Supplementary Material

Half a century of change in floristics and structure in an urban grassy woodland: implications for conservation management

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Table S1. Constants and coefficients for year in the linear models for richness (rich.) variables. ns = P > 0.05, * = P =/<0.05, ** = P = < 0.01, *** = P < 0.001

Variable	Constant	1974	1984	1994	2001
Species richness	47.23***	-3.16***	2.38***	0.91ns	0.62ns
Native species rich.	30.21***	-2.03***	1.34**	0.61ns	0.11ns
Native richness (%)	65.04***	-	-	-	-
Non-native rich.	14.44***	-1.04***	1.13***	0.22ns	-0.19ns
Annual herb richness	1.32***	-0.67***	0.42***	-0.16ns	-0.03ns
Perennial herb rich.	3.42***	0.27ns	1.48***	-0.39ns	-0.47*
Annual grass richness	7.53***	-	-	-	-
Perennial grass rich.	4.41***	-0.92***	0.36*	0.46**	0.26ns
Sedge and rush rich.	2.31***	-0.71***	0.26ns	0.37**	0.39**
Shrub richness	20.39***	-	-	-	-
Tree richness	1.02***	-0.80***	-0.66***	0.19ns	0.19ns
Geophyte richness	-0.37*	-0.06ns	0.31***	0.08ns	0.06ns

Table S2. Percentage frequency of taxa found at least 5% of plots surveyed from 1974 – 2022, showing the significance of the variation between years. Taxa are ordered from greatest to smallest change in frequent from 1974 to 2022 within each life form class. '#' indicates change from 2022/1984 instead of 2022/1974 as taxon was not recorded in 1974. A = non-native taxon, B = both non-native and native species in taxon. Bold values are the highest frequencies for a taxon. Underlined values exhibit a continuous increase or decrease across the years. Significance of change in time was determined by Chi-squared analysis with * = p <0.05, ** = p < 0.01, ***= p < 0.001, ns = not significant.

Taxon	1974	1984	1994	2000	2022	Significance of change	Average frequency	Change 2022/ 1974
Annual herbs								
[A]*Cirsium vulgare*	0.0	5.8	2.9	1.4	**21.7**	***	6.4	3.8[#]
[A]*Petrorhagia nanteuilii*	2.9	26.1	26.1	**47.8**	29.0	***	26.4	10
[A]*Sonchus* spp.	5.8	**37.7**	4.3	4.3	18.8	***	14.2	3.3
[A]*Centaurium erythraea*	7.2	18.8	33.3	17.4	**46.4**	***	24.6	6.4
[A]*Vicia* spp.	11.6	**17.4**	13.0	4.3	10.1	ns	11.3	0.9
Senecio spp.	37.7	53.6	33.3	42.0	**58.0**	*	44.9	1.5
Perennial herbs								
[A]*Lysimachia arvensis*	2.9	**13.0**	1.4	1.4	11.6	**	6.1	4
[A]*Medicago* spp.	2.9	**21.7**	2.9	0.0	0.0	***	5.5	0
[A]*Trifolium* spp.	4.3	2.9	13.0	**14.5**	11.6	ns	9.3	2.7
Leptorhynchos nitidulus	7.2	10.1	4.3	**17.4**	13.0	ns	10.4	1.8
[B]*Linum* spp.	13.0	**36.2**	17.4	11.6	23.2	**	20.3	1.8
Ranunculus lappaceus	**11.6**	10.1	2.9	10.1	8.7	ns	8.7	0.8
Oxalis perennans	44.9	40.6	17.4	14.5	**47.8**	***	33.0	1.1
Wahlenbergia spp.	11.6	**15.9**	4.3	11.6	11.6	ns	11.0	1
[A]*Hypochaeris radicata*	27.5	**60.9**	31.9	15.9	23.2	***	31.9	0.8
Hackelia suaveolens	0.0	17.4	13.0	11.6	**20.3**	***	12.5	1.2[#]
Chrysocephalum apiculatum	7.2	11.6	**20.3**	11.6	2.9	*	10.7	0.4
[A]*Urospermum dalechampii*	53.6	**60.9**	59.4	53.6	47.8	ns	55.1	0.9
Gonocarpus tetragynus	18.8	18.8	14.5	**23.2**	11.6	ns	17.4	0.6
[A]*Sanguisorba minor*	11.6	**23.2**	20.3	13.0	4.3	*	14.5	0.4
[A]*Plantago lanceolata*	78.3	79.7	**87.0**	85.5	63.8	**	78.8	0.8
Plantago varia	**58.0**	33.3	20.3	30.4	27.5	***	33.9	0.5
Goodenia lanata	**11.6**	**11.6**	4.3	2.9	4.3	ns	7.0	0.4
Geranium potentilloides	24.6	**33.3**	14.5	15.9	10.1	**	19.7	0.4
Acaena echinata	<u>**73.9**</u>	<u>63.8</u>	<u>59.4</u>	<u>58.0</u>	<u>40.6</u>	**	59.1	0.5

