Foraging efficiency of insect pollinators of the Pitcher’s Thistle, *Cirsium pitcheri*, an endangered plant at the Indiana Dunes, IN

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**METHODS: CHASING INSECTS IN THE DUNES**

Figure 1. Pitcher’s thistle, *Cirsium pitcheri*, with insects foraging for nectar and pollen. I recorded the number of flowers visited, the length of time on each flower, time and directionality of flight between flowers, and used it to generate 1000 simulations on foraging efficiency.

Figure 2. Protected (a) and Open (b) Dunes. Flowering plants were identified, and 50 insects landing on them were observed for 15 minutes at different times of the day during flowering, summer 2008.

Figure 3. Insects visiting flowers: metallic bees (Agapostemon), cloud skippers, and bumblebees.

**RESULTS**

![Graph showing average time per flower](image)

Figure 4: Average time per flower from foraging strategies in open (a1) and protected (a2) dunes. If the abundance of flowers foraged per time exceeds 0.0129, the strategy of taking flowers from Open dunes (a1) is superior to foraging flowers from the protected Dunes (a2). Below a foraging strategy of 0.0129 flowers / s, the best strategy is to forage in protected dunes (blue line).

![Graph showing cumulative energy per time](image)

Figure 5. Cumulative energy per time for the simulation of 100 flower encounters. After 200 s of elapsed time (foraging), when a1 = 0.5 flowers / s, and a2 has any value, the rate of energy reaches a yield of 0.25 J/s (red line) which constitutes the expected optimal strategy.

**CONCLUSIONS**

The best strategy was to forage in Open Dunes

Insects foraged more time and shorter distances in Open dunes than in Protected dunes.

**FUTURE STUDIES**

Longer distances traveled by insect pollinators in protected dunes will increase gene flow and connectivity between fragmented plant populations. This hypothesis is being tested in the lab using genetic methods of parentage analysis.

**LITERATURE CITED**


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**CONTACT INFORMATION**

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