

# **USFWS 2010/11 Cactus Mapping Protocol for the San Diego Multiple Species Conservation Program**

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*Objective: Determine the location and size of cactus patches within the MSCP. Map patches into GIS.*

*Timeline: December 2010 through May, 2011.*

Prickly pear (*Opuntia* spp.) and cholla (*Cylindropuntia* spp.) in the MSCP area are the exclusive habitat for the coastal cactus wren (*Campylorhynchus brunneicapillus couesi*), a covered species under the MSCP. Mapping of cactus patches will precede and inform an effort to collect baseline survey data on coastal cactus wrens.

## ***Sampling Strategy***

Surveys during the 2009 field season utilized focused models to define potential cactus habitat within the MSCP. Habitat was defined as aspects which face southwest (from 170° to 280°) and fell below 305 m elevation (1000 feet; Rea and Weaver 1990). This area was mapped in GIS using a 10m digital elevation model and utilized the March 2007 version of HabiTrak to define areas of access. Coastal sage scrub was taken from a GIS layer created by SANDAG in 1995. The MSCP preserve layer was constrained to areas facing south to west, from 10 degrees east of south to 10 degrees north of west (170° to 280°). The area burned during the 2003 fires was also excluded. The vast majority of known cactus and cactus wren locations within the MSCP preserves fall within the resulting polygons. The resulting GIS polygons will need to be surveyed for cactus.

This methodology will likely capture the vast majority of cactus in the MSCP preserves, but some may be missed. There will be some cactus patches that fall outside these polygons, particularly on southeast facing slopes. For example, one area that we are aware of is on the north side of Lake Hodges, at the base of Bernardo Mountain. The coastal sage scrub habitat mapping is known to not be 100% reliable. There are approximately 5 historical sightings from above 300 m. Because of the lag time in incorporating recently acquired areas into HabiTrak, the land acquisition tracking system, some recently acquired lands may not be shown on the GIS files we created. Wolf Canyon in Chula Vista appears to be one of these areas. There are several cactus wren records from there, but it is not included within HabiTrak yet. All these constraints may have eliminated some cactus from the survey polygons. However, systematically surveying all southeast facing slopes would have likely double the amount of effort with diminishing returns. Cactus that is known or observed during surveys outside survey polygons will also be mapped.

## ***Mapping Protocol***

The Service has produced GIS files and maps of the areas that need to be surveyed for cactus patches (see appendix). Technicians will carry maps into the field and systematically check each polygon for cactus.

The locations of the polygons must be inferred from the aerial photos on the maps. Additionally, if necessary, it may be possible to enter the polygons into the GPS units. Polygons can simply be scanned with binoculars from an appropriate vantage point to determine if cactus are present. If cactus are present and appear to be over 75 cm, they need to be mapped. If cactus are present, but under 75 cm, they are recorded as described below. Most of the MSCP preserves are bounded by roads and infiltrated with trails. Access to many places will be easy and fast.

Surveyors should watch for cactus that fall outside the survey polygons, especially on south-east facing slopes. Any cactus observed on southeast facing slopes or elsewhere should also be mapped following the same protocols.

Cactus will be primarily mapped using an Impulse 200 LR laser rangefinder by Laser Technology Inc., attached to a GPS unit. The rangefinder is used to “shoot” a point and the readout will tell the distance to the point. The GPS unit communicates with the rangefinder and takes a GPS point at the point where the rangefinder hits. Thus, a GPS point can be taken without actually visiting the point. Some care must be taken to make sure the laser rangefinder is actually measuring the distance the operator thinks it is measuring. The laser can reflect off an intervening branch or cactus pad, giving a closer distance than was planned. The Impulse’ maximum measuring distance is 575 m for broad targets like the side of a hill. The GPS Unit will have a data dictionary in which all the necessary data can be recorded, such as patch identification number, level, etc. (see below).

