

# **Guidelines for Cactus Salvage and Propagation**

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## **Introduction**

This paper was prepared with the intent to provide land managers with a general “How to” for cactus salvage, propagation and habitat management. The recommendations included here are not intended to replace or eliminate the need for site specific planning efforts. Each site is different and there is no cook book answer or silver bullet solution to the problems of weed invasion or other long-term management issues. Typically it takes a significant labor effort and diligent follow-up weed control for this type of restoration and enhancement to be successful at most locations. Results of the type of restoration and enhancement efforts described here have been positive and these programs can increase and hopefully sustain coastal cactus wren populations in the area.

## **Timing of Cactus Salvage**

Cactus can be salvaged any time of year. Survivorship of salvaged cactus is likely to be higher if the plants are collected when they are not severely drought stressed. The plants are typically most drought stressed in the fall before the rains start. During the fall season, the plants are often wrinkled/shriveled which is an indication that they have less stored water. After significant winter rains begin the plants quickly take up water and lose their wrinkled appearance. If the loss of the cactus resource is imminent, proceed with salvage regardless of the level of drought stress.

Generally, coast cholla and prickly pear put on new growth in spring as it warms up. If you try and remove and root newly emerging shoots that haven't finished elongating yet, they will likely die. Collection of individual stem segments that are fully grown gives the best results. When salvaging the cactus, it is best to not try to handle them directly. Using pitch forks, tongs or other tools reduces the chance of being injured by spines.

During salvage efforts for prickly-pear, care should be taken to avoid collecting the non-native and often cultivated mission prickly pear (*Opuntia ficus-indica*). This non-native species is found throughout coastal Southern California often associated with old ranch houses and urban areas. This species is spineless or nearly so and can hybridize with native prickly pear cactus. Although the mission prickly pear can reach a tall size, the spineless nature of the plant may not provide the protection from predators for cactus wrens that the native cactus species afford.

## **Storage and Propagation**

After cuttings are collected, the broken ends of the stems should be allowed to dry and callus. This callusing process reduces the chance the plants will rot. Callusing of the stems can take a few days if the weather is warm and dry or possibly up to a couple of weeks under cool moist conditions. After the plants are callused, they can be propagated using different methods, depending on the project goals and budget. Below are some methods that have been used and are known to be successful.

Plants may be taken directly to the restoration/enhancement site after collection and the stems can be callused in place by laying the cuttings on the ground directly where they are intended to grow. You don't need to actually plant them in the soil as they can root from any spine cluster that is in contact with the ground. If the restoration site will not be watered, then placing the cuttings out in the fall-winter is best since then they will get some rain to help them root. It is cheapest and most efficient to take stem cuttings and disperse them directly at the intended site in the fall-winter and let them root and grow on their own. Large numbers of stems can be put out if you don't take the time to actually put them in the soil. After being placed on the ground the stems will bend themselves until they contact the soil surface and then they will form roots. If you have the ability to water them, planting the cactus at anytime of the year works well. With supplemental water, the plants will grow faster than if they are limited to just natural rainfall. If the salvage takes place in late spring or summer and no water source is available for irrigation, it is still worth putting the cuttings out at the restoration site, if they can't be taken to a nursery for storage. The plants are pretty resilient, so a portion of the stems will root even without irrigation under warm conditions.

Placing cuttings in containers requires more effort to get the plants started than just putting them directly on the ground. This container method also requires more effort for transporting the plants to the restoration site and planting them. But the labor involved with planting and transporting containers can be worth the effort if you are trying to encourage longer stem growth in a shorter amount of time. This container planting method will reduce the time it takes to get the stems to the 3' minimum nesting size. To encourage the plants to go taller in a shorter amount of time, pruning of the side branches also forces the plant to grow more upright. The new cuttings that result from the pruning can be used to propagate more plants.

