Abstract

Cirsium pitcheri (Pitcher’s thistle) is a threatened plant species endemic to the Great Lakes region. Our study investigated the spatial distribution of C. pitcheri and its relationship to sand erosion and vegetation density on a blowout in Rosy Mound Natural Area. Methods used in the study included using erosion pins to measure changes in elevation within the blowout, GPS mapping of plant locations, and observing vegetation density areas. Vegetation quadrats were used to take randomized sample plots of vegetation density. Results show that C. pitcheri was largely found in areas of mild erosion and previously established vegetation areas. This study will aid park managers in better managing populations of C. pitcheri in the future.

Methods

We took data on C. pitcheri at various stages of development (Figure 4), surrounding vegetation, and sand movement; methods used are explained in Table 1.

Results

We mapped the locations of 444 C. pitcheri plants within our study location (Figure 5). C. pitcheri was found in many parts of the blowout, in areas ranging from sparse to dense vegetation. Ages of C. pitcheri ranged from seedlings to dead plants. Erosion pins were used to determine changes in erosion, and the data was graphed (Figures 6-7). We also analyzed and graphed vegetation density and area coverage (Tables 2-3).

Discussion

As seen in our research, sparse vegetation is most conducive for C. pitcheri growth. With this in mind, protection of sparsely vegetated areas on and around blowouts is an excellent management method. Another method of management is boardwalks; however, these are already in place and seem fairly effective in allowing people with the opportunity to enjoy their surroundings while keeping off fragile dune areas (Figure 8).

Conclusions

The blowout contained 444 recorded C. pitcheri plants which were distributed largely in areas with less erosion. We found that Pitcher’s thistle thrives in areas with less erosion and medium vegetation density.

Acknowledgements

We would like to thank the Ottawa County Parks staff for allowing us to conduct research in Rosy Mound Natural Area. We are thankful for the grant provided by the Michigan Space Grant Consortium. We would also like to thank Calvin University, Prof. Deanna van Dijk, and our mentor Nathan Hilbrands for their assistance.

Works Cited


Introduction

Pitcher’s thistle, Cirsium pitcheri (Figure 1), is a threatened plant endemic to the Great Lakes which faces various threats [1-3]. Our project seeks to understand the spatial distribution of C. pitcheri through the example of a population on a blowout in Rosy Mound Natural Area.

Study Objectives

• Map locations and characteristics of C. pitcheri
• Record changes in elevation: erosion and deposition
• Analyze vegetation density

Study Area

Our study area is a blowout in Ottawa County Parks’ Rosy Mound Natural Area, located approximately 3 km south of Grand Haven, Michigan (Figures 2 and 3). The blowout is part of a system of blowouts and parabolic dunes along the western edge of the park.

Figure 1. A flowering example of Pitcher’s thistle on the blowout.

Figure 2. Location of the study site.

Figure 3. Eastward facing view of the study location.

Figure 4. Clockwise from top left: seedling, juvenile, flowering, and dead C. pitcheri.

Figure 5. A map of all C. pitcheri recorded.

Figure 6 (above). Numbered points show erosion pins. Total changes in elevation at each point (in cm) from day 0 (setup) to day 14 (final measurements) are shown in purple. Positive numbers indicate deposition; negative numbers indicate erosion.

Figure 7 (left). Total change in elevation on each erosion pin to the nearest 0.5 cm.

Figure 8. A sign asking people to stay off the dunes, explaining why humans should stay out of the area.

Table 1. The methods used within the study.

<table>
<thead>
<tr>
<th>Objectives</th>
<th>Variables</th>
<th>Methods</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mapping and classifying C. pitcheri</td>
<td>C. pitcheri locations and stages of development</td>
<td>Use handheld Trimble systems to record the locations of C. pitcheri, classify according to different stages of development (seedling, juvenile, flowering, dead)</td>
</tr>
<tr>
<td>Analyzing vegetation</td>
<td>Vegetation diversity (number of species) and density</td>
<td>Wooden quadrats thrown randomly to observe vegetation, specifically in areas with C. pitcheri</td>
</tr>
<tr>
<td>Recording erosion and deposition</td>
<td>Changes in elevation due to erosion and deposition</td>
<td>Recorded data taken at designated erosion pins once a week for a duration of 2 weeks in total</td>
</tr>
</tbody>
</table>

Table 2 (left). Each area of vegetation, its total number of C. pitcheri, and the density of C. pitcheri obtained by dividing the number of plants by area.

<table>
<thead>
<tr>
<th>Location</th>
<th>C. pitcheri population (#)</th>
<th>Area (m²)</th>
<th>Density (#/m²)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sparse</td>
<td>228</td>
<td>3205</td>
<td>0.071</td>
</tr>
<tr>
<td>Dense</td>
<td>30</td>
<td>549</td>
<td>0.055</td>
</tr>
<tr>
<td>Shrub</td>
<td>125</td>
<td>3377</td>
<td>0.037</td>
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</tbody>
</table>

Table 3 (right). The percent of vegetation within the quadrats with the areas averaged together and the average number of species.

<table>
<thead>
<tr>
<th>Vegetation category</th>
<th>Average vegetative cover</th>
<th>Average number of species</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sparse (light green)</td>
<td>20%</td>
<td>1.9</td>
</tr>
<tr>
<td>Shrub (dark green)</td>
<td>30%</td>
<td>2.7</td>
</tr>
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</table>