Investigation of Variables affecting a Rare Plant Species, *Cirsium pitcheri*, on Mt. Baldy in P.J. Hoffmaster State Park

**Abstract**

*Cirsium pitcheri*, an endangered plant found only in specialized dune conditions, serves as an exemplar of environment-vegetation interactions. We investigated these interactions by focusing on variables that might affect the survival and growth of *C. pitcheri* on Mt. Baldy in P.J. Hoffmaster State Park, Michigan. Our objectives were to document plant characteristics and investigate the optimal conditions for plant growth. Using GPS units and ArcGIS visualization, we mapped the locations of the plants and dune sub-environments. Measurements of leaf length, plant health, evidence of herbivory, slope angle, and aspect were recorded for each located plant. In addition, vegetation density and diversity were measured and recorded in each dune sub-environment. Study results showed *C. pitcheri* was abundant in several dune sub-environments, including windward and leeward dune slopes, as well as deflation areas of blowouts; a majority were found on south-facing slopes. No significant relationship was found between slope angle and maximum blowouts; a majority were found on south-facing slopes. Results suggest *C. pitcheri* grow well on south-facing slopes where light availability is highest. Slope angle appears to have little effect on the health or growth of individuals, suggesting *C. pitcheri* easily adapts to a wide range of slope angles.

**Study Area**

The study took place on Mt. Baldy in Hoffmaster State Park, along the eastern shore of Lake Michigan (figure 2). At this site, we chose two large study areas that could be divided into dune sub-environments based on their characteristics.

**Methods**

Characteristics of individual *C. pitcheri*, the dunes and the surrounding vegetation were measured and analyzed to compare patterns in plant health and location (table 1). The majority (45%) of plants surveyed were found on south-facing slopes (figure 6) with steepness less than 30°.

**Results**

No statistically significant relationship was found between dune slope angle and *C. pitcheri* plant health, or between slope angle and maximum leaf length of *C. pitcheri* individuals (figure 5). The majority of *C. pitcheri* individuals are in the seedling or small juvenile age class (figure 4). The mean and median distance between *C. pitcheri* individuals are 1.5m and 1.2m, respectively.

**Discussion**

The abundance of young *C. pitcheri* (figure 7) indicates that individuals are not reaching older age classes due to negative impacts, or that many individuals in the previous generation successfully flowered and died (figure 7), creating an abundant new generation. The latter is probable, since many dead individuals were observed but not surveyed due to time constraints.

**Conclusions**

The *C. pitcheri* populations studied on Mt. Baldy appear healthy with the ability to produce well-sized future generations. Various conditions found at this site seem to promote the growth and survival of the populations, including south-facing slopes. Restoration efforts should seek to plant *C. pitcheri* individuals in clusters on south-facing slopes at angles of less than 30°.

**References**


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