

SAGUARO NATIONAL MONUMENT BACKCOUNTRY CAMP SITE MONITORING MANUAL

DESCRIPTION OF PROCEDURES

Manual Revision Date: 8/92

For the purposes of this manual camp sites are defined as designated sites in one of six designated camping areas in the Rincon Mountain District (RMD). Site boundaries are delineated by vegetation and soil disturbance caused by visitor overnight camping and/or day-use activities. A fire site may or may not be present. All camping areas in the RMD have multiple sites and there may not always be undisturbed areas separating sites. Under these circumstances an arbitrary decision may be necessary to define separate sites.

During subsequent surveys an attempt should be made to relocate and assess all sites from the preceding survey. Former designated sites which have been closed should be treated as illegal sites. Always note information regarding the history of site use under the Comments parameter.

Materials:

- Compass, peephole or mirror type (corrected for declination)
- Topographic maps
- Tape measure, 50 ft minimum (metric or english units in 0.1 ft increments)
- Diameter tape measure (metric or english units)
- Flagged wire pins (20 minimum), one larger steel centerpoint stake
- Camera, 35mm SLR, 35-70mm lens and ASA 100 color print film recommended
- Clipboard, pencil, field forms (some on waterproof paper), procedures manual
- Steel nails (20 penny)
- Magnetic pin locator (type which locates only ferrous metals)

PROCEDURES

GENERAL SITE INFORMATION

- 1) Name of camp area: There are six designated camping areas in the RMD; Manning Camp, Spud Rock Spring, Happy Valley, Grass Shack Spring, Douglas Spring and Juniper Basin. Camping areas are marked with aluminum signs which give the name and elevation of the area. Overnight camping is prohibited in the Tucson Mountain District. Record the name of the camping area in the space provided.
- 2) Site number: Each camping area in the RMD has multiple designated camp sites (six at Manning Camp and three at each of the other areas). Each camp site is marked with a small aluminum sign engraved with the site number. Record the site number in the space provided.
- 3) Site location: Briefly describe the location of the camp site within the camping area using local geographic features and distances in sufficient detail so that someone five years later could relocate the site.
- 4) Inventoried by / Date: List the names of field personnel involved in data collection and the month, day, and year the camp site was evaluated (eg. June 12, 1989 = 06/12/89).

INVENTORY PARAMETERS

- 5) **Overstory Species:** Record the name(s) (common or scientific) of all tree species that form the canopy over the camp site.
- 6) **Tree Canopy Cover Over Site:** Estimate the percentage of tree canopy cover directly over the camp site:
1=0-25 % 2=26-50 % 3=51-75 % 4=76-100 %
- 7) **Number of 8x10 tent pads:** Number of relatively level and rock/stump-free sites (including satellites) where an 8x10 foot tent could be comfortably erected allowing for social space differences, ie. take into account how close to each other tents would be set up by a larger party. The intent is to determine which sites are appropriate for group use versus use by small parties.
- 8) **Number of Other Camp Sites Visible:** Record the number of other camp sites which, if occupied, would be visible from the camp site. This is a social variable to assess site intervisibility, ie. to assess where visitors might experience solitude or camp with other visitors in a more social setting.
- 9) **Toilet:** Search general area for the presence of any NPS provided toilet. Each camping area at Saguaro National Monument has some sort of toilet available. Briefly describe the type of toilet available and note its location in relation to the camp site being inventoried.
- 10) **Fire grate:** Record the presence or absence of a fire grate within the camp site. If a fire grate is present enter (y). If no fire grate is found enter (n). Briefly describe the type of grate.

IMPACT PARAMETERS

The first step is to establish the camp sites' boundaries and measure its size. The following procedures describe the use of the Variable Radial Transect Method (refer to diagrams following these procedures) for determining the sizes of camp sites. This is accomplished by measuring the lengths of linear transects radiating from a permanently defined center point to the camp site boundary.

- Step 1. Identify Camp Site Boundaries and Flag Transect Endpoints.** Walk the camp site boundary and place flagged wire pins at locations which, when connected with straight lines, will define a polygon whose area approximates the camp site area. Use as few pins as necessary, typical camp sites can be adequately flagged with 10-15 pins. Look both directions along camp site boundaries as you place the flags and try to balance areas of the camp site which fall outside the lines with undisturbed areas which fall inside the lines. Pins do not have to be placed on camp site boundaries, as demonstrated in the diagram following these procedures. Project camp site boundaries straight across areas where trails enter the site. Identify camp site boundaries by pronounced changes in vegetation cover, vegetation height/disturbance, vegetation composition, surface organic litter, and topography (refer to photographs following these procedures). Many sites with dense forest overstories will have very little vegetation and it will be necessary to identify boundaries by examining changes in organic litter, ie. leaves which are untrampled and intact vs. leaves which are pulverized or absent. In defining the camp site boundaries be careful to include only those areas which appear to have been disturbed from human trampling. Natural factors such as dense shade, surface runoff, and thin soils can create areas lacking vegetative cover. Do not include these areas if they appear "natural" to you. When in doubt, it may also be helpful to speculate on which areas typical visitors might use based on factors such as slope or rockiness.
- Step 2. Select and Reference Camp Site Centerpoint.** Select a camp site centerpoint which is preferably: a) visible from all the camp site boundary pins, b) easily referenced by distinctive permanent features such as larger trees or boulders, and c) approximately 5 feet from the steel firegrate. Insert centerpoint stake in the soil at the centerpoint location and reference it to at least three features. Try to select reference features in three opposing directions as this will enable future workers to triangulate the center point location. For each feature, take a compass bearing (nearest degree) and measure the distance (nearest 1/10 ft or cm) from the feature to the centerpoint. Also measure the approximate diameter of reference trees at 4.5 feet above ground (dbh). Be extremely careful in taking these bearings and measurements

