Rancho La Costa
Habitat Conservation Area

A Dedicated Natural Open Space System Set Aside as part
of the La Costa Villages, University Commons, and
Cassia Professional Offices Developments
and also includes the "Nelson" and "Meadowlark" parcels.

(CNLM No's: S016, S020, S022, S026, S036, and S043)
(USFWS: University Commons 1919/2285 & 2703; Cassia 4751; La Costa Villages 3939)

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TABLE OF CONTENTS

TABLE OF APPENDICES

I. INTRODUCTION AND SUMMARY

This annual work plan has been developed from the guidelines for goals and objectives set forth in the Habitat Management Plan for the Rancho La Costa Habitat Conservation Area (Plan) dated May 2005 (CNLM 2005). The Plan includes management requirements agreed to by the United States Fish and Wildlife Service (USFWS) and California Department of Fish and Game (CDFG), and additional management activities that the Center for Natural Lands Management (Center or CNLM) has determined are appropriate to protect and maintain the natural resources in perpetuity. The Center holds fee title and conservation easements (CE) to the Rancho La Costa Habitat Conservation Area (HCA) and performs or oversees the tasks identified in the Plan.

The HCA covers several areas which were dedicated to the Center for long-term management from the La Costa Villages, University Commons, and Cassia Professional Offices (Cassia) developments. Each development dedicated several parcels that have been identified in the past by various names or associations. The La Costa Villages project dedicated parcels referred to as the Oaks, Ridges, Greens, Choumas-Pappas, and Alemir, of which the former three are located in the City of Carlsbad, and the latter two are located in the County of San Diego. The University Commons project dedicated parcels referred to as the "on-site parcels", Frank's Peak, Pfau (CE), Huff, Wilern, Winston, Setter, and Elfin Forest (CE). The Elfin Forest parcels are located both on-site (San Marcos) and within the County of San Diego. The Setter parcel is within the County of San Diego. All the other University Commons parcels are located within the City of San Marcos. The Nelson parcel, located in San Diego County, was purchased by the National Fish and Wildlife Foundation and deeded to the Center. The "Cassia" parcel was added in 2007 and is located adjacent to the "Greens" parcel in Carlsbad. The Meadowlark parcel (acquired via the Environmental Trust bankruptcy) was added in early 2009 and is located in the City of San Marcos between the Wilern and on-site University Commons parcels.

As of October 2007, the Center owns or holds CEs on all the properties set aside by these developments. Long-term stewardship of the entire HCA is also completely funded by their project proponents.

The purpose of this work plan is to identify the tasks and budget required to complete the management activities for this fiscal year. The fiscal year encompasses the period from October 1, 2010 through September 30, 2011. Unless otherwise stated, all tasks will be performed by the Center's Preserve Managers, Jessica Vinje and Patrick McConnell, and Rangers, Justin Trujillo, Roberto Bejar and Zadok Othniel.

Summary of Tasks and Goals for the Fiscal Year:

- Replace and install signs, fix and replace fencing as necessary.
- Note all animal species observed and map locations of any sensitive species.
- Monitor wildlife corridors using digital cameras.

- Conduct vegetation sampling at permanent plots within the thread-leaf brodiaea (*Brodiaea filifolia*) populations.
- Count individuals, perform a habitat assessment, and control weeds in the San Diego thornmint (*Acanthomintha ilicifolia*) occurrence.
- Finalize surveys for San Diego marsh-elder (*Iva hayesiana*) and southwestern spiny rush (*Juncus acutus* ssp. *leopoldii*).
- Continue to work with the San Diego thornmint rare plant working group and establish rare plant working groups for the following three listed plant species: thread-leaf brodiaea, Del Mar Manzanita (*Arctostaphylos glandulosa* ssp. *crassifolia*), and Orcutt's hazardia (*Hazardia orcuttii*) and complete CNLM Plant Abstracts for these four species.
- Collect data from vegetation monitoring plots within coastal sage scrub (CSS) located on the HCA.
- Count the Orcutt's hazardia transplanted container plants on the Greens and survey for seedlings.
- Remove non-native plant species, especially perennial pepperweed (*Lepidium latifolium*), onion weed (*Asphodelus fistulosus*), Ward's weed (*Carrichtera annua*), pampas grass (*Cortaderia* spp.), and tamarisk (*Tamarix* spp.) using Center funds and funds received from the TransNet Grant and the Vallecitos Water District.
- Control weeds growing in the transplanted Orcutt's brodiaea (*Brodiaea orcuttii*) population on the Winston parcel.
- Maintain and monitor the Huff and Hubbard restoration sites.
- Coordinate with Homeowner's Associations (HOAs) on HCA issues and coordinate public outreach events and prepare public outreach literature.
- Coordinate with trail volunteers, Eagle Scouts, and the San Diego Mountain Biking Association to accomplish HCA projects.
- Mow and clear fuel breaks.
- Patrol and conduct site enforcement on a regular basis.
- Report and describe data collected and management actions taken on the HCA to the regulatory agencies.
- Finalize the five-year management plan.
- Conduct CE compliance monitoring and prepare reports.
- Provide an accounting of funds to be spent in the next fiscal year.

Appendix 1 identifies the approximate schedule of field work throughout the fiscal year. Maps of the HCA are located in Appendix 2.

II. MANAGEMENT ACTIVITIES

The following sections identify and describe the activities to be performed during this fiscal year. Based upon the Property Analysis Record© (*PAR*) developed by the Center to outline long-term management tasks and costs, management activities for the HCA can be categorized into several

groups: Capital Improvements, Biological Surveys, Habitat Maintenance and Restoration, Public Services, Reporting, Office Maintenance, and Operations. Each of these categories will be discussed below.

A. CAPITAL IMPROVEMENTS

Fencing and signing are the only capital improvements to be undertaken during the upcoming fiscal year.