Cactus patches will be defined at 3 different “levels.” An internal thick patch, and two peripheral layers of more diffuse cactus. The first level, called “A” level for convenience, is patches of impenetrable cactus. A level cactus is too thick to walk or maneuver through without causing damage to the cactus (much less the surveyor). Remember that cactus takes a long time to grow and damage should be avoided at all times. Cactus in the “A” patch should nearly always have some individuals over 75-100 cm. The A patch should have 10 or more cactus. Essentially an A patch is a patch where we would not be able to do a point transect without damaging the cactus. A series of points will be taken using the Impulse laser rangefinder of the perimeter of these patches (see figures). Points should be < 2 meters from the ideal boundary. Points need not be accurate to within centimeters of the edge of the patch; such accuracy is not necessary. Obstruction by cactus will make it impossible to be so accurate without moving to different vantage points. Points taken within 2 meters of the boundary are sufficient. More accuracy has no real biological meaning in this case.

The second level, the “B” level, consists of cactus over 75 cm tall peripheral to the “A” patch or alone but with 3 cactus over 75 cm. A surveyor could find their way through most of a B level cactus patch without causing any damage. The rule for including cactus within the “B” boundary is that they are within 15 m of each other or the A patch (see figures 1-3). A B patch may exist without an interior A patch. But a B patch must have at least 3 cacti over 75 cm within 15 m of each other to qualify as a B patch.

“C” level cactus is cactus under 75 cm, or any cactus over 75 cm is in groups (less than 15 m apart ) of less than 3. C level cactus that is peripheral to or in the same polygon as A and B level cactus is not mapped. C level cactus that occurs in a polygon without any A or B level cactus is recorded on the data form and a single GPS point taken in the polygon so the polygon can be identified. C level cactus may become habitat in future years or may be suitable locations for habitat improvement. If it does not occur within a polygon, take a GPS point in the center of the patch.

