

STATUS OF VEGETATION (BASELINE DATA) ON THE  
TANQUE VERDE GRAZING ALLOTMENT, SAGUARO NATIONAL MONUMENT

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PROJECT SUPERVISOR: Warren F. Steenbergh, Research Scientist,  
Cooperative National Park Resources Studies  
Unit, University of Arizona.

FIELD ASSISTANTS: Stephen Bogen, Robert Schmalzel,  
Paul Fugate.

DATES: Field work was carried out from May 3, 1976  
to June 16, 1976.

THE PROBLEM: The condition of natural vegetation in the Rincon Mountains has been substantially altered by decades of domestic livestock grazing. The removal of domestic livestock from these lands will allow natural regeneration of native vegetation to occur. Information on the current status of vegetation has been provided by this study, and will provide a basis for future measurements to determine the nature and rate of change in the natural vegetation that will occur with release from the pressures of domestic livestock grazing.

ACCOMPLISHMENTS: Ten permanent study plots were established in representative plant communities and the current status of included perennial vegetation was documented.

Permanent photo points were established, both in the immediate vicinity of study plots and in other habitats not represented by study plots. Photographs were taken from all photo points and annotated. The methods are described for use in follow-up studies.

## METHODS:

A. Plot sites: Plots 7601 and 7602, 7603 and 7604, 7605 and 7606, 7607 and 7608 are all paired plots. Plot 7601 (ungrazed) is outside the barbed wire fence near the monument loop drive, and 7602 (grazed) is inside the fence.

7603 is immediately adjacent to Mica tank, where cattle congregate. Plot 7604 is located in a less intensively grazed situation near the Douglas Spring Trail. Both plots are situated on northwest-facing slopes.

Similarly, plot 7605 is located near Aguila tank while plot 7606 is in a lightly grazed situation near the trail. Both plots are on north-facing slopes.

7607 is adjacent to Mica tank. 7608 is near Douglas Spring Trail. Both plots are on south-facing slopes in representative saguaro habitat.

In all cases, sites for paired plots were chosen for similarity of exposure, elevation, and vegetation type. See plot diagrams, and location map for more information.

Vegetation in plot 7609 is dominated by Agave schottii and Happlopappus laricifolius. Plot 7610 is located near Douglas Spring, el. 4800 ft, and is dominated by Agave schottii, Nolina microcarpa, and manzanita (Arctostaphylos pungens). These plots are unpaired.

B. Plot layout: All plots are 20 x 50 meters, rectangular (90 degree corners), with steel stakes at each corner. These stakes have brass tags designating the number of each corner: plot number (7601, 7602, etc.) followed by 01, 02, 21, 22

respectively. Each 50 meter side has 7-inch galvanized gutter spikes driven in the ground at 2.5 meter intervals (no numbers on spikes). Nineteen spikes and two stakes per 50 meter side mark the 21 lines used for intercept data. Many of these spikes may be missing by the time the plots are re-done, since, in many cases, solid rock was very close to the surface and the spikes could not be hammered in very far. This should not pose much of a problem, however, as long as the corner stakes are present. In many cases, the spikes on opposite ends of lines are not exactly 20 meters apart, because of the bedrock problem. However, all lines were run uphill so that "0" on the intercept is uphill and 2000 cm is wherever that point on the tape falls (the downhill spike is used for a reference point in running the line but is not assumed to be the 2000 cm mark).

C. Information recorded:

1. Line-intercept data: The line-intercept method of Canfield (1941) was used with some modifications. For basal intercept of grasses, that part of the base of a clump overlapping the intercept line was recorded. The point at which the base touched the line was recorded as the "in" point, and the last point of touch was recorded as the "out" point. Delta ( $\Delta$ ) was in all cases the "out" intercept minus the "in" intercept. For the crown cover measurement, it was assumed that the crown was circular, with an imaginary line connecting all the outermost blades of grass (see intercept diagram). A meter stick was used to determine a perpendicular line from the edge

of the crown to the line--a 30-meter steel tape graduated at 10 cm intervals. The "in" and "out" intercept was recorded to the nearest half centimeter using tape markings and meter stick. In many cases, the crown was so heavily grazed that it was practically non-existent. In these instances, the base and crown were considered to have the same intercept points, since it is not clear where the base ends and the crown begins. Clumps of grasses were counted, but not individual stems; each clump was considered as the individual unit. The height was recorded for each clump. This measurement was the maximum height, perpendicular to the ground, whether that part fell on the intercept or not. The meter stick was placed inside the clump, and the height read as that part of the clump reaching the highest point on the meter stick.