1. Fencing. The Center will construct barbed wire fencing or other appropriate types of fencing in several locations throughout the HCA as needed in areas where the public is trespassing.

2. Signing. Center signs have been posted at all of the major access points to the HCA. Additional signs will be installed in other strategic locations throughout the HCA. Each sign explains that the HCA is a dedicated open space, and that off-highway vehicle (OHV) activity, dumping, and shooting are prohibited. Specialized trail signs, illustrating and describing proper trail usage, will also be installed on Denk Mountain.

B. BIOLOGICAL SURVEYS

The following section outlines monitoring activities planned for the next fiscal year. All data will be entered or stored in Geographic Information System (GIS) and/or MSAccess/excel databases. A brief description of monitoring activities outlined by taxa is provided below.

1. Vegetation Sampling in Thread-leaved Brodiaea Populations

One of the Center's goals is to collect information on the grassland areas that are known to support thread-leaf brodiaea. The Center's objective is to maintain a healthy, stable population of thread-leaf brodiaea and decrease the percent cover of non-native grasses, specifically purple-false brome (*Brachypodium distachyon*). Appendix 3 (Research Proposal for the Herbicide Application of *Fusilade II* to thread-leaf brodiaea (*Brodiaea filifolia*) describes the vegetation sampling proposal and recent methodology modifications. The fourth year of data collection occurred during the 2009-2010 fiscal year and the fifth year of data collection will occur during this upcoming fiscal year. The methodology will differ somewhat from that described in Appendix 3 in that only vegetative and flowering count data will be collected this upcoming fiscal year. Although the study will continue for one or more years, the principle objective has been reached: evidence has been provided that *Fusilade* is an effective herbicide for controlling non-native grasses in occupied thread-leaf brodiaea habitat and that, in the short run, Fusilade II does not appear to harm or kill thread-leaf brodiaea. The Center will continue to count vegetative and flowering thread-leaf brodiaea to determine if there are any long-term negative effects from the use of *Fusilade* II in occupied thread-leaf brodiaea habitat.

2. Vegetation Sampling in San Diego Thornmint Occurrences A monitoring methodology was established to monitor the San Diego thornmint occurrence located at the

Greens during the 2008-2009 fiscal year. This methodology was again implemented during the 2009-2010 fiscal year. A stratified random sampling methodology was employed within the occurrence to collect data on percent cover, abundance, and diversity of native and non-native plant species. Monitoring transects were randomly placed within the previously demarcated boundaries of the occurrence and quadrats were randomly placed along the transects and data was collected within each quadrat. This monitoring will occur again during this next fiscal year. Removal of non-native species will occur before data collection and the methodology will be repeated each year to track the changes in percent cover, abundance and diversity. Management of the occurrence will be modified if necessary based on the results of the annual monitoring.

3. Long-term Coastal Sage Scrub (CSS) Monitoring As per the Plan, the Center has a goal of setting up long-term CSS monitoring plots to track changes in the CSS community. In 2005, we set up vegetation transects stratified by fire history, distance from edge and vegetation sub-association. We used those data to direct our current action and plan (Appendix 4). We established the majority of our CSS plots per the CSS monitoring plan during 2008, 2009 and 2010 and we finished monitoring all of these established plots during the spring of 2010. This upcoming fiscal year, we will likely establish a few more plots. We will continue to collect data from the plots that we have not yet sampled and we will also collect data from plots that will be re-sampled annually. Two years of data have already been collected for the plots that will be sampled annually. This fiscal year will be the third year of annual data collection for those chosen plots. See Appendix 4 for the most recent methodology modifications.

4. Sensitive Plant Species The HCA supports more than 10 sensitive plant species. The location and abundance of each of these species was mapped and counted in 2003 and some were again mapped and counted in 2008. These surveys are repeated every three to five years depending on the species (see Plan). During this upcoming fiscal year, we will monitor the thread-leaf brodiaea and San Diego thornmint occurrences at the Greens and conduct our vegetation sampling projects within the occupied habitat for both of these species (discussed in Section B.1. and B.2.) and we will count the Orcutt's hazardia transplanted population at the Greens and survey for seedlings within this population. Lastly, we will finalize surveys and mapping for San Diego marsh-elder and southwestern spiny rush. Surveys were initiated for these species in 2008, but never finalized. Additionally, during all patrol and survey activities, a plant species list will be created and added to the master plant species list at the end of the year.

During the 2008-2009 fiscal year, a presentation was made to the USFWS and the CDFG regarding thread-leaf brodiaea, San Diego thornmint, Del Mar Manzanita, and Orcutt's hazardia. Based on discussions at that meeting, the Center agreed to establish "working groups" for these four species. The San Diego Thornmint Working Group was the first established. This group will continue to meet this upcoming fiscal year and the Center will establish working groups for the remaining three plants, provided there is sufficient interest among other management entities. Lastly, plant abstracts will be prepared for each plant. These abstracts will contain information on current status, distribution, current and ongoing research, monitoring and management, and future research needs for each of these four listed plant species.

5. Wildlife The Center will monitor wildlife movement in several locations in the HCA using digital remote sensing cameras. These cameras will be placed in strategic locations throughout the HCA that were chosen during previous years. The Center will be able to track wildlife movement through designated and potential wildlife corridors using these cameras. Additionally, during all patrol and survey activities, a wildlife species list will be created and added to the master wildlife species list at the end of the year.

C. HABITAT MAINTENANCE AND RESTORATION

1. Habitat maintenance. Habitat maintenance will continue during this upcoming fiscal year. Since 2002, many non-native plants and acreage infested by non-native plants has been treated by CNLM. Non-native plants will continue to be treated by Center staff this upcoming fiscal year. The Center will use money allocated from our budgets to treat the non-native plants and money received from the TransNet Environmental Mitigation Program and funds received from the Vallecitos Water District.