as they are critical to relocating the centerpoint in the future. Record this information in the spaces provided on the back of the form.

- Examples:
- 1) From Alligator Juniper, 0.7 ft dbh, 12.4 ft at 52°
 - 2) From Ponderosa Pine, 1.2 ft dbh, 23.2 ft at 208°
 - 3) From Boulder, 17.9 ft at 312°, (distance and bearing from highest point)
 - 4) From NW corner of cement fire grate slab, 1.6 ft at 193°
 - 5) From Camp site sign post, 4.5 ft at 183°

Take a photograph which clearly shows the centerpoint location in relation to nearby trees or other reference features, such as the steel grate, nearby trees, or boulders. Record the roll and frame number in the photo log. When you have completed procedures 1 through 24 remove the centerpoint stake and place a 20 penny nail in the centerpoint location so that the head is about 1 inch below the surface. During future site assessments a magnetic pin locator can be used to locate the centerpoint. Locating the centerpoints near the firegrates, which are semi-permanently anchored, will simplify their relocation. However, interference with the steel in the grates may be encountered if the centerpoint nail is closer than 5 feet to the grate.

Options: Some sites may lack the necessary permanent reference features enabling the center point to be accurately relocated. If only one or two permanent reference features are available, use these and take additional photographs from several angles. If permanent features are unavailable simply proceed with the remaining steps without permanently referencing the center point. This option will introduce more error in comparisons with future measurements, particularly if the camp site boundaries are not pronounced. Note your actions regarding use of these options in the Comments section.

Step 3. Record Transect Azimuths and Lengths. Standing directly over the centerpoint, identify and record the compass bearing (azimuth) of each camp site boundary pin working in a clockwise fashion (in the exact order you would encounter them if you were walking the camp site boundary). Be careful not to miss any pins hidden behind vegetation or trees. Be extremely careful in identifying the correct compass bearings to these pins as error in these bearings will bias current and future measurements of camp site size. Next, anchor the end of your tape to the centerpoint stake, measure and record the length of each transect (nearest 1/10 foot), starting with the same boundary pin and in the same clockwise order as before. Be absolutely certain that the appropriate pin distances are recorded adjacent to their respective compass bearings. Leave boundary pins in place until you finish all other camp site measurements and photos.

Step 4. Measure Island and Satellite Areas. Identify any undisturbed "islands" of vegetation inside camp site boundaries (often due to clumpings of trees or shrubs) and disturbed "satellite" use areas outside camp site boundaries (often due to tent sites or cooking sites). Use camp site boundary definitions for determining the boundaries of these areas. Use the Geometric Figure Method to determine the areas of these islands and satellites (refer to the diagrams following these procedures). This method involves superimposing one or more imaginary geometric figures (rectangles, circles, trapezoids, or right triangles) on island or satellite boundaries and measuring appropriate dimensions to calculate their areas. Record the types of figures used and their dimensions on the back of the form; the sizes of these areas should be computed in the office with a calculator.

Site Remeasurement: During site remeasurement the centerpoint and all camp site boundary pins will be relocated according to center point references and transect compass bearings and distances. If steel centerpoint nails were embedded in the ground, a magnetic pin locator can also assist in this process. Boundary pin locations will then be reassessed based on the following procedures:

- 1) Keep the same transect length if that length still seems appropriate, ie. there is no compelling reason to alter the initial boundary determination.
- 2) Record a new transect length if the prior length is inappropriate, ie. there is compelling evidence that the present boundary does not coincide with the pin and the pin should be relocated either closer to or further from the centerpoint along the prescribed compass bearing.
- 3) Repeat Steps 1 and 3 from above to establish additional transects where necessary to accommodate any changes in the shape of camp site boundaries (refer to diagram following these procedures). Also repeat Step 4.

These additional procedures are designed to eliminate much of the measurement error associated with different individuals making subjective judgements on those sites or portions of sites where boundaries are not pronounced. These procedures may only be used for sites whose centerpoints can be relocated.

