CLEVELAND NATIONAL FOREST,DESCANSO RANGER DISTRICT

Procedures for Planting Fully Sheltered Acorns

Descanso Oak Reforestation Plan

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Procedure for Planting Fully Sheltered Acorns using *Tubex* Tree Shelters

Equipment:

- Shovel and hand trowel
- Mallet
- Permanent marker for labeling/dating tree shelter
- McCloud for extremely heavily weeded areas
- *VisPore* 3'x 3' Tree Mats
- Sod Staples,6" X 1" (4 per mat)
- *Tubex* Tree Shelters
- White Oak Stakes (1 per tree shelter)
- Insect/bird protective nets
- 'Gopher Guard' stainless steel mesh
- Zip-lock bags for transporting acorns
- 1 Gallon zip-lock bags or small bucket for carrying native soil/duff gathered from beneath healthy nearby oaks, preferably from oak tree the acorns were collected from.

Planting Procedure:

- Mat down weeds in selected 3' x 3' area or clear with hands, shovel or McCloud
- Dig a hole 10" x 10", about 10" deep
- Backfill hole with soil until it is 5" deep
- Center 'Gopher Guard' bag (bottom of bag opened)in hole and fill to about 5"
- Fill in rest of hole with soil around 'Gopher Guard"
- Place a handful of native soil in center, place two acorns on their sides over soil and cover with no more than 1-1.5" soil

- Pound oak stake several inches into soil adjacent to 'Gopher Guard"
- Lower *Tubex* Tree Shelter's plastic loops over oak stake, taking care to center the base of the shelter over the acorns and push down a few inches into soil. (Note: the slightly flared end of the *Tubex* is the ***top*** of the tree shelter.)
- Use mallet to drive oak stake down until the top of the stake is just above the top loop of the tree shelter
- Work the small insect/bird protective net over the top of the tree shelter.

Drive oak stake down to just above the top loop of the Tubex

- Work the *Vispore* Tree Mat, (there is an opening in it's center), down over the tree shelter
- Work the top of the "Gopher Guard" mesh up through the opening in the Tree Mat around the base of the tree shelter
- Stretch out the mat, fold corner under two times, push staple through and use your hand, shoe or mallet to drive it down into the soil.

Securing Corners of Tree Mat with Staples

Finally, if applicable, use the permanent marker to label tree shelter with date and information pertinent to the project.

Procedure for Planting Fully Sheltered Acorns using *Tree Sentry* Tree Shelters

Equipment:

- Shovel and hand trowel
- Mallet
- Permanent marker for labeling/dating tree shelter
- McCloud for extremely heavily weeded areas
- *VisPore* 3'x 3' Tree Mats
- Sod Staples,6" X 1" (6 per mat)
- *Tree Sentry* Tree Shelters
- 42" Browse mesh
- Gopher Guard' stainless steel mesh
- Zip-lock bags for transporting acorns
- 1 Gallon zip-lock bags or small bucket for carrying native soil/duff gathered from beneath healthy nearby oaks, preferably from oak tree the acorns were collected from.
- Knit gloves coated with rubber or latex.

Planting Procedure:

- Mat down weeds in selected 3' x 3' area or clear with hands, shovel or McCloud
- Dig a hole 10" x 10", about 10" deep
- Center 'Gopher Guard' in hole and fill to about 8 1/2" deep.
- Fill in rest of hole with soil around 'Gopher Guard"
- Place a handful of native soil in center, place two acorns on their sides over soil and cover with no more than 1-1.5" soil, leaving little or no mesh on surface.
- Stretch out the tree mat,(with opening centered over planting), fold corner under two times , push staple through and use your hand, shoe or mallet to drive it down into the soil. Secure all four corners, making mat as taught and smooth as possible
- Stretch tree mat opening around 'Gopher Guard'; secure both 'Gopher Guard' and tree mat down with one sod staple on either side (total of 2).
- Start all three wires of *Tree Sentry* straight through tree mat and into the soil, taking care the stakes are straight and vertical. Using the weight of your shoulders in a rocking/rolling action fully seat the cone into the soil.