The following non-native plant removal projects will occur in the upcoming fiscal year and will be carried out using money allocated through the Center budgeting process. We will:

- Drill and fill, or cut and stump spray, eucalyptus (*Eucalyptus* spp.) trees in various locations throughout the HCA.
- Treat fennel (*Foeniculum vulgare*), artichoke thistle (*Cynara cardunculus*), pampas grass, tamarisk, ice plant (*Carpobrotus* spp.), and tree tobacco (*Nicotiana glauca*) at the Greens and in other various locations throughout the HCA.
- Treat weeds growing in the Huff restoration area.
- Continue to treat about ½ acre of pampas grass at the Brouwer parcel and all of the pampas grass located on the Greens parcel as resprouts are observed.
- Treat pampas grass located in Box Canyon and in the tributaries to Box Canyon.
- Treat fountain grass (*Pennisetum setaceum*), castor bean (*Ricinus communis*), acacia (*Acacia* spp.), and blue-eye cape-marigold (*Dimorphotheca sinuata*) along the old Rancho Santa Fe Road.
- Use a line trimmer to cut non-native plants that are growing in the Orcutt's brodiaea transplantation site at the Winston parcel.
- Control using post-emergent spot applications and hand pulling, the non-native annual weeds that are growing in the San Diego thornmint occurrence at the Greens.

<u>Transnet Grant – Weeds</u>

In early 2009, the Center applied for grant funding through the TransNet Environmental Mitigation Program. The Center was awarded approximately $50,000.00 to continue weed treatments at the Greens and Meadowlark parcels over the next five years. The following weeds will be treated during this upcoming fiscal year: perennial pepper weed (Greens population), onion weed (Meadowlark population), Ward's weed (Greens population), and perennial veldt grass (*Ehrharta calycina*) (Greens population and the old Rancho Santa Fe population if funds permit).

Vallecitos Water District – Weeds and Restoration

The Center received compensatory funds from the Vallecitos Water District for wetland/riparian vegetation impacts at the North County Habitat Bank (Center-owned HCA in Carlsbad) in 2009. As part of the agency mitigation requirements, Vallecitos Water District is required to remove all non-native riparian plants from a wetland area located on the Greens parcel north and west of the Poinsettia and Alicante Avenue intersection. Additionally, they are required to plant arroyo willow (*Salix lasiolepis*) cuttings in the same area where non-native plant removal occurred. The non-native plant removal commenced in October 2009 and the arroyo willow cuttings were planted shortly thereafter. The Center will continue to monitor the non-native plant treatments and initiate remedial measures in the arroyo willow cutting locations should they be required.

2. **Habitat Restoration** During the 2006 fiscal year, the Center began restoring the upland areas in the former mulch facility area at the Huff parcel. We hydro-seeded the area with a native CSS mix and planted approximately 100 coast live oak trees in the fall and winter of 2005. We also installed an irrigation system on one-third of the area in 2006 and we installed approximately 100 native perennial container plants in the middle section of the restoration area in 2008. Additionally, irrigation was installed in the southern portion of the site in late 2008 and an additional 500 native perennial container plants were planted in this section in early 2009. The Huff restoration site will be weeded during this upcoming fiscal year. All supplemental irrigation has been ceased in the restoration site and the plants are well established.

   In 2008 the Center received funds to restore approximately one acre of eroded, disturbed land in the City of San Marcos located in the HCA. This restoration project is called the "Hubbard Slope" as the funds were provided to the Center by Hubbard Engineering as mitigation for impacts to sensitive habitat. In 2008, the eroded slope was graded and smoothed and straw wattles were installed. Approximately 900 native perennial container plants were installed in January 2009 and another 60 native perennial container plants were installed in January 2010. These 900 container plants were hand watered by a contractor for one year. The additional 60 plants will continue to receive supplemental irrigation through

this next fiscal year. Straw wattles and other erosion control devices were installed in fall 2009 prior to the rainy season and non-native plants were treated on an as needed basis. This upcoming fiscal year, weeds will be treated on an as-needed basis and the erosion control measures will be monitored throughout this upcoming fiscal year.

We will be mowing and clearing several fuel management areas adjacent to homes that border the HCA. We will be using contract crews to accomplish this work.

D. PUBLIC SERVICES

Public services activities include the patrolling of the HCA and the response to emergencies. However, other opportunities for public service will undoubtedly be forthcoming during the year, such as a spring nature walk, local groups and individuals interested in volunteering labor for HCA projects, and class field trips from local schools. We will accommodate these activities whenever possible.

1. **Patrols.** Patrols will be performed approximately once to twice per week.

2. **Emergency Response.** Staff time has been allocated from the current budget for management to respond to emergencies on the HCA. Such emergencies could include response to wildfires, wildlife problems reported by neighbors, and trespass.

3. **Nature Walks/Outreach/Trails**. During this fiscal year, the Center will be blocking off unwanted and illegal trails on Denk Mountain and in the Box Canyon area. We may also be working with a local mountain biking group (San Diego Mountain Biking Association) to maintain existing trails and with HOAs on HCA issues. Additionally, we will be preparing public outreach literature for the HOAs and lastly, we will be working with local Eagle Scouts to accomplish HCA projects.

E. REPORTING

Activities included within reporting requirements include the management of the HCA's database/GIS system, the photo-documentation stations, and the production of various status reports to the USFWS, CDFG, and Center administration.

1. Database/GIS Management

Data derived from routine patrols and photo-documentation will be entered into and maintained in the HCA's existing database/GIS system. Additional databases will be established for the various biotic monitoring programs including the production of

historical and current vegetation maps. Efforts will be made to coordinate and standardize database fields and parameters with other reserves.

2. Photo-documentation Stations

Photo-documentation stations were created in 2003 and 2004. Photos will be taken at these stations every three years and were last taken in 2006. Due to a drop in funding, the Center will not be updating the photographs at each photo-documentation station as this is not deemed a priority. Instead, we will take photos of various activities during the fiscal year, including non-native removal tasks, public outreach events and/or any vandalism that we observe.

