Rainbow Saguaro Project 2019

Data Gathering at Tohono Chul and Other Interesting Information

Tohono Chul
GARDENS • GALLERIES • BISTRO
Why we’re here

• Provide stories, facts, and myths to share with our visitors
• Profile Saguaro Huggers
• Share initial study results
• Invite you to join our awesome team
Who got to Tucson first?

- People?
- Saguaro?
- Javelinas?
Where do Saguaro grow?
Map of Saguaro Range

- Saguaro grow in SOME areas of the Sonoran desert
- Growth limiting factors:
  - Microclimate
  - Temperature
  - Water
  - Altitude/thermal belt
  - Competition
Questions we’ve been asked

• How many saguaros in Tohono Chul
• Cacti vs cactuseessses
New Sub Species

- Carnegiea gigantea verizonii
How fast do Saguaro cactuses grow?

- .1 inch per year
- .5 inch per year
- 5.8 inches per year
- Depends …

Age/Height Relationships For the Saguaro Cactus
Myth? Saguaro gets revenge!

- 1982
- David Grundman and Friend
- Darwin Award
One of the Greats – Old Granddaddy
Saguaro National Park

• 200-300 years old
• 45-52 arms
• 45-52 feet-tall
• 10 -15 tons
• Died 1992-1996 due to the succulent equivalent of extreme old age
• Bacterial Necrosis after Freezing
Saguaro Huggers - Why?

- Share information with Tohono Chul visitors
- Better understand growth rates at Tohono Chul
- Contribute to citizen science projects and Phenology studies
Saguaro Huggers – Brief History

• Started in 1999 with 3 intrepid volunteers
• Ann Nylan kept the project alive
• 2012 - evaluate viability
• Late 2012 - restarted Saguaro Study
• May 2016 –began Phenology study
• Sept 2018 – began data analysis group
Saguaro Huggers – Overcoming Challenges

• Hard to find saguarias in study – “under the palo verde”
  Solution: GPS, Photos
• Missing tags
  Solution: Replaced
• Changing reference point for measuring
  Solution: 16” rebar posts installed
• Saguaros getting taller
  Solution: ladders and extendable pole
• Too much to do
  Solution: Form parallax and painting teams
Saguaro Huggers – Current Team Members

Don Johnson
Julie Hallbach
Hank Verbais
Karen Endorf
Julia Nelson
Olivia Carey
Glen Ostrander
Zoe Holmes
Don Eagle
Rick Anderson
Mack Consigny
Cindy Maize
Saguaro Huggers – Field Work

• Winter:
  – Measure and record height of ~300 individual saguaros
  – Paint spines on crown (doesn’t hurt saguaro)
  – Count number of new areoles
  – Touch-up old paint

• Spring/Summer:
  – Gather Phenology data
Saguaro Huggers - Analysis

- Data input to local Database
- Maps built from GPS Data
- Data Analysis:
  - Phenology
  - Growth
Map of Saguaro in Study
Tohono Chul

Rainbow Saguaro Project - Overview
2/1/2019
Saguaro Database

- Used to store and extract information

<table>
<thead>
<tr>
<th>CactusID</th>
<th>Date</th>
<th>Side</th>
<th>Height</th>
<th>Color</th>
<th>Areoles</th>
<th>Last Color</th>
<th>Note</th>
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<td>9</td>
<td></td>
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</tr>
<tr>
<td>G002</td>
<td>09/28/2000</td>
<td>N</td>
<td>13</td>
<td>Sienna</td>
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<tr>
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<td>E</td>
<td>201</td>
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<td>Purple</td>
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<tr>
<td>G003</td>
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<td>E</td>
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<td>Pink</td>
<td>1</td>
<td>Purple</td>
<td></td>
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<td>G003</td>
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<td>E</td>
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<td>Apple Green</td>
<td>3.5</td>
<td>Pink</td>
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<tr>
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<td>293</td>
<td>Aqua</td>
<td>3</td>
<td>Apple Green</td>
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<td>E</td>
<td>356</td>
<td>Dandelion</td>
<td>3~3.5</td>
<td>Aqua</td>
<td></td>
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</table>
More FAQs about Saguaro\s?

- How many flowers per season? 6-100 per stem
- How many seeds in a fruit? 2,000 – 2,500
- How many seeds reach maturity? <1% survive 1st year
- How old does it need to be to grow arm? 50-75 years
- Can an arm grow on an arm? Yes
- Can an arm grow near a crown? Never, Maybe
What is Phenology?

