

BioBlitz Inventory of Saguaro Cacti (*C. gigantea*) in Section 17 of Saguaro National Park

Report to Saguaro National Park and the Western National Parks Association



Section 17 facing north, near Broadway Avenue, taken December 20, 2011.

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Contents

List of Figures.....	3
Acknowledgements	4
Introduction	5
Methods.....	7
Plans for Future Monitoring.....	10
Bibliography	11

List of Figures

Figure 1. Location of Section 17 (map from project web site).....	5
Figure 2. 1941 aerial photograph of Section 17.....	5
Figure 3. Educational poster created for the BioBlitz census of Section 17.....	6
Figure 4. Key people participating in the Section 17 census.....	7
Figure 5. Photographs taken during the Section 17 census.....	8
Figure 6. Design of the database containing the 1941 saguaro census data.....	9

Acknowledgements

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The late Paul Lightle, Lake Gill and James Mielke counted every single saguaro in Section 17 of Saguaro National Park East and meticulously documented their work so that it can be analyzed seventy years later. Veteran saguaro researcher Tom Orum carefully preserved this valuable data. The author would like to thank him for granting permission for the data to be used in this study.

Student Conservation Association volunteer Irene Weber was responsible for coordinating the logistics of the BioBlitz saguaro census and recruiting volunteer citizen-scientists. The author would also like to thank the following people for their support: Don Swann and Becky MacEwen of Saguaro National Park and Professors Eric Betterton and Gary Christopherson of the University of Arizona.

Finally the author would like to express great gratitude to the enthusiastic citizen-scientists who conducted the BioBlitz Section 17 census. This includes the adult volunteers, high school students and their teachers.

Introduction

Section 17 is located in the northwest corner of the Rincon Mountain District (S17, R16E, T14S). It has an area of one square mile (Figure 1). It is divided into 8 rows that are labeled A through H. Each row contains 8 plots that are 4 hectares each in size (Figure 2).

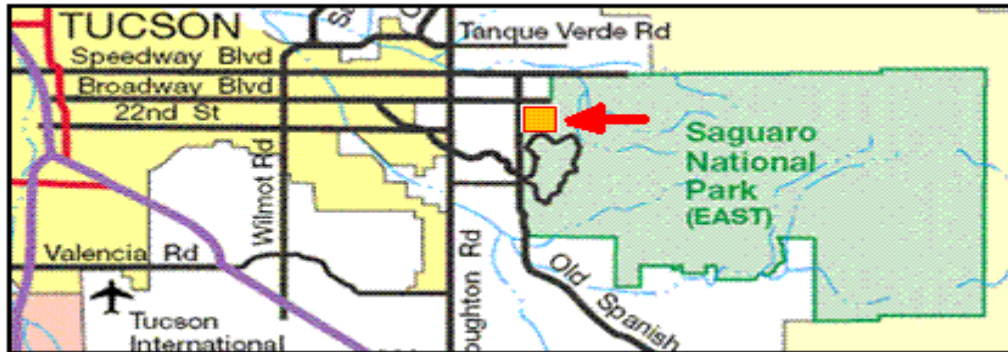


Figure 1: Location of Section 17 in SNP. This map was taken from the project web site.

When Saguaro National Monument was established in 1933, scientists and park managers were already beginning to observe a decline in the number of these magnificent cacti. To gain a better understanding of this problem, Paul Lightle, Lake Gill and James Mielke counted and evaluated the health of all 13,304 cacti in Section 17 of Saguaro National Park East. They conducted their first saguaro census in 1941 and repeated the census every year through 1946.