- 11) Vegetative Ground Cover Onsite: An estimate of the percentage of live non-woody vegetative ground cover (including herbs, grasses, and mosses and excluding tree seedlings, saplings, and shrubs) within the flagged camp site boundaries using the coded categories listed below (refer to photographs following these procedures). Include any disturbed "satellite" use areas and exclude undisturbed "islands" of vegetation. For this and the following two parameters, it is often helpful to narrow your decision to two categories and concentrate on the boundary that separates them. For example, if the vegetation cover is either category 2 (6-25%) or category 3 (26-50%), you can simplify your decision by focussing on whether vegetative cover is greater than 25%.
1=0-5% 2=6-25% 3=26-50% 4=51-75% 5=76-95% 6=96-100%
- 12) Vegetative Ground Cover Offsite: An estimate of the percentage of vegetative ground cover in an adjacent but largely undisturbed "control" area. Use the codes and categories listed above. The control site should be similar to the camp site in slope, aspect, tree canopy cover (amount of sunlight penetrating to the forest floor), and other environmental conditions. The intent is to locate an area which would closely resemble the camp site area had the camp site never been used. In instances where you cannot decide between two categories, select the category with less vegetative cover. The rationale for this is simply that, all other factors being equal, the first campers would have selected a site with the least amount of vegetation cover.
- 13) Soil Exposure Onsite: An estimate of the percentage of soil exposure, defined as ground with very little or no organic litter (partially decomposed leaf, needle, or twig litter) or vegetation cover, within the camp site boundaries and satellite use areas (refer to the photographs following these procedures). Dark organic soil, which typically covers lighter colored mineral soil, should be assessed as bare soil. Assessments of soil exposure may be difficult when organic litter becomes highly decomposed and forms a patchwork with areas of bare soil. If patches of organic material are relatively thin and few in number, the entire area should be assessed as bare soil. Otherwise, the patches of organic litter should be mentally combined and excluded from assessments. Code as for vegetative cover above.
- 14) Soil Exposure Offsite: An estimate of the percentage of soil exposure on the control site used in item 12 above. Code as for vegetative cover above.
- 15) Number of Trees with Damage: Tally each live tree (> 1 inch diameter at 4.5 feet) within or on camp site boundaries to one of the tree damage rating classes described below (refer to the photographs following these procedures). Include trees within undisturbed "islands" and disturbed "satellite" areas. Multiple tree stems from the same species which are joined at or above ground level should be counted as one tree when assessing damage to any of its stems. Assess a cut stem on a multiple-stemmed tree as tree damage, not as a stump. Do not count tree stumps as tree damage. Take into account tree size. For example, a certain size scar may be moderate damage for a large tree, but severe damage for a small one. Omit scars which are clearly not human-caused (eg. lightning strikes).

None/Slight - No or slight damage such as broken or cut smaller branches, one nail, or a few superficial trunk scars.

Moderate - Numerous small trunk scars and/or nails or one moderate sized scar.

Severe - Trunk scars numerous with many that are large and have penetrated to the inner wood; any complete girdling of tree (cutting through tree bark all the way around tree).

- 16) Number of Trees with Root Exposure: Tally each live tree (> 1 inch diameter at 4.5 feet) within or on camp site boundaries to one of the root exposure rating classes described below. Include trees within undisturbed "islands" and disturbed "satellite" areas. Omit exposed roots which are clearly not human-caused (eg. stream/river flooding).

None/Slight - No or slight root exposure such as is typical in adjacent offsite areas.

