

Defining the Seed Bank of a Rare Texas Cactus (*Echinocereus chisoensis*, Cactaceae) in Big Bend National Park

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Abstract

Echinocereus chisoensis (ECCH), a threatened plant species in the Cactaceae family, is restricted to a 10 square mile area within Big Bend National Park, Brewster County, TX. The threatened status of the taxon is due to high mortality, low seedling recruitment, and predation from both illegal harvesting and herbivory. Results from a recent 12-year monitoring survey, show populations are in decline. The presence of a seed bank is a vital component of the reproductive ecology of any plant species, but particularly so for a rare plant, in that the seed bank stores genetic variation and provides insurance for growth and maintenance of populations. Our objectives were to determine if ECCH has a seed bank, and if present, describe its characteristics.

Three sites (referred to as Mesa, Ernest, Glenn) were selected for study, each representing different areas of the taxon's range. We collected six soil samples (202 cm³ soil volume per sample, extending 2.5 cm deep) near each of 60 ECCH plants. Location for a sample was determined first by a randomly selected compass heading and then distance from the plant base (10 cm and 25 cm). Each sample was stored separately and subsequent seed counts for each sample were tied to site, plant identification, distance, and direction. Column heights and diameters were measured for each plant and nurse plant species noted.

A total of 370 intact seeds were found. Models of relationship between seed count as a function of site, nurse plant, direction, and distance were constructed using a generalized linear mixed effect model with Poisson distribution. Plant identification was considered a random effect. The simplification model used was Akaike's information criterion. Results showed that the number of seeds declined as distance from the plant increased (average seed count: 10 cm=1.42, 25 cm=0.64). The species of nurse plant did not play a role in seed count. Using a linear hypothesis, differences in seed counts at Ernst and Mesa sites were not significantly different, but counts at Glenn were lower and statistically different from both Ernst and Mesa. Seed counts for samples were sorted by direction into west, south, east, or north quadrats. A Tukey's post hoc test showed average seed count was dependent on ordinal direction. Counts between east and north and between south and west were not significantly different; however, all other directional interactions were significantly different from one another with the highest seed counts in the south and west quadrats. Based on these results, ECCH has a small seed bank with the largest component located south and west of the plant and near the plant.

Germination tests are currently being used to test the viability of harvested seeds. Additional statistical analyses (i.e. plant volume and seed number, location and seed viability) will be conducted. The completed manuscript will be submitted to the *Journal of Arid Environments* for publication consideration.