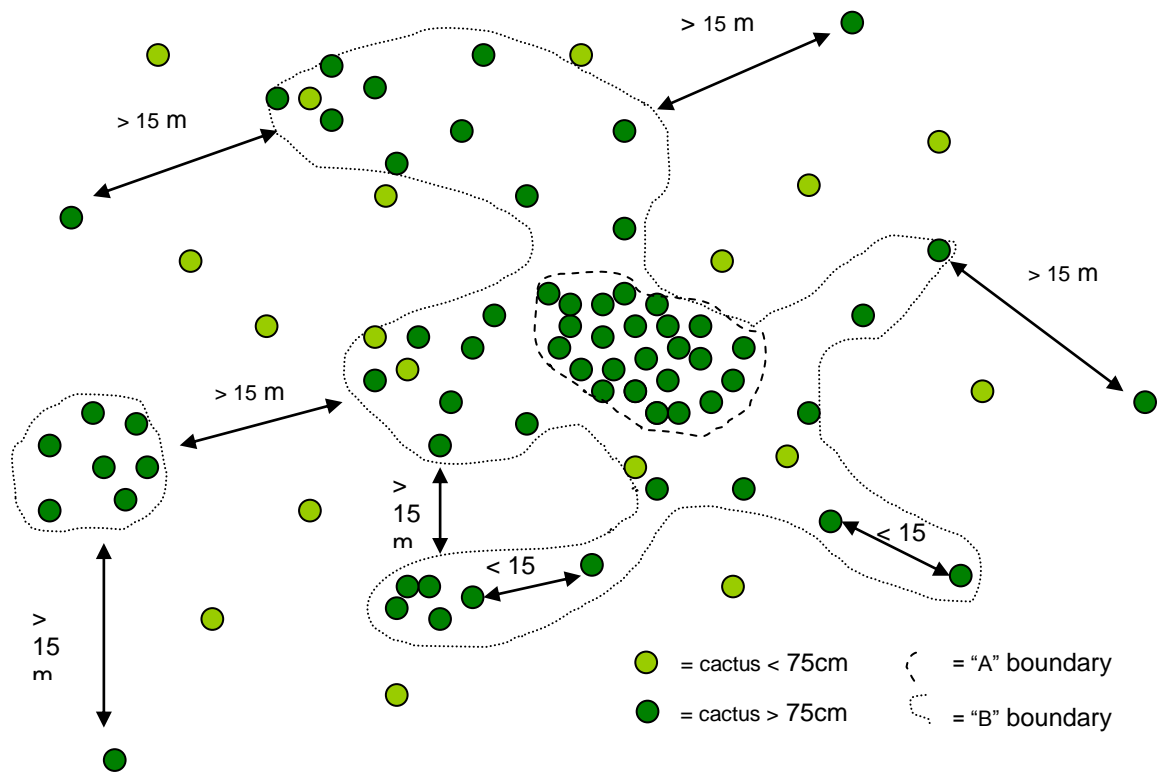


Figure 1. Mapping cactus patches using the 15 m rule. Dark green circles represent individual cactus plants over 75 cm in height; light green circles represent cactus under 75 cm. Arrows show distances that are less than or greater than 15 m.

Most cactus that is used by cactus wren is 1 m or taller. The 1 m rule is used in Orange County. Seventy-five cm is used for our purposes because that is the lowest height of cactus found to be used by Rea and Weaver (1990) and they will only grow taller unless they burn.

Most cactus will be on slopes where they can be conveniently delineated with the Impulse laser rangefinder. However, if the Impulse is not available or an unobstructed view cannot be obtained, the A and B boundaries must be walked and mapped with a GPS unit. These boundaries will be mapped with a WAAS-enabled GPS unit (sub-meter accuracy is not necessary) and a smaller laser rangefinder. The GPS unit must be capable of recording a track or route that can be downloaded to a GIS program. These tracks must be labeled in the GPS unit and on the datasheet in the same way as cactus delineated with the Impulse. The surveyor will use the GPS unit to record the boundary of a cactus patch as he/she walks around it. The laser rangefinder is used to measure the gaps between cactus. If the gap is less than 15 m, and the cactus is taller than 75 cm, the surveyor includes that cactus in the patch he/she is mapping and walks out around it. If the distance is greater than 15 m or the cactus is shorter than 75 cm, the surveyor continues mapping the patch and returns to map the other cactus as a separate patch (Figure 1). With a little experience, a surveyor shouldn't have to measure the height of every cactus. Patches may range from several hectares to a patch of 3 cactus.