3. Reports

a. **Year-End/Agency Reports** By December 2011, a year-end report will be prepared by the Preserve Manager detailing the results of the year's management activities. This report will include recommendations for the continuation of various activities for the following fiscal year and will be submitted to the County of San Diego, City's of San Marcos and Carlsbad, the USFWS and the CDFG as required under permit reporting conditions.

b. **Annual Work Plan** The work plan for the 2011-2012 fiscal year will be formulated by the end of the 2010-2011 fiscal year and will be based upon experiences during previous years' operations. This work plan will be submitted to the County of San Diego, City's of San Marcos and Carlsbad, USFWS and CDFG.

c. **Management Plan** The management plan for the HCA was updated in June of 2005 and submitted to the County, City's of San Marcos and Carlsbad and the wildlife agencies. An updated management plan will be submitted by October 1, 2011.

d. **CE Compliance** Current CE's include the Pfau CE near Frank's peak, Lot 8 of University Commons and the Elfin on- and off-site properties. Center practices for monitoring and reporting on CEs is derived from the CE agreement, CNLM's CE enforcement policy, and Land Trust Alliance standards (through which CNLM is an accredited land trust). A baseline report is prepared on a preserve, or on the portion where the CE exists, and then annual monitoring (or as often as stipulated in the CE) occurs to document any changes in the baseline condition. Time has been allocated for the HCA manager to monitor compliance of the CE portion of the HCA. This process insures CEs are being managed appropriately, and ensures continuity of process.

F. OFFICE MAINTENANCE

HCA Management will maintain offices in an organized manner to facilitate maximum efficiency. This section of the budget includes outlays for general office work, utilities, and telephones, among other items/tasks.

G. OPERATIONS

Operations include the training and professional growth of Preserve Management personnel and inspection of the HCA by Center administration. Funds have been allocated in the current budget for both the Preserve Manager to attend an organization-wide Retreat, management-related training or seminars, and/or conferences during the fiscal year. Also included within this category of activity is the conduction of employee reviews.

III. WORKLOAD AND BUDGETS

A. SUPERVISION & STAFFING

The Preserve Managers and Rangers will be supervised by the Area Manger, Markus Spiegelberg, and by the Center's Director of Conservation Science (DCS), Deborah Rogers. Tasks and priorities will be coordinated by the Area Manager and approved by the DCS. Additionally, Dr. Rogers will assist with document review and scientific research conducted on Center preserves.

B. BUDGETING

The total budget for this fiscal year is (based on the interest generated from six endowments and the initial and capital from one project, (Cassia Professional Offices): Nelson, La Costa Villages, University Commons (Brookfield Development), Cassia Professional Offices, Elfin Forest (Scandia Development portion of University Commons), and Meadowlark are: $2,865, $58,962, $25,781, $4,238, $5,064, and $422 respectively. Every effort will be made by the Center to allocate time and expenses according to these estimated budgets.

IV. REFERENCES

CNLM 2005. Habitat Management Plan for the Rancho La Costa Habitat Conservation Area. June 2005.

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IV. APPENDICES

Appendix 1 - Task Schedule

Task	October-December 2010	January-March 2011	April- June 2011	July-September 2011
Non-native Plant Removal	X	X	X	X
Rare Plant Surveys and Rare Plant Vegetation Analyses		X	X	
Establish and Monitor CSS Vegetation Plots		X	X	
Wildlife Monitoring	X	X	X	X
Restoration and Maintenance Activities	X	X	X	X
Clear Fuel Breaks			X	
Report and plan preparation	X			