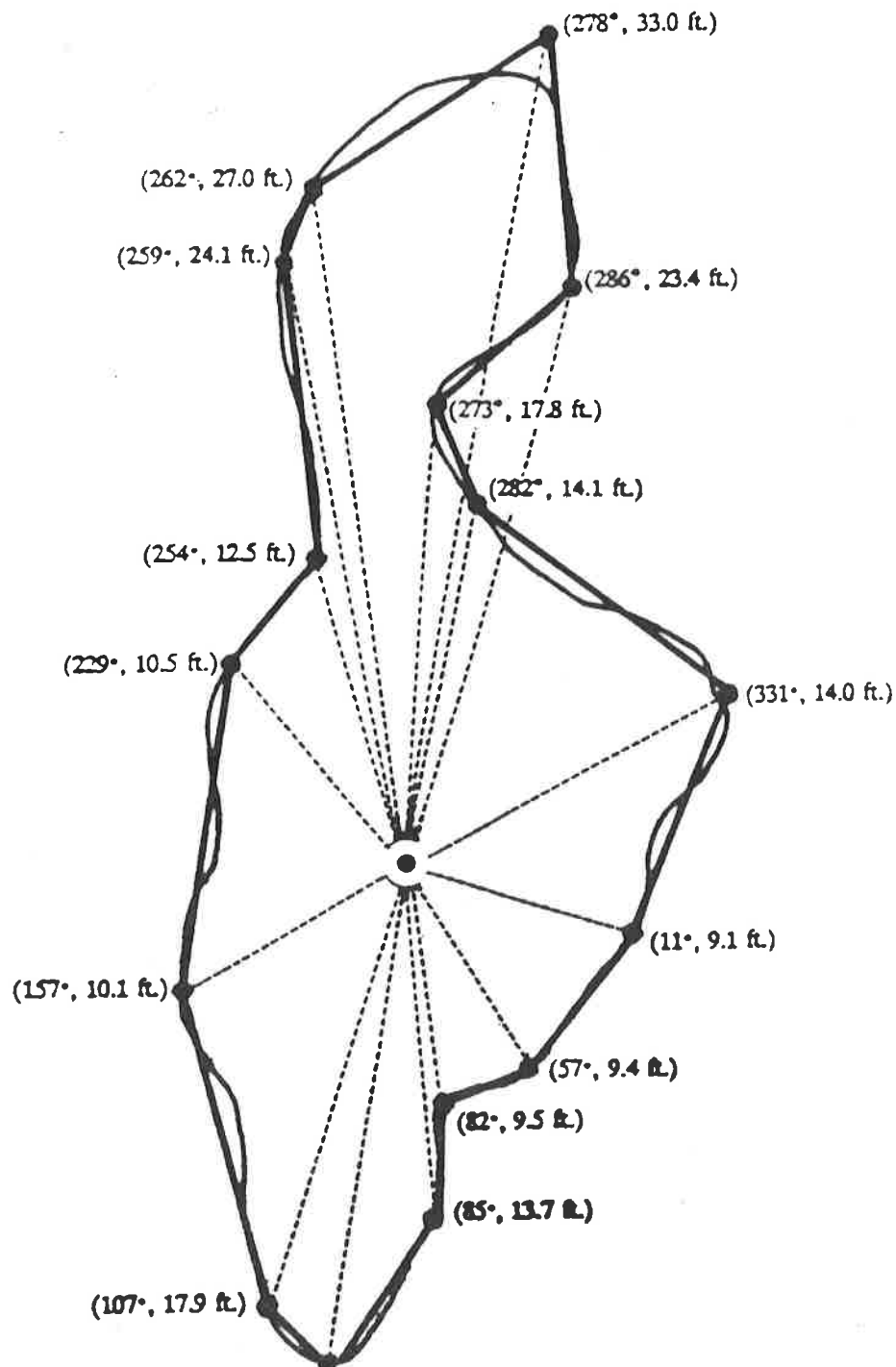
Moderate - Top half of many major roots exposed more than one foot from base of tree.

Severe - Three-quarters or more of major roots exposed more than one foot from base of tree; soil erosion obvious.

- 17) Number of Tree Stumps: A count of the number of tree stumps (> 1 in. diameter) within or on camp site boundaries. Include tree stumps within undisturbed "islands" and in disturbed "satellite" areas. Do not include cut stems from a multiple-stemmed tree.
- 18) Number of Trails: A count of all trails leading away from the outer camp site boundaries. It is assumed that each campsite will have one access trail, so do not count this trail. Count all other trails radiating out from the campsite. Do not count extremely faint trails which have untrampled tall herbs present in their tread or trails leading out to any satellite areas.
- 19) Number of Fire Sites: A count of each fire site within camp site boundaries, including satellite areas. Include old inactive fire sites as exhibited by blackened rocks, charcoal, or ashes. Do not include locations where charcoal or ashes have been dumped. However, if it is not clear whether or not a fire was built on the site, always count questionable sites that are within site boundaries and exclude those that are outside site boundaries.
- 20) Litter/Trash: Evaluate the amount of litter/trash on the site. Use the following coded categories: N=None, S=Some - any trash up to enough to fill a one gallon bucket, M=Much - enough to fill more than a one gallon bucket.
- 21) Human Waste: Follow all trails connected to the site to conduct a quick search of likely "toilet" areas, typically areas just out of sight of the camp site. Count the number of individual human waste sites, defined as separate locations exhibiting toilet paper and/or human feces. The intent is to identify the extent to which improperly disposed human feces is a problem. Use the following coded categories: N=None, S=Some - 1 to 3 sites evident, M=Much - 4 or more sites evident.
- 22) Horse Manure: Record the presence of horse manure on the site. Use the following coded categories: N=None, S=Some - 1 to 3 droppings, M=Much - 4 or more droppings.
- 23) Comments: An informal list of comments concerning the site: note any assessments that you felt were particularly difficult or subjective, problems with monitoring procedures or their application to this particular camp site, suggestions for clarifying monitoring procedures, recommendations regarding site management, or any other comments.
- 24) Camp Site Photograph: Select a good vantage point for viewing the entire camp site, preferably one of the camp site boundary flags, and take a picture of the camp site (color print film and a 35mm wide angle lens is recommended). The intent is to obtain a photograph which includes as much of the site as possible to provide a photographic record of site conditions. It will also allow future workers to make a positive identification of the camp site. Staple the camp site picture, the center point location picture, and any others to a blank sheet of paper and attach to the camp site form. Store and label the negatives.
- * Collect all camp site boundary pins, the centerpoint stake, and all other equipment.
- 25) Total Camp Site Area: A computer program will be used to calculate camp site area based on the recorded transect measurements. Add the area of any satellite sites and subtract the area of any undisturbed islands to obtain the Total Camp Site Area.