Procedure for measuring the herb and shrub and tree layers was the same for height but not for intercept. In the case of non-grasses, the basal area was not measured; only that vertically projected part of the crown which intercepted the line was considered. The same technique used for estimating crown cover of grasses was used for non-grasses. The difficulties, however, were much greater, especially for trees and widely-spreading shrubs like ocotillo. The crown was considered as a circular shape connecting the outermost points around the plant. A perpendicular line was then projected from the edge of the crown to the surveyor's tape using the meter stick, and the "in" and "out" intersect points were recorded. Only the live part was measured--dead parts were considered to be

non-existent. If no live parts overlapped the intercept line, the plant was not counted. In the case of plants higher than 2 meters, the perpendicular was estimated by standing under the part of the crown overlapping the intercept line, and projecting an imaginary line from the crown edge to the steel tape.

Weight measures for tall plants were estimated by eye. Any plant over 2 meters tall was placed into one of three classes--over 2 m, over 2.5 m, and over 3 m. Plants less than 2 meters were measured with the meter stick. The maximum height of the live part was recorded, even if this part fell outside of the intercept. The recorded height was the perpendicular distance from the tallest part to the ground directly below it.

In all cases a perennial part rather than a flower or flower stalk was used to document height. In certain cases, it was difficult to tell if a part was alive or dead, such as with Encelia farinosa, Mimosa biuncifera, and Acacia greggi wherein most of the plant was in leaf but some of the upper parts were not. In these cases the part was considered alive if it was flexible and dead if it was so brittle that it broke off (in which case, future measurements will not have to contend with the specific part of that plant).

Continuous coverage was recorded for all plants, rather than attempting to determine where overlapping individuals ended and began. In the case of Agave schottii, Nolina and manzanita, it was impossible to tell how many individuals were involved.

In the case of cacti, spines were considered as leaves and counted in height and intercept points. Fruits were ignored.

2. 20 x 5 meter plots: Except for 7609, vegetation in 20 x 5 m subplots was recorded as follows: all individuals over 25 cm in height were tallied (exact height was not measured). In plot 7609, individuals over 25 cm height were recorded only in subplots A and B. In the eight remaining 20 x 5 m 7609 subplots, only individuals over 50 cm were tallied. This was necessary because A. schottii completely dominated the plot. Most of the individuals were between 23 and 27 cm in height, all overlapped, and most had a common root system, all of which made individual counts impractical. The only agaves recorded as over 50 cm in height (with some exceptions) were those with live flowering stalks. This information was recorded as a matter of curiosity. The number of individuals over 50 cm with live stalks is specified on the worksheet.

3. 2 x 5 meter subplots: Each plot diagram shows the location of the 2 x 5 m subplots in the plot. In these plots, every individual of every species encountered was counted, and the height range (minimum to maximum) was recorded for each subplot.

String was used to delimit the 20 x 5 m and 2 x 5 m subplots. This was done by tying twine at stake 02, then running it out 20 meters to stake 01, then from 01 to spike 03, 20 meters to spike 04, then to 06, then 20 meters to its opposite spike, and the following spikes on each 50 meter side had twine between them: 01-03; 04-06; 05-07; 08-10; 09-11;

12-14; 13-15; 16-18; 17-19; 20-22. This gave ten 20 x 5 m subplots, and one of the 5 meter sides to each of the ten 20 x 5 m subplots. The 2 meter sides of the latter subplots were measured with the meter stick. Because of the nature of the interaction between the string and the spines and vegetation the strings did not always run perfectly true.

D. Photo documentation: Photo points were marked by steel stakes identical to those used as plot corner stakes, and brass tags were used to designate the numbers. Photo points were numbered consecutively, CP 7601 to CP 7660. There were 4 to a plot (CP7601 to CP7640), with tags CP7641 to CP7660 used in situations not covered by plots.

1. Plots: Approximately 20 black and white photos (1 roll) were taken per plot, including 4 or 5 stereo pairs. These were taken by shooting a picture, and keeping the exact subjects in the frame, then shooting a second picture after moving 4 inches to the right. In other words, the 2 pictures have the same subjects, but with about a 4 inch base separation. For maximum coverage, a 28 mm lens was used to shoot the stereo pairs, at least those facing into the plots.

Orientation photos were also taken, using a 50 mm lens so the landmarks would appear in the photos as an observer would actually see them. The following information was recorded for all photos:

1. CP number, and location of photo point in reference to landmarks or stakes in the plot

2. Compass direction the photographer was facing when the shot was taken, and orientation of photographer in relation to photo point (whether in front, over, beside, etc.).

3. Roll and frame number, film used, and lens used: Kodak Plus-X Pan film (ASA 125) was used for all photography, and 28 and 50 mm lenses were used. A Canon F-1 camera was used. All shots were over-exposed 1 stop for detail.

4. Dominant plant species appearing in photo: In general, the same dominants appear in each photo on a plot or at a particular photo point, so the species were listed for one picture and for succeeding frames only additional species not appearing before are listed. When a photo is of a situation different from the rest, however, species are listed again.

See photo data sheets and plot diagrams for additional information. Plot diagrams show location of photo points, and approximate direction of shot. Photo data sheet lists compass direction of shot. This information was designed to allow photos of exact same coverage in later years. Should succeeding photographers not have a 28 mm lens, 2 side-by-side shots with a 50 mm would provide approximate coverage.