Appendix 2 - HCA Location Maps

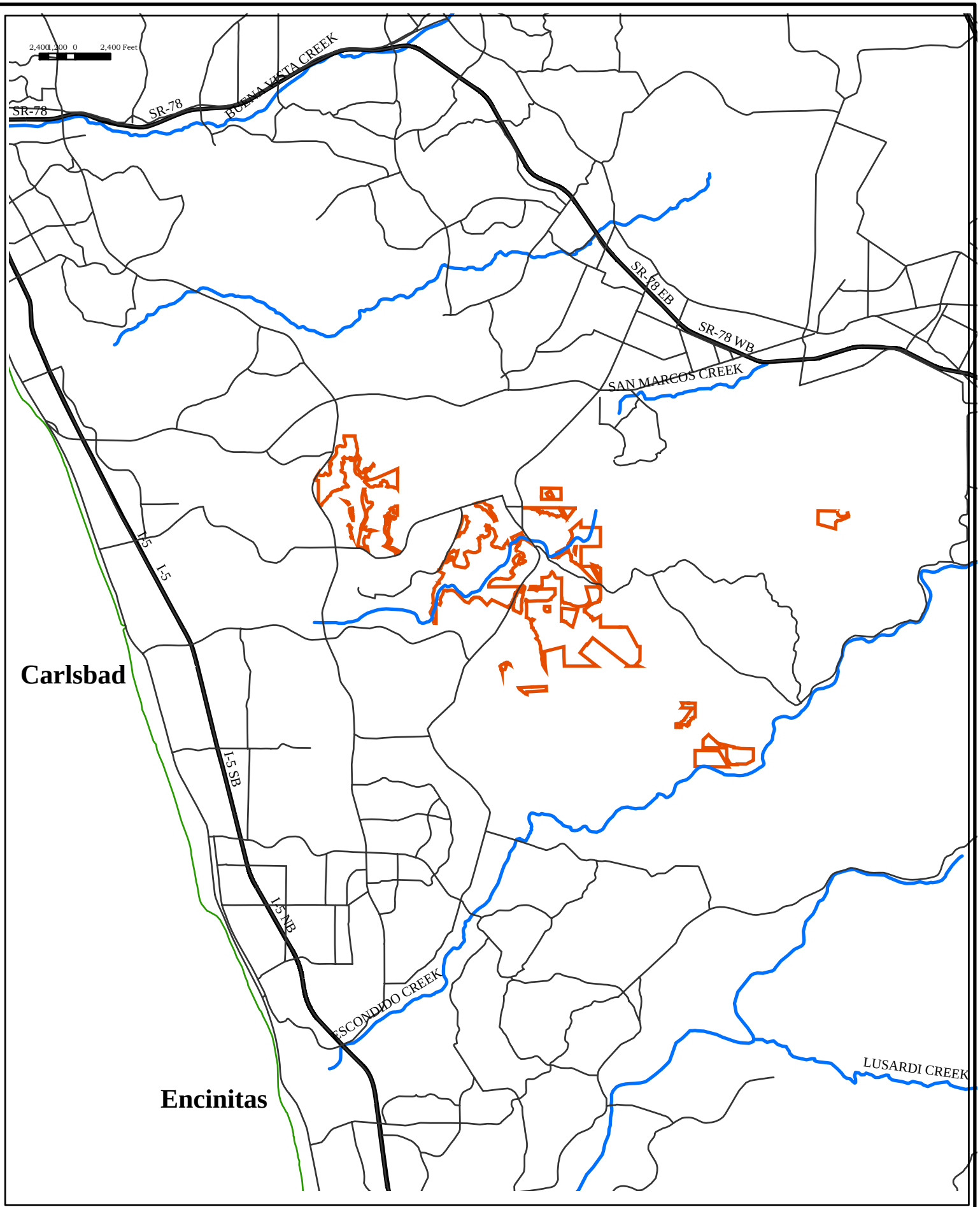

Figure 1
Preserve Vicinity
Rancho La Costa Habitat Conservation Area

Center for Natural Lands Management

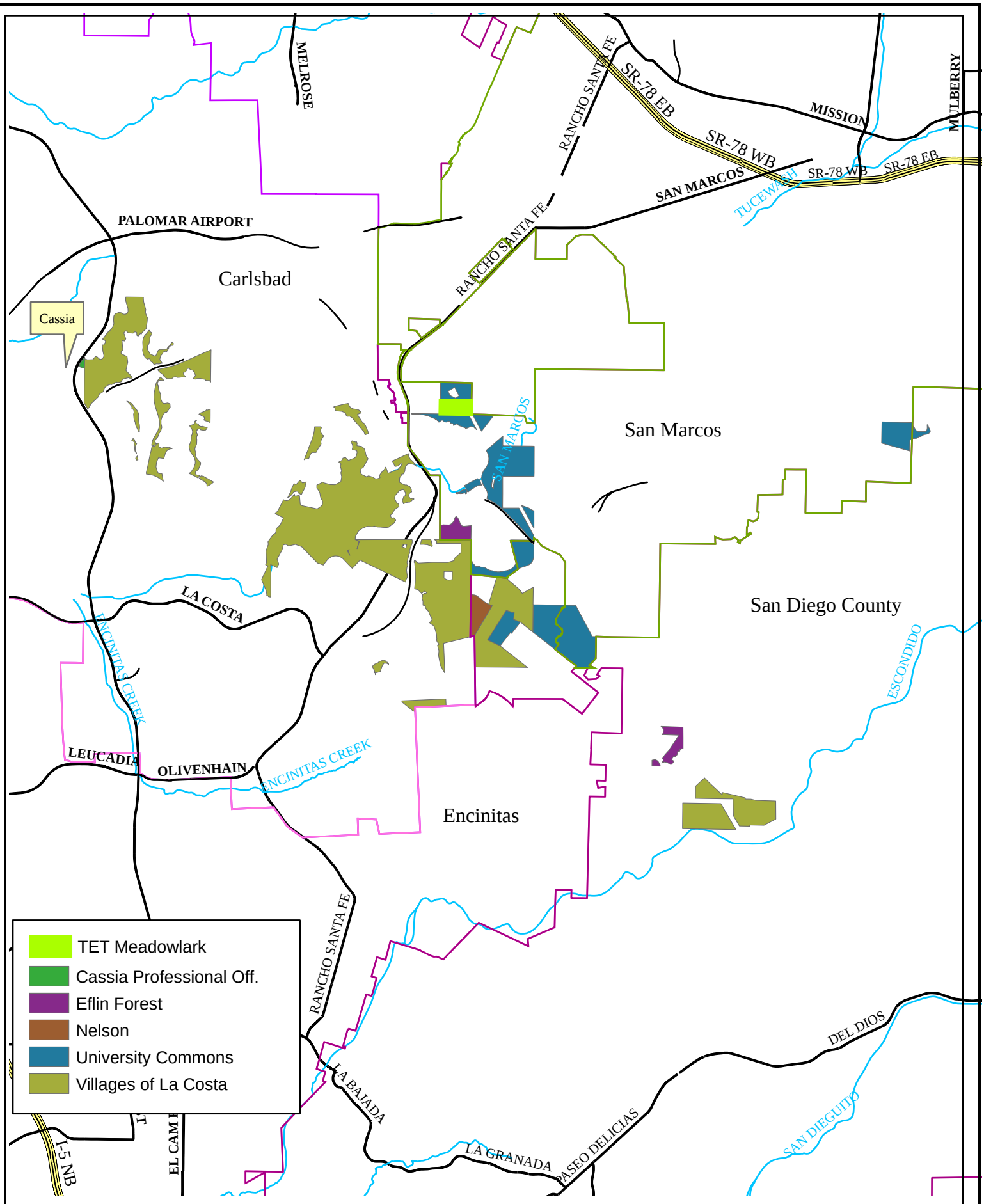

Figure 2
Preserve Location
Rancho La Costa Habitat Conservation Area

1,900 950 0 1,900 Feet

Center for Natural Lands Management

Appendix 3 - Thread-leaf Brodiaea (*Brodiaea filifolia*) Revised Research Methodology

Thread-leaf Brodiaea (*Brodiaea filifolia*) Research Study Methodology (Revised in 2009 and 2010)

Survey Design and Sampling Methodology

CNLM applied Fusilade to one of the established subplots (described in Survey Design and Sampling Methodology below) in February 2008 after receiving permission from the CDFG. This subplot contained approximately 50 thread-leaf brodiaea (BRFIL). In 2009, CNLM received permission from CDFG to apply Fusilade to eight subplots after Fusilade was found to not impact (kill) BRFIL after the 2008 application.

