Dune Demography Lab
EEB 373 Spring 2023

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Background

Dune ecosystems are one of Michigan's most unique ecosystems, covering about 270,000 acres of our state. Dunes are considered a relatively species-poor landscape, as not many organisms are equipped to survive living in a substrate that regularly reach 120˚C during the day. However, there are 31 rare plants and 6 rare animals that call this ecosystem home, including the endangered plant *Cirsium pitcheri* (or pitchers thistle) that we'll be studying today in lab.

By the end of today's lab, you should be able to:

1. Learn to identify *Cirsium pitcheri* in the field.
2. Understand the importance of demographic studies.

Dune ecosystems

Dunes are ecosystems characterized by sandy soils, grass and shrub dominated plants, and large amounts of wind disturbance. Importantly, sand dunes like those you'll see today are under threat due to human intervention. Off-road vehicles and humans walking from the road to the beach can destroy early successional plant species that stabilize the dunes, leaving them vulnerable to excessive sand erosion, especially during windstorms. This can lead to areas that even early successional species can have difficulty establishing on. All these factors have contributed to the population decline of our species of focus today, pitcher's thistle.

Cirsium pitcheri (pitchers thistle)

Pitcher's thistle is a perennial dune plant with distinct white-green leaf color and sparse spines (Table 1). Pitcher's thistle has a very long tap root (as long as 12ft!) allowing it to survive in the hot, dry, and unstable conditions of the foredunes and it plays a major role in stabilizing dunes for other species. Importantly, pitcher's thistle is federally endangered. Human impact as described above is a large cause, but this plant is additionally threatened by three species of weevils initially introduced to reduce invasive thistle species. These weevils either eat the seeds of the plant (reducing reproduction) or bore into the root stem of adult (preventing reproduction by killing the plant).

Table 1: Pitchers thistle age-class identifications and their physical descriptions.

Seedling (year 1)	Juvenile (year 2-5)	Adult (year 3-8)
		
• Small, rounded leaves (usually fewer than 5) in a rosette	• Serrate leaves (5 leaves or more) in a rosette • Can be relatively small (young) or as large as an adult (older) • Does not have any flowers or flower buds visible	• Serrate leaves and usually a large rosette • Typically growing upward (leaves growing on a stem rather than coming out of the base) • **Producing flowers or flower buds**

For all endangered species, it's important to keep track of existing populations and how they grow and change over time. Changes in a population's structure (e.g., how many adults there are) or changes in annual growth rates (e.g., how many new plants there are each year) can be indications that management or restoration should be done to that area. Researchers have been surveying pitcher's thistle communities across the dunes annually for the last 25 years! Today, we will be contributing to that important knowledge by collecting data on the demography of pitcher's thistle populations on heavily trafficked areas on the sturgeon bay dunes.

Materials

1. A compass (an app on your phone will suffice)
2. A 10m transect tape

Methods

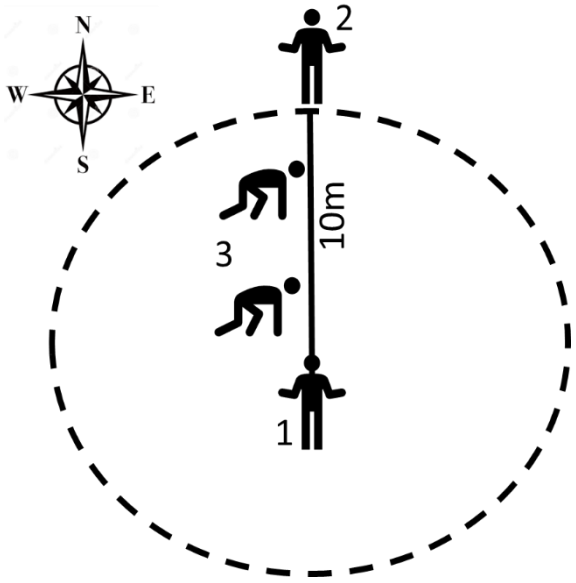

Figure 2: Diagram indicating how to establish a transect. One individual should stand at the centerpoint and be the recorder (1) while another takes the transect tape 10m towards true north (2). The other individuals (1 or 2 depending on group size) will be responsible for searching for pitchers thistle plants (3).

1. Go to the center point indicated on the map and, using your phone's map app, **write down your latitude and longitude.**

2. One student should stand at the centerpoint and have a compass available (this person will be the data recorder).

3. Another student should run the transect tape 10m away from the centerpoint at true north (0˚ on your compass).

    a. The transect you are sampling in will be a 10m circle around your centerpoint.

4. The students not yet assigned a task will be responsible for searching for pitchers thistle plants. They should stand equidistant from the other members (see figure 2).

5. The student holding the transect tape furthest from the centerpoint should move the tape in a clockwise direction 10m from the centerpoint until the tape touches a pitchers thistle plant, at which point the following should be recorded in your notebooks (see Table 2 for an example of headings):
    a. The location of the plant which includes:
        i. The degree of rotation along your transect (on your compass, your best estimate is fine!)
        ii. The distance along the transect tape the plant is located at.
    b. The age class of the plant (seedling, juvenile, adult, refer to table 1 for descriptions of each age class)
6. Continue moving the transect tape around the circle, recording plant information, until you get back to the starting point.

Table 2: Example header of a datasheet

Degree of rotation	Distance along the transect (m)	Age class	Stem diameter (cm)
4	4.5	Juvenile	0.4

Questions to consider after completing your transect:

1. Consider the number of individuals you surveyed in each age class, does one group seem to be underrepresented? What might that mean for the population's growth into the future?

2. Many consider early successional communities to have less value than later successional communities such as forests. How might you explain to a layperson, using your knowledge of pitcher's thistle to battle that misconception.