

Geographic Distribution of *Coryphantha robustispina* ssp. *robustispina* (Pima Pineapple Cactus) and *Echinomastus erectocentrus* var. *erectocentrus* (Needle-spined Pineapple Cactus) within the extended City of Tucson HCP Southlands planning area.

Final Report

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Abstract

Geographic distribution and relative densities of *Coryphantha robustispina* ssp. *robustispina* and *Echinomastus erectocentrus* var. *erectocentrus* within approximately 63 mi² of the extended City of Tucson HCP Southlands planning area were estimated using belt transects. The majority of the 279 individuals recorded for *C. robustispina* occurred in the vicinity of Vail, and south throughout most of the study area except for the rugged terrain in the extreme southeast. The majority of the 1133 individuals recorded for *E. erectocentrus* were restricted to the eastern portion of the study area east of Vail, and south for approximately 11 km. Estimated density for *C. robustispina* was one in 1.65 ha and for *E. erectocentrus* was one in 0.13 ha.

Introduction

A study was undertaken to estimate the geographic distribution and relative densities of *Coryphantha robustispina* ssp. *robustispina* and *Echinomastus erectocentrus* var. *erectocentrus* within approximately 63 mi² of the extended City of Tucson HCP Southlands planning area. Approximately 326 kilometers of belt transects were used to survey the areas as evenly as possible. The design was intended to maximize the chance of locating populations and to record data for the comparison of plant densities across trials (either through time or across sites), but was not intended to survey for 100% of individuals within the study area.

Methodology

Orthophoto quadrangles with an overlay (Arcview shapefile) of known occurrences of *C. robustispina* ssp. *robustispina* were used to draw polygons of potential occurrence for individuals of *C. robustispina* ssp. *robustispina* and *Echinomastus erectocentrus* var. *erectocentrus* and exclude areas where both species were already known. Prior to fieldwork, approximate locations of proposed belt transects were selected, two transects per square mile of total extended planning area, with each transect two kilometers in length by approximately 20m wide. Transects began at a single point and looped back to the point of origin. After the first few transects, it became clear that one transect per square mile, approximately four kilometers in length, would provide better geographic coverage within a given square mile. Primarily owing to the irregularity of the study site, the actual average transect length was approximately 5.2 km per square mile. Garmin GPS 72 and GPS 76 units were used to facilitate orientation and to record the actual locations (tracks) of transects and locations (points) of cactus individuals. The datum used was UTM, NAD27 CONUS, zone 12. Transects were walked at a rate of no faster than 2 km/hr, with close attention paid to open areas. Location data for transects and individuals were downloaded to create Arcview shapefiles. The UTM data were reprojected to State Plane, Arizona, Central, NAD83, feet, in order to overlay onto orthophoto quadrangles. GPS data were provided in electronic form to the City of Tucson.

Results and Discussion

Within the survey area, 279 individuals of *Coryphantha robustispina* and 1133 individuals of *Echinomastus erectocentrus* were located and recorded. Individuals of *C. robustispina* were absent in the northern sections of the study area and those of *E. erectocentrus* occurred only in the southern tip of the northeastern section. Individuals of *C. robustispina* occurred in the vicinity of Vail, and south throughout most of the study area except for the rugged terrain in the extreme southeast. Individuals of *E. erectocentrus* were restricted to the eastern portion of the study area east of Vail, and south for approximately 11 km. For both species, individuals were much denser in some areas relative to others.

Within the present study, estimated density of *Coryphantha robustispina* individuals along transects within or near (within one kilometer of) occupied habitat was one in 1.65 ha. Of the 279 individuals recorded, twelve were dead and six were recorded incidentally along vehicle routes, leaving 251 live individuals along transects. GPS tracks recorded a total of 207km for transects in or near occupied habitat. Using the assumption of an average effective transect width of 20m, the number of hectares surveyed was $207\text{km} \times 1000\text{m}/\text{km} \times 20\text{m} \div 10000\text{m}^2/\text{ha} = 414$ ha. The number of hectares per individual thus being $414 \text{ ha} / 251$ individuals. According to unpublished data from the Heritage Data Management System, AZ Game and Fish Department, Phoenix, AZ, the average density for individuals of the taxon is one in 1.6 ha. Although this number appears to agree with the current results, there was only one pass per transect in this study whereas the data from the Heritage Data Management System may reflect the U. S. Fish and Wildlife protocol of conducting several passes per transect. The estimated density of *C. robustispina* individuals for the Southlands areas to the northwest of the present study was one individual in 5.1 ha. The estimated density within this study for *Echinomastus erectocentrus* individuals along transects within or near occupied habitat was one in 0.13 ha or more than 12 times as dense as for *C. robustispina*.