- Study of seasonal plant and animal life cycle events
- National Phenology Network (NPN)
- Purpose is to identify and predict threats to humans and environment
- Tohono Chul group formed in 2016
Data Collection

- Data worksheet based on Nature’s Notebook
- 10 saguaros in Phenology Study
- Data collected on all saguaros in height study:
  - Physique
  - Environment
- Data input into local Database
Environmental Triggers:

- Initial trigger to flowering process is a fall/winter rain
- Rate of bud development depends on winter and spring temperatures
- Peak bloom: mid-May to Mid-June
- Abundant autumn rains and warm temperatures trigger early blooms
Saguaro Phenophase
2017 vs 2018

### 2017 Saguaro Phenophase
**TOTAL**

Max Buds, Flowers & Fruit = 544

- **Number**

  - **4/27**
  - **5/4**
  - **5/9**
  - **5/16**
  - **5/21**
  - **5/25**
  - **5/31**
  - **6/6**
  - **6/13**
  - **6/20**
  - **6/27**
  - **7/5**

- **Ripe Fruits**
- **Fruits**
- **Open Flowers**
- **Buds**

### 2018 Saguaro Phenophase
**TOTAL**

Max Buds, Flowers & Fruit = 1012

- **Number**

  - **4/18**
  - **4/25**
  - **5/2**
  - **5/9**
  - **5/16**
  - **5/23**
  - **5/31**
  - **6/6**
  - **6/12**
  - **6/20**
  - **6/25**
  - **6/29**

- **Ripe Fruits**
- **Fruits**
- **Open Flowers**
- **Buds**
Data Points: 263
No. over 15 ft tall: 39
No. over 15 ft tall w/arms: 29 (74%)
SAGUARO GROWTH STUDY
Saguaro Growth Study Overview

• 314 saguaros in database; height measured annually
• 1999 – 2018:
  – 32 saguaros added to database in 1999
  – 27 saguaros measured in 2018
• 2000 – 2018:
  – 62 saguaro added to database in 1999
  – 43 saguaro measured in 2018
• 2001 – 2018:
  – 157 saguaro entered into database in 1999
  – 116 saguaro measured in 2018
• Overall:
  – 251 saguaro entered (1999 – 2001)
  – 186 saguaro still active in 2018
Saguaro Growth Analysis
1999 to 2018

1999: 32 saguaro
2018: 27 saguaro
Saguaro Growth Analysis
2000 vs 2018

- 2000: 62 saguaro
- 2018: 43 saguaro
Saguaro Growth Analysis
2001 vs 2018

2001: 157 saguaro
2018: 116 saguaro
Saguaro Growth Analysis
(1999-2001) vs 2018

<table>
<thead>
<tr>
<th>Height (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of Saguaros</td>
</tr>
<tr>
<td><code>99-</code>01: 251 saguaro</td>
</tr>
<tr>
<td>2018: 186 saguaro</td>
</tr>
</tbody>
</table>

Graph showing the number of saguaros vs height from 1999-2001 and 2018.
Saguaro Growth Analysis
Linear estimation of growth

**Saguaro G006**

- **Minimum**: 0 mm
- **Maximum**: 1400 mm
- **Mean height**:

**Slope** = 0.127 mm/day; 46.4 mm/year

**R** = 0.99

25.4 mm = 1 inch

Time:
- 07/24/1998
- 07/23/2003
- 07/21/2008
- 07/20/2013
- 07/19/2018

Height (mm)
Saguaro Growth Analysis
Effect of Height on Growth Study
(1999-2001) to 2018

\[ y = -8E-06x^2 + 0.0772x - 4.8203 \]
\[ N = 186 \]
What more can be looked at?

What do you want to know?

- Observations of saguaros
- Water Availability, Type, and Distance
- Nurse trees/bushes
- Slope/Grade
- Microclimate behavior & growth
- Competition/proximity to other saguaros
- # of arms and bird holes
- Twins, triplets, quads
- Annual rainfall & temperature
- Total Number of Saguaros in Tohono Chul
- Drought Index
- Evapo-transpiration
- Climatic Water Deficit
- Degree Days
- Tarantula nests & termites
- Pollinators
- Nurse trees/bushes
- Water Availability, Type, and Distance
Reasons for Participating…. 
Some comments from Cactus Huggers

• I love saguaros
• My participation will be help to our understanding and the survival of these wonderful plants.
• You needed typing. I can do that.
• I am interested in organizing valuable data.
• I feel I'm doing something useful.
• I'm learning new things every week.
• I love watching the saguaro growth year to year.
• The Saguaro Huggers are a great group.
Questions?

• What did the saguaro say when he ran into a bar?

OUCH!!!!
Join fellow Docent Scientists

“When one tugs at a single thing in nature, he finds it attached to the rest of the world.”
- John Muir
Backup
Saguaro Growth Analysis
Annual Growth vs Height: Saguaro Parks East vs West

Saguaro Growth Analysis
Effect of Rainfall on Saguaro Diameter and Height

Hastings JR  Precipitation and Saguaro Growth.  http://hdl.handle.net/10150/303630