One caution for this container method is that trying to move the plants around when they are in pots is more difficult to do without getting stabbed once the plants get bigger. Using one-gallon pots for planting is good since this container size will encourage good plant growth, but the weight of the pot and soil are not too heavy to transport with relative ease. As we saw on the field trip, large specimen cholla plants can be successfully moved using heavy equipment and large box containers. This large container method is just more costly. Prior to moving container plants to the restoration site, breaking off some of the side branches that tend to be loose (particularly on coast cholla) and leaving the main stem intact helps with transporting them. Pruning the plants prior to moving them is beneficial since the branches are then less likely to break off and fall on your hands. As mentioned before, the side branches that were removed can then be used to produce more plants.

For propagation in a nursery setting, you can also plant the stems directly in the ground (after callusing) and water them to make them to grow faster. After the plants reach the desired size, you can dig them up and move the larger stems to the restoration/enhancement site. Breaking off the side branches as described above prior to moving them is helpful for transport and for propagating more plants.

### **Recommended Planting Densities and Planting Locations**

Recommended density for planting the cholla or prickly pear cuttings varies depending on local soil conditions. It will take some trial and error to determine what the optimal planting density is for any particular site and soil condition. In good quality native soil, cholla cuttings can be planted at around two to three per square meter. At sites that have very low natural organic content, such as the subsoil often found on manufactured slopes, a higher density of up to five cholla cuttings per square meter may provide a better assurance of successful rooting and establishment.

Generally, prickly pear cuttings should be planted at a lower density than cholla since the individual plants tend to spread over a larger area than individual cholla. Planting one prickly pear pad per square meter may be adequate, but the planting density for both cholla and prickly pear will vary depending on local site conditions and project goals. Over time, as the cuttings grow and mature, if the project biologist believes that the plant density is too high then the cactus patch can be thinned by digging up a portion of the plants and moving them to another location where more plants are needed. This thinning process would only need to be done if the project biologist believes that the cactus are competing with each other to the point that the upward growth of the plants is being limited by competition.

Based on past experience, it is best to plant cuttings in naturally open areas with a coastal sage or maritime succulent scrub matrix. Planting in natural openings will reduce the level of effort needed for long-term native shrubs control. If cuttings are planted in close proximity to dense shrubs, then more labor will be required to maintain the cactus patch over time. Potential competition with surrounding shrubs for light and water can affect the health of the cactus. Having dense shrub cover immediately adjacent to the restored patches will also likely make the cactus more susceptible to damage by intense fires. We recommend choosing the cactus planting locations carefully to minimize long-term maintenance costs due to competitive interactions with shrubs and to reduce the risk of fire damage.

### **Watering “Schedule”**

Cactus should never be watered on a schedule, only water them after the soil has dried from the last watering. If the soil is not allowed to dry between watering events, the plants will have a much higher chance of rotting, especially when you are making the initial attempt to get them to root. Watering frequently during the warm spring and summer months, after the plants have established roots, is less likely to cause rot problems than over watering in the winter, since the plants will tend to be actively growing when it is warm. Once the plants are established, they are somewhat more tolerant of extra water, but the dry to the touch soil rule between watering is still the best way to go.

### **Site Preparation**

If the proposed restoration and enhancement site is covered by dead annual weed thatch or actively growing non-native annuals we recommend that this material be removed or controlled prior to dispersing the cactus. After callusing, the cuttings will send roots through the air towards the ground "looking" to make contact with the soil and if there is dried grass thatch between the cuttings and the soil, the cacti will have a tougher time making contact with the ground. Weed whips can be used to cut the dried weed thatch outside of the nesting season to minimize potential wildlife impacts. Once the dried grass is cut, the material can be raked into piles and then disposed of off-site at a landfill or it can be composted on-site if the project budget is limited.

In cases where weeds are actively growing (i.e. during and after the rainy season), the weeds should be controlled through hand pulling or spot spraying with herbicide such as glyphosate prior to placing cuttings

on the ground. Competition from weeds makes it more difficult for the cholla stems to root and survive because the grasses take up much of the available water and eventually cover the stems up so they get much reduced light. This light reduction will eventually lead to unhealthy cholla and a greater likelihood of rot occurring.

At sites where soil compaction may be an issue, such as along old roads, we generally do not recommend ripping the road because this disturbance tends to encourage weed growth. Another reason we do not recommend ripping the soil is that cryptogamic crusts, containing lichens and mosses, may be present in or next to the disturbed/road area. The presence of these living soil crusts can help to reduce future weed invasion by minimizing the number suitable germination sites for weeds. Once the disturbance of driving on the road is stopped, the crust starts to grow back within a season or two (although it can take years for full recovery). If you disturb the soil surface through ripping, this will delay the crust recovery. "Don't bust the crust" is the motto we try to follow when considering decompaction issues. If the soil is compacted, a simple technique to employ, in lieu of ripping the soil, is to use a rock hammer or pick to make a small hole in the soil to place the cactus cutting. This will ensure that the stem is in contact with the soil which will encourage root formation.

#### **Follow-up Weed Control-Long-term Management Issues**

Due to the competitive nature of the weeds, we don't think the cactus will win the battle with the weeds over the long-term without control measures being taken. Some sites may not have much of a weed load to start with so maybe weed control efforts won't be necessary in those situations, but most places will need to be weeded.

If you have successfully gotten cholla to start growing, eventually it will be impossible to hand weed the area (for obvious spiny reasons). We have successfully used glyphosate to control weeds around cholla stems without any apparent problems. If the cholla are not actively growing (with fresh new elongating shoots that have the little deciduous leaf remnants on them) they do not have leaves and do not seem to translocate the herbicide as other plant species typically would. The cholla is basically "glyphosate ready" so to speak. We do our best to try and not get any herbicide on the stems, but if you do get a little on them, it doesn't seem to negatively affect them. With that said, it is always best if you have trained people spraying who know to avoid the "good" plants. The only time when extra caution would be needed while spraying around the plants, as mentioned above, is when the new stems are growing/elongating and they have the little green leaf vestiges that might be able to translocate the herbicide. Fortunately these cacti are very tough and relatively indestructible.

Over time, if the cholla patches have gotten off to a good start growing, the patches that form have such dense root systems that taller more mature plants can compete with the weeds, but then the problem can be that the mature plants become more susceptible to being damaged by fire. We recommend controlling the weeds as much as possible within the limited budgets available, because if we don't do something to control the weeds, the MSS/CSS areas with cholla and prickly pear will eventually type convert to non-native grassland and herb communities with the occurrence of repeat fires. We will need to prioritize where we use the limited funding available for management.

#### **Summary**

Our local cholla and prickly pear cactus are generally easy to grow, but reducing the amount of handling and not potting them up makes budgets go much farther. Just putting out cuttings in the fall-winter rainy season and letting the rains do the work is the cheapest way to get good results. Based on our experience, small one stem cutting takes about 6-8 years to grow to around three feet without supplemental water, but growth will vary depending on soil conditions and annual rainfall patterns. If you do direct planting of cuttings and then water them at the intended habitat site, they will grow even faster.

Here is a bulleted summary of the techniques described above:

- Allow stems to callus prior to planting in soil.
- Dispersing salvaged cholla cuttings directly at the restoration site by laying them on the ground and letting them root on their own with no supplemental water is the cheapest method of propagation.
- Planting cuttings in containers or the ground at a nursery with supplemental water can help produce larger plants in a shorter time. This method can significantly reduce the amount of time it takes to produce nesting sized cholla/prickly pear. But with this container method there is a greater labor cost for maintenance and transporting the plants.
- Don't water plants when the soil is still moist. Allow the soil to dry between watering to reduce the chance of stem rot.

- Remove and control weeds prior to dispersing cuttings to increase survivorship and maintain good plant health.
- Conduct follow-up weed control as needed during plant establishment and over the long-term to reduce competition and the chance of repeat fires that cause high cactus mortality.