Leptorhynchos squamatus	**29.0**	23.2	23.2	18.8	5.8	*	20.0	0.2
Annual grasses								
[A]*Aira* spp.	31.9	**55.1**	43.5	53.6	52.2	*	47.2	1.6
[A]*Briza* spp.	30.4	**34.8**	14.5	29.0	33.3	ns	28.4	1.1
[A]*Vulpia* spp.	14.5	**20.3**	18.8	11.6	15.9	ns	16.2	1.1
Perennial grasses								
Microlaena stipoides	1.4	27.5	5.8	18.8	**39.1**	***	18.6	27
[A]*Dactylis glomerata*	13.0	14.5	**31.9**	23.2	27.5	*	22.0	2.1
[A]*Holcus lanatus*	**8.7**	2.9	5.8	5.8	**8.7**	ns	6.4	1
Anthosachne scabra	53.6	**89.9**	82.6	85.5	71.0	***	76.5	1.3
Austrostipa spp.	73.9	94.2	94.2	**95.7**	91.3	***	89.9	1.2
Deyeuxia quadriseta	0.0	21.7	**31.9**	17.4	18.8	***	18.0	0.9[#]
Poa rodwayi	88.4	85.5	85.5	89.9	**94.2**	ns	88.7	1.1
Rytodosperma spp.	94.2	84.1	94.2	**98.6**	81.2	**	90.4	0.9
Themeda triandra	91.3	94.2	92.8	**95.7**	78.3	**	90.4	0.9
Dichelachne spp.	**76.8**	71.0	75.4	63.8	63.8	***	70.1	0.8
Lachnagrostis aemula	58.0	62.3	**71.0**	42.0	33.3	***	53.3	0.6
Pentapogon quadrifidus	14.5	**21.7**	10.1	10.1	1.4	**	11.6	0.1
[A]*Lolium perenne*	**17.4**	10.1	10.1	7.2	4.3	ns	9.9	0.3
Sedges and rushes								
Schoenus apogon	1.4	**47.8**	44.9	31.9	29.0	***	31.0	20
Lomandra longifolia	18.8	24.6	30.4	27.5	**31.9**	ns	26.7	1.7
Dianella spp.	23.2	34.8	44.9	**52.2**	33.3	**	37.7	1.4
Lepidosperma laterale	21.7	26.1	34.8	**37.7**	24.6	ns	29.0	1.1
Lepidosperma gunnii	24.6	29.0	**44.9**	34.8	24.6	*	31.6	1
Carex breviculmis	68.1	71.0	62.3	**76.8**	33.3	***	62.3	0.5
Shrubs								
Styphelia humifusa	10.1	14.5	23.2	20.3	**33.3**	***	20.3	3.3
Olearia ramulosa	8.7	14.5	**23.2**	**23.2**	17.4	ns	17.4	2
Lissanthe strigosa	8.7	14.5	**18.8**	15.9	15.9	ns	14.8	1.8
Bossiaea prostrata	53.6	46.4	59.4	**72.5**	52.2	*	56.8	1
[A]*Rosa rubiginosa*	10.1	13.0	**15.9**	**15.9**	7.2	ns	12.5	0.7
[A]*Acacia pycnantha*	5.8	8.7	8.7	**10.1**	1.4	ns	7.0	0.3
Pimelea humilis	**44.9**	40.6	39.1	34.8	34.8	ns	38.8	0.8
Hibbertia hirsuta	**11.6**	10.1	7.2	7.2	7.2	ns	8.7	0.6