Three macroplots (Macroplots #1 through #3) were established at the Greens in February 2007. Each macroplot was placed in areas known to support BRFIL. These macroplots were placed across the slope topography (perpendicular to the slopes). A balanced randomized complete block design was used to stratify the treatments. Each macroplot contains sixteen subplots, with four replicates of each treatment. Each subplot occupies an area of 1 meter by 10 meters. These rectangular belt subplots were chosen to better capture the clumped distribution of BRFIL. The treatments consisted of: 1) Fusilade application according to the label 2) Fusilade application plus dethatching of dried litter material 3) Dethatching of dried litter material only and 4) control (no Fusilade application or dethatching). Macroplot 2 was removed from the study in 2010, thus no data will be analyzed for that macroplot in the future.

Monitoring occurs two times per year, once to capture vegetative BRFIL (February data collection) and once to capture flowering BRFIL (May data collection). This helps to determine the true population of BRFIL in the study areas since less than 10-percent of the true population is estimated to bloom in any given year. It also allows us to assess the effect of Fusilade on the vegetative portion of BRFIL.

The data collection will span a seven-year time frame to account for weather variation and fluctuation. The first two years (2007 and 2008) are pilot study years. Data collection and Fusilade application to one subplot occurred in early 2008, as mentioned above. Fusilade was applied to eight subplots in early 2009. In 2010, Fusilade was applied to all 16 treatment plots (eight in Macroplot 1 and eight in Macroplot 3). Eight total years of data collection will occur with modifications to the sampling objectives and/or sampling methodology, if necessary, after assessing the results of the first two pilot years.

Within each subplot a direct vegetative count of BRFIL was conducted in February 2007 and in February 2008. Since counting vegetative BRFIL was extremely time consuming and cost prohibitory, estimations were made instead during the 2009 and 2010 vegetative surveys. A 0.5 by 1 meter quadrat was

placed every other meter along the 10-meter tape that was placed in the middle of the 10-meter long belt transect. The start location was at 0 meters and the quadrat was placed on alternating left and right-hand sides of the meter tape at every meter until the end of the belt transect (total of ten quadrates per belt transect). Vegetative BRFIL was counted in each quadrat and then doubled for a total estimated BRFIL count per belt transect. A direct flowering count was conducted in May 2007, May 2008, May 2009, and May 2010. Species richness was collected by recording all species encountered within each subplot. Percent cover by species was collected in each subplot using a 0.5 by 1 meter quadrat placed at random intervals on the right and left hand sides of a meter tape placed in the middle of each subplot. Three quadrats were read per subplot, and placement of the quadrat on either side of the measuring tape was determined with the flip of a coin. The quadrat contained 36 points, located when metal wires arranged within the quadrat intersected at one decimeter intervals, thus supplying 108 total points per subplot for estimating percent vegetative and ground cover. Vegetative cover was recorded by species. Ground cover was recorded as either bare ground or litter. Likewise, litter was characterized as former live vegetation lying directly on the ground as thatch, or rabbit droppings. Height and number of flower heads were also measured in each of the subplots in May 2008.

In 2008, the BRFIL that were measured were randomly chosen. Another meter tape was placed perpendicular at each meter interval along the 10-meter belt transect tape. Five of the closest BRFIL to that perpendicular tape at each meter were measured. After analyses were completed, it was determined that either height or number of flower heads could be measured as these two variables were highly correlated. As such, in May 2009, only BRFIL flowering height was measured. Twenty-five BRFIL were selected and measured within each treatment subplot. If twenty-five plants were not growing within each treatment subplot, then all of the plants in that treatment subplot were measured. All scapes for each selected plant were measured using a ruler. To accomplish this, a tape measure was stretched out in the middle of each subplot to run the length of each subplot. To avoid subjective choice, a ruler was laid out perpendicular to the subplot at every half-meter interval (.5, 1, 1.5, etcetera) along the tape. The closest BRFIL to the intersection of the ruler and measured interval along the tape was selected.

In 2010, the height measurement methodology was modified, because it was determined that our scape choice methodology was flawed. Using closest to pre-determined point methodology was found to be a biased method of choosing replicates for measurement, and is discussed in Measuring and Monitoring Plant Populations (Elzinga et. al. 1998). In order to reduce subjectivity, all flowering BRFIL encountered within each treatment subplot within macroplot 1 that contained less than 50 plants were measured. All flowering individuals in macroplot 3 were measured, since flowering was not as dense as in macroplot 1. In Macroplot 1, where greater than 50 plants were flowering (the majority of subplots) quadrats were randomly placed throughout the subplots until fifty individuals were measured.

Dethatching of dried litter material occurred in October 2007 and in September 2009 in order to avoid affecting BRFIL during its vegetative, flowering, or seeding stages.

Statistical Methodology

Five attributes are being measured. These include percent cover, direct counts of vegetative and flowering BRFIL, species richness, and BRFIL height. Average number of vegetative and flowering BRFIL will be calculated per macroplot, as will average percent cover by category (litter, bare, cover by species), and average species richness by category (native, non-native). From this, repeated measures ANOVA may be performed annually on these attributes after the first year's analysis is conducted in 2009. Analyses will also be run for site differences. Since CDFG limited our initial treatment replicates, we have been unable to lump macroplot 1 with macroplot 3, and these must be assessed separately. It is still undecided if repeat measures ANOVA is appropriate, since much of our count collection methodologies include total within-plot counts. This may limit our year to year comparisons with respect to ANOVA and significance testing, since we revisited these random sample frames from year to year. Concerning counts, due to the patchy nature of brodiaea, it would be cost-prohibitive and potentially misleading to re-randomize or to sub-sample in different specific localities each year. Low counts during particular years can also lead to increased error in estimating vegetative brodiaea, and may lead to erroneous conclusions.