- If planting on a sloped site, take care to position the *Tree Sentry* perpendicular to the *earth* and not the surface of the slope. Some leveling of the soil immediately surrounding the planting may be necessary.
- (If shelters are stuck together tightly in the stacks and don't slip apart easily, lay the stack down on its side, apply generous pressure with your foot, roll the stack back and forth under your partial weight a few times to free them. Shelters are resilient and will resume their shape immediately when weight is removed.)
- Use the permanent marker to label the tree shelter with date and other information pertinent to the project.

<u>If installing a browse net:</u>

- Dispense mesh from bundles by drawing an individual mesh from INSIDE of a bundle.
- With two hands held around a mesh, push the mesh over the installed *Tree Sentry* as far as it will go, sliding hands over the base of the cone as you force the mesh downward. Push forcefully and tight – mesh should nearly reach the ground.
- **DON'T** try to extend the height of the mesh by putting it on loosely. (**TIP**: tight fitting knit gloves coated with rubber or latex work well for dispensing shelters from stacks and mesh from bundles.)

Where and How Many to Plant?

There are differing ideas on oak planting, *in Regenerating Rangeland Oaks In California*, Douglas McCreary (2001) suggests 40 fully sheltered plantings per acre, one cluster every 30-40 feet, 3-4 per cluster. He suggests planting in greater density in riparian zones, with clusters 15-20 feet apart.

In areas such as campgrounds, where tree mortality is high and tree removal has occurred, it is a good idea to simply look around and see how the trees do, (or did), naturally grow in that particular spot, and mimic this. Keep in mind that Black Oak is not shade tolerant, so avoid planting with tree shelters in the shade of pines or healthy large oaks. Sites with good drainage are important; acorns will deteriorate due to lack of drainage. If possible, plant non-sheltered (no tree shelter) acorns in areas that offer natural protection, such as a small rock outcropping (devoid of gopher tunnels) to shelter from wind and full sun. Water stress is most acute at the seedling stage; for non-sheltered acorns, consider the overstory of nearby low vegetation as a means of shading seedlings, elevating relative humidity, reducing temperature and wind speed and thereby improving moisture retention (Bernhardt and Sweicki 2001). Tree shelters and weed mats will provide these advantages for the fully-sheltered plantings.

When planting, avoiding drought-prone areas such as south facing slopes with rocky, shallow soil will minimize soil moisture limitations. Areas with naturally high soil moisture would be the obvious preferred planting site, and though identifying the best sites may not be possible, avoiding the least favorable sites will help achieve better outcomes.

Since fiscal year 2006, 114 oaks have been removed from Burnt Rancheria Campground due to mortality and posing a hazard to the public. 67 hazard oaks have been removed from Laguna Campground. It is unknown the extent of the mortality that has yet to occur. Successive plantings, followed by monitoring, “filling-in”, and protecting the naturally regenerated oak seedlings, will help us re-establish our previously self-sustaining oak woodlands.

Monitoring

Descanso Oak Reforestation Plan

Maureen Anderson

9/16/2010

Monitoring procedures for reforested sites.

Monitoring Coast Live Oak

Seedlings should be monitored bi-annually for the first two years, and annually thereafter for at least a total of five years. Seedlings will emerge at different times roughly throughout early March to early June. At six to seven months after planting, monitoring will include:

1. Checking each planting site (numbered tree shelter) and noting seedling height, or "NV" for "nothing visible". If weeds have grown high in the tree shelter, tree shelter can be removed, area weeded, seedling measured, and shelter re-installed. Note if one or two seedlings have emerged.
2. Checking each planting site for integrity of tree shelter (straighten if leaning, note if damaged, assure tree-sentry netting in place, assure weed mat still firmly secured with sod staples.)
3. Logging observations, measurements and actions taken.
4. If planting occurred in a season of extremely low rainfall, plan a watering schedule.

(Watering: *acorns planted directly in the field produce seedlings that demand much less water than transplanted seedlings. In an exceptionally dry year, hand watering with one to two gallons of water, once in July and once in September, for the first two years, until the seedling is firmly established, could easily be accomplished in administrative sites that are close to water supply and roads, such as campgrounds and fire stations. In fact, in sites such as Laguna and Burnt Rancheria campgrounds,* ***overwatering*** *by well meaning campers is a big concern. Educational signage will be needed in these sites****.)***

At the end of the first year, monitoring will include steps 1-3, (step 4, watering, will not be necessary in the winter months) plus these actions:

5. If two seedlings have sprouted in the tree shelter, carefully thin down to one by removing the least vigorous seedling. This is best done when the soil is wet, in winter or early spring. If nothing has emerged in the tree shelter, note "NV" (nothing visible), in the logbook.
6. Record the first year's findings in a table format such as the sample, *Table 1*, on the following page.

