



School of Natural Resources and the Environment

Towards Understanding the Ecohydrologic Controls on the Phenology of Pima Pineapple Cactus

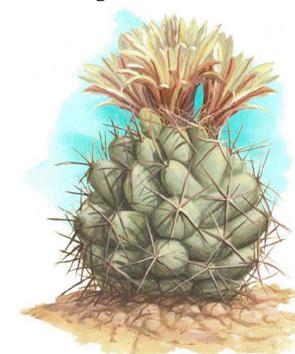


Ami L. Kidder (*akidder@email.arizona.edu*)¹, Shirley A. Papuga¹, David D. Brehears¹, Darin J. Law¹
¹*School of Natural Resources and the Environment, University of Arizona*

1. Introduction

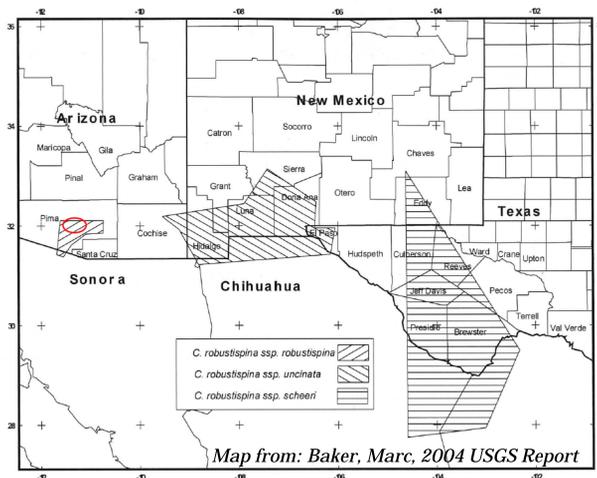
Under pressures of global change, land and wildlife managers are looking to find new ways to manage and preserve threatened and endangered species in their areas. A first step of managing local threatened and endangered species, is to understand the phenological cues as indicators of ecohydrological controls affecting the growth and distribution of the species. One example of this is the Pima Pineapple Cactus (*Coryphantha robustispina* var. *scheeri*), located in a small range within Texas, New Mexico, Southern Arizona, and a small region in Northern Chihuahua and Sonora Mexico. Because of the species' very sparse distribution, little is known about the factors that contribute to Pima Pineapple Cactus distribution or growth.

Previous research indicates that Pima Pineapple Cactus is not pollinator limited, but little is known about the other conditions triggering flowering.



Coryphantha robustispina ssp. *robustispina*

Image from: McDonald, C. 2007. Pima Pineapple Cactus: A Unique Cactus Hiding in Plain Sight. The Plant Press Vol. 31 No. 1.



As we continue this research, we will collect both intensive (many observations in one place) and extensive (limited observations in many places) data within this range to understand variability in Pima Pineapple Cactus distribution and phenology.

2. Problem Statement and Objective

- Intensifying land use and changing climate are affecting plant distributions and their *phenology* – the timing of important biological events such as flowering.
- Flowering conditions are especially critical for endangered species to preclude their ongoing demise.
- Often little is known about because their endangered status limits observations (in space and in time) of flowering and associated environmental conditions.

Our objective was to identify ecohydrological parameters that elicit flowering responses in the endangered Pima Pineapple Cactus.

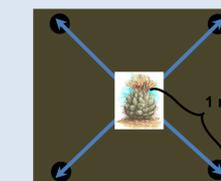
3. Methods

- Air Force Plant 44 (AFP44) located in Tucson, Arizona, houses a rare relatively large, dense population of Pima Pineapple Cactus that has not been well characterized.
- Three phenological cameras (Moultrie I60) were installed in July 2013 to capture hourly photos of Pima Pineapple Cactus at three randomly selected sites within AFP44.