The potential effect of location had been accounted for by stratifying the random placement of experimental units throughout each macroplot, and each of the three sites.

The null hypothesis is that there will be no difference between controls and experimental manipulation subplots. The null hypothesis will be rejected if there is a difference in any of the response variables categorized by treatment. The null hypothesis will be rejected if the resulting probability (p) that the results are due to chance outcome alone (thus likely not due to treatment) is less than 5 percent ($p < .05$). Graphics will be produced which carefully illustrate pattern.

Elzinga, Caryl L.; Daniel Salzer; and John Willoughby. 1998. Measuring and Monitoring Plant Populations. Bureau of Land Management. National Business Center. Denver, Colorado. July.

Appendix 4 - The Center for Natural Lands Management - San Diego: Coastal Sage Scrub Monitoring Plan

The Center for Natural Lands Management-San Diego: Coastal Sage Scrub Monitoring Plan (Revised in 2010)

Objective: Track the changes in structure and composition of the coastal sage scrub (CSS) community.

a. Use data to evaluate the structure and composition of the CSS vegetation community and its correlation to predictions of vegetation changes based on theories postulated by ecological and threats models.
b. Use data to evaluate changes or trends in "populations", presence/absence and/or occupied/unoccupied habitat of sensitive animal species, primarily the coastal California gnatcatcher (*Polioptila californica californica*)(CAGN).
c. Use data to evaluate changes in species richness.
d. Use data to evaluate changes over time from a baseline vegetation pattern.
e. Use data to guide vegetation management decisions (i.e. non-native plant removal, rare species range increases/introductions).

Background of Need:

The Center for Natural Lands Management (CNLM) manages several thousand acres of CSS in San Diego County. These areas host many threatened, endangered and sensitive plant and wildlife species, provide for wildlife movement and are some of the last remaining stands of CSS in coastal San Diego. These areas were also specifically designated as important areas to conserve under the regional Habitat Conservation Planning (HCP) conservation efforts.

As a result, the CNLM needs to be able to evaluate recruitment and vigor of this vegetation community over time to guide management decisions and to evaluate changes in plant and animal communities. This monitoring will also provide an opportunity to evaluate theorized predictions of changes in vegetation communities resulting from urbanization, non-native species invasion, global warming, increased edge, altered fire regime and fragmentation (to name a few).

Background of Ecological Model and Threats

CSS is a fire-adapted vegetation community with fires occurring naturally, but most severely under the extreme Santa Ana heat and winds of late summer and fall and during drought conditions. During these conditions there would generally be a "complete burn" where all above ground vegetation within the fire's path would be consumed. After such a fire, herbaceous plants (fire followers), which are known to sprout after fires, would dominate the landscape for a few years. Over time (3-5 years) the shrub lands would regain their dominance, and after 5-10 years a mature assemblage of plants and wildlife would again be found on site (Dallman 1998).

The fire frequency in CSS is as frequent as chaparral due to the volatile oils and resins that occur in CSS plants. The plants, such as white sagebrush (*Saliva apiana*), are able to resprout after a fire or produce many seedlings from the dormant seed bank that lies in the soil. Seed germination of some species may also be stimulated by fire (Holland and Keil 1995, Dallman 1998). However, if the fire frequency and intensity are too great, plants in the CSS community, such as black sage (*Salvia mellifera*) and California sagebrush (*Artemisia californica*) are permanently killed and can no longer regenerate, slowly converting the CSS community to a non-native, annual grassland (Southwest Division, Naval Facilities Engineering Command 1998).

Each CNLM preserve in San Diego has a different fire history and a different predicted fire future. For example, most of the Rancho La Costa (RLC) Habitat Conservation Area (HCA) burned in the Harmony Grove fire in October of 1996, while the Manchester HCA has not burned (except two very small fires) in its entirety since 1917. Prior to 1917 no data are recorded, so it is uncertain as to when the last significant fire event occurred in the Manchester HCA.

Regardless of fire history and the current vegetation characteristics, there are many realized or potential threats to the integrity of the CSS vegetation community (See RLC Habitat Management Plan CSS Ecological Model and Threats Section (CNLM 2005) that need to be evaluated including:

1. What is the effect of an altered fire regime at each HCA?
2. What is the potential effect of global climate change?
3. What are the effects of urban edge?
4. What are the effects of fragmentation and isolation?
5. What are the effects of altered wildlife usage patterns?

The answers to these threats questions lead to other questions that are associated with effects on ecological processes and patterns, such as:

1. Are the variables investigated representing a threat?
2. At what spatial scale are the variables representing a threat?
3. How do the effects of the threats listed above effect the distribution and abundance of sensitive plant and wildlife species?
4. How do the threats listed above effect the distribution of non-sensitive plants and animals?
5. How do the effects of each threat alter ecological processes?
6. How do the various measured factors interact?

Predictions

Fire. We predict that as a result of fragmentation, complete burns of preserves are now less likely and that there will be fewer, smaller fires resulting in a mosaic of CSS with various age structures.