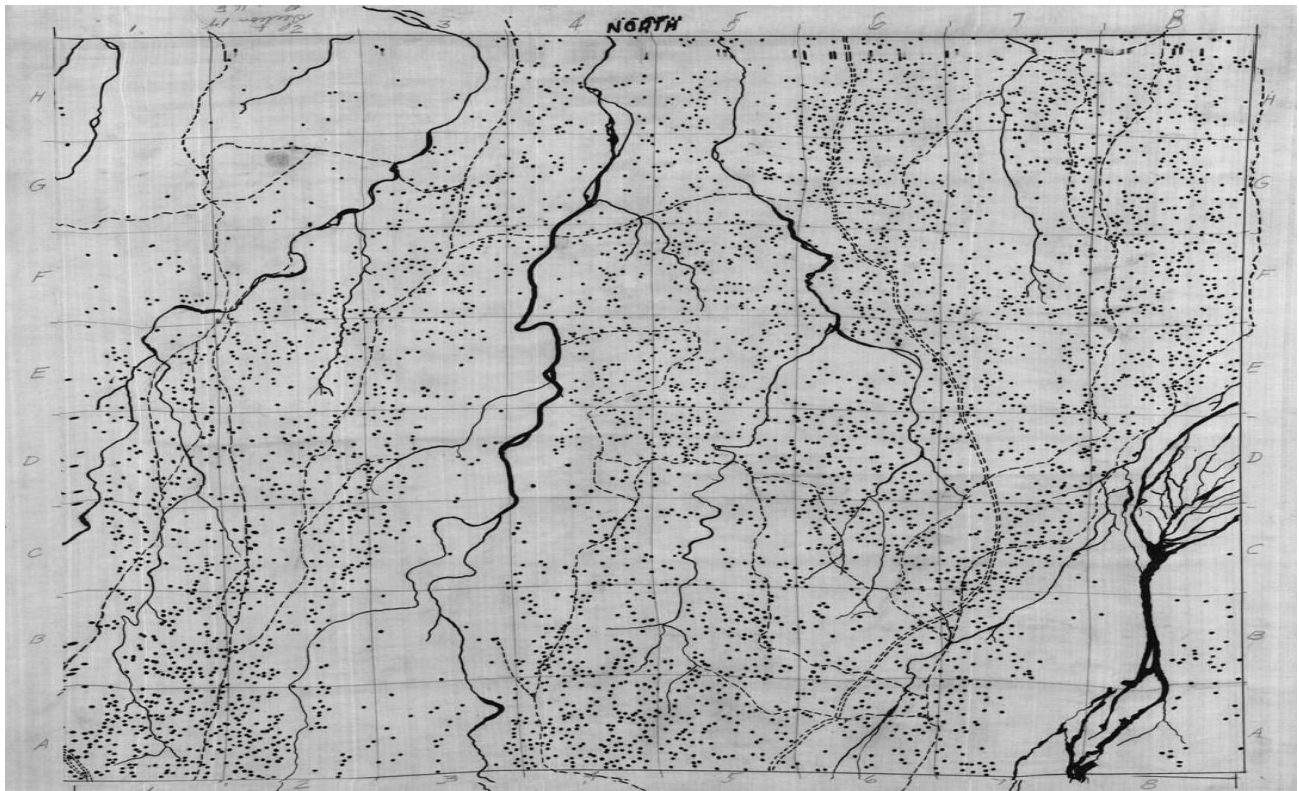


Figure 2: 1941 aerial photograph of Section 17, which was digitized for this project. The black dots are shadows from larger saguaros.

At the time, the decline in the saguaro population was believed to be caused by a contagious bacterial disease. To test this hypothesis, Lightle, Gill and Mielke removed and buried dead and dying saguaros in the southern half of Section 17 while smaller lesions were treated with antibiotics. Saguaros in the northern half of Section 17 were left untreated and served as a control. Now it is believed that many saguaros died from two intense freezes in 1937 and 1939 rather than bacterial rot. Other contributing factors are believed to be wood-cutting which removed the saguaros' protective "nurse trees", cactus piracy and cattle grazing (Steenbergh and Lowe 1977 and 1983).

During the 2011 National Geographic BioBlitz, adult and high-school citizen-scientists began a new census of Section 17. This BioBlitz grant funded the creation of a poster to educate the citizen-scientists who were conducting the census. The grant also funded the digitization of the 1941 Lightle, Gill and Mielke observations as well as the 1941 aerial photograph shown in Figure 2.