At one and a half year's time, follow all procedures above excluding #6. If no seedlings are visible in the tree shelter, now is the time to remove the shelter and the weed guard. If a naturally regenerated seedling has sprouted nearby, apply the weed guard and tree shelter to it, and note it in the log.

Years two through 5*:* once a year check all sites, measure seedlings, take actions necessary, record actions taken, and record findings on the data table.

Supplies needed for monitoring*:* backpack, trowel, mallet, a few sod staples, gloves, permanent black marker, logbook, knife, camera, pencils, stack of 5 extra tree shelters.

Table 1-Summary of Descanso Work Center Coast Live Oak Seedlings 2010-2015

(Fictional Example of table monitoring a site planted with 4 different inputs, 100 plantings, after the second year of a five year monitoring schedule.)

12/2010 *RF=29.36"* Number of Plantings	3' Tubex w/weed mat and mulch layer 25	3' Tubex w/weed mat, no mulch layer 25	2' Tree Sentry w/browse net, weed mat and mulch layer 25	2' Tree Sentry w/browse net, weed mat, no mulch layer 25	Total number of plantings: 100
12/2011 *RF=* Number of emerged seedlings	22 seedlings (88%) Mean height: 7.1"	19 seedlings (76%) Mean height: 6.4"	23 seedlings (92%) Mean height: 7.7	20 seedlings (80%) Mean height: 6.9"	Total number of seedlings:84 Mean height: 7.02
12/2012 *RF=* Number survived	20 Survive (80%) Mean height: 17.2"	17 survive (68%) Mean height: 15.4"	20 survive (80%) Mean height: 18.4"	19 survive (76%) Mean height: 16.8	Total surviving:76 (76%) Mean height: 16.95"
12/2013 *RF=* Number survived	Mean height:	Mean height:	Mean height:	Mean height:	Total surviving: Mean height:
12/2014 *RF=* Number survived	Mean height:	Mean height:	Mean height:	Mean height:	Total surviving: Mean height:
12/2015 *RF=* Number survived	Mean height:	Mean height:	Mean height:	Mean height:	Total surviving: Mean height:

RF: Rainfall measurements from Descanso RAWS, from July 1st through June 30th. Average yearly rainfall for Descanso, CA is 24.73".

Monitoring California Black Oak

The same procedures for monitoring Coast Live Oak should be followed, but different characteristics of the species should be kept in mind. Unlike Coast Live Oak, which is a fast growing oak, Black Oak spends up to the first six years developing a deep root base. Then lateral root development and shoots begin to "take off". Studies have shown Black Oak to be little more than two feet tall at five years, whereas Coast Live Oak can be, in the right conditions, anywhere from 6-10' tall. (Fritzke, 1997; Costello et al, 2002). Black Oak seedlings at six years have been observed to die completely back, only to resprout vigorous "seedling sprouts" from the root crown. A five year monitoring schedule would not tell us much about the growth and survival of our Black Oak seedlings.

"Oak woodland restoration is in its infancy in California." (Bernhardt & Sweicke, 2001). There is a growing amount of data on the Blue, Valley, and Coast Live Oak species, but very little on Black Oak. At least the first planting in Burnt Rancheria of 200 fully sheltered acorns , monitored yearly for growth and survival for ten years, would provide a wealth of data for others planning similar reforestation projects.