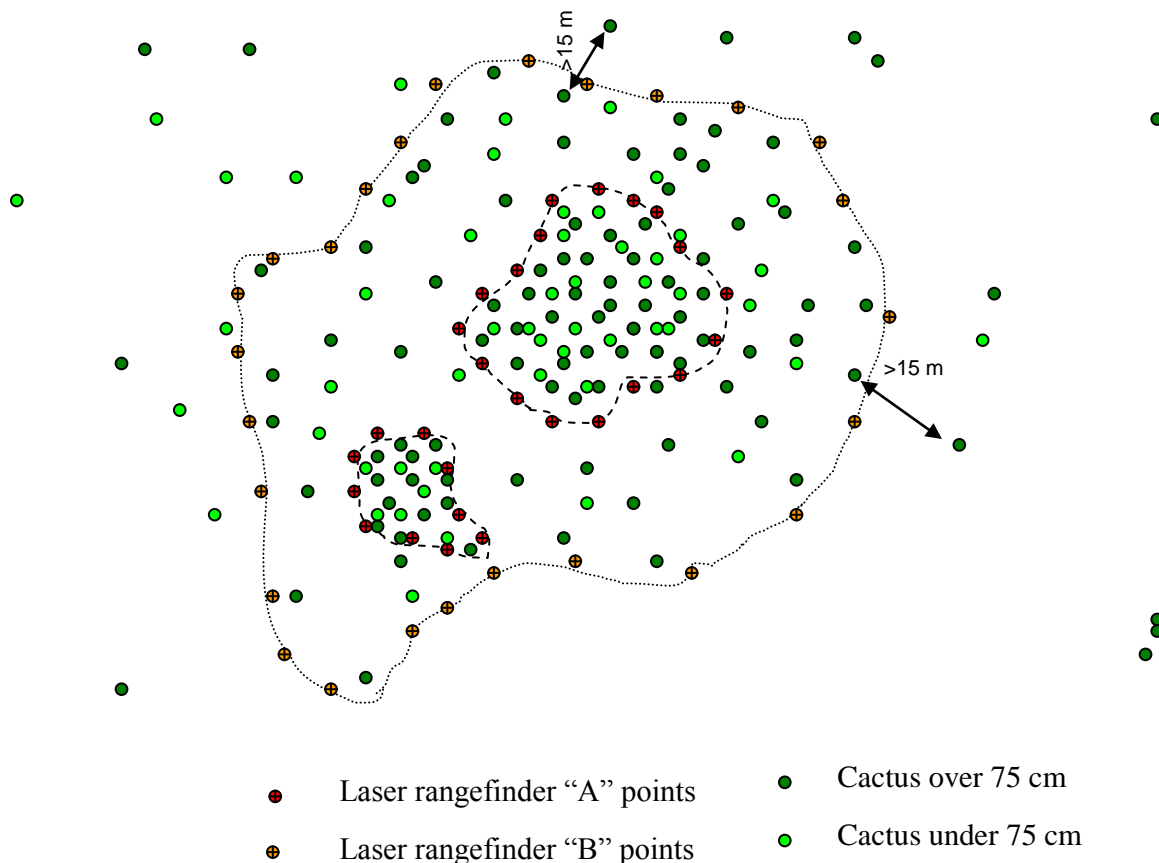


Figure 2. A larger cactus patch showing two internal A patches. Red and orange hatched circles represent points taken with Impulse rangefinder.

Each cactus patch and level must have a unique number for identification. This will be based on the map number, then the level of the patch (A, B, or C) followed by sequential number of the order the patches were mapped (e.g., the first mapped patch is 1, the next is 2, and so on), followed by the team letter if necessary (B or C, etc., in case more than one team is mapping in a map at once). The first team (the A team) doesn't need to enter a letter. So when a single team is mapping cactus from map 53, the first cactus patch mapped will be 53A1 and 53B1 for the two levels. The next patch will be 53A2 and 53B2 and so on. If a second team is also mapping in the same area, they will also number their patches sequentially, but end with B, e.g., 53A2B. This identification number is used to identify the points taken with the Impulse and the tracks taken with GPS units.

When taking points with the Impulse rangefinder and attached Trimble GPS unit, the data dictionary will simply require the identification number for the level being mapped.

If a polygon that is surveyed has no cactus over 75 cm or no cactus in large enough patches (3 or greater), but cactus is present ("C" level cactus), the presence of cactus will be noted on the data sheet or in the data entry unit with a GPS point anywhere in the polygon and entered with a C, e.g. 53C1. We want to know if a polygon has cactus that may be habitat in the future.

Some areas that will be mapped burned in 2007. Cactus should still be mapped if it is showing signs of resprouting (which most are according to field reports). Completely burned cactus that is showing no signs of recovery should be noted as "C" level cactus but not mapped. It may not be possible to tell that the location burned.

Particularly at locations that are difficult to find or access, cactus mappers will take a point that is recommended for cactus wren surveyors to start from when they survey for cactus wrens. This point should ideally be at location where all areas of the patch can be seen, but is not more than 50 m away. Mappers should not spend too much time on this, just recommend a point to make it easier for the surveyors. The surveyors will not be required to use your point. The point should also be able to be accessed without going through the cactus patch and disturbing the wrens.