PHOTO NUMBERING SYSTEM: The first two digits designate the roll number, next four digits designate plot or CP number if non-plot photo, and the last digit or two designate the frame number. L = left, R = right for stereo pairs. To find photo of a particular location, determine roll number first, and under a specific roll look for the frame number (from data sheets). Example: #12-7601-03 is roll 12, plot 7601, frame 3.

ADDENDUM AND COMMENTS: Additional information recorded for each plot was the approximate slope angle and percent bare rock. On some plots percent bare rock was recorded on line intercept data. On others it was estimated by eye. Future investigators may want to use different methods than were used on a particular plot so as to determine accuracy and consistency of such measurements.

Slope angle was determined by using a Brunton Pocket Transit (Ainsworth) according to manufacturer's instructions.

REFERENCES:

Canfield, R. 1941. Application of the line-interception method in sampling range vegetation. J. Forestry 39:388-394.

## CAMERA POINT

## GENERAL LOCATION

|             |                                                                                                                                                                                                                                                    |
|-------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 7601 - 7604 | Plot 7601, outside fence, loop drive.                                                                                                                                                                                                              |
| 7605 - 7608 | Plot 7602, inside fence, loop drive.                                                                                                                                                                                                               |
| 7609 - 7612 | Plot 7607, south slope, Mica tank.                                                                                                                                                                                                                 |
| 7613 - 7616 | Plot 7603, north slope, Mica tank.                                                                                                                                                                                                                 |
| 7617 - 7620 | Plot 7604, north slope, near fence gate,<br>near Douglas Spring Trail.                                                                                                                                                                             |
| 7621 - 7624 | Plot 7605, north slope, near Aguila tank.                                                                                                                                                                                                          |
| 7625 - 7628 | Plot 7606, north slope, near junction of<br>Douglas Spring Trail and first jeep road<br>which crosses it.                                                                                                                                          |
| 7629 - 7632 | Plot 7608, south slope, second hilltop south<br>of trail, near fence.                                                                                                                                                                              |
| 7633 - 7636 | Plot 7609, north slope by trail, 2 mi before<br>Douglas Spring.                                                                                                                                                                                    |
| 7637 - 7640 | Plot 7610, flat area, east of Douglas Spring.                                                                                                                                                                                                      |
| 7641, 7642  | At catchment pool, near Tina Larga tank.                                                                                                                                                                                                           |
| 7643        | First wash NE of plot 7601, inside fence,<br>loop drive.                                                                                                                                                                                           |
| 7644        | Beside fence, 10 meters beyond first large<br>wash south of gate at parking lot entrance<br>of Douglas Spring Trail.                                                                                                                               |
| 7645        | 30 meters from Douglas Spring Trail, at 180<br>degrees from a point on the trail which is<br>18 meters from the very large, sandy wash<br>(at junction of Douglas Spring Trail and<br>prominent cattle trail) about 0.4 mi from<br>start of trail. |

## CAMERA POINT

## GENERAL LOCATION

- 7646 Near trail, 35 meters west of the point at which trail becomes level after initial steep climb (about 0.9 mi after start of trail). Jojoba habitat.
- 7647 Near trail, 50 meters east (80 degrees) of point mentioned for 7646.
- 7648 Near trail and Tina Larga tank. 123 degrees, 100 meters from junction of trail and second jeep road which crosses it.
- 7649 In large wash just after above point.
- 7650 In wash, Mica tank, between plots 7603 and 7607.
- 7651 Just off trail, between Douglas Spring and upper fence in pine-oak habitat.
- 7652 In wash (scoured bare rock), pine zone above 7651.
- 7653 Wash SW of 7601, outside fence, 100 meters 150 degrees from parking area. This parking area is the large one 5 mi. after start of loop drive.
- 7654 Same wash, inside fence
- 7655 Inside fence, 200 meters, 115 degrees from parking area 5.6 mi on left, after start of loop drive.
- 7656 Outside fence, 110 meters, 115 degrees from same parking area.

CAMERA POINT

GENERAL LOCATION

|      |                                                                                                                     |
|------|---------------------------------------------------------------------------------------------------------------------|
| 7657 | Inside fence, 250 meters, 155 degrees from parking area 6.2 mi from start of loop drive, on left. Follow deep wash. |
| 7658 | First wash north of entrance through gate on trail to Juniper Basin (starts in monument picnic area).               |
| 7659 | Second wash north of above gate. Turn NE, go 40 meters into wash.                                                   |
| 7660 | Hill facing south, just north of above wash.                                                                        |

Date 5/27/76

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Rock 1400  
5/9/22 24

18'19" = 10'11"  
 16'17" = 5'6"  
 15'13" = 1'13"  
 14'11" = 1'14" (plot error)  
 13'10" = 1'10"  
 12'02" = 2'  
 11'17" = 1'17"

Repetition frames  
 - 1st. 1st.