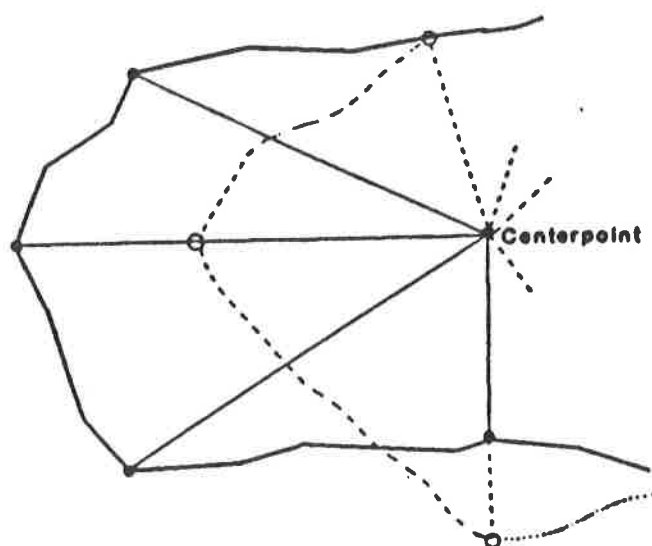
VARIABLE RADIAL TRANSECT METHOD

This method for determining the area of recreation sites is relatively time intensive but measurements made with this method are more accurate than other methods. Follow the steps presented above to assure accurate measurement and remeasurement of recreation sites.



SITE REMEASUREMENT USING VARIABLE RADIAL TRANSECT METHOD

Follow the procedures presented above to assure accurate remeasurement of recreation sites.



LEGEND

- Original boundary point
- Current boundary point
- Original boundary and transects
- Current boundary and transects

GEOMETRIC FIGURE METHOD

This method for determining the area of recreation sites, disturbed "satellite" sites, and interior undisturbed "island" sites is relatively rapid and can be quite accurate if applied with good judgement. Begin by carefully studying the site's shape, as if you were looking down from above. Mentally superimpose and arrange one or more simple geometric figures to closely match the site boundaries. Any combination and orientation of these figures is permissible, see the examples below. Measure the dimensions necessary for computing the area of each geometric figure. It is best to complete area computations in the office with a calculator to reduce field time and minimize errors.

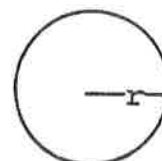
Good judgement is required in making the necessary measurements of each geometric figure. As boundaries will never perfectly match the shapes of geometric figures, you will have to mentally balance disturbed and undisturbed areas included and excluded from the geometric figures used. For example, in measuring an oval site with a rectangular figure, you would have to exclude some of the disturbed area along each side in order to balance out some of the undisturbed area included at each of the four corners. It may help, at least initially, to place plastic tape or wire flags at the corners of each geometric figure used. In addition, be sure that the opposite sides of rectangles or squares are the same length.