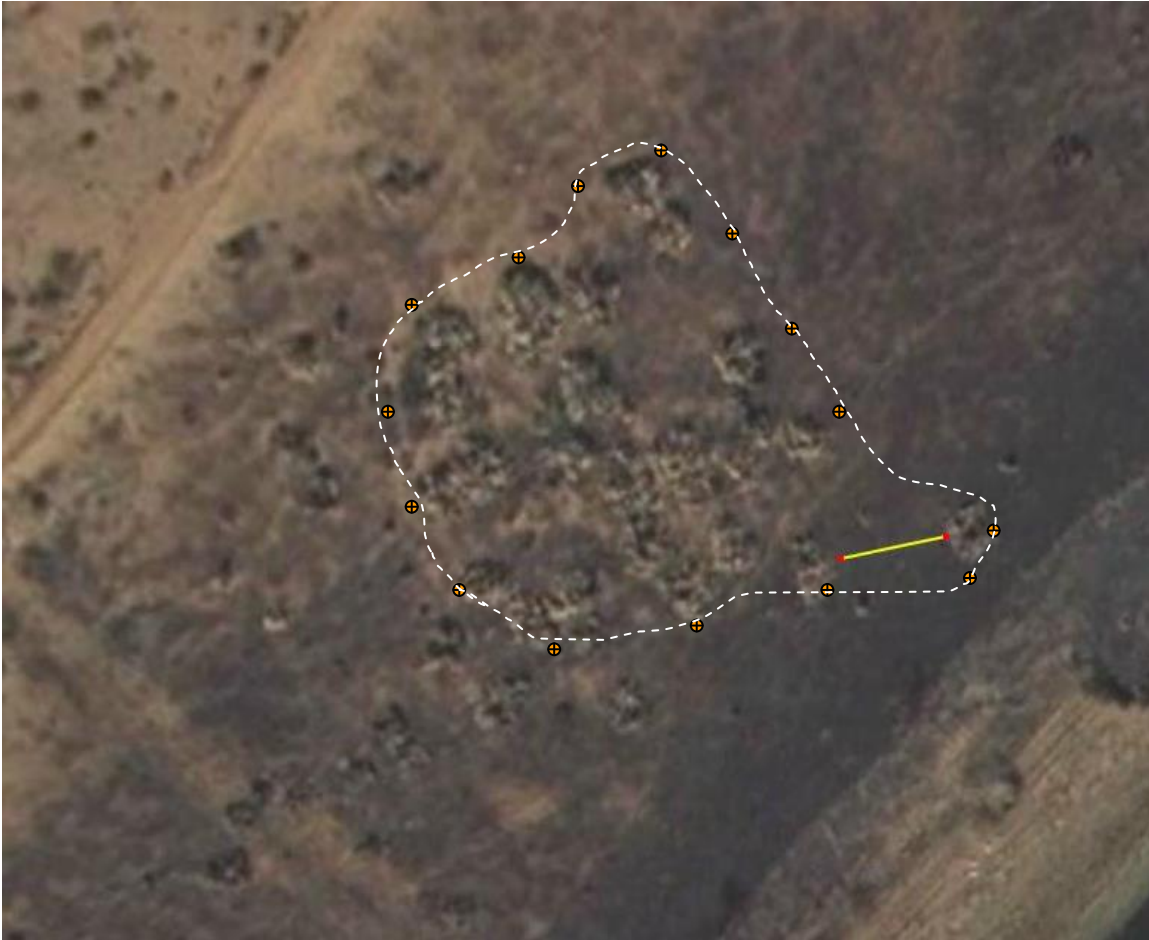


Figure 3. A cactus patch near Lake Hodges. The yellow measuring line is 13 m. This patch is too small for an internal A patch. The boundary line drawn in this picture assumes that the external cactus are shorter than 75 cm. This location burned in 2007. Image from GoogleEarth.

Once the field data are collected, the GPS data will be transferred to a Geographic Information System (GIS). The final result will be a GIS layer with numerous polygons of various sizes that will be used to delineate plots for surveys for cactus wrens.

### ***Patch Covariates***

Various kinds of information (covariates) need to be recorded about each patch. Some of this information will be recorded during the mapping phase; some will be recorded during the later surveys for cactus wrens. This data will be entered into a Pendragon form in a Trimble Juno handheld computer.

The information needed is as follows:

- Species and number of cactus per patch
- Number of Mexican Elderberry
- Burned in 2007 or not
- Digital Photo Number

- Cactus Wren Sign
- Cactus type per Hamilton (O.C. county methodology)

### ***Cactus Taxa***

For each patch, A and B levels, the number of cholla (*Cylindropuntia*) and the number of prickly pear (*Opuntia*) is recorded. The number of each over 75 cm is also recorded. There are several *Opuntia* and *Cylindropuntia* species in the area. There is not time to identify every individual in each patch, but qualitative notes on the species composition of the patch will be taken. Cacti will be keyed out with information provided by Jon Rebman of the San Diego Natural History Museum. There are 3 *Cylindropuntia* taxa and around 5 *Opuntia* taxa that are likely to be important.