Soil Moisture

- Daily “Fieldscout TDR 300 Soil Moisture Meter” measurements
- Taken at each cactus ~45° offset from the Cartesian coordinates (i.e. NE, SE, SW, and NW)
- Taken no closer than 1 m from the cactus to avoid impacting the wide and shallow root system (USFWS)



4. Results

Flowering Events

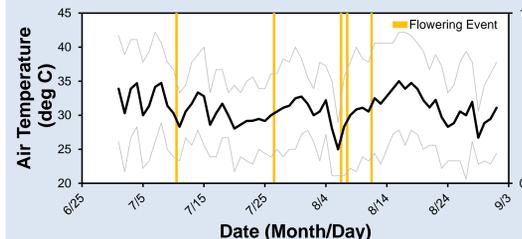
Values are the number Pima Pineapple Cactus that started to flower within the frame of the phenological camera at the site on the given date.

	07/10	07/26	08/06	08/07	08/11
Site 1	2	2	1	0	2
Site 2	3	3	0	0	0
Site 3	3	3	2	1	2

- Five flowering events captured in just over one month

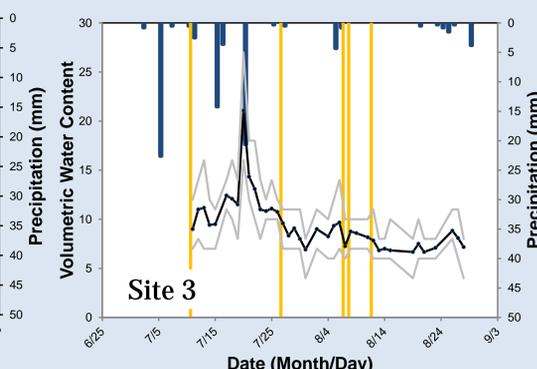
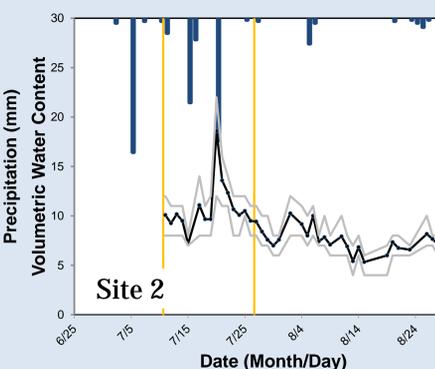
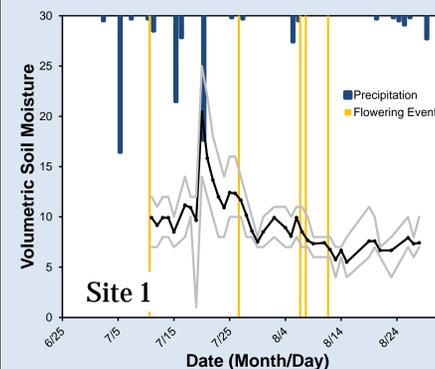
Temperature

Daily temperature and precipitation data were obtained from Tucson International Airport meteorological station.



- Flowering does not appear to be associated with air temperature

Precipitation and Soil Moisture



- Pima Pineapple Cactus flowering events tend to be preceded by large monsoon rain events.
- Flowering events were observed between 7 and 12% Volumetric Water Content.
- Site 2 had the fewest flowering cactus and the lowest average Volumetric Water Content
- Across the three sites, Pima Pineapple Cactus flower synchronously several times in a single season.

Big First Step:

We captured five flowering events spanning three sites in a single season and have collected associated soil moisture data.



5. Take Home Message

Based on these observations – to our knowledge the first photo-captured time series for the endangered Pima Pineapple Cactus – we hypothesize that flowering events for this species are triggered by a limited range of soil moisture conditions following a large monsoon rain event.

6. Acknowledgments

Support of this project is provided by Raytheon Missile Systems and the U.S. Air Force. Dr. Michael Crimmins has provided the Fieldsout TDR Probe. Dr. Mitch McClaran and the Papuga and Brehears Labs have provided invaluable insights on this preliminary research.