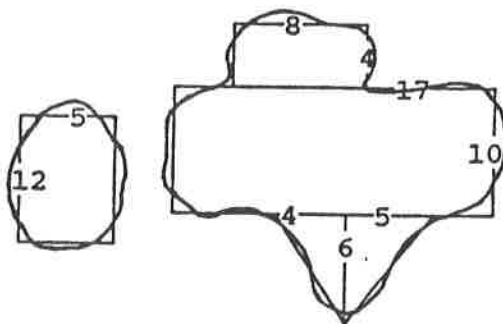
$$A = l \times w$$



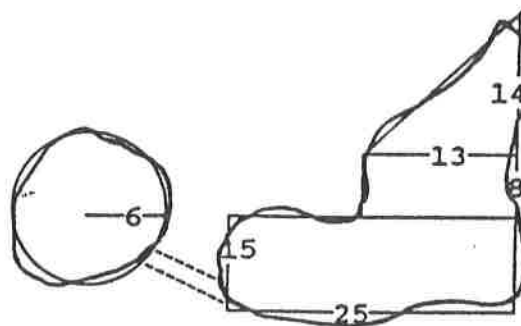
$$A = 0.5 \times b \times h$$



$$A = 3.14 \times r \times r$$

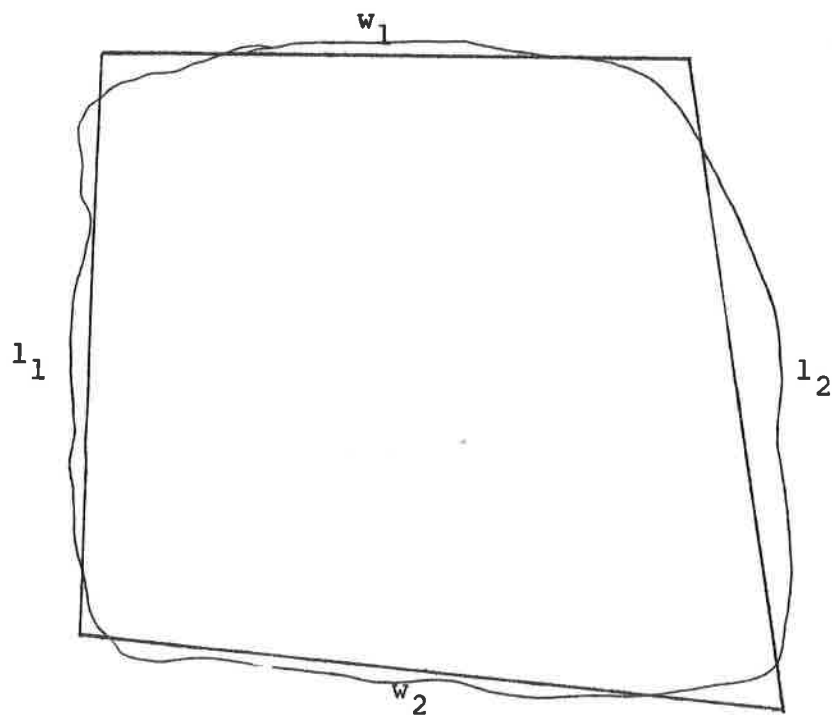


$$\begin{aligned} A &= (8 \times 4) + (17 \times 10) + (5 \times 12) + \\ &\quad (.5 \times 4 \times 6) + (.5 \times 5 \times 6) \\ A &= 289 \end{aligned}$$



$$\begin{aligned} A &= (.5 \times 13 \times 14) + (13 \times 8) + \\ &\quad (15 \times 25) + (3.14 \times 6 \times 6) \\ A &= 683 \end{aligned}$$

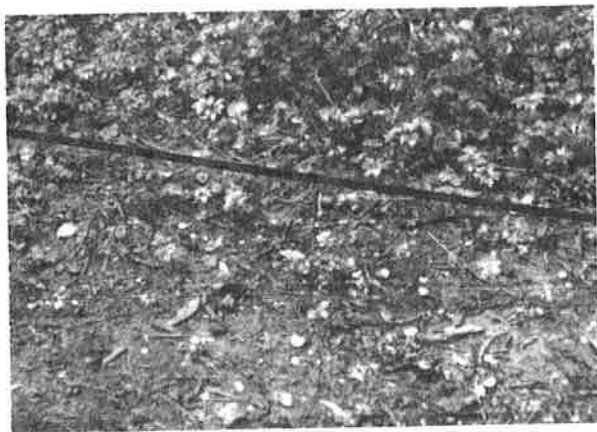
GEOMETRIC FIGURE METHOD (continued)



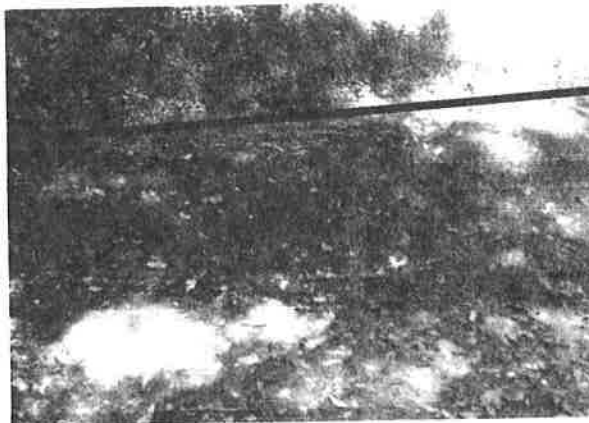
$$A = \frac{l_1 + l_2}{2} \times \frac{w_1 + w_2}{2}$$

SITE BOUNDARIES

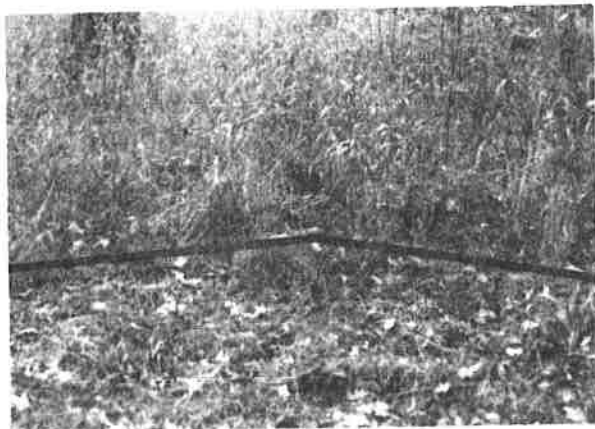
Identified by pronounced changes in vegetation, organic litter, or topography.