Individuals of *Coryphantha robustispina* ssp. *robustispina* occurred between 935 m (3070 ft) and 1165m (3830 ft) elevation, within the range for the taxon. Habitats were variable, with *Cylindropuntia fulgida*, *Larrea tridentata*, and/or *Prosopis velutina* as the dominant or co-dominant woody perennials. Although individuals generally occurred in open areas (tree/shrub cover less than 20.0% and herbaceous cover less than 5-10%), several were recorded where woody vegetation was much denser, especially within *Larrea tridentata* scrub, or where annual and/or perennial grasses were dense. General soil characteristics included silt to clay-silt originating from multiple bedrocks, often red-brown in color. Although the soil surface generally included a layer of gravel, several areas were devoid of gravel or were dominated by small rocks. Topography varied from nearly flat plains, to lower bajadas and narrow to broad, low ridges.

Associated species: *Acacia constricta*, *Acacia greggii*, *Acourtia nana*, *Atriplex canescens*, *Bahinia absinthifolia*, *Carnegiea gigantea*, *Cercidium microphyllum*,

Cylindropuntia arbuscula, *Cylindropuntia fulgida*, *Cylindropuntia leptocaulis*, *Cylindropuntia spinosior*, *Echinocereus fendleri*, *Ephedra trifurca*, *Erioneuron pulchellum*, *Ferocactus wislizenii*, *Fouquieria splendens*, *Gutierrezia microcephala*, *Isocoma tenuisecta*, *Janusia gracilis*, *Lycium andersonii*, *Lycium berlandieri*, *Lycium exertum*, *Machaeranthera pinnatifida*, *Mammillaria grahamii*, *Muhlenbergia porteri*, *Opuntia engelmannii*, *Opuntia macrocentra*, *Opuntia phaeacantha*, *Pennisetum ciliare*, *Pleuraphis mutica*, *Prosopis velutina*, *Psilostrophe cooperi*, *Scleropogon brevifolius*, *Thymophylla pentachaeta*, *Tiquilia canescens*, *Yucca baccata*, *Yucca elata*, *Zinnia acerosa*, and *Ziziphus obtusifolia*.

Individuals of *Echinomastus erectocentra* var. *erectocentra* occurred between 1005 m (3300 ft) and 1145m (3760 ft) elevation generally within sparse *Larrea tridentata* scrub on gravelly to rocky slopes and tops of low hills and ridges. Only a few individuals were recorded in the deeper soils of valley floors. General soil characteristics included silt to clay-silt originating from multiple bedrocks, most often pale gray in color.

Associated species: *Acacia constricta*, *Acourtia nana*, *Agave palmeri*, *Aristida purpurea*, *Atriplex canescens*, *Bouteloua curtipendula*, *Calliandra eriopoda*, *Condalia warnockii*, *Coryphantha vivipara*, *Cylindropuntia leptocaulis*, *Cylindropuntia spinosior*, *Cylindropuntia versicolor*, *Dasyllirion wheeleri*, *Echinocereus fasciculatus*, *Erioneuron pulchellum*, *Ferocactus wislizeni*, *Fouquieria splendens*, *Hilaria belangeri*, *Juniperus coahuilensis*, *Krameria erecta*, *Machaeranthera pinnatifida*, *Mammillaria grahamii*, *Opuntia engelmannii*, *Parthenium incanum*, *Pleuraphis mutica*, *Porophyllum gracile*, *Prosopis velutina*, *Psilostrophe cooperi*, *Tiquilia canescens*, *Yucca schidigera*, *Zinnia acerosa*, and *Ziziphus obtusifolia*.