	forb	W	W
141	*Thrincia nudicaulis*	forb	G	NC
142	*Thymus glabrescens*	forb	G	NC
143	*Thymus sp.*	forb	.	.
144	*Tragopogon dubius*	forb	DT	DT
145	*Tragopogon floccosus*	forb	S	NC
146	*Trifolium alpestre*	forb	G	NC
147	*Trifolium arvense*	forb	DT	DT
148	*Trifolium campestre*	forb	DT	DT
149	*Trifolium pratense*	forb	DT	DT
150	*Trifolium repens*	forb	DT	DT
151	*Trifolium striatum*	forb	NP	NC
152	*Verbascum phoeniceum*	forb	G	NC
153	*Verbascum sp.*	forb	.	.
154	*Veronica arvensis*	forb	DT	DT
155	*Veronica dillenii*	forb	NP	NC
156	*Veronica prostrata*	forb	G	NC
157	*Veronica verna*	forb	NP	NC
158	*Vicia angustifolia*	forb	DT	DT
159	*Vicia grandiflora*	forb	DT	DT

160	*Vicia hirsuta*	forb	DT	DT
161	*Vicia lathyroides*	forb	NP	NC
162	*Vicia sp.*	forb	.	.
163	*Vicia villosa*	forb	W	W
164	*Viola kitaibeliana*	forb	NP	NC

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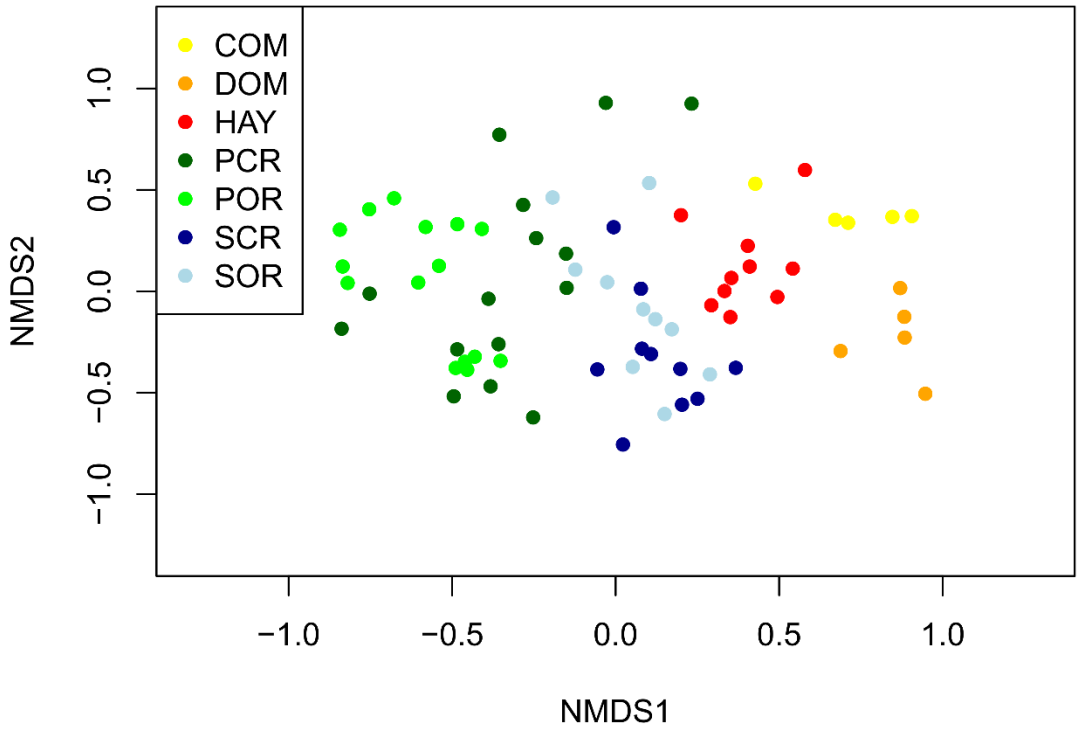
Appendix S4. Results of NMDS analysis based on presence/absence data. Abbreviations: primary closed reference (PCR), primary open reference (POR), secondary closed reference (SCR), secondary open reference (SOR), commercial seed mixture (COM), seeds of a single dominant species (DOM), hay transfer (HAY).



Appendix S5. Results of ANOSIM analysis with species richness. Significant differences are given in bold. Abbreviations: primary closed reference (PCR), primary open reference (POR), secondary closed reference (SCR), secondary open reference (SOR), commercial seed mixture (COM), seeds of a single dominant species (DOM), hay transfer (HAY).

	HAY	COM	DOM	POR	PCR	SOR
	R/p value	*R/p* value	*R/p* value	*R/p* value	*R/p* value	*R/p* value
COM	**0.55/0.001**	.	.	.	.	.
DOM	**0.69/0.001**	**0.81/0.011**	.	.	.	.
POR	**0.87/0.001**	**0.98/0.001**	**0.99/0.002**	.	.	.
PCR	**0.63/0.001**	**0.85/0.001**	**0.83/0.001**	**0.40/0.001**	.	.
SOR	**0.65/0.001**	**0.92/0.001**	**0.94/0.001**	**0.79/0.001**	**0.61/0.001**	.
SCR	**0.59/0.001**	**0.92/0.002**	**0.88/0.001**	**0.80/0.001**	**0.50/0.001**	0.08/0.119