Global Climate Change. We predict that rainfall patterns will change (likely decrease) over the next 100 years resulting in a lengthening of the fire season, increased frequency of lightening fires, increased frequency of drought, and areas burned. We predict:

1. Possible regime shifts (altered abundance and recruitment patterns in various native vegetation assemblages)
2. Altered invasion severity of exotic species due to changes from native-adapted variations in weather phenomena
3. Lowered native seedling survival of species due to changes from native-adapted variations in weather phenomena
4. Lowered seed and/or clonal production of future generations due to changes from native-adapted variations in weather phenomena
5. Negative interactions between native wildlife and changes resulting from the above mentioned predictions in vegetative cover

Habitat Fragmentation and Urban Edge. We predict that habitat fragmentation will reduce plant diversity and migration and/or genetic exchange between plant populations. This could affect the CSS community by reducing vigor within populations and eventually leading to extinctions of specific plant species.. Habitat fragmentation has resulted in an increase of urban edge on all our preserves. We predict that this will result in increased pressures from non-native plant species, illegal vegetation clearing, dumping, erosion, and other threats that will change the vegetation structure and composition.

Monitoring Methodology

Approximately fifty plots will be established inside three of our preserves, and the number per preserve allocated by the amount of acreage currently occupied by CSS in each preserve. These plots will be placed in a stratified random manner across our preserves. Stratification will take into account:

1. Size of preserve
2. Slope and aspect
3. Distance from preserve edge/urban edge
4. Presence or absence of CAGN or San Diego horned lizard (*Phrynosoma coronatum blainvillii*)
5. Fire history

Plot Design and Setup

The plot design will be of a modified Whittaker nested vegetation sampling design as in Stohlgren et al. 1995. The dimensions of the macroplot will be 50 meters long by 20 meters wide. Three smaller nested plots will be placed inside the macroplot. The larger of these three is to be 20 meters long and 5 meters wide, placed in the center of the macroplot, with the long axis corresponding to that of the macroplot. The two other nested plots will be at opposite corners of the macroplot, and will be 5 by 2 meters in length, again with the long axis corresponding to that of the macroplot. The design of the

modified Whittaker plot we are using deviates from that described in Stohlgren et al. 1995 by not including the 12 smaller 1-square meter rectangles. The long axis of the modified Whittaker plots will be set to cross the environmental gradient present at the macroplot location. Sampling will be carried out for both continuous variables (percent cover by species) and non-parametric and semi-continuous variables (count of dead shrubs, species richness).

Point Intercept Data (Percent Cover)

Percent cover by species will be gathered by running a point-intercept transect along the upper border of each macroplot. The point-intercept transects will be measured at half meter intervals, thus generating 98 "hits" along the long (50 meter) side of the macroplot. Living plants will count as a point or "hit," if a 1.5 millimeter dowel is intersected in the vertical plane by the living tissue of a plant. At each half meter, data pertaining to bare ground, rock, or litter incident with the dowel will also be collected. Dead branches attached to a living shrub do not count as a "hit." If a completely dead shrub is incident to the dowel along the point intercept line, that shrub is noted by species (if possible) in a separate column from living plant "hits." The hope is that this may generate information pertaining to large-scale shrub die-off, as has been recently noticed, but had gone quantitatively undocumented in the Rancho La Costa HCA.

Species Richness

Information gathered inside the smaller sub-plots located inside each macroplot will include species presence. Each species occurring within the sub-plot is recorded. Plants are identified to species and subspecies whenever possible.

We obtained shrub counts in our plots during our first year of sampling (N = 17 macroplots), and found that any counting inside subplots in addition to noting species richness cannot be supported on our HCA endowments. Collecting species richness in these subplots is the most time-consuming portion of each visit.

Sampling intensity

CNLM met with Dr. Douglas Deutschman at San Diego State University to inquire into methods of maximizing our return from our effort. We could not afford to monitor more than approximately 20 macroplots per year. Also, the effects of trampling could mislead our conclusions about trend over time if we re-visited the same sites every year over the course of many years. It is necessary to capture the yearly variation in conditions such as rainfall and temperature, and thus we knew that many replicates would be needed in order to capture meaningful patterns.

Dr. Deutschman suggested a "rotating panel" approach. This approach incorporates visiting a subsample of all macroplots on a yearly basis, ensuring to balance the replicates according to aspect and to spread these replicates across the landscape in order to capture variation in weather or rainfall that may take place across our sample region. It was

suggested that we re-visit eight macroplots over the course of three years, while rotating 12 or more new macroplots over the course of the three years. Thus, after the third year of sampling, roughly 50 plots have been visited, and the variation in measures among the eight re-visit macroplots can be compared to the rotating macroplots. In this manner we can judge if yearly re-visits are necessary in the long-term, or if more sites are needed each year.

For instance, one potential outcome is that the region in which we are sampling does not vary substantially in factors influenced by weather or disturbance, and that by stratifying sub-sampling across the region and visiting a subsample of the whole, we can adequately capture the variation in vegetative and species richness measures without overtaxing our annual budgets. Another potential outcome is that we will obtain substantial information from this rotating panel design to indicate how many more sites should be visited on a yearly basis to capture the yearly variation without visiting the entirety of our plots.

Rational for a Two-Tiered Approach

The data collected in the macroplot, and smaller sub-plots will be useful in generating species area curves and (more importantly) in documenting species presence or absence, as well as recruitment and mortality over time. The advantages of using a multi-scaled approach to quantifying species richness are identified in Stohlgren et al. 1995. As the years progress, small changes in species presence or seedling recruitment may be observed as disappearances, appearances, increases, or decreases on the micro-scale of sub-plot. The appearance of non-native species may be quickly identified on the macroplot scale, while the disappearance or lack of recruitment among native shrubs may be apparent on the smaller plot scale prior to any notice of change on the macroplot scale.

The point-intercept transect measures will provide a method of quantifying change in abundance by species and edaphic cover which may also tie into species richness changes observed within the sub-plots. For instance, non-native grasses and/or litter cover changes may be predictive as explanatory variables in a multi-factorial analysis of the response variables mortality or species decline. Other variables that may be tied into a model explaining the measured pattern may include regional rainfall totals for the season and/or seasonal temperature averages, slope and aspect of macroplots, fire history, and the presence or absence of animal herbivory.

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