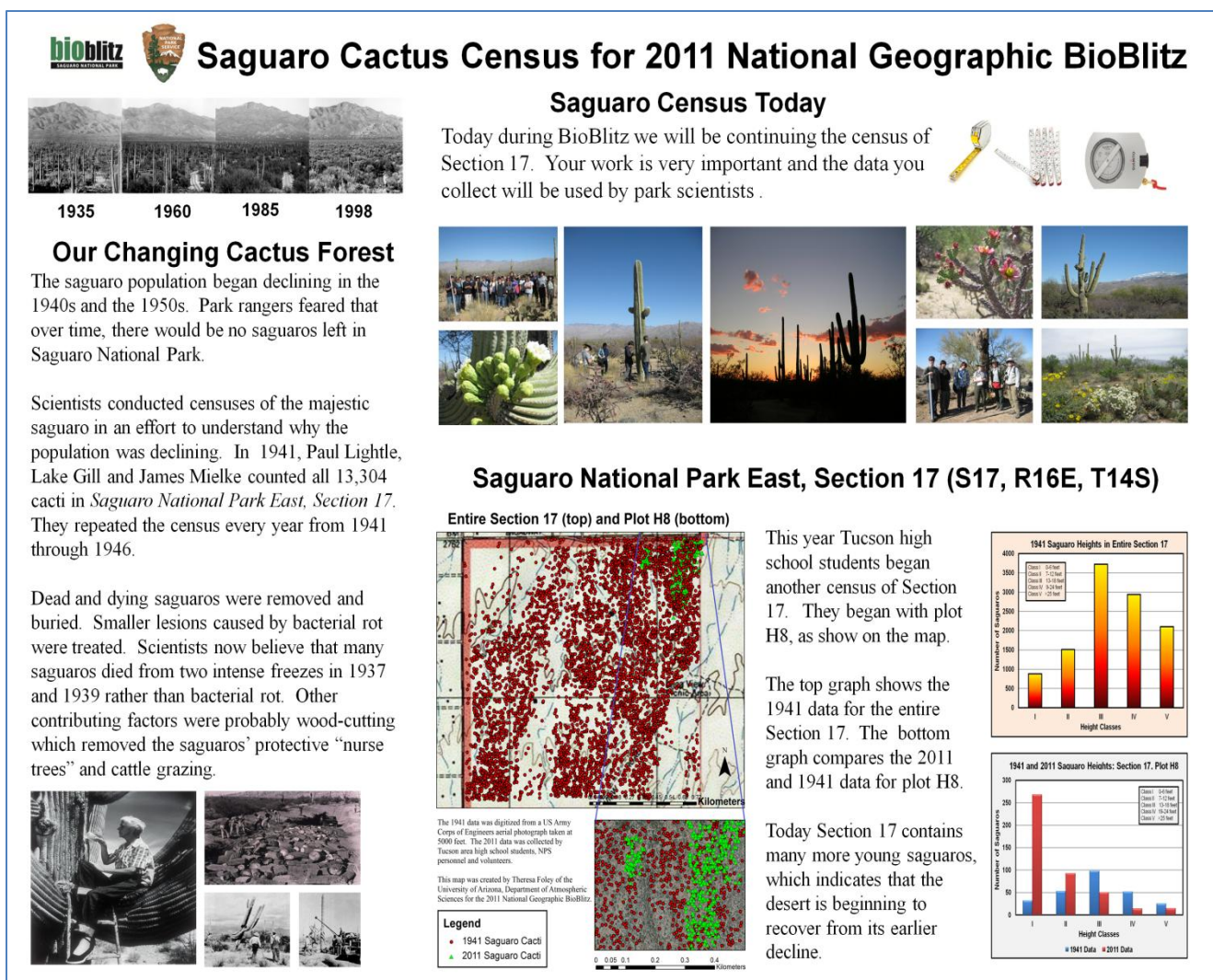


Figure 3: Educational poster created for the BioBlitz Section 17 census.

Methods

Collection of Census Data

120 high school students and 36 adult volunteers were enthusiastic participants in the BioBlitz Saguaro census (Figures 4 and 5). The following parameters were measured: cactus height, GPS coordinates, the number of arms and whether the cactus had any bird holes. The BioBlitz field protocol was similar to the protocol of O'Brien et al. (2011).

Teams containing three or four high school students were led by the adult volunteers. One student measured cactus height with a yardstick previously calibrated against a clinometer, another student used a hand held GPS to measure its coordinates and a third student marked the location of each cactus with a brightly colored flag to prevent double-counting. The observations were recorded by the fourth student or adult volunteer.



Figure 4: Key people involved in the BioBlitz saguaro census data collection. Clockwise from top left: Section 17 coordinator Irene Weber, veteran saguaro researchers Tom Orum and Nancy Ferguson, photographer Tom Uhlman and the adult volunteers.



Figure 5: Photographs of the BioBlitz saguaro census data collection. Clockwise from top left: a student team records the geographic coordinates of a smaller cactus, measuring cactus height using a calibrated yardstick, a large cactus counted during BioBlitz, enthusiastic younger volunteers on the second day of the BioBlitz, an adult volunteer poses with her team and a dead cactus.

Database Creation

Lightle, Gill and Mielke recorded their saguaro census data in two sections. The first section contains the height class, codes describing the size and location of lesions and page numbers which correspond to pages in the second section of detailed field notes. There is a lot of overlap because both sections contain information on saguaro treatment and many comments are also found in the first section. Very few discrepancies between the two sections were found.

The database was designed so that the organization of the data into tables is logical and minimizes redundancy (Figure 6). The Main Table contains information on saguaro height and location. All 13,304 saguaros inventoried by Lightle, Gill and Mielke were assigned a number which is contained in the Cactus_No field. The Cactus_No field serves as a link to additional tables that document saguaro condition as well as dead, treated, chopped and removed saguaros. The database also includes lookup tables for saguaro height classes and saguaro condition codes.

The page numbers recorded in the first section of the 1941 notes are contained in a table called Page Numbers. The detailed field observations that correspond to the page numbers are contained in another table called Notes. The Page_No field in the Page Numbers table serves as a link to the Notes table. The Notes table is also linked to the Main table through the Cactus_No field. The redundant Page Numbers table is included so that all of the 1941 data is preserved.