Table 1. Cactus taxa in the MSCP area that could potentially be used by cactus wrens. Numerically important species are likely to be present in large enough numbers to be biologically important to the cactus wren. Other species present in very small numbers may not be biologically important to cactus wren.

| SCIENTIFIC NAME   | COMMON NAME                      |
|---|----------------------------------|
| <b><i>Numerically Important Species</i></b>               |                                  |
| <i>Cylindropuntia prolifera</i>                           | Coast Cholla                     |
| <i>Cylindropuntia californica</i> var. <i>californica</i> | Snake Cholla                     |
| <i>Cylindropuntia californica</i> var. <i>parkeri</i>     | Snake Cholla                     |
| <i>Opuntia oricola</i>                                    | Chaparral Prickly-Pear           |
| <i>Opuntia littoralis</i>                                 | Coast Prickly-Pear               |
| <i>Opuntia</i> x <i>occidentalis</i>                      | Western Prickly-Pear             |
| <i>Opuntia</i> x <i>vaseyi</i>                            | Mesa Prickly-Pear                |
| <i>Opuntia ficus-indica</i> *                             | Mission Prickly-Pear, Indian Fig |
| <b><i>Present in Very Small Numbers</i></b>               |                                  |
| <i>Opuntia robusta</i> *                                  | Silver Dollar Prickly-Pear       |
| <i>Opuntia phaeacantha</i>                                | Desert Prickly-Pear              |
| <i>Bergerocactus emoryi</i>                               | Golden Snake Cactus              |
| <i>Opuntia leucotricha</i> *                              | Nopal Blanco                     |
| <i>Opuntia microdasys</i> *                               | Bunny-ears Cactus                |

\*non-native

*Cylindropuntia prolifera*, *Opuntia oricola*, and *O. littoralis* are probably the species that are most important to cactus wren. A premium should be placed on identifying these taxa. Because of the hybridization that occurs, identification of the *Opuntia* species may be difficult. Except for *O. ficus-indica*, which is very common, the introduced species occur in very small numbers.

### ***Cactus Species Information***

*Cylindropuntia prolifera* – Coast Cholla. This species is common in the MSCP. The height and many branches make it ideal for cactus wrens.

*Cylindropuntia californica* var. *californica* and *C. c.* var. *parkeri* – Snake Cholla. This species was listed as *Opuntia parryi* in the Jepson Manual. *C. c.* var. *californica* is decumbent and thus probably not utilized by cactus wrens often. This species is relatively rare.

*Opuntia oricola* – Chaparral Prickly-Pear. This species is generally more erect and thus taller than *O. littoralis* and consequently is thought to be more important for cactus wrens.

*Opuntia littoralis* – Coast Prickly-Pear. This species is more decumbent and spreading than *O. oricola* and so may take longer to reach heights sufficient for use by cactus wrens.

*Opuntia* x *occidentalis* – Western Prickly-Pear. This is a hybrid of origin *O. littoralis* x (*O. engelmannii* x *O. phaeacantha*). It has been collected occasionally for the San Diego Plant Atlas in the MSCP area. According to Jepson Manual, usually less than 1 m tall, so this taxon is unlikely to be often important to cactus wrens.

*Opuntia* x *vaseyi* – a hybrid of origin *O. littoralis* X *O. phaeacantha*. This hybrid is actually quite common in the MSCP area according the plant atlas. According to Jepson Manual, usually less than 1 m tall, so this taxon is unlikely to be often important to cactus wrens.

*Opuntia ficus-indica* – Mission Prickly-Pear, Indian Fig. This is an introduced species that is often seen at the urban/wildlands interface. It seems to rarely if ever be used by cactus wren, perhaps because it usually lacks substantial spines. Mapping this species is not a priority.

*Opuntia robusta* (may be confused with *O. ficus-indica*) have been observed to escape cultivation a few times in San Diego County (San Diego Plant Atlas). Stems are more blue-green than other *Opuntia*, with round stem segments.

*Opuntia phaeacantha* – Desert Prickly Pear. This species occurs primarily in the desert, but was collected once by the San Diego Plant Atlas at Camp Pendleton.