CLEVELAND NATIONAL FOREST, DESCANSO RANGER DISTRICT

Equipment Costs, Sources, and Time

Descanso Oak Reforestation Plan

Maureen Anderson

9/16/2010

Sources

Gopher Guards 9”……Western Planting Solutions

Dan Schweitzer (530) 751-3366

dschweitzerwps@yahoo.com

Tree Sentry Tree Shelters, sod staples……Summit Environmental Group

Browse nets, corrugated weed mat 1-(419) 720-0185

www.TreeSentry.com

Tubex Tree Shelters, oak stakes, VisPore Tree…….Ben Meadows

Mats, shovels, wire stake flags, 1-(800) 241-6401

4 Mil. *Ziploc* bags, work gloves www.benmeadows.com

Trowels w/ inch line markers……Alpine Ace Hardware

(619) 445-5674

Equipment Cost and Sources

Equipment	**Quantity**	**Cost**
Gopher Guards 9"	100	200.00
18" ***Tree Sentry*** **w/42" Mesh**	100	320.00
VisPore Tree Mat	100	133.00
6" Staples for Tree Mat	600	60.00
21' wire stakes	400	28.00
Cost per 100 w/ ***Tree Sentry***		**741.00**

One Time Purchase:		
4-Mil Reclosable bags 5x7	1000/case	62.00
Shovel: D-Top Round Pt.	10	311.00
Hand Trowel w/inch lines	10	85.00
Work Gloves	10	200.00
Total One Time Cost		**658.00**

Equipment Cost and Sources

Product	Quantity	Cost
Gopher Guards 9"	100	200.00
4' **Tubex Tree Shelter***	100	400.00
Oak Stakes	100	196.00
VisPore Tree Mat	100	133.00
6" Staples for Tree Mat	400	40.00
21" Wire Stake Flags**	400	28.00
Cost per 100 w/*Tubex*		**1,022.00**

***Tree shelters /oak stakes will vary in length dictated by site and type of browsers:**

4'	Deer/other mammals	400.00 Tubex/196.00 Oak Stakes
3'	Deer/small mammals	320.00 Tubex/164.00 Oak Stakes
2'	Rabbits, rodents	200.00 Tubex/108.00 Oak Stakes

****When acorns are plentiful, 40 'non-sheltered' (planted 1.5" and marked with wire flag)plantings per 10 fully sheltered plantings .**

Time Per Administrative Site (will vary with size of project):

Gathering acorns..... 2-4 days

Testing & storing acorns.....5 hrs

Acorn preparation for planting.....4 hrs

Equipment and site preparation for planting.....1 day

Planting.....1-5 days

Monitoring (annually).....6 days

Watering (twice in summer) .....2-4 days

Preparing /posting educational material re. project.....2-4 days

Protecting naturally regenerated oaks.....5 days

Filling in (successive years).....10 days

Procedures/Discussion: these costs are based upon planting 100 fully sheltered acorns and up to 400 non-sheltered acorns if acorns are plentiful. There are two types of tree shelters to consider in the restoration of Descanso District's administrative sites, the most commonly used *Tubex* cylindrical shelter, which has proven highly successful with oaks, and the newer cone shaped self-staking *Tree Sentry*. (It has 3 metal pins attached to the base for staking.) Silviculturist Gayle Richardson, of the Apache-Sitgreaves N.F. , prefers working with the Tree Sentry due to the ease of installation, re-collection and storage(personal communication, March 23, 2010). For monitoring purposes, there could be the benefit of easy removal of the shelter to weed inside of it and check/measure seedlings, which is somewhat difficult with 3 foot shelters attached to an oak stake. From a cost perspective, the savings with the Tree Sentry is in time and the cost of eliminating the oak stakes, which run about 164.00 per 100. Another time-saver associated with the Tree Sentry is due to the three-point staking system, it should not begin to lean due to high winds, thus won't have to be straightened in the future. There are few comparison studies of the two; both would be purchased for the 2011/2012 projects and compared.

Gathering acorns: 2-5 days. To ensure that the trees will be adapted to the environmental conditions of the planting site**, "**It is best to collect acorns from native oaks growing close to your planting site, within a mile or so if possible. It may also be helpful to match the seed source to the planting site, for example, collecting from a riparian area if planting will occur along a creek." (*Guide to Growing California Oaks,* 2001). Collecting from a number of different trees in the area increases the genetic diversity of the seeds. Many sources recommend collecting at two to three intervals throughout the acorn season. Coast Live Oaks in the Descanso, Guatay and Pine Valley area produced viable acorns in 2009 from October through December. Black Oak acorns up in the Laguna area should be harvested in September-October.