[A]*Chrysanthemoides monilifera*	**15.9**	13.0	7.2	4.3	2.9	*	8.7	0.2
Trees								
Eucalyptus pulchella	2.9	1.4	7.2	5.8	**14.5**	*	6.4	5
Allocasuarina verticillata	8.7	26.1	47.8	47.8	**72.5**	***	40.6	8.3
Eucalyptus globulus	1.4	4.3	7.2	7.2	**10.1**	ns	6.1	7
Acacia mearnsii	11.6	8.7	14.5	11.6	**39.1**	***	17.1	3.4
Eucalyptus viminalis	14.5	13.0	39.1	30.4	**39.1**	***	27.2	2.7
Dodonaea viscosa	7.2	5.8	5.8	7.2	**17.4**	ns	8.7	2.4
Bursaria spinosa	37.7	31.9	47.8	**60.9**	50.7	**	45.8	1.3
Geophytes								
Thelymitra spp.	1.4	**17.4**	15.9	11.6	2.9	**	9.9	2
Arthropodium milleflorum	30.4	24.6	30.4	**39.1**	26.1	ns	30.1	0.9
[A]*Romulea longifolia*	36.2	**59.4**	30.4	14.5	10.1	***	30.1	0.3

Table S3. Significance of relationships between disturbance, climatic and landscape variables, and the most frequent taxa found on Queens Domain.

The significance of the relationship was determined by; ANOVA or Chi-square and is represented by * = p <0.05 , ** = p < 0.01, *** = p < 0.001 , ns = not significant (**Error! Reference source not found.**). The impact of the relationship on taxon frequency is represented by + = positive effect on taxon occurrence related to an increase in the factor; - = negative effect on taxon occurrence related to an increase in the factor. A = non-native taxon, B = both non-native and native species in taxon

Taxon	Management condition[1]	Mown status[2]	No. of fires in the decade previous to surveying[1]	Time since fire[1]	Burnt status (2 years prior to surveying)[2]	Summer radiation[3]	Equinox radiation[3]	Winter radiation[3]	Slope (°)[3]	Aspect[3]	Altitude (m)[3]
Annual herbs											
[A]*Centaurium erythraea*	ns	ns	ns	ns	ns	***-	***-	***-	ns	***+	***+
[A]*Cirsium vulgare*	ns	**-	***+	ns	*+	*+	**+	**+	ns	*-	**-
[A]*Petrorhagia nanteuilii*	ns	***-	***+	***-	***+	*+	***+	***+	ns	***-	ns
Senecio spp.	ns	***-	**+	***-	**+	*-	**-	**-	ns	ns	**+
[A]*Sonchus* spp.	ns	***-	**+	*-	***+	ns	ns	ns	ns	***-	ns
[A]*Vicia* spp.	ns	**+	*-	**+	ns	ns	*-	ns	**-	***+	ns
Perennial herbs											
Acaena echinata	ns	ns	ns	*-	ns	ns	ns	ns	ns	***+	**+
Chrysocephalum apiculatum	ns	ns	*-	ns	*-	ns	**+	**+	ns	ns	***-
Geranium potentilloides	ns	ns	ns	ns	ns	ns	ns	ns	ns	*+	*+
Gonocarpus tetragynus	ns	ns	ns	ns	ns	***-	***-	***-	**+	***+	**+
Goodenia lanata	ns	ns	ns	**-	*+	ns	ns	ns	ns	ns	ns
Hackelia suaveolens	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns
[A]*Hypochaeris radicata*	ns	***+	**-	**+	ns	ns	ns	ns	ns	**+	ns

Leptorhynchos nitidulus	ns	ns	ns	*-	ns		ns	ns	ns	ns	ns
Leptorhynchos squamatus	ns	***+	***-	ns	*-	ns	*-	***-	**-	***+	ns
[B]*Linum* spp.	ns	*-	*+	ns	**+	ns	*-	*-	ns	***-	ns
[A]*Lysimachia arvensis*	*3	ns	***+	ns	*+	ns	ns	ns	ns	ns	ns
[A]*Medicago* spp.	ns	***+	**-	*+	ns	*+	ns	ns	**-	*+	ns
Oxalis perennans	ns	ns	ns	ns	ns	*-	**-	*-	ns	ns	ns
[A]*Plantago lanceolata*	ns	***+	***-	**+	ns	ns	*-	*-	*-	***+	ns
Plantago varia	ns	ns	*-	ns	**-	ns	*-	*-	ns	***+	ns
Ranunculus lappaceus	ns	ns	ns	ns	ns	***-	***-	***-	***+	***+	**+
[A]*Sanguisorba minor*	ns	ns	ns	ns	ns	ns	ns	ns	ns	**-	ns
[A]*Trifolium* spp.	*1	***+	ns	*+	ns	*+	ns	*-	***-	***+	ns
[A]*Urospermum dalechampii*	ns	*+	*-	*+	ns	***+	***+	***+	ns	ns	***-
Wahlenbergia spp.	ns	ns	ns	ns	ns	**-	*-	*-	ns	ns	**+
Annual grasses											
[A]*Aira* spp.	ns	***+	ns	ns	ns	ns	ns	*-	***-	*+	ns
[A]*Briza* spp.	ns	ns	*+	ns	ns	ns	***-	***-	ns	*+	***+
[A]*Vulpia* spp.	ns	***+	ns	ns	*-	*+	*-	***-	***-	***+	ns
Perennial grasses											
Anthosachne scabra	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns
Austrostipa spp.	*3	ns	*+	ns	ns	*-	ns	ns	*+	ns	**+
[A]*Dactylis glomerata*	***3	***+	ns	***+	ns	ns	*-	ns	**-	ns	ns
Deyeuxia quadriseta	ns	**-	ns	ns	ns	***-	***-	***-	**+	ns	***+
Dichelachne spp.	ns	*-	**+	***-	**+	ns	ns	ns	ns	ns	***+
[A]*Holcus lanatus*	ns	ns	ns	***+	ns	**+	ns	ns	***-	**+	*-
Lachnagrostis aemula	*1	ns	**-	*-	ns	ns	ns	ns	ns	***+	*+
[A]*Lolium perenne*	ns	***+	***-	***+	**-	ns	*-	**-	**-	***+	*-
Microlaena stipoides	ns	*-	***+	ns	**+	ns	**-	***-	ns	ns	*+

