Supplementary Table S1. Water depths from every control and treatment plot in Long Point (LP) and Rondeau Provincial Park (RPP). Control (n = 39) and treatment (n = 41) plots were paired by August 2016 water depths across the range occupied by invasive *P. australis* at sufficient density to warrant herbicide application (> 20 stem m-2). Control plot RCP16 was mistakenly treated and thus was re-coded. Further, control plot RPC41 became inaccessible in 2018, reducing the number of control plots to 38.

| SiteID | Location | Treatment | Water Depth (cm) | | |
| --- | --- | --- | --- | --- | --- |
|  |  |  | 2016 | 2017 | 2018 |
| LPC25 | LP | Control | 10 | 38 | 27 |
| LPC24 | LP | Control | 13 | 36 | 44 |
| LPC39 | LP | Control | 13 | 28 | 20 |
| RPC04 | RPP | Control | 13 | 29 | 37 |
| RPC15 | RPP | Control | 13 | 14.5 | 34 |
| LPC26 | LP | Control | 14 | 39 | 52 |
| LPC27 | LP | Control | 17 | 42 | 50 |
| RPC14 | RPP | Control | 17 | 36 | 56 |
| LPC33 | LP | Control | 18 | 32 | 34 |
| LPC37 | LP | Control | 18 | 46 | 40 |
| LPC32 | LP | Control | 19 | 40 | 46 |
| LPC31 | LP | Control | 20 | 46 | 36 |
| RPC05 | RPP | Control | 20 | 37 | 50 |
| RPC08 | RPP | Control | 20 | 45 | 46 |
| RPC18 | RPP | Control | 20 | 39 | 53 |
| LPC21 | LP | Control | 21 | 52 | 60 |
| RPC12 | RPP | Control | 21 | 42 | 50 |
| LPC28 | LP | Control | 23 | 44 | 54 |
| RPC11 | RPP | Control | 23 | 46 | 43 |
| RPC20 | RPP | Control | 23 | 40 | 43 |
| LPC23 | LP | Control | 24 | 59 | 52 |
| LPC36 | LP | Control | 24 | 45 | 45 |
| RPC10 | RPP | Control | 24 | 41 | 48.5 |
| RPC07 | RPP | Control | 25 | 46 | 53.5 |
| LPC30 | LP | Control | 26 | 49 | 41 |
| LPC35 | LP | Control | 28 | 54 | 43 |
| LPC40 | LP | Control | 28 | 33 | 35 |
| LPC29 | LP | Control | 29 | 53 | 61 |
| RPC03 | RPP | Control | 32 | 49 | 60.5 |
| RPC06 | RPP | Control | 32 | 42 | 62 |
| RPC09 | RPP | Control | 32 | 37 | 53 |
| RPC17 | RPP | Control | 32 | 49.5 | 61 |
| LPC38 | LP | Control | 34 | 53 | 35 |
| RPC13 | RPP | Control | 34 | 42 | 42 |
| LPC22 | LP | Control | 36 | 48 | 63 |
| LPC34 | LP | Control | 38 | 61 | 44 |
| RPC02 | RPP | Control | 42 | 53.5 | 54 |
| RPC19 | RPP | Control | 44 | 48 | 55 |
| RPC41 | RPP | Control | 48 | 79 | NC |
| LPT13 | LP | Treatment | 13 | 43 | 39 |
| LPT41 | LP | Treatment | 13 | 43 | 32 |
| RPT28 | RPP | Treatment | 16 | 35 | 39 |
| RPT34 | RPP | Treatment | 16 | 28.5 | 45 |
| LPT15 | LP | Treatment | 17 | 44.5 | 35 |
| RPT32 | RPP | Treatment | 17 | 39 | 34 |
| LPT12 | LP | Treatment | 18 | 46.5 | 39 |
| LPT19 | LP | Treatment | 18 | 52 | 62 |
| RPT22 | RPP | Treatment | 18 | 52 | 53 |
| RPT37 | RPP | Treatment | 18 | 41 | 47 |
| LPT16 | LP | Treatment | 19 | 42 | 31 |
| RPT31 | RPP | Treatment | 20 | 38 | 45 |
| LPT08 | LP | Treatment | 21 | 45 | 40 |
| LPT18 | LP | Treatment | 21 | 55 | 40 |
| RPT25 | RPP | Treatment | 21 | 45 | 53 |
| RPT39 | RPP | Treatment | 21 | 42.5 | 45 |
| LPT07 | LP | Treatment | 22 | 43.5 | 44 |
| LPT10 | LP | Treatment | 22 | 60 | 41 |
| LPT14 | LP | Treatment | 22 | 43.5 | 43 |
| RPT30 | RPP | Treatment | 22 | 46 | 58 |
| LPT09 | LP | Treatment | 24 | 49 | 34 |
| LPT20 | LP | Treatment | 24 | 43 | 38 |
| LPT42 | LP | Treatment | 24 | 55 | 47 |
| RPT40 | RPP | Treatment | 24 | 44 | 46 |
| LPT43 | LP | Treatment | 25 | 50 | 39 |
| RPT24 | RPP | Treatment | 26 | 49 | 58 |
| LPT11 | LP | Treatment | 28 | 58 | 44 |
| LPT06 | LP | Treatment | 30 | 43 | 43 |
| LPT05 | LP | Treatment | 31 | 65 | 43 |
| RPT23 | RPP | Treatment | 31 | 55 | 61 |
| RPT33 | RPP | Treatment | 31 | 46 | 57 |
| RPT29 | RPP | Treatment | 32 | 45 | 40 |
| LPT44 | LP | Treatment | 33 | 61.5 | 29 |
| RPT21 | RPP | Treatment | 33 | 62 | 64 |
| RPT38 | RPP | Treatment | 33 | 48 | 61 |
| RPC16 | RPP | Treatment | 41 | 25 | 48 |
| LPT17 | LP | Treatment | 42 | 62 | 5 |
| RPT27 | RPP | Treatment | 44 | 57.5 | 65 |
| RPT36 | RPP | Treatment | 45 | 44 | 92 |
| RPT35 | RPP | Treatment | 46 | 48 | 61 |
| RPT26 | RPP | Treatment | 47 | 65.5 | 86 |

Supplementary Table S2. Two-way ANOVA results, type III SS with year (2016, 2017, 2018) and treatment as fixed factors. The percent of PAR penetrating the canopy was log10 transformed. There was a significant interaction for every measured variable.

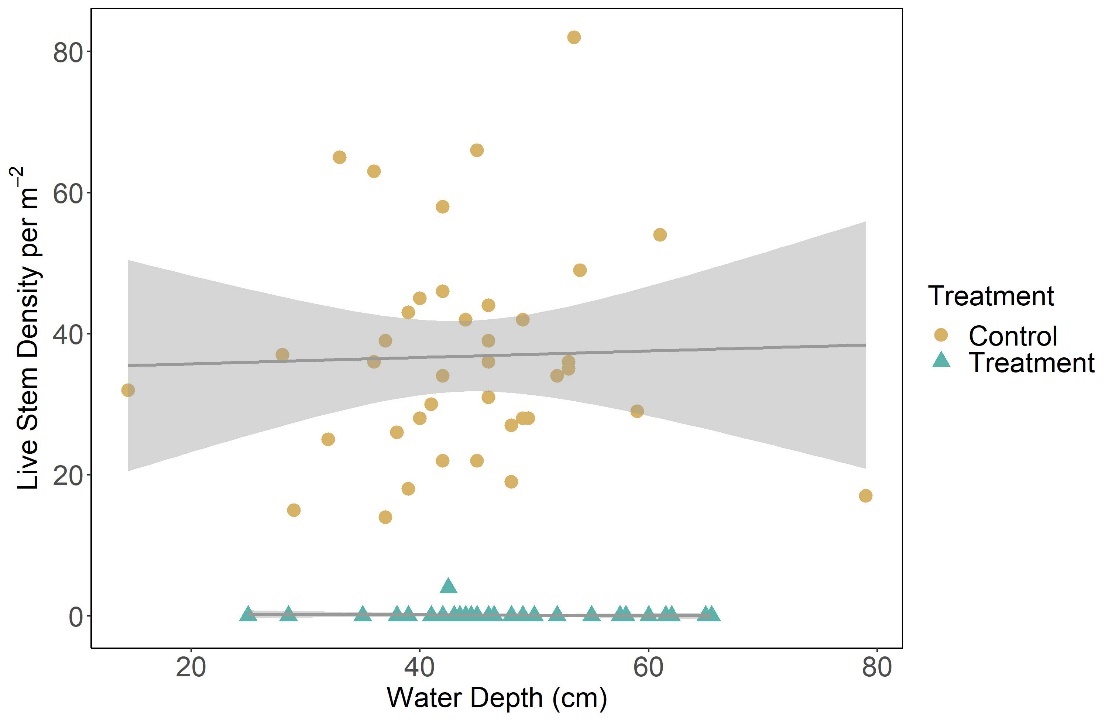
|  | Live stems (per m2) | | | Total stems (per m2) | | | Canopy Height (cm) | | | PAR penetration (% incident light) | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | df | F | p | df | F | p | df | F | p | df | F | p |
| Year | 2 | 3.62 | 0.03 | 2 | 0.45 | 0.64 | 2 | 0.27 | 0.77 | 2 | 1.70 | 0.19 |
| Treatment | 1 | 0.74 | 0.39 | 1 | 0.31 | 0.58 | 1 | 0.05 | 0.84 | 1 | 1.24 | 0.27 |
| Year x Treatment | 2 | 60.61 | < 0.001 | 2 | 19.29 | < 0.001 | 2 | 138.25 | < 0.001 | 2 | 51.21 | < 0.001 |
| Error | 233 |  |  | 233 |  |  | 233 |  |  | 233 |  |  |

Supplementary Table S3. The average, standard deviation, minimum and maximum live invasive *P. australis* stem density, total (live & dead) stem density, canopy height and photosynthetically active radiation (PAR) penetration in both treatments over the three years; pre-treatment (2016) and two years post-treatment (2017 and 2018).

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  | Live Stems (per m-2) | | | Total Stems (per m-2) | | | Canopy Height (cm) | | | PAR penetration  (% incident light) | | |
|  |  | Avg. (std.) | Min. | Max. | Avg. (std.) | Min. | Max. | Avg. (std.) | Min. | Max. | Avg. (std.) | Min. | Max. |
| Control | 2016 | 34.7 (13.1) | 13 | 68 | 102 (46.2) | 20 | 193 | 362 (61.1) | 237 | 526 | 4.1 (4.3) | 0.4 | 17.0 |
|  | 2017 | 36.8 (15.3) | 14 | 82 | 112 (49.0) | 15 | 229 | 372 (50.4) | 270 | 470 | 6.0 (7.5) | 0.6 | 33.8 |
|  | 2018 | 29.8 (12.3) | 10 | 66 | 105 (49.5) | 37 | 200 | 367 (47.4) | 260 | 460 | 6.0 (8.6) | 0.7 | 50.6 |
| Treatment | 2016 | 37.0 (15.8) | 11 | 81 | 108 (47.5) | 23 | 229 | 358 (41.5) | 285 | 470 | 4.7 (3.9) | 0.3 | 13.6 |
|  | 2017 | 0.1 (0.6) | 0 | 4 | 50.2 (52.3) | 0 | 120 | 40.7 (65.5) | 0 | 207 | 56.3 (27.4) | 11.0 | 99.6 |
|  | 2018 | 1.5 (5.6) | 0 | 28 | 24.3 (30.5) | 0 | 198 | 121 (102) | 0 | 275 | 61.1 (26.6) | 9.0 | 99.4 |

Supplementary Table S4. Two-way ANOVA results, type III SS, comparing total stem density, live stem density, and photosynthetically active radiation (PAR) penetration in 2017 and 2018 between Long Point and Rondeau Provincial Park. Secondary treatment (e.g. rolling and mowing) occurred in Long Point but not Rondeau. The percent of PAR penetrating the canopy was log10 transformed.

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Total stems (per m-2) | | | Live stems (per m-2) | | | PAR penetration (% incident light) | | |
|  | df | F | P | df | F | P | df | F | P |
| Year | 1 | 1.26 | 0.27 | 1 | 0.88 | 0.35 | 1 | 2.48 | 0.12 |
| Location | 1 | 51.91 | < 0.001 | 1 | 0.02 | 0.88 | 1 | 7.09 | 0.01 |
| Year x Location | 1 | 4.29 | 0.04 | 1 | 0.06 | 0.82 | 1 | 8.46 | 0.01 |
| Error | 78 |  |  | 78 |  |  | 78 |  |  |



Supplementary Figure S1. Glyphosate-based herbicide was effective at suppressing invasive *P. australis* along the entire water depth gradient. The number of live invasive *P. australis* stems (per m2) in the control plots one year after treatment occurred were significantly higher than in the herbicide-treated plots and there was no difference in live invasive *P. australis* stem density along the water depth gradient (cm). Shaded area represents 95% confidence intervals. Made with ggplot2 (Whickham 2016).

Supplementary Table S5. A significant difference in vegetation community composition arose between treatment and control plots after the herbicide was applied (i.e. the interaction term was significant). Thus, we conclude that treatment had an effect on the vegetation community structure. Results represent the average test statistics taken from 500 runs of a perMANOVA performed using stratified random sampling with replacement. Values in parentheses are the standard deviation.

|  |  |  |  |
| --- | --- | --- | --- |
|  | df | Average Pseudo-F | Average p-value |
| Treatment | 1 | 170.20 (± 14.90) | 0.001 (< 0.001) |
| Year | 2 | 61.51 (± 6.13) | 0.001 (< 0.001) |
| Treatment x year | 2 | 44.77 (± 5.33) | 0.001 (< 0.001) |
| Residual | 222 |  |  |

Supplementary Table S6. The correlation coefficients (r) and coefficient of determination (r2) of all the vectors in the 3D NMDS ordination for the control, treatment, and reference condition plots. Vectors with an r2 ≥ 0.150 are considered reasonably correlated with points and were included in Figure 4.

|  |  | Axis 1 | | Axis 2 | | Axis 3 | |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Full name | Taxonomic Authority | r | r2 | r | r2 | r | r2 |
| Water depth |  | -0.271 | 0.073 | 0.215 | 0.046 | 0.144 | 0.021 |
| Open water |  | -0.685 | 0.469 | -0.507 | 0.257 | -0.141 | 0.020 |
| Litter |  | -0.012 | 0.000 | 0.055 | 0.003 | -0.549 | 0.301 |
| Standing dead |  | -0.438 | 0.192 | -0.264 | 0.070 | 0.529 | 0.280 |
| *Calamagrostis canadensis* | (Michx.) P. Beauv. | -0.145 | 0.021 | -0.330 | 0.109 | -0.249 | 0.062 |
| *Campanula aparinoides* | Pursh | -0.037 | 0.001 | -0.105 | 0.011 | -0.042 | 0.002 |
| *Calystegia sepium* | (L.) R. Br. | -0.070 | 0.005 | -0.090 | 0.008 | 0.055 | 0.003 |
| *Carex aquatilis* | Wahlenb. | -0.050 | 0.003 | -0.169 | 0.029 | -0.220 | 0.048 |
| *Carex buxbaumii* | Wahlenb. | -0.149 | 0.022 | -0.157 | 0.025 | -0.298 | 0.089 |
| *Carex crawei* | Dewey | -0.102 | 0.010 | -0.128 | 0.016 | -0.058 | 0.003 |
| *Carex comosa* | Boott | 0.063 | 0.004 | 0.014 | 0.000 | -0.010 | 0.000 |
| *Carex lacustris* | Willd. | -0.036 | 0.001 | 0.026 | 0.001 | 0.206 | 0.043 |
| *Carex lasiocarpa* | Ehrh. | 0.017 | 0.000 | -0.119 | 0.014 | -0.134 | 0.018 |
| *Carex sartwellii* | Olney | -0.055 | 0.003 | -0.054 | 0.003 | -0.291 | 0.085 |
| *Carex* spp. | L. | 0.055 | 0.003 | -0.004 | 0.000 | -0.045 | 0.002 |
| *Cladium mariscoides* | (Muhl.) Torr. | -0.130 | 0.017 | -0.109 | 0.012 | -0.392 | 0.154 |
| *Cornus sericea* spp. *sericea* | L. | -0.146 | 0.021 | -0.172 | 0.030 | 0.005 | 0.000 |
| *Decodon verticillatus* | (L.) Elliott | -0.010 | 0.000 | 0.058 | 0.003 | -0.009 | 0.000 |
| *Dulichium arundinaceum* | (L.) Britton | 0.091 | 0.008 | -0.006 | 0.000 | 0.007 | 0.000 |
| *Eleocharis palustris* | (L.) Roem. & Schult. | 0.173 | 0.030 | -0.023 | 0.001 | -0.017 | 0.000 |
| *Elodea canadensis* | Michx. | 0.041 | 0.002 | -0.056 | 0.003 | -0.010 | 0.000 |
| *Eleocharis* spp. | R. Br. | -0.056 | 0.003 | -0.058 | 0.003 | -0.104 | 0.011 |
| *Equisetum fluviatile* | L. | -0.071 | 0.005 | 0.183 | 0.034 | 0.017 | 0.000 |
| *Fontinalis* sp. | Hedw. | -0.103 | 0.011 | -0.028 | 0.001 | -0.016 | 0.000 |
| *Galium aparine* | L. | 0.079 | 0.006 | -0.013 | 0.000 | -0.001 | 0.000 |
| *Hydrocharis morsus-ranae* | L. | -0.384 | 0.147 | 0.866 | 0.749 | -0.056 | 0.003 |
| *Hypericum kalmianum* | L. | -0.128 | 0.016 | -0.174 | 0.030 | -0.081 | 0.007 |
| *Iris versicolor* | L. | -0.101 | 0.010 | -0.127 | 0.016 | -0.103 | 0.011 |
| *Juncus balticus* | Willd. | -0.059 | 0.003 | -0.054 | 0.003 | -0.226 | 0.051 |
| *Lemna minor* | L. | -0.042 | 0.002 | 0.137 | 0.019 | -0.073 | 0.005 |
| *Lysimachia thyrsiflora* | L. | -0.145 | 0.021 | -0.156 | 0.024 | -0.156 | 0.024 |
| *Achillea millefolium* | L. | -0.132 | 0.017 | -0.016 | 0.000 | -0.096 | 0.009 |
| *Myriophyllum sibiricum* | Kom. | -0.082 | 0.007 | 0.022 | 0.000 | -0.046 | 0.002 |
| *Myriophyllum*spp. | L. | -0.088 | 0.008 | 0.013 | 0.000 | 0.136 | 0.019 |
| *Nuphar variegata* | Durand | 0.029 | 0.001 | 0.037 | 0.001 | -0.094 | 0.009 |
| *Nymphaea odorata* | Aiton | 0.006 | 0.000 | 0.148 | 0.022 | -0.031 | 0.001 |
| *Phragmites australis* ssp*. australis* | (Trin.) ex | 0.968 | 0.937 | -0.078 | 0.006 | 0.080 | 0.006 |
| *Persicaria amphibia* | (L.) Delarbre | 0.102 | 0.011 | -0.017 | 0.000 | 0.071 | 0.005 |
| *Polygonum*spp. | (L.) Mill. | -0.133 | 0.018 | -0.071 | 0.005 | 0.198 | 0.039 |
| *Potamogeton* spp. | L. | -0.083 | 0.007 | -0.067 | 0.004 | -0.058 | 0.003 |
| *Sagittaria* spp. | L. | 0.054 | 0.003 | -0.028 | 0.001 | 0.026 | 0.001 |
| *Sagittaria latifolia* | Willd. | -0.068 | 0.005 | 0.112 | 0.013 | -0.057 | 0.003 |
| *Schoenoplectus acutus* var. *acutus* | (Muhl. Ex Bigelow) A. Love & D. Love | -0.028 | 0.001 | -0.079 | 0.006 | -0.007 | 0.000 |
| *Bolboschoenus fluviatilis* | (Torr.) Sojak | 0.074 | 0.006 | 0.004 | 0.000 | -0.047 | 0.002 |
| *Schoenoplectus tabernaemontani* | (C.C. Gmel.) Palla | 0.046 | 0.002 | 0.010 | 0.000 | -0.004 | 0.000 |
| *Sparganium eurycarpum* | Engelm. | -0.072 | 0.005 | 0.209 | 0.044 | 0.026 | 0.001 |
| *Sparganium* spp. | L. | -0.075 | 0.006 | 0.005 | 0.000 | -0.052 | 0.003 |
| *Spirodela polyrrhiza* | (L.) Schleid. | 0.065 | 0.004 | 0.010 | 0.000 | 0.005 | 0.000 |
| *Solanum* spp. | L. | 0.046 | 0.002 | 0.030 | 0.001 | -0.027 | 0.001 |
| *Solidago* spp. | L. | -0.113 | 0.013 | -0.143 | 0.020 | -0.051 | 0.003 |
| *Typha* spp. | L. | -0.313 | 0.098 | 0.048 | 0.002 | 0.595 | 0.354 |
| *Typha angustifolia* | L. | 0.220 | 0.048 | -0.016 | 0.000 | -0.125 | 0.016 |
| *Typha* x *glauca* | Godr. (pro sp.) | 0.180 | 0.032 | 0.065 | 0.004 | -0.231 | 0.053 |
| *Typha latifolia* | L. | 0.060 | 0.004 | -0.022 | 0.001 | -0.049 | 0.002 |
| *Utricularia intermedia* | Hayne | -0.111 | 0.012 | 0.004 | 0.000 | -0.222 | 0.049 |
| *Utricularia vulgaris* | L. | -0.157 | 0.025 | -0.052 | 0.003 | -0.045 | 0.002 |
| Unknown |  | -0.093 | 0.009 | -0.069 | 0.005 | -0.083 | 0.007 |
| *Zizania palustris* | L. | -0.085 | 0.007 | -0.115 | 0.013 | -0.033 | 0.001 |