Vegetation Cover



Vegetation Composition



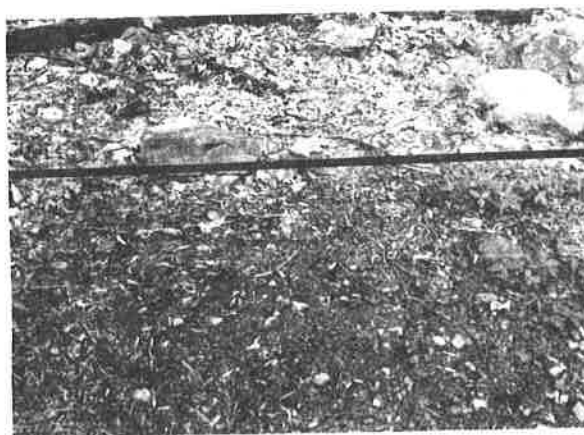
Vegetation Height/Disturbance



Topography



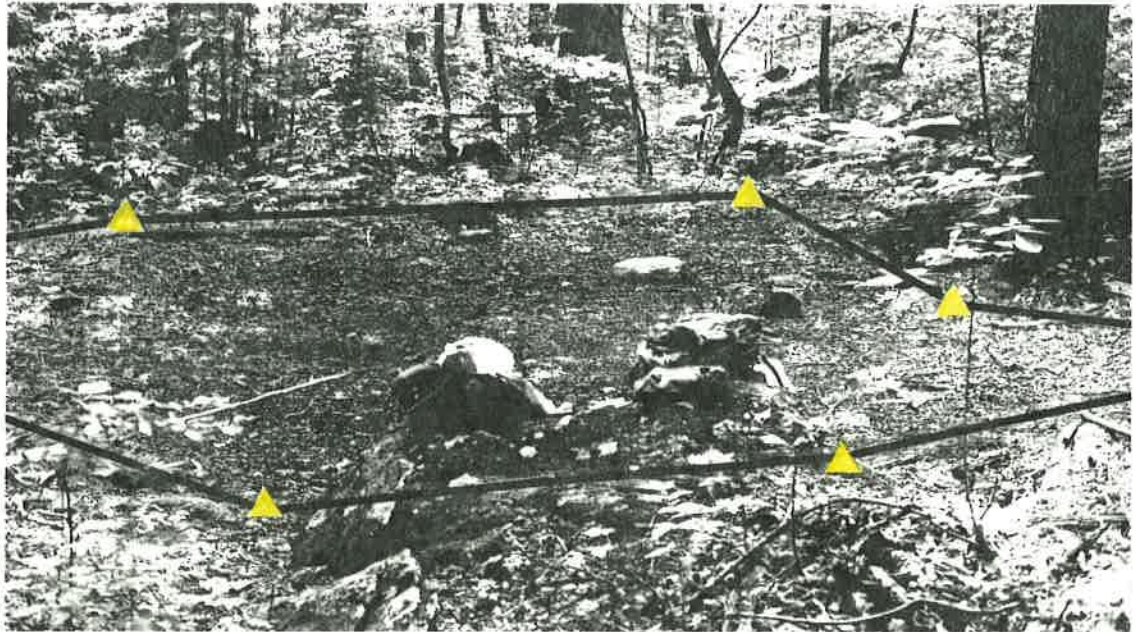
Organic Litter



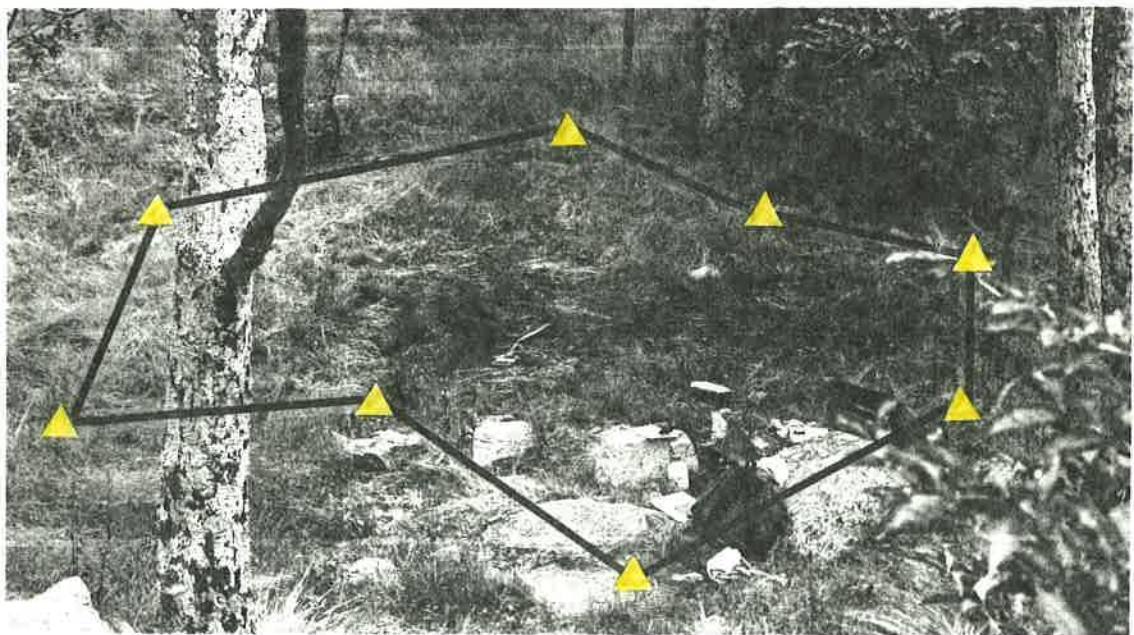
Organic Litter

SITE BOUNDARIES

Yellow triangles indicate flagged pin locations which delineate site boundaries.