*Bergerocactus emoryi* – Golden Snake Cactus – this is a rare species listed in the CNPS Inventory of rare and endangered plants, but has no state or federal status. It grows on Point Loma and in a few other areas, typically where ocean breezes occur. It appears to be non-branching at the upper extremities and may not be suitable for cactus wrens.

*Opuntia leucotricha* – Nopal Blanco. This introduced species is known from one locality in San Diego County, just east of Balboa Park.

*Opuntia microdasys* – Bunny-ears cactus. Grossly similar to beavertail cactus, *O. basilaris*, this species should not be easily confused with other *Opuntia* in the area. It doesn't have long spines, but does have the "short spines".



A key provided by Jon Rebman will be used to differentiate these species. More information can also be found in the Jepson Manual (which is also online) and at [www.efloras.org](http://www.efloras.org).

### ***Other Data to be Recorded***

Blue or Mexican elderberry (*Sambucus mexicana*) is a shrub or tree that may be associated with cactus wrens because the berries provide a source of food. There is evidence from Orange County that cactus wrens occur more often when this species is nearby (Milan and Mitrovich 2007). With some practice, this species should not be difficult to identify. The scientific name has recently been changed to *Sambucus nigra* ssp. *canadensis*. Record the number of individuals within the A and B levels. If elderberry occurs outside the A and B boundaries, record it as outside and measure the distance with the rangefinder.

Some of the areas to be surveyed burned in the 2007 wildfires, particularly the San Pasqual Valley. Record a “Y” for yes if the area clearly burned in 2007. Remember that burned areas are only mapped if the cactus is growing again.

One or two representative photographs will be taken with a digital camera of each cactus patch. The number of the photo from the camera’s automatic numbering system is entered into the data form.

If cactus wrens are observed, or nests, enter wren or nest into the data form. Take notes separately on whether it was a pair and whether the nests appeared current or old (collapsed).

Rea and Weaver (1990) observed that cactus wrens appeared to be more associated with some particular perennials (other than cactus). California sagebrush (*Artemisia californica*) and flat-top buckwheat (*Eriogonum fasciculatum*) were positively associated with cactus wrens, but areas dominated by white sage (*Salvia apiana*) and black sage (*Salvia mellifera*) were avoided. Record each of these 4 that is present within a level and which one is dominant (most common) of the 4. Use two letter code: AR, ER, AP, ME.

In Orange County cactus mapping, a different method was used to assess quality of cactus patches. To allow comparison with Orange County data, we will also evaluate patches based on the Orange County protocol. Under this protocol, entire patches must be evaluated together so A and B levels will be evaluated together. Consequently, on the datasheet the types should be the same for A and B.

Under the OC protocol, cactus patches are evaluated as Cactus Scrub Type and Cholla Type. Each patch will be classified as Cactus Scrub Type I, II, III, or IV (explained below). It should be noted that this classification uses a cut-off of 1m for cactus instead of 0.75 m used in the cactus mapping portion of this protocol. The vast majority of cactus wren nests are found in cactus above 1 m tall, though some are found in shorter cactus.

Thus the 0.75 m cutoff is all-inclusive, while the 1 m cutoff will incorporate habitat that is far more likely to be good habitat.

*Cactus Scrub Type I:* Highest quality. Mapped cactus polygon is at least 1 acre and is greater than 20% estimated areal cover of cactus and cactus is generally all greater than 1 m tall.

*Cactus Scrub Type II:* Consists of at least 1 acre of cactus within the plot, but the mapped cactus polygons need not be continuous. Cactus need not all be over 1 m.

*Cactus Scrub Type III:* Less than 1 acre of mapped cactus, but at least 1 cholla plant taller than 1 m. Density of cactus is irrelevant.

*Cactus Scrub Type IV:* Mapped cactus covers less than 1 acre and does not include at least 1 cholla over 1 m. Density is irrelevant.

For reference, 1 acre = 0.4 ha = 4,046 m<sup>2</sup>, which is a circle of radius 36 m (diameter 72 m) or a square 63 m on a side.

The presence of cholla was found to be important in Orange County, therefore a classification of cholla was also used in Orange County (Mitrovich and Hamilton 2007). The amount of branching is important as it determines whether a nest can be supported in the plant.