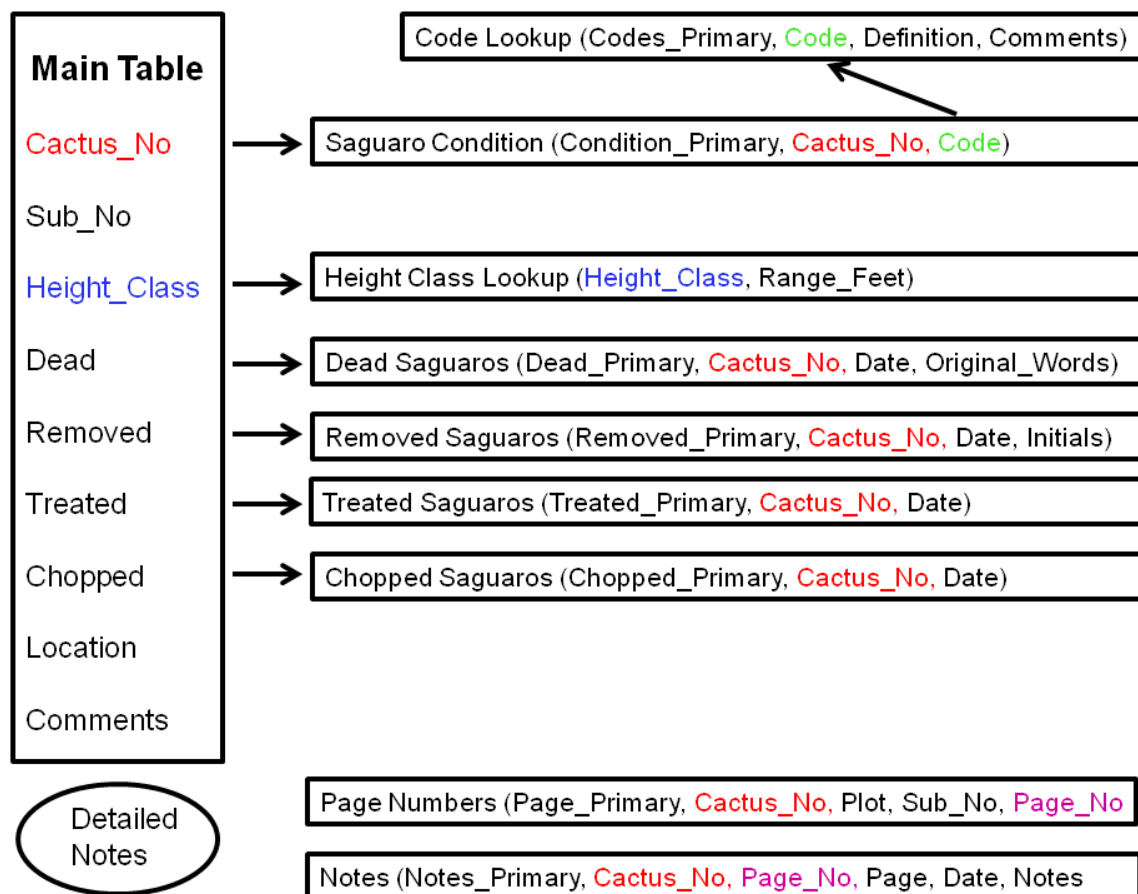


Figure 6: Design of the database containing the 1941 saguaro census data. Fields that serve as links to other tables are highlighted.

The date field in many of the tables is formatted as text rather than as a date/time field because many dates are unknown or only recorded as month and year. Access requires all the data in a field to share the same format and does not allow individual cells to be formatted. In Access, these dates appear as number strings. The dates can be recovered by importing into Excel, converting the text to numbers and then selecting the time/date format.

Plans for Future Monitoring

Through this BioBlitz grant, the 1941 hand-written field notes of Lightle, Gill and Mielke were converted into a database suitable for additional analysis. The geographic coordinates of saguaro cacti found in a 1941 aerial photograph were also digitized using a geographical information system. Finally this grant funded the creation of an educational poster that was used during the during the BioBlitz saguaro census.

The Section 17 saguaro census effort will continue until all 64 plots of Section 17 are inventoried. At the time of this report, 34 plots have been completed. SNP hopes to finish a census of the entire Section 17 by the end of March. The Section 17 team is now applying for additional funding so that the 1941 and 2011-2012 BioBlitz data can be analyzed. The results will be published in a peer-reviewed scientific journal such as Ecology.

The goal of the BioBlitz Section 17 is to learn more about the long term population dynamics of *C. gigantea* populations at SNP. The Section 17 saguaro census project is one of the longest biological monitoring studies in a national park. Well-known writer Mary Kay Carson and photographer Tom Uhlman attended the BioBlitz saguaro census. The Section 17 project will be included in their children's book called Scientists in our National Parks, which is tentatively scheduled for publication in 2014.

Bibliography

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