Site boundaries determined by pronounced changes in vegetation cover.



Site boundaries determined by pronounced changes in vegetation height/disturbance.

VEGETATIVE GROUND COVER

Live non-woody vegetative ground cover (including herbs, grasses, and mosses).



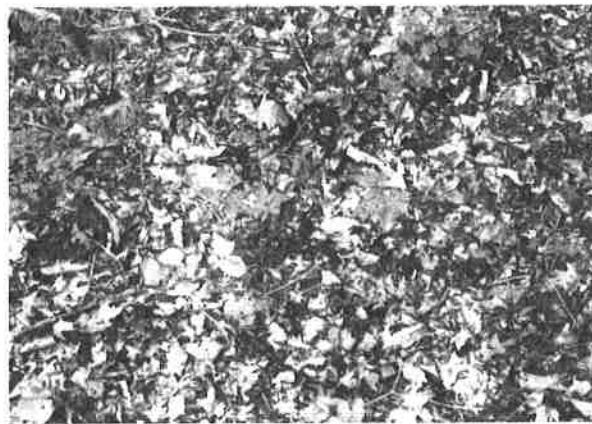
1 = 0-5%



2 = 6-25%



3 = 26-50%



4 = 51-75%



5 = 76-95%



6 = 96-100%

SOIL EXPOSURE

Areas of predominantly bare soil; very little or no organic litter or vegetation cover.



Organic litter on left is pulverized but still covers underlying organic and mineral soil. Dark organic soil on right, which covers lighter colored mineral soil, should be assessed as bare soil.



As organic litter is pulverized and eroded from sites the remaining materials often clump together, resulting in a patchwork of organic litter and bare soil which is difficult to evaluate. If patches of organic material are relatively thin and few in number, as illustrated in the photo above, the entire area should be assessed as bare soil. Otherwise, the patches of organic litter should be mentally combined and excluded from assessments.

TREE DAMAGE



NONE/SLIGHT



MODERATE



NONE/SLIGHT: No or slight damage such as broken or cut smaller branches, 1 nail, or a few superficial trunk scars.

MODERATE: Numerous small trunk scars and nails or 1 moderate sized scar.

SEVERE: Trunk scars numerous with many that are large and have penetrated to the inner wood; any complete girdling of tree.



SEVERE

ROOT EXPOSURE

NONE/SLIGHT: No or slight root exposure such as is typical in adjacent offsite areas.

MODERATE: Top half of many major roots exposed more than 1 foot from base of tree.

SEVERE: Three-quarters or more of major roots exposed more than 1 foot from base of tree; soil erosion obvious.



NONE/SLIGHT



MODERATE



SEVERE

**Saguaro National Monument
Backcountry Campsite Monitoring Form**

- 1) Name of camp area _____ 2) Site number _____
- 3) Describe location of site so others could find it _____

- 4) Inventoried by _____ Date _____

Inventory Parameters

- 5) Overstory species _____
- 6) Tree canopy cover _____
(1=0-25%, 2=26-50%, 3=51-75%, 4=76-100%)
- 7) Number of 8x10 tent pads _____
- 8) Number of other recreation sites visible _____
- 9) Toilet (y or n) _____
Describe _____
- 10) Fire grate (y or n) _____
Describe _____

Impact Parameters (Begin with site boundary determination)

- 11) Vegetative ground cover onsite _____
(1=0-5%, 2=6-25%, 3=26-50%, 4=51-75%, 5=76-95%, 6=96-100%)
- 12) Vegetative ground cover offsite _____
- 13) Mineral soil exposure onsite _____
- 14) Mineral soil exposure offsite _____
- 15) Tree damage
none/slight _____ moderate _____ severe _____
- 16) Root exposure
none/slight _____ moderate _____ severe _____
- 17) Number of tree stumps _____
- 18) Number of trails _____
- 19) Number of fire sites _____
- 20) Litter/Trash (N=none, S=some, M=much) _____
- 21) Human Waste (N=none, S=some, M=much) _____
- 22) Horse Manure (N=none, S=some, M=much) _____

23) Comments/Recommendations: _____

24) Take Center Point and Recreation Site Photographs

<u>Recreation Site Center Point References</u>	<u>Transect Data</u> <u>Bearing Distance (ft)</u>
1)	Site Photo 1)
2)	2)
	3)
3)	4)
	5)
4)	6)
	7)
<u>Satellite Site Dimensions</u>	8)
	9)
	10)
	11)
	12)
	13)
	14)
	15)
<u>Island Site Dimensions</u>	16)
	17)
	18)
	19)
	20)
	21)
	22)
	23)
Recreation Site Area from Program _____	24)
+ Satellite Area _____	25)
- Island Area _____ =	
25) Total Recreation Site Area _____ (sq. ft.)	