Species											
Pentapogon quadrifidus	ns	**+	ns	ns	ns	ns	ns	ns	ns	ns	ns
Poa rodwayi	ns	ns	ns	ns	*-	ns	ns	ns	ns	***+	ns
Rytodosperma spp.	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns
Themeda triandra	ns	*+	ns	ns	ns	ns	ns	ns	ns	ns	ns
Sedges and rushes											
Carex breviculmis	ns	ns	***-	ns	ns	ns	ns	ns	ns	**+	
Dianella spp.	ns	***-	ns	ns	ns	***-	ns	ns	***+	ns	
Lepidosperma gunnii	ns	ns	ns	*-	ns	ns	ns	ns	ns	ns	**+
Lepidosperma laterale	ns	***-	ns	**-	ns	**-	*+	***+	***+	***-	*-
Lomandra longifolia	ns	***-	ns	ns	ns	***-	***-	***-	***+	ns	ns
Schoenus apogon	ns	ns	ns	*+	ns	ns	***-	***-	ns	***+	*+
Shrubs											
[A]*Acacia pycnantha*	ns	ns	ns	*-	ns	ns	***+	**+	ns	*-	ns
Bossiaea prostrata	ns	ns	ns	**-	ns	ns	ns	*-	ns	*+	***+
[A]*Chrysanthemoides monilifera*	ns	*-	ns	ns	ns	***-	ns	ns	**+	ns	ns
Hibbertia hirsuta	ns	ns	ns	ns	ns	ns	***-	***-	ns	***+	***+
Lissanthe strigosa	ns	ns	ns	ns	ns	*-	***-	***-	ns	***+	**+
Olearia ramulosa	ns	***-	ns	ns	ns	***-	***-	***-	***+	**+	***+
Pimelea humilis	ns	ns	ns	ns	ns	***-	ns	***-	**+	ns	ns
[A]*Rosa rubiginosa*	ns	ns	**-	*+	ns	*-	***-	***-	ns	ns	Rosa
Styphelia humifusa	ns	ns	*+	ns	ns	***-	***-	***-	**+	ns	***+
Trees											
Acacia mearnsii	ns	**-	**+	ns	ns	ns	ns	ns	ns	ns	ns
Allocasuarina verticillata	***3	***-	***+	***-	***+	ns	**+	**+	***+	***-	*+
Bursaria spinosa	ns	**-	ns	ns	ns	***-	ns	ns	***+	*+	ns
Dodonaea viscosa	ns	**-	**+	*-	ns	ns	ns	ns	ns	ns	ns
Eucalyptus globulus	ns	ns	ns	ns	ns	***-	***-	***-	ns	***+	ns
Eucalyptus pulchella	ns	*-	ns	ns	ns	**-	***-	***-	ns	***+	*+
Eucalyptus viminalis	ns	ns	ns	ns	ns	ns	ns	ns	ns	**+	**+

	Geophytes										
Arthropodium milleflorum	ns	ns	ns	ns	ns	***-	***-	***-	*+	***+	***+
[A]*Romulea longifolia*	ns	***+	ns	ns	ns	***+	ns	ns	***-	ns	ns
Thelymitra spp.	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns