**Supporting Information**. Drees, T.H. and K. Shea, 2023. “Elevated temperatures shift flower head height distributions and seed dispersal patterns in two invasive thistle species.” *Ecology*.

**Appendix S2.** Alternative representation of Figure 1, dispersal kernels for various combinations of treatment and species, and tables with select statistics comparing dispersal simulations between both warmed/unwarmed treatments and maximum/distributed flower head height.

**Chart, line chart

Description automatically generated**

**Figure S1.** Distribution of observed flower head heights for *C. nutans* and *C. acanthoides* under the control and warming treatments. Solid lines indicate mean probability density for a given height, and error bands indicate a 95% bootstrap interval.

**A picture containing text, diagram, plot, line

Description automatically generated**

**Figure S2.** Dispersal kernels for warmed and unwarmed *C. nutans*, as well as for warmed and unwarmed *C. acanthoides*. Solid lines indicate mean dispersal kernels generated using the entire observed distribution of flower heights, while the dotted lines indicate those generated using only the mean maximum flower head height. Error bands indicate a 95% bootstrap interval.

**Table S1**. Dispersal statistics from the first set of simulations comparing warmed and unwarmed treatments for *C. nutans* (CN) and *C. acanthoides* (CA). Values are shown for the mean and lower/upper bounds of the 95% bootstrap interval (BI).

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Mean dispersal distance (m)** | | **95% BI Lower** | **Mean** | **95% BI Upper** |
| CN | Unwarmed | 2.84 | 3.05 | 3.27 |
|  | Warmed | 3.45 | 3.70 | 3.96 |
| CA | Unwarmed | 2.28 | 2.46 | 2.63 |
|  | Warmed | 3.19 | 3.39 | 3.62 |
|  | | | | |
| **95th percentile dispersal distance (m)** | |  |  |  |
| CN | Unwarmed | 9.77 | 10.53 | 11.43 |
|  | Warmed | 11.84 | 12.76 | 13.77 |
| CA | Unwarmed | 7.80 | 8.48 | 9.13 |
|  | Warmed | 10.88 | 11.69 | 12.54 |
|  | | | | |
| **99th percentile dispersal distance (m)** | |  |  |  |
| CN | Unwarmed | 22.55 | 25.15 | 28.07 |
|  | Warmed | 27.39 | 30.37 | 33.80 |
| CA | Unwarmed | 17.89 | 19.97 | 22.32 |
|  | Warmed | 24.91 | 27.58 | 30.72 |
|  | | | | |
| **10-m warmed/unwarmed risk ratio** | |  |  |  |
| CN |  | 1.15 | 1.36 | 1.59 |
| CA |  | 1.44 | 1.71 | 2.04 |
|  | | | | |
| **50-m warmed/unwarmed risk ratio** | |  |  |  |
| CN |  | 0.91 | 1.66 | 2.86 |
| CA |  | 1.15 | 2.44 | 4.83 |

**Table S2**. Dispersal statistics from the second set of simulations comparing warmed and unwarmed treatments, paired with either the distribution of all flower head heights or the mean maximum flower head height as a point source, for *C. nutans* (CN) and *C. acanthoides* (CA). Values are shown for the mean and lower/upper bounds of the 95% bootstrap interval (BI).

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Mean dispersal distance (m)** | | | **95% BI Lower** | **Mean** | **95% BI Upper** |
| CN | Ht. Dist. All | Unwarmed | 2.84 | 3.05 | 3.27 |
|  |  | Warmed | 3.45 | 3.70 | 3.96 |
|  | Ht. Max. PS | Unwarmed | 3.18 | 3.54 | 3.92 |
|  |  | Warmed | 3.82 | 4.22 | 4.61 |
| CA | Ht. Dist. All | Unwarmed | 2.31 | 2.47 | 2.62 |
|  |  | Warmed | 3.18 | 3.39 | 3.61 |
|  | Ht. Max. PS | Unwarmed | 2.49 | 2.75 | 3.05 |
|  |  | Warmed | 3.79 | 4.24 | 4.70 |
|  | | | | | |
| **95th percentile dispersal distance (m)** | | |  |  |  |
| CN | Ht. Dist. All | Unwarmed | 9.77 | 10.53 | 11.43 |
|  |  | Warmed | 11.84 | 12.79 | 13.83 |
|  | Ht. Max. PS | Unwarmed | 11.32 | 12.60 | 13.95 |
|  |  | Warmed | 13.57 | 15.03 | 16.51 |
| CA | Ht. Dist. All | Unwarmed | 7.89 | 8.50 | 9.13 |
|  |  | Warmed | 10.90 | 11.67 | 12.56 |
|  | Ht. Max. PS | Unwarmed | 8.72 | 9.81 | 11.00 |
|  |  | Warmed | 13.64 | 15.14 | 16.85 |
|  | | | | | |
| **99th percentile dispersal distance (m)** | | |  |  |  |
| CN | Ht. Dist. All | Unwarmed | 22.55 | 25.15 | 28.07 |
|  |  | Warmed | 27.26 | 30.34 | 33.80 |
|  | Ht. Max. PS | Unwarmed | 26.91 | 30.85 | 35.24 |
|  |  | Warmed | 32.24 | 36.71 | 41.62 |
| CA | Ht. Dist. All | Unwarmed | 18.02 | 20.00 | 22.33 |
|  |  | Warmed | 24.93 | 27.55 | 30.43 |
|  | Ht. Max. PS | Unwarmed | 20.81 | 23.93 | 27.22 |
|  |  | Warmed | 32.29 | 36.86 | 41.72 |
|  | | | | | |
| **10-m maximum/distribution risk ratio** | | |  |  |  |
| CN |  | Unwarmed | 1.06 | 1.32 | 1.60 |
|  |  | Warmed | 1.05 | 1.25 | 1.50 |
| CA |  | Unwarmed | 1.01 | 1.28 | 1.59 |
|  |  | Warmed | 1.20 | 1.46 | 1.73 |
|  | | | | | |
| **50-m maximum/distribution risk ratio** | | | | | |
| CN |  | Unwarmed | 0.94 | 1.78 | 3.12 |
|  |  | Warmed | 0.98 | 1.62 | 2.56 |
| CA |  | Unwarmed | 0.76 | 1.87 | 3.95 |
|  |  | Warmed | 1.24 | 2.09 | 3.37 |

**Table S3**. Dispersal statistics from the third set of simulations comparing warmed and unwarmed treatments, paired with either the distribution of all flower head heights or the distribution of maximum flower head heights, for *C. nutans* (CN) and *C. acanthoides* (CA). Values are shown for the mean and lower/upper bounds of the 95% bootstrap interval (BI).

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Mean dispersal distance (m)** | | | **95% BI Lower** | **Mean** | **95% BI Upper** |
| CN | Ht. Dist. All | Unwarmed | 2.84 | 3.05 | 3.27 |
|  |  | Warmed | 3.45 | 3.70 | 3.96 |
|  | Ht. Dist. Max. | Unwarmed | 3.23 | 3.44 | 3.66 |
|  |  | Warmed | 3.86 | 4.12 | 4.39 |
| CA | Ht. Dist. All | Unwarmed | 2.29 | 2.46 | 2.64 |
|  |  | Warmed | 3.17 | 3.39 | 3.61 |
|  | Ht. Dist. Max. | Unwarmed | 2.48 | 2.67 | 2.86 |
|  |  | Warmed | 3.91 | 4.12 | 4.34 |
|  | | | | | |
| **95th percentile dispersal distance (m)** | | |  |  |  |
| CN | Ht. Dist. All | Unwarmed | 9.77 | 10.53 | 11.43 |
|  |  | Warmed | 11.81 | 12.75 | 13.72 |
|  | Ht. Dist. Max. | Unwarmed | 11.03 | 11.85 | 12.72 |
|  |  | Warmed | 13.24 | 14.21 | 15.20 |
| CA | Ht. Dist. All | Unwarmed | 7.82 | 8.47 | 9.11 |
|  |  | Warmed | 10.86 | 11.68 | 12.61 |
|  | Ht. Dist. Max. | Unwarmed | 8.52 | 9.25 | 9.97 |
|  |  | Warmed | 13.18 | 14.06 | 14.98 |
|  | | | | | |
| **99th percentile dispersal distance (m)** | | |  |  |  |
| CN | Ht. Dist. All | Unwarmed | 22.55 | 25.15 | 28.07 |
|  |  | Warmed | 27.23 | 30.31 | 33.72 |
|  | Ht. Dist. Max. | Unwarmed | 25.24 | 28.11 | 31.36 |
|  |  | Warmed | 30.18 | 33.65 | 37.46 |
| CA | Ht. Dist. All | Unwarmed | 17.82 | 19.96 | 22.37 |
|  |  | Warmed | 24.77 | 27.54 | 30.64 |
|  | Ht. Dist. Max. | Unwarmed | 19.68 | 21.87 | 24.28 |
|  |  | Warmed | 29.79 | 33.01 | 36.77 |
|  | | | | | |
| **10-m maximum/distribution risk ratio** | | |  |  |  |
| CN |  | Unwarmed | 1.03 | 1.21 | 1.42 |
|  |  | Warmed | 1.01 | 1.18 | 1.35 |
| CA |  | Unwarmed | 0.96 | 1.17 | 1.43 |
|  |  | Warmed | 1.16 | 1.34 | 1.54 |
|  | | | | | |
| **50-m maximum/distribution risk ratio** | | | | | |
| CN |  | Unwarmed | 0.74 | 1.37 | 2.28 |
|  |  | Warmed | 0.79 | 1.31 | 2.11 |
| CA |  | Unwarmed | 0.61 | 1.40 | 2.96 |
|  |  | Warmed | 0.93 | 1.60 | 2.70 |