Depending upon the acorn crop and the proximity of the healthy trees, one or two people can collect hundreds of acorns in a day if lower branches are within reach and abundant with seed. "Regardless of whether you are planting acorns you collect or seedlings raised elsewhere…an effort should be made to use local seeds for all wildland planting. Scientists believe that local ecotypes, or strains of species, have evolved in response to local conditions and are therefore best adapted for survival" (Johnson, 1991)

It is best to collect acorns directly from the tree, as fallen acorns become quickly desiccated by insects and dryness. Acorns on the lowest branches ripen first; acorns are ripe when they easily twist out of their caps. They can be picked or knocked off the branch with a stick or piece of lightweight PVC pipe. If acorns are only available higher up and must be knocked out of the tree, lay down a plastic tarp to catch them in. Depending upon branch levels, abundance of acorn crop, and collecting at least twice through the acorn season, five days would be about the maximum time for collection by one or two people .

Testing acorns: 2-3 hrs. Testing acorns for viability is a simple process. Fill containers or buckets with water. Remove all acorn caps and put the acorns in the water; desiccated acorns will quickly float to the surface. Immediately discard the floaters. Leave them in the water for another hour and discard any others that floated to the surface. If acorns were scarce and had to be collected from the ground, leave

these acorns in water for 24 hours, as they may have only been dry, but not damaged. Discard the floaters. Air-dry on newspaper. .

Storing acorns: 2-3 hrs. Place no more than 100 acorns in 4-mil *Ziploc* bags. Leave about an inch or so open to prevent condensation (acorns will produce heat in storage). Store the acorns in an environment with temperatures around 40 degrees Fahrenheit, such as a refrigerator. Many sources suggest storing in peat, saw dust or vermiculite: I tested these methods and found that storing without any medium, with a slight opening, in the vegetable drawer of my refrigerator kept Coast Live Oak acorns viable for several months. Acorns stored in a medium tended to mildew and sprout radicals (tap roots), thus needing immediate planting and probably sustaining damage to the radical. Do check the bags periodically for mildew; if it develops simply rinse and dry the acorns and pack in a clean *Ziploc* bag. .

Acorn preparation for planting: **4 hrs**. Float the acorns again and select the sinkers. Air dry and re-bag according to the planting plan i.e. if you have 10 planters, each to plant 10 fully sheltered (2 acorns apiece in shelter) and 40 non-sheltered, each bag should contain a minimum of 60 acorns. You can also select the biggest and best looking acorns for the sheltered plantings, @ 20 per bag, and choose a minimum of 40 for non-sheltered plantings . If acorns were labeled during pre-refrigeration, i.e. for aspect or riparian area collections or even from a particular tree, label the smaller bags also. Keep acorns in a cooler when transporting to the planting site.

Planting: **1-5 days**. In the Cuyamaca State Park planting, utilizing the help of 67 middle school students broken into 10 crews with one crew leader per crew, each crew planted 10 fully sheltered sites (tree shelter, gopher guard, weed mat) and 40 non-sheltered (planted with no protection: flagged)in less than three hours, a total of 600 plantings. *Tubex* tree shelters were utilized, which involve slightly more time to install due to the need to pound in an oak stake to attach the tree shelter to, than the *Tree Sentry* shelter, which is self-staking. At Camp Oliver in Descanso, ten 6-person crews of very young students planted 50 fully sheltered sites and fifty sites utilizing just gopher guards in less than three hours time.

In terms of the time it takes to plant, and the costs related to time, much depends on the site itself, how difficult or easy it is to access and get equipment to, and how damp the soil is. Planting is recommended after the first few good fall rains (2009 acorns were planted in December and early January). Administrative sites such as campgrounds and fire stations on the district are close to roads, making accessibility less of a time issue. The ten crew leaders on the Cuyamaca State Park project could probably have planted the same number of sheltered and non-sheltered sites as the 67 students did themselves in a day's work. The same student volunteers utilized on these 2009 projects could be utilized in 2010 at no cost except the equipment. Some of the Laguna Mountain Volunteers have also expressed an interest in the oak restoration: they could be utilized as crew leaders for the students, or just formed into a planting crew led by district employees. So this cost is variable. At least one full day is necessary to survey the area beforehand and plot the planting sites. Thus, depending upon the number of planters, and the moisture of the soil, 100 fully-sheltered plantings plus 400 non-sheltered plantings could take anywhere from 1-5 days**,** including a minimum of one full day to survey the site.