*Cholla Type 1:* At least one cluster of cholla greater than 1.3 m tall with extensive branching.

*Cholla Type 2:* At least one cluster of cholla greater than 1 m tall, with branching that could support a nest.

*Cholla Type 3:* No cholla or no cholla clusters that have branching sufficient to hold a nest.

*Proto-Cactus Scrub:* Cactus that is less than 1 m tall or otherwise doesn't fall into the above categories.

Other covariates will be calculated in GIS or collected during wren surveys.

***To be calculated in GIS:***

Aspect, slope, A and B area, distance to nearest patch, and distance to nearest occupied patch.

### **Equipment Needed for Cactus Mapping:**

Impulse Laser Rangefinder

Trimble GPS Unit

*or*

Garmin GPS Unit

Handheld laser rangefinder

Trimble Juno

Measuring stick

Measuring tape

Binoculars

Digital Camera

More

## “CHEAT SHEET”

A Level: impenetrable,  $\geq 10$  cactus, any height

B Level: at least 3 cactus over 75 cm

C Level: under 75 cm

Patch Number: Polygon Map # | Level | Number of Patch that date | Group Letter (if necessary) – e.g. 27A20B, 3C4A, 56B1

Number of Prickly Pear: Count individuals

Number of Prickly Pear > 75 cm: Count individuals over 75 cm

Number of Cholla: Count individuals

Number of Cholla > 75 cm: Count individuals over 75 cm.

Patch Height Above or Below 75 cm: are at least 3 cactus in the patch above 75 cm? (is this redundant?)

Number of Elderberry bushes: Number of bushes in patch. If not in patch, measure distance to nearest.

Burned in 2007?: yes or no

Cactus Scrub Type: I, II, III, IV, proto

Cholla Type: I, II, III, proto

GPS Point: GPS coordinates giving the rough location of C level cactus not associated with A or B level cactus.

Digital Photo Number: Number from the camera

Cactus Wren Sign: Wren, Nest

Perennials present: AR (*Artemisia californica*), ER (*Eriogonum fasciculatum*), AP (*Salvia apiana*), ME (*Salvia mellifera*).

Dominant perennial: AR (*Artemisia californica*), ER (*Eriogonum fasciculatum*), AP (*Salvia apiana*), ME (*Salvia mellifera*).

Cactus Species Present and Estimated Proportions: Here provide information on the species present in the patch to an expedient level of detail (i.e. don't take much time).

# CACTUS MAPPING DATASHEET

Map Number\_\_\_\_\_ Date\_\_\_\_\_ Surveyors\_\_\_\_\_

| Patch Number | Number Prickly Pear | Number of Prickly Pear > 75 cm | Number Cholla | Number of Cholla >75 cm | Patch Height Above or Below 75 cm | Number of Elderberry in Patch or Distance to Nearest | Burned in 2007? | Cactus Scrub Type (I, II, III, or IV) | Cholla Type (I, II, or III) |
|--------------|---------------------|--------------------------------|---------------|-------------------------|-----------------------------------|--|-----------------|---------------------------------------|-----------------------------|
| 35A1         | 15                  | 11                             | 0             | 0                       | Above                             | 150m   | N               | IV                                    | III                         |
| 35B1         | 4                   | 0                              | 0             | 0                       | Below                             | 47m  | N               | IV                                    | III                         |
| 35C2         | 3                   | 0                              | 0             | 0                       | Below                             | 1  | N               | proto                                 | proto                       |
| 35A3         | 4                   | 4                              | 17            | 15                      | Above                             | 3  | N               |                                       |                             |
| 35B3         |                     |                                |               |                         |                                   |  |                 |                                       |                             |
| 35A1B        |                     |                                |               |                         |                                   |  |                 |                                       |                             |
| 35B1B        |                     |                                |               |                         |                                   |  |                 |                                       |                             |
| 35B2B        |                     |                                |               |                         |                                   |  |                 |                                       |                             |
| 35A3B        |                     |                                |               |                         |                                   |  |                 |                                       |                             |
| 35B3B        |                     |                                |               |                         |                                   |  |                 |                                       |                             |
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