Monitoring: 3-6 days. Seedlings will emerge at different times roughly throughout early March to early June. To thoroughly check each of 100 shelters, (assuming at one admin site) weed inside the shelter, note observations, and check/note the flagged unsheltered plantings could involve 2-3 full days time for one person. The purpose of the unsheltered flagged planting sites is that they involve very little effort, very little time, to plant, and if a seedling emerges where none emerged in a tree shelter, the shelter can be easily transferred to protect the successful planting. Ideally, this transferring of tree shelters from non-successful plantings to successful non-sheltered plantings should be done by six months to a year after the initial planting. The tree shelter will act as a mini-greenhouse; the weed mat will help conserve soil moisture by limiting evaporation and eliminating competition from annual grasses, which "has been shown to be a major threat to seedling survival" (Adams, Sands & Weitkamp, 1989). It is also at this time that if both acorns (two planted per shelter) sprouted seedlings in the shelter, the least vigorous seedling should be eliminated.

To assess if our inputs are producing the outputs we desire, after documenting seedling size and number at six months time, then a year's time, they should be monitored at least yearly beyond this. To monitor one area planted with 100 sheltered plantings and 400 non-sheltered plantings, around 6- 8 months after planting, one person may require up to 6 days**. "**Outcomes for a given set of restoration inputs may vary by year, location, and species. Because our ability to predict project outcomes is limited, every restoration project is experimental. Replicated trials of specific techniques and appropriate monitoring of restoration projects over an extended time period are needed to determine whether inputs have been effective over the long term" (Bernhardt & Sweicki, 2001).

Watering: 2 days, one each in July/September. Acorns planted directly in the field produce seedlings that demand much less water than transplanted seedlings, and only in extremely dry years. Hand watering with one to two gallons of water, once in July and once in September, for the first two years while the seedling becomes firmly established, could easily be accomplished in administrative sites that are close to water supply and roads, such as campgrounds and fire stations. In fact, in sites such as Laguna and Burnt Rancheria campgrounds, ***overwatering*** by well meaning campers is a big concern. Educational signage will be needed in these sites. The night before a watering day either in Laguna or Burnt Rancheria campgrounds an announcement or even a presentation could be given in the amphitheatre about reforestation due to GSOB. Organizing one or two watering days in the campgrounds could easily be accomplished, utilizing the campers and one gallon milk jugs.

Drip irrigation systems would not be considered. Experts argue against drip irrigation systems for differing reasons beyond cost effectiveness. Douglas McCreary believes that native, local seed planted on sites with good soil conditions and aspect are adapted to the conditions, and can survive with little watering unless in an unusually dry season. Bernhardt and Sweicki have "observed sites where oaks became highly water-stressed when irrigation was discontinued, presumably due to effects of irrigation on root distribution and/or root: shoot ratios. Irrigated planting sites are also more likely to be attacked

by ground squirrels and gophers than non- irrigated sites. Consequently, summer irrigation does not always improve oak seedling growth and survival… (Bernhardt & Sweicki, 1997).

Preparing /posting educational material: 2-4 days. This would involve the designing of signs, taking layouts to printer and picking up from printer, or producing from district office printers, and posting the signs.

Protecting naturally regenerated oaks: **variable/5 days per year**. In GSOB threatened areas where naturally regenerated seedlings are occurring, it would be simple to install a wide-based *Tree Sentry* tree shelter over them to provide protection and enhance survival. With an extra supply of tree shelters and a supply of simple, low cost (32.00 per 100) corrugated weed guards made by *Tree Sentry* , young seedlings beneath the maternal canopies of dying trees in the administrative sites would not only be protected, but highly visible to campers walking through the campgrounds and to the contractors removing the trees. An opportunity to look for natural regeneration is when surveying the site for either planting or hazard tree removal. **The cost of 100 Tree Sentry shelters plus 100 corrugated weed mats and staples is about $400.00**

Filling in (successive years): variable. By keeping track of plantings through monitoring and labeling/numbering each shelter, sites that did not produce seedlings by the end of the